

**ENVIRONMENTAL ASSESSMENT
FOR
HYDROPOWER LICENSE**

Great Falls Hydroelectric Project
Docket No. P-2839-015
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

ACHP	Advisory Council on Historic Preservation
APE	area of potential effect
°C	degree Celsius
Certification	water quality certification
CFR	Code of Federal Regulations
cfs	cubic feet per second
cm	centimeters
Commission	Federal Energy Regulatory Commission
Commerce	U.S. Department of Commerce
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
EA	environmental assessment
EFH	essential fish habitat
ESA	Endangered Species Act
°F	degree Fahrenheit
FERC	Federal Energy Regulatory Commission
FPA	Federal Power Act
fps	feet per second
FWS	U.S. Fish and Wildlife Service
Great Falls Project	Great Falls Hydroelectric Project
HPMP	Historic Properties Management Plan
IPaC	U.S. Fish and Wildlife Service Information for Planning and Consultation
Interior	U.S. Department of the Interior
Lyndonville	Village of Lyndonville Electric Department
mg/L	milligrams per liter
msl	mean sea level
MW	megawatt
MWh	megawatt-hours
National Register	National Register of Historic Places
NERC	North American Electric Reliability Corporation
NHPA	National Historic Preservation Act
NLEB	northern long-eared bat
NMFS	National Marine Fisheries Service
NPCC	Northeast Power Coordinating Council, Inc.
NRI	Nationwide Rivers Inventory
PAD	Pre-Application Document
RM	river mile
SCADA	supervisory control and data acquisition
SCORP	Statewide Outdoor Recreation Plan

SHRU	Salmon Habitat Recovery Unit
USGS	U.S. Geological Survey
Vermont ANR	Vermont Agency of Natural Resources
Vermont DEP	Vermont Department of Environmental Protection
Vermont DIFW	Vermont Department of Inland Fisheries and Wildlife
Vermont DMR	Vermont Department of Marine Resources
Vermont SHPO	Vermont State Historic Preservation Officer
Vermont AEC	Vermont Agency of Environmental Conservation
Vermont DEC	Vermont Department of Environmental Conservation
WUA	weighted usable area

ENVIRONMENTAL ASSESSMENT

Federal Energy Regulatory Commission Office of Energy Projects Division of Hydropower Licensing Washington, DC

GREAT FALLS HYDROELECTRIC PROJECT Project No. 2839-015 – Vermont

1.0 INTRODUCTION

1.1 APPLICATION

On May 26, 2017, the Village of Lyndonville Electric Department (Lyndonville) filed an application with the Federal Energy Regulatory Commission (Commission) for a new license to continue to operate and maintain the Great Falls Hydroelectric Project No. 2839 (Great Falls Project or project).¹ The 2.05-megawatt (MW) project is located on the Passumpsic River, in the Town of Lyndon, Caledonia County, Vermont (Figure 1).² The project does not occupy federal land.

¹ The prior license for the project was issued on June 29, 1979, for a term of 40 years, with an effective date of June 1, 1979, and an expiration date of May 31, 2019. *See Vill. of Lyndonville Elec. Dep't*, 7 FERC ¶ 61,324 (1979). An annual license for the project was issued on June 18, 2019, for the continued operation of the project under the terms and conditions of the prior license until either a new license is issued, or the project is otherwise disposed of as provided in section 15 or any other applicable section of the Federal Power Act.

² In its May 26, 2017 license application, Lyndonville states that it is seeking a subsequent license. The Commission's regulations define a "subsequent license" as a license for a water power project issued under Part 1 of the Federal Power Act after a minor or minor part license that is not subject to sections 14 and 15 of the FPA expires. 18 C.F.R. § 16.2(d) (2019). The regulations define a minor water power project as a project that would have a total installed generating capacity of 1.5 megawatts (MW) or less. Because the total installed generating capacity of the project, as currently licensed, is greater than 1.5 MW and the current license for the project is subject to sections 14 and 15 of the FPA, the application is for a "new license," not a subsequent license. *See* 18 C.F.R. § 16.2(a) (2019).

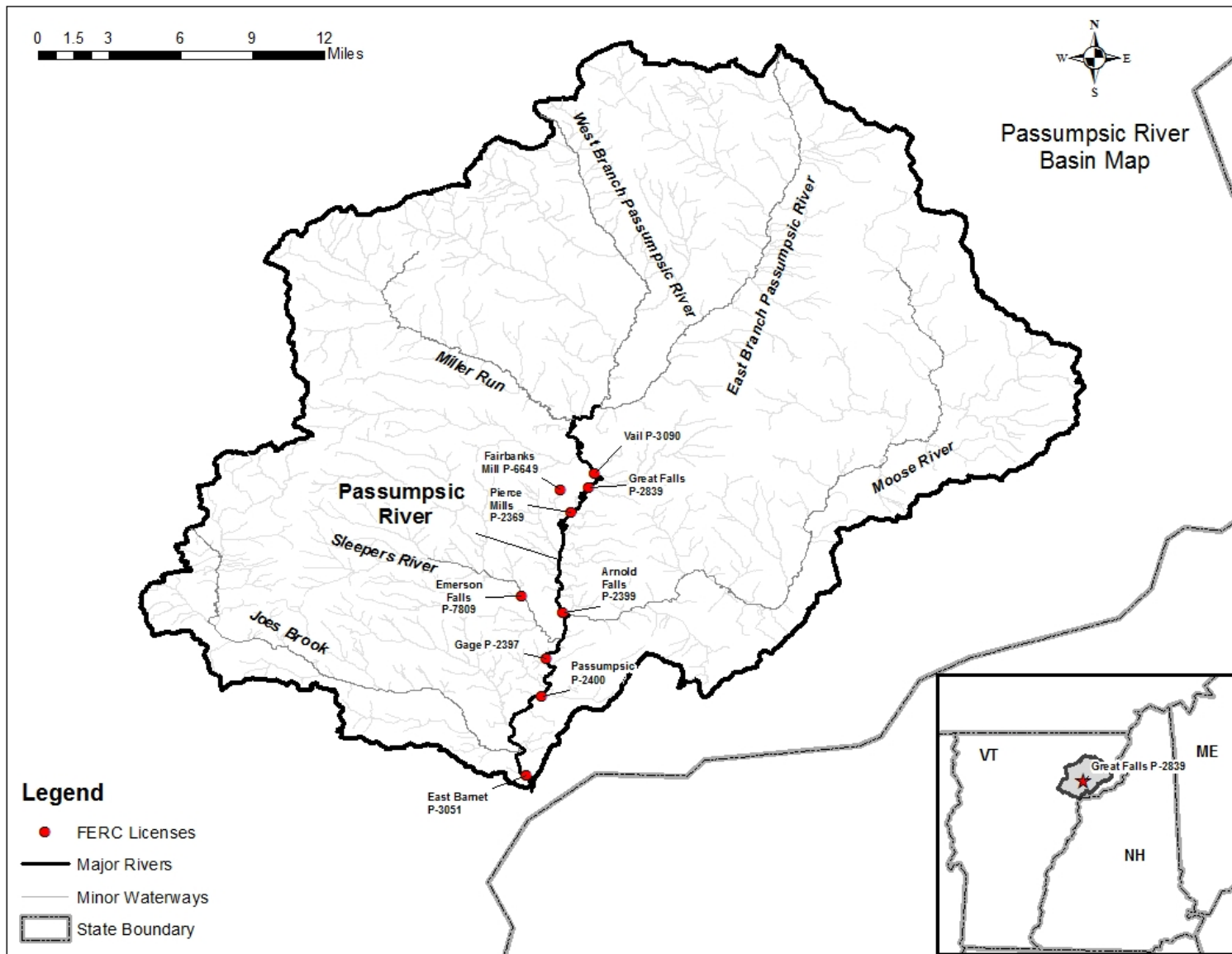


Figure 1. Location of the Great Falls Project and other FERC-licensed hydroelectric projects in the Passumpsic River Basin. (Source: staff).

1.2 PURPOSE OF ACTION AND NEED FOR POWER

1.2.1 Purpose of Action

The purpose of the Great 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 Lyndonville for the Great Falls 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 the waterway. In addition to the power and developmental purposes for which licenses are issued (such as flood control, irrigation, and water supply), the Commission must give equal consideration to the purposes of: (1) energy conservation; (2) the protection, 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 Great Falls Project would allow Lyndonville to continue to generate electricity at the project for the term of the new license, making electric power from a renewable resource available to its customers.

This environmental assessment (EA) analyzes the effects associated with operation of the project and alternatives to the project, and makes recommendations to the Commission on whether to issue a license, and if so, recommends terms and conditions to become a part of any license issued.

The EA assesses the environmental and economic effects of: (1) operating and maintaining the project as proposed by Lyndonville; and (2) operating and maintaining the project as proposed by Lyndonville, with additional staff-recommended measures (staff alternative). We also consider the effects of the no-action alternative. Under the no-action alternative, the project would continue to operate as it does under the existing license, and no new environmental protection, mitigation, or enhancement measures would be implemented. The primary issues associated with relicensing the project are providing recreation opportunities at the project and protecting cultural resources.

1.2.2 Need for Power

The Great Falls Project has an installed capacity of 2.05 MW and an average annual generation of about 3,960 megawatt-hours (MWh) from 2003 through 2013. The project provides power to Lyndonville's residential and industrial customers.

To assess the need for power, we looked at the needs in the operating region in which the project is located. The North American Electric Reliability Corporation (NERC) annually forecasts electrical supply and demand nationally and regionally for a

10-year period. The Great Falls Project is located within the Northeast Power Coordinating Council's New England region (NPCC-New England) of the NERC. According to NERC's 2018 Long-Term Reliability Assessment, the summer internal demand for this region is projected to decrease by 0.25 percent from 2019 to 2028. The anticipated reserve margin (*i.e.*, the primary metric used to evaluate the adequacy of projected generation resources to serve forecasted peak load) is forecasted to range from 29.43 percent in 2019 to 29.24 percent in 2028. The NPCC-New England assessment area is forecasted to meet NPCC-New England's target reserve margin of 16.91 in 2019, 17.20 in 2020 and 16.36 in 2021 through 2028 (NERC, 2018).

Although demand is projected to decrease in the region, we conclude that power from the project would continue to help meet the regional need for power. In addition, the project would provide power that could help maintain the stability of the power system and respond rapidly to a major system outage. The project provides power that can displace 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

A 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 below.

1.3.1 Federal Power Act

1.3.1.1 Section 18 Fishway Prescriptions

Section 18 of the 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 (Commerce) or the U.S. Department of the Interior (Interior). Neither Commerce nor Interior filed fishway prescriptions for the project or requested a reservation of authority to prescribe fishways.

1.3.1.2 Section 10(j) Recommendations

Under section 10(j) of the FPA, 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 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 federal or state fish and wildlife agency filed recommendations under section 10(j).

1.3.2 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 (certification) 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 certification. A waiver occurs if the state agency does not act on a request for certification within a reasonable period of time, not to exceed one year after receipt of such request.

On January 11, 2019, Lyndonville applied to the Vermont Department of Environmental Conservation (Vermont DEC) for section 401 certification for the Great Falls Project. Vermont DEC received the request on January 17, 2019. Vermont DEC has not yet acted on the application. The certification is due by January 17, 2020.

1.3.3 Endangered Species Act

Section 7 of the Endangered Species Act (ESA), 16 U.S.C. § 1536, requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of the critical habitat of such species. On June 13, 2019, we accessed the U.S. Fish and Wildlife Service's (FWS) Information for Planning and Consultation (IPaC) database to determine whether any federally listed species could occur in the project vicinity. According to the IPaC database, the federally threatened northern long-eared bat (*Myotis septentrionalis*) could occur in the project vicinity.³ No critical habitat has been designated for this species.

Our analysis of project impacts on the northern long-eared bat is presented in section 3.3.3.2, *Threatened and Endangered Species – Environmental Effects*. Based on available information, we conclude that licensing the project, as proposed with the staff-recommended measures, would not be likely to adversely affect the northern long-eared bat.

1.3.4 Coastal Zone Management Act

The Coastal Zone Management Act (CZMA) of 1972, as amended, requires review of the project's consistency with a state's Coastal Management Program for

³ See Interior's official list of threatened and endangered species, accessed by staff using the IPaC database (<https://ecos.fws.gov/ipac/>) on June 13, 2019, and added by staff to the Project No. 2839 docket on June 13, 2019.

projects within or affecting the coastal zone. Under section 307(c)(3)(A) of the CZMA, 16 U.S.C. §1456(c)(3)(A), the Commission cannot issue a license for a project within or affecting a state's coastal zone unless the state's CZMA agency concurs with the license applicant's certification of consistency with the state's CZMA Program, or the agency's concurrence is conclusively presumed by its failure to act within 180 days of its receipt of the applicant's certification.

The State of Vermont does not have a Coastal Zone Management Program. Therefore, a CZMA consistency certification is not required.

1.3.5 National Historic Preservation Act

Section 106 of the National Historic Preservation Act (NHPA), 54 U.S.C. § 306108, requires that a federal agency "take into account" how 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 Lyndonville's May 27, 2014 request, Commission staff designated Lyndonville as its non-federal representative for the purposes of conducting section 106 consultation under the NHPA on September 29, 2014. Pursuant to section 106, and as the Commission's designated non-federal representative, Lyndonville initiated consultation with the Vermont Division for Historic Preservation, which functions as the State 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). This consultation, and other investigations conducted to date, identified the Great Falls Hydroelectric Power Station as eligible for listing on the National Register. The 700-kilowatt (kW) powerhouse (*i.e.*, the "old powerhouse"), the 1,350-kW powerhouse (*i.e.*, the "new powerhouse"), the penstock, the spillway and power canal, and the Great Falls dam are contributing elements to the overall Great Falls Hydroelectric Power Station.

To meet the requirements of section 106 of the NHPA, we intend to execute a Programmatic Agreement with the Vermont SHPO for the protection of historic properties from the effects of continued operation and maintenance of the Great Falls Project. The terms of the Programmatic Agreement would ensure that Lyndonville protects all historic properties identified within the project's APE through the implementation of a Historic Properties Management Plan (HPMP).

1.4 PUBLIC REVIEW AND COMMENT

The Commission's regulations (18 CFR § 16.8) 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 (16 U.S.C. § 661 *et seq.*), ESA, 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, we conducted scoping to determine what issues and alternatives should be addressed. Scoping Document 1 (SD1) was distributed to interested agencies and others on September 27, 2017. It was noticed in the *Federal Register* on October 4, 2017. The following entities provided written comments pertaining to SD1:

<u>Commenting Entity</u>	<u>Date Filed</u>
Connecticut River Conservancy	October 20, 2017
Vermont Agency of Natural Resources	October 27, 2017
Vermont Division for Historic Preservation	October 30, 2017

A revised scoping document (SD2), addressing these comments was issued on November 30, 2017.

1.4.2 Interventions

On December 17, 2018, the Commission issued a notice accepting the application and setting February 15, 2019 as the deadline for filing motions to intervene and protests. The notice was published in the *Federal Register* on December 21, 2018. On February 8, 2019, the Commission issued a notice of comment period extension due to a funding lapse at certain federal agencies, which extended the deadline for motions to intervene and protests to March 22, 2019. The following entities filed motions/notices of intervention (none opposed issuance of a license):

<u>Intervenor</u>	<u>Date Filed</u>
Vermont Agency of Natural Resources	January 17, 2019
Connecticut River Conservancy	March 22, 2019

1.4.3 Comments on the Application

On December 17, 2018, the Commission issued a notice setting February 15, 2019 as the deadline for filing comments, recommendations, terms and conditions, and prescriptions. The notice also established a deadline of April 1, 2019 for filing reply comments. On February 8, 2019, the Commission issued a notice of comment period extension due to a funding lapse at certain federal agencies, which extended the deadline for comments, recommendations, terms and conditions, and prescriptions to March 22, 2019 and the deadline for reply comments to May 6, 2019. The following entities responded:

<u>Commenting Entity</u>	<u>Date Filed</u>
Interior	March 19, 2019
Vermont Division of Historic Preservation	March 22, 2019

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 existing 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 Great Falls Project is located on the Passumpsic River in the Town of Lyndon, Caledonia County, Vermont, approximately 17.0 river miles upstream of the confluence of the Passumpsic River and the Connecticut River. The project facilities are shown in Figure 2.

