

**FINAL ENVIRONMENTAL ASSESSMENT
FOR HYDROPOWER LICENSE**

Bolton Falls Hydroelectric Project, P-2879-012

Vermont

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Licensing
888 First Street, NE
Washington, D.C. 20426

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ACRONYMS AND ABBREVIATIONS

APE	area of potential effect
Bolton Falls Project	Bolton Falls Hydroelectric Project
°C	degrees Celsius
C.F.R.	Code of Federal Regulations
cfs	cubic feet per second
Commission	Federal Energy Regulatory Commission
CWA	Clean Water Act
CEQ	Council on Environmental Quality
DO	dissolved oxygen
EA	environmental assessment
EFH	Essential Fish Habitat
EIA	U.S. Energy Information Administration
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
°F	degrees Fahrenheit
FERC	Federal Energy Regulatory Commission
FPA	Federal Power Act
fps	feet per second
FWS	U.S. Fish and Wildlife Service
GMP	Green Mountain Power Corporation
HPMP	Historic Properties Management Plan
Interior	U.S. Department of the Interior
IPaC	Information for Planning and Consultation
kV	kilovolt
kWh	kilowatt-hours
MW	megawatt
MWh	megawatt-hours
mg/L	milligrams per liter
NEPA	National Environmental Policy Act
National Register	National Register of Historic Places
NHPA	National Historic Preservation Act
NPCC-New England	Northeast Power Coordinating Council's New England region
NLEB	Northern long-eared bat
O&M	operation and maintenance
PA	Programmatic Agreement
PM&E	protection, mitigation, and enhancement
RM	river mile
RMP	Recreation Management Plan
SD1	Scoping Document 1
SD2	Scoping Document 2
SCORP	Statewide Comprehensive Outdoor Recreation Plan
USGS	U.S. Geological Survey
Vermont ANR	Vermont Agency of Natural Resources
Vermont DEC	Vermont Department of Environmental Conservation
Vermont DHP	Vermont Division for Historic Preservation

Vermont FWD
Vermont SHPO
Waterbury Project
WQC

Vermont Fish and Wildlife Department
Vermont State Historic Preservation Office
Waterbury Hydroelectric Project
Clean Water Act section 401 water quality certification

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1.0 INTRODUCTION

1.1 APPLICATION

On January 30, 2020, Green Mountain Power Corporation (GMP) filed an application with the Federal Energy Regulatory Commission (Commission) for a new license to continue to operate and maintain the Bolton Falls Hydroelectric Project No. 2879 (Bolton Falls Project or project).¹ The 7.5-megawatt (MW) project is located on the Winooski River in Washington County, Vermont (figure 1). The project does not occupy federal land.

1.2 PURPOSE OF ACTION AND NEED FOR POWER

1.2.1 Purpose of Action

The purpose of the Bolton Falls Project is to provide a source of hydroelectric power. Therefore, under the provisions of the Federal Power Act (FPA), the Commission must decide whether to issue a new license to GMP for the project and what conditions should be placed on any license issued. In deciding whether to issue a license for a hydroelectric project, the Commission must determine that the project would be best adapted to a comprehensive plan for improving or developing a waterway.

¹ A license for the project was issued on February 5, 1982, for a term of 40 years, with an effective date of February 1, 1982, and an expiration date of January 31, 2022. See *Green Mountain Power Corporation*, 18 FERC ¶ 62,156 (1982).

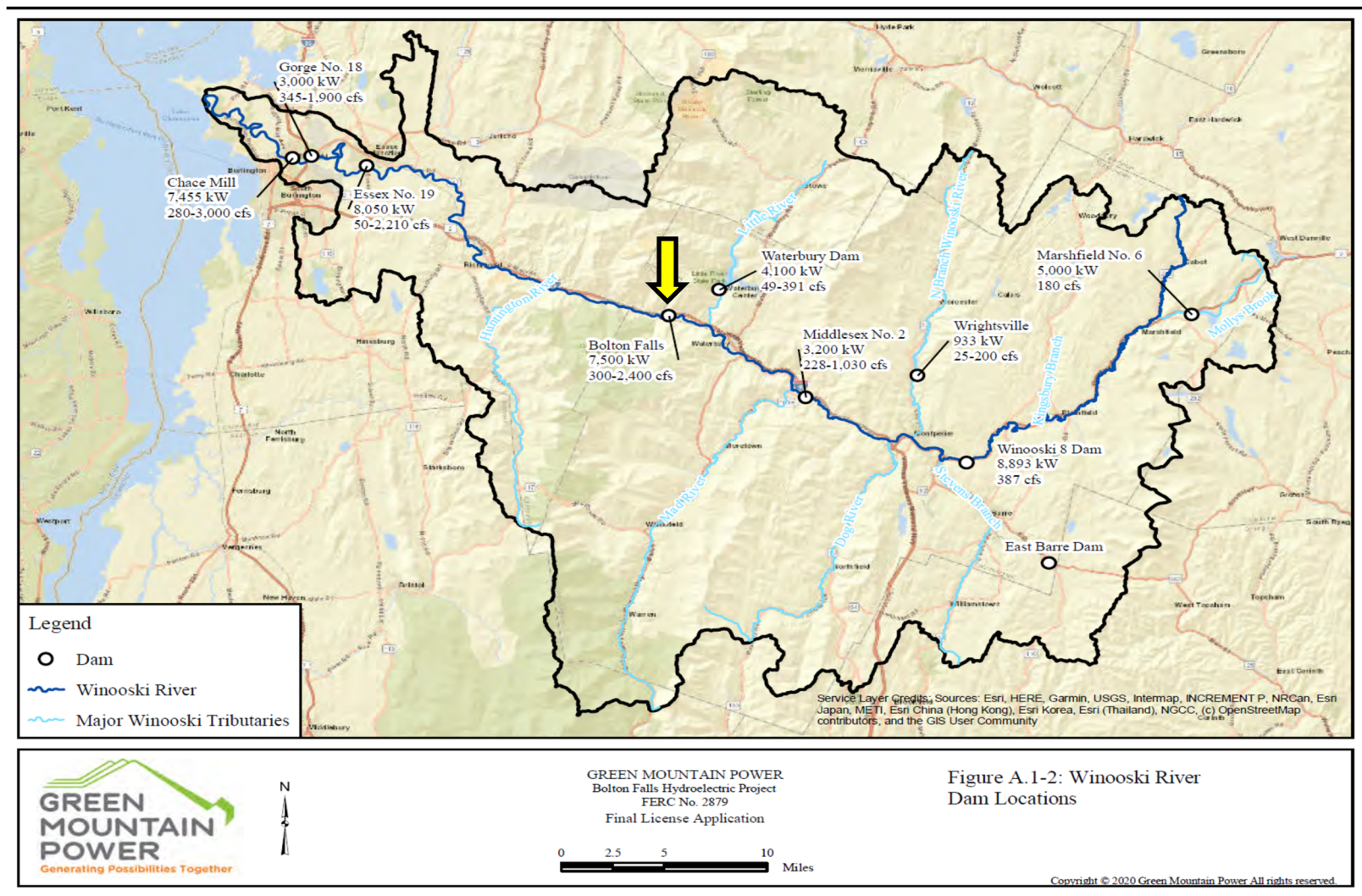


Figure 1. Location of the Bolton Falls Project and other hydroelectric dams in the Winooski River (Source: license application; staff)

In addition to the power and developmental purposes for which licenses are issued (such as flood control, irrigation, or water supply), the Commission must give equal consideration to the purposes of: (1) energy conservation; (2) the protection of, mitigation of damage to, and enhancement of fish and wildlife resources; (3) the protection of recreational opportunities; and (4) the preservation of other aspects of environmental quality.

Issuing a new license for the Bolton Falls Project would allow GMP to continue to generate electricity at the project for the term of the new license, making electric power from a renewable resource.

This environmental assessment (EA) has been prepared in compliance with the National Environmental Policy Act (NEPA)² of 1969 to assess the environmental and economic effects associated with operation of the project, and alternatives to the proposed project. It includes recommendations to the Commission on whether to issue a new license, and if so, recommends terms and conditions to become part of any issued license.

In this EA, we assess the environmental and economic effects of continued project operation as proposed by the applicant (proposed action) and with staff-recommended measures (staff alternative). We also consider the effects of the no-action alternative. The primary issues associated with relicensing the project are the effects of continued operation and maintenance on aquatic species (including resident fish and freshwater mussels) and their habitat, recreation and aesthetic resources, and cultural resources.

1.2.2 Need for Power

The Bolton Falls Project would continue to provide hydroelectric generation to meet part of the region's power requirements, resource diversity, and capacity needs. The Bolton Falls Project has a generating capacity of 7.5 MW and generates an average of 26,301 megawatt-hours (MWh) per year.

The U.S. Energy Information Administration (EIA) provides estimates of electrical supply and demand nationally and regionally for a 10-year period in its Annual Energy Outlook Report. The Bolton Falls Project is located within the Northeast Power Coordinating Council's New England region (NPCC-New England), which is one of six regional reliability councils. According to EIA's 2021 Energy Outlook Report, electric demand in the NPCC-New England region is projected to increase by about 21 percent over the 10-year period from 2020 to 2030 (EIA, 2021).

If it is relicensed, power from the Bolton Falls Project would continue to help meet the need for power in the NPCC-New England region. The project would continue to provide low-

² On July 16, 2020, the Council on Environmental Quality (CEQ) issued a final rule, *Update to the Regulations Implementing the Procedural Provisions of the National Environmental Policy Act* (Final Rule, 85 Fed. Reg. 43,304), which was effective as of September 14, 2020. Commission staff prepared this EA in accordance with CEQ's new regulations.

cost power that displaces generation from non-renewable sources. Displacing the operation of non-renewable facilities may avoid some power plant emissions, thus creating an environmental benefit.

1.3 STATUTORY AND REGULATORY REQUIREMENTS

Any new license for the project would be subject to numerous requirements under the FPA and other applicable statutes. The major regulatory and statutory requirements are described in Appendix A.

1.4 PUBLIC REVIEW AND COMMENT

The Commission's regulations [18 Code of Federal Regulations (C.F.R.) §§ 5.1-5.16] require applicants to consult with appropriate resource agencies, tribes, and other entities before filing an application for a license. This consultation is the first step in complying with the Fish and Wildlife Coordination Act, Endangered Species Act (ESA), National Historic Preservation Act (NHPA), and other federal statutes. Pre-filing consultation must be completed and documented according to the Commission's regulations.

1.4.1 Scoping

Before preparing this EA, staff conducted scoping for the project to determine what issues and alternatives should be addressed. Scoping Document 1 (SD1) was distributed on March 31, 2017. Scoping meetings were held on April 25, 2017, in Waterbury, Vermont, and on April 26, 2017, in Montpelier, Vermont, to obtain comments on the project. A court reporter recorded all comments and statements made at the scoping meetings, and a transcript is part of the Commission's public record for the project. In addition to the comments provided at the scoping meetings, Vermont Agency of Natural Resources (Vermont ANR)³ filed comments on May 30, 2017, and Vermont Division for Historic Preservation (Vermont DHP)⁴ filed comments on May 31, 2017.

A revised scoping document (SD2), addressing these comments was issued on July 12, 2017.

³ Vermont ANR is an umbrella agency consisting of three departments: (1) Vermont Department of Environmental Conservation (Vermont DEC), which administers the State's section 401 Clean Water Act water quality certification program; (2) Vermont Department of Fish and Wildlife (Vermont FWD); and (3) Vermont Department of Forests, Parks, and Recreation. The comment letters did not specify individual comments from each department but were filed collectively as comments from Vermont ANR. Therefore, we will refer to these entities under the collective term of Vermont ANR throughout the EA unless otherwise specified.

⁴ Vermont DHP acts as the State's Historic Preservation Office (SHPO).

1.4.2 Interventions

On December 1, 2020, the Commission issued a notice accepting the license application and stating the application was ready for environmental analysis. This notice set February 1, 2021,⁵ as the deadline for filing motions to intervene and protests. Vermont ANR filed a motion to intervene (not in opposition to the project) on February 1, 2021.

1.4.3 Comments on the Application

The December 1, 2020 notice also requested comments, recommendations, terms and conditions, and prescriptions. The U.S. Department of the Interior (Interior) filed comments on January 26, 2021. Vermont ANR filed comments and recommendations on February 1, 2021.

GMP did not file reply comments.

1.4.4 Comments on the Draft Environmental Assessment

Commission staff issued its draft EA for the relicensing of the Bolton Falls Hydroelectric Project (Bolton Falls Project) on August 13, 2021. Comments on the draft EA were due by September 12, 2021. Vermont ANR filed comments on the draft EA on September 13, 2021, and the Vermont SHPO filed comments on the draft EA on October 15, 2021.

Appendix H summarizes the comments that were filed, includes our responses to those comments, and indicates where we made modifications to the EA.

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 NO ACTION ALTERNATIVE

Under the no-action alternative, the project would continue to operate under the terms and conditions of the current license, and no new environmental protection, mitigation, or enhancement measures would be implemented. We use this alternative to establish baseline environmental conditions for comparison with other alternatives.

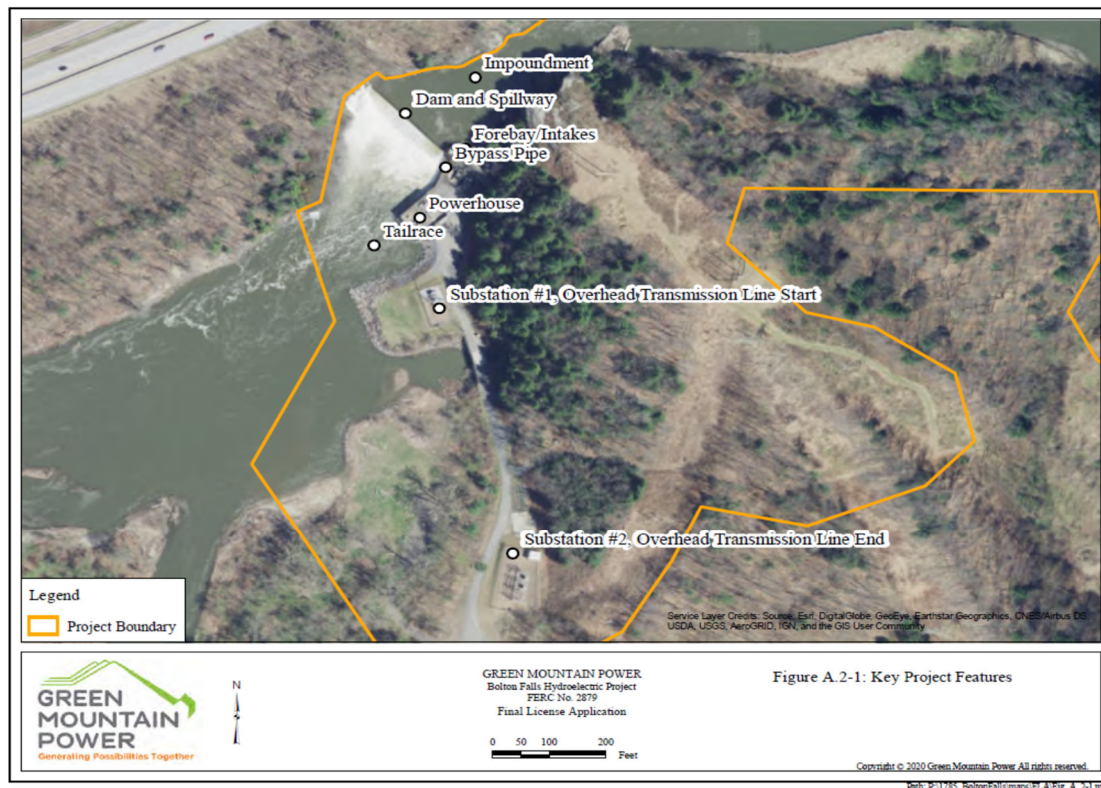
2.1.1 Existing Project Facilities

The project facilities are shown in figures 2 and 3. Bolton Falls Dam is a 92-foot-high, 275-foot-long timber crib dam with a maximum crest elevation of 397 feet when the 5-foot-high rubber bladder atop the dam is inflated and a maximum elevation of 392 feet when the rubber

⁵ The Commission's Rules of Practice and Procedure provide that if a filing deadline falls on a Saturday, Sunday, holiday, or other day when the Commission is closed for business, the filing deadline does not end until the close of business on the next business day. 18 C.F.R. § 385.2007(a)(2). Because the 60-day filing deadline fell on a Saturday (i.e., January 30, 2021), the filing deadline was extended until the close of business on Monday, February 1, 2021.

bladder is deflated.⁶ The concrete spillway is 196 feet long with a crest elevation of 392 feet. The project forebay includes two concrete intakes. The intake structure is equipped with 27-foot-wide, 43-foot-high trash racks angled at 70 degrees from the horizontal plane with 3-inch clear spacing between the bars and a trash raking system. Two 10-foot diameter, 120-foot-long steel penstocks encased in concrete extend from each intake through the dam to the generating units. The powerhouse is 73 feet long and 57 feet wide and contains two horizontal, 3,750-kilowatt Kaplan turbines with a total installed capacity of 7,500 kilowatts. The project also includes a 75-foot-long, 36-inch diameter bypass pipe with an invert elevation of 383 feet, located on the left side of the spillway base (when looking downstream), which can discharge up to 114 cubic feet per second (cfs) to the bypassed reach to drain the reservoir prior to conducting maintenance activities. Project power is transmitted through an approximately 130-foot long, 5-kilovolt underground transmission line that connects to an adjacent switchyard which steps up the voltage to 34.5 kilovolts. From the adjacent switchyard, a 600-foot-long, 34.5-kilovolt overhead transmission line connects to a second switchyard that interconnects with the regional grid.

The dam creates an approximately 2.1-mile-long impoundment with 4.2 miles of shoreline. At a normal full pool elevation of 397 feet, the impoundment has a surface area of 59 acres and storage capacity of 300 acre-feet.



⁶ Unless otherwise noted, all elevations are referenced to the National Geodetic Vertical Datum of 1929.

Figure 2. Major Dam Facilities at the Bolton Falls Hydroelectric Project (Source: license application).

GMP maintains a day-use recreation area below the dam that contains a picnic area, parking lot, and canoe put-in. GMP also maintains a canoe take-out on the impoundment and portage trail connecting the take-out and put-in (figure 3).

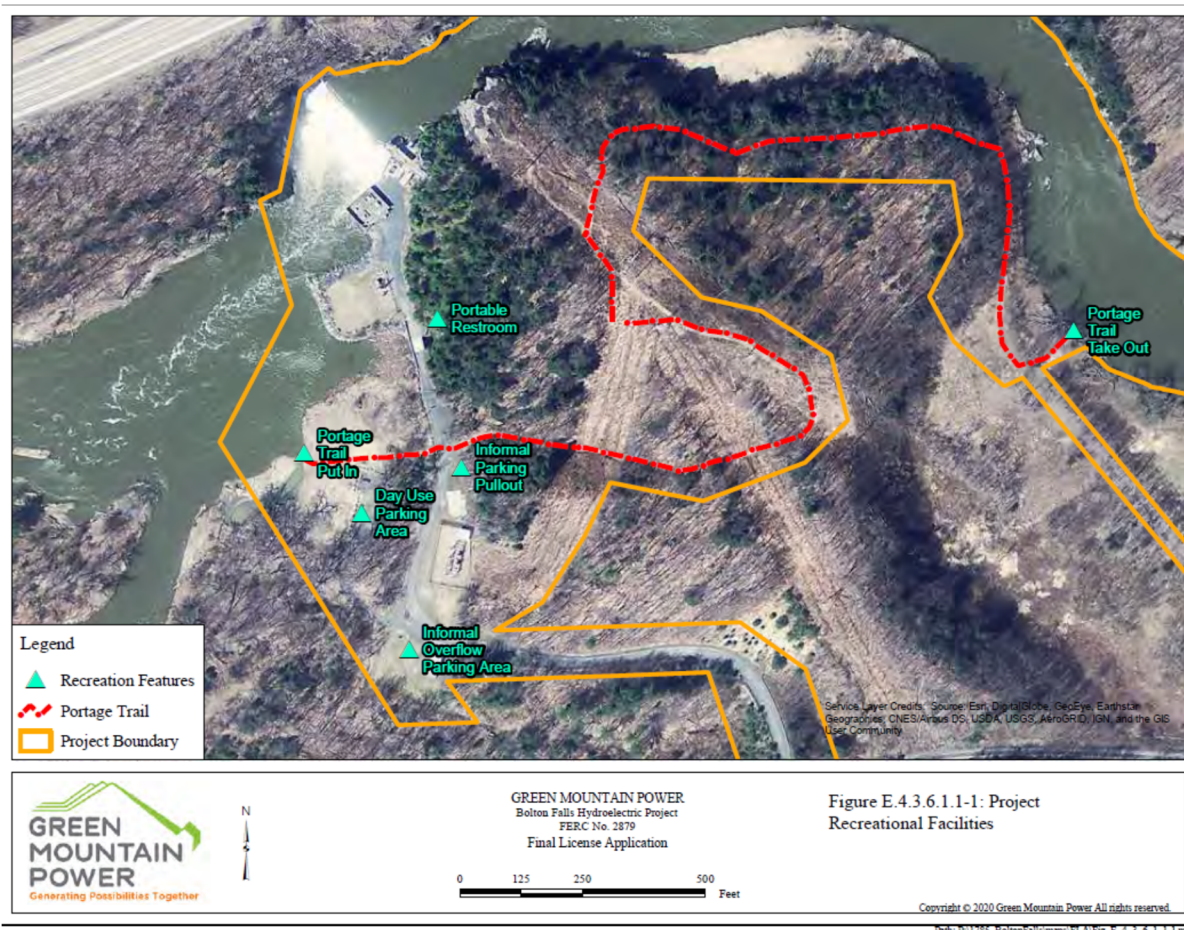


Figure 3. Existing recreation facilities at the Bolton Falls Hydroelectric Project in relation to the proposed project boundary (Source: license application).

2.1.2 Current Project Boundary

The project boundary currently encompasses 93.4 acres. The existing project boundary generally follows the 397-foot contour elevation around the impoundment and encloses the impoundment, dam, powerhouse, transmission line, substations, Day Use Area, portage trail, and canoe take-out and put-in (figure 4).

2.1.3 Project Safety

The Bolton Falls Project has been operating since 1982 under its existing license.⁷ During this time, Commission staff has conducted operational inspections focusing on the continued safety of the structures, identification of unauthorized modifications, efficiency and safety of operations, compliance with the terms of the licenses, and proper maintenance.

As part of the licensing process, Commission staff will evaluate the continued adequacy of the project's facilities under a new license. Special articles will be included in any license issued, as appropriate. Commission staff will continue to inspect the project during the term of any new license to assure continued adherence to Commission-approved plans and specifications, special license articles relating to construction (if any), operation and maintenance, and accepted engineering practices and procedures.

2.1.4 Current Project Operation

The current license permits GMP to operate in store-and-release (i.e., peaking mode) and fluctuate the reservoir level between 391.0 and 397.0 feet while discharging a minimum flow of 300 cfs⁸ or inflow, whichever is less, into the Winooski River downstream of the project. However, in practice, GMP operates in run-of-river mode with project outflows approximating inflows to the impoundment at any given point in time. A pond level sensor is installed in the headpond near the powerhouse intake to monitor water levels and to adjust generation flows through the powerhouse via the turbine wicket gates to maintain the project impoundment water level at 397.0 feet elevation which is just below the crest of the rubber bladder. The rubber bladder operates through an air compressor system located on the intake structure and automatically begins to deflate when the impoundment rises more than a foot above the top of the bladder. The bladder system can also be manually controlled to lower the impoundment when necessary to facilitate project maintenance.

The maximum combined hydraulic capacity of the two project turbines is 2,400 cfs. Flow in excess of the maximum hydraulic capacity passes over the spillway. As flow exceeds maximum hydraulic capacity and the reservoir level rises, the inflatable rubber bladder is deflated to pass additional flow over the spillway to help control upstream water levels. When inflow drops below 365 cfs (which is the lowest flow that GMP can operate one of its turbines), the turbine wicket gates are closed to prevent flow through the intake system and all flow is allowed to spill over the rubber bladder into the bypassed reach. The 36-inch-diameter bypass pipe is capable of passing approximately 114 cfs at a pond elevation of 397 feet, but is generally only used when the project impoundment is drawn down for maintenance purposes.

⁷ *Green Mountain Power Corporation*, 18 FERC ¶ 62,156.

⁸ GMP complies with its 300-cfs minimum flow discharge requirement via generation flows through the powerhouse or by spilling the required minimum flow over the dam into the bypassed reach when the powerhouse is not operating.

The project generates an average of 26,301 MWh of energy per year. At the rated plant capacity of 7.5 MW, the annual plant capacity factor is about 40 percent.

Maintenance Drawdowns

GMP states that impoundment drawdowns for repair and maintenance may occur between 0 and 10 times annually. Maintenance drawdowns typically range from less than a day to about a month for more lengthy repairs (average duration is about a week), and typically involve lowering the impoundment level by five feet down to an elevation of 392.0 feet (to the level of the dam crest with the rubber bladder deflated). GMP states it prefers to perform planned maintenance during the summer low-flow season when possible. Typical activities performed during maintenance drawdowns include repairs to the rubber bladder (i.e., patch leaks), removal of large woody debris that cannot otherwise safely be passed downstream, repairs to the intake and headgate infrastructure, repairs to the fall protection line, and inspection and repairs to the dam infrastructure.

2.2 GMP'S PROPOSAL

2.2.1 Proposed Facility and Project Boundary Modifications

GMP proposes to add the following areas to the project boundary: (1) approximately 1.4 acres of land upstream of the dam to enclose a secondary access road used by GMP to access the project dam and canoe take-out from River Road and the canoe take-out; (2) approximately 4.1 acres of land along the middle section of the portage trail to enclose the full portage trail extent; and (3) approximately 2.1 acres of land along the primary project access road (i.e., Power Plant Road) used by GMP to access project facilities below the dam and also used by the public to access to the Day Use Area from River Road.

GMP also proposes to remove the following land and waters from the project boundary because they are not connected to project recreation facilities, are not necessary for project operation and maintenance, and are outside of the influence of project operation: (1) approximately 4.2 acres of land south of the portage trail; (2) approximately 2.9 acres of land south of Power Plant Road; and approximately 2.1 acres of the Winooski River and shoreline downstream of the project bypassed reach and tailrace areas. Additionally, GMP proposes to adjust the boundary along the impoundment to more accurately enclose the shoreline along the 397-foot contour elevation (figure 4).

The new project boundary would enclose 91.8 acres of land and water within the project boundary (figure 4).

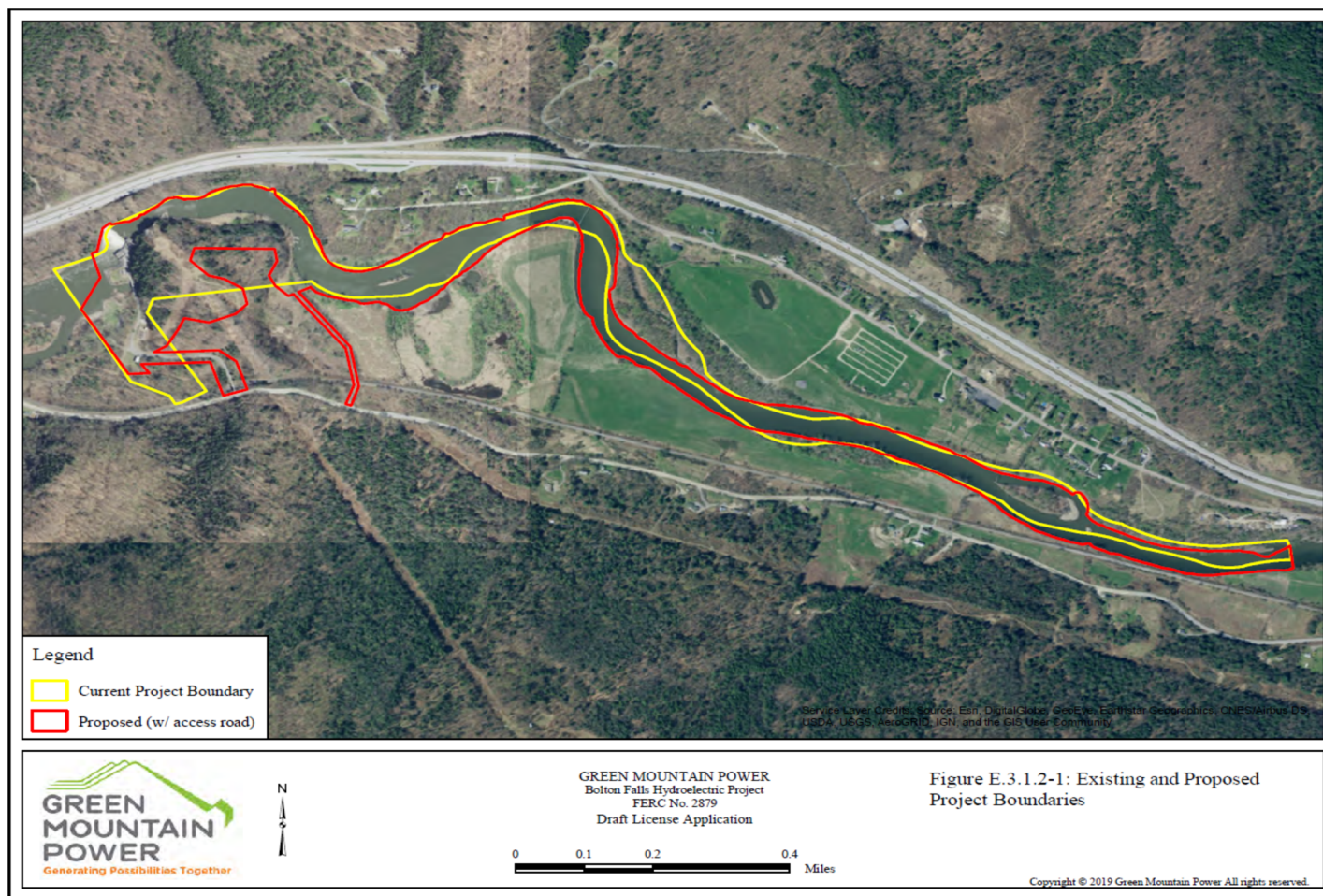


Figure 4. Proposed changes to the project boundary (Source: license application).