The existing Great Falls Project includes: (1) a 160-foot-long, 32-foot-high curved, concrete dam with 2-foot-high flashboards at an elevation of 668.38 feet above mean sea level (msl);⁴ (2) a 6-foot-long, 15-foot-wide, 28-foot-high concrete headworks structure with two 5-foot-wide, 8-foot-high wood and iron headgates; and (3) an 8-foot-long, 8-foot-wide, 12-foot-high brick headworks gate house. The project impoundment

⁴ Exhibits A and E and the Supporting Design Report included in Exhibit F of the final license application indicate the dam is 32 feet-high. However, the drawing on page F-2 of Exhibit F indicates the dam is 38.3 feet high as measured from the dam crest (666.4 feet msl) to the toe of the dam (628.1 feet msl).

has a surface area of approximately 15.7 acres and a storage capacity of 135 acre-feet at a normal full pond water surface elevation of 668.38 feet msl.

From the impoundment, water flows through the headgates to an approximately 282-foot-long, 22-foot-wide power canal that is covered for 70 feet. From the power canal, water enters the powerhouses through a 22.5-foot-long, 10-foot-diameter metal penstock that reduces to a 165-foot-long, 7.33-foot-diameter metal penstock that trifurcates to one 22-foot-long, 6-foot diameter, and two 9-foot-long, 3-foot-diameter penstocks. The penstock intake includes two 15-foot-wide, 22-foot-high trashracks with clear bar spacing of 1.5 to 1.75 inches. In addition, the power canal is equipped with a 4-foot-wide, 4-foot-high wood and iron skimming sluice gate and a 4-foot-wide, 5-foot-high wood and iron sand sluice gate that are adjacent to the penstock intake.

There are two powerhouses at the project: a 47-foot-long, 25-foot-wide powerhouse containing a 1,350-kW vertical turbine-generator unit and a 40-foot-long, 40-foot-wide concrete powerhouse containing two 350-kW horizontal turbine-generator units, for a total capacity of 2,050 kW. Water is discharged from the two powerhouses via 4-foot-diameter steel draft tubes into the 184-foot-long tailrace where it returns to the Passumpsic River. A 380-foot-long, 2.4-kilovolt above-ground transmission line connects the turbine-generator leads to a substation step-up transformer where the project is interconnected with the Lyndonville distribution system.

There are no designated recreation facilities located at the project.

2.1.2 Current Project Boundary

The current project boundary for the Great Falls Project, as established in the Commission's June 29, 1979 license order and amended in the Commission's September 13, 1984 order, encompasses approximately 20.54 acres⁵ and includes the 15.7-acre

⁵ The original license issued by the Commission on June 29, 1979, as amended on September 13, 1984 and March 8, 1985, does not specify a total project boundary acreage. See *Vill. of Lyndonville Elec. Dep't*, 7 FERC ¶ 61,324 (1979), *Vill. of Lyndonville Elec. Dep't*, 28 FERC ¶ 62,372 (1984) (1984 Amendment Order), and *Vill. of Lyndonville*, 30 FERC ¶ 62,250 (1985). Commission staff estimates that the existing project boundary encompasses approximately 20.54 acres based on project features identified in the original license order and license amendment orders. Staff used georeferenced shapefiles, aerial photographs, Exhibit G maps, and the project descriptions in the June 29, 1979 license order, and the September 13, 1984 and March 8, 1985 amendment orders to measure lands associated with the project features.

impoundment up to a contour elevation of 668.38 feet msl⁶ and land that is needed for project purposes, including land associated with the dam, powerhouses, power canal, tailrace, and appurtenant facilities. As shown on the Exhibit G map approved by the Commission on March 8, 1985, a four and a half story storage building (*i.e.*, referred to herein as the “old mill” building) is located within the current project boundary. The majority of the approximately 1,050-foot-long access road (approximately 950 feet) is not included within the current project boundary. The current project boundary does not include any federal land.

⁶ The original license describes the size of the impoundment as 12 surface acres at an elevation of 668.38 feet msl. *See Vill. of Lyndonville Elec. Dep't*, 7 FERC ¶ 61,324 at Ordering Paragraph (B)(2). However, the actual impoundment size is 15.7 surface acres at an elevation of 668.38 feet msl, as verified by updated geographically-referenced data filed by Lyndonville on October 26, 2017.



Figure 2. Great Falls Project facilities (Source: staff).

2.1.3 Project Safety

The Great Falls Project has been operating for more than 40 years under the existing license. 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 license, and proper maintenance.

As part of the licensing process, Commission staff would evaluate the continued adequacy of the project's facilities under a new license. Special articles would 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 project is manually operated by on-site staff. As required by the 1984 Amendment Order, the project is operated in an instantaneous run-of-river mode. When generating, water is conveyed from the project impoundment to the power canal and penstock, and into the project powerhouses, where it is then discharged to the Passumpsic River through the project tailrace. The project creates an approximately 750-foot-long bypassed reach of the Passumpsic River between the dam and the tailrace.

Collectively, the turbine generators have minimum and maximum hydraulic capacities of 15 and 450 cubic feet per second (cfs), respectively. Pursuant to the 1984 Amendment Order, the project releases a minimum flow of 10 cfs (or inflow to the impoundment, whichever is less) from the dam to the 750-foot-long bypassed reach. When river flow is greater than the 450-cfs maximum hydraulic capacity of the project, water is spilled over the dam and into the bypassed reach. In the event of an outage or when the generators are offline, a minimum flow of 75 cfs is released through the 1,350-kW powerhouse into the tailrace to maintain aquatic habitat for fish and aquatic communities in the downstream reach, pursuant to the 1984 Amendment Order.

Non-project recreation facilities include a 0.25-mile-long, packed earth and log canoe portage route located on the east bank of the river, and a swimming area in the bypassed reach.

The annual energy production of the project from 2003 through 2013 averaged 3,960 MWh.

2.2 APPLICANT'S PROPOSAL

2.2.1 Proposed Project Facilities

Based on the Exhibit G filed on October 26, 2017, Lyndonville proposes a project boundary that encompasses approximately 22.77 acres of land and water, which is 2.23 acres greater than the existing project boundary. Lyndonville proposes to modify the current project boundary by:

- Removing approximately 0.12 acre of land associated with the Old Mill building;
- Adding approximately 0.66 acre of land associated with the existing access road and a proposed parking area for recreation users; and
- Adding the approximately 1.69-acre bypassed reach.

2.2.2 Proposed Operation and Environmental Measures

Lyndonville proposes to:

- Continue to operate the project in a run-of-river mode to protect aquatic resources, and install a pond level control system and governor upgrade to assist with maintaining run-of-river operation;
- Increase the minimum flow released from the dam into the bypassed reach from 10 cfs to 62 cfs or inflow, whichever is less, to protect aquatic resources;
- Develop a “minimum flow management and monitoring plan” to verify that the minimum flow is being released into the bypassed reach;
- Continue to release 75 cfs or inflow, whichever is less, from the 1,350-kW powerhouse during shutdowns to protect aquatic resources;
- Implement a recreation management plan that includes the following provisions: (1) construct and maintain a new 10-foot-wide, 60-foot-long gravel parking area for recreation users; (2) develop and maintain a new 10-foot-wide, 90-foot-long grass-covered trail leading to a site located on the western shoreline of the bypassed reach that Lyndonville is proposing to designate as a bank fishing area; (3) develop and maintain a new 10-foot-wide, 60-foot-long grass-covered trail leading to a site on the west bank of the Passumpsic River, downstream of the tailrace, that Lyndonville is proposing to designate as a carry-in boat access area; (4) install directional signage to the carry-in boat access site; (5) install an informational kiosk identifying

recreational amenities at the project; (6) continue to operate and maintain the 0.25-mile-long canoe portage route as a non-project recreation facility; and (7) conduct a recreation inventory, use, and needs assessment within one year of installation of the project recreation facilities to evaluate recreation use, potential safety issues, and the need for mitigation measures to improve existing project facilities.

2.3 STAFF ALTERNATIVE

Under the staff alternative, the project would be operated as proposed by Lyndonville with some modifications and additional staff-recommended measures described below.

The staff alternative for the project includes modifications of and additions to Lyndonville's proposed measures as follows:

- Develop an operation compliance monitoring plan instead of a minimum flow management and monitoring plan;
- Avoid cutting trees between June 1 and July 31 to protect roosting northern long-eared bats;
- Revise the proposed recreation management plan to include the following additional provisions: (1) operate and maintain the existing non-project canoe portage route as a project recreation feature; (2) install a parallel boat slide along the steep section of the portage route to enhance boater safety; and (3) install signage to indicate the location of the take-out and put-in for the canoe portage route;
- Develop an HPMP to protect historic properties that are eligible for or listed on the National Register; and
- Revise the project boundary as follows: (1) add approximately 0.66 acre of land associated with the existing access road and a new parking area, as proposed by Lyndonville; and (2) add approximately 0.15 acre of land associated with the canoe portage route.⁷

⁷ Staff is neither recommending Lyndonville's proposal to add the 1.69-acre bypassed reach to the project boundary nor to remove 0.12 acre of land associated with the Old Mill building from the project boundary.

2.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

Project decommissioning was considered as an alternative to the project, but has been eliminated from further analysis because it is not reasonable in the circumstances of this case. We discuss our justification for eliminating project decommissioning as an alternative below.

2.4.1 Project Decommissioning

As the Commission has previously held, decommissioning is not a reasonable alternative to relicensing a project in most cases, when appropriate protection, mitigation, and enhancement measures are available.⁸ 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 there are serious resource concerns that cannot be addressed with appropriate license measures, making decommissioning a reasonable alternative to relicensing.⁹ This is consistent with the National Environmental Policy Act of 1969 (NEPA) and the Commission's obligation under section 10(a) of the FPA to issue licenses that appropriately balance developmental and environmental interests.

Project retirement could be accomplished with or without dam removal.¹⁰ Either alternative would involve denial of the license application and surrender or termination of the existing license with appropriate conditions.

⁸ See, e.g., *Eagle Crest Energy Co.*, 153 FERC ¶ 61,058, at P 67 (2015); *Pub. Util. Dist. No. 1 of Pend Oreille Cty.*, 112 FERC ¶ 61,055, at P 82 (2005); *Midwest Hydro, Inc.*, 111 FERC ¶ 61,327, at PP 35-38 (2005).

⁹ 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).

¹⁰ In the unlikely event that the Commission denies relicensing of 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 (2019). 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.

No participant has recommended project retirement, there are no critical resource concerns, and we have no basis for recommending project retirement. The Great Falls Project is a source of clean, renewable energy. This source of power would be lost if the project was retired. There also could be significant costs associated with retiring the project's powerhouses and appurtenant facilities.

Project retirement without dam removal would involve retaining the dam and disabling or removing equipment used to generate power. Certain project works could remain in place and could be used for historic or other purposes. This approach would require the State of Vermont to assume regulatory control and supervision of the remaining facilities. However, no participant has advocated for this alternative, and we do not have any basis for recommending it. Removing the dam would be more costly than retiring it in place, and removal could have substantial, negative environmental effects.

3.0 ENVIRONMENTAL ANALYSIS

This section includes: (1) a general description of the project vicinity, (2) an explanation of the scope of our cumulative effects analysis, and (3) our analysis of the proposed action and other recommended environmental measures. Sections are organized by resource area (*e.g.*, aquatic and recreation). Historic and current conditions are described under each resource area. The existing conditions are the baseline against which the environmental effects of the proposed action and alternatives are compared, including an assessment of the effects of proposed mitigation, protection and enhancement measures, and any potential cumulative effects of the proposed action and alternatives. Staff conclusions and recommended measures are discussed in section 5.1, *Comprehensive Development and Recommended Alternative*.¹¹

3.1 GENERAL DESCRIPTION OF THE RIVER BASIN

The Great Falls Project is located at river mile 17.4 on the Passumpsic River, approximately 17 miles upstream of the confluence between the Passumpsic River and the Connecticut River. The mainstem of the Passumpsic River is formed by the confluence of the East and West Branch Passumpsic Rivers in Lyndon, Vermont. The Passumpsic River Basin has a total drainage of 507 square miles and extends from Vermont's northeastern border with the Canadian province of Quebec, through Essex and

¹¹ Unless otherwise indicated, our information is taken from the application for license filed by Lyndonville on May 26, 2017, and Lyndonville's license amendments filed on July 31, 2017, August 25, 2017, August 29, 2017, October 26, 2017, November 22, 2017, January 26, 2018, February 8, 2018, March 22, 2018, May 3, 2018, August 20, 2018, and October 16, 2018.

Caledonia Counties and portions of Orleans and Washington Counties, and ends at the confluence of the Passumpsic River and the Connecticut River. There are seven dams on the Passumpsic River that are used for hydropower generation (Table 1). The major tributaries of the Passumpsic River include Joes Brook, Moose River, Miller Run, and Sleepers River.

Table 1. Hydropower Projects on the Passumpsic River.

Project	FERC No.	River Mile	Generation Capacity (kW)	Dam Height (feet)	Surface Area (acres)	Impoundment Volume (acre-feet)
Vail	3090	18.5	350	32	5.0	150
Great Falls	2839	17.4	2,050	32	12.0	135
Pierce Mills	2396	15.8	250	23	1.0	300
Arnold Falls	2399	10.5	350	21	7.0	170
Gage	2397	8.1	700	13	15.0	69
Passumpsic	2400	6.0	700	11	18.3	70
East Barnet	3051	1.3	2,200	12	25.0	136

(Source: Lyndonville, 2017, as modified by staff).

The Great Falls Project lies within the Vermont piedmont region of the Northeast Highlands (Johnson, 1980). The Vermont piedmont region consists of largely rolling terrain with a plateau-like upland that stretches east from the foothills of the Green Mountains to the Connecticut River (Stewart and MacClintock, 1969). The topography varies from undulating to rough, with numerous steep-sided valleys, small hills, and steeply-incised streams that generally run north-northeast to south-southwest. The project lies near the boundary between two natural forest vegetation zones: the Spruce-Fir-Northern Hardwoods and Northern Hardwoods-Hemlock-White Pine zones (Meeks, 1975). Approximately 76 percent of the total land cover in the project vicinity is forestland, followed by agriculture at approximately 12 percent of the land cover. Overall, only a small percentage of the project vicinity is developed (3.1 percent) (NOAA CCAP, 2010).

Based on climatological data from 1981 to 2010 that was collected at the National Weather Service monitoring station (USW00054742) located approximately 6 miles south of the project in St. Johnsbury, Vermont, the average air temperature is 45 °F, with July being the warmest month and January being the coldest month (NOAA, 2010). The average annual precipitation including the water equivalent of snow is 39.5 inches. For the time period on record, July is the wettest month and February is the driest month.

3.2 SCOPE OF CUMULATIVE EFFECTS ANALYSIS

According to the Council on Environmental Quality's regulations that implement NEPA (40 C.F.R. § 1508.7), a cumulative effect is the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative effects can result from individually minor, but collectively significant actions taking place over a period of time, including hydropower and other land and water development activities.

Based on our review of the license application, as well as agency and public comments, we have identified water quality and fisheries as having the potential to be cumulatively affected by the continued operation and maintenance of the Great Falls Project, in combination with other hydroelectric projects and activities in the Passumpsic River Basin.

3.2.1 Geographic Scope

The geographic scope of the cumulative effects analysis defines the physical limits or boundaries of the proposed action's effects on the resource, and contributing effects from other hydropower and non-hydropower activities. We have identified the geographic scope for our cumulative effects analysis for water quality and fish to include the Passumpsic River from the confluence of the East and West Branches of the Passumpsic River downstream to the confluence of the Passumpsic River and the Connecticut River.

3.2.2 Temporal Scope

The temporal scope of our cumulative effects analysis includes a discussion of past, present, and reasonably foreseeable future actions and their effects on each resource that could be cumulatively affected. Based on the potential term of a new license, the temporal scope looks 30 to 50 years into the future, concentrating on the effects on the resources from reasonably foreseeable future actions. The historical discussion is limited, by necessity, to the amount of available information. We identified the present resource conditions based on the license application, agency comments, and comprehensive plans.

3.3 PROPOSED ACTION AND ACTION ALTERNATIVES

In this section, we discuss the project-specific 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 site-specific environmental issues.

Only the resources that would be affected, or about which comments have been received, are addressed in detail in this EA. Based on this, we have determined that aquatic resources, terrestrial resources, threatened and endangered species, land use and recreation, and cultural resources may be affected by the proposed action and alternatives. We have not identified any substantive issues related to geology and soils, aesthetic resources, or socioeconomics associated with the proposed action; therefore, these resources are not addressed in the EA. We present our recommendations in section 5.1, *Comprehensive Development and Recommended Alternative*.

3.3.1 Aquatic Resources

3.3.1.1 Affected Environment

Water Quantity

The Great Falls Project receives water from the Passumpsic River, which has a drainage area of approximately 507 square miles. The drainage area upstream of the project dam is approximately 229 square miles.¹² The 15.7-acre project impoundment is 1.1 river miles long, with an average depth of 11.3 feet, and has minimal storage capacity (135-acre feet). Lyndonville manually operates the project as a run-of-river facility. An operator is on site for some or all of an 8-hour shift and away for the remaining 16 or more hours. Run-of-river operation relies on accurate forecasting of inflows for the day and the ability of the operator to set the turbine to the correct opening to match inflows. During the 8-hour shift, the operator monitors the pond level and adjusts turbine settings to ensure run-of-river operation. If the forecast is incorrect, or the turbine governor is set incorrectly, then outflows from the project may deviate from inflows to the impoundment.

The existing license requires a continuous minimum flow of 10 cfs, or inflow to the impoundment, whichever is less, to be spilled from the dam into the approximately 750-foot bypassed reach. In addition, the current license requires Lyndonville to release 75 cfs from the 1,350-kW powerhouse into the project tailrace during shutdowns. Flows less than the project's minimum hydraulic capacity of 15 cfs and flows exceeding the project's maximum hydraulic capacity of 450 cfs are spilled over the dam.

¹² Lyndonville states in the license application that the drainage area upstream of the dam is 232 square miles. However, USGS (2016) indicates that the drainage area upstream of the dam is 229 square miles.

Table 2 shows monthly Passumpsic River flow data at the project from January 1, 1980 to December 31, 2017.¹³ The mean annual flow is 435 cfs, with monthly flows generally lowest from July to September and highest in April. The maximum peak flow recorded during the period of record was 5,988 cfs, which occurred in April 2014. The lowest peak flow recorded during the period of record was 33 cfs, which occurred in September 1999. For the period of record, flow exceeded 450 cfs about 29.0 percent of the time and 10 cfs about 99.9 percent of the time.

Table 2. Minimum, mean, and maximum flow from the Great Falls Project (January 1980 to December 2017).

Month	Minimum Daily Flow (cfs)	Mean Daily Flow (cfs)	Maximum Daily Flow (cfs)
January	88	335	3,781
February	55	295	3,939
March	49	525	4,648
April	211	1,134	5,988
May	115	622	5,462
June	58	385	4,470
July	38	275	3,540
August	35	246	5,105
September	33	199	2,432
October	56	357	3,965
November	95	420	2,742
December	95	420	4,648
Annual	33	435	5,988

(Source: staff).

Water Quality

State Water Quality Classifications

The Passumpsic River is classified by the state of Vermont as Class B(2) and designated as cold water fish habitat (Vermont DEC, 2017). Vermont DEC's criteria for these waters include, but are not limited to:

¹³ The monthly flow data in Table 2 is based on information collected at U.S. Geological Survey (USGS) gage no. 01135500, which is located in Passumpsic, Vermont, 12.1 miles downstream of the project dam and 5.2 miles downstream of the confluence with the Moose River. Staff prorated the Passumpsic River flow by a factor of 0.53 to compensate for the difference in drainage area at the Passumpsic gage (436 square miles) and at the project (229 square miles).

- (1) total phosphorus concentrations of 15 micrograms per liter;
- (2) pH values between 6.5 and 8.5;
- (3) a total increase from the ambient temperature due to all discharges and activities not exceeding 1.0°F;
- (4) turbidity levels not to exceed 25 Nephelometric Turbidity Units;
- (5) dissolved oxygen (DO) concentrations not less than 6 milligrams per liter (mg/l) and 70 percent saturation at all times; and
- (6) for purposes of recreation/swimming, *Escherichia coli* (*E. coli*) levels not exceeding a geometric mean of 126 organisms/100 milliliters obtained over a representative period of 60 days, and no more than 10 percent of samples above 235 organisms/100 milliliters.

In addition, Vermont DEC requires that changes to flow characteristics, physical habitat structure, and stream processes be limited to moderate differences from the natural condition and consistent with the full support of high quality aquatic habitat.

Currently, the Passumpsic River downstream of St. Johnsbury, Vermont, does not meet the recreation criteria because of high *E. coli* concentrations (Vermont DEC, 2019). In the project boundary, the Passumpsic River does not meet the aquatic habitat standard because of alterations to the flow regime in the bypassed reach (Vermont DEC, 2019).

Water Quality Monitoring

To monitor temperature and DO, Lyndonville deployed data loggers in the upper impoundment, middle impoundment, intake canal, tailrace, and bypassed reach (Figure 3). The data loggers were installed two to five feet below the surface, collected temperature and DO data every 15 minutes, and collected data from mid-June through mid-September, 2017. Lyndonville also installed an air pressure sensor (*i.e.*, a barologger) on the peninsula between the tailrace and bypassed reach to collect data for calculating the oxygen saturation of the water.

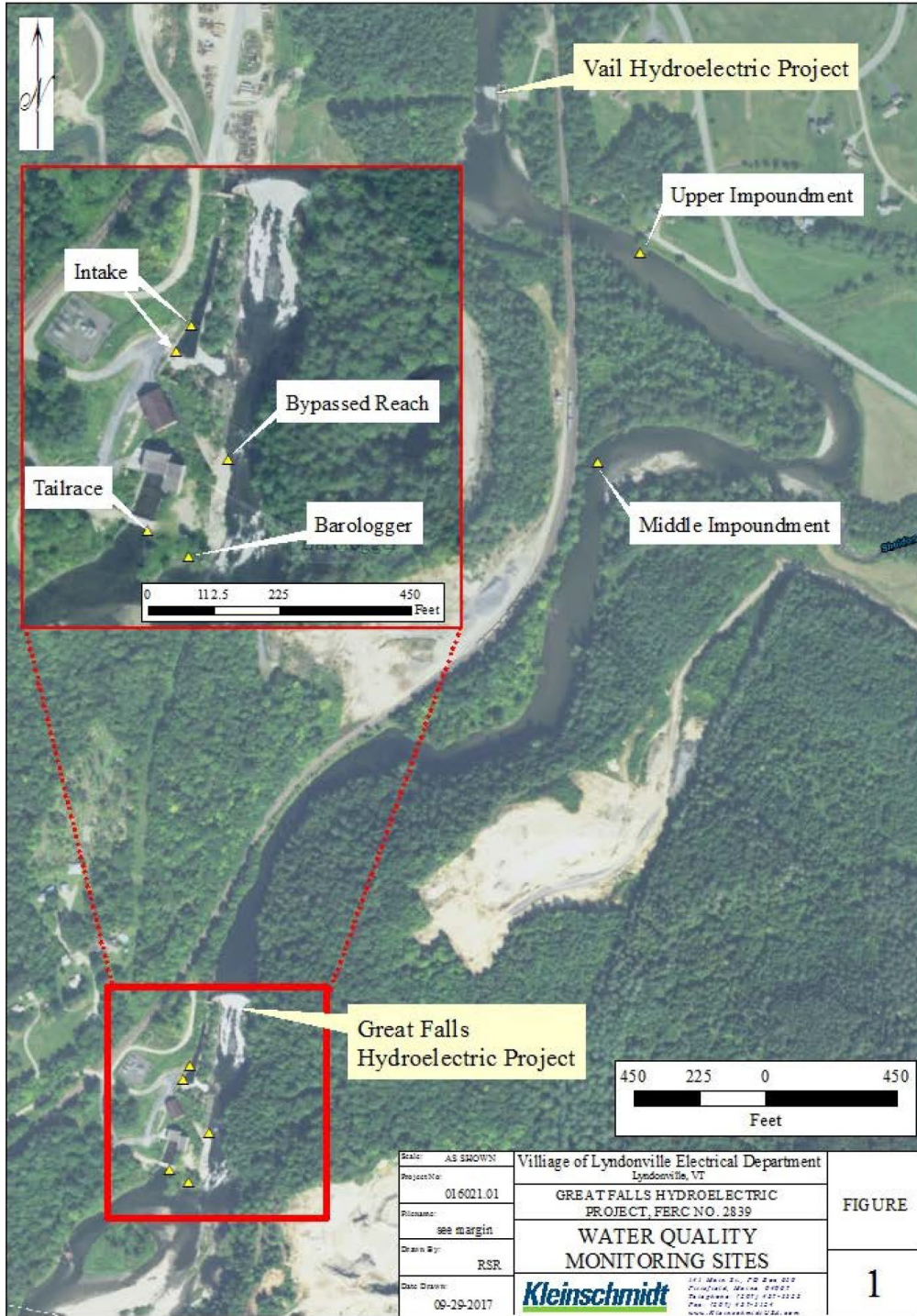


Figure 3. Locations of temperature and DO data loggers and barologger. (Source: Lyndonville)

During the study, the monthly average DO concentrations ranged from 8.7 to 10.7 mg/L and 92.9 to 103.2 percent saturation across the five monitoring locations.¹⁴ The lowest DO concentrations generally occurred in July and the highest concentrations occurred in September. DO ranged from 3.9 mg/L to 11.4 mg/L during the study period. DO saturation ranged from 42.4 to 120.0 percent. DO concentrations were within 0.7 mg/L of each other on average each month. Differences in DO saturation among the sites tended to be less than 5 percent on average.

Water temperature increased from June through August. The difference in average water temperature among the five sites was generally less than 0.5 °F. Throughout June, July, and August, the water temperature ranged from 55.4 °F to 73.0 °F, and the average monthly water temperature at the five sites ranged between 62.2 °F to 64.4 °F for this period. The water temperature decreased at the end of August through mid-September and ranged from 51.8 °F to 62.4 °F.

Aquatic Habitat

Impoundment Habitat

The 15.7-acre project impoundment is 1.1 river miles long, has an average depth of 11.3 feet, and has a storage capacity of 135 acre-feet. The shoreline immediately surrounding the project impoundment is mostly forested, with the exception of agricultural land that is located approximately 0.75 mile upstream of the project dam along the northeastern end of the impoundment. With the exception of some level terraces around the northern end of the impoundment, the gradient along the shoreline generally exceeds 15 percent. The soil within the project boundary is predominantly loamy fine sand with low to moderate susceptibility to erosion.

Bypassed Reach

¹⁴ Lyndonville excluded certain DO data from its water quality study report. During the study, Lyndonville observed that DO concentrations dropped rapidly toward 0.0 mg/L in the upper impoundment, intake, and tailrace either during or following precipitation events and elevated river flows. During the first data download on July 10, 2017, Lyndonville found that sand covering the upper impoundment and tailrace loggers resulted in the low readings. Altogether, DO data was excluded on the following days due to abnormally low concentrations: June 14, June 16, June 18, June 19, June 20, June 30, July 10, September 8, and September 12, 2017. For additional information, *see* Lyndonville's October 26, 2017 license application amendment at Exhibit E, Appendix B (Study Reports – Water Quality Study, October 2017 Draft Report).

The Great Falls Project creates an approximately 750-foot-long bypassed reach of riverine habitat between the dam and the tailrace. Substrate in the bypassed reach is dominated by boulder, cobble, and ledge outcrops. Mesohabitat in the bypassed reach includes two cascades, a riffle, a run, and two pools (Figure 4). The upper portion of the reach near the dam is primarily bedrock cascade and waterfalls with nearly vertical embankments. The rest of the bypassed reach is made up of a large plunge pool below the falls, a low-gradient riffle, a run, a cascade, and a large pool just upstream of the tailrace. Pool and cascade habitat are the most abundant habitat types (45.0 and 35.2 percent, respectively), followed by run (10.8 percent) and riffle (9.0 percent).

Under the current license, Lyndonville spills 10 cfs over the dam into the bypassed reach via a slot in the flashboards at the middle of the dam. When inflow is less than 15 cfs (the minimum hydraulic capacity of the turbines) and greater than 450 cfs (the maximum hydraulic capacity of the turbines), flows spill over the dam into the bypassed reach.



Figure 4. Great Falls Project bypassed reach mesohabitats. (Source: Lyndonville).

Fishery Resources

The development of dams on the Passumpsic River changed the composition and distribution of riverine habitat primarily through the creation of several shallow, narrow impoundments. Vermont DEC classifies the Passumpsic River as cold water fish habitat. While fish community data from the Passumpsic River are unavailable, Yoder *et al.* (2009) surveyed the Connecticut River approximately 1,200 feet downstream of the Passumpsic River confluence and collected black crappie, brown trout, longnose dace, slimy sculpin, smallmouth bass, rainbow trout, and white sucker. These species also likely inhabit the Passumpsic River, including the project area.

The Passumpsic River and its tributaries provide a variety of riverine habitat (*e.g.*, runs, riffles, and pools) that are available for rearing, overwintering, and spawning of cold water fish species, including native and stocked trout. Most of these tributaries have an excellent fishery, and several of them support wild brook trout populations (Vermont DEC, 2013). The Vermont Department of Fish and Wildlife (Vermont DFW) stocks brown trout, rainbow trout, and brook trout in the Passumpsic River annually. There is no documentation as to whether Vermont DFW actively stocks trout within the Great Falls impoundment, but Vermont DFW has previously stocked trout in various reaches of the Passumpsic River, including from Burke, Vermont (approximately 12 miles upstream of the project) to St. Johnsbury, Vermont (approximately 7 miles downstream of the project).

No migratory fish species are currently found in the project vicinity. Historically, Atlantic salmon were found in the Passumpsic River watershed, but were extirpated from the Connecticut River Basin in the late 1700s after the construction of dams to power mills and factories (Gephard and McMenemy, 2004). A joint effort by the states of Connecticut, Massachusetts, Vermont, and New Hampshire to restore Atlantic salmon to the Connecticut River was begun in the late 1960's (Gephard and McMenemy, 2004). However, FWS terminated the Connecticut River Basin Atlantic salmon restoration program in 2012 due to low adult returns and the cost of the restoration program. American eels were not found by Yoder *et al.* (2009) upstream of river mile 89 on the Connecticut River (140 miles downstream of the Passumpsic River mouth); however, the Vermont Agency of Natural Resources (Vermont ANR) (2015) reported that eels were found in Hall Lake and Morey Lake, which are connected to tributaries that enter the Connecticut River approximately 30 and 42 miles, respectively, downstream of the Passumpsic River mouth.

The benthic macroinvertebrate communities in the mainstem and tributaries upstream and downstream of the Great Falls dam have been classified as good to excellent (Vermont DEC, 2013), indicating that there is a reliable forage base for resident and stocked fish species.

3.3.1.2 Environmental Effects

Water Quality

Lyndonville proposes to continue to operate the project in run-of-river mode, with outflow from the project approximating inflow to the impoundment. Lyndonville also proposes to increase the minimum flow released from the dam into the bypassed reach from 10 cfs to 62 cfs or inflow, whichever is less, to protect aquatic resources. In addition, Lyndonville proposed to continue to release 75 cfs or inflow, whichever is less, from the 1,350-kW powerhouse to the tailrace during generation shutdowns.

Our Analysis

Dissolved Oxygen

Dissolved oxygen is an important indicator of water quality and is required at an adequate concentration to sustain aquatic resources. After removing the anomalous DO data from the water quality study results in 2017, DO concentration and saturation were consistent with the Vermont water quality standard of 6 mg/L or 70 percent saturation throughout the entire monitoring period in the upper impoundment, middle impoundment, tailrace, and bypassed reach sites. DO also met the standard at the intake except for short periods on July 22 (two hours), July 23 (nine hours), and July 24 (five hours) when it decreased to as low as 4 mg/L and 45 percent saturation. The cause of the decrease in DO concentration and percent saturation at the intake is unknown. However, during the 16 hours that DO was below the standard in the intake area (0.7 percent of all measurements), DO ranged from approximately 8.1 mg/L to 10.2 mg/L in the tailrace, indicating that DO returned to suitable levels after passing through the powerhouse. Given that a large increase in DO concentration and saturation between the intake and tailrace occurred during these observations, but not at other times, suggests that the intake data logger may have been affected by biofouling or sedimentation. Continuing to operate the project in run-of-river mode will help maintain adequate DO concentrations in the project impoundment, tailrace, and downstream of the project.

While the project did not shut down during the study, low flows from August 29 to September 4 greatly reduced generation. During this period, discharge from the powerhouses was approximately 100 cfs, with DO concentrations ranging from 8.5 to 11.5 mg/L, and DO saturation ranging from 90 to 110 percent. Given that DO concentrations and saturation in the tailrace were well above Vermont water quality standards during this low-flow period, it seems likely that releasing 75 cfs from the 1,350-kW powerhouse during shutdowns would be sufficient to maintain adequate oxygenated conditions in the tailrace when the project is not generating.

With regard to the bypassed reach, DO levels were consistent with the Vermont water quality standard when a minimum flow of 10 cfs was being released from the dam into the bypassed reach. Increasing the minimum flow to the bypassed reach to 62 cfs or inflow would expand the amount of aquatic habitat available in the bypassed reach, and additional water spilled into the bypassed reach would be well-oxygenated based on the oxygen levels in the middle impoundment upstream of the project dam.