2.2.2 Proposed Operation and Environmental Measures

GMP proposes to:

- Continue to operate the project in a run-of-river mode where at any given point in time, outflow approximates inflow;⁹
- Continue to monitor impoundment levels using the existing pond level sensor located near the powerhouse intake and adjust the flow through the turbines to maintain the impoundment water level at 397.25 feet when aesthetic spill flows are provided (as further described below) and at 397.00 feet at all other times;
- Rather than continuing to maintain a 300-cfs minimum discharge downstream of the project, provide a 75-cfs flow or inflow, whichever is less, into the bypassed reach via spill over the dam during daylight hours from April 1 through December 15 to enhance aesthetics and aquatic habitat downstream of the dam and provide leakage flow¹⁰ into the bypassed reach during nighttime hours from April 1 through December 15 and daytime and nighttime hours from December 16 through March 31;¹¹
- Implement the Recreation Management Plan (RMP) filed with the license application, which includes provisions to within 2 years of license issuance: (1) improve the Day Use Area by adding two picnic tables¹² and an information kiosk with a site map and

⁹ GMP proposes to maintain flexibility to temporarily modify run-of-river operation and aesthetic spill flow measures due to the following: (1) approved maintenance and dam safety monitoring activities; (2) “extreme hydrologic conditions” defined as the occurrence of events beyond GMP’s control such as but not necessarily limited to abnormal precipitation, extreme runoff, flood conditions, ice conditions, or other hydrologic conditions such that the operational restrictions and requirements are impracticable to achieve or are inconsistent with the safe operation of the project; or (3) via an agreement between GMP, the Vermont ANR, and appropriate state and/or federal fisheries management agencies.

¹⁰ GMP states that leakage occurs from two openings located at the base of the dam and ranges from 0 to 16 cfs depending on ambient conditions.

¹¹ GMP defines “nighttime hours” as one half-hour after sunset to one half-hour before sunrise based on the middle date of each month. Therefore, GMP would provide aesthetic spill flows during the following hours (based on Eastern Standard Time or Daylight Savings Time) per month: April (5:40am to 8:06pm); May (4:56am to 8:42pm); June (4:38am to 9:08pm); July (4:53am to 9:04pm); August (5:26am to 8:27pm); September (6:02am to 7:32pm); October (6:38am to 6:37pm); November (6:19am to 4:54pm); and December (6:53am to 4:42pm).

¹² In its additional information response filed on June 1, 2020, GMP states that one of the two picnic tables would be accessible to persons with a disability. GMP also states that the

user responsibilities, and relocate the primary parking area out of the floodplain to the existing informal lot; (2) modify the informal lot by laying gravel and creating 16 standard parking spaces and one parking space designed to provide for the needs of persons with disabilities; (3) improve the portage take-out by clearing vegetation, grading, installing a 12-foot wide concrete level slab that allows recreation users to land their boats on a stable surface, and installing timber steps leading from the take-out to the top of the bank where it joins the portage trail; (4) clear vegetation and brush along the portage trail, and install new directional signage for boaters; (5) place large boulders and new signs at the western end of the grassy picnic area to redirect users away from areas that contain creeping lovegrass, a state-designated rare plant; and (6) maintain and monitor the recreation facilities over the course of the new license;¹³ and

- Implement the final Historic Properties Management Plan (HPMP) filed on March 31, 2022, to protect and preserve cultural resources.

2.3 STAFF ALTERNATIVE

Under the staff alternative, the project would be operated as proposed by GMP, with the modifications and additional staff-recommended measures described below. Some of these measures include the mandatory conditions contained in Vermont ANR's Clean Water Act section 401 water quality certification (WQC) which is included in Appendix I:

- Provide a 75-cfs flow or inflow, whichever is less, into the bypassed reach via spill over the dam during daylight hours from April 1 through October 31 (rather than April 1 through December 15 as proposed) to enhance aesthetics and aquatic habitat downstream of the dam;
- Conduct any planned, non-emergency drawdown of the impoundment below the normal operating limits of the license between November 1 and August 15 to protect sensitive life stages of Eastern pearlshell mussels and notify Vermont ANR prior to conducting a planned drawdown of the impoundment below the normal operating limits as required by WQC condition G;
- Develop an operation compliance monitoring plan that includes provisions for monitoring and reporting compliance with the operating requirements of the license

proposed portage take-out would be a concrete level slab, instead of a concrete ramp, to prevent a slipping hazard and that the landing would be 12 feet wide instead of 20 feet wide.

¹³ GMP proposes to clean sediment off the take-out launch steps and platform on an annual basis and conduct other maintenance and repairs as-needed (including cleanup and minor vegetation trimming/clearing and portable toilet maintenance). In addition, GMP proposes to review the RMP (including conducting a site evaluation and capacity review) every 10 years and submit a report to FERC following each review that contains the results of GMP's evaluation and any proposed modifications.

- (e.g., run-of-river operation, spill flows, maintaining impoundment levels, timing of planned maintenance), and reporting deviations from operating requirements to the Commission and Vermont ANR as required by WQC condition C;
- Develop a debris disposal plan in consultation with Vermont ANR consistent with the requirements in WQC condition F; and
 - Revise the RMP to include a provision to improve the existing access road to provide better access from the relocated parking area for persons with disabilities, include the picnic table for persons with disabilities, provide more detail on the construction of the portage take-out, and develop the plan and schedule in consultation with Vermont ANR as required by WQC condition E.

Water Quality Certification Conditions Not Recommended

The staff alternative does not include the following WQC conditions because, pursuant to sections 4(e) and 10(a) of the FPA, the benefits would not justify the costs, or the conditions do not address a project-related effect: (1) operate the project so that outflow always equals (rather than approximates) inflow on an instantaneous basis (WQC condition B); (2) spill 100 cfs over the dam into the bypassed reach continuously when generating (WQC condition B); develop a flow management and monitoring plan that details how the project will operate in an instantaneous run-of-river mode, continuously monitor and show compliance with the conservation flow,¹⁴ impoundment levels, and inflows, and maintain flow data on a “near real-time basis” (WQC condition C); (3) consult with the Vermont Fish and Wildlife Department (Vermont FWD) prior to the next trash rack replacement to determine the appropriate bar clearance spacing and location (WQC condition D); and develop a water level management plan that includes provisions for protecting freshwater mussels from being dewatered during planned maintenance drawdowns of the impoundment and protects aquatic biota and wildlife in wetlands impacted by maintenance-related drawdowns (WQC condition G).

2.4 STAFF ALTERNATIVE WITH MANDATORY CONDITIONS

The staff alternative with mandatory conditions includes all the WQC conditions and staff’s additional measures except where superseded by the mandatory WQC conditions (i.e., staff’s recommended 75 cfs spill flow). Additionally, this alternative would include a requirement that the flow management and monitoring plan required by WQC condition B identify the impoundment level that would need to be maintained to provide the agency’s

¹⁴ Staff assumes that the term “conservation flow” refers to Vermont ANR’s requirement that GMP maintain a flow of 100 cfs year-round into the bypassed reach via spill over the dam.

required 100-cfs continuous spill flow and that the plan be submitted for review and approval by the Commission prior to implementation.

2.5 ALTERNATIVE CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

Certain alternatives to GMP's proposal were considered but eliminated from further analysis because they are not reasonable in this case. These alternatives are presented in Appendix B.

3.0 ENVIRONMENTAL ANALYSIS

This section includes: (1) a general description of the project vicinity and (2) our analysis of the proposed action and other recommended environmental measures. Sections are organized by resource (aquatic resources, recreation, etc.). Historic and current conditions are described under each resource. The existing condition is the baseline against which the environmental effects of the proposed action and alternatives are compared, including an assessment of the effects of proposed protection, mitigation, and enhancement (PM&E) measures. Staff conclusions and recommended measures are discussed in section 5.1, *Comprehensive Development and Recommended Alternative*.¹⁵

3.1 GENERAL DESCRIPTION OF THE RIVER BASIN

The Bolton Falls Project is located at river mile (RM) 43 on the Winooski River in Washington County, Vermont. The Winooski River begins in the town of Cabot and flows in a northwesterly direction for approximately 90 miles where it enters Lake Champlain. The Winooski River watershed has a total drainage area of about 1,080 square miles of which 821 square miles composes the Bolton Falls Dam drainage area. Major tributaries contributing flow into the Winooski River include Kingsbury Branch, Little River, Mad River, Dog River, Stevens Branch, North Branch, and Huntington River.

There are six existing FERC-licensed hydroelectric projects located on the Winooski River and its major tributaries (i.e., Winooski 8, North Branch No. 3, Waterbury, Bolton Falls, Essex No. 19, and Chace Mill) and three non-FERC-licensed projects (Marshfield No. 6, Middlesex No. 2, and Gorge No. 18). The Bolton Falls Project is the fourth hydroelectric dam on the mainstem Winooski River upstream of Lake Champlain (see figure 1).

Deciduous, mixed, and evergreen forests make up more than 75 percent of the watershed. Agriculture (pasture/hay and cultivated crops) accounts for approximately 10 percent while the remainder is classified as developed (8 percent), wetland (3 percent), shrub/scrub (1 percent) and open water, grassland/herbaceous, or barren land (each less than 1 percent). Land use surrounding the project is dominated by forest and agriculture, and is intersected by roads, a

¹⁵ Unless otherwise indicated, our information is taken from the application for license filed by GMP on January 30, 2020, and from responses to requests for additional information filed on June 1, 2020; August 11, 2020; and November 13, 2020.

railroad, and a power transmission corridor.

Mean annual precipitation in the region is 42.4 inches. Mean monthly temperatures range from 15.8 to 67.5 degrees Fahrenheit (°F) with January being the coldest month of the year and July being the hottest month of the year.

3.2 PROPOSED ACTION AND ACTION ALTERNATIVES

In this section, we discuss the effects of the project alternatives on environmental resources. For each resource, we first describe the affected environment, which is the existing condition and baseline against which we measure project effects. We then discuss and analyze the environmental effects of the project alternatives.¹⁶ Only the resources that have the potential to be affected are addressed in this EA. We have determined that aquatic resources (i.e., water quantity, water quality, and fisheries including freshwater mussels), terrestrial resources, threatened and endangered species, recreation and aesthetic resources, and cultural resources would be affected by the proposed action and alternatives. We have not identified any substantive issues related to geology and soils associated with the proposed action; therefore, these resources are not addressed in the EA. We also consider the effects of the project on environmental justice communities. We present our recommendations in section 5.1, *Comprehensive Development and Recommended Alternative*.

3.2.1 Aquatic Resources

3.2.1.1 Affected Environment

Water Quantity

The Bolton Falls Project impoundment extends about two miles upstream of the dam and has a surface area of approximately 59 acres. The impoundment has a volume of approximately 300 acre-feet; however, because the project is operated as a run-of-river facility by maintaining a relatively stable reservoir elevation, there is very little usable storage capacity under normal operating conditions. Daily inflow to the impoundment varies seasonally based upon Winooski River flows, the operation of upstream hydroelectric dams, and regulated and unregulated tributary inflow. The maximum hydraulic capacity of the powerhouse is approximately 2,400 cfs. The two closest operating stream gages to the project are U.S. Geological Survey (USGS) gage no. 04286000 located about 16 miles upstream at Montpelier, Vermont, and USGS gage no. 04290500 located about 25 miles downstream at Essex Junction, Vermont. To provide current data on streamflows in the project reach, GMP estimated inflow at the project using 90 years of flow data from the Essex Junction gage for the period 1928 to 2018.¹⁷ Table 1 summarizes

¹⁶ Per CEQ's final rule (July 15, 2020), Commission staff considered and evaluated effects that are reasonably foreseeable and have a reasonably close causal relationship (proximate cause) to the proposed action.

¹⁷ The drainage area at the Essex Junction gage is 1,044 square miles, while the drainage area at Bolton Falls Dam is 821 square miles. Therefore, in order to provide an estimate of

monthly flow data for the Winooski River at the project based on the prorated data collected by GMP.

Table 1. Average, minimum, and maximum daily inflow for the project based on prorated gage data for the period 1928 to 2018 (source: license application).

Month	Mean (cfs)	Median (cfs)	Minimum (cfs)	Maximum (cfs)
January	1,126	818	138	20,918
February	1,010	767	94	12,425
March	2,036	1,298	142	32,714
April	4,045	3,374	377	22,255
May	2,222	1,695	208	19,896
June	1,145	810	62	16,908
July	743	473	34	20,997
August	620	403	35	22,884
September	559	376	19	23,435
October	984	579	43	14,155
November	1,300	975	63	14,863
December	1,270	944	70	18,559
Annual	1,422	814	19	32,714

In the past, project operation was largely driven by outflow from the Waterbury Hydroelectric Project (Waterbury Project, FERC No. 2090) which is located upstream of the Bolton Falls Project on the Little River which drains into the Winooski River approximately 2.25 miles upstream of Bolton Falls Dam. Historically, the Waterbury Project operated in store-and-release (i.e., peaking mode) with a seasonal winter drawdown of 34 to 37 feet followed by a spring re-fill of 34 feet.¹⁸ Outflows from the Waterbury Project typically fluctuated between 10 cfs (leakage plus a 3-cfs minimum flow release) and 620 cfs (generation).

In a new license issued to the Waterbury Project on February 19, 2016, the Commission began a multi-year, multi-phase process to require the Waterbury Project to transition its project operation from peaking mode to year-round run-of-river mode. The current operating phase (Phase II) began in April 2018 and requires modified run-of-river operations for most of the year (May 16 through December 31) with a more constricted winter drawdown and refill period occurring from January through mid-May. Phase III (i.e., “instantaneous” run-of-river mode)

inflow to the project, the Essex Junction flow data were prorated by a factor of 0.79 to reflect the difference in drainage areas between the gage and the project site (i.e., $821/1,044 = 0.79$).

¹⁸ The peaking mode operations for the Waterbury Project occurred from Monday through Friday (the project did not produce power on the weekends).

will begin once the Waterbury Dam’s reservoir spillway and tainter gates are repaired. The date on which instantaneous run-of-river operations at the Waterbury Project will begin has not yet been determined (VHB, 2021).

As a result of the ongoing change in operations at the Waterbury Project, which affects flow at the Essex Junction gage, Commission staff did not use the entire historical dataset provided by GMP to estimate inflow conditions at Bolton Falls. Instead, staff estimated inflow at the project using prorated gage data for the most recent five-year period (i.e., 2015 to 2020) which coincides with the period since the Waterbury Project was relicensed and began shifting to run-of-river operations. Table 2 summarizes monthly flow data for the Winooski River at the project based on the prorated gage data for the period 2015 to 2020.

Table 2. Average, minimum, and maximum daily inflow for the project based on prorated gage data for the period 2015 to 2020 (source: staff).

Month	Mean (cfs)	Median (cfs)	Minimum (cfs)	Maximum (cfs)
January	1,478	1,122	608	10,112
February	1,623	964	563	12,482
March	1,902	1,462	415	7,900
April	4,214	3,539	786	13,114
May	2,414	1,916	591	11,060
June	1,841	1,236	220	13,509
July	1,032	640	164	12,324
August	513	402	170	3,942
September	381	282	119	2,070
October	899	563	134	4,913
November	1,568	1,067	443	16,353
December	1,773	1,256	507	15,326
Annual	1,637	1,122	119	16,326

Once the Waterbury Project begins operating in a run-of-river mode year-round, outflow from Waterbury Dam is expected to decrease during the winter months and increase during the spring compared to existing conditions. This would result in a corresponding change to inflow at Bolton Falls. Over the potential license term, run-of-river operation at Waterbury should result in an unregulated flow regime at Bolton Falls.

Water Withdrawals and Discharges

There are no permitted water withdrawals from the project impoundment. Further upstream in the watershed, an estimated 27 million gallons per day (or approximately 50 cfs) is withdrawn from upstream tributaries mostly for domestic water supply purposes, ski resort snowmaking, and golf course irrigation.

A total of 14 permitted wastewater discharges occur upstream from the project (including four on the mainstem Winooski River), with the closest being Waterbury Wastewater Treatment Facility located approximately three miles upstream of the project dam. Eleven permitted wastewater discharges occur on the Winooski River downstream of the project with the closest being Richmond Wastewater Treatment Facility, located approximately 8.5 miles downstream of the project dam.

Water Quality

The State of Vermont assigns classification to all its surface waters, which determine the criteria that apply to a specific water. The Winooski River in the vicinity of the project is designated as a Class B(2) water and is also classified as a cold water fishery. Class B(2) waters are managed to support the following designated and existing uses: aquatic biota and wildlife; aquatic habitat; aesthetics; public water supply, with filtration and disinfection or other required treatment; irrigation of crops and other agricultural uses; swimming and other primary contact recreation; and boating, fishing, and other related recreational uses. Relevant water quality standards for Class B(2) waters and coldwater fish habitat are included in table 3 below.

Table 3. Summary of relevant water quality criteria applicable to the Bolton Falls Project (source: license application).

Parameter	Criteria
Dissolved Oxygen	Not less than 6 mg/l and 70% saturation at all times in all other waters designated as a cold water fish habitat.
Temperature	General: The change or rate of change in temperature, either upward or downward, shall be controlled to ensure full support of aquatic biota, wildlife, and aquatic habitat uses. Class B(2) Cold Water: The total increase from the ambient temperature due to all discharges and activities shall not exceed 1.0° F.
Aquatic Biota and Wildlife	Change from the natural condition for aquatic macroinvertebrate and fish assemblages not exceeding moderate changes in the relative proportions of taxonomic, functional, tolerant, and intolerant aquatic organisms.
Aquatic Habitat	Rivers and Streams: Changes to flow characteristics, physical habitat structure, and stream processes limited to moderate differences from the natural condition and consistent with the full support of high quality aquatic habitat.
Aesthetics	Water character, flows, water level, bed and channel characteristics, and flowing and falling water of good aesthetic value.
Boating	Waters shall be managed to achieve and maintain a level of water quality compatible with good quality boating.
Hydrology: Streamflow Protection	Any change from the natural flow regime shall provide for maintenance of flow characteristics that ensure the full support of uses and comply with the applicable water quality criteria.

Hydrology: High-flow Regime	No change from the natural flow regime that would result in runoff causing an increase in the frequency, magnitude, or duration of peak flows adversely affecting channel integrity or prevent the full support of uses.
Water Level Fluctuations	Riverine impoundments may exhibit artificial variations in water level when subject to water level management, but only to the extent that such variations ensure full support of uses.
mg/L = milligrams per liter % - percent °F – degrees Fahrenheit	

Additionally, the State of Vermont’s anti-degradation policy (Vermont ANR, 2017) applies to all waters in Vermont. This policy is intended to protect, maintain, and improve water quality relative to existing conditions in order to support designated uses. For any waters that currently exceed the requirements of the state water quality criteria, the policy states that reductions in water quality are only permitted when economic and social considerations outweigh the benefits of maintaining the higher water quality and when best management practices and the highest criteria requirements are applied. The following uses are to be protected and maintained in accordance with the anti-degradation policy: aquatic biota and wildlife; habitat that supports existing aquatic biota, wildlife, or plant life; recreation and fishing; and water supply or commercial activity that depends directly on the preservation of an existing high level of water quality.

Water Quality Monitoring

In 2018, GMP collected dissolved oxygen (DO) and water temperature data at 15-minute increments from June 1 through September 30 at the following locations: upstream of the project impoundment outside of the influence of the project, at two locations in the project impoundment upstream of the dam, near the project intake, in the bypassed reach, in the project tailrace, and in the Winooski River downstream of the project tailrace. GMP’s water quality study report found that flow conditions during the study represented typical low-flow, warm-weather circumstances when DO concentrations are expected to be the lowest at the project.

The data indicated DO concentrations on average met or exceeded the State standard levels [i.e., 6 milligrams per liter (mg/L) and 70 percent saturation] at all seven monitoring locations the majority of the time although there were several days in late August and early September when DO conditions fell below the State standard levels both above and below the dam. GMP reported that these low DO periods coincided with periods when the project was shut down due to low flows and that DO subsequently met the minimum levels established by the State’s DO standards after river flows increased and the project began generating again. DO measurements near the intake, tailrace, and bypassed reach also fell below the State standard levels on occasions in early June during a period when GMP drew down the impoundment to make repairs to the inflatable rubber bladder (repairs lasted from May 29 through June 28). Compared to the upstream stations, DO in the bypassed reach met the minimum levels established by the State’s DO standards for a greater portion of the study period, including

during the approximately three-week period in late August and early September when DO levels were below the State minimum upstream and downstream of the project.

Water temperatures during the study ranged from 10.9 degrees Celsius (°C) to 28.6°C (or 51.6°F to 83.48°F), averaging between 19.1°C to 20.1°C (or 66.4°F to 68.2°F). The temperatures remained similar and fluctuated in sync upstream to downstream of the project during the study period. No stratification (of temperature or DO) was observed in the project impoundment during the study.

As requested by Vermont ANR, GMP collected additional spot water quality data in the bypassed reach to help determine if there is adequate flow and circulation throughout the bypassed reach during the summer low-flow period. GMP collected one-time vertical profiles (1-meter depth interval) for temperature and DO along a gridded pattern within the bypassed reach on July 22, 2019, when the project wasn't spilling. The total river flow at the time of the sampling was approximately 864 cfs. All DO measurements at the sampling locations met the minimum levels established by the State's DO standards, and both temperature and DO were relatively uniform throughout the water column and aurally throughout the bypassed reach.

Other Relevant Background Water Quality Data

GMP conducted a water quality study upstream of Bolton Falls Dam during the relicensing of the Waterbury Project in the early 2000's (GMP, 2001). GMP monitored water quality in the Little River downstream of Waterbury Dam, at the confluence of the Little River with the Winooski River, in the Winooski River above the Little River confluence, and in the Winooski River downstream to Bolton Falls Dam. The study found that flow releases at Waterbury Dam as a result of peaking operations influenced water temperatures at the Bolton Falls Project, particularly during the warm summer months. For example, water temperatures decreased 2 to 5°C at Bolton Falls after approximately 1 to 2 hours following the release of generation flows at Waterbury Dam compared to when only leakage flows were passing through Waterbury Dam. GMP suspects that reduced pulses of cooler generation flows being released during the warm summer months as a result of run-of-river operation at Waterbury Dam could result in higher water temperatures being maintained in the Little River and in the Winooski River around the Bolton Falls Project area during the mid- to late summer months compared to existing conditions.

Aquatic Habitat

Impoundment

The width of the two-mile-long project impoundment varies between 90 feet and 450 feet as the river meanders. The upper portion of the impoundment tends to be a shallower mix of riffle, run, and pool habitat with a mix of coarse sand, gravel, and cobble substrate and moderate to fast flows. The middle and lower reaches of the impoundment consist of slower moving deep run and pool habitat with silt, sand, gravel, cobble, and boulder substrate and depths reaching up to 50 feet (Biodrawiversity LLC, 2018). Some sand and gravel bars and islands are present in the impoundment and can shift and adjust over time during flood events.

Bypassed Reach

The project bypassed reach extends approximately 150 feet downstream of the dam spillway and the width varies between 120 feet and 200 feet. The habitat in the bypassed reach consists of a large deep pool that remains wetted under all operating conditions from a combination of spill and/or backwatered powerhouse outflows and leakage through the dam. The bottom substrate consists primarily of bedrock with depths reaching up to 25 feet. GMP states that 0 to 16 cfs of leakage flow enters the bypassed reach through the base of the dam even when the dam isn't spilling. Vermont ANR states that the large pool downstream of the project dam is important to the fishery as it offers deep water habitat which is currently limited in the Winooski River downstream of the project dam and can provide cover and stable habitat conditions for overwintering trout and other fish.

Tailwater

The tailwater area is approximately 650 feet in length and 450 feet in width at the downstream end. The deeper tailrace channel flows along river-right (when looking downstream). The river-left area widens out into shallow gravel bars with areas of exposed sand and mud depending on flow and water level. The Winooski River further downstream of the project is largely comprised of shallow riffle and run habitat.

Fish Community

Resident Fish

Common resident fish species found in project waters include rainbow trout, brown trout, brook trout, fallfish, smallmouth bass, longnose dace, golden shiner, white sucker, smallmouth bass, slimy sculpin, bullhead catfish species, and panfish. Vermont ANR stocks rainbow trout in the Winooski River upstream of the project dam and stocks brown trout in the Winooski River both upstream and downstream of the project dam. Vermont ANR states that the approximate 26-mile reach of the Winooski River from Bolton Falls Dam downstream to Essex 19 Dam is of strategic importance to the agency in that a 4.4-mile portion of this reach is one of only seven locations in Vermont that is managed under special wild trout regulations. It is also home to the blacknose shiner, which is classified as 'extremely rare' by Vermont's Natural Heritage Inventory Program and is a species of special conservation concern to Vermont ANR. Most resident fish found in the project area prefer cool, well oxygenated riverine environments with a mixture of pool, riffle, and run habitats; slow to moderate velocities; substrate mixtures of rubble, gravel, and sand with silt overlays; and abundant instream and overhead cover (Vermont FWD, 2015; 2018). Rainbow trout, fallfish, white sucker, smallmouth bass, and slimy sculpin spawn in the spring and early summer months while golden shiners, longnose dace, brown trout, and brook trout spawn in the late summer and fall months.

Migratory Fish

Landlocked Atlantic salmon and steelhead trout (migratory form of rainbow trout) migrate from Lake Champlain into the Winooski River to spawn. Upstream migrating salmon and trout entering the Winooski River first encounter the Chace Mill Project (also known as the

Winooski One Project, FERC No. 2756) where they are trapped, trucked, and subsequently released into the Winooski River upstream of Chace Mill Dam. Steelhead trout are released immediately upstream of Chace Mill Dam where their upstream movements are blocked by the next dam upstream (i.e., the non-FERC licensed Gorge 18 Dam). Landlocked Atlantic salmon are trucked further upstream and are subsequently released in the reach between Essex 19 Dam (FERC No. 2513) and Bolton Falls Dam where they can access approximately 26 miles of additional habitat, including spawning habitat. The trap and truck program has been provided at the Chace Mill Project since 1993. The program typically operates from mid-March to mid-May and again from October to mid-November. Steelhead trout are targeted in the spring while landlocked Atlantic Salmon are targeted in the fall. Fall salmon counts at the Chace Mill Project for the period 1993-2019 ranged from 1 to 189 individuals with an average of 52 salmon captured each year. Downstream passage is provided at all three dams downstream of Bolton Falls (i.e., Essex 19, Gorge 18, and Chace Mill). Therefore, adult and juvenile salmon utilizing the reach downstream of Bolton Falls Dam can eventually migrate back downstream to Lake Champlain to complete their life cycle. While no salmon spawning habitat or redds have been identified in the project bypassed reach or tailrace areas, suitable spawning habitat may occur in the Winooski River downstream of the project.

Freshwater Mussels

In late July 2018, GMP conducted a mussel survey within the impoundment and approximately 0.2-mile downstream of the project dam. Surveyors identified high quality mussel habitat throughout the impoundment, especially in more stable areas with deeper water (more than three feet deep) that contained moderate flow velocities, a streambed with a mix of both fine and coarse rocky substrates, and stable streambanks. Forty-two state-listed threatened Eastern pearlshell mussel individuals were found (i.e. 41 in the impoundment and 1 in the Winooski River a short distance downstream of the project) in depths ranging from 2.5 feet to 11 feet. This represents the furthest downstream on the Winooski River the species has been recorded in the past 177 years (Biodrawversity LLC, 2018). Additionally, one common Eastern elliptio was found in the upper reach of the impoundment. Half of the mussels were found within depths of 5 feet or less which is within the zone of fluctuation for maintenance. Mussel lengths ranged from 74.0 to 140 millimeters (average of 97.1 millimeters) indicating the population is mostly composed of mature (i.e., older) adults, and the observed shell condition indicated only light shell erosion. Additional life history information for the Eastern pearlshell mussel is provided below.