Water Temperature

Operating a dam on a riverine system has the potential to affect water temperature by increasing the residence time of water in an impoundment and openly exposing water at the surface to the heat of the sun, without cover from the streambank. High temperatures are associated with lower DO and shifts in water chemistry that can be harmful to fish and other aquatic organisms. Changes in temperature are most evident during low flow periods when residence time is already longer because of the reduced volume of water reaching the impoundment.

Data collected on water temperatures in the upper impoundment, middle impoundment, intake, bypassed reach, and tailrace indicate that there is little temperature deviation between these five sites. Water temperatures recorded during the water quality study were consistent with the Vermont water quality standard of a total increase from the ambient temperature due to all discharges and activities of less than 1.0 °F. Continuing to operate the project in a run-of-river-mode, as proposed by Lyndonville, would minimize project effects on the water temperature of the Passumpsic River. Because of the similarity in temperatures between the impoundment, intake, tailrace, and bypassed reach, the water temperature downstream of the impoundment would not likely be affected by the proposed minimum flow released from the 1,350-kW powerhouse during shutdowns or from the increased minimum flow to the bypassed reach.

Run-of-River Operation

Lyndonville proposes to continue operating the Great Falls Project in run-of-river mode. To assist with maintaining run-of-river operation, Lyndonville proposes to install a pond level control system to ensure project outflow approximates inflow.¹⁵

¹⁵ The pond level control system would consist of a sensor in the impoundment that measures the impoundment water surface elevation and compares it to the desired elevation (in this case, the desired impoundment elevation would likely be 668.38 feet msl). Based on that measurement, the system would send a signal to the turbine governor to increase or decrease generation to bring the impoundment elevation back to the desired level.

Lyndonville's proposed system would include supervisory control and data acquisition (SCADA) capabilities, such as remote alarming and data recording.

Our Analysis

Lyndonville manually operates the project in run-of-river mode. An operator is on site for some or all of an 8-hour shift and away for the remaining 16 or more hours. Manual operation relies on accurate forecasting of inflows for the day and the ability of the operator to set the turbine during the shift to the correct opening to match inflows. If the forecast is incorrect, or the turbine governor is set incorrectly, outflow would not approximate inflow, and the project would deviate from run-of-river operation.

Installing a pond level control system would minimize unnatural fluctuations in the project impoundment and the flow regime of the Passumpsic River downstream of the powerhouses. Accurately maintaining stable impoundment levels would reduce disruption to shoreline habitat and benefit fish and other aquatic organisms that rely on near-shore habitat for spawning, foraging, and cover. In addition, intentionally maintaining downstream flow rates and fluctuations similar to those of the river immediately upstream of the project's impoundment would protect near-shore spawning habitat in the river downstream of the project from rapid flow changes that could otherwise be caused by abrupt changes in project generation.

Utilizing a SCADA system at the project would allow for remote monitoring of the pond level and other operating parameters. If project operation deviates from run-of-river mode while the station is unstaffed, the system would send an alarm to a central location. This would allow Lyndonville to correct project operation more quickly compared to the existing manual operating scheme where staff is only onsite for 8 hours each day. In addition, data records of pond levels would be collected automatically and be available for compliance monitoring to ensure run-of-river operation.

Operation Compliance Monitoring Plan

Lyndonville proposes to operate the project in run-of-river mode and release a minimum flow of 62 cfs or inflow, whichever is less, from the dam into the bypassed reach during normal operation. Lyndonville also proposes to release 75 cfs or inflow, whichever is less, from the 1,350-kW powerhouse during generation shutdowns.

As described above, Lyndonville proposes to install a pond level control system to automate run-of-river operation. Lyndonville would use sensors to monitor water levels at the project and to control the impoundment and discharges from the 1,350-kW powerhouse to the downstream reach. To ensure that that minimum flow is released into the bypassed reach, Lyndonville proposes to develop a "minimum flow management and monitoring plan" within one year of license issuance.

Our Analysis

Although compliance measures do not directly affect environmental resources, they do allow the Commission to ensure that a licensee complies with the environmental requirements of a license. Therefore, operation compliance monitoring and reporting are typical requirements in Commission-issued licenses.

Based on the description in the final license application, Lyndonville's proposed minimum flow management and monitoring plan would only describe how Lyndonville would control minimum flow releases and verify that minimum flows are being released into the bypassed reach. Lyndonville does not currently have formalized monitoring protocols or reporting requirements to verify compliance with run-of-river operation, and Lyndonville does not state if the proposed minimum flow management and monitoring plan would be used to verify compliance with run-of-river operation. Monitoring and verifying only minimum flow releases would not ensure that Lyndonville operates the project in run-of-river mode and minimizes impoundment level fluctuations. Therefore, developing an operation compliance monitoring plan that includes monitoring run-of-river operation in addition to minimum flow releases would help Lyndonville document its compliance with the operational provisions of any new license, provide a mechanism for reporting operational data and deviations, facilitate administration of the license, ensure the protection of resources that are sensitive to impoundment fluctuations, and ensure that minimum flows are conveyed to the bypassed reach.

Minimum Flow

Lyndonville proposes to continue to release 75 cfs or inflow, whichever is less, from the 1,350-kW powerhouse during generation shutdowns to protect aquatic resources in the tailrace. Lyndonville also proposes to increase the minimum flow released from the dam into the bypassed reach from 10 cfs to 62 cfs or inflow, whichever is less, to protect aquatic resources. Lyndonville developed the minimum flow proposal in consultation with Vermont ANR.

Our Analysis

Minimum Flow in the Tailrace

The existing 75-cfs minimum flow requirement was originally developed in consultation with resource agencies and included in the June 29, 1979 license order.¹⁶

¹⁶ *Vill. of Lyndonville Elec. Dep't*, 7 FERC at ¶ 61,726.

Seventy-five cfs is higher than the 7Q10 flow¹⁷ for the Passumpsic River at the project location. Therefore, releasing 75 cfs or inflow from the 1,350-kW powerhouse during shutdowns would be a higher flow than what occurs during low-flow periods. No entity has reported adverse effects on aquatic organisms or habitat in the project tailrace during previous shutdowns or during previous low-flow conditions, and staff expects that continuing to release 75 cfs during future shutdowns would continue to protect aquatic resources in the tailrace.

Minimum Flow in the Bypassed Reach

In June 2017, Lyndonville conducted an instream flow study to assess the relationship between river flow and aquatic habitat for selected aquatic organisms in the 750-foot-long bypassed reach between the Great Falls dam and the tailrace. Lyndonville established three transects in the bypassed reach (Figure 5). Transects 1 and 2 were located in run habitats, and Transect 3 was located in a riffle habitat (see Figure 4). Transect 1 represented run habitat with abundant cover and velocity refugia, and Transect 2 represented run habitat with limited cover and refugia. Lyndonville collected habitat data along each transect at 9 cfs, 60 cfs, and 115 cfs.¹⁸ These flows represent the approximate current minimum flow, the 7Q10 flow, and the approximate aquatic base flow under the FWS's minimum flow guideline, respectively.¹⁹ Lyndonville measured depth, velocity, and water surface elevation at 9 cfs and 60 cfs, and measured only water surface elevation at 115 cfs. Lyndonville also recorded substrate and cover availability along each transect.

¹⁷ The 7Q10 flow represents the lowest 7-day average flow that occurs once every 10 years. The 7Q10 is often used to estimate a low streamflow value and analyze discharge effects in the permitting process for the national pollution discharge elimination system that is implemented under the Clean Water Act.

¹⁸ While Lyndonville attempted to release 10 cfs, 60 cfs, and 116 cfs, the actual measured flows for the study were 9 cfs, 60 cfs, and 115 cfs.

¹⁹ The FWS aquatic base flow guideline is a method of estimating a minimum flow value that would protect aquatic organisms. The aquatic base flow is estimated by multiplying the watershed area in square miles by 0.5 cfs (FWS, 1981). For the Great Falls Project, the aquatic base flow is 0.5 multiplied by 232 (the drainage area upstream of the project dam as described in the license application), which equals 116 cfs.

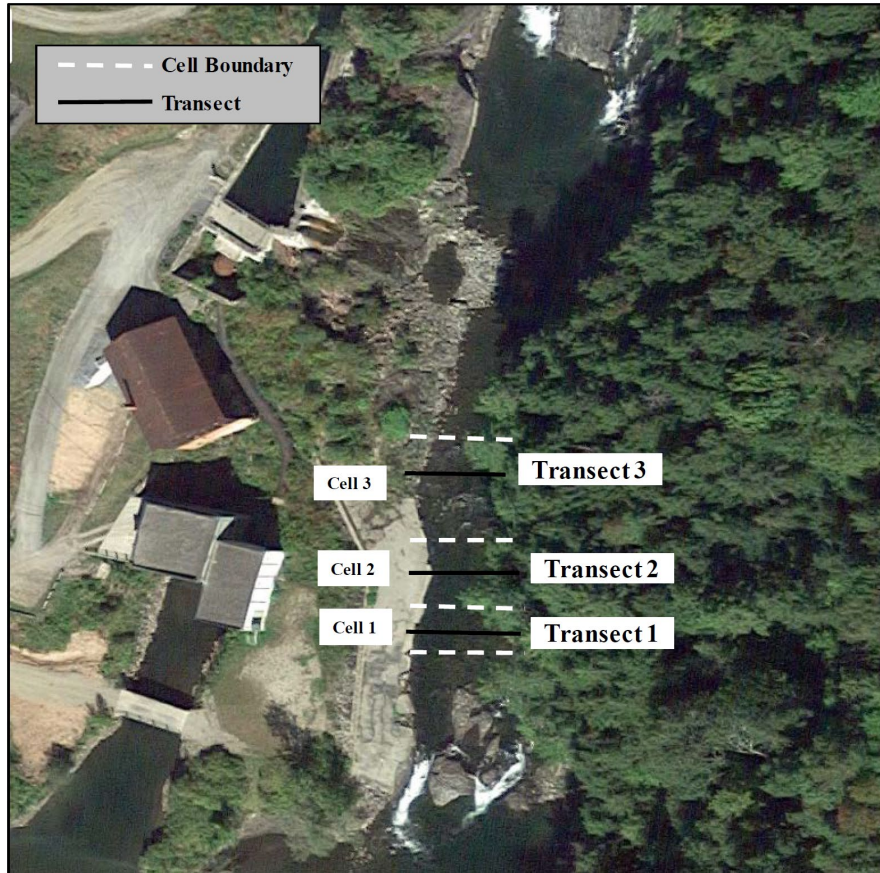


Figure 5. Transect locations in the Great Falls Project bypassed reach. (Source: Lyndonville)

Using the depth, velocity, substrate, and cover data, Lyndonville conducted habitat modeling to evaluate the relationship between the amount of suitable habitat for select fish species and flow in the bypassed reach. Specifically, Lyndonville used the Physical Habitat Simulation (PHABSIM) system, which combines a hydraulic model with habitat suitability criteria of selected species to simulate how a habitat index (weighted usable area, WUA) changes over a range of flows between 9 cfs and 115 cfs. Lyndonville calculated the WUA for juvenile and adult rainbow trout, juvenile and adult brook trout, adult longnose dace, and benthic macroinvertebrates.

The maximum WUA in the bypassed reach occurred between 30 cfs and 80 cfs for all species and life stages except benthic macroinvertebrates (Table 3). Both 40 cfs and 60 cfs would provide 91 to 100 percent of the maximum WUA for all the fish species and life stages. However, a flow of 60 cfs would provide an additional 24 percent of the maximum WUA for benthic macroinvertebrates compared with a flow of 40 cfs (Table 3). Flows at 40 cfs and 60 cfs would provide a 58.7 to 208.3 percent increase in WUA for the life stages of the fish species of interest, relative to the WUA that would be available at 9 cfs. In addition, flows at 40 cfs and 60 cfs would provide a 1002.6 to

1603.4 percent increase in WUA compared to the WUA available at 9 cfs for benthic macroinvertebrates (Table 4).

Table 3. Percent of maximum WUA in the bypassed reach by flow. (Source: Lyndonville)

Flow (cfs)	Juvenile Rainbow Trout	Adult Rainbow Trout	Juvenile Brook Trout	Adult Brook Trout	Adult Longnose Dace	Benthic Macro-invertebrates
9	53	30	61	60	50	4
20	87	61	91	86	80	19
30	100	79	100	93	92	34
40	100	92	100	99	98	44
60	100	91	97	100	100	68
80	100	93	90	96	97	88
100	91	100	78	91	89	94
115	83	95	72	88	81	96

Table 4. Percent increase of WUA in the bypassed reach compared to the WUA available at 9 cfs. (Source: Lyndonville and staff)

Flow (cfs)	Juvenile Rainbow Trout	Adult Rainbow Trout	Juvenile Brook Trout	Adult Brook Trout	Adult Longnose Dace	Benthic Macro-invertebrates
20	64.3	103.0	48.9	43.0	59.8	364.0
30	88.9	164.9	63.1	54.7	82.9	749.8
40	89.8	208.3	63.0	65.7	95.4	1002.6
60	89.0	205.7	58.7	66.7	99.8	1603.4
80	89.3	212.7	47.4	60.0	93.5	1949.8
100	72.7	235.1	27.1	52.3	77.3	2240.8
115	57.3	219.9	17.7	46.5	62.6	2301.9

Altogether, flows of 40 cfs and 60 cfs would provide substantially more habitat than 9 cfs, which is approximately equal to the current minimum flow to the bypassed reach. Providing 91 percent to 100 percent of the maximum WUA would mean that almost all of the available habitat for these fish species could be utilized at flows of 40 to

60 cfs, and that these species would be able to occupy habitat that is unavailable at the current minimum flow of 10 cfs. Furthermore, this habitat would be available throughout the year, which could increase the abundance of fish species in the bypassed reach.

As for benthic macroinvertebrates, the increase in the WUA that occurs between 40 cfs and 60 cfs is the largest increase between any two consecutive flow levels analyzed. Providing 60 cfs to the bypassed reach would provide a 17-fold increase in the WUA for benthic macroinvertebrates compared to 9 cfs. Such a large increase in the amount of available habitat would likely increase the production of benthic macroinvertebrates in the bypassed reach, which would increase the amount of forage available to fish in the bypassed reach and downstream areas. Increasing the amount of available forage would further improve the habitat quality of the bypassed reach for fish.

Entrainment and Impingement

Water flows from the impoundment into a 282-foot-long power canal. At the end of the power canal is a penstock intake equipped with two trashracks, each of which is approximately 15 feet wide and 22 feet tall. The trashracks are made of full depth, steel vertical bars with clear spacing between the bars that varies between 1.5 and 1.75 inches. Lyndonville confirmed the clear spacing in the field in June 2017 and states that the variation in spacing is likely a result of debris or ice impact that has misaligned the trashrack bars over time. Three turbines are contained in two powerhouses, including a 1,350-kW vertical turbine and two 350-kW horizontal turbines.

Our Analysis

Lyndonville assessed the physical size of stocked trout and their swimming speeds to evaluate the risk of entrainment through the turbines and impingement on the trashracks. Vermont ANR stocks brook, brown, and rainbow trout in the project area. Lyndonville consulted Vermont ANR's trout stocking records to determine the lengths of fish stocked in the Passumpsic River and used the length-to-width ratios reported by Smith (1985) to estimate the widths of the stocked fish (Table 5). In addition, Lyndonville estimated sustained, prolonged, and burst swim speeds for trout based on the body length per second speeds reported by Beamish (1978), Bell (1991), and FWS (1989) (Table 6).²⁰

²⁰ The sustained swimming speed (3 body lengths per second) is the speed a fish can maintain indefinitely and is also called the cruising speed. The prolonged swimming speed (5 body lengths per second) is the speed a fish can maintain for a specific period of time (*i.e.*, up to 200 minutes). The burst swimming speed (7 body lengths per second) is the fastest swimming speed, which can only be maintained for a short duration (*i.e.*, approximately 20 seconds).

Table 5. Lengths and widths of trout stocked in the project area. (Source: Lyndonville, as modified by staff)

Species	Length (inches)	Calculated Body Width (inches)
Brook trout	9.1	1.11
Brown trout	8.4 to 9.3	0.99 to 1.10
Rainbow trout	10.2 to 10.9	1.17 to 1.25

Table 6. Estimated sustained, prolonged, and burst swim speeds in feet per second (fps) for trout by length. (Source: Lyndonville)

Length (inches)	Sustained Swim Speed (fps)	Prolonged Swim Speed (fps)	Burst Swim Speed (fps)
6	1.5	2.5	3.5
7	1.8	2.9	4.1
8	2.0	3.3	4.7
9	2.3	3.8	5.3
10	2.5	4.2	5.8
11	2.8	4.6	6.4
12	3.0	5.0	7.0

To better understand the potential effects of existing project operation on impingement and entrainment, Commission staff calculated the velocity through the trashracks (*i.e.*, “through velocity”) at the maximum hydraulic capacity of the turbines.²¹

²¹ Lyndonville provided an estimate of through velocity in Appendix B of the revised Exhibit E filed October 26, 2017. However, the through velocity estimate Lyndonville provided was based on trashracks that are 26.5 feet wide and 13 feet high. However, Lyndonville states in the revised Exhibit A, filed October 26, 2017, that the trashracks are 15 feet wide and 22 feet high. Therefore, staff assumed that the trashrack dimensions provided in the revised Exhibit A are the correct dimensions.