Eastern Pearlshell Mussel

The Eastern pearlshell is a medium-sized mussel growing to lengths of 120 millimeters. Preferred habitat occurs in cold, well-oxygenated streams that are heavily shaded by a riparian canopy and have stable channels with substrates of coarse sand, gravel, and cobble (Geist and Auerswald 2007; Nedeau et al. 2008). The species is long-lived, with individuals reportedly living 100 years or longer (Fichtel and Smith, 1995). During the breeding season (expected from mid to late summer), males release sperm into the water column where it is then picked up by the female. Egg and partial larval development then take place within the female. Freshwater mussels have a unique reproductive strategy in that most species utilize one or more fish species as temporary hosts for their larvae (also referred to as glochidia). From late August to October,

female Eastern pearlshell mussels release their glochidia which then attach to the gills or fins of the host fish (i.e., resident trout and land-locked Atlantic salmon) where they feed as a blood parasite for periods ranging from a week to several weeks (Smith, 1976; Fichtel and Smith, 1995). When metamorphosis of the young mussel is complete, it drops from the host fish to the stream or lake bottom, where further development of the mussel begins. Eastern pearlshell mussels have the highest fecundity reported for any freshwater mussel with females capable of producing as many as 17 million glochidia annually, although four to eight million is more typical (Bauer 1987; 1994). They become sexually mature somewhere between 12 and 20 years of age and their fecundity does not diminish with age (Bauer 1987; Nedeau et al. 2008). This species also has a remarkable ability to become hermaphroditic (capable of self-fertilization) when population densities become very low (Bauer, 1987). Adults spend their lives situated in the bottom substrates of streams or lakes feeding on microscopic plants and animals, and they rarely move more than a few meters in a lifetime (Fichtel and Smith, 1995).

3.2.1.2 Environmental Effects

Run-of-River Operation and Impoundment Levels

Flow fluctuations during the operation of hydropower projects can affect shoreline littoral and riverine habitat in impoundments and downstream reaches by exposing them to periodic dewatering, making them unsuitable for aquatic biota.

GMP proposes to continue operating the project in a run-of-river mode similar to its current practice where at any given point in time, outflow approximates inflow. GMP proposes to maintain the impoundment elevation at 397.25 feet when spill flows of 75 cfs are being released over the dam for aesthetic and aquatic habitat purposes (i.e., during daylight hours from April 1 through December 15) and at 397.00 feet at other times during the year. GMP would continue to monitor impoundment levels via a pond level sensor installed near the powerhouse intake and adjust turbine wicket gates to maintain the project impoundment at the desired water level.

Vermont ANR's WQC condition B requires that the project be operated in an "instantaneous run-of-river mode with outflow equal to inflow on an instantaneous basis except for short term deviations" such as during impoundment refilling following planned or unplanned maintenance activities.

Staff Analysis

Even though the project currently operates as a run-of-river facility, total outflow can vary to a limited extent as units, gates, and spillway mechanisms (i.e., the rubber bladder) are raised and lowered to manage pond levels. As discussed previously, the rubber bladder operates through an air compressor system located on the intake structure and automatically begins to deflate in a step-wise manner when the impoundment rises more than a foot above the top of the bladder and then inflates similarly in a step-wise manner once impoundment levels decrease. Also, GMP states that following a storm or flood event when flows in the river rise quickly and the rubber bladder fully deflates, GMP staff needs to first verify that conditions are safe before

beginning the inflation sequence.¹⁹ These adjustments result in short-term fluctuations in the impoundment level and flows spilling into the bypassed reach. These fluctuations occur most frequently during and immediately following the spring run-off period (April through May) when inflows are often higher than the maximum hydraulic capacity of the powerhouse turbines and following storms or flood events.

These minor fluctuations in impoundment levels and flow spilling into the bypassed reach would continue under GMP's proposal as they do now for the reasons noted above. However, GMP's proposal to adjust the impoundment level to provide a 75-cfs spill flow to the bypassed reach would result in more frequent (i.e., twice per day) fluctuations in the impoundment level (0.25 feet) and flows in the bypassed reach between April 1 and December 15 relative to existing conditions. These minor, daily fluctuations would still maintain relatively stable impoundment levels that would protect shoreline habitat and fish or other aquatic organisms that rely on near-shore habitat in the impoundment for spawning, foraging, and cover and would avoid dewatering Eastern pearlshell mussels which are located in depths 2.5 feet or greater in the impoundment. Also, because the bypassed reach remains watered throughout the year, the daily fluctuations in flow spilling into the bypassed reach are not expected to cause dramatic shifts in water levels that would adversely affect fish and other aquatic biota in the bypassed reach or in the Winooski River downstream.

Operating the project in an instantaneous run-of-river mode where outflow always equals inflow would essentially eliminate any of the minor fluctuations that currently occur when adjustments are made to project facilities or that would occur on a daily basis between April 1 and December 15 under GMP's proposed operation. However, there is no indication that the project is technologically capable of operating under such conditions; although the project can operate such that outflow approximates inflow. Further, there is no evidence to suggest that current, minor fluctuations are adversely affecting habitat in the impoundment or downstream of the dam. Therefore, there would be little benefit to littoral and aquatic habitat in converting from current run-of-river operations to instantaneous run-of-river operation.

Bypassed Reach Flows

Under the existing license, GMP is required to maintain a 300-cfs minimum flow in the Winooski River downstream of the project which can occur via powerhouse flow releases or spill over the dam. These requirements were included in the license to maintain adequate flows during peaking operations.

Rather than providing a 300-cfs minimum flow downstream of the project, GMP proposes to continue to operate in a run-river mode and to maintain a spill flow of 75 cfs over the rubber bladder into the bypassed reach during daylight hours from April 1 through December 15 to enhance aesthetics and aquatic habitat in the bypassed reach. Leakage flows of up to 16 cfs would enter the bypassed reach through the base of the dam during the nighttime hours from April 1 through December 15 and at all times of the day during the remainder of the year. GMP

¹⁹ See telephone summary memorandum filed by Commission staff on August 6, 2021.

believes a flow of 75 cfs would satisfy the state's water quality criteria for aesthetics by providing "good aesthetic value" and would increase active circulation in the bypassed reach.

Vermont ANR initially recommended that GMP provide a continuous 150-cfs spill flow into the bypassed reach. However, WQC condition B now requires that GMP maintain a continuous 100-cfs spill flow into the bypassed reach year-round. Vermont ANR reasons that, based on habitat quality conditions (broken water surface and circulation patterns) observed during GMP's bypass habitat assessments, the best habitat conditions in the bypassed reach occurred at the highest flow observed of 217 cfs. However, based on new information provided by GMP, Vermont ANR now finds that a spillage flow of 100 cfs still "provides high-quality aquatic habitat in the bypassed reach" by maintaining a broken water surface across 45 percent of the reach, active circulation across 83 percent of the reach, and notably that these improved conditions were distributed across the entire channel. Vermont ANR contends that a flow of 75 cfs does not provide high-quality aquatic habitat to the reach, as much of the habitat on river-right (when looking downstream) did not have conditions that were deemed by Vermont ANR to be suitable.

Vermont ANR's WQC condition C requires that GMP develop a flow management and monitoring plan detailing how the project would operate in a run-of-river mode while also maintaining the required 100-cfs spill flow into the bypassed reach continuously year-round.

GMP has not indicated to the Commission that it agrees to adopt the agency's continuous 100-cfs spill flow measure as part of its proposal. However, GMP states that to provide a continuous spill of 150 cfs, it would need to maintain the impoundment level at 397.32 feet (i.e., 0.32 feet higher than existing conditions and 0.07 feet higher than proposed) and that maintaining spill flows beyond December 15 would be problematic because the impoundment often freezes over during the cold winter months. GMP states that if ice forms on the downstream side of the rubber dam, it could impede GMP's ability to inflate or deflate its rubber bladder to maintain pond levels and would not result in a uniform spill flow over the dam until the ice melts.²⁰

Staff Analysis

Water Availability for Bypassed Reach Flows

Table 4 displays the median monthly inflow at the project and the anticipated spill flow expected to enter the bypassed reach under existing conditions, GMP's proposal, and Vermont ANR's required 100-cfs spill flow year-round. The project's minimum hydraulic capacity is 365 cfs and its maximum capacity is 2,400 cfs. Under current operations, the bypassed reach remains wetted but flow is reduced to leakage most of the year, with spillage regularly occurring only in April and September.

To meet GMP's proposed and Vermont ANR's required spill flow requirements, GMP would need to curtail generation in all months except April when flows frequently exceed the

²⁰ See telephone summary memorandum filed by Commission staff on August 6, 2021.

maximum generating capacity of the project. Similarly, median flows for September are typically below the 365-cfs minimum hydraulic capacity needed for the project to generate; therefore, spill flows would be the same during this month under all three operation alternatives. In August and September, GMP would likely need to stop generating to provide a spill of 100 cfs and during daylight hours to provide its proposed flow of 75 cfs (table 4). Compared to existing conditions, GMP's proposal would result in an additional 75 cfs being spilled into the bypassed reach during daylight hours during the early summer months of May through July and during the fall months of October through middle of December. At night during these periods, up to 16 cfs would continue to leak from the dam. Vermont ANR's required operation alternative would result in an additional 100 cfs being spilled continuously into the bypassed reach during these same months as well as January through March (table 4).

Under existing conditions, there is insufficient inflow for the powerhouse to operate 42 to 68 percent of the time during the months of August and September and 10 to 24 percent of the time during June, July, and October (table 5). Under GMP's proposal, there would be insufficient inflow for the powerhouse to operate 56 to 79 percent of the time during August and September, and 19 to 39 percent of the time during June, July, and October. Under Vermont ANR's required continuous spill flow, there would be insufficient inflow for the powerhouse to operate 58 to 81 percent of the time during the months of August and September, 21 to 42 percent of the time during the months of June, July, and October, and 1 to 3 percent of the time during the months of March and November (table 5).

Additionally, under existing conditions GMP does not regularly spill during the winter months and usually can pass all inflow through the powerhouse. If GMP were required to continuously spill 100 cfs over the dam during the winter as required by Vermont ANR, GMP may not be able to maintain a continuous, uniform spill over the dam due to ice buildup on the downstream side of the rubber bladder.

Developing a flow management plan as required by Vermont ANR would help identify the impoundment level that would need to be maintained as well as any structural or operational changes needed to maintain the agency's required spill flows throughout the year. Outside of identifying how GMP would maintain spill flows during the winter, there would be no reason to develop such a plan.

Table 4. Spill flow into the bypassed reach and available generation flows under existing condition as well as proposed and recommended aesthetic spill flow alternatives. (Source: Staff)

Month	Median inflow to Bolton Falls Dam (cfs)	Existing condition		Proposed action (75-cfs spill flow during daylight hours April 1 through December 15)		Vermont ANR's required 100-cfs spill flow year-round	
		Spill flow into bypassed reach (cfs) ^a	Flow available for generation (cfs) ^a	Spill flow into bypassed reach day/night (cfs) ^b	Flow available for generation day/night (cfs) ^b	Spill flow into bypassed reach (cfs) ^c	Flow available for generation (cfs) ^c
Jan	1,122	0	1,122	0 / 0	1,122 / 1,122	100	1022
Feb	964	0	964	0 / 0	964 / 964	100	864
Mar	1,462	0	1,462	0 / 0	1,462 / 1,462	100	1,362
Apr	3,539	1,139	2,400	1,139 / 1,139	2,400 / 2,400	1,139	2,400
May	1,916	0	1,916	75 / 0	1,841 / 1,916	100	1,816
Jun	1,236	0	1,236	75 / 0	1,161 / 1,236	100	1,136
Jul	640	0	640	75 / 0	565 / 640	100	540
Aug	402	0	402	402 / 0	0 / 402	402	0
Sep	282	282	0	282 / 282	0 / 0	282	0
Oct	563	0	563	75 / 0	488 / 563	100	463
Nov	1,067	0	1,067	75 / 0	992 / 1,067	100	967
Dec	1,256	0	1,256	75 / 0	1,181 / 1,256	100	1,156

^a Under existing conditions, the powerhouse operates when flow is at or exceeds 365 cfs (minimum inflow needed to operate GMP's lowest capacity turbine unit). When inflow is below 365 cfs, the turbine wicket gates are closed and all flow is allowed to spill over the dam. When inflow exceeds 2,400 cfs (maximum combined hydraulic capacity of the powerhouse turbines), the excess flow is spilled at the dam.

^b Under GMP's proposal during daylight hours from April 1 through December 15, the powerhouse would operate when inflow is at or exceeds 440 cfs (365-cfs minimum hydraulic capacity plus providing a 75-cfs aesthetic spill flow over the dam). When inflow is less than 440 cfs during this period, the powerhouse would shut down and all flows would be passed over the dam into the bypassed reach. Inflow in excess of 2,475 cfs (2,400-cfs maximum combined hydraulic capacity plus 75-cfs aesthetic spill flow) would also be

spilled into the bypassed reach at the dam. From December 16 through March 31 and during nighttime hours April 1 through December 15, the powerhouse would operate the same as existing conditions.

^c Under Vermont ANR's required spill flow, the powerhouse would operate when inflow is at or exceeds 465 cfs (365-cfs minimum hydraulic capacity plus providing a 100-cfs spill flow) year-round. When inflow is less than 465 cfs, the powerhouse would shut down and all flows would be passed over the dam into the bypassed reach. Inflow in excess of 2,500 cfs (2,400-cfs combined maximum hydraulic capacity plus providing a 100-cfs spill flow) would also be spilled into the bypassed reach at the dam.

Table 5. Percent time there is insufficient inflow for the powerhouse to operate under existing condition and proposed and recommended aesthetic spill flows alternatives. (Source: Staff).

Aesthetic Spill Flow / Aesthetic Spill Flow + Minimum Hydraulic Capacity (cfs)	Percent of Time Inflow does not Exceed Aesthetic Spill Flow + Minimum Hydraulic Capacity by Month (i.e., powerhouse is shut down)											
	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
0 / 365	0%	0%	0%	0%	0%	10%	23%	42%	68%	24%	0%	0%
75 / 440	0%	0%	1%	0%	0%	19%	31%	56%	79%	39%	0%	0%
100 / 465	0%	0%	3%	0%	0%	21%	34%	58%	81%	42%	1%	0%

Effects on Aquatic Habitat

In October 2019, GMP and Vermont ANR staff observed habitat conditions in the bypassed reach under various spill flows (i.e., 0 cfs/leakage, 15 cfs, 50 cfs, 75 cfs, 150 cfs, and 217 cfs) that were being evaluated as part of GMP's *Aesthetic Flow Study* (discussed further in section 3.2.5, *Aesthetic Resources*). At the request of Vermont ANR, GMP conducted a supplemental study in November 2021 to: observe habitat conditions in the bypassed reach at spill flows of 100 cfs and 125 cfs (alternatives not originally assessed in the 2019 study); and observe conditions at spill flows of 75 cfs and 150 cfs a second time. The assessment team used the following metrics to compare habitat conditions in the bypassed reach under each of the spill flow alternatives: (1) the percentage of the wetted area within the bypassed reach with a broken surface, and (2) the percentage of wetted area within the bypassed reach with active water circulation. Study participants assumed that stagnant or less turbulent conditions would represent poorer riverine pool habitat conditions whereas a higher percentage of broken surface and active water circulation would be expected to represent higher quality riverine pool habitat for fish and other aquatic biota. The results of the bypass habitat assessments are shown in table 6. Photographs of conditions in the bypassed reach taken during the assessments for the different spill flow alternatives are provided in Appendix E of this EA.

Table 6. Bypassed Reach Habitat Assessment Results (source: license application; GMP's Bypassed Habitat Assessment Revised Final Study Report filed on December 3, 2021)

Spill Flow (cfs)	Percent of Reach with Broken Surface	Percent of Reach with Active Circulation
0 (leakage)	10-15	25
15	25	35
50	33	50
75	40	75
100	45	83
125	51	85
150	55/60*	90/92*
217	92	100

* The assessment conducted in 2019 and the supplemental assessment conducted in 2021 yielded slightly different results for the 150-cfs spill flow alternative. During the 2019 assessment, the evaluation team indicated a spill flow of 150 cfs resulted in 60 percent of the reach showing a broken surface and 92 percent of the reach showing active circulation. During the 2021 supplemental study, the assessment team found a flow of 150 cfs resulted in 55 percent of the reach showing a broken surface and 90 percent of the reach showing active circulation.

When the dam isn't spilling, leakage flow through the dam provides localized flow in the center of the channel leaving the remaining left and right sides of the reach mostly stagnant. Under the 15-cfs spill flow, water movement in the center of the bypassed reach channel was slightly wider with some broken surface and circulation occurring on the river-left side of the reach (when looking downstream). Circulation increased significantly on the river-left and somewhat on the river-right side of the bypassed reach under the 50 and 75 cfs spill flows with the largest jump in active circulation occurring under the 75-cfs spill flow. Habitat metrics further improved in the center and river-right side of the channel under spill flows of 100 cfs and

125 cfs, including an eddy (i.e. swirling water) forming on the river right-channel under the 125-cfs spill flow. Under the 150-cfs spill flow, observers stated there were few areas lacking active circulation. Under the highest spill flow of 217 cfs, water movement and circulation were prevalent throughout the bypassed reach.

Even though the bypassed reach remains wetted throughout the year under existing conditions, GMP's proposal to provide additional spill flow over the dam would increase circulation in the pool habitat below the dam which would enhance aquatic habitat conditions for fish and mussels in the bypassed reach, particularly during the drier months of July through October when water temperatures tend to be warmer, DO concentrations are lower, and flow in the reach is often slower and more stagnant. GMP's proposal to spill 75 cfs into the bypassed reach would triple the percent of the reach with a broken surface and active circulation during daylight hours from May through mid-December compared to existing conditions. In addition, maintaining spill flows in the summer under both flow alternatives would help to aerate water and may result in a very slight cooling in summer water temperatures due to the dilution of heat energy (Poole and Berman, 2001) which could provide a minor beneficial effect on dissolved oxygen concentrations and water temperatures in the bypassed reach during the summer and early fall months compared to existing conditions.

Vermont ANR's required 100-cfs spill flow would provide a greater benefit by maintaining 83 percent active circulation in the bypassed reach throughout the year (both day and night) compared to 25 percent active circulation maintained in the reach under existing conditions and 75 percent active circulation maintained in the reach during daylight hours from April 1 through December 15 under GMP's proposal.

Project Operation Monitoring

Although compliance measures do not directly affect environmental resources, they assist the Commission in determining whether a licensee is complying with the environmental requirements of a license. Therefore, operational compliance monitoring and reporting are typical requirements in Commission-issued licenses.

GMP does not propose any formal measures for monitoring and reporting compliance with its proposed operating mode (i.e., run-of-river operation, maintaining impoundment levels, spill flows). However, GMP states that its automated monitoring and control system can continuously monitor impoundment levels and adjust project flow-regulating facilities in real time. The system consists of a pond level sensor installed near the powerhouse intake that continuously monitors impoundment levels and automatically adjusts powerhouse flows and the rubber bladder to maintain impoundment levels at the desired elevation.²¹ GMP indicates that its automated system is capable of logging impoundment water surface elevations and powerhouse flow levels at 15-minute intervals, but it does not currently transmit the data to the internet. GMP would continue to use the automated system to maintain compliance with its proposed run-of-river and any spill flow operating requirements.

²¹ See August 6, 2021 telephone summary memorandum.

Vermont ANR's WQC condition C requires that GMP include as part of a flow management plan a method for continuous monitoring and reporting of flow releases at the project (including spill flows, turbine discharge, impoundment levels, and inflows), that the plan include provisions for the flow data "to be available on a near real-time basis",²² and that the plan include procedures for reporting deviations from operating requirements to Vermont DEC within 15 days of the deviation indicating the cause, severity, and duration of the deviation, observed or reported adverse environmental impacts from the incident, pertinent data, and measures to be taken to avoid recurrences.

Staff Analysis

GMP's existing automated impoundment level monitoring and control system would be sufficient to monitor compliance with its proposed run-of-river operation and spill flow requirements. This is because the pond level sensor coupled with logging generation outflow would adequately demonstrate compliance with maintaining defined impoundment levels and any required spill flows in 15 minute intervals, which would be indicative of run-of-river operation. Additionally, the aesthetic flow study results show that GMP can use the existing pond level sensor to provide its proposed 75-cfs spill flow or higher spill flows up to 217 cfs by operating the rubber dam in an inflated position and maintaining the impoundment elevation at pre-determined elevations.

Vermont ANR's requirement to monitor inflows, outflows, and spill over the dam and make the data "available on a near real-time basis" could also be used to monitor compliance with run-of-river operation and spill flow releases. However, we are not aware of any existing stream gages in or near the project's impoundment, in the bypassed reach, or immediately below the powerhouse that could be used for continuous real-time monitoring and reporting. To monitor and report inflow, outflow, and spill on a "near real-time basis" would require GMP to install and operate at least two stream gages that are capable of continuously monitoring stream flows and transmitting the data in real-time.²³ However, because GMP's existing impoundment level monitoring and control system would be sufficient to monitor compliance with project operating requirements, there would be no project-related benefits from requiring GMP to install and operate new stream gages to monitor inflows and bypassed reach flows at the project in real time.

In regard to reporting deviations from operating requirements, GMP does not formally propose to maintain a log of project operation, nor does it propose to report any deviations from its proposed operating requirements to the Commission. While reporting deviations to Vermont

²² Vermont ANR does not indicate the frequency of monitoring that would be needed to satisfy its condition but requires that the data be "available on a near-real time basis." However, staff assumes this could be achieved via continuous monitoring and reporting at 15-minute intervals.

²³ Although there is no stream gage that is capable of monitoring outflows from the powerhouse, GMP's existing automated monitoring system is capable of continuously monitoring powerhouse outflows and recording them at 15-minute intervals.

DEC as required by WQC condition C would assist GMP and Vermont DEC in tracking compliance with GMP's operating requirements, it would not be sufficient for the Commission to determine compliance with the operating requirements of the license. Developing an operation compliance monitoring plan that includes GMP's proposed operation monitoring procedures with requirements to maintain a log of project operation and report deviations to the Commission and Vermont ANR would also enable the Commission to track compliance with the operating requirements of the license and WQC.

Impoundment Drawdowns for Project Maintenance

Under existing conditions, GMP periodically (up to 10 times annually) draws the impoundment down five feet to maintain the dam or its flow regulating equipment (i.e., patches or repairs to the rubber bladder, removal of large woody debris, repairs to intake and headgate infrastructure, etc.). There are no limits in the existing license on the timing of planned maintenance activities, but GMP typically conducts these activities during the low-flow summer or early fall period when weather conditions are more favorable and the powerhouse would already be shut down at times due to insufficient inflows. GMP proposes to continue this practice under any subsequent license issued.

Vermont ANR's WQC condition G requires that GMP develop a water level management plan that includes measures GMP would take to protect freshwater mussels during planned maintenance drawdowns of the impoundment and that the plan be reviewed and approved by Vermont ANR prior to GMP submitting the plan to FERC. While the WQC did not specify any operational measures that should be included in the plan, Vermont ANR's comments on the draft EA recommend that the plan include provisions to avoid maintenance drawdowns during the mussel breeding season, plan drawdowns to occur on cool and overcast days, limit the duration of the drawdown "as much as possible," and that the plan include a "protective drawdown rate."

WQC condition G also requires that GMP notify and receive approval from Vermont DEC prior to drawing down the impoundment and other maintenance activities, if the work may have a "material adverse effect on water quality or cause less-than-full support of an existing use or a beneficial value or use of State waters."

Staff Analysis

Due to their sedentary nature and limited mobility, freshwater mussels can become exposed during impoundment drawdowns for the maintenance and repairs of project facilities. Because these events can last for several weeks (or more) and involve rapid changes in water levels that exceed the movement ability of freshwater mussels, such maintenance activities could cause mussels to become stranded, desiccate, and possibly die (Galbraith et al., 2015).

GMP's mussel survey conducted in late July of 2018 found that half (21 out of 42) of the Eastern pearlshell mussels were within water depths of 5 feet or less which would be within the zone of fluctuation for maintenance drawdowns. Prior to the survey, GMP drew down the impoundment twice, once from May 29 to June 28 to repair the inflatable rubber bladder and again from July 19 through July 24, four days prior to conducting the mussel survey. The fact that live mussels were found within the fluctuation zone following these events suggests that

Eastern pearlshell mussels can survive and persist during and immediately following typical maintenance drawdowns at the project. Nonetheless, drawing down the impoundment during the sensitive late summer breeding season and early fall months of September and October when female Eastern pearlshell mussels are expected to be releasing larval stages into the water column (Smith, 1976; Fichtel and Smith, 1995) could expose these sensitive life stages to dewatering and potentially result in their desiccation and death if they were present within the five-foot maintenance fluctuation zone. Thus, avoiding planned maintenance drawdowns from the late summer through early fall months (i.e., August 16 through October 31) would minimize exposure of these sensitive mussel life stages to temporary dewatering and desiccation.

Vermont ANR's requirement that GMP develop a water level management plan to protect mussels from dewatering during planned maintenance drawdowns lacks any specific measures for Commission staff to evaluate at this time. Other than avoiding drawing down the reservoir during the breeding season as noted above and relocating mussels found in the drawdown zone to deeper waters during the drawdown, we are not aware of any other measures that could be taken to avoid dewatering mussels. If GMP were required to relocate mussels during a maintenance drawdown, they would likely need to perform targeted surveys in the areas around the impoundment known to contain mussels in water depths five feet or less and use divers to collect and transport mussels quickly underwater (same day they are collected) to deeper areas with similar substrate preferably in locations where other mussels are located. Vermont ANR's other recommendations to conduct maintenance drawdowns on "cool and overcast days" and limit the duration of drawdowns "as much as possible" could further reduce exposure of mussels to direct sunlight and high temperatures during planned maintenance performed during the summer months. However, these measures are not likely to be needed given that Eastern pearlshell mussels at the project site have been shown to survive and persist during and immediately following the typical maintenance drawdowns at the project, including following the extended drawdowns previously performed in July which is typically the hottest month of the year. Further, it may be impractical to time maintenance activities around such variable weather conditions.

Vermont ANR's recommendation that GMP develop "a protective drawdown rate" lacks specificity. However, the benefits to mussels of restricting the rate at which GMP draws down the impoundment water level to perform maintenance would be limited due to the species' sedentary nature and low mobility.

Notifying and receiving feedback from Vermont DEC prior to conducting a planned drawdown as required by Vermont ANR's WQC condition G would allow the agency to make recommendations to GMP to minimize adverse effects to mussels that may result from such maintenance drawdowns. However, Vermont ANR's requirement that GMP receive approval from Vermont DEC prior to performing planned or unplanned maintenance repairs could limit GMP's ability to complete needed repairs in a timely fashion.

Fish Impingement and Entrainment

The passage of large volumes of water through trash racks and turbines can result in fish impingement and entrainment mortality at hydropower projects. Blade strikes are thought to be the primary source of mortality for fish entrained through hydropower projects although the

physical properties of turbine units also play a role in turbine mortality (Franke et al., 1997; Pracheil et al., 2016). Fish size also plays an important role in entrainment susceptibility and turbine mortality, with smaller fish more likely to be entrained but experience lower turbine mortality compared to larger fish (Čada et al., 1997; Winchell et al., 2000; Pracheil et al., 2016).

GMP proposes to maintain the project's existing trash racks at the intake which are currently 27 feet wide, 43 feet high, angled 70 degrees from the horizontal plane, and contain a total of 87, 0.5-inch-thick trash rack bars with a 3-inch clear spacing between the bars.

No entity has recommended modifying or replacing GMP's existing trash racks. However, Vermont ANR's WQC condition D requires that GMP consult with Vermont FWD prior to the next planned replacement of the trash racks regarding the trash rack design, placement, and appropriate bar clearance spacing and file the design information with Vermont DEC for approval prior to replacing the racks.

Staff Analysis

Fish in the impoundment that approach the intake may swim away after approaching the rack, become impinged on the rack if they are too big to pass through the rack openings and cannot overcome the anticipated water velocities at the rack, or become entrained into the penstock where they would encounter the project's Kaplan turbines before being discharged to the Winooski River through the powerhouse tailrace flows. To assess the potential for entrainment and impingement of resident fish found in the project impoundment, GMP conducted a desktop evaluation comparing the body size of target fish (i.e., rainbow trout, brown trout, brook trout, fallfish, longnose dace, golden shiner, white sucker, smallmouth bass, and slimy sculpin²⁴) to the spacing in the existing trash rack as well as the relative swim speeds of the target fish to the estimated approach velocities expected to be experienced by fish as they approach the trash rack.

Based on GMP's literature review of fish sizes and relative body widths, all target fish species assessed (both adult and juveniles) would be expected to fit through the 3-inch trashrack openings (see table 7). Thus, the risk of impingement on the existing trash rack at the Bolton Falls Project is expected to be very low.

Table 7. Size ranges of resident fish utilizing the impoundment and the maximum size expected to pass through the trash racks with 3.0-inch bar spacing, based on the body width scaling factors in Smith (1985).

Species	Length Range (inches)	Maximum Length of fish expected to be able to pass through 3-inch bar spacing (inches)
Rainbow Trout	12 to 20	26

²⁴ GMP used mottled sculpin as a surrogate for slimy sculpin in its desktop entrainment and impingement analysis study.