Assuming a minimum clear spacing of 1.5 inches,²² the velocity through the open spaces of the trashrack would be approximately 0.8 fps.²³ The 8.4-inch to 10.9-inch trout Vermont ANR stocks in the Passumpsic River could overcome this through velocity and, therefore, avoid involuntary entrainment and impingement (Table 6). In fact, only trout less than 1.25 inches long would be entrained by the project assuming a burst swim speed of 7 body lengths per second.

However, while the through velocity is low enough to prevent involuntary entrainment of all but the smallest trout, the clear-bar spacing of the trashracks would not physically exclude the stocked trout, which have a body width between 0.9 and 1.25 inches (Table 5). Therefore, fish attempting to move downstream through the intake would be entrained and could potentially be injured or killed by the turbines.

Cumulative Effects

Based our review of the of the license application, as well as agency and public comments, we have identified fisheries and water quality as resources that could be cumulatively affected by activities in the Passumpsic River Basin. The activities that could potentially affect fisheries and water quality include the operation and maintenance of hydropower projects on the Passumpsic River, the presence of multiple wastewater treatment plants and combined sewer outflows in the basin, and agricultural and industrial uses.

Our Analysis

Fisheries

²² Although Lyndonville reported variable trashrack spacing under current conditions, staff used the originally-installed, uniform 1.5-inch clear spacing for the analysis. Any variability from 1.5 inches to 1.75 inches would decrease the through velocity, and thereby decrease the risk of impingement relative to the velocities reported below for 1.5-inch clear spacing.

²³ To estimate the flow velocity through the trashracks, Commission staff calculated the effective area in which flow could pass through the trashracks at the project. Specifically, staff accounted for the following parameters: (1) the effective intake width (25.7 feet), as calculated from (a) the clear spacing of the trashracks (1.5 inches) and (b) the number of bars necessary to span the two 15-foot-wide trashracks (206 bars at a standard bar thickness of 0.25 inch); and (2) the effective intake height (21.3 feet), as calculated from a 22-foot-high intake opening that is assumed to be installed at a standard angle of 15 degrees. Staff calculated the velocity through the clear spaces of the trashracks by dividing the maximum hydraulic capacity of the turbine (450 cfs) by the effective area of the trashracks (547 square feet).

The project's dam, in combination with six other dams on the Passumpsic River, have adversely affected fish populations and fish habitat by fragmenting aquatic habitat and reducing streamflow in bypassed reaches. In addition, the seven hydropower projects on the Passumpsic River have the potential to kill or injure fish that are moving downstream, due to unsafe passage through turbines and other flow-regulating equipment (e.g., sluice gates and spillways). In addition, dams within the Passumpsic River watershed historically blocked the passage of diadromous fish species, which no longer occur in the project vicinity.

While project effects due to entrainment and habitat fragmentation would continue at the project under any new license, Lyndonville's proposal to increase the minimum flow released into the bypassed reach and install a pond level control system would benefit the resident fish community in the project area and in downstream reaches. Increasing the minimum flow in the bypassed reach from 10 cfs to 62 cfs would maximize the amount of habitat in the bypassed reach available for juvenile and adult trout and longnose dace, and this habitat would be available year-round. In addition, releasing 62 cfs would greatly increase the amount of habitat available to benthic macroinvertebrates compared to current operation. Increasing the amount of habitat would likely increase the production of benthic macroinvertebrates in the bypassed reach, which would increase the amount of benthic macroinvertebrates available as food for fish in the bypassed reach and downstream reaches. Installing a pond level control system would increase the stability of aquatic habitat in the project impoundment over current operation because project operation would no longer depend on predictions of flow levels when the operator was not present at the station. This would, in turn, produce a more natural flow regime for downstream reaches. Overall, Lyndonville's proposal would benefit the resident fish community in the Passumpsic River Basin relative to existing conditions. Therefore, the project would not significantly add to the cumulative effects on fisheries that have been historically caused by the project and other activities in the basin, or that may be caused by new activities in the basin in the future.

Water Quality

The Passumpsic River Watershed Quality Assessment Report (Vermont DEC 2019) states that the Passumpsic River (downstream of St. Johnsbury, Vermont), the Moose River, and the Sleepers River do not meet the state's water quality standard for recreation because of high *E. coli* concentrations. In addition, Vermont DEC's report states that the Passumpsic River in the project vicinity does not meet the state's water quality standard for aquatic habitat because of alterations to the flow regime in the bypassed reach. In addition, the water quality in Millers Run and Dishmill Brook is degraded by sedimentation from agricultural lands and upstream development, respectively. Failing septic systems and manure storage are the sources of *E. coli* in the Moose River, and combined sewer outflows are the source of *E. coli* on the Sleepers

River and Passumpsic River. The Water Andric (a stream in Caledonia County, Vermont) is affected by high nutrient and low DO concentrations caused by wastewater treatment plant effluent. Lastly, Lily Pond Outlet Stream and Sleepers River do not meet water quality standards due to pollutants released from hazardous waste sites.

In addition, three sand and gravel surface mines are located in the project area.²⁴ Two of the mines are adjacent to the impoundment, and the third is immediately downstream of the bypassed reach. The margin between the mines and the Passumpsic River is almost completely vegetated or forested, which likely reduces the input of fine-grained sediments into the river during precipitation events. Furthermore, there is no information in the record indicating that excessive sediment loads enter the river from these mines. Therefore, the mines appear to have a minimal effect on water quality and aquatic habitat in the Passumpsic River.

Based on the water quality study Lyndonville conducted in 2017, the project appears to have no effect on DO concentrations and an insignificant effect on water temperature. There is no indication that the proposed project would significantly add to the cumulative effects on water quality associated with wastewater treatment plants, sewer outflows, and agricultural and industrial uses, or any additional cumulative effects that may occur in the future from any new activities in the basin.

3.3.2 Terrestrial Resources

3.3.2.1 Affected Environment

The project is located in the Northern Piedmont area of the Northeastern Highland ecoregion (Griffith *et. al.*, 2009), which is characterized by nutrient poor glacial soils and northern hardwood and spruce fir forests. Hills and mountains are prominent in the region. The project vicinity consists primarily of forested upland, with some commercial, agricultural, and residential land present. Wetlands in the project vicinity are primarily limited to deepwater habitats and fringe areas within littoral zones, although some forested, scrub-shrub, and emergent wetlands are present.

Approximately 7.1 acres of upland and 1.4 acres of forested/scrub-shrub wetland occur within the project boundary. Land within the project boundary is primarily forested and undeveloped. Land near the northern end of the project impoundment is composed of mixed hardwood forests. Tree species include sugar maple, American beech, and yellow birch. Land near the southern end of the impoundment is composed of softwood forest species, including hemlock, white pine, balsam fir, and red spruce. The 1.4-acres of forested/scrub-shrub wetland is located near the southern portion of the

²⁴ See section 3.3.4.1, *Land Use and Recreation – Affected Environment*, for additional information on the surface mines.

project boundary. Typical wetland species include green ash, red maple, silver maple, speckled alder, and common buttonbush.

The project vicinity supports various wildlife habitats, including habitats associated with wooded upland and urban/suburban areas. Mammals common to the project vicinity include red fox, raccoon, skunk, eastern chipmunk, squirrels, and white-footed mouse. Bird species in the project vicinity include black-capped chickadee, white-breasted nuthatch, black and white warbler, blue jay, red-eyed vireo, broad-winged hawk, and osprey. The Passumpsic River watershed also supports a variety of water birds, including spotted sandpipers, great blue heron, green heron, mallard, and black duck.

3.3.2.2 Environmental Effects

Lyndonville proposes to continue to operate the project in a run-of-river mode and increase the minimum flow release to the bypassed reach from 10 cfs to 62 cfs or inflow, whichever is less, during normal operation.

Ground disturbance would be associated with certain recreation access improvements that Lyndonville is proposing at the project. Specifically, Lyndonville proposes to: (1) construct and maintain a new 10-foot-wide, 60-foot-long gravel parking area for recreation users; (2) develop and maintain a new 10-foot-wide, 90-foot-long grass-covered trail leading to a site located on the shoreline of the bypassed reach that Lyndonville is proposing to designate as a fishing area; and (3) develop and maintain a new 10-foot-wide, 60-foot-long grass-covered trail leading to a site on the west bank of the Passumpsic River, downstream of the tailrace, that Lyndonville is proposing to designate as a carry-in boat access area. In addition, Lyndonville maintains certain land in the project boundary (*e.g.*, mowing, trimming, tree maintenance), including land associated with the project dam, powerhouses, transmission line, and the 0.25-mile-long non-project canoe portage route.

Lyndonville does not propose any specific measures for the protection of terrestrial resources at the project. No agencies filed recommendations for botanical or wildlife resources.

Our Analysis

Operating the project in a run-of-river mode would continue to maintain stable impoundment levels and minimize effects on terrestrial habitat along the shoreline of the impoundment and the downstream reach. Wetland habitat in the bypassed reach and downstream reach would be protected by continuing to provide a minimum flow through the bypassed reach. Similar to the existing 10-cfs minimum flow to the bypassed reach, a 62-cfs minimum flow would also ensure a continuous flow of water to protect wetland habitat in the bypassed reach.

The proposed gravel parking area would be located in an area that was previously disturbed. Constructing and maintaining the parking area would result in only minor vegetation disturbance associated with the removal of existing grass and the placement of gravel in the designated area. There would be up to 600 square feet of terrestrial vegetation disturbance associated with the gravel parking area.

The proposed 60-foot-long, 10-foot-wide carry-in boat access trail would extend from the project's access road to the shoreline of the downstream reach. Developing the access trail and carry-in access site would require the removal of some grasses and small riparian shrubs. The development and maintenance of the boat access trail would disturb up to 600 square feet of terrestrial vegetation, including periodic mowing.

The proposed 90-foot-long, 10-foot-wide fishing access trail would extend from the existing access road to the proposed fishing area. Developing the access trail and fishing area would require the removal of some grasses and small riparian shrubs. The development and maintenance of the fishing access trail would disturb up to 900 square feet of terrestrial vegetation, including periodic mowing.

Finally, maintaining the canoe portage route on the eastern side of the impoundment, as proposed by Lyndonville, would result in the disturbance of wildlife habitat along the 0.25-mile-long train, including vegetation maintenance (*e.g.*, tree trimming, mowing). If a parallel boat slide was constructed for the safety of recreation users, as discussed in section 3.3.4.2, then approximately 330 square feet of wildlife habitat would be disturbed by the boat slide, which would displace wildlife from the construction area to adjacent areas along the shoreline and upland areas around the impoundment.

In conclusion, while the development, operation, and maintenance of the project recreation facilities would cause some land disturbance and could increase the prevalence of human activity at the project relative to existing conditions, the recreation facilities would primarily be located in an area that is already disturbed by ongoing project activities. We anticipate that additional land disturbance and human activity associated with project recreation would not significantly affect wildlife habitat or wildlife populations in the project vicinity relative to the environmental baseline.

3.3.3 Threatened and Endangered Species

FWS's IPaC system indicates that the federally threatened northern long-eared bat (NLEB) could occur in the project vicinity. No critical habitat has been designated for this species.

3.3.3.1 Affected Environment

The NLEB was listed as a federally threatened species under the ESA on May 4, 2015. Vermont has also designated the NLEB as an endangered species. In January 2016, the FWS finalized the 4(d) rule for this species, which focuses on preventing effects on bats in hibernacula associated with the spread of white-nose syndrome²⁵ and effects of tree removal on roosting bats or maternity colonies (FWS, 2016b). As part of the 4(d) rule, FWS proposes that 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 – July 31);²⁶ and (3) avoids cutting or destroying any tree within a 150-foot radius of a known, occupied maternity tree during the pup season. The 4(d) rule provides flexibility to landowners, land managers, government agencies, and others as they conduct activities in areas that could be NLEB habitat.

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 trees with a diameter of 3 inches or greater at breast height.²⁷ Winter hibernation typically occurs in caves and areas around them and can be used for fall-swarming²⁸ and spring-staging.²⁹

²⁵ 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.

²⁶ Pup season refers to the period when bats birth their young.

²⁷ Diameter at breast height refers to the tree diameter as measured about 4 to 4.5 feet above the ground.

²⁸ 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.

²⁹ 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

The project is located within the white-nose syndrome buffer zone for this species.³⁰ Although there is no documentation of NLEB at the project, and no known NLEB hibernacula sites occur within 0.25 mile of the project, the project vicinity contains mature, upland forest that could provide suitable habitat for NLEB summer roosting and foraging activities.

3.3.3.2 Environmental Effects

Lyndonville does not propose any measures for the protection of the NLEB, and no agency recommendations were received regarding the NLEB.

Our Analysis

Lyndonville has not proposed any major ground disturbing or tree clearing activities that would affect potential NLEB summer roosting and foraging habitat. Construction of the parking area and two paths to provide improved recreation access would only result in minor ground disturbance, and no mature trees would be removed. However, project maintenance activities during the term of any new license could require periodic tree removal that may affect NLEB habitat (*e.g.*, vegetation maintenance in the 380-foot-long transmission line right-of-way and at project recreation sites). While no occupied maternity roost trees are known to occur in the project vicinity, no surveys have been conducted to verify the absence of maternity roost trees.

Removing occupied maternity roost trees or any trees within 150 feet of an occupied roost tree is prohibited during the NLEB pup season (June 1 – July 31) (FWS, 2016b). To avoid prohibited incidental take of NLEB, Lyndonville could restrict tree removal activities to time periods outside of the pup season. With this measure in place, we conclude that the project would not be likely to adversely affect NLEB. We will follow FWS's optional streamlined consultation framework that allows federal agencies to rely on the 4(d) rule to fulfill section 7(a)(2) consultation requirements for NLEB (FWS, 2016a).

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).

³⁰ 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.

3.3.4 Land Use and Recreation

3.3.4.1 Affected Environment

Land Use

Caledonia County occupies an area of approximately 649 square miles in Vermont, which is primarily forested (78 percent) and agricultural land (12 percent). The Great Falls Project is located in the Town of Lyndon, which is predominantly rural and composed mainly of forests and agricultural lands, with minimal development.

Land in the project vicinity is zoned as commercial and rural residential. While the project impoundment shorelines are steep and predominantly forested, agriculture and large-scale commercial developments exist nearby. The shoreline immediately surrounding the project impoundment is mostly forested, with the exception of agricultural land that is located approximately 0.75 mile upstream of the project dam along the northeastern end of the impoundment. Additionally, three sand and gravel surface mines are located in the immediate vicinity of the project. Two of the mines are adjacent to the impoundment and are approximately 49 acres and 9 acres in size, respectively. The other mine is approximately 18 acres and is located about 150-feet from the shoreline of the Passumpsic River, immediately downstream of the bypassed reach. Active railroad tracks also pass along the western side of the project boundary.

The current project boundary for the Great Falls Project encompasses approximately 20.54 acres,³¹ including the 15.7-acre impoundment up to a contour elevation of 668.38 feet msl and land needed for project purposes, including land associated with the dam, powerhouses, power canal, tailrace, and appurtenant facilities. Public access to the project boundary is limited to daytime use only by a gated entryway located on the access road.

No federal land exists within or adjacent to the project boundary. No lands in the immediate vicinity of the project are included in the national trails system, nor are there any designated wilderness lands. The Passumpsic River is not on the list of wild and scenic rivers.

Statewide Recreation Plan

The 2014 – 2018 Vermont Statewide Comprehensive Outdoor Recreation Plan (SCORP) assesses outdoor recreation needs and priorities in the state, and sets forth a plan of action for achieving outdoor recreation goals. The SCORP recommends enhancing and expanding recreation programs and participation by emphasizing the

³¹ See *supra* at note 5 for additional information on the project boundary acreage.

health benefits of recreation, opportunities for public recreation access on private lands, and the tourism and economic benefits of protecting natural and cultural heritage (Vermont ANR, 2014).