Brown Trout	10 to 18	25
Brook Trout	8 to 22	25
Fallfish	7 to 20	23
Longnose Dace	2.5 to 4.5	22
Golden Shiner	3 to 8	28
White Sucker	12 to 20	21
Smallmouth Bass	10 to 18	23
Mottled Sculpin	3 to 4.5	20

Although the 3-inch bar spacing on the trash rack would not physically exclude resident fish from entering the penstock, some individuals approaching the intake could be deterred by the trash rack and attempt to avoid entrainment by swimming back upstream away from the intake. To determine whether any resident fish could swim back upstream after approaching the intake, we compare the fishes swimming capabilities with the estimated range of approach and through velocities at the trash rack under the minimum and maximum hydraulic capacities of the turbine. At the minimum hydraulic capacity of 365 cfs, the approach velocity would be about 0.30 feet per second (fps). At the maximum hydraulic capacity of 2,400 cfs, the approach velocity would be about 2.07 fps.²⁵ In addition, as fish reach the trash rack, velocities increase as water is forced to pass through a smaller surface area. At the minimum hydraulic capacity of 365 cfs, the through velocity for water passing between the trash rack bars would be about 0.40 fps. At the maximum hydraulic capacity of 2,400 cfs, the through velocity would be about 2.54 fps.²⁶

Based on available burst swim speeds for juvenile and adult resident fish shown in table 8 below, the maximum 2.07-fps approach velocities and 2.54 fps through velocities at the trash rack could be overcome by most resident adult and juvenile fish, except for golden shiner, juvenile white sucker, juvenile smallmouth bass, and juvenile sculpin. However, even if golden shiners and other juvenile resident fish were entrained through the project, they would be expected to exhibit high turbine survival (greater than 90 percent) through the project's Kaplan turbines due to their small size (Winchell et al., 2000). Therefore, continuing to maintain the project's existing trash racks, as proposed by GMP, would not be expected to adversely affect resident fish populations residing in the project impoundment.

²⁵ The approach velocity was calculated by dividing the hydraulic capacity of the turbine over the total cross-sectional area of the trash rack at the intake (about 1,161 square feet at normal pool elevation).

²⁶ The through velocity was calculated by dividing the hydraulic capacity of the turbine over the estimated cross-sectional area of the trash rack where water can actually pass through versus being blocked by bars, etc. (about 946 square feet at normal water surface elevation).

Table 8. Expected burst speeds of adult and juvenile resident fish expected in the Bolton Falls impoundment. (Source: license application)

Species	Burst Speed (fps) ^a		Source
	Adult	Juvenile	
Rainbow Trout	2.4 to 11.5	3.6 to 5.8	Domenici and Blake, 1997; Froese and Pauley, 2010
Brown Trout	7.0 to 12.7	2.7 to 7.1	Bell, 1991
Brook Trout ^b	7.0 to 12.7	1.8 to 3.5	Bell, 1991
Fallfish ^c	0.8 to 4.1	-	Bell, 1991
Longnose Dace	3.8 to 4.4	1.9 to 3.4	Aedo et al., 2009
Golden Shiner ^d	1.4 to 1.8	-	Bell, 1991
White Sucker	5.2 to 10.2	1.4 to 2.2	MTO, 2006; Bell, 1991
Smallmouth Bass	3.5 to 5.6	1.5 to 2.1	Peake, 2004; Bell, 1991
Mottled Sculpin	3.6 to 4.3	1.4 to 1.7	Aedo et al., 2009

^a Burst speed is the swim speed a fish can maintain for a short period of time (i.e., for a few seconds).

^b GMP did not find burst speeds for adult brook trout in its literature review but assumed burst speeds for adult brook trout would be the same or similar to adult brown trout.

^c GMP did not find direct burst speeds for adult or juvenile fallfish in its literature review but estimated burst speeds using swim speeds reported for “chub” (Bell, 1991) which are similar in size to fallfish.

^d GMP did not find direct burst speeds for juvenile golden shiner in its literature review.

GMP has not proposed to modify or replace its existing trash racks and there is no evidence to suggest that entrainment of small, juvenile resident fish is having an adverse effect on resident fish populations at the project. Further there is no information to suggest that the trash racks have reached the end of their useful lives or will do so in the near future. Therefore, there would be no apparent resource benefit from a license condition requiring GMP to consult with Vermont FWD and Vermont DEC prior to the next planned replacement of the trash racks as required by Vermont ANR.

Debris Management

GMP states that project personnel regularly clean the intake trash racks, conduct general groundskeeping, and periodically clear debris from the Day Use picnic area and parking lot after floods but does not indicate how or where it disposes of the debris.

Vermont ANR’s WQC condition F requires that “debris associated with Project operations shall be disposed of in accordance with state laws and regulations.” Vermont ANR

states that depositing or emitting debris and other solids²⁷ to state waters would violate Vermont's solid waste laws and standards and notes that debris that is not properly disposed of may also impair aesthetics and boating at the project.

Staff Analysis

Organic and inorganic debris typically collect on the intake trash racks of a hydroelectric project. Although no debris piles or other solids have been observed at the project, periodic disposal would prevent accumulation of unsightly debris and keep that debris from entering the river where it could degrade water quality. Developing a debris disposal plan would avoid misunderstandings and guide how and when GMP is to remove and dispose of debris.

3.2.2 Terrestrial Resources

3.2.2.1 Affected Environment

Terrestrial habitat within the project boundary consists of upland habitat; riverbanks and mud flats; cliffs, rock outcrops, and rocky areas; and sand and cobble shore. The upland habitat is a mixture of deciduous and coniferous trees, such as maple species and white pine. The riverbanks are vegetated with silver maple, green ash, American elm, willows, sedges, and rushes. Palustrine forest and scrub-shrub wetlands exist downstream of the Bolton Falls Dam, most notably on the southern side of the river east of Power Plant Rd.

GMP surveyed project land for rare, threatened, and endangered plants. The study area included the entire area within the project boundary and adjacent lands within an approximately 50-foot-wide buffer. No federal or state-listed threatened or endangered plant species were found. However, three species listed as rare by the state were located during the study: creeping lovegrass, stout goldenrod, and hay sedge. A previously known occurrence of creeping lovegrass, comprising hundreds of plants, was identified at the project's Day Use Area. A previously undocumented occurrence of an individual stout goldenrod plant was observed growing out of a crevice in a rock outcrop immediately upstream from the dam. A previously undocumented occurrence of hay sedge was identified within the overhead transmission line right-of-way south of the dam; the number of plants was not disclosed. In addition, GMP found invasive plant species such as reed canarygrass, purple loosestrife, and Japanese knotweed in the survey area.

Wildlife

Upland, riverbank, cliff, and shore habitats in the vicinity of the Bolton Falls Project support a variety of wildlife species, including resident and migratory birds, herptiles, and small and large mammals. Many raptor species, such as red-tailed hawk, osprey, and bald eagle, use habitat in the Winooski Valley (GMP, 2020). Herptiles common to the area include spotted

²⁷ Vermont ANR does not define debris or other solids. We assume that they are referring to wood, tires, and other floating trash that could be caught on the trash racks or collected from the Day Use picnic area or parking lot after a flood.

salamander, American toad, green frog, painted turtle, northern water snake, and garter snake. Mammals common to the area include eastern chipmunk, gray squirrel, porcupine, black bear, and white-tailed deer (GMP, 2020).

No wildlife studies were requested and GMP did not conduct surveys for any animal species. However, in its comments on the Pre-Application Document, Vermont ANR expressed concern that project flow regulation might jeopardize the future viability of local populations of the cobblestone tiger beetle, which is state-listed as threatened.

The monarch butterfly was listed as a candidate species under the ESA on December 17, 2020. The monarch butterfly exclusively uses milkweed (*Asclepias* spp.) as its larval host plant. The project is located within the range of the eastern migratory population of the monarch butterfly. The license application provides no information about butterfly occurrences at the project, but common milkweed was documented within project transmission lines and general uplands (GMP, 2020b). Therefore, Monarch butterflies could use project lands for summer breeding, but are not known to overwinter near the project area.

3.2.2.2 Environmental Effects

Transmission Line Effects on Raptors

Some electric transmission designs can cause raptor electrocutions or collisions, resulting in injury or mortality. The project includes an approximately 730-foot-long transmission line, consisting of a 130-foot-long underground section that connects the powerhouse to a project switchyard, and a 600-foot-long overhead section that connects the project switchyard to a second project switchyard containing an interconnection with the regional grid. GMP states that it routinely utilizes a number of general company-wide measures to protect birds from interference with overhead utility infrastructure, such as the use of bird guards on transmission line structures to prevent contact between a bird and electrical current, time of year restrictions on maintenance activities to avoid the nesting season when a legally protected bird or avian species of concern is nesting, installing osprey platforms on top of power poles, and relocating raptor nests as necessary when transmission line operation would interfere with bird use of the nest. Therefore, GMP states that it expects that continued operation of the overhead transmission line would have no significant effects on raptors and other birds. GMP did not propose and no one recommended any measures to protect raptors.

Staff Analysis

Several raptor species use habitat in the Winooski Valley, including the bald eagle. Many birds, especially raptors, select power poles for perching and sometimes for nesting. Raptors and other large birds can be electrocuted if they simultaneously contact two energized conductors or an energized part and a grounded part. In addition, collision with the transmission line may result in avian injury or mortality.

There are no reports of raptor electrocutions or collisions at the project; therefore, GMP's existing measures are adequate to protect raptor species.

Special Status Plants and Animals

Three state-designated rare plant species have been identified within the project boundary—creeping lovegrass, stout goldenrod, and hay sedge—that may be affected by project operation, maintenance, and recreation. In addition, the state-listed threatened cobblestone tiger beetle and ESA-candidate monarch butterfly may be affected by project operation.

In the RMP, GMP proposes to minimize trampling of the population of creeping lovegrass at the Day Use Area by placing large boulders and signage at the western end of the picnic area to direct recreationists away from areas where the plant grows.

No entity filed any recommended measures specific to special status plants and animals at the project.

Staff Analysis

Creeping Lovegrass

A vigorous population of the rare creeping lovegrass grows on generally sandy or fine gravelly substrate in the project Day Use Area. GMP's survey results suggest that approximately 20 percent of the population is being impacted by public recreational use. This conclusion is based on the lack of creeping lovegrass in the highest-traffic portions of the area, and the plants' greater density and vigor, as indicated by larger plants with more flowering and fruiting heads, where foot traffic appeared to be less frequent. The survey also noted, however, that the portions of the public recreation area that were more heavily used by the public were also generally less naturally suitable for creeping lovegrass; the species typically grows in substrate that remains wet or somewhat wet throughout the growing season, and the parts of the Day Use Area that showed evidence of the greatest public use were slightly higher, where the sand was drier. Notwithstanding less favorable moisture conditions, a small number of creeping lovegrass plants were observed in the drier portion of the public recreation area, and GMP suggested that the entire area would be potentially suitable habitat, but for the ongoing disturbance by recreationists using the area for river access and other recreation. GMP stated that assuming that the frequency and intensity of public recreational use continues to be similar to current levels, the anticipated direct impact to creeping lovegrass from the project would be slight and insufficient to put the population at risk of significant decline or extirpation from this site. GMP's proposed use of boulders and signs to prevent trampling would help minimize project recreational use conflicts.

Stout Goldenrod

Stout goldenrod was not identified in any area designated for power generation or recreation, and GMP observed no impacts or disturbance to the single stout goldenrod plant growing on the exposed rock outcrop near the dam. However, the survey noted evidence of informal human access to the area in the form of graffiti on the rocks and food wrappers and miscellaneous garbage. GMP does not propose and no one recommends any measures to limit human access to the area and potential disturbance to the stout goldenrod plant. Continued operation and maintenance of the project would be unlikely to affect this species.

Hay Sedge

A previously undocumented occurrence of hay sedge was identified within the overhead transmission line right-of-way south of the dam. Vegetative cover in the transmission line right-of-way is dominated by blackberry, birch saplings, bracken fern, and hay-scented fern, and the hay sedge plants were found growing in small areas with a lower cover density than surrounding areas. The right-of-way would continue to be maintained by cutting tall shrubs and saplings to prevent woody vegetation from growing to a height that threatens the overhead lines. GMP's existing vegetation management maintains the right-of-way in an early-successional, open condition that has created favorable hay sedge habitat. Therefore, continued operation and maintenance would be likely to continue to benefit this species.

Cobblestone Tiger Beetle

The known distribution of the cobblestone tiger beetle in Vermont consists of island or shore cobble habitat associated with three rivers: the Winooski River, the White River, and the West River. The two documented occurrences along the Winooski River are several miles downstream from the project: one at the mouth of the Huntington River (about 7 miles downstream from the dam) documented in 1997, and the other in Richmond (about 11 miles downstream from the dam) documented in 2008. Cobblestone tiger beetle habitat consists of cobblestone bars often found on the upstream sides of islands, as well on spits connected to the river shore. Adults spend much of their time in cobblestone habitat but may also forage on nearby sand banks or riverbanks.

Cobblestone tiger beetle habitat is created and maintained by natural hydrological disturbances, including ice scour, spring freshets, and flooding. Vegetation density may be reduced by scour, and sand and suitable cobbles may be deposited during flood events (FWS, 2018). The U.S. Fish and Wildlife Service (FWS) identified river flow regulation from the construction and operation of hydropower projects as one of the largest risks to the long-term viability of the species.

However, GMP's proposal and Vermont ANR's recommendation to continue to operate the project in a run-of-river mode would not significantly affect river flows and would not prevent the occurrence of hydrological disturbances that are needed to create and maintain cobblestone tiger beetle habitat; therefore, operations would have no effect on known downstream populations of cobblestone tiger beetle.

Monarch Butterfly

Vegetative cover in the transmission line right-of-way would continue to be maintained by cutting tall shrubs and saplings to prevent woody vegetation from growing to a height that threatens the overhead lines. GMP's existing vegetation management maintains the right-of-way in an early-successional, open condition that has created favorable habitat for milkweed. Therefore, continued operation and maintenance is likely to continue to benefit milkweed and provide opportunity for monarchs to breed.

Impoundment Drawdowns for Project Maintenance

As previously discussed in section 3.2.1.2 *Aquatic Resources, Environmental Effects*, GMP periodically (up to 10 times annually) draws the impoundment down five feet to maintain the dam or its flow regulating equipment and drawdowns typically range from less than a day to about a month for more lengthy repairs (average duration is about a week). There are no limits in the existing license on the timing or duration of planned maintenance activities, but GMP typically conducts these activities during the low-flow summer or early fall period when weather conditions are more favorable and the powerhouse would already be shut down at times due to insufficient inflows. GMP would continue this practice under the term of any license issued.

Vermont ANR's WQC condition G requires that GMP develop a water level management plan that includes measures GMP would take to protect aquatic biota and wildlife in wetlands impacted by maintenance-related drawdowns and that the plan be reviewed and approved by Vermont ANR prior to GMP submitting the plan to FERC. The WQC does not elaborate on what aquatic biota and wildlife the plan is targeting to protect or what measures might be implemented. However, Vermont ANR's comments on the draft EA suggest that the measure is intended primarily to protect mussels (discussed above in section 3.2.1.2).

Staff Analysis

Aquatic biota and wildlife in wetlands may be affected by the frequency, duration, seasonality and rate of impoundment drawdowns. Drawing down the impoundment for maintenance would temporarily dewater wetlands at the impoundment shoreline and expose some slower moving invertebrates and amphibians to desiccation and predation. Avoiding drawing down the impoundment during the mussel breeding season (i.e., August 16 through October 31) to minimize adverse effects to sensitive mussel life stages would reduce potential effects on shoreline soil moisture, reduce vegetation desiccation and protect wetland habitat for wildlife during a season when inflows to the impoundment are at their lowest. However, there is no evidence in the project record to suggest that the short-term, periodic drawdowns that occur at the project adversely affect aquatic biota, wildlife residing in wetlands, or have resulted in long-term impacts to wetland habitat.

3.2.3 Threatened and Endangered Species

3.2.3.1 Affected Environment

The FWS Information for Planning and Consultation (IPaC) database indicates that the threatened northern long-eared bat (*Myotis septentrionalis*) and candidate monarch butterfly (*Danaus plexippus*) have the potential to occur within the project boundary.²⁸ There are no proposed or designated critical habitats in the project area.

²⁸ See Interior's official lists of threatened and endangered species, accessed by staff using the IPaC database (<https://ipac.ecosphere.fws.gov>) on March 3, 2022, and placed into the records for Docket No. P-2879-012 on the same day. The new review resulted in the addition of the monarch butterfly.

Northern Long-eared Bat

The northern long-eared bat (NLEB) was listed as a federally threatened species on May 4, 2015.²⁹ In January 2016, the FWS finalized the ESA section 4(d) rule for this species, which focuses on preventing effects on bats in hibernacula associated with the spread of white-nose syndrome³⁰ and effects of tree removal on roosting bats or maternity colonies (FWS, 2016a). As part of the 4(d) rule, take incidental to certain activities conducted in accordance with the following habitat conservation measures, as applicable, would not be prohibited: (1) occurs more than 0.25-mile from a known, occupied hibernacula; (2) avoids cutting or destroying known, occupied maternity roost trees during the pup season (June 1 through July 31);³¹ and (3) avoids cutting or destroying any tree within a 150-foot radius of a known, occupied maternity tree during the pup season.

Traditional ranges for the NLEB include most of the central and eastern U.S., as well as the southern and central provinces of Canada, coinciding with the greatest abundance of forested areas. The NLEB, whose habitat includes large tracts of mature, upland forests, typically feeds on moths, flies, and other insects. These bats are flexible in selecting roost sites, choosing roost trees that provide cavities and crevices and with a diameter of 3 inches or greater at breast height.³² Human-made structures, such as buildings, barns, bridges, and bat houses can be considered potential summer habitat. However, trees found in highly developed urban areas (e.g., street trees, downtown areas) are unlikely to be suitable NLEB habitat (FWS, 2014). NLEB are generally active from April through October (FWS, 2015, FWS, 2016b), and hibernate over the winter season. Winter hibernation typically occurs in caves and areas around them and can be used for fall-swarming³³ and spring-staging.³⁴

²⁹ 80 Fed. Reg. 17,974.

³⁰ A hibernaculum is where a bat hibernates over the winter, such as in a cave. White-nose syndrome is a fungal infection that agitates hibernating bats, causing them to rouse prematurely and burn fat supplies. Mortality results from starvation or, in some cases, exposure.

³¹ Pup season refers to the period when bats birth their young.

³² Diameter at breast height refers to the tree diameter as measured about 4 to 4.5 feet above the ground.

³³ Fall-swarming fills the time between summer and winter hibernation. The purpose of swarming behavior may include: introduction of juveniles to potential hibernacula; copulation; and gathering at stop-over sites on migratory pathways between summer and winter regions.

³⁴ Spring-staging is the time period between winter hibernation and migration to summer habitat. During this time, bats begin to gradually emerge from hibernation and exit the hibernacula to feed, but re-enter the same or alternative hibernacula to resume daily bouts of torpor (i.e., a state of mental or physical inactivity).

The project is located within the white-nose syndrome buffer zone for this species.³⁵ The Vermont Natural Resources Atlas indicates that no known NLEB hibernacula sites occur within 0.25 mile of the project, and no known maternity roost trees occur within 150 feet of the project (Vermont ANR, 2021). Further, no critical habitat has been designated for NLEB. Although there is no documentation of NLEB use of habitat at or near the project, upland forests within the project boundary may provide suitable habitat for NLEB summer roosting and foraging activities.

3.2.3.2 Environmental Effects

The following discussion addresses environmental effects on threatened and endangered species that would result from relicensing the Bolton Falls Project under the Staff Alternative with Mandatory Conditions for the purposes of consultation under section 7 of the ESA. This alternative includes relicensing the project with all staff-recommended environmental measures and modifications to GMP's proposal as outlined in section 2.3 of this EA, as well as the mandatory measures outlined in section 2.4 of this EA.

Staff Analysis

GMP states that maintenance activities at the Bolton Falls Project during the term of a new license would require periodic mowing and tree trimming, but no information suggests that tree removal occurring at the project would have the potential to affect NLEB maternity roost habitat. Therefore, we conclude that relicensing the Bolton Falls Project under the Staff Alternative with Mandatory Conditions may affect the NLEB, but any incidental take that may result is not prohibited by the final 4(d) rule.

3.2.4 Recreation Resources

3.2.4.1 Affected Environment

Project Recreation Facilities

The Bolton Falls Project offers a variety of day-time recreational opportunities within the project boundary, including boating, fishing, swimming and picnicking. No camping is permitted. The project has two recreation facilities maintained by GMP: the Day Use Area and a canoe portage. The Day Use Area is located approximately 600 feet south of the dam and accessed from River Road. It consists of a parking lot with room for 12 vehicles, a grassy picnic area with one grill, and an unimproved put-in for canoes and non-motorized boats. The canoe portage consists of an un-improved boat landing upriver from the dam (i.e., portage take-out), and an approximately 0.5-mile-long trail that crosses Power Plant Road and connects the take-

³⁵ The white-nose syndrome buffer zone encompasses counties within 150 miles of a U.S. county or Canadian district in which white-nose syndrome or the fungus that causes white-nose syndrome is known to have infected bat hibernacula.

out and put-in (see Figure 3 in section 2.1.1, *Existing Project Facilities* showing the locations of the project recreation facilities).

Besides parking at the Day Use Area, recreationists can also park in two informal parking areas. The first is located along Power Plant Road at a large flat overflow lot just before River Road divides to go to the Day Use Area or to the powerhouse. The second is a small pullout along Power Plant Road between the overflow parking area and the project powerhouse (see Figure 3). GMP also provides a portable restroom open to the public along Power Plant Road just outside of the gate to the powerhouse and dam (approximately 300 feet north of the Day Use Area).

Recreation Use, Capacity, and Needs

GMP conducted a *Recreational Resources Use and Needs Assessment* in 2018 to assess use of project recreational facilities and to identify opportunities to improve recreation at the project. The study characterized types of use, capacity, conditions of project facilities, and assessed future recreation needs related to public access to project lands and waters through spot counts, visitor intercept surveys, and supplemental trail camera monitoring. GMP also implemented an online survey to collect data from potential users.

Total recreational use at the project was estimated to be 7,442 recreation days³⁶ for the period of April through October 2018. An estimated 92 percent of the recreational use occurred at the Day Use Area and 8 percent occurred at the portage area. The most popular recreation activities were boating (combined kayaking, canoeing, and tubing accounting for 39 percent of total use), fishing from the shore (25 percent), and wading and swimming (10 percent). Picnicking, wildlife viewing, biking, and hunting each accounted for less than 10 percent of recreational use. The Day Use Area parking lot was utilized at 8 percent of its total capacity, on average, during non-peak summer weekends. During peak recreation periods, the Day Use Area parking lot was at 92 percent of capacity (11 of the 12 spaces occupied) on the fourth of July and at 100 percent of capacity during the Onion River Race and Ramble in June, when 21 vehicles were observed parked at the Day Use Area lot and in the informal overflow parking areas along Power Plant Road. Surveys at the portage area recorded only two users throughout the study period. Spot counts recorded zero users. Trail camera imagery reviewed as part of the study recorded an average of 0.15 boaters using the portage per day.

Visitor surveys were collected from 48 respondents. Results revealed most recreationists were satisfied with project recreation facilities and opportunities. The most common suggestions of how project recreation could be improved included adding toilet facilities and removing litter. Other suggestions included adding trash cans, picnic tables, improving the portage take-out, and improving signage.

³⁶ A recreation day is defined as each visit by a person to the project for recreational purposes during any portion of a 24-hour-period.

3.2.4.2 Environmental Effects

To manage project recreation facilities, GMP proposes to implement the Recreation Management Plan (RMP) filed with its license application. The plan includes enhancements to the Day Use Area and portage take-out and assessments of recreation use and needs every 10 years. Proposed improvements to the Day Use Area include: (1) relocating the primary parking area out of the floodplain to minimize maintenance following flood events; (2) placing large boulders and new signs at the western end of the grassy picnic area to redirect users away from areas that contain creeping lovegrass, a state-designated rare plant; (3) adding two picnic tables, including one for persons with disabilities, to the grassy area west of the existing parking area; and (4) adding an information kiosk at the north end of the existing parking area. Information to be provided at the kiosk includes a site map with the locations of the Day Use Area, portage, and the existing portable restroom, allowed uses, and instructions for users to pack out all garbage. GMP proposes to relocate the primary parking area to the informal overflow parking area at the junction of Power Plant Road and the entrance to the Day Use Area. The informal parking area would be improved by graveling the existing grassy lot, and providing 16 standard parking spaces and one additional parking space that would be designed to accommodate persons with disabilities. Access to the existing parking area would be blocked by boulders and left in its existing condition. Users would be required to walk approximately 400 feet to access the Day Use Area, via the existing gravel access road.

GMP also proposes to improve the portage by clearing vegetation, grading, and installing a 12-foot wide concrete level slab at the take-out, installing timber steps from the take-out to the top of the bank where it joins the portage trail; improving signage at the take-out so that boaters can locate the take-out; and clearing vegetation along the portage trail and ensuring signage is adequate to guide boaters to the put-in.

GMP proposes to implement all of its proposed enhancement measures within two years of license issuance.

Vermont ANR's WQC condition E requires that GMP develop a plan and implementation schedule for recreation enhancements and that the plan and schedule be subject to approval by Vermont ANR prior to implementation.³⁷

Staff Analysis

Improvements to the Day Use Area and Portage Take-Out

The addition of two picnic tables to the Day Use Area would provide visitors a place to sit, enjoy a snack or meal, and take in the surrounding views, where none currently exist. The addition of the information kiosk would enhance visitor enjoyment of project facilities by directing them to the location of Day Use Area and portable restroom. The existing portable restroom is located close to the project access road and powerhouse, which facilitates GMP

³⁷ Vermont ANR does not specify whether GMP's proposed RMP would satisfy its WQC condition E or whether a new or modified plan would need to be developed.

maintenance and reduces vandalism. Similarly, while there are no trash receptacles at the Day Use Area, current low levels of use most of the time do not warrant adding trash receptacles to the Day Use Area. Instructing users to pack out all garbage through improved signage as proposed by GMP should be sufficient to maintain trash at the site except during peak weekend use. More clean-up and maintenance of the recreation area may be required following peak periods, such as the July 4th holiday and during the Onion River Race and Ramble.

Enhancing the portage take-out, improving signage, and increasing vegetation and other maintenance measures at exit points near the river would improve public egress from project waters. Providing a 12-foot wide concrete level slab would allow recreation users to land their boats safely and disembark onto a firm landing above the water line and have less of an impact on riparian vegetation.

Redirecting foot traffic to avoid adverse impacts to creeping lovegrass would increase protection to this state listed, rare species (discussed previously in section 3.2.2.2, *Terrestrial Resources, Environmental Effects*) and would not be expected to have adverse impacts to recreation.

Relocating the Primary Parking Area Out of Floodplain

The project currently provides parking for up to approximately 34 vehicles (i.e., 12 vehicles in the existing Day Use Area parking lot, 17 vehicles in the overflow parking area along Power Plant Road, and an additional 5 vehicles that can park in the informal pullout located along Power Plant Road between the overflow parking and the project powerhouse). GMP states that the existing Day Use parking lot floods to varying degrees approximately 3 to 5 times per year. Damages from flooding include erosion of the gravel parking lot and littering of the parking area and Day Use Area with debris. Occasionally, during more extreme flooding events, signage at the Day Use Area is damaged or lost. Depending on the degree of damage for any given flood, GMP states that work crews spend between 5 to 40 hours cleaning and repairing the Day Use Area parking lot and annual costs for these activities range from approximately \$10,000 to \$30,000.

GMP's proposal to close vehicle access to the Day Use Area and redirect drivers to the overflow lot would reduce GMP's maintenance requirements. It would also reduce total parking capacity from 34 vehicles to 22 vehicles (17 at the over flow lot and 5 at the informal pullout). The Day Use Area parking lot was utilized at 8 percent of its total capacity, on average, during non-peak summer weekends and was observed to be near or at capacity only on certain peak holidays and special events (e.g., such as the Onion River Race when a maximum of 21 cars were observed in the Day Use Area parking lots and pull-out). Thus, the 22 spaces that would remain between the overflow parking lot and the informal pullout should provide sufficient parking most of the time.

However, relocating parking to the overflow lot would also require users to walk about 400 feet to the Day Use Area along grades that could pose a challenge for those with limited mobility and discourage the use and purpose of adding a picnic table designed to provide for the needs of persons with disabilities to the Day Use Area. In GMP's June 1, 2020 filing, it considered four alternatives for providing user access to the Day Use Area, but did not propose

to modify its RMP to include these additional measures. These four alternatives included: (1) paving the existing parking lot to provide two accessible parking spaces and 21 standard spaces at a total capital and operation cost over the course of the 40-year license estimated at \$1,157,000; (2) in addition to their current proposal to relocate the parking area to the overflow lot, GMP would pour a concrete slab in a portion of the existing lot to provide 2 accessible parking spaces and a turn-around area at a total cost over the course of the 40-year license estimated at \$848,000; (3) GMP would close the existing access road and relocate the parking area to the over flow lot as it currently proposes, but would raise the existing access road to reduce the slope to provide better access from the relocated parking area for persons with disabilities at a total cost over the course of the 40-year license estimated at \$540,000; and (4) no action, which would leave the existing lot as-is, with no improvements, with a total cost over the course of the 40-year license estimated at \$800,000.

Paving the existing parking lot or leaving the existing lot in its current condition would continue to provide users with the same level of access as they currently experience, but would still require GMP to maintain the lot following flood events (e.g., clearing debris etc.). In addition to annual flood maintenance, GMP states that paving would increase its maintenance requirements because it would need to strip the asphalt down to the subbase every 2 years, and strip, relevel, and repave the entire surface of the lot every eight years.