Regional Recreation Opportunities

The Passumpsic River is located on the border of the Vermont Piedmont and Northeast Highlands of Vermont. The Piedmont region runs the entire length of eastern Vermont and is composed of lakes, rolling hills, and fertile valleys at the base of the Green Mountains. The Northeast Highlands encompasses the northeastern corner of Vermont, and the region is characterized by granite mountains, and swift-flowing streams. These regions have an abundance of public lands, resorts, boating, fishing, swimming, hiking, biking, hunting, picnicking, horseback riding, trail running, and camping. In winter months, regional recreation includes skiing, snowmobiling, and snowshoeing.

The project is located in the northeast corner of Vermont, in a region referred to as the “Northeast Kingdom” region of Vermont. The Northeast Kingdom is composed of Essex, Orleans, and Caledonia counties and has several state parks, over a dozen state forests, and wildlife management areas. Within an approximately 20-mile radius, there are two state parks, five state forests, and six wildlife management areas.

The Town of Lyndon and the Village of Lyndonville have three parks: Power Park, Bandstand Park, and Lyndon Outing Club. These parks include a winter recreation area, and several sports facilities, including: fields, gymnasiums, an ice arena, and an outdoor swimming pool. Additionally, Kingdom Trails is an extensive network of trails with year-round recreation including mountain biking, hiking, trail running, cross country skiing, and snowshoeing on Burke Mountain, and across Darling State Park and Victory State Forest. Finally, seven canoe portage facilities are located along the main stem of the Passumpsic River to create a 23-mile navigable water trail.

Recreation Opportunities at the Project

Lyndonville currently allows public access to the project land and waters; however, there are no designated recreation facilities at the project. Project access is limited due to the lack of access roads, surrounding private land ownership, and railroad tracks paralleling the impoundment’s western shoreline. However, there are two non-project recreation facilities: (1) a 0.25-mile-long canoe portage route, with a takeout located on the eastern side of the impoundment and a put-in located immediately downstream of the Great Falls dam on the east bank of the bypassed reach; and (2) a swimming area located immediately downstream from the canoe takeout on the eastern side of the impoundment. The canoe portage route is composed of packed earth and log steps and was constructed in 1995 by Lyndonville and the Lyndon State College Recreation Department.

Recreational Use at the Project

The project was exempted from FERC Form 80 recreational reporting requirements on February 11, 1991. However, based on qualitative observations made by Lyndonville, the project likely sees light recreational use in the form of swimming, hand-carry boating, and fishing.

3.3.4.2 Environmental Effects

Recreation Use and Access

Lyndonville is proposing to implement a July 2017 recreation management plan that includes the following provisions: (1) construct a new 10-foot-wide, 60-foot-long gravel parking area along the project access road for recreation users; (2) develop and maintain a new 10-foot-wide, 90-foot-long grass-covered trail leading to a site located on the western shoreline of the bypassed reach that Lyndonville is proposing to designate as a bank fishing area; (3) develop and maintain a new 10-foot-wide, 60-foot-long grass-covered trail from the access road to a site on the west bank of the Passumpsic River, downstream of the tailrace, that Lyndonville is proposing to designate as a carry-in boat access area; (4) install directional signage to the carry-in boat access site; (5) install an informational kiosk at the edge of the parking area that identifies project recreation amenities, safety information, and waste disposal procedures; (6) maintain the existing 0.25-mile-long canoe portage route as a non-project recreation facility; and (7) conduct a recreation inventory, use, and needs assessment within one year of installation of the proposed recreational improvements (Figure 6).

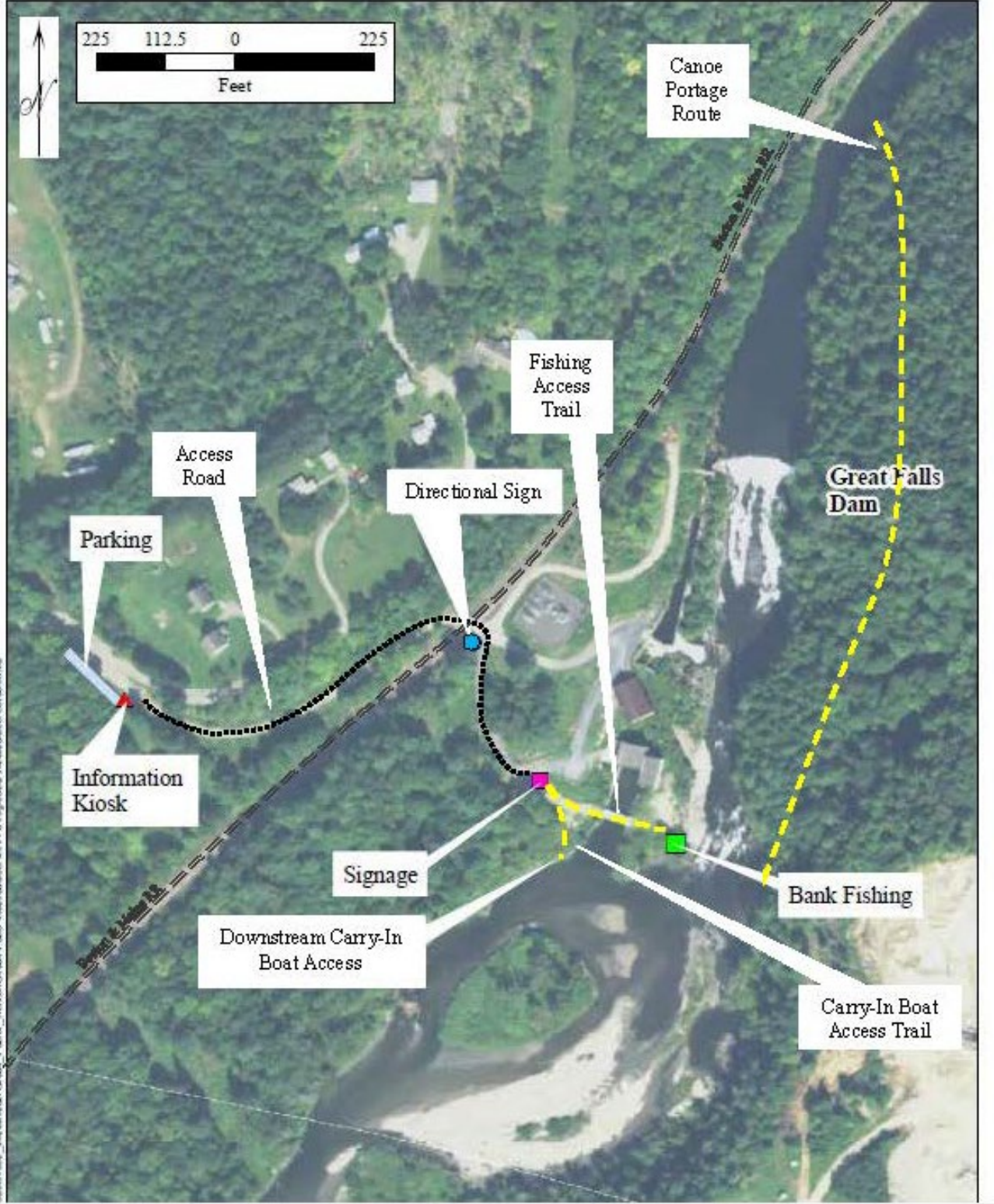


Figure 6. Great Falls Project proposed recreation facilities (Source: Lyndonville, as modified by staff).

Our Analysis

The lack of designated access to the Passumpsic River may limit the amount of recreation use in the project vicinity. Lyndonville's proposed recreation facilities, including a new parking area, access trails, and designated fishing and boating areas, would improve public access for recreation at the project.

Recreation Facilities Downstream of the Project

The development of a new carry-in boat access area and trail, as proposed by Lyndonville, would provide recreation users with a designated site for accessing the Passumpsic River for boating activities in the downstream reach. In addition, installing directional signage along the carry-in boat access trail, as proposed by Lyndonville, would improve site accessibility by helping users locate the carry-in boat access area. Similarly, Lyndonville's proposal to improve access for anglers by developing a fishing access trail and bank fishing area would ensure recreation access to the bypassed reach and the downstream reach of the Passumpsic River, and improve the overall recreation experience for anglers visiting the project. As project recreation facilities, Lyndonville would provide routine maintenance of the trails and access areas during the term of any new license.

Lyndonville's proposal to construct a new parking area and install an informational kiosk would improve public access to the bypassed reach and downstream reach of the Passumpsic River. The proposed parking lot is located approximately 1,000 feet from the carry-in boat access area and approximately 1,130 feet from the bank fishing area. The parking lot and informational kiosk are proposed to be co-located at the head of the access road, which leads directly to the proposed carry-in boat and fishing access trails. A new parking area would provide safer parking for project recreation access by reducing the need for recreation users to park on the shoulders of Great Falls Drive. The proposed informational kiosk would improve site access and safety by providing recreation users with information about the recreational features of the project, safety measures, and waste disposal requirements at the Great Falls Project.

Canoe Portage Facility

Access to the Passumpsic River for hand-carry boats is available upstream of the project, including through a canoe portage facility that is located 1.1 miles upstream of the project as part of Vail Project No. 3090. Similarly, there are canoe portage facilities at six additional downstream hydropower project facilities, all of which contribute to a contiguous 23-mile navigable water trail. Lyndonville proposes to continue to operate and maintain the existing 0.25-mile-long, packed earth and log canoe portage route, but is not proposing to designate the existing site as a project recreation facility due to "steep slopes along the informal primitive canoe portage route and lack of suitable alternative portage sites."

The existing canoe portage route at the project traverses terrain with moderate to steep slopes, ranging from approximately 14 to 44 degrees.³² The initial 106 feet of the portage route from the water's edge at the impoundment, at the take-out point is the steepest, at approximately 44 degrees. The steep terrain would be difficult for boaters to safely traverse while transporting their boats and associated gear. Without a safe, properly maintained portage facility at the Great Falls Project, boaters that access the Passumpsic River upstream of the project may experience unsafe conditions when approaching the Great Falls dam and attempting to portage around the project dam.

Operating and maintaining the existing canoe portage facility as a project recreation facility, along with additional safety measures, would ensure safe portage for boaters that access the impoundment. Providing a means to safely transport a boat along the steep section of the portage route, such as a parallel boat slide,³³ could increase boater safety and the user experience at the Great Falls Project. In addition, the installation of signage that indicates where the boat take-out/put-in are located, would help guide boaters to the recreation facilities. Collectively, these measures would improve safety for boaters seeking portage at the project.

Lyndonville also proposes to conduct a post-license recreation inventory, use, and needs assessment to evaluate recreation use, potential safety issues, and the need for mitigation measures to improve existing project facilities. The Great Falls Project was exempted from FERC Form 80 recreational reporting requirements on February 11, 1991 due to low recreation use. While the proposed project facilities appear to be sufficient to meet recreation demand in the project vicinity, an evaluation of recreational use and needs following the installation of the proposed project recreation facilities could be used to ensure the adequacy and safety of the recreation facilities at the project.

Modification of the Project Boundary

In its October 26, 2017 filing, Lyndonville proposes a project boundary that encompasses approximately 22.77 acres of land and water, which is 2.23 acres greater than the existing project boundary.³⁴ Lyndonville proposes to modify the current project

³² MilerMeter, August 12, 2019 *Elevation Map of Canoe Portage Route at the Great Falls Project*, <https://www.gmap-pedometer.com/?r=7398678> (last visited on Aug. 20, 2019).

³³ A boat slide is a slide or ramp that is used to move a boat up or down an incline for both launching or beaching a boat.

³⁴ The existing project boundary encompasses approximately 20.54 acres and includes a 15.7-acre impoundment, as verified by updated geographically-referenced

boundary by: (1) removing approximately 0.12 acre of land associated with the Old Mill building; (2) adding approximately 0.66 acre of land associated with the existing access road and proposed parking area for recreation users; and (3) adding the approximately 1.69-acre bypassed reach.

Our Analysis

As discussed below in section 3.3.5.2, the Old Mill building has an historic connection to the project and together with four other project facilities, composes the Great Falls Hydroelectric Power Station, which is eligible for listing in the National Register. If any license issued for the project requires Lyndonville to protect the Great Falls Hydroelectric Power Station, including the Old Mill building, then removing the 0.12 acre of land from the project boundary would not be warranted.

As discussed above, operation and maintenance of the existing canoe portage route is necessary to improve boater safety at the project. Therefore, if any license issued for the project requires Lyndonville to continue to operate and maintain the existing canoe portage route, then inclusion of the 0.15 acre of land in the project boundary would be warranted.

The approximately 0.66 acre of land associated with the existing access road and proposed parking area would serve a project purpose, including providing access to project facilities for project operation and recreation. Therefore, inclusion of this land within the project boundary would be warranted.

Lyndonville did not provide an explanation for its proposal to add the approximately 1.69-acre bypassed reach to the project boundary, and it does not appear to be necessary for project operation, flood control, recreation, the protection of fish and wildlife, or other developmental and non-developmental interests of the project. Therefore, inclusion of the 1.69 acres of land and water in the project boundary does not appear to be warranted.

3.3.5 Cultural Resources

3.3.5.1 Affected Environment

Area of Potential Effects

Under section 106 of the NHPA of 1966, as amended, the Commission must take into account whether any historic properties within the proposed project's APE could be

data. *See supra* at note 6 for additional information on the size of the project impoundment.

affected by the issuance of a license for the project. The Advisory Council on Historic Preservation defines an APE as the geographic area or areas in which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist (36 C.F.R. § 800.16(d)).

In its October 4, 2018 Phase IB archaeological survey, Lyndonville defines the APE for archaeological resources as the zone within which foreseeable effects to potential archaeological resources may occur as a result of the project, including: (1) land enclosed within the existing project boundary, access road, and the proposed parking area for recreation users; and (2) any land or properties outside of the project boundary where project operation or project-related actions may cause changes in the character or use of historic properties, if any exist.³⁵ The APE for the project covers approximately 47.4 acres.

Cultural History Overview

Pre-contact Period

The earliest known archaeological remains in Vermont date to the Paleoindian period. These sites were created by small groups of hunter-gatherers who colonized the recently deglaciated sections of the state during the eleventh millennium before present (BP) (Deller and Ellis, 1992; Ellis and Deller, 2000; Stork, 1997 and 2004). Paleoindian people living in the region are characterized as highly mobile hunters and gatherers reliant mainly on caribou that were abundant at that time (Spiess *et al.*, 1998).

The Archaic period represents the longest cultural period in the region. The Archaic period is subdivided into at least three sub periods, the Early (10,000 to 7500 BP), Middle (7500 to 6000 BP), and Late Archaic (6000 to 3000 BP). These sub periods are largely demarcated by changes in projectile point styles. In southern Vermont, the transition to the Early Archaic was contemporaneous with the continued warming trend in the early Holocene and the replacement of spruce and fir by pine as the dominant tree species (Carr *et al.*, 1977). Archaeologists have long thought that people remained within these territories, spending portions of the year in larger base camps and then moving to smaller, more task-specific camps in the surrounding area (Snow, 1980:171). The number of known sites, diagnostic artifact types, and projectile points dating to the Late Archaic (6000 to 3000 BP) is far greater throughout the Northeast and Vermont than for any of the preceding periods. There is also evidence of the development of mortuary ceremonialism.

³⁵ See Lyndonville's October 16, 2018 filing of the October 4, 2018 Phase IB Archaeology Survey (privileged).

The Woodland period is marked by the introduction of ceramic technology about 3,000 years ago. This new technology allowed the production of containers that could withstand cooking with direct heat. This new capability likely affected nutrition and therefore population dynamics. Ceramics also enhanced the capability to store food, which by offsetting seasonal changes in the availability of different foods, made it possible for people to become more sedentary. Despite the possibilities presented by this new technology, there is little evidence of any profound changes in life across Vermont.

There is little archaeological evidence of the Early Woodland in Vermont. Middle Woodland sites in western Vermont, such as the Winooski archaeological site (Power *et al.*, 1980) and the McNeil Generating Station archaeological site (Thomas, 1980), illustrate the use of areas along the lower reaches of rivers flowing into Lake Champlain. These sites are located in Burlington, Vermont and indicate the presence of large gatherings of people who fished, harvested nuts, and hunted.

Throughout the Northeast, the Late Woodland period is associated with the introduction of horticulture, particularly the importation of domesticated maize. Although maize was adopted throughout New England, there is little evidence of the development of large sedentary villages based on maize horticulture (*c.f.*, Petersen and Cowie, 2002). Rather, archaeological evidence indicates that people remained mobile hunter-gatherers who only used maize as a dietary supplement. The Late Woodland period ended with European contact in approximately 1600 AD.

Post-contact Period

The coming of Europeans to New England in the seventeenth century introduced foreign diseases that caused an overall population decline for Native Americans and territorial changes across the region. The native inhabitants of Vermont, the Abenaki, experienced severe population loss as a result of European diseases. The Abenaki received tribal recognition from the State of Vermont in 2006.