Paving a portion of the existing parking lot would provide limited parking for persons with disabilities and a turn-around for those wishing to drop off a boat closer to the Day Use Area compared to the informal lot. However, GMP states the lifespan of the concrete slab needed to provide the parking is estimated at twenty years and would have to be replaced at least once during the course of the license. GMP states it would also need to regrade the lower turnaround area and replace eroded material every 8 years in addition to annual flood maintenance. Also because GMP would still allow cars to enter the Day Use Area in this scenario, it would need to ensure signs are adequate to redirect most drivers to the informal lot while informing drivers that the parking adjacent to the Day Use Area is limited to persons with disabilities and those temporarily dropping off boats or other recreation equipment.

Raising the access road to reduce the slope would provide better access for persons with disabilities from the overflow lot down to the Day Use Area while decreasing GMP's Day Use Area maintenance requirements. The reduced slope would also make it easier to carry boats down to the river from the overflow lot.

Revising the Recreation Management Plan

GMP's proposed RMP would provide a framework for GMP to operate and maintain all existing project recreation facilities, enhance existing recreation facilities, and monitor recreation use and needs over the term of any new license. However, the RMP needs to be updated because it does not include adding a picnic table for persons with disabilities because GMP committed to this measure after filing the RMP. In addition, the RMP lacks details about the revised design of the portage take-out that were described in GMP's AIR response letter filed on June 1, 2020. Modifying the plan to include these measures would provide clear direction on what GMP is proposing and facilitate Commission administration of the license. Consulting with Vermont ANR on the revised plan prior to filing it with the Commission would allow the agency to

provide additional feedback on the provisions included in the plan to enhance recreation at the Bolton Falls Project.

3.2.5 Aesthetic Resources

3.2.5.1 Affected Environment

Project Setting

Vermont Route 100 from the towns of Waterbury to Stowe is classified by the State of Vermont as a state scenic byway (State of Vermont, 2019). The 14.5-mile stretch, known as the Green Mountain Byway, offers views of the northern peaks of the Green Mountains to the west and the Worcester Mountain range to the east. Vermont's highest peak, Mount Mansfield, is visible for much of the byway. The road is spotted with forests and small villages containing historic homes, farms, and mills. Activities along the byway include hiking, skiing, snowshoeing, paddling, fishing, and biking. Points of interest near the project area include the Waterbury Reservoir and Waterbury railroad station.

The Winooski River from the confluence of Alder Brook to the confluence of the Little River (starting approximately 2.2 miles upstream of the project dam) is categorized as "stressed" aesthetically due to the presence of nutrient enrichment, siltation and turbidity, habitat alteration, urban runoff, gravel road runoff, and eroding and de-vegetated streambanks (Vermont DEC, 2008).

The area adjacent to the project is relatively undeveloped. Both riverbanks are forested with the exception of a power line right-of-way that runs perpendicular to the Winooski River just upstream of the project dam. Below the project dam and powerhouse, a small, unforested peninsula contains rip rap on its banks. The Vietnam Veteran Memorial Highway (US Route 89) runs parallel to the Winooski River in Waterbury, but the river and project are not clearly visible from the roadway. River Road and a railroad run parallel to the Winooski River in Duxbury, but the Project is not clearly visible from the roadway. The dam is visible to the public from the Day Use Recreation Area.

As discussed previously in section 3.2.1.1 *Aquatic Resources, Affected Environment*, the Winooski River in the vicinity of the project is designated as a Class B(2) water under the State of Vermont's Water Quality Standards which are managed to support multiple designated uses, including aesthetics. The management objectives for waters designated as Class B(2) for aesthetics is to achieve and maintain "good aesthetic quality" and the criteria for rivers are "water character, flows, water level, bed and channel characteristics, and flowing and falling water of good aesthetic value" (see table 3 in section 3.2.1.1).

Aesthetic Flow Study

GMP conducted an aesthetic flow study on October 4, 2019, which involved Vermont ANR and GMP staff observing a series of demonstration spill flows over the dam and describing their aesthetic value. The observed spill flows were 0 cfs (leakage), 15 cfs, 50 cfs, 75 cfs, 150

cfs, and 217 cfs.³⁸ The assessment team members evaluated the overall aesthetics from a publicly accessible vantage point located approximately 500 feet downstream of the project dam near the project's Day Use Area. Each observer considered water character, flows, water level, as well as bed and channel characteristics for each spill flow. Following the individual assessments, a "consensus" form was filled out to reflect the group's overall judgment on each demonstration flow. Below is a summary of the results of the aesthetic flow demonstration study. Photographs taken during the study for each of the test flows is included in Appendix E of this EA.

The 0-cfs (leakage) scenario provided "poor to fair aesthetic value" at the vantage point. Study participants noted that there was no water spilling over the dam and the historic stonework of the dam was visible. In addition, there was some water movement in the bypassed reach resulting from the leakage flow through the dam.

The 15-cfs spill flow provided "fair aesthetic value" at the vantage point. There was some water spilling over the left portion of the dam (when looking downstream); however, this spill was somewhat obscured by the powerhouse.

The 50-cfs spill flow provided "fair to good aesthetic value" at the vantage point. There was an increase in the width of overall spill across the dam and the spill veil was fuller in some areas. On river right (when looking downstream), water was seen flowing over the bedrock outcropping below the abutment.

The 75-cfs spill flow provided "good aesthetic value" at the vantage point. Water was spilling over the full width of the dam at this flow, with variability in the thickness of the veil. A second cascade formed over the bedrock outcropping below the right abutment as the flow increased from 50 to 75 cfs.

The 150-cfs spill flow provided "very good aesthetic value" at the vantage point. The spill veil was thicker over the width of the dam, and a spray mist began to form. The cascades along the bedrock outcropping below the right abutment were also more prevalent.

The 217 cfs spill flow provided "very good aesthetic value" at the vantage point. This flow provided the highest veil thickness, the highest amount of spray mist, and the highest flow cascading along the bedrock outcropping.

3.2.5.2 Environmental Effects

Diverting flow for generation affects the amount of flow available to pass over the dam, which in turn can affect the aesthetic quality of the environment for recreational users that are able to view it.

³⁸ At the request of Vermont ANR, GMP conducted a supplemental study in November 2021 to observe habitat conditions in the bypassed reach under spill flows of 100 cfs and 125 cfs but did not conduct an aesthetic evaluation of these flows.

GMP proposes to modify its current operations to provide a 75-cfs flow or inflow, whichever is less, into the bypassed reach via spill over the dam during daylight hours from April 1 through December 15 to enhance aesthetics and aquatic habitat downstream of the dam. GMP would provide leakage flow into the bypassed reach during the remainder of the year (i.e., nighttime hours from April 1 through December 15 and daytime and nighttime hours from December 16 through March 31).³⁹

Vermont ANR's WQC condition B requires that the project maintain a continuous (both day and night) 100-cfs spill flow over the dam year-round to enhance aesthetics and aquatic habitat downstream of the dam.

Staff Analysis

Based on the results of the aesthetic study, spill flows do not become aesthetically pleasing until at least 50 cfs is flowing over the dam and becomes increasingly more pleasing as the flows increase to provide a more uniform and thicker veil of water across the dam. As explained earlier in 3.2.1.2, *Aquatic Resources, Environmental Effects*, water is rarely spilled over the dam under existing operations, except during the high flow month of April and low flow month of September. During April, median inflow (i.e., 3,359 cfs) often exceeds the maximum hydraulic capacity of the powerhouse resulting in a median spill of 1,139 cfs (see table 4). During September, the inflows are often below the hydraulic capacity of the project (365 cfs), resulting in a median spill of 282 cfs (table 4). Thus, under current operations, views of the dam are considered poor to fair much of the year because spill is often limited to leakage. Given that the recreation season typically lasts from April through October each year,⁴⁰ the project is expected to provide aesthetically-pleasing spill flows over the dam during only two of the seven months when people are recreating at the project under existing conditions.

Compared to existing conditions, providing a flow of 75 cfs during day light hours from April 1 to December 15 as proposed by GMP would provide a more aesthetically pleasing view of the dam to visitors to the Day Use Area and those boating in the river below the dam during all of the prime recreation season and spring and early fall shoulder recreation seasons. However, the benefit of providing the 75 cfs from November through March would be minimal because visitor usage is likely low to non-existent due to weather conditions (i.e., colder temperatures and icy, snowy conditions) and lack of recreational activities at the site during the winter months. Providing a continuous year-round spill flow of 100 cfs as required by Vermont ANR would provide a more aesthetically pleasing view of the dam compared to both existing

³⁹ GMP states that "nighttime hours" are defined as one half-hour after sunset to one half-hour before sunrise based on the middle date of each month. Therefore, GMP would provide aesthetic spill flows during the following hours (based on Eastern Standard Time or Daylight Savings Time) per month: April (5:40am to 8:06pm); May (4:56am to 8:42pm); June (4:38am to 9:08pm); July (4:53am to 9:04pm); August (5:26am to 8:27pm); September (6:02am to 7:32pm); October (6:38am to 6:37pm); November (6:19am to 4:54pm); and December (6:53am to 4:42pm).

⁴⁰ Trout fishing season begins in April and closes at the end of October.

operations and GMP's proposal because of a thicker veil of flow, but would also occur at times when few recreation visitors are likely to be present. For the reasons noted above, the aesthetic benefits for visitors and users is likely to be minimal during the late fall and winter months (i.e., November through March). Also, because users cannot view the dam during night-time hours, there would be no aesthetic benefit to providing spill flows at night.

3.2.6 Cultural Resources

3.2.6.1 Affected Environment

Section 106 of the NHPA requires that the Commission take into account the effects of its actions on historic properties and afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on the undertaking.⁴¹ Historic properties are those that are listed or eligible for listing in the National Register of Historic Places (National Register). The regulations implementing section 106 of the NHPA also require that the Commission seek concurrence with the State Historic Preservation Office (SHPO) on any finding involving effects or no effects on historic properties, and consult with interested Native-American tribes that attach religious or cultural significance to historic properties that may be affected by an undertaking. In this EA, we also use the term "cultural resources" for properties that have not been determined eligible for listing in the National Register. Cultural resources represent things, structures, places, or archaeological sites that can be either prehistoric or historic in origin. In most cases, cultural resources less than 50 years old are not considered historic.

On March 31, 2017, the Commission designated GMP as the non-federal representative for carrying out day-to-day consultation regarding the licensing efforts, pursuant to section 106 of the NHPA. However, the Commission remains largely responsible for all findings and determinations regarding the effects of the project on any historic property.

Area of Potential Effect

Pursuant to section 106 of the NHPA, the Commission must take into account whether any historic property could be affected by the issuance of a license within a project's area of potential effects (APE). The APE is determined in consultation with the Vermont SHPO and is defined as the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The APE for this project is defined as all lands within the project boundary and any lands within 100 feet (or 33 meters) of the project boundary. The APE encompasses the access road, substations, recreation facilities, dam, powerhouse, impoundment, transmission infrastructure, maintenance

⁴¹ An undertaking means "a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; and those requiring a Federal permit, license, or approval." 36 C.F.R. § 800.16(y). Here, the undertaking is the potential issuance of a new license for the Bolton Falls Project.

building, and tailrace. The Vermont SHPO filed a letter on October 15, 2021 stating that it concurs with the APE.

Cultural and Historical Background⁴²

Aboriginal Settlement

The archaeological record of Vermont dates back to about 10,000 years ago and is divided into five major periods known as the Archaic, the Late Archaic and Transitional, the Woodland, the Middle Woodland, and the Late Woodland periods. A few sites have been found containing Early Archaic bifurcated-base points. These sites are found in the Missisquoi, Lamoille, Winooski, and Otter Creek Valleys; interior ponds and lakes along the foothills and lowlands of the Green Mountains; and occasionally along the margins of Lake Champlain. This diversity of environmental zones suggests that human exploitation patterns were geared to a broad resource base (Mueller et al., 1979).

The Late Archaic and Transitional Period (about 6,000 to 2,000 years ago) people relied upon hunting and gathering with evidence of nut harvesting and utilization of local lacustrine and inland aquatic resources. A small circle of post molds found in Rutland County indicates small social units and a transient occupation.

The earliest evidence of the Woodland Period (about 2,500 years ago) in Vermont comes from cemeteries along the Missisquoi River in Highgate and East Creek in Orwell. Habitation sites during this time are very rare in the Northeast United States. The cemeteries contain Adena-style artifacts indicating long distance trade networks (e.g. raw materials from the Ohio Valley, shells from the mid-Atlantic, and copper from Lake Superior). Subsistence activities such as hunting, fishing, and gathering was not markedly different from the preceding Archaic Period (Mueller et al., 1979).

The Middle Woodland Period (about 1,000 to 1,700 years ago) is not yet clearly understood and there are 14 Middle Woodland sites known in the Lake Champlain drainage of the state, although many are still unexcavated. A number of these are heavily utilized sites and occur in the Lower Winooski, Lamoille, Missisquoi, and Otter Creek just before the rivers enter into Lake Champlain (Thomas and Robinson, 1979). Comparable data from the Hudson Valley suggests a continuation of hunting, fishing, and gathering activities with corn horticulture being introduced toward the end of this period.

During the Late Woodland (about 350 to 1,000 years ago) horticulture became increasingly more important while hunting, fishing, and gathering activities continued as the

⁴² The cultural and historical background is taken and generalized from the final HPMP filed on March 31, 2022, and the Pre-Application Document, filed on January 31, 2017.

main subsistence base. Habitation sites of this period are fairly common and range from large villages to small campsites and rock shelters.

Euro-American Settlement and Occupation

Euro-American settlement within Waterbury and Duxbury townships did not occur until the mid-1780's. The Winooski River has long provided a transportation corridor for populations of people and animals into to the Champlain Valley uplands and through the Green Mountains. The use of electrical power in the Waterbury community was initiated in 1891 by the Vermont Electrical Company and in 1898, construction of a log crib and earthen dam began on Bolton Falls, which was subsequently reinforced two years later by the present stone dam. The flood of record at the dam site occurred on November 4, 1927, with the dam overtopped by some 31 feet of water at a peak discharge of about 98,000 cfs. The flood damaged the powerhouse and caused the project to shut down. In October 1986, the dam was repaired and a new powerhouse was constructed and the site again generated power (Northeast Engineering Associates, Inc., 1995).

Archeological and Historic Resources Investigations

Background

The project area was among the earliest sites to be documented (late nineteenth century) as containing archaeological artifacts in Vermont. The project area was a focus of Native-American occupation for millennia; however, physical evidence of this occupation was destroyed by significant flood events, during the original hydroelectric facility construction in 1898, during dam renovations completed in the 1980's, and as a result of looting.

Prior to the relicensing efforts, only one archaeological site was recorded on the State Register of Historic Places in or near the project boundary. It is listed as the Bolton Falls site, number WA-2, which is characterized as a multicomponent prehistoric "cave/rock shelter/ledge" on the south side of the river, upstream from the dam. This site was found to contain Archaic materials and recent Iroquois clay pots, as well as a musket, in the water. Other sensitive zones which have a high potential for yielding prehistoric sites include the entire floodplain, the terrace in the southeast corner of the project, the high bluff above the dam, and the "cave" area located both above and below the existing dam infrastructure.

Investigations for Relicensing Efforts

GMP, with assistance from their contractors, VHB and the University of Vermont Consulting Archaeology Program, conducted a cultural resources assessment in December 2018 and an archaeological resources assessment in November 2019. In addition, a targeted Phase I survey of the project APE was conducted May to July 2020, followed by Phase II investigations in August and September of 2020. Details of the various survey findings and investigations are discussed below.

Historic Architectural Resources

As part of the cultural resources assessment, GMP completed a desktop review of previously surveyed properties and a systematic on-site pedestrian survey of the APE. Only one National Register-eligible above-ground cultural resource was previously identified within the APE. Other properties within the APE were previously determined ineligible due to age, previous alterations, or lack of architectural significance.

The one eligible National Register historic resource is the existing Bolton Falls stone dam constructed in 1900. The dam was determined by the Vermont SHPO to be eligible for listing in the National Register in 1981. The Secretary of the Department of the Interior determined that the property was eligible on March 19, 1981, as an early representative example of a hydroelectric generating facility.

Archaeological Resources

GMP's archaeological assessment identified more than a dozen archaeologically sensitive areas within the project's APE, including: (1) the high knoll above the dam where caves and/or rockshelters have been located, (2) discrete level sites along the portage trail and the bluff overlooking the falls and river, and (3) discrete portions of the floodplain along the left bank of the river in the impoundment. GMP's targeted Phase I surveys identified two previously unknown pre-Contact era Native-American sites overlooking the Winooski River (labeled as site VT-WA-0200 and site VT-WA-0201), and documented the two rockshelters within the previously recorded site labeled VT-WA-0008. The two identified rockshelters, designated "Eastern Rockshelter" and "Western Rockshelter" were within the approximate location of previously identified site VT-WA-0008 and located close to the existing GMP powerline access road and portage trail and, as such, appear to have been visited and impacted by public use.

The three pre-Contact era Native American sites (VT-WA-0008, VT-WA-0200, and VT-WA-0201) were evaluated as part of GMP's archaeological Phase II investigations. Overall, 43 percent of the samples produced over several hundred pre-Contact era Native-American lithic artifacts. The lithic artifacts were found no deeper than 40 centimeters below the ground surface. The Phase II investigation states that due to the very fine and silty soil, future disturbance of the soil by heavy machinery or campfire would be expected to have an adverse impact on the archaeological resources at the site.

A total of 11 test pits were excavated at the VT-WA-0201 site and preliminary laboratory analysis indicated that the site consists of only a limited artifact inventory of lithic artifacts recovered from the upper portions of the intact subsoil, 10 to 30 centimeters below the ground surface.

A total of 31 test pits and eight one-meter square test units were excavated at site VT-WA-0008. Based on these excavations, the chronology of the Western Rockshelter extends at least 400 to 4,000 years into the past and a large number of samples of collected carbonized floral elements have the potential to further extend this time frame. Subsurface testing at the Eastern Rockshelter resulted in the identification of several distinct cultural features and paleosols, both from within the shelter itself and just beyond and downslope. The Phase II Investigation found that there has likely been impacts to archaeological resources at site VT-WA-0008, because of maintenance associated with Power Plant Road and portage trail.

Furthermore, historic site looting activities and more recent recreational use of the two shelters, evidenced by campfires and refuse, indicates ongoing threats to the integrity of these sites.

All three pre-Contact era Native-American sites contain evidence of habitation minimally dating as early as 4,000 years before present, with the potential that two sites preserve evidence of even earlier Native-American use of the project APE. Based on the cumulative results of the Phase I and Phase II studies at these sites, the reports stated the sites have great integrity and all three retain data potential that makes them highly valuable archaeological properties. As a result, the surveyors concluded that site VT-WA-0008, site VT-WA-0200, and site VT-WA-0201 are significant and eligible for listing on the State and National Registers of Historic Places under Criterion D. To be eligible under Criterion D, a property must meet both of the following requirements: (1) the property must have, or have had, information to continue our understanding of human history or prehistory, and (2) the information must be considered important. The site assessment concluded that because there were no plans to undertake any actions at any of the identified archaeological sites, ongoing site protection and preservation should be adequate and that any potential threat from recreation should be addressed as part of the project's HPMP.

3.2.6.2 Environmental Effects

To protect cultural resources during the term of the license, GMP proposes to implement an HPMP⁴³ that includes: (1) management of known archaeological resources; (2) protocols for conducting additional archaeological review when undertakings have any potential to impact the historic properties within the project area; (3) identification of activities exempt from historic architectural and archaeological review; (4) consultation and reporting protocols with FERC, Vermont SHPO and other stakeholders; (5) a schedule of future evaluations on resources for historic significance; (6) procedures to address effects that occur during emergencies; (7) procedures for handling unanticipated discovery of historic properties; (8) treatment of human remains; (9) training of personnel regarding cultural resources; (10) periodic review and revision of the HPMP; and (11) procedures for dispute resolution. Management of known archaeological resources includes installing fences and signs to direct the public away from site areas without calling attention to them, and documentation of historic resources in accordance with the Vermont Division of Historic Preservation standards. In addition, GMP would monitor the three known archaeological sites by visiting the sites on an annual basis and documenting any activity, or lack thereof, via photographs and written notes and forwarding the results to a qualified archaeologist to determine if a site inspection is required for that particular year. If no site inspection is required, GMP would provide the photographs, written notes, and archaeologist's review to the Vermont SHPO. If an additional site inspection is required, the archaeologist would conduct the inspection and provide a report to GMP and GMP would provide this report to the Vermont SHPO prior to taking any further action at the sites.

Staff Analysis

⁴³ GMP filed a draft HPMP on February 12, 2021. After consulting with the Vermont SHPO, GMP filed a final revised HPMP on March 31, 2022.

The Bolton Falls dam is eligible for listing on the National Register. We concur that Sites VT-WA-0008, VT-WA-0200, and VT-WA-0201 are eligible for listing on the National Register given the highly significant archaeological properties that these sites hold in Vermont. GMP's HPMP provides a process and set of procedures to address any potential adverse effects to the Bolton Falls Dam and any other historic properties that may be found at the project for the term of a new license. The mitigation measures proposed in the HPMP should minimize impacts to archaeological resources from ongoing maintenance activities and recreation.

With execution of the PA, and implementation of the HPMP, any potential project-related adverse effect to historic properties would be adequately resolved over the term of a new license.

3.2.7 Environmental Justice

3.2.7.1 Affected Environment

In conducting NEPA reviews of proposed hydropower projects, the Commission follows the instruction of Executive Order 12898, which directs federal agencies to identify and address “disproportionately high and adverse human health or environmental effects” of their actions on minority and low-income populations (i.e., environmental justice communities).⁴⁴ Executive Order 14008 also directs agencies to develop “programs, policies, and activities to address the disproportionately high and adverse human health, environmental, climate-related and other cumulative impacts on disadvantaged communities, as well as the accompanying economic challenges of such impacts.”⁴⁵ Environmental justice is “the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies” (EPA, 2021a).

Consistent with CEQ and EPA guidance, Commission staff considers: (1) whether environmental justice communities (e.g., minority or low-income populations)⁴⁶ exist in the project area; (2) whether impacts on environmental justice communities are disproportionately high and adverse; and, if so, (3) what mitigation measures might be needed (CEQ, 1997; EPA,

⁴⁴ Exec. Order No. 12,898, 59 Fed. Reg. 7629 (Feb. 16, 1994). While the Commission is not one of the specified agencies in Executive Order 12898, the Commission nonetheless addresses environmental justice in its analysis, in accordance with our governing regulations and guidance, and statutory duty to evaluate all factors bearing on the public interest.

⁴⁵ Exec. Order No. 14,008, 86 Fed. Reg. 7619 (Feb. 1, 2021). The term “environmental justice community” includes disadvantaged communities that have been historically marginalized and overburdened by pollution. *Id.* § 219, 86 Fed. Reg. 7619, 7629. The term also includes, but may not be limited to, minority populations, low-income populations, or indigenous peoples (EPA, 2021b).

⁴⁶ *See generally* Exec. Order No. 12,898, 59 Fed. Reg. 7629 (Feb. 16, 1994). Minority populations are those groups that include: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic (CEQ, 1997 at 25).

2016). Following the recommendations set forth in *Promising Practices*, the Commission uses the fifty-percent and the meaningfully greater analysis methods to identify minority populations (EPA, 2016 at 21-25). Using this methodology, minority populations have been defined as block groups within the area of study where: (1) the aggregate minority population of the block group in the affected area exceeds 50 percent; or (2) the aggregate minority population in the block group affected is 10 percent higher than the aggregate minority population percentage in the county.⁴⁷

CEQ's *Environmental Justice Guidance* also directs low-income populations to be identified based on the annual statistical poverty thresholds from the U.S. Census Bureau (Census; CEQ, 1997). Using *Promising Practices*' low-income threshold criteria method, low-income populations are identified as block groups where the percent of low-income population in the identified block group is equal to or greater than that of the county (EPA, 2016).

To identify potential environmental justice communities for the analysis presented here, Commission staff used 2019 U.S. Census American Community Survey data for the race, ethnicity, and poverty data at the block group level (Census, 2020). For this project, staff chose a 1-mile radius around the project boundary as the area of study. The 1-mile radius includes all census block groups that border the Bolton Falls Project in two counties where the project is located – Chittenden and Washington Counties. Staff found that a 1-mile radius is the appropriate unit of geographic analysis given the limited scope of the project proposal and concentration of project-related effects on the segment of the Winooski River.

Within the study area, staff identified one census block group in which the population qualifies as an environmental justice community with a minority population meaningfully greater than the minority population within their surrounding counties (see Table 9 and figure 5 below). The identified block group is Census Tract 9543, Block Group 2 in Washington County.

No block groups meet the threshold for environmental justice communities on the basis of low income status.⁴⁸

⁴⁷ Here, Commission staff selected “county” as the comparable reference community to ensure that affected environmental justice communities are properly identified. A reference community may vary according to the characteristics of the particular project and the surrounding communities.

⁴⁸ Data from the 2019 U.S. Census American Community Survey File # B01017 and File # B03002, the most recently available data, were used as the source for race, ethnicity, and poverty data at the census block group level (U.S. Census Bureau, 2020).

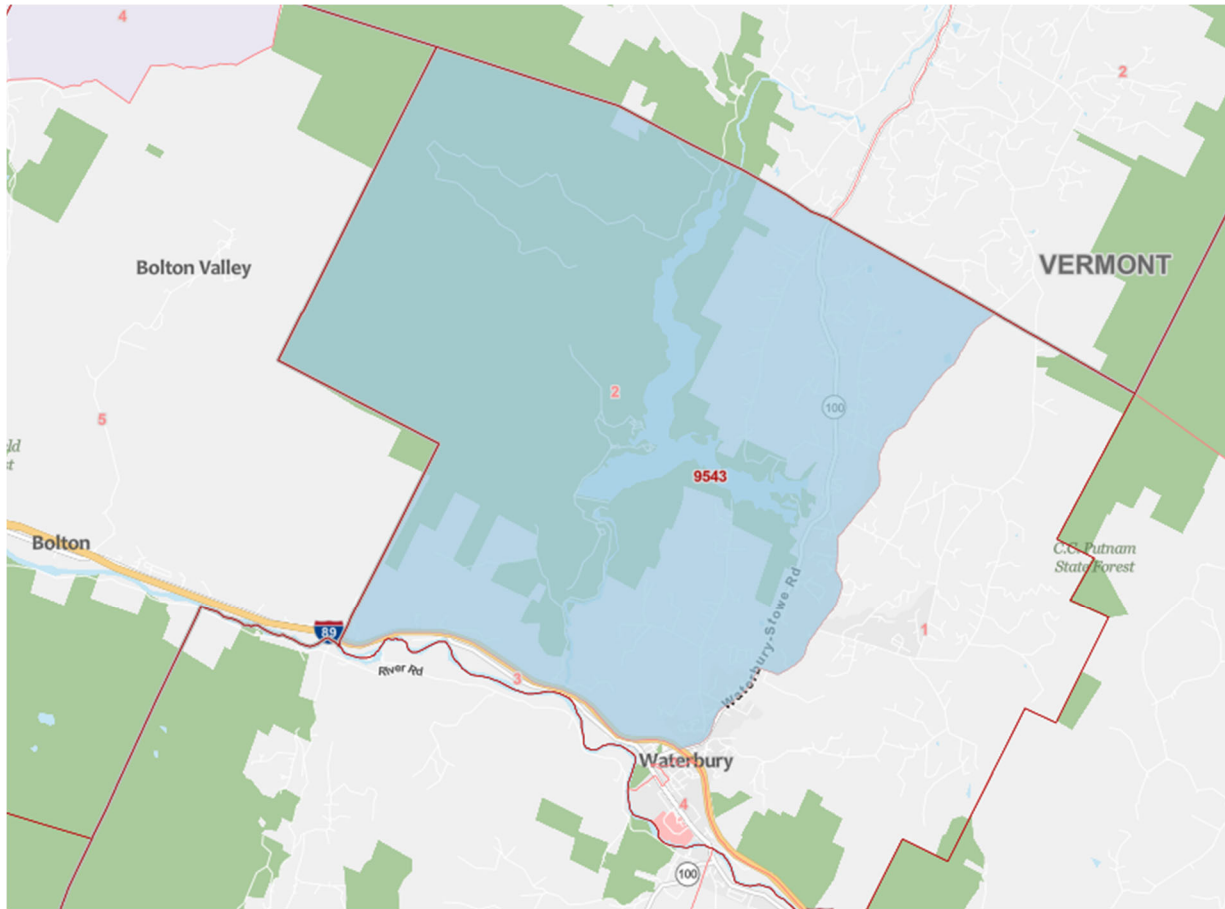


Figure 5. Environmental Justice Community (Census Tract 9543, Block Group 2 within 1-mile of the project boundary (source: United States Census Bureau).

Table 9. Minority and low-income populations within one mile of the project boundary. (Source: U.S. Census Bureau, 2020, as modified by staff).

Area	Race and Ethnicity										Low Income
	Total Population	White (%)	African American/ Black (%)	American Indian / Alaska Native (%)	Asian (%)	Native HI & Other Pacific Islander (%)	Some Other Race (%)	Two or More Races (%)	Hispanic Origin (any race) (%)	Total Minority Population (%)	Households in Poverty (%)
Vermont	n = 624,313	92.8% n= 579,340	1.3% n= 7,901	0.3% n= 1,807	1.7% n= 10,393	.05% n= 296	0.1% n= 758	1.9% n= 11,780	1.9% n= 12,038	7.2% n = 44,973	11.2%
Chittenden County	n = 162,646	88.5% n= 143,961	2.6% n= 4,206	0.2% n= 346	4% n= 6,509	.05% n= 83	0.2% n= 339	2.1% n= 3,389	2.3% n= 3,813	11.5% n = 18,685	11.8%
Census Tract 29, Block Group 4	n = 1,240	94% n = 1,166	0.4% n = 5	0.2% n = 3	1.4% n = 17	0% n = 0	0% n = 0	2.3% n = 28	1.7% n = 21	6% n = 74	1.4%
Washington County	n = 58,350	94.2% n = 54,957	0.8% n= 494	0.2% n= 112	0.8% n= 483	.06% n= 35	.04% n= 24	1.9% n= 1,110	1.9% n= 1,135	5.8% n = 3,393	9.8%
Census Tract 9543, Block Group 2	n = 1,755	93% n = 1,632	0% n = 0	0% n = 0	0% n = 0	0% n = 0	0% n = 0	4.2% n = 73	2.8% n = 50	7% n = 123	7.5%
Census Tract 9543, Block Group 3	n = 515	98.1% n= 505	0% n = 0	0% n = 0	1.9% n = 10	0% n = 0	0% n = 0	0% n = 0	0% n = 0	1.9% n = 10	6.6%
Census Tract 9544, Block Group 3	n = 1,160	95.7% n = 1,110	0% n = 0	0% n = 0	2.1% n= 24	0% n = 0	0.3% n = 3	1.6% n = 18	0.4% n = 5	4.3% n = 50	8.3%

Note: Gray shading indicates an environmental justice community.

3.2.7.2 Environmental Effects

As described in section 2.2.2, *Proposed Operation and Environmental Measures*, GMP proposes and Vermont ANR's WQC requires that the project continue to be operated in a run-of-river mode while also providing spill flows over the dam into the bypassed reach. As previously discussed in section 3.2.4, *Recreation Resources*, GMP proposes to improve the project's Day Use Area by adding two picnic tables, an information kiosk, and relocating the primary parking area out of the floodplain to the existing informal lot and laying gravel and creating 17 parking spaces. GMP also proposes to install a 12-foot-wide concrete level slab and construct timber steps leading from the take-out to the top of the bank where it joins the portage trail. Lastly, GMP proposes to place large boulders and new signs at the western end of the grassy picnic area to redirect users away from areas that contain creeping lovegrass, a state-designated rare plant.

No entity provided comments or recommendations regarding the effects of the project on environmental justice communities in response to the Commission's notice that the application was ready for environmental analysis.

Staff Analysis

GMP proposes no changes to project operation that would adversely affect environmental resources, including water supply, water quality or fisheries. Continuing to operate in a run-of-river mode with minimal impoundment fluctuations would protect aquatic and riparian habitat and would have no effect on water supply or other aquatic resources. Construction activities associated with modifying GMP's recreation facilities would be of short duration and scope and are unlikely to negatively affect noise, visual resources, or traffic within the identified environmental justice community, given that the community is located across the river from the proposed construction. Although the concentration of recreation use at the Bolton Falls Project could increase as a result of planned improvements to the Day Use Area, portage take-out, and portage trail, the site is unlikely to experience large increases in usage that would adversely affect the identified community through increases in traffic or overfishing. In summary, continuing to operate the project, as proposed with the staff-recommended measures, would not result in a disproportionately high and adverse impact on the environmental justice community present within the project area.

4.0 DEVELOPMENTAL ANALYSIS

In this section, we look at the project's use of the Winooski River for hydropower generation to see what effect various proposed or recommended environmental measures would have on the cost to operate and maintain the project and on the project's power generation. Under the Commission's approach to evaluating the economics of hydropower projects, as articulated in *Mead Corp.*,⁴⁹ the Commission compares the current cost to produce project power

⁴⁹ See *Mead Corp.*, 72 FERC ¶ 61,027 (July 13, 1995). In most cases, electricity from hydropower would displace some form of fossil-fueled generation, in which fuel cost is the largest component of the cost of electricity production.

to an estimate of the cost to provide the same amount of energy and capacity⁵⁰ for the region using the most likely alternative source of power (cost of alternative power). In keeping with the policy described in *Mead Corp.*, our economic analysis is based on current electric power cost conditions and does not anticipate or estimate changes in fuel costs that could occur during a project’s license term.

For each of the licensing alternatives, our analysis includes an estimate of: (1) the annualized cost of providing the individual measures considered in the EA; (2) the cost of the most likely alternative source of project power; (3) the total annual project cost (i.e., for construction, operation, maintenance, and environmental measures); and (4) the difference between the cost of the current alternative source of project power and the total annual project cost. If the difference between the cost to produce an equivalent amount of power from an alternative source and the total annual project cost is positive, the project produces power at a cost less than the cost of producing power from the most likely least-cost source of alternative power. If the difference between the alternative source of power’s annual cost and the total annual project cost is negative, the project costs more to produce power than the cost to produce an equivalent amount of power from the most likely least-cost source of alternative power. This estimate helps support an informed decision concerning what is in the public interest with respect to a proposed license. However, project economics is only one of many public interest factors the Commission considers in determining whether, and under what conditions, to issue a license.

4.1 POWER AND DEVELOPMENTAL BENEFITS OF THE PROJECT

Table 10 summarizes the assumptions and economic information used in the analysis. Most of this information is provided by the applicant in its license application. Some is developed by Commission staff. The values provided by the applicant are typically reasonable for the purposes of our analysis. If they are not, it is noted below. Cost items common to all alternatives include taxes and insurance; estimated capital investment required to develop the project or major modifications for relicensing; licensing costs; normal operation and maintenance cost; and Commission fees. All costs are adjusted to current year dollars.

Table 10. Parameters for economic analysis of the Bolton Falls Project (source: license application; staff) (All costs are escalated from 2019 and 2020 to 2022).

Parameter	Value
Installed capacity	7.5 MW
Average annual generation (under no action alternative)	26,301 MWh
Period of analysis	30 years
State and local property tax	\$232,266

⁵⁰ We use the term “Capacity benefit” to describe the benefit a project receives for providing capacity to the grid, which may be in the form of a dependable capacity credit or credit for monthly capacity provided.

Parameter	Value
Insurance rate	Included in the Operation and Maintenance (O&M) cost
Interest rate	5.5%
Application cost	\$413,645
Operation and maintenance ^a	\$225,000/year
Cost of Alternative Power (2020) ^c	
1) Energy cost (2021)	\$63.27/MWh
2) Dependable Capacity Cost (2021)	\$162.14/kW-year
^a The annual operation and maintenance cost includes insurance, interim replacements, and administrative and general costs associated with the operation of the project.	
^b The Commission collects an annual administration charge for all licensed projects which is based on the authorized installed capacity of the project and amount of federal land occupied by the project.	
^c The alternative source of power cost is based on the current cost of providing the same amount of generation and capacity from a natural gas-fired combined cycle plant, as reported by The U.S. Energy Information Administration, Annual Energy Outlook 2022, for the Division 1, New England Region. The total cost of alternative power, reported in table 11, is a combination of the cost of energy and capacity benefit.	

4.2 COMPARISON OF ALTERNATIVES

Table 11 summarizes the installed capacity, annual generation, capacity benefit, alternative source of power's cost, estimated total project cost, and difference between the alternative source of power's cost and total project cost for each of the alternatives considered in this EA: no-action, the applicant's proposal, the staff alternative, and the staff alternative with mandatory conditions.

Table 11. Summary of the annual cost of alternative power and annual project cost for four alternatives for the Bolton Falls Project (source: staff).

	No Action	Applicant's Proposal	Staff Alternative	Staff Alternative with Mandatory Conditions
Installed capacity	7.5 MW	7.5 MW	7.5 MW	7.5 MW
Annual generation	26,301 MWH	25,660 MWH	25,766 MWH	24,231 MWH
Capacity benefit ^a	6.25 MW	5.63 MW	5.63 MW	4.37 MW
Current alternative source of power cost ^b	\$2,677,439	\$2,536,356	\$2,543,063	\$2,243,269

	No Action	Applicant's Proposal	Staff Alternative	Staff Alternative with Mandatory Conditions
Total annual project cost (2022) ^c	\$480,513	\$541,716	\$552,741	\$644,733
Difference between the alternative source of power cost and total annual project cost	\$2,196,926	\$1,994,640	\$1,990,322	\$1,598,536

- ^a Staff estimated the capacity benefit based on the ratio of the mean annual flow available for generation for each of 12 months, and the hydraulic capacity of the project. This ratio is multiplied by the authorized installed capacity to determine the capacity benefit.
- ^b The value of power for the Bolton Falls Project is based on the alternative source of power cost in the New England Region, as identified in table 10 above.
- ^c Project costs include the cost of environmental measures listed in table 12 in Appendix C (with the exception of the spill flow opportunity cost which is already reflected in the reduced annual generation under the applicant's proposal and staff alternative relative to the no action alternative), and the costs identified in table 10. All project costs were adjusted to 2022 dollars.

4.2.1 No-Action Alternative

Under the No-Action alternative, the project has an installed capacity of 7.5 MW, a capacity benefit of 6.25 MW, and an average annual generation of 26,301 MWh. The alternative source of power's current cost to produce the same amount of energy and provide the same capacity benefit is \$2,677,439. The total annual project cost is \$480,513. Subtracting the total annual project cost from the alternative source of power's current cost, the project's cost to produce power and capacity is \$2,196,926 less than that of the alternative source of power's cost.

4.2.2 Applicant's Proposal

Under the applicant's proposal, the project would have a total installed capacity of 7.5 MW, a capacity benefit of 5.63 MW, and an average annual generation of 25,660 MWh. When compared to current conditions, generation would be reduced by 641 MWh/year from maintaining a spill flow of 75 cfs over the dam during daylight hours from April 1 through December 15. The alternative source of power's current cost to produce the same amount of energy and provide the same capacity benefit would be \$2,536,356. The total annual project cost would be \$541,716. Subtracting the total annual project cost from the alternative source of power's current cost, the project's cost to produce 25,660 MWh of power and 5.63 MW of capacity would be \$1,994,640 less than that of the alternative source of power's cost.

4.2.3 Staff Alternative

Under the staff-recommended alternative, the project would have a total installed capacity of 7.5 MW, a capacity benefit of 5.63 MW, and an average annual generation of 25,766 MWh. When compared to current conditions, generation would be reduced by 535 MWh/year from maintaining a spill flow of 75 cfs over the dam during daylight hours from April 1 through October 31. The alternative source of power's current cost to produce the same amount of energy and provide the same capacity benefit would be \$2,543,063. The total annual project cost would be \$552,741. Subtracting the total annual project cost from the alternative source of power's current cost, the project's cost to produce 25,766 MWh of power and 5.63 MW of capacity would be \$1,990,322 less than that of the alternative source of power's cost.

4.2.4 Staff Alternative with Mandatory Conditions

Under the staff-recommended alternative with mandatory conditions, the project would have a total installed capacity of 7.5 MW, a capacity benefit of 4.37 MW, and an average annual generation of 24,231 MWh. When compared to current conditions, generation would be reduced by 2,070 MWh/year at an opportunity cost of about \$79,112 annually from maintaining a spill flow of 100 cfs over the dam continuously year-round. The alternative source of power's current cost to produce the same amount of energy and provide the same capacity benefit would be \$2,243,269. The total annual project cost would be \$644,733. Subtracting the total annual project cost from the alternative source of power's current cost, the project's cost to produce 24,231 MWh of power and 4.37 MW of capacity would be \$1,598,536 less than that of the alternative source of power's cost.

4.3 COST OF ENVIRONMENTAL MEASURES

Table 12 in Appendix C presents the cost of each of the environmental enhancement measures considered in our analysis for the Bolton Falls Project. All costs are in 2021 dollars. We convert all costs to equal annual (levelized) values over a 30-year period of analysis to give a uniform basis for comparing the benefits of a measure to its cost.

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 COMPREHENSIVE DEVELOPMENT AND RECOMMENDED ALTERNATIVE

Sections 4(e) and 10(a)(1) of the FPA require the Commission to give equal consideration to the power development purposes and to the purposes of energy conservation; the protection, mitigation of damage to, and enhancement of fish and wildlife; the protection of recreational opportunities; and the preservation of other aspects of environmental quality. Any license issued shall be such as in the Commission's judgment will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for all beneficial public uses. This section contains the basis for, and a summary of, our recommendations for relicensing the project. We weigh the costs and benefits of our recommended alternative against other proposed measures.

Based on our independent review of agency and public comments filed on the project and our review of the environmental and economic effects of the proposed project and project alternatives, we selected the staff alternative as the preferred alternative for the Bolton Falls Project. We recommend this alternative because: (1) issuing a new license would allow the applicant to continue operating the project as a beneficial and dependable source of electrical energy; (2) the 7.5-MW of electric capacity of the Bolton Falls Project comes from renewable resources that do not contribute to atmospheric pollution; (3) the public benefits of the staff alternative would exceed those of the no-action alternative; and (4) the recommended measures would protect and enhance fish and wildlife, recreation, and cultural resources at the project.

In the following sections, we make recommendations as to which environmental measures proposed by GMP, or recommended or required by agencies should be included in any license issued for the project. We also recommend additional environmental measures to be included in any license issued for the project. Finally, for the reasons outlined below, we do not recommend including the following WQC conditions: operate the project so that outflow always equals (rather than approximates) inflow on an instantaneous basis (WQC condition B); spill 100 cfs over the dam into the bypassed reach continuously when generating (WQC condition B); develop a flow management and monitoring plan (WQC condition C); consult with the Vermont FWD prior to the next trash rack replacement to determine the appropriate bar clearance spacing and location (WQC condition D); and develop a water level management plan (WQC condition G). We recognize, however, that the Commission must include these conditions in any new license issued for the project because they are mandatory.

5.1.1 Measures Proposed by GMP

Based on our environmental analysis of GMP's proposal in section 3.0, *Environmental Analysis*, and the costs presented in section 4.0, *Developmental Analysis*, we conclude that the following environmental measures proposed by GMP would protect or enhance environmental resources and would be worth the cost. Therefore, we recommend including these measures in any license issued for the project.

- Continue to operate the project in a run-of-river mode where at any given point in time, outflow approximates inflow;
- Continue to monitor impoundment levels using the existing pond level sensor located near the powerhouse intake and adjust the flow through the turbines to maintain the impoundment water level needed to comply with spill flow requirements;
- Implement the RMP filed with the license application, which includes provisions to within 2 years of license issuance: (1) improve the Day Use Area by adding two picnic tables and an information kiosk with a site map and user responsibilities, and relocate the primary parking area out of the floodplain to the existing informal lot; (2) modify the informal lot by laying gravel and creating 16 standard parking spaces and one parking space designed to provide for the needs of persons with disabilities; (3) improve the portage take-out by clearing vegetation, grading, installing a 12-foot wide concrete level slab that allows recreation users to land their boats on a stable surface, and installing timber steps leading from the take-out to the top of the bank

where it joins the portage trail; (4) clear vegetation and brush along the portage trail, and install new directional signage for boaters; (5) place large boulders and new signs at the western end of the grassy picnic area to redirect users away from areas that contain creeping lovegrass, a state-designated rare plant; and (6) maintain and monitor the recreation facilities over the course of the new license; and

- Implement the final HPMP filed on March 31, 2022, to protect and preserve cultural resources.

We also recommend authorizing GMP's proposed modifications to the project boundary (*see* Section 2.2.1) because the additional lands that would be brought into the project boundary include features that are necessary to operate and maintain the project. Further, the land and water that would be removed are not affected by project operation and do not serve any project purpose.

5.1.2 Additional Measures Recommended by Staff

The staff alternative includes the following additions or modifications to GMP's proposed measures:

- Provide a 75-cfs flow or inflow, whichever is less, into the bypassed reach via spill over the dam during daylight hours from April 1 through October 31 (rather than April 1 to December 15 as proposed) to enhance aesthetics and aquatic habitat downstream of the dam;
- Conduct any planned, non-emergency drawdown of the impoundment below the normal operating limits of the license between November 1 and August 15 to protect sensitive life stages of Eastern pearlshell mussels and notify Vermont ANR prior to conducting a planned drawdown of the impoundment below the normal operating limits as required by WQC condition G;
- Develop an operation compliance monitoring plan that includes provisions for: monitoring and reporting compliance with the operating requirements of the license (e.g., run-of-river operation, spill flows, maintaining impoundment levels, timing of planned maintenance), and reporting deviations from operating requirements to the Commission and Vermont ANR, as required by WQC condition C;
- Develop a debris disposal plan in consultation with Vermont ANR consistent with the requirements in WQC condition F; and
- Revise the RMP to include a provision to improve the existing access road to provide better access from the relocated parking area for persons with disabilities, include the picnic table for persons with disabilities, and provide more detail on the construction of the portage take-out, and develop the plan and schedule in consultation with Vermont ANR as required by WQC condition E.

Minimum Spill Flow

Under current operation, flow into the reach below the dam is reduced to leakage much of the year; however, the pool at the base of the dam remains wetted year-round. GMP proposes to maintain a spill flow of 75 cfs over the dam into the bypassed reach during daylight hours from April 1 through December 15 to enhance aesthetics and aquatic habitat downstream of the dam. Vermont ANR's WQC condition B requires that GMP maintain a continuous 100-cfs spill flow over the dam year-round while its condition C requires that GMP develop a flow management and monitoring plan detailing how the project would operate in run-of-river mode while also releasing its recommended 100-cfs spill flow into the bypassed reach continuously year-round.

Our analysis in section 3.2.5.2 shows that both spill flow alternatives would enhance the aesthetic enjoyment of the river for recreation users over existing conditions, with Vermont ANR's recommended higher spill flow expected to provide a slightly greater aesthetic benefit by maintaining a thicker spill veil over the dam. However, given that the recreation season typically lasts from April through October each year and recreation usage is expected to be low to non-existent in the colder months of November through March, there would be little to no aesthetic benefit of maintaining spill flows from November 1 to December 15. Further, the Day Use Area from which views of the dam are most visible is only open to the public during the day; therefore, there would be no aesthetic benefit of providing aesthetic flows at night.

Our analysis in section 3.2.1.2 shows that both spill alternatives would increase water turbulence and circulation in the pool below the dam. GMP's proposed spill flow would increase the percent of the reach showing active circulation from 25 percent at all times of the day under existing conditions to 75 percent during daylight hours; it would increase up to 83 percent at all times of the day under Vermont's ANR's required 100-cfs spill flow. These increases in active water circulation would enhance water quality and aquatic habitat conditions for fish and mussels in the bypassed reach during the summer and early fall months, when water in the reach is often stagnant, water temperatures are at their warmest, and DO concentrations are at their lowest. Vermont ANR's higher required spill flow would provide a greater benefit by maintaining 83 percent active circulation in the bypassed reach continuously both day and night throughout the year compared to GMP's proposal which would increase active circulation in the bypassed reach during daylight hours in the summer and fall only. However the benefits to water quality and aquatic habitat of providing any spill during late fall and winter would be minor because the reach remains wetted throughout the year and water temperatures during these months are colder and DO concentrations higher than during the summer and early fall months. Further, providing spill flows during the winter months would also likely be problematic as the impoundment is typically frozen and any associated ice formation on the inflatable rubber dam crest resulting from a spillage flow, could interfere with the proper operation of the rubber dam.

Maintaining GMP's proposed 75-cfs spill flow over the dam during daylight hours from April 1 through December 15 would reduce generation by approximately 641 MWh per year, resulting in a staff estimated levelized annual opportunity cost of \$24,511. Maintaining Vermont ANR's required continuous 100-cfs spill flow over the dam would reduce generation by approximately 2,070 MWh per year, resulting in a levelized annual opportunity cost of \$79,112, which is \$54,601 more than the cost of GMP's proposal. Given that there would be little to no aesthetic benefit from providing spill flows during the winter months and at night, and only slightly greater aesthetic and aquatic habitat benefits for fish and mussels by maintaining a 100-cfs spill flow during the remainder of the year, we conclude that the additional aesthetic and

aquatic habitat benefits of providing a continuous 100-cfs spill flow over the dam are not worth the higher opportunity costs.

Further, given that the recreation season lasts from April through October each year and the limited water quality benefits expected from providing spill flows during the late fall and winter when DO concentrations are generally higher, there would be little benefit to maintaining spill flows over the dam beyond October 31. We estimate that maintaining a 75-cfs aesthetic spill flow over the dam during daytime hours from April 1 through October 31 would reduce generation by approximately 535 MWh per year, resulting in a levelized annual opportunity cost of \$20,489, which is \$4,022 less than the cost of GMP's proposal. We conclude that the marginal aesthetic and aquatic habitat benefits from maintaining a 75 cfs spill flow from November 1 through December 15 would not be worth the lost generation and associated opportunity cost. Therefore, we do not recommend that GMP provide spill flows after October 31.

Even though we do not recommend the agency's higher continuous spill flow for the reasons discussed above, we also recognize that the agency's higher spill flow would be included in any license because it is mandatory. To that end, we recommend that the flow management plan required by Vermont ANR's WQC condition C identify the specific impoundment elevation needed to maintain the agency's required spill flow, detail how the project would provide the spill flow continuously throughout the year, and that the plan be provided to the Commission for review and approval prior to implementation.

Impoundment Drawdown Measures to Protect Mussels

GMP periodically (up to 10 times annually) draws the impoundment down five feet (down to an elevation of 392 feet from 397 feet) to maintain the dam and its flow regulating equipment (i.e., repair the rubber bladder, remove large woody debris, repair the intake and headgate infrastructure, etc.). GMP prefers to conduct these maintenance activities during the summer and fall when flow and temperature conditions make it easier to perform the work. Vermont ANR's WQC condition G requires that GMP develop a water level management plan that includes provisions for protecting freshwater mussels from being dewatered as a result of maintenance-related drawdowns of the impoundment, provisions for protecting aquatic biota and wildlife in wetlands impacted by maintenance-related drawdowns, and for GMP to notify and receive approval from Vermont ANR prior to drawing down the impoundment below normal operating levels. The WQC does not elaborate on what measures should be included in the plan, but Vermont ANR's comments on the draft EA indicate that the plan should include provisions to avoid maintenance drawdowns during the mussel breeding season, conduct drawdowns on "cool and overcast days," limit the duration of the drawdown "as much as possible," and include "a protective drawdown rate."

GMP's mussel surveys found that half (21 of 42) of the state-listed threatened Eastern pearlshell mussels found in the impoundment are located at depths of five feet or less. Because adult Eastern pearlshell mussels rarely move more than a few meters in their lifetime (Fichtel and Smith, 1995), they would continue to be exposed to temporary dewatering during planned maintenance drawdowns. However, populations persist in the impoundment, and there is no evidence to suggest that they are being significantly affected by impoundment fluctuations from

maintenance drawdowns. For example, GMP found live adult mussels within the 5-foot fluctuation zone even though it had conducted a maintenance drawdown of the impoundment 4 days prior to the mussel survey during the month of July which is typically the hottest month of the year.

Nonetheless, the Eastern pearlshell mussel is a state-listed species that is of management concern. Our analysis in section 3.2.1.2 suggests that given the species' limited mobility, the only measures that could be taken to avoid dewatering mussels would be to conduct targeted surveys around the impoundment known to contain mussels in depths 5 feet or less and relocate any mussels in the drawdown zone to deeper waters. Given that GMP conducts up to 10 maintenance drawdowns per year, we estimate that performing targeted surveys and relocating mussels could cost up to an estimated \$50,000 annually.

Adverse effects on mussels also could be minimized by avoiding drawing down the impoundment during the breeding season (August 16 to October 31) to limit dewatering of sensitive reproductive or larval mussel life stages. Avoiding planned drawdowns during this period would still provide GMP nine months to conduct planned drawdowns, including the low flow months of June, July and the first half of August. Thus, we estimate there would be little cost to restrict planned maintenance activities to this period. Further, our analysis in 3.2.2.2 suggests that avoiding planned maintenance drawdowns during the late summer and early fall would reduce potential effects on shoreline soil moisture, reduce vegetation desiccation, and protect wetland habitat for wildlife during a season when inflows to the impoundment are typically at their lowest. Planning maintenance drawdowns around short-term weather conditions (i.e., cloudy days) may not be practical and limiting the duration of the drawdown is in the best interest of minimizing lost generation; therefore this is likely to occur without a specific license requirement to do so. Further, such conditions would be difficult to enforce.

Because Eastern pearlshell mussels at the project site have been shown to survive and persist during and immediately following typical maintenance drawdowns, there is no evidence to suggest that additional measures beyond avoiding the mussel breeding season are needed (such as conducting surveys and relocating mussels during each drawdown, planning drawdowns to occur on cool or overcast days, limiting the drawdown rate, etc.). We conclude that the high costs of conducting mussel surveys and relocation would not be justified by the limited benefits. Therefore, rather than developing a plan to protect mussels from dewatering, we recommend that GMP conduct planned drawdowns between November 1 and August 15 to avoid periods when sensitive mussel life stages are likely to be present.

Finally, our analysis indicates that consulting with Vermont DEC prior to conducting a planned drawdown of the reservoir as required by Vermont ANR's WQC condition G would allow the agency to make recommendations to GMP to minimize adverse effects to aquatic resources (including mussels) from such maintenance drawdowns. However, obtaining Vermont DEC approval prior to performing planned or unplanned maintenance repairs as required by the WQC could limit GMP's ability to complete needed repairs in a timely fashion. Therefore, we recommend that GMP consult Vermont DEC prior to conducting a planned drawdown but do not recommend that GMP be required to obtain approval from Vermont DEC before conducting a maintenance drawdown or completing other maintenance activities at the project.

Operation Compliance Monitoring

GMP does not propose any formal measures for monitoring and reporting compliance with its proposed operating mode (i.e., run-of-river operation, maintaining impoundment levels, spill flows). GMP would continue to use its automated monitoring and control system to continuously monitor impoundment levels and adjust powerhouse flows and the rubber bladder to maintain the impoundment at the desired elevation. GMP indicates that its automated system is capable of logging impoundment water surface elevations and powerhouse flow levels at 15-minute intervals, but it does not currently report the data or transmit the data to the internet.

Vermont ANR's WQC condition C requires that GMP include as part of a flow management plan a method for continuous monitoring and reporting of flow releases at the project (including spill flows, turbine discharge, impoundment levels, and inflows), that the flow data "be available on a near real-time basis", and that the plan include procedures for reporting deviations from operating requirements to Vermont DEC within 15 days of a deviation.

As noted above, we are recommending additional operating requirements to protect freshwater mussels, including limiting planned maintenance requiring an impoundment drawdown to the period November 1 through August 15, which GMP would also need to report for compliance purposes.

Our analysis in section 3.2.1.2 indicates that GMP's existing automated impoundment level monitoring and control system would be sufficient to monitor compliance with its proposed run-of-river operation and spill flow requirements. Additionally, the aesthetic flow study results demonstrated that GMP can use its existing equipment to provide required spill flows.

While Vermont ANR's requirement to monitor inflows, outflows, and spill over the dam and make the data "available on a near real-time basis" could also be used to monitor compliance with run-of-river operation and spill flow releases, GMP would likely need to install and operate at least two stream gages that are capable of continuously monitoring stream levels and transmitting the data in real-time to meet Vermont ANR's objectives. We estimate that installing and maintaining two new gages for monitoring inflow and bypassed reach flows would add \$41,648 in levelized annual costs compared to continuing to monitor impoundment levels using GMP's automated system as it does currently. Because monitoring impoundment levels via GMP's existing automated monitoring and control system would achieve the same compliance objectives at a lower cost, we conclude the benefits of the real-time flow monitoring would not be worth the higher costs.

However, to enable the Commission to track compliance with the operating requirements of any license issued for the project, we recommend that GMP develop an operation compliance monitoring plan that includes a detailed description of how the licensee would monitor compliance with the operational requirements of the license (i.e., run-of-river operation, impoundment levels, spill flows, timing of planned maintenance etc.), maintain a log of project operation, and report deviations from operating requirements to the Commission and Vermont ANR. Vermont ANR's WQC condition C requires GMP to report deviations from operating requirements to Vermont DEC within 15 days of a deviation. The WQC does not require that the deviations be reported to the Commission. Typically, to reduce the reporting burden, the

Commission requires licensees to report unplanned deviations that last less than 3 hours and do not result in any observable environmental effects in a yearly report. The Commission is notified of deviations that last longer than 3 hours or result in observable environmental effects within 14 days. Therefore in addition to notifying the Vermont ANR in the manner required by the WQC, we recommend that GMP notify the Commission within 14 days of deviations lasting longer than 3 hours or resulting in observable environmental effects and to include in a yearly report, deviations lasting less than 3 hours and not resulting in any observable environmental effects. We estimate that the annual levelized cost of developing an operation and compliance monitoring plan with the above provisions would be \$1,344, and conclude that the compliance benefits outweigh the cost.

Debris Disposal Plan

GMP states that project personnel regularly clean the intake trash racks, conduct general groundskeeping, and periodically clear debris from the Day Use picnic area and parking lot after floods but does not indicate how or where it disposes debris collected at the project. Vermont ANR states in the WQC that depositing debris and other solids to state waters would violate Vermont's solid waste laws and standards and that debris that is not properly disposed of may also impair aesthetics and boating at the project. Therefore, WQC condition F requires that "debris associated with Project operations shall be disposed of in accordance with state laws and regulations."