Before Vermont was admitted as a state to the Union in 1791, Vermont was organized as an independent republic from 1777-1791. At this time, Vermont had its own constitution, currency, and postal service. The Village of Lyndonville lies within the Town of Lyndon, near the center of the county. The Honorable Jonathan Arnold, Daniel Cahoon, and Daniel Owen of Providence, Rhode Island (veterans of the American Revolution), came to what became Lyndon in 1780. The Vermont legislature created Caledonia County in 1792 from the division of Chittenden and Orange counties. Today, the county contains 17 towns; Governor Wentworth of New Hampshire founded three of these in 1763, when Vermont was considered a land grant of New Hampshire. The other 14 towns were created between 1780 and 1798 by the Vermont legislature (Louis Berger, 2018).

The first significant stage of growth in Lyndon was driven in part by access to water power in the mid-nineteenth century. In particular, growth occurred in two locations in Lyndon, known as “Great Falls” and “Little Falls,” (Hayward, 1839:226). Little Falls had already been developed into a mill facility beginning in the 1790s. Great Falls was not developed for industrial purposes until the late 1800s (Child 1887). Water-powered mills provided the necessary facilities for agricultural products (including grain and wool) to be processed prior to shipment to market. Waterpower also enabled sawmills to process timber from the surrounding forests, and provided raw material for local commercial and residential construction (Shores, 1986:20).

The Connecticut and Passumpsic Rivers Railroad (now known as the Boston and Maine Railroad) was constructed near the project in ca., 1840, and still runs along the west bank of the river (Louis Berger, 2018). In 1876, C.T. Wilder and Co. of Boston built a pulp mill (referred to as the “Old Mill” in this EA) at Great Falls off present day U.S. Route 5.

Great Falls dam is located on the Passumpsic River, near Lyndon’s southern border with St. Johnsbury. The Lyndonville Electric Company constructed the existing dam and powerhouse facility at the Great Falls site in 1915 (referred to as the 700-kW powerhouse in this EA). In 1979, a new powerhouse was constructed at the project site (*i.e.*, the 1,350-kW powerhouse). In 1984, the original license was amended to include the 700-kW powerhouse, and the two turbines housed within it.³⁶ Both operational powerhouses, which are connected to each other, are located in the Great Falls APE (Louis Berger, 2018). The Great Falls dam is still owned and operated by the Town of Lyndonville Electric Department and is used to generate power locally for Lyndon residents.

Cultural Resources Investigations and SHPO Consultation Summary

Lyndonville conducted an Archaeological Resources Assessment and Historic Properties Assessment (ARA) in May 2017. The ARA consisted of background research and visual field inspection. Based on the results of the ARA, filed on August 25, 2017, Lyndonville concluded that the project would have no effect on archaeological resources. In its October 26, 2017 filing, Lyndonville stated that it is no longer proposing to develop an HPMP, based on the results of the ARA.

³⁶ When the original license for the project was issued by the Commission on June 29, 1979, the two original units located in the 700-kW powerhouse were scheduled for retirement. The 1984 Amendment Order authorized reactivation of the two units. *See Vill. of Lyndonville Elec. Dep’t*, 7 FERC at ¶ 61,726, *Vill. of Lyndonville Elec. Dep’t*, 28 FERC at ¶ 63,666.

In a letter dated October 27, 2017, the Vermont SHPO stated that it did not concur with Lyndonville's recommendation that the project would have no effect on archaeological resources. The Vermont SHPO recommended that a Phase IB archaeological survey be performed along most of the shoreline, and that any sites identified should be subject to a Phase II site evaluation to determine eligibility for listing on the National Register.

On March 23, 2018, Lyndonville and the Vermont SHPO held a conference call to discuss further cultural resources surveys. During the conference call, Lyndonville agreed to conduct a Phase IB archaeological survey and additional investigation of architectural resources. Lyndonville agreed to conduct the Phase IB archaeological survey within 100 feet from the top of the bank of the impoundment to the uplands. Lyndonville stated that it would develop an HPMP if the Phase IB survey or additional investigations indicated that the project is affecting cultural resources.³⁷

In June 2018, Lyndonville conducted a Phase IB archaeological survey to identify archaeological sites located in the project vicinity. The investigation consisted of background research, field inspection, and limited subsurface testing.³⁸ As part of the survey, Lyndonville completed archaeological testing in three terraces within the APE that were considered archaeologically sensitive. Areas of archaeological sensitivity were determined using the *Environmental Predictive Model for Locating Precontact Archaeological Sites* (VT DHP 2017), background research, and visual field inspection.³⁹ Within each of the three terraces, subsurface testing was completed within 30-50 feet of the shoreline, and as near to the bank of the Passumpsic River, as possible. This testing was consistent with the Vermont SHPO's request for subsurface testing within 30-100 feet of the banks of the impoundment.⁴⁰ There were no archaeological sites identified within the project's APE.

Lyndonville also conducted an architectural evaluation of five structures located within the project APE, including the Old Mill, the 700-kW powerhouse (old powerhouse), the 1,350-kW powerhouse (new powerhouse), the penstock, the spillway

³⁷ See Lyndonville's May 3, 2018 letter and conference call summary.

³⁸ See Lyndonville's October 16, 2018 filing of the October 4, 2018 Phase IB Archaeology Survey (privileged).

³⁹ See Lyndonville's June 9, 2017 Archaeological Resource Assessment and Historic Properties Assessment (privileged).

⁴⁰ See Lyndonville's May 3, 2018 letter and conference call summary.

and power canal, and the Great Falls dam (collectively, these five structures are known as the “Great Falls Hydroelectric Power Station”). According to the results of the architectural evaluation, these above-ground structures meet the requirements for listing in the National Register under Criterion A as an early and continuously operated municipality-owned hydroelectric facility that contributed to the development of the community (Figure 7).⁴¹

Lyndonville filed a combined revised ARA, Phase IB archaeological survey report, and Historic Documentation Report on August 20, 2018. On September 12, 2018, Lyndonville and the Vermont SHPO held a conference call to discuss the revised ARA, Phase IB archaeological survey, and Historic Documentation Report. During the conference call, the Vermont SHPO requested several revisions to the submitted reports. Lyndonville agreed to reissue the reports to address the Vermont SHPO’s comments on each report. Additionally, the Vermont SHPO stated that the project would require an HPMP.⁴²

⁴¹ Criterion A of National Register eligibility is satisfied by sites that are associated with events that have made a significant contribution to the broad patterns of history (NPS, 2002).

⁴² See Lyndonville’s October 16, 2018 letter and conference call summary.



Figure 7. Contributing Resources to Great Falls Hydroelectric Station (Source: staff).

3.3.5.2 Environmental Effects

Lyndonville’s proposed recreational enhancements (including construction of a carry-in boat access route, informational kiosk, parking area, and a bank fishing area), and maintenance activities associated with routine operation of the project have the potential to affect cultural resources in the APE.

In a letter dated March 22, 2019, the Vermont SHPO states that the proposed recreational enhancements have not been completely reviewed and that the full APE has not been adequately defined.⁴³ The Vermont SHPO also states that relicensing may result in adverse effects to the identified historic properties and potentially unidentified

⁴³ See Vermont SHPO’s March 22, 2019 letter.

archaeological sites. The Vermont SHPO recommends that a Programmatic Agreement and HPMP be developed to resolve potential adverse effects on historic properties.

Our Analysis

As proposed, the APE includes the existing project boundary, access road, and the proposed parking area, along with any land or properties outside of the project boundary where the project may affect historic properties. However, as discussed above in section 3.3.4.2, changes to the existing project boundary are warranted to include additional project recreation facilities and the access road. Since the APE must include the geographic area in which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, the definition of the APE should be revised to include the revised project boundary defined in any new license, including all land and water used for project purposes.⁴⁴

Continued operation and maintenance of the project could have adverse effects on the Great Falls Hydroelectric Power Station if there are no protective measures in place. Specifically, adverse effects could occur in the event repairs are needed to maintain the structure and function of the aging facilities, or to fix structural damage that occurs in the course of project operation. Failure to maintain individual contributing resources to the Great Falls Hydroelectric Power Station could have adverse effects on the integrity of the historic property. During the license term, it is also possible that unknown historic resources may be discovered during project operation or other project-related activities that require ground disturbance, such as Lyndonville's proposed recreational enhancements within the APE.⁴⁵ Section 3.3.4, *Land Use and Recreation*, discusses proposed recreation facilities in greater detail. Figure 6 illustrates where proposed recreation facilities would be located.

Lyndonville states that the Old Mill building is not needed for project purposes and proposes to remove the Old Mill building from the project boundary.⁴⁶ Lyndonville

⁴⁴ See 36 C.F.R § 800.4(b)(1) (2019).

⁴⁵ Staff is recommending that the existing canoe portage route be included in the project recreation facilities. The project APE would be revised to include the canoe portage route.

⁴⁶ See Lyndonville's May 26, 2017 license application.

does not plan to maintain the structure.⁴⁷ The Old Mill building is a contributing resource to the National Register-eligible Great Falls Hydroelectric Power Station. Without maintenance of the Old Mill building, physical deterioration of the structure could occur. Neglect of a historic property, which causes its deterioration, is considered an adverse effect under NHPA.⁴⁸ Any adverse effects to the Old Mill building have the potential to have adverse effects on the Great Falls Hydroelectric Power Station.

Developing and implementing an HPMP, in consultation with the Vermont SHPO, would ensure that measures are in place to protect historic properties in the APE from adverse effects related to the construction, operation, and maintenance of all project facilities, including project recreation facilities that could otherwise diminish the integrity of the design and materials of historic properties. An HPMP would also ensure that any previously undiscovered archaeological resources within the APE are not adversely affected by the project.

To meet requirements of section 106, the Commission intends to execute a Programmatic Agreement with the Vermont SHPO for the proposed project to protect historic properties that could be affected by the continued operation and maintenance of the project. The terms of the Programmatic Agreement would require Lyndonville to develop and implement an HPMP to ensure that continued operation and maintenance of the project would have no adverse effect on historic properties within the APE.

4.0 DEVELOPMENTAL ANALYSIS

In this section, we look at the project's use of the Passumpsic River for hydropower purposes to see what effects various environmental measures would have on the project's costs and 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 project cost to an estimate of the cost of obtaining the same amount of energy and capacity using a likely alternative source of power for the region (cost of alternative power). In keeping with Commission policy as described in *Mead Corp.*, our economic analysis is based on current electric power cost conditions and

⁴⁷See Lyndonville's October 16, 2018 Historic Documentation Great Falls "Old Mill" (privileged).

⁴⁸ See 36 C.F.R § 800.5(a)(2)(vi) (2019)

⁴⁹ See *Mead Corp., Publ'g Paper Div.*, 72 FERC ¶ 61,027 (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.

does not consider future escalation of fuel prices in valuing the hydropower project’s power benefits.

For each of the licensing alternatives, our analysis includes an estimate of: (1) the cost of individual measures considered in the EA for the protection, mitigation, and enhancement of environmental resources affected by the project; (2) the cost of alternative power; (3) the total project cost (*i.e.*, construction, operation, maintenance, and environmental measures); and (4) the difference between the cost of alternative power and total project cost for the project. If the difference between the cost of alternative power and total project cost is positive, the project helps to produce power for less than the cost of alternative power. If the difference between the cost of alternative power and total project cost is negative, then the project helps to produce power for more than the cost of alternative power. This estimate helps to 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 ECONOMIC BENEFITS OF THE PROJECT

Table 7 summarizes the assumptions and economic information we use in our analysis for the project. This information was provided by Lyndonville in its license application or estimated by staff. We find that the values provided by Lyndonville are reasonable for the purposes of our analysis. Cost items common to all alternatives include: taxes and insurance costs, net investment, estimated future capital investment required to maintain and extend the life of facilities, relicensing costs, normal operation and maintenance cost, and Commission fees.

Table 7. Parameters for economic analysis of the Great Falls Project.

Parameters	Values (2018 dollars)	Sources
Period of analysis	30 years	Staff
Term of financing	20 years	Staff
Escalation rate	0 percent	Staff
Alternative energy value	\$34.00/MWh	Staff ^a
Federal tax rate	21 percent	Staff

Parameters	Values (2018 dollars)	Sources
Local tax rate	8.50 percent	Staff
Interest rate	7 percent	Staff
Discount rate	7 percent ^b	Staff
Net remaining investment	\$1,400,438 ^c	Lyndonville
Annual operation and maintenance cost	\$145,871 ^d	Lyndonville

^a Based on Vermont Department of Public Service 2019 Annual Energy Report.

^b Assumed by staff to be the same as the interest rate.

^c Based on Lyndonville’s remaining undepreciated net investment and cost to develop the license application for the project.

^d Lyndonville’s value for the project’s operation and maintenance cost includes insurance, administrative cost, and general expenses.

4.2 COMPARISON OF ALTERNATIVES

Table 8 summarizes the installed capacity, annual generation, annual cost of alternative power, annual project cost, and difference between the cost of alternative power and project cost for each of the alternatives considered in this EA: no-action, Lyndonville’s proposal, and the staff alternative.

Table 8. Summary of the annual cost of alternative power and annual project cost for the three alternatives for the Great Falls Project.

	No Action	Lyndonville’s Proposal	Staff Alternative
Installed capacity (megawatts)	2.05	2.05	2.05
Annual generation (MWh)	3,960	2,535	2,535
Annual cost of alternative power (\$ and \$/MWh)	\$134,640 34.00	\$86,190 34.00	\$86,190 34.00
Annual project cost	\$182,761	\$245,972 ^a	\$244,306 ^a

	No Action	Lyndonville's Proposal	Staff Alternative
(\$ and \$/MWh)	46.15	97.03	96.37
Difference between the cost of alternative power and project cost (\$ and \$/MWh)	(\$43,905) ^b (12.15)	(\$159,782) ^b (63.03)	(\$158,116) ^b (62.37)

^a The loss of generation is reflected as a higher project cost, rather than a lower power value.

^b Numbers in parenthesis are negative.

4.2.1 No-Action Alternative

Under the no-action alternative, the project would continue to operate as it does now. The project would have an installed capacity of 2.05 MW, and generate an average of 3,960 MWh of electricity annually. The average annual cost of alternative power would be \$134,640 or about \$34.00/MWh. The average annual project cost would be \$182,761, or about \$46.15/MWh. Overall, the project would produce power at a cost that is \$43,905, or \$12.15/MWh, more than the cost of alternative power.

4.2.2 Lyndonville's Proposal

Table 9 lists all environmental measures, and the estimated cost of each, considered for the Great Falls Project. Under Lyndonville's proposal, the Great Falls Project would have an installed capacity of 2.05 MW, and generate an average of 2,535 MWh of electricity annually. The average annual cost of alternative power would be \$86,190 or about \$34.00/MWh. The average annual project cost would be \$245,972, or about \$97.03/MWh. Overall, the project would produce power at a cost that is \$159,782, or \$63.03/MWh, more than the cost of alternative power.

4.2.3 Staff Alternative

The staff alternative is based on Lyndonville's proposal with staff modifications and additional measures. The staff alternative would have an installed capacity of 2.05 MW and an average annual generation of 2,535 MWh. The cost of alternative power would be \$86,190 or about \$34.00/MWh. The average annual project cost would be \$244,306, or about \$96.37/MWh. Overall, the project would produce power at a cost that is \$158,116, or \$62.37/MWh, more than the cost of alternative power.

4.3 COST OF ENVIRONMENTAL MEASURES

Table 9. Cost of environmental mitigation and enhancement measures considered in assessing the effects of operating the Great Falls Project.