Although there is no evidence of accumulating debris at the project (e.g., presence of debris piles or other solids), our analysis in section 3.2.1.2 indicates that periodic disposal would prevent accumulation of unsightly debris and keep that debris from entering the river where it could degrade water quality. Developing a debris disposal plan, after consultation with Vermont ANR, would avoid misunderstandings and guide how and when GMP is to remove and dispose of debris. We estimate that the annual levelized cost of developing a debris disposal plan would be \$334, and conclude that the operational and resource benefits would be worth the cost.

Day Use Parking and Revised Recreation Management Plan

GMP states that the primary 12-vehicle parking lot for the Day Use Area floods to varying degrees approximately 3 to 5 times per year and that work crews spend between 5 to 40 hours cleaning and repairing the parking area at a cost of approximately \$10,000 to \$30,000 each year. To reduce maintenance costs, GMP proposes to relocate the primary parking lot to an existing informal overflow lot and block access to the current parking lot via boulders. GMP's proposal would reduce the overall parking capacity at the project from 34 vehicles to 22 vehicles.

Our analysis in section 3.2.4.2 shows that the existing parking lot adjacent to the Day Use Area is utilized at less than eight percent of its total capacity most of the time, and that demand reaches capacity only during infrequent holidays and special events. Therefore, GMP's proposal to relocate parking from the Day Use Area to the overflow lot would provide sufficient parking most of the time.

However, relocating parking to the overflow lot would require users to walk about 400 feet further compared to existing conditions, which could pose a challenge for those with limited

mobility and discourage the use and purpose of adding picnic table designed for persons with disabilities to the recreation area. We considered three alternatives to that would improve access for people with disabilities as compared to GMP's current proposal: paving the entire existing parking lot adjacent to the Day Use Area instead of relocating parking to the overflow lot; relocating parking to the overflow lot as proposed by GMP, but also paving a portion of the lot to provide two accessible parking spaces and drop-off for boaters; and relocating the parking to the overflow lot as proposed by GMP but also reducing the slope of the existing road leading down to the Day Use Area.

Paving the current parking lot would continue to provide users with the same level of access as they currently experience, but would still require GMP to repair the lot following flood events (e.g., clearing debris, etc.) and would increase its maintenance requirements (i.e., stripping the asphalt down to the subbase every 2 years and stripping, releveling, and repaving the entire surface of the lot every 8 years). The estimated annual levelized cost to implement the RMP as proposed by GMP is \$54,733. Staff estimates the levelized annual cost of revising the RMP to include this alternative (in addition to implementing GMP's other proposed improvements to the Day Use Area and portage) would be \$75,200 (or \$20,467 more than GMP's proposal).

Paving a portion of the lot would maintain some limited parking adjacent to the Day Use Area for persons with disabilities and a turn-around for those wishing to drop off a boat. However, the lifespan of the concrete slab that would be installed under this alternative is estimated at twenty years and would have to be replaced at least once during the course of the new license term. GMP also states it would need to regrade the lower turnaround area and replace eroded material every 8 years in addition to conducting annual flood maintenance. Staff estimates the levelized cost of revising the RMP to include this alternative would be \$72,584 (or \$17,851 more than GMP's proposal).

Closing the current parking area to vehicle traffic and relocating the parking to the overflow lot as proposed by GMP while also improving the access road to reduce the slope would better accommodate persons with disabilities. Boaters would still need to carry their boats to the put-in over a greater distance than they currently experience but the reduced slopes should make it easier for users to carry their boats down to the river compared to leaving the current gravel road in its existing condition. Staff estimates the levelized cost of revising the RMP to include this alternative would be \$64,087 (or \$9,354 more than GMP's proposal). Given that modifying the road would provide access at a lesser cost than maintaining parking closer to the Day Use Area, we recommend improving the road and conclude that the benefits to people with disabilities from modifying the existing gravel road to reduce the slope would be worth the additional costs.

Further, as discussed in 3.2.4.2, the RMP filed with the license application does not include GMP's proposal that one of the two picnic tables to be added would be for persons with disabilities and also lacks details about the design of the modified portage take-out that GMP provided in a subsequent filing. Therefore, we recommend that GMP revise the RMP to include these elements in addition to the staff recommendation to modify the existing gravel road to reduce the slope.

Finally, Vermont ANR's WQC condition E requires that the RMP be approved by Vermont ANR prior to implementation. While we agree that the revised RMP should be developed in consultation with Vermont ANR, final approval of the plan is the responsibility of the Commission.

5.1.3 Measures Not Recommended

Some of the measures recommended by Vermont ANR do not have a sufficient connection to a project effect or would not result in benefits to non-power resources that would be worth their cost. The following discussion includes the basis for staff's conclusion not to recommend such measures.

Instantaneous Run-of-River Operation

GMP proposes to continue operating the project in run-of-river mode where outflow approximates inflow. It would do so by maintaining impoundment levels at an elevation of 397.25 feet (when maintaining aesthetic spill flows over the dam) or at 397.00 feet at all other times. Vermont ANR's WQC condition B requires that GMP operate the project in run-of-river mode where outflow always equals inflow (rather than approximately inflow) on an instantaneous basis throughout the year except for short term deviations such as during impoundment re-filling following planned or unplanned maintenance activities.

As discussed in section 3.2.1.2, run-of-river operation minimizes fluctuations in the project impoundment and downstream of the project, which would protect shoreline habitat, protect fish or other aquatic organisms that rely on near-shore habitat in the impoundment and downstream of the dam for spawning, foraging, and cover and would avoid dewatering Eastern pearlshell mussels located in the impoundment. Even though the project currently operates as a run-of-river facility, total outflow can vary to a limited extent (i.e., total outflows *approximate* total inflows) as units, gates, and spillway mechanisms (i.e., rubber bladder) are raised and lowered to manage pond levels. There is no evidence in the record to suggest that current operations, which are nearly instantaneous, are adversely affecting littoral and riparian habitats. Further, there is no indication that the project is technologically or mechanically capable of operating under conditions where outflow from the project equals inflow on an instantaneous basis such that a perfectly stable reservoir elevation would be maintained at all times. For these reasons, there is no substantial evidence to support Vermont ANR's required measure. However, we also recognize that this measure would be included in any license issued as a condition of Vermont ANR's WQC. To that end, we recommend that the flow management and monitoring plan required by Vermont ANR's condition C identify how GMP proposes to operate in instantaneous run-of-river mode throughout the year and that the plan be provided to the Commission for review and approval prior to implementation.

Trash Rack Consultation

GMP proposes to maintain its existing trash racks at the intake which currently have a 3-inch clear spacing between the bars. No entity has recommended modifying or replacing GMP's existing trash racks. However, Vermont ANR's WQC condition D requires that GMP consult with Vermont FWD prior to the next planned replacement of the trash racks regarding the trash

rack design, placement, and appropriate bar clearance spacing and file the design information with Vermont DEC for approval prior to commencement of any work.

Our analysis in section 3.2.1.2 shows that the risk of impingement of adult and juvenile resident fish is very low because they are all likely able to pass through the 3-inch trashrack openings. Also, the burst swim speeds for juvenile and adult resident fish suggest that most fish could overcome the maximum approach and through velocities at the trash rack and swim away. Fish species and life-stages with a greater likelihood of entrainment (i.e., golden shiners, juvenile white sucker, juvenile smallmouth bass, and juvenile sculpin) are expected to exhibit high turbine survival (greater than 90 percent) through the project's Kaplan turbines due to their small size. Further, there is no information to suggest entrainment is adversely affecting resident fish populations residing in the project impoundment or that the trash rack would need to be replaced. Therefore, there is no benefit to support a license requirement that GMP consult on the existing trash racks or submit new trash rack design plans. However, we also recognize that this measure would be included in any license issued as a condition of Vermont ANR's WQC.

5.2 UNAVOIDABLE ADVERSE IMPACTS

Continued operation of the project would result in some unavoidable entrainment injury or mortality to resident fish passing through the intake, penstock, and powerhouse turbines. Impoundment fluctuations associated with project maintenance could reduce near-shore aquatic habitat and result in temporary dewatering of freshwater mussels and other aquatic biota located within the five-foot fluctuation zone. Continuing to operate in a run-of-river mode with minimal impoundment fluctuations would result in infrequent and minimal disturbances to aquatic and riparian habitat. Conducting planned maintenance drawdowns outside of time periods when sensitive life stages of mussels would be present would further minimize the effects of impoundment drawdowns on sensitive life stages of mussels.

5.3 FISH AND WILDLIFE AGENCY RECOMMENDATIONS

Under the provisions of section 10(j) of the FPA, each hydroelectric license issued by the Commission shall include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, or enhancement of fish and wildlife resources affected by the project.

Section 10(j) of the FPA states that whenever the Commission finds that any fish and wildlife agency recommendation is inconsistent with the purposes and the requirements of the FPA or other applicable law, the Commission and the agency shall attempt to resolve any such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of the agency.

No section 10(j) recommendations were filed.⁵¹

⁵¹ Vermont ANR's letter filed on February 1, 2021 did not specify whether their recommendations were submitted under section 10(j) of the FPA. Therefore, while staff

5.4 CONSISTENCY WITH COMPREHENSIVE PLANS

Section 10(a)(2)(A) of the FPA, 16 U.S.C., § 803(a)(2)(A), requires the Commission to consider the extent to which a project is consistent with federal or state comprehensive plans for improving, developing, or conserving a waterway or waterways affected by the projects. We reviewed the following 15 comprehensive plans that are applicable to the Bolton Falls Project. No inconsistencies were found.

Fisheries Technical Committee. Strategic plan for Lake Champlain Fisheries. Lake Champlain Fish and Wildlife Management Cooperative. U.S. Fish and Wildlife Service. Essex Junction, Vermont. July 2009.

Lake Champlain Fish and Wildlife Management Cooperative. Strategic Plan for Lake Champlain Fisheries. Essex Junction, Vermont. July 2020.

National Park Service. The Nationwide Rivers Inventory. Department of the Interior, Washington, D.C. 1993.

U.S. Fish and Wildlife Service. The Lower Great Lakes/St. Lawrence Basin: A component of the North American waterfowl management plan. December 29, 1988.

U.S. Fish and Wildlife Service. Fisheries USA: the recreational fisheries policy of the U.S. Fish and Wildlife Service. Washington, D.C. n.d.

Vermont Agency of Environmental Conservation. Vermont Rivers Study. Waterbury, Vermont. 1986.

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evaluated Vermont ANR's recommendations in the EA, they were not considered under section 10(j) of the FPA.

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Vermont Fish and Wildlife Department. The Vermont Plan for Brook, Brown, and Rainbow Trout. Montpelier, Vermont. January 2018.

6.0 FINDING OF NO SIGNIFICANT IMPACT

If the Bolton Falls Project is issued a new license as proposed with the additional staff-recommended measures, the project would continue to operate while enhancing and protecting aquatic, recreation, cultural, and historic resources in the project area.

Based on our independent analysis, we find that the issuance of a new license for the Bolton Falls Project, with additional staff-recommended environmental measures, would not constitute a major federal action significantly affecting the quality of the human environment.

7.0 LITERATURE CITED

The literature cited in this EA is presented in Appendix F.

8.0 LIST OF PREPARERS

The list of preparers of this EA is presented in Appendix G.

APPENDIX A. STATUTORY AND REGULATORY REQUIREMENTS

Federal Power Act

Section 18 Fishway Prescriptions

Section 18 of the Federal Power Act (FPA), 16 U.S.C. § 811, states that the Commission is to require construction, operation, and maintenance by a licensee of such fishways as may be prescribed by the Secretaries of the U.S. Department of Commerce or the U.S. Department of the Interior (Interior).

By letter filed January 26, 2021, Interior requests that a reservation of authority to prescribe fishways under section 18 be included in any license issued for the project.

Section 10(j) Recommendations

Under section 10(j) of the FPA, 16 U.S.C. § 803(j)(1), each hydroelectric license issued by the Commission must include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, or enhancement of fish and wildlife resources affected by the project. The Commission is required to include these conditions in any new or subsequent license unless it determines that they are inconsistent with the purposes and requirements of the FPA or other applicable law. Before rejecting or modifying an agency recommendation, the Commission is required to attempt to resolve any such inconsistency with the agency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency.

No section 10(j) recommendations were received by the Commission.

Clean Water Act

Under section 401(a)(1) of the Clean Water Act (CWA), 33 U.S.C. § 1341(a)(1), a license applicant must obtain either a water quality certification (WQC) from the appropriate state pollution control agency verifying that any discharge from the project would comply with applicable provisions of the CWA, or a waiver of such WQC. A waiver occurs if the state agency does not act on a request for a WQC within a reasonable period of time, not to exceed one year after receipt of such request.

On January 22, 2021, Green Mountain Power (GMP) applied to the Vermont Department of Environmental Conservation (Vermont DEC) for a WQC for the project, which Vermont DEC received on the same day. Vermont DEC issued a WQC to GMP on January 19, 2022 and filed a copy of the WQC with the Commission on the same day. The conditions of the WQC are included in Appendix I and discussed in section 5.1, *Comprehensive Development and Recommended Alternative*.

Endangered Species Act

Section 7 of the Endangered Species Act, 16 U.S.C. § 1536, requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of the critical habitat of such species. On November 19, 2021, we accessed the U.S. Fish and Wildlife Service’s Information for Planning and Consultation (IPaC) database to determine whether any federally listed species could occur in vicinity of either project. According to the IPaC database, the threatened northern long-eared bat (*Myotis septentrionalis*) and candidate monarch butterfly (*Danaus plexippus*) have the potential occur within the project boundary.⁵² There are no proposed or designated critical habitats in the project area.

Our analysis of the impacts of the project on the northern long-eared bat is presented in section 3.2.3, *Threatened and Endangered Species*, and our recommendations are included in section 5.1, *Comprehensive Development and Recommended Alternative*. Based on available information, we conclude that relicensing the project under the Staff Alternative with Mandatory Conditions may affect the northern long-eared bat, but any incidental take that may result from these activities is not prohibited under the final 4(d) rule,⁵³ and relicensing the project would have no effect on monarch butterflies.

National Historic Preservation Act

Section 106 of the National Historic Preservation Act (NHPA), 54 U.S.C. § 306108, requires that every federal agency “take into account” how each of its undertakings could affect historic properties. Historic properties are districts, sites, buildings, structures, traditional cultural properties, and objects significant in American history, architecture, engineering, and culture that are eligible for inclusion in the National Register of Historic Places (National Register).

In response to GMP’s January 30, 2017, request, Commission staff designated GMP as its non-federal representative for the purposes of conducting section 106 consultation under the NHPA on March 31, 2017. Pursuant to section 106, and as the Commission’s designated non-federal representative, GMP initiated consultation with the Vermont Historic Preservation Officer (Vermont SHPO) to identify historic properties, determine National Register eligibility, and assess potential adverse effects on historic properties within the project’s area of potential effects (APE). The results of GMP’s cultural resource investigations conclude that three sites (site VT-WA-0008, site VT-WA-0200, and site VT-WA-0201) located within the APE are eligible for listing on the National Register. Results also indicate that the project’s potential effects to historic and archaeological resources in the APE include potential impacts from future renovation of the historic dam, and potential adverse impacts to archaeological sites as a result of project-related recreation.

⁵² See Interior’s official lists of threatened and endangered species, accessed by staff using the IPaC database (<https://ipac.ecosphere.fws.gov>) on March 3, 2022, and placed into the records for Docket No. P-2879-012 on the same day.

⁵³ 81 Fed. Reg. 1900-22 (Jan. 14, 2016).

To meet the requirements of section 106, the Commission intends to execute a Programmatic Agreement (PA) with the Vermont SHPO for the protection of historic properties from the effects of operating the Bolton Falls Project. A draft PA was issued for review and comment on September 3, 2021. Comments on the draft PA were filed by the Vermont SHPO on October 15, 2021. Commission staff intends to address the comments and reissue the PA for signature. The terms of the PA would require GMP to address and treat all historic properties identified within the project's APE by implementing a Historic Properties Management Plan (HPMP).⁵⁴ There are no plans for modifying project facilities or operations that could affect the Bolton Falls dam or the archaeological sites potentially eligible for listing on the register. Further, the HPMP includes measures for the continued protection and preservation of the dam and the sites from recreation. Our analysis suggests that with execution of a PA, and implementation of the HPMP, any potential project-related adverse effect to historic properties would be adequately resolved over the term of a new license.

Executive Orders 12898 and 14008

In conducting NEPA reviews of proposed hydropower projects, the Commission follows the instruction of Executive Order 12898, which directs federal agencies to identify and address “disproportionately high and adverse human health or environmental effects” of their actions on minority and low-income populations (i.e., environmental justice communities).⁵⁵ Executive Order 14008 also directs agencies to develop “programs, policies, and activities to address the disproportionately high and adverse human health, environmental, climate-related and other cumulative impacts on disadvantaged communities, as well as the accompanying economic challenges of such impacts.”⁵⁶ Environmental justice is “the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies” (EPA, 2021a).

Staff identified one environmental justice community within a 1-mile radius of the project boundary and considered how the community may be affected by GMP's proposal to operate in run-of-river mode with minimal impoundment fluctuations. Staff also considered how the community may be affected by noise, visual, and traffic impacts associated with modifying

⁵⁴ GMP filed a draft HPMP on February 12, 2021. After consulting with the Vermont SHPO, GMP filed a final revised HPMP on March 31, 2022.

⁵⁵ Exec. Order No. 12,898, 59 Fed. Reg. 7629 (Feb. 16, 1994). While the Commission is not one of the specified agencies in Executive Order 12898, the Commission nonetheless addresses environmental justice in its analysis, in accordance with our governing regulations and guidance, and statutory duty to evaluate all factors bearing on the public interest.

⁵⁶ Exec. Order No. 14,008, 86 Fed. Reg. 7619 (Feb. 1, 2021). The term “environmental justice community” includes disadvantaged communities that have been historically marginalized and overburdened by pollution. *Id.* § 219, 86 Fed. Reg. 7619, 7629. The term also includes, but may not be limited to, minority populations, low-income populations, or indigenous peoples (EPA, 2021b).

recreation facilities, concentration of recreational activity, and the effect of project operation and recreation on subsistence fishing. Our analysis of the project's impacts on this community is presented in section 3.2.7, *Environmental Justice*. We conclude that relicensing the project, as proposed with staff's recommended measures or as would be required under the staff alternative with mandatory conditions, would not result in disproportionately high and adverse impacts on the identified environmental justice population.

APPENDIX B. ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

Issuing a Non-power License

A non-power license is a temporary license that the Commission would terminate when it determines that another governmental agency will assume regulatory authority and supervision over the lands and facilities covered by the non-power license. At this time, no agency has suggested a willingness or ability to take over the project. No party has sought a non-power license, and we have no basis for concluding that the Bolton Falls Project should no longer be used to produce power.

Federal Government Takeover

Federal takeover and operation of the Bolton Falls Project would require congressional approval. While that fact alone would not preclude further consideration of this alternative, there is currently no evidence to indicate that federal takeover should be recommended to Congress. No party has suggested that federal takeover would be appropriate, and no federal agency has expressed interest in operating the project.

Project Retirement

As the Commission has previously held, decommissioning is not a reasonable alternative to relicensing in most cases.⁵⁷ Decommissioning can be accomplished in different ways depending on the project, its environment, and the particular resource needs.⁵⁸ For these reasons, the Commission does not speculate about possible decommissioning measures at the time of relicensing, but rather waits until an applicant actually proposes to decommission a project, or a participant in a relicensing proceeding demonstrates that there are serious resource concerns that cannot be addressed with appropriate license measures and that make decommissioning a reasonable alternative.⁵⁹

⁵⁷ See, e.g., *Eagle Crest Energy Co.*, 153 FERC ¶ 61,058, at P 67 (2015); *Public Utility District No. 1 of Pend Oreille County*, 112 FERC ¶ 61,055, at P 82 (2005); *Midwest Hydro, Inc.*, 111 FERC ¶ 61,327, at PP 35-38 (2005).

⁵⁸ In the event that the Commission denies relicensing a project or a licensee decides to surrender an existing project, the Commission must approve a surrender “upon such conditions with respect to the disposition of such works as may be determined by the Commission.” 18 C.F.R. § 6.2. This can include simply shutting down the power operations, removing all or parts of the project (including the dam), or restoring the site to its pre-project condition.

⁵⁹ See generally *Project Decommissioning at Relicensing*; Policy Statement, FERC Stats. & Regs., Regulations Preambles (1991-1996), ¶ 31,011 (1994); see also *City of Tacoma, Washington*, 110 FERC ¶ 61,140 (2005) (finding that unless and until the Commission has a specific decommissioning proposal, any further environmental analysis of the effects of project decommissioning would be both premature and speculative).

GMP does not propose decommissioning, nor does the record to date demonstrate there are serious resource concerns that cannot be mitigated if the project is relicensed; as such, there is no reason, at this time, to include decommissioning as a reasonable alternative to be evaluated and studied as part of staff's NEPA analysis.

APPENDIX C. SUMMARY OF COST OF ENVIRONMENTAL MEASURES

Table 12. Cost of environmental measures considered in assessing the environmental effects of operating the Bolton Falls Project (source: GMP and staff).

Enhancement/Mitigation Measures	Recommending Entity	Capital cost ^a (\$2022)	Annual Cost ^{a,b} (\$2022)	Levelized Annual Cost ^c (\$2022)
Aquatic Resources				
1a. Continue to operate the project in a run-of-river mode where outflow from the project approximates inflow and continue to monitor impoundment levels to track compliance with run-of-river operation	GMP; Staff	\$0	\$0	\$0
1b. Operate the project in an instantaneous run-of-river mode where outflow from the project equals inflow except for short term deviations such as during impoundment re-filling following planned or unplanned maintenance activities ^d	Vermont ANR	Unknown - costs related to any required new or upgraded equipment needed for compliance with measure cannot be accurately estimated	Unknown - costs related to any required new or upgraded equipment needed for compliance with measure cannot be accurately estimated	Unknown
2a. Provide a bypass spill flow of 75 cfs over the dam during daylight hours from April 1 through December 15	GMP	\$0	\$24,511	\$24,511

Enhancement/Mitigation Measures	Recommending Entity	Capital cost^a (\$2022)	Annual Cost^{a,b} (\$2022)	Levelized Annual Cost^c (\$2022)
2b. Provide a bypass spill flow of 75 cfs over the dam during daylight hours from April 1 through October 31	Staff	\$0	\$20,489 ^e	\$20,489
2c. Provide a continuous bypass spill flow of 100 cfs over the dam year-round ^d	Vermont ANR	\$0. However, costs would depend on whether any structural modifications are necessary to maintain the higher flow continuously year-round	\$79,112 ^f	\$79,112
3a. Develop a flow management plan detailing how the project would operate in instantaneous run-of-river mode where outflow equals inflow while maintaining 100 cfs over the dam year-round and include a method for continuous (near real-time) monitoring and reporting of impoundment levels, inflows, spill flows into the bypassed reach, and turbine discharges ^d	Vermont ANR	\$5,000 ^g	\$Up to \$60,000 in year 1 for installing two new gages capable of real-time flow monitoring and reporting data at 15-minute increments, and up to \$40,000 to maintain the gages each year thereafter ^g	\$41,648
3b. Develop an operation compliance monitoring plan	Staff	\$5,000 ^g	\$1,000 ^g	\$1,344

Enhancement/Mitigation Measures	Recommending Entity	Capital cost^a (\$2022)	Annual Cost^{a,b} (\$2022)	Levelized Annual Cost^c (\$2022)
4a. Develop a water level management plan that includes provisions to protect freshwater mussels, wetlands, and other aquatic biota and wildlife from being impacted during planned maintenance drawdowns, and receive approval from Vermont ANR prior to conducting planned maintenance drawdowns ^d	Vermont ANR	\$5,000 ^g	Up to \$50,000 ^h	\$50,344
4b. Restrict the timing of planned maintenance activities to November 1 through August 15 and notify Vermont ANR prior to planned maintenance drawdowns of the impoundment	Staff; Vermont ANR	\$0 ^g	\$0 ^g	\$0
5. Prior to replacing trash racks, consult with Vermont DFW on trash rack design, placement, and bar clearance spacing and file the design information with Vermont DEC for approval prior to commencement of work ^d	Vermont ANR	\$0. However, costs depend on whether any new or modified trash racks are eventually proposed ⁱ	\$0. However, costs depend on whether any new or modified trash racks are eventually proposed ⁱ	\$0
6a. Dispose project-related debris in accordance with state laws and regulations ^d	Vermont ANR	\$Unknown, as it would depend on the quantity and method of disposal ^g	\$Unknown, as it would depend on the quantity and method of disposal ^g	\$0

Enhancement/Mitigation Measures	Recommending Entity	Capital cost^a (\$2022)	Annual Cost^{a,b} (\$2022)	Levelized Annual Cost^c (\$2022)
6b. Develop a debris disposal plan in consultation with Vermont ANR	Staff	\$5,000 ^g	\$0 ^g	\$334
Terrestrial Resources				
7. Place large boulders and new signs at the western end of the grassy picnic area to redirect users away from areas that contain creeping lovegrass	GMP, Staff	\$6,620	\$0	\$455
Recreation				
8a. Implement the RMP	GMP	\$212,300 ^j	\$39,820 annually, \$9,900 once over the license term ^j	\$54,733
8b. Revise the RMP to include reducing the slope of the existing access road to provide better access from the relocated parking area for persons with disabilities	Staff	\$345,400 ^k	\$39,820 annually, \$20,900 every 20 years ^k	\$64,087
8c. Revise the RMP to include paving the existing Day Use Area parking lot	Evaluated by staff, but not selected as part of the staff alternative	\$228,800 ^l	\$39,820 annually, \$23,100 every 2 years, \$90,200 every 8 years ^l	\$75,200

Enhancement/Mitigation Measures	Recommending Entity	Capital cost^a (\$2022)	Annual Cost^{a,b} (\$2022)	Levelized Annual Cost^c (\$2022)
8d. Revise the RMP to include the installation of a concrete slab for two accessible spaces and a drop-off at the existing Day Use Area parking lot	Evaluated by staff but not selected as part of the staff alternative	\$352,000 ^m	\$45,320 annually, \$9,900 every 5 years, \$53,900 every 20 years ^m	\$72,584
8e. Receive approval by Vermont ANR on the RMP prior to implementation ^d	Vermont ANR	\$0. However, costs would depend on whether any new or modified measures are eventually required by Vermont ANR after reviewing the RMP.	\$0. However, costs would depend on whether any new or modified measures are eventually required by Vermont ANR after reviewing the RMP.	\$0
Cultural Resources				
9. Implement the HPMP	GMP, Staff	\$0	\$6,015 ⁿ	\$6,015

^a Cost were provided by GMP in their license application or subsequent additional information request responses unless otherwise noted.

^b Annual costs typically include project operation and maintenance costs and any other costs that occur on a yearly basis.

^c All capital and annual costs are converted to equal annual costs over a 30-year period to give a uniform basis for comparing all costs.

^d Mandatory Clean Water Act Section 401 Water Quality Certification condition.

^e This is an estimate of the cost that would result from providing spill flows of 75 cfs over the dam during daylight hours from April 1 through October 31 (opportunity cost). The measure would reduce generation by 535 MWh per year. Using an energy cost of \$34.74/MWh from the applicant as an estimate of the project's power value, 535 MWh of foregone generation would be valued at \$18,618/year. The generation losses were estimated by staff based on information filed by GMP on June 1, 2020. Staff also escalated the values to 2022 dollars in the table.

- ^f This is an estimate of the cost that would result from providing spill flows of 100 cfs over the dam continuously year around (opportunity cost). The measure would reduce generation by 2,070 MWh per year. Using an energy cost of \$34.74/MWh from the applicant as an estimate of the project's power value, 2,070 MWh of foregone generation would be valued at \$71,885/year. The generation losses were estimated by staff based on information filed by GMP on June 1, 2020. Staff also escalated the values to 2022 dollars in the table.
- ^g Cost estimated by staff.
- ^h Cost estimated by staff. Assumes the plan would require targeted mussel surveys and relocation (costing \$5,000 for each survey/relocation) during each planned maintenance drawdown of the impoundment which GMP states can occur up to 10 times annually.
- ⁱ Cost estimated by staff. Assumes \$0 additional costs for consulting with Vermont ANR prior to routine maintenance/replacement of the existing trash racks. If modified or new trash racks are proposed in the future as a result of this consultation, the costs associated with that action would be evaluated at that time and would be based on the design configuration/dimensions of any new, modified trash racks proposed to be installed at the project by GMP.
- ^j Costs include GMP's capital and maintenance costs for implementing the provisions of GMP's Recreation Management Plan (RMP) filed with the license application, the capital and maintenance costs of GMP's proposed modifications to the portage take-out improvements and flood maintenance costs for the Day Use Area (submitted in GMP's additional information response filed on June 1, 2020), and a staff estimated cost of \$5,000 to revise the RMP. Staff also escalated the values to 2022 dollars in the table.
- ^k Costs were derived from GMP's additional information response filed on June 1, 2020 and include all the capital and maintenance costs associated with GMP's proposal reflected in 8a with additional costs for improving the existing access road for persons with disabilities and associated maintenance of the modified road. Staff also escalated the values to 2022 dollars in the table.
- ^l Costs were derived from GMP's additional information response filed on June 1, 2020 and include all the capital and maintenance costs associated with GMP's proposal reflected in 8a except for costs for laying gravel and maintaining the overflow lot and includes additional costs for paving the entire Day Use Area parking lot and the associated maintenance costs for maintaining the paved lot. Staff also escalated the values to 2022 dollars in the table
- ^m Costs were derived from GMP's additional information response filed on June 1, 2020 and include all the capital and maintenance costs associated with GMP's proposal reflected in 8a and additional costs for constructing a concrete slab and maintaining two paved parking spaces and a drop off area at the existing Day Use Area parking lot. Staff also escalated the values to 2022 dollars in the table.
- ⁿ Costs include GMP's capital and maintenance costs for implementing the HPMP filed with the license application and a staff estimated cost of \$500 for GMP to conduct annual monitoring of the three known archaeological sites that GMP proposed in their final HPMP filed on March 31, 2022.

APPENDIX D. DRAFT LICENSE CONDITIONS RECOMMENDED BY COMMISSION STAFF

We recommend including the license articles below in any license issued for the project. The articles are based on including Vermont ANR's mandatory water quality certification conditions:

Draft Article 001. *Flow Management Plan.* Within 6 months of license issuance, the licensee must file with the Commission for approval, the flow management and monitoring plan required by Vermont Agency of Natural Resources' (Vermont ANR) water quality certification condition C (Appendix I). The plan must include all the provisions required by Vermont ANR's condition C and must also identify the specific impoundment water level elevation (in feet U.S. Geological Survey Datum) needed to provide a 100 cubic feet second (cfs) minimum spill flow into the bypassed reach required by Vermont ANR's water quality certification condition B (Appendix I).

The licensee must prepare the plan after consultation with Vermont ANR. The licensee must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to Vermont ANR, and specific descriptions of how the agency's comments are accommodated by the plan. The licensee must allow a minimum of 30 days for the agency to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on project specific information.

The Commission reserves the right to require changes to the plan. The licensee must not begin implementing the plan until the Commission notifies the licensee that the plan is approved. Upon Commission approval the licensee must implement the plan, including any changes required by the Commission.

Draft Article 002. *Project Operation.* In addition to implementing the run-of-river operation and minimum spill flow requirements of Vermont Agency of Natural Resource's (Vermont ANR) water quality certification condition B (Appendix I), the licensee must:

- (1) maintain the impoundment water level at the elevation(s) specified in the flow management and monitoring plan required by Vermont ANR's water quality certification condition C (Appendix I) and Draft Article 001; and
- (2) limit any planned, non-emergency maintenance activities that will require the impoundment to be drawn down below the limits specified in item 1 to the period between November 1 and August 15 to protect Eastern pearlshell mussels in the project impoundment.

Reporting of Planned Deviations

Run-of-river operation and spill flow requirements of Vermont ANR's water quality certification condition B (Appendix I) and impoundment level requirements of this article may

be temporarily modified for short periods, of up to 3 weeks, after mutual agreement among the licensee and Vermont Department of Environmental Conservation, and Vermont Fish and Wildlife Department (collectively, resource agencies). After concurrence from the resource agencies and filing a report with Vermont Department of Environmental Conservation (Vermont DEC) as required by Vermont ANR's water quality certification conditions C and G (Appendix I), the licensee must file a report with the Secretary of the Commission as soon as possible, but no later than 14 days after the onset of the planned deviation. Each report must include: (1) the reasons for the deviation and how project operations were modified, (2) the duration and magnitude of the deviation, (3) any observed or reported environmental effects and how potential effects were evaluated, and (4) documentation of consultation with the resource agencies. For planned deviations exceeding 3 weeks, the licensee must file a report with Vermont DEC and receive approval from Vermont DEC as required by Vermont ANR's water quality certification conditions C and G (Appendix I) and must file an application for a temporary amendment of the operational requirements and receive Commission approval prior to implementation.

Reporting of Unplanned Deviations

Run-of-river operation and spill flow requirements of Vermont ANR's water quality certification condition B (Appendix I) and impoundment level requirements of this article may be temporarily modified if required by operating emergencies beyond the control of the licensee (i.e., unplanned deviations). In addition to filing a report with Vermont DEC as required by Vermont ANR's water quality certification condition C (Appendix I), for any unplanned deviation from run-of-river operation, spill flow, or impoundment level requirements that lasts longer than 3 hours or results in visible environmental effects such as a fish kill, the licensee must notify the resource agencies within 24 hours, and the Commission within 14 days, and file a report as soon as possible, but no later than 30 days after each such incident. The report must include: (1) the cause of the deviation, (2) the duration and magnitude of the deviation, (3) any pertinent operational and/or monitoring data, (4) a timeline of the incident and the licensee's response, (5) any comments or correspondence received from the resource agencies, or confirmation that no comments were received from the resource agencies, (6) documentation of any observed or reported environmental effects and how potential effects were evaluated, and (7) a description of measures implemented to prevent similar deviations in the future.

In addition to filing a report with Vermont DEC as required by Vermont ANR's water quality certification condition C (Appendix I), for unplanned deviations from run-of-river operation, spill flow, or impoundment level requirements lasting 3 hours or less that do not result in visible environmental effects, the licensee must file an annual report, by March 1, describing each incident that occurred during the prior January 1 through December 31 time period. The report must include for each 3 hours or less deviation: (1) the cause of the deviation, (2) the duration and magnitude of the deviation, (3) any pertinent operational and/or monitoring data, (4) a timeline of the incident and the licensee's response to each deviation, (5) any comments or correspondence received from the resource agencies, or confirmation that no comments were received from the resource agencies, and (6) a description of measures implemented to prevent similar deviations in the future.

Draft Article 003. *Operation Compliance Monitoring Plan.* Within six months of license issuance, the licensee must file with the Commission for approval, an operations compliance monitoring plan that includes the following:

- (1) a detailed description of how the licensee will monitor compliance with the operational requirements of Draft Article 002 (*Project Operation*), including descriptions of the mechanisms and instrumentation or gages used (i.e., type and exact locations of all flow and impoundment elevation monitoring equipment), and procedures for maintaining and calibrating all compliance monitoring equipment;
- (2) a provision to maintain a log of project operation; and
- (3) an implementation schedule.

The licensee must prepare the plan after consultation with Vermont Department of Environmental Conservation and Vermont Fish and Wildlife Department (collectively, agencies). The licensee must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensee must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on project specific information.

The Commission reserves the right to require changes to the plan. The licensee must not begin implementing the plan until the Commission notifies the licensee that the plan is approved. Upon Commission approval the licensee must implement the plan, including any changes required by the Commission.

Draft Article 004. *Debris Disposal Plan.* Within six months of license issuance, the licensee must file with the Commission for approval, a debris disposal plan that is consistent with the requirements specified in Vermont Agency of Natural Resources' (Vermont ANR) water quality certification condition F (Appendix I) and includes the following provisions:

- (1) a detailed description of the licensee's procedures for collecting, managing and disposing of organic and inorganic debris at the project; and ;
- (2) An implementation schedule.

The licensee must prepare the plan after consultation with Vermont ANR. The licensee must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to Vermont ANR and specific descriptions of how their comments are accommodated by the plan. The licensee must allow a minimum of 30 days for Vermont ANR to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a

recommendation, the filing must include the licensee's reasons, based on project specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensee is notified by the Commission that the plan is approved. Upon Commission approval, the licensee must implement the plan, including any changes required by the Commission.

Draft Article 005. *Reservation of Authority to Prescribe Fishways.* Authority is reserved to the Commission to require the licensee to construct, operate, and maintain fishways as may be prescribed by the Secretary of the U.S. Department of the Interior pursuant to section 18 of the Federal Power Act.

Draft Article 006. *Recreation Management Plan.* Within 6 months of license issuance, the licensee must file with the Commission for approval, the final Recreation Management Plan required by Vermont Agency of Natural Resource's (Vermont ANR) water quality certification condition E (Appendix I). The plan must include all of the provisions included in the Recreation Management Plan in Appendix H of the license application, filed on January 30, 2020, and the following additional provisions:

- (1) Install and maintain a picnic table that is accessible to persons with a disability;
- (2) Install a 12-foot-wide concrete level slab at the portage take-out;
- (3) Design drawings for improving the slope of the existing access road to enhance access for persons with disabilities; and
- (4) An implementation schedule for completing the above improvements within 2 years of license issuance.

As required by Vermont ANR's water quality certification condition E (Appendix I), the licensee must prepare the plan and implementation schedule after consultation with Vermont ANR. The licensee must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to Vermont ANR and specific descriptions of how their comments are accommodated by the plan. The licensee must allow a minimum of 30 days for Vermont ANR to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on project specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensee is notified by the Commission that the plan is approved. Upon Commission approval, the licensee must implement the plan, including any changes required by the Commission.

Draft Article 007. Programmatic Agreement and Historic Properties Management Plan. The licensee must implement the “Programmatic Agreement Between the Federal Energy Regulatory Commission and the Vermont State Historic Preservation Officer for Managing Historic Properties that May be Affected by Issuance of a License to Green Mountain Power for the Continued Operation of the Bolton Falls Hydroelectric Project in Washington County, Vermont (FERC No. 2879-012),” executed on [date], and including but not limited to the approved Historic Properties Management Plan (HPMP) for the project. In the event that the Programmatic Agreement is terminated, the licensee must continue to implement the provisions of its approved HPMP.

The Commission reserves the authority to require changes to the HPMP at any time during the term of the license.

**APPENDIX E. PHOTOGRAPHS OF THE DAM AND BYPASSED REACH TAKEN
DURING THE AESTHETIC SPILL FLOW AND BYPASS HABITAT
ASSESSMENTS**



Photo E-1. View of the Bolton Falls Dam with a Spill Flow of 0 cfs. Source: license application.



Photo E-2. View of the Bolton Falls Dam with a Spill Flow of 15 cfs. Source: license application.



Photo E-3. View of the Bolton Falls Dam with a Spill Flow of 50 cfs. Source: license application.



Photo E-4. View of the Bolton Falls Dam with a Spill Flow of 75 cfs. Source: license application.



Photo E-5. View of the Bolton Falls Dam with a Spill Flow of 150 cfs. Source: license application.



Photo E-6. View of the Bolton Falls Dam with a Spill Flow of 217 cfs. Source: license application.



Photo E-7. View of the Project Bypassed Reach with a Spill Flow of 0 cfs/leakage flow.
Source: license application.



Photo E-8. View of the Project Bypassed Reach with a Spill Flow of 15 cfs. Source: license application.



Photo E-9. View of the Project Bypassed Reach with a Spill Flow of 50 cfs. Source: license application.



Photo E-10. View of the Project Bypassed Reach with a Spill Flow of 75 cfs. Source: license application.



Photo E-11. View of the Project Bypassed Reach with a Spill Flow of 100 cfs. Source: Bypass Habitat Assessment Revised Final Study Report filed by GMP on December 3, 2021.



Photo E-12. View of the Project Bypassed Reach with a Spill Flow of 125 cfs. Source: Bypass Habitat Assessment Revised Final Study Report filed by GMP on December 3, 2021.



Photo E-13. View of the Project Bypassed Reach with a Spill Flow of 150 cfs. Source: license application.



Photo E-14. View of the Project Bypassed Reach with a Spill Flow of 217 cfs. Source: license application.

APPENDIX F. LITERATURE CITED

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APPENDIX G. LIST OF PREPARERS

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APPENDIX H. STAFF RESPONSE TO COMMENTS ON DRAFT ENVIRONMENTAL ASSESSMENT

Commission staff issued its draft environmental assessment (draft EA) for the relicensing of the Bolton Falls Hydroelectric Project (Bolton Falls Project) on August 13, 2021. Staff requested comments on the draft EA to be filed within 30 days of the issuance date, by September 12, 2021. The following entities filed comments pertaining to the draft EA.

<u>Commenting Entity</u>	<u>Date Filed</u>
Vermont Agency of Natural Resources (Vermont ANR)	September 13, 2021
Vermont State Historic Preservation Office (Vermont SHPO)	October 15, 2021

Below, we summarize the comments received on the draft EA that pertain to our analysis; respond to those comments; and indicate, where appropriate, how we modified the EA. The comments are grouped by topic for convenience. We do not summarize and respond to comments that request legal determinations, only express general opinions either for or against the proposed project or the staff alternative, or simply reiterate a stakeholder's position or recommendation.

Aquatic Resources

Comment: Vermont ANR suggests that the continuous water quality data GMP collected at the project better supports an analysis of operational effects on dissolved oxygen (DO) than the limited one-time spot measurements of DO that GMP collected in the bypassed reach as part of its *Bypass Habitat Assessment*. For example, Vermont ANR states the one-time spot measurements showed that DO in the bypassed reach met the state standard when the project wasn't spilling but noted that the measurements were taken 48 hours after spillage had occurred (thus suggesting that DO may have been elevated at the time) whereas the data collected under GMP's *Water Quality Study* showed that DO at the project fell below state standards at times during low flow periods or when GMP drew down the impoundment to make repairs on the inflatable bladder. Vermont ANR states this larger dataset indicates that some aspects of GMP's operation do not continuously meet water quality standards, specifically those periods when little to no flow is provided to the bypassed reach.

Response: Our description of existing water quality conditions in the draft EA considered all the site-specific water quality data collected by GMP at the project, not just the limited spot count measurements collected in the bypassed reach as part of the *Bypass Flow Study*. For instance, section 3.2.1.1 of the EA states that while DO concentrations at the project generally meet or exceed the State standard levels the majority of the time, the data collected under GMP's *Water Quality Study* showed there were several days in late August and early September when DO concentrations at the project fell below the State standard levels coinciding

with periods of low flows or when the impoundment was drawn down for maintenance repairs. Thus, the EA sufficiently considered the information cited by Vermont ANR.

Comment: Vermont ANR states that the draft EA does not specifically mention that the Eastern pearlshell mussel population found in the impoundment is composed of mostly older individuals. Vermont ANR states this population structure indicates that recruitment of younger individuals is potentially an issue at the project which could be exacerbated by impoundment drawdowns for maintenance.

Response: Section 3.2.1.1 of the EA acknowledges that the population of Eastern pearlshell mussels found in the impoundment is composed mostly of larger, mature adults. Also, the EA already includes an evaluation of some potential measures for minimizing adverse effects to younger mussel life stages such as avoiding planned drawdowns during the breeding season when sensitive life stages are present and conducting mussel surveys and relocating mussels to deeper waters during a drawdown.

Comment: Vermont ANR indicates that while it generally supports the Commission's recommendation in the draft EA for GMP to conduct planned drawdowns between November 1 and August 15 to avoid the mussel breeding season, the agency continues to recommend that GMP develop a water level management plan to protect mussels during maintenance drawdowns. Vermont ANR recommends that the plan include the Commission's recommended measure along with additional provisions such as "planning drawdowns on cool and overcast days, a protective drawdown rate, and limiting the duration of the drawdown as much as possible." In support of this recommendation, Vermont ANR states that *The Vermont Wildlife Action Plan* identifies "hydropower dams that create an unnatural frequency of water level changes" as a habitat threat to mussel populations and the plan identifies "working through the FERC process to reduce operational impacts on mussel populations" as a management action that needs to be addressed to ensure mussel populations are protected at hydroelectric dams.

Response: We included additional analysis in section 3.2.1.2 that addresses the provisions recommended by Vermont ANR. In section 5.1.2, we continue to recommend that GMP avoid drawing down the impoundment during the mussel breeding season (August 16 to October 31) to limit exposure of sensitive reproductive or larval mussel life stages to dewatering. However, our analysis also concludes that because Eastern pearlshell mussels at the project site have been shown to survive and persist during and immediately following typical maintenance drawdowns, there is no evidence to suggest that additional measures beyond avoiding the mussel breeding season are needed (such as conducting surveys and relocating mussels during each drawdown, planning drawdowns to occur on cool or overcast days, limiting the drawdown rate, etc.). Therefore, rather than developing a plan to protect mussels from dewatering, we continue to recommend that GMP conduct planned drawdowns between November 1 and August 15 and that GMP notify Vermont ANR prior to planned drawdowns of the impoundment below the normal operating limits (consistent with Vermont ANR's water quality certification condition G). Nonetheless, as stated in section 5.1.2 of the EA, we recognize that this will be a requirement in any new license issued for the project given the mandatory nature of the water quality certification.

As far as the *Vermont Wildlife Action Plan* cited by Vermont ANR, Commission staff reviewed the plan and conclude that our recommendations for GMP to operate in a run-of-river mode with minimal impoundment fluctuations and conducting planned maintenance drawdowns outside of the mussel breeding season would minimize adverse effects of project operation and maintenance on sensitive life stages of mussels and would be consistent with the goals and objectives of the plan.

Comment: Vermont ANR states that a spill flow of 150 cfs would provide high quality aquatic habitat in the bypassed reach because it would increase broken water surface and active circulation on both sides of the reach and water movement/circulation would extend further downstream in the reach compared to a spill flow of 75 cfs. Vermont ANR contends that spill flow of 75 cfs would primarily enhance conditions on the river-left channel (when looking downstream) with water movement/circulation extending only a short distance from the base of the dam on the right-right channel. Vermont ANR also suggests that “a flow somewhere between 75 cfs and 150 cfs may also meet the criteria for high quality aquatic habitat” and that aquatic habitat is a designated use pursuant to the state standards and that it must be supported on a continuous basis.

Response: As we already stated in the draft EA, a spill flow of 75 cfs would triple active circulation in the bypassed reach (from 25 percent of the reach under existing conditions to 75 percent) and triple the percentage of the reach showing a broken surface (from 10-15 percent under existing conditions to 40 percent). The increased water movement in the reach below the dam would enhance aquatic habitat conditions for fish and mussels, particularly during the drier months of July through October when water temperatures tend to be warmer, DO concentrations are lower, and flow in the reach below the dam is often slower and more stagnant. Our analysis in section 3.2.1.2 acknowledges that Vermont ANR’s previous recommendation of a year-round 150-cfs spill flow and its revised recommendation of a year-round 100-cfs spill flow (which is now a mandatory condition of Vermont ANR’s water quality certification) would provide an even greater increase in water movement and circulation in the reach compared to a spill flow of 75 cfs. However, given that there would be little to no aesthetic benefit from providing spill flows over the dam during the winter months and at night, and only slightly greater aesthetic and aquatic habitat benefits for fish and mussels by maintaining the higher spill flow during the summer and early fall compared to a spill flow of 75 cfs, we continue to conclude pursuant to sections 4(e) and 10(a) of the FPA that the additional aesthetic and aquatic habitat benefits of the agency’s higher spill flows are not worth the higher opportunity costs of providing the higher flow (in terms of forgone generation). Therefore, we continue to recommend under the Staff Alternative that GMP provide a 75-cfs flow or inflow, whichever is less, into the bypassed reach via spill over the dam during daylight hours from April 1 through October 31 to enhance aesthetics and aquatic habitat downstream of the dam. However, we also recognize that pursuant to section 401 of the Clean Water Act, the 100-cfs spill flow will be a requirement of any new license given the mandatory nature of the water quality certification.

Comment: Vermont ANR clarified that it is not recommending “a license requirement that GMP consult on the existing trash racks or submit new trash rack design plans”. However, it states that over the course of a licensing term, there may be a need to replace the trash racks that is not anticipated at this time. Thus, the agency recommends that GMP consult with the Vermont Fish and Wildlife Department should the need to replace the trash racks arise to ensure

that the project continues to maintain a trashrack design that limits the potential for fish mortality and complies with state standards.

Response: Our analysis in section 3.2.1.2 continues to show that the existing trash racks maintained by GMP are adequate at preventing most fish from being impinged or entrained at the project and there is no information to suggest entrainment is adversely affecting resident fish populations residing in the project impoundment or that the trash rack would need to be replaced. Thus, we continue to find pursuant to sections 4(e) and 10(a) of the FPA that there is no benefit to support a license requirement that GMP consult on the existing trash racks or submit new trash rack design plans when the trash racks need to be replaced and do not recommend it under the Staff Alternative. However, we also recognize in section 5.1.2 of the EA that this measure would be included in any license issued as a condition of Vermont ANR's water quality certification.

Comment: Vermont ANR clarified that its recommendation that flow monitoring and compliance data "be available on a near real-time basis" was in reference to the GMP having access to the data, not necessarily Vermont ANR. Vermont ANR recommends that GMP maintain data logs which would be available should it be requested but that the need for two new gauges both upstream and downstream of the project is unnecessary to meet this objective and that flow data can be derived using GMP's existing equipment.

Response: We revised the description of Vermont ANR's measure in the EA and acknowledge that it is now a condition of Vermont ANR's water quality certification and would be included in any license issued for the project. Even with Vermont ANR's clarification, we are not aware of how GMP could use its existing monitoring equipment to document compliance and report on a "near real time basis" an instantaneous run-of-river operation (i.e., data showing outflows equaling inflows), and measuring and reporting data on spill flows in the bypassed reach without installing new gauges that would be capable of directly measuring and reporting stream flows in real-time. Therefore we have no basis to modify our analysis or our recommendation in section 5.1.2.

Aesthetic Resources

Comment: Vermont ANR states that its analysis differs from the Commission's analysis because Vermont ANR does not consider lost generation in determining spillage requirements needed to meet Vermont Water Quality Standards. Vermont ANR states that aesthetics are a designated use that must be met continuously and that spillage also provides an auditory experience during day and night-time hours.

Response: As noted in sections 1.2.1 and section 5.1 of the EA, sections 4(e) and 10(a) of the FPA require the Commission to give equal consideration to the aesthetic benefits and opportunity costs of the spillage. While we agree aesthetic spill flows can provide an auditory benefit, that public interest benefit at the project is limited because the Bolton Falls Project is not in an urban setting where there are likely to be a substantial number of visitors to hear the falls at night and there are no areas where the public would be able to see the falls at night. Therefore, giving equal consideration to the benefits and costs of the flow pursuant to section 4(e) and 10(a) of the FPA, we continue to find that the limited aesthetic benefit of maintaining spill flows

during night-time hours does not justify the opportunity cost. Also, given that the recreation season typically lasts from April through October each year and recreation usage is expected to be low to non-existent in the colder months of November through March, we likewise continue to find there would be little to no aesthetic benefit of maintaining spill flows from November 1 to December 15. However, we also state in section 5.1.2 that the 100-cfs spill flow would be required in any new license because of the mandatory nature of the water quality certification pursuant to section 401 of the Clean Water Act.

Cultural Resources

Comment: The Vermont State Historic Preservation Officer (Vermont SHPO) suggests that for both the EA and the Programmatic Agreement, the references to implementing the February 2021 Historic Properties Management Plan (HPMP) be rephrased to, “finalize and implement the draft HPMP.”

Response: GMP filed its final HPMP on March 31, 2022. Therefore we have revised all references to the final HPMP.

Comment: The Vermont SHPO requests that the word “likely” be deleted in the EA section 3.6.2 in reference to the National Register of Historic Places (NRHP) eligibility of archaeological sites because the licensee and the Vermont SHPO have both concurred that the sites are NRHP eligible.

Response: We have revised section 3.6.2 in the EA to reflect the Vermont SHPO’s requested changes in reference to the eligibility of archaeological sites.

Comment: The Vermont SHPO states that they support the FERC staff alternative of the EA and concurs with the area of potential effect (APE) as described in section 3.2.6.1 of the EA.

Response: We have added a footnote to section 3.2.6.1 of the EA noting that the Vermont SHPO concurs with the APE in its letter filed October 15, 2021.

APPENDIX I. VERMONT AGENCY OF NATURAL RESOURCES WATER QUALITY CERTIFICATION (issued January 19, 2022)

Decision and Certification

The Department has examined the Project application and other pertinent information deemed relevant by the Department in order to issue a decision on this certification application pursuant to the Department's responsibilities under Section 401 of the federal Clean Water Act. After examination of these materials, the Department certifies that there is reasonable assurance that operation of the Project, when done in accordance with the following conditions will not violate Standards; will not have a significant impact on use of the affected waters by aquatic biota, fish or wildlife, including their growth, reproduction, and habitat; will not impair the viability of the existing populations; will not result in a significant degradation of any use of the waters for recreation, fishing, water supply or commercial enterprises that depend directly on the existing level of water quality; and will be in compliance with sections 301, 302, 303, 306, and 307 of the Federal Clean Water Act, 33 U.S.C. section 1341, and other appropriate requirements of state law:

- A. **Compliance with Conditions.** The Applicant shall operate and maintain this Project consistent with the findings and conditions of this certification. The Applicant shall not make any changes to the Project or its operations that would have a significant or material effect on the findings, conclusions or conditions of this Certification without approval of the Department.

See finding 113 for a statement of necessity. 10 V.S.A. § 1258 & Vt. Code R. 12 030 026 § 29A- 101.

- B. **Flow Management.** The Project shall be operated in instantaneous run-of-river mode with outflow equal to inflow on an instantaneous basis. Instantaneous run-of-river operation means no utilization of impoundment storage and that outflow from the facility is equal to inflow to the impoundment on an instantaneous basis except for short term deviations, as further described in Finding 70 and incorporated by reference. When generating, the Project shall spill 100 cfs continuously year-round in the bypass reach unless otherwise indicated in the flow management and monitoring plan (Condition C). When the Project is not operation, all flow shall be spilled at the dam.

See finding 70, 71, 74, 76, and 123-127 for a statement of necessity. 10 V.S.A. § 1258 & Vt. Code R. 12 030 026 § 29A-304 & § 29A-306 (b) & § 306 (c)(3)(B)(i).

- C. **Flow Management and Monitoring Plan.** The licensee shall develop within 180 days of the effective date of the FERC license, a flow management plan detailing how the Project will operate in a true run-of-river mode and seasonal flow management to comply with the conservation flow. The plan will also include a method for continuous monitoring and reporting (to allow records to be furnished upon request) of flow releases at the Project (conservation flow, spillage, and turbine discharge),

impoundment levels, and inflows. The plan shall include provisions for the flow data to be available on a near real-time basis.

The plan will include procedures for reporting deviations from prescribed operating conditions to the Department. Reports shall be made within 15 days after a deviation and will include, if possible, the causes, severity and duration of the deviation, observed or reported adverse environmental impacts from the incident, pertinent data, and measures to be taken to avoid recurrences.

The plan shall be subject to Department approval. The Department reserves the right to review and approve any material changes made to the plan.

See finding 113 and 127 for a statement of necessity. 10 V.S.A. § 1258 & Vt. Code R. 12 030 026 § 29A-304 & § 29A-306(b).

- D. **Trashracks.** Prior to the next replacement of the trashracks at the Project, the Applicant shall consult with the Fish and Wildlife Department with respect to the trashrack design and placement, to determine the appropriate bar clearance spacing and location. The Applicant shall file the trashrack design information with the Department of Environmental Conservation for approval prior to commencement of work.

See finding 57-63, and 119 for a statement of necessity. 10 V.S.A. § 1258 & Vt. Code R. 12 030 026 § 29A-306(a).

- E. **Recreational Facilities.** The Applicant shall develop within 180 days of the effective date of the FERC license, a plan and implementation schedule for recreation enhancements. The plan and schedule shall be developed in consultation with relevant stakeholders and shall be subject to approval by the Agency prior to implementation.

See finding 90, 102, 105, 134, 138, and 139 for a statement of necessity. 10 V.S.A § 5403 & 10.V.S.A. § 1258 & Vt. Code R. 12 030 026 § 29A-103(b)(1)(G).

- F. **Debris Disposal.** Debris associated with Project operations shall be disposed of in accordance with state laws and regulations.

See finding 107 and 140 for a statement of necessity. 10 V.S.A. § 1258 & Vt. Code R. 12 030 026 § 29A-303(1).

- G. **Maintenance Plan and Repair Work.** The licensee shall develop within 180 days of the effective date of the FERC license, a water level management plan for when drawdowns are needed for planned maintenance activities at the Project. The plan shall include provisions that will be taken to protect freshwater mussels from being dewatered during these activities, and will protect aquatic biota and wildlife in wetlands impacted by maintenance-related drawdowns. The plans shall be subject to review and approval by the Agency prior to being submitted to FERC. Additionally,

any Project maintenance or repair work, including drawdowns below the normal operating range to facilitate repair/maintenance work, shall be filed with the Department for prior review and approval, if said work may have a material adverse effect on water quality or cause less-than-full support of an existing use or a beneficial value or use of State waters.

See finding 80, 80, 87, 88, 129 and 133 for a statement of necessity. 10 V.S.A § 1258 & Vt. Code R. 12 0330 026 § 29A-103(a), § 29A-306(b) and § 29A-304(b).

- H. **Compliance Inspection by Department.** The Applicant shall allow the Department to inspect the Project area at any time to monitor compliance with certification conditions.

See finding 113 for a statement of necessity. 10 V.S.A § 1258 & Vt. Code R. 12 0330 026 § § 29A-104(a).

- I. **Posting of Certification.** A copy of the certification shall be prominently posed within the Project powerhouse.

See finding 113 for a statement of necessity. 10 V.S.A § 1258 & Vt. Code R. 12 0330 026 § 29A-104(a).

- J. **Modification of Certification.** The conditions of this certification may be altered or amended by the Department to assure compliance with the Vermont Water Quality Standards and to respond to any changes in classification of management objectives for the waters affected by the Project, when authorized by law, and, if necessary, after notice and opportunity for hearing.

See finding 113 for a statement of necessity. 10 V.S.A § 1258 & Vt. Code R. 12 0330 026 § 29A-104(a).