Enhancement/Mitigation Measures	Entity	Capital cost	Annual cost^a	Levelized annual cost^b
General				
Continue to operate the project in a run-of-river mode.	Lyndonville, Staff	\$0	\$0	\$0
Install a pond level control system and governor upgrade to maintaining run-of-river operation.	Lyndonville, Staff	\$122,448 ^c	\$0	\$15,828
Develop a minimum flow management and monitoring plan.	Lyndonville	\$30,612 ^c	\$0	\$3,957
Develop an operation compliance monitoring plan	Staff	\$10,000	\$0	\$1,293
Aquatic Resources				
Provide a continuous minimum flow of 62 cfs or inflow, whichever is less, from the dam into the bypassed reach.	Lyndonville, Staff	\$0	\$54,435 ^d	\$43,004

Enhancement/Mitigation Measures	Entity	Capital cost	Annual cost^a	Levelized annual cost^b
Continue to release 75 cfs, or inflow, whichever is less, from the 1,350-kW powerhouse during shutdowns.	Lyndonville, Staff	\$0	\$0	\$0
Threatened and Endangered Species				
Avoid cutting trees between June 1 and July 31 to protect roosting northern long-eared bats.	Staff	\$0	\$0	\$0
Recreation Resources				
Implement a recreation management plan that includes the following provisions: (1) construct and maintain a new gravel parking area; (2) develop and maintain a new trail leading to a proposed bank fishing area; (3) develop and maintain a new trail leading to a proposed carry-in boat access area; (4) install directional signage to the carry-in boat access site; (5) install an informational kiosk identifying recreational amenities; (6) continue to operate and maintain the 0.25-mile-long canoe portage route as a non-project recreation facility; and (7) conduct a recreation inventory, use, and needs assessment.	Lyndonville	\$63,265 ^c	\$3,061 ^e	\$10,596

Enhancement/Mitigation Measures	Entity	Capital cost	Annual cost^a	Levelized annual cost^b
Implement Lyndonville's proposed recreation management plan, with the following additional provisions: (1) operate and maintain the existing canoe portage route as a project recreation facility; (2) install a boat slide along the steep section of the portage route to ensure boater safety; and (3) install signage to indicate the location of the take-out and put-in for the canoe portage route.	Staff	\$65,365 ^f	\$3,163 ^g	\$10,948
Land Use				
Add approximately 0.66 acre of land associated with the existing access road and a proposed parking area for recreation users to the existing project boundary.	Lyndonville, Staff	\$0	\$0	\$0
Add the approximately 1.69-acre bypassed reach to the existing project boundary.	Lyndonville	\$0	\$0	\$0
Remove approximately 0.12 acre of land associated with the Old Mill building from the existing project boundary.	Lyndonville	\$0	\$0	\$0
Add approximately 0.15 acre of land associated with the canoe portage route to the existing project boundary.	Staff	\$0	\$0	\$0

Enhancement/Mitigation Measures	Entity	Capital cost	Annual cost^a	Levelized annual cost^b
Cultural Resources				
Develop and implement an HPMP in consultation with the Vermont SHPO for the protection of historic properties.	Staff	\$5,000	\$0	\$646

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

^b 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.

^c Costs reflect inflation to 2018 dollar value.

^d The loss of generation is reflected as a higher project cost, rather than a lower power value.

^e Annual costs for maintenance are included in the recreation site improvement costs provided by Lyndonville.

^f Staff estimates the capital costs of the boat slide and signage to be approximately \$2,000 and \$100, respectively.

^g The annual cost for maintaining the boat slide is estimated to be approximately \$100.

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 would 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. This alternative includes elements of the applicant's proposal and some additional staff-recommended measures. We recommend this alternative because: (1) issuing a new hydropower license for the project would allow Lyndonville to continue operating its project as a dependable source of electrical energy for its customers; (2) the 2.05 MW of electric capacity comes from a renewable resource that does not contribute to atmospheric pollution; (3) the public benefits of the staff alternative would exceed those of the no-action alternative; and (4) the proposed and recommended measures would protect and enhance aquatic, terrestrial, recreation, and cultural resources, and a federally-threatened species.

In the following section, we make recommendations as to which environmental measures proposed by Lyndonville or recommended by agencies or other entities should be included in any new license issued for the project. In addition to Lyndonville's proposed environmental measures listed below, we recommend additional staff-recommended environmental measures to be included in any license issued for the project.

5.1.1 Measures Proposed by Lyndonville

Based on our environmental analysis of Lyndonville's proposal in section 3, *Environmental Analysis*, and the costs presented in section 4, *Developmental Analysis*, we conclude that the following environmental measures proposed by Lyndonville would protect and 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 to protect aquatic resources, and install a pond level control system and governor upgrade to assist with maintaining run-of-river operation;
- Increase the minimum flow released from the dam into the bypassed reach from 10 cfs or inflow to 62 cfs or inflow, whichever is less, to protect aquatic resources;
- Continue to release 75 cfs or inflow, whichever is less, from the 1,350-kW powerhouse during shutdowns to protect aquatic resources;
- Implement a recreation management plan that includes the following provisions: (1) construct and maintain a new 10-foot-wide, 60-foot-long gravel parking area for recreation users; (2) develop and maintain a new 10-foot-wide, 90-foot-long grass-covered trail leading to a site located on the western shoreline of the bypassed reach that Lyndonville is proposing to designate as a bank fishing area; (3) develop and maintain a new 10-foot-wide, 60-foot-long grass-covered trail leading to a site on the west bank of the Passumpsic River, downstream of the tailrace, that Lyndonville is proposing to designate as a carry-in boat access area; (4) install directional signage to the carry-in boat access site; (5) install an informational kiosk identifying recreational amenities at the project; and (6) conduct a recreation inventory, use, and needs assessment within one year of installation of the project recreation facilities to evaluate recreation use, potential safety issues, and the need for mitigation measures to improve existing project facilities; and
- Revise the project boundary by adding approximately 0.66 acre of land associated with the existing access road and proposed parking area for recreation users.⁵⁰

5.1.2 Additional Measures Recommended by Staff

In addition to Lyndonville's proposed measures noted above, we recommend the following additional measures in any license that may be issued for the Great Falls Project.

- Develop an operation compliance monitoring plan instead of Lyndonville's proposed minimum flow management and monitoring plan;

⁵⁰ The acreage within existing project boundary has been revised to encompass approximately 20.54 acres, including the 15.7-acre impoundment as verified by updated geographically-referenced data.

- Avoid cutting trees between June 1 and July 31 to protect roosting northern long-eared bats;
- Revise the proposed recreation management plan to include the following additional provisions: (1) operate and maintain the existing non-project canoe portage route as a project recreation feature; (2) install a parallel boat slide along the steep section of the portage route to ensure boater safety; and (3) install signage to indicate the location of the take-out and put-in for the canoe portage route;
- Develop an HPMP in consultation with the Vermont SHPO to protect historic properties that are eligible for or listed on the National Register; and
- Revise the project boundary by adding approximately 0.15 acre of land to include the approximately 0.25-mile-long, 5-foot-wide canoe portage route.

Below, we discuss the basis for our additional staff-recommended modifications and measures.

Operation Compliance Monitoring Plan

Lyndonville proposes to continue operating the project in run-of-river mode, to release a year-round minimum flow of 62 cfs or inflow, whichever is less, from the dam to the bypassed reach, and to release 75 cfs or inflow, whichever is less, from the 1,350-kW powerhouse during shutdowns. In addition, Lyndonville proposes to install a pond level control system to automate run-of-river operation. Lyndonville would use sensors to monitor water levels at the project and to control the impoundment and discharges from the powerhouses to the downstream reach. To ensure that that minimum flow is released into the bypassed reach, Lyndonville proposes to develop a minimum flow management and monitoring plan within one year of license issuance.

Lyndonville's proposed minimum flow management and monitoring plan would only describe how Lyndonville would control minimum flow releases and verify that minimum flows are being released into the bypassed reach. Lyndonville does not currently have formalized monitoring protocols or reporting requirements to verify compliance with run-of-river operation, and Lyndonville does not state if the proposed minimum flow management and monitoring plan would be used to verify compliance with run-of-river operation. Monitoring and verifying only minimum flow releases would not ensure that Lyndonville operates the project in run-of-river mode and minimizes impoundment level fluctuations. Therefore, developing an operation and compliance monitoring plan that includes monitoring run-of-river operation in addition to minimum flow releases would help Lyndonville document its compliance with the operational provisions of any new license, provide a mechanism for reporting operational data and deviations, facilitate administration of the license, ensure the protection of

resources that are sensitive to impoundment fluctuations, and ensure that minimum flows are conveyed to the bypassed reach. We recommend that Lyndonville develop an operation compliance monitoring plan that includes provisions for monitoring minimum flows and impoundment elevation levels to document compliance with the provisions of any new license; and a provision for reporting operational data and deviations to the Commission. We estimate that the annual levelized cost of developing a monitoring plan would be \$129, and conclude that the benefits of the plan outweigh the cost.

Northern Long-Eared Bat Protection

As discussed in section 3.3.3, *Threatened and Endangered Species*, maintenance of the transmission right-of-way and recreation facilities could periodically require the removal of vegetation, including trees within the project boundary. Trees provide valuable habitat for NLEB during their roosting reproductive phase, which takes place in the summer months, and tree removal during these months may disturb NLEB. Implementing a seasonal clearing restriction for trees greater than 3 inches in width at breast height, between June 1 and July 31, would avoid the time period when NLEB may be occupying nearby roosting trees, at no additional cost to Lyndonville. Accordingly, we recommend that Lyndonville implement this measure.

Recreation Facilities

Lyndonville proposes to perform operational maintenance and regular inspections on the existing, non-project canoe portage route along the east bank of the Passumpsic River. The 0.25-mile-long canoe portage route was constructed in 1995 in partnership with the Lyndon State College Recreation Department and has been maintained as a non-project recreation feature by Lyndonville since construction. The canoe portage at the Great Falls project is one of seven portages along the main stem of Passumpsic River to create a 23-mile navigable water trail. Access to the Passumpsic River for hand-carry boats is available upstream of the project, including through a canoe portage facility that is located 1.1 miles upstream of the project as part of Vail Project No. 3090.

As discussed in section 3.3.4.2, to ensure contiguous recreation access to the waters of the Passumpsic River, and to ensure that safe portage is provided for boaters that access the project impoundment, we recommend that Lyndonville operate and maintain the canoe portage route as a project recreation facility.⁵¹ Due to the steep terrain along the portage route, we recommend that a parallel boat slide be installed along the steep section of the portage route to assist boaters in safely transporting their boats

⁵¹ Based on the project purposes served by operating and maintaining the existing canoe portage facility, we also recommend revising the project boundary by adding approximately 0.15 acre of land associated with the portage route.

around the project dam. In addition, we recommend the installation of signage to guide boaters to the boat take-out/put-in areas. We estimate that the annual levelized cost of revising the recreation management plan to include the operation and maintenance of the canoe portage route as a project recreation facility, and the installation of the parallel boat slide and signage, would be \$352, and conclude that the benefits of these recreation enhancements outweigh the cost.

Cultural Resources

In the license application filed May 26, 2017, Lyndonville proposed to develop an HPMP in consultation with the Vermont SHPO. However, Lyndonville later retracted its proposal to develop an HPMP. In an October 26, 2017 filing, Lyndonville stated that based on the results of an archaeological survey, an HPMP was no longer proposed due to the lack of project effects on historic properties.⁵²

As discussed in section 3.3.5.2, *Cultural Resources – Environmental Effects*, continued operation and maintenance of the project could have adverse effects on the National Register-eligible Great Falls Hydroelectric Power Station if there are no protective measures in place. During the license term, it is also possible that unknown historic resources may be discovered during project operation or other project-related activities that require ground disturbance, such as Lyndonville’s proposed recreational enhancements within the APE.⁵³ We recommend that Lyndonville develop and implement an HPMP in consultation with the Vermont SHPO to protect the project’s historic properties that are eligible for or listed on the National Register. We estimate that the annual levelized cost of developing an HPMP would be \$646, and conclude that the benefits of an HPMP outweigh the cost.

5.1.3 Measures Not Recommended

Some of the measures proposed by Lyndonville would not contribute to the best comprehensive use of Passumpsic River’s water resources. The following discussion includes the basis for staff’s conclusion not to recommend such measures.

⁵² Although Lyndonville later indicated that it would develop an HPMP if project effects were identified, Lyndonville has not formally stated that an HPMP would be developed for the project. See Lyndonville’s May 3, 2018 letter and conference call summary.

⁵³ Staff is recommending that the existing canoe portage route be included in the project recreation facilities. The project APE would be revised to include the canoe portage route.

Minimum Flow Management and Monitoring Plan

Based on the monitoring provisions included in staff's recommended operation compliance monitoring plan (see section 5.1.2), staff does not recommend Lyndonville's proposed minimum flow management and monitoring plan. Staff's recommended operation compliance monitoring plan would ensure that Lyndonville operates the project in run-of-river mode in addition to ensuring compliance with the proposed minimum flow requirements.

Project Boundary

Based on the Exhibit G filed on October 26, 2017, Lyndonville proposes to revise the project boundary by removing approximately 0.12 acre of land associated with the Old Mill building, and adding the approximately 1.69-acre bypassed reach.

As discussed in section 3.3.5, *Cultural Resources*, the Old Mill building is a contributing resource to the National Register-eligible Great Falls Hydroelectric Power Station, which comprises the project's facilities. Lyndonville does not plan to maintain the structure.⁵⁴ By not maintaining the Old Mill building, physical deterioration of the structure may occur. Neglect of a property, which causes deterioration, may have an adverse effect on historic properties.⁵⁵ Any adverse effects to the Old Mill building would have the potential to adversely affect the National Register-eligible Great Falls Hydroelectric Power Station. Therefore, because we recommend that the HPMP include provisions to protect the Old Mill building, we do not recommend revising the project boundary to remove the Old Mill building.

Lyndonville has not specified a project purpose for the additional 1.69 acres of land and water associated with the bypassed reach that Lyndonville proposes to be included within the project boundary.⁵⁶ The land and water associated with the bypassed reach does not appear to be necessary for project operation, flood control, recreation, the protection of fish and wildlife, or other developmental and non-developmental interests

⁵⁴See Lyndonville's October 16, 2018 Historic Documentation Great Falls "Old Mill" (privileged).

⁵⁵ See 36 C.F.R § 800.5(a)(2)(vi) (2019).

⁵⁶ Lyndonville's final license application does not include a discussion about adding this area to the project boundary; however, it is included within the revised Exhibit G filed on October 26, 2017. For purposes of our analysis herein, Commission staff considers Lyndonville's Exhibit G to be its proposal to revise the project boundary.

of the project. Therefore, we do not recommend revising the project boundary to include the 1.69-acre bypassed reach.

5.1.4 Conclusion

Based on our review of the comments filed on the project and our independent analysis pursuant to sections 4(e), 10(a)(1), and 10(a)(2) of the FPA, we conclude that licensing the Great Falls Project, as proposed by Lyndonville (with the exception of the proposed minimum flow management and monitoring plan, the proposed exclusion of the Old Mill from the project boundary, and the addition of the bypassed reach to the project boundary), with the additional staff-recommended measures, would be best adapted to a plan for improving the Passumpsic River Basin.

5.2 UNAVOIDABLE ADVERSE IMPACTS

Most adult trout could avoid involuntary entrainment through the project's penstock intake, but entrainment of juvenile trout less than 1.25 inches long could still occur. Some of the fish that pass through the project's intake and then on to the turbines could be injured or killed.

5.3 SUMMARY OF SECTION 10(J) 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.

No section 10(j) recommendations were filed in response to our December 17, 2018 notice accepting the application to relicense the project and soliciting motions to intervene, protests, comments, recommendations, preliminary terms and conditions, and preliminary fishway prescriptions.

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 project. We reviewed the following 12 comprehensive plans that are applicable to the Great Falls Project. No inconsistencies were found.

Atlantic States Marine Fisheries Commission. 2000. Interstate Fishery Management Plan for American eel (*Anguilla rostrata*). (Report No. 36). April 2000.

- Atlantic States Marine Fisheries Commission. 2008. Amendment 2 to the Interstate Fishery Management Plan for American eel. Arlington, Virginia. October 2008.
- Atlantic States Marine Fisheries Commission. 2013. Amendment 3 to the Interstate Fishery Management Plan for American eel. Arlington, Virginia. August 2013.
- Atlantic States Marine Fisheries Commission. 2014. Amendment 4 to the Interstate Fishery Management Plan for American eel. Arlington, Virginia. October 2014.
- Vermont Agency of Natural Resources. 2014. Passumpsic and Upper Connecticut River Tactical Basin Plan. Montpelier, Vermont. June 2014.
- Vermont Department of Conservation. Vermont State Comprehensive Outdoor Recreation Plan (SCORP): 2003-2008. Augusta, Vermont. October 2003.
- Vermont Department of Conservation. 1982. Vermont rivers study-final report. Augusta, Vermont. May 1982.
- Vermont Department of Fish and Wildlife. 1993. The Vermont plan for brook, brown, and rainbow trout. Waterbury, Vermont. September 1993.
- Vermont Fish and Wildlife Department. 2017. Statewide Management Plan for Largemouth and Smallmouth Bass. Montpelier, Vermont. August 2017.
- Vermont State Planning Office. 1987. Vermont comprehensive rivers management plan. Augusta, Vermont. May 1987.
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- U.S. Fish and Wildlife Service. No date. Fisheries USA: the recreational fisheries policy of the U.S. Fish and Wildlife Service. Washington, D.C.

6.0 FINDING OF NO SIGNIFICANT IMPACT

If the Great Falls Project is issued a new license as proposed with the additional staff-recommended measures, the project would continue to operate while providing protection and enhancements to aquatic resources and threatened and endangered species, improved access to recreation facilities, and protection of historic properties associated with the project.

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

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