ENVIRONMENTAL ASSESSMENT
FOR
HYDROPOWER LICENSE

Riverdale Mills Hydroelectric Project

Docket No. P-9100-040

Massachusetts

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

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ACRONYMS AND ABBREVIATIONS

APE	area of potential effect
certification	water quality certification
C.F.R.	Code of Federal Regulations
cfs	cubic feet per second
Commerce	U.S. Department of Commerce
Commission	Federal Energy Regulatory Commission
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DO	dissolved oxygen
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
Interior	U.S. Department of the Interior
IPaC	U.S. Fish and Wildlife Service Information for Planning and Consultation
kW	kilowatt
Massachusetts DEP	Massachusetts Department of Environmental Protection
Massachusetts DFW	Massachusetts Division of Fisheries and Wildlife
Massachusetts SHPO	Massachusetts State Historic Preservation Officer
mg/L	milligrams per liter
msl	mean sea level
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
NPCC-New England	Northeast Power Coordinating Council's New England Region
Riverdale Mills	Riverdale Mills Hydroelectric Project No. 9100
Riverdale Power	Riverdale Power & Electric Company, Inc.
SCORP	Statewide Comprehensive Outdoor Recreation Plan

ENVIRONMENTAL ASSESSMENT

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1.0 INTRODUCTION

1.1 APPLICATION

On April 27, 2017, Riverdale Power & Electric Co., Inc. (Riverdale Power) filed an application with the Federal Energy Regulatory Commission (Commission or FERC) for a subsequent license to continue to operate and maintain the Riverdale Mills Hydroelectric Project No. 9100 (Riverdale Mills Project, or project).[1] The 150-kilowatt (kW) project is located on the Blackstone River in the town of Northbridge, Worcester County, Massachusetts (see Figure 1). The project does not occupy federal land.

1.2 PURPOSE OF ACTION AND NEED FOR POWER

1.2.1 Purpose of Action

The purpose of the Riverdale Mills 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 subsequent license to Riverdale Power for the Riverdale Mills 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 will be best adapted to a comprehensive plan for improving or developing a waterway. In addition to the power and developmental purposes for which licenses are

[1] The original license for the project was issued on June 15, 1987, for a term of 30 years, with an effective date of June 1, 1987, and an expiration date of on May 31, 2017. *See James M. Knott,* 39 FERC ¶ 62,308 (1987) (1987 License Order); *James M. Knott, Sr. and James M. Knott, Jr.,* 167 FERC ¶ 62, 047 (2019); and *James M. Knott, Jr. and Riverdale Power and Electric Company, Inc.*, Docket No. P-9100-042, at 2 (May 7, 2019) (delegated letter order). A notice of authorization for continued project operation was issued on June 6, 2017, for the project. Under section 9(b) of the Administrative Procedure Act, 5 U.S.C. 558(c), and as set forth at 18 C.F.R. 16.21(a), the licensee having filed an application for a subsequent license, may continue to operate the project in accordance with the terms and conditions of the license until the Commission acts on its application.

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 of, mitigation of damage to, and enhancement of fish and wildlife resources; (3) the protection of recreational opportunities; and (4) the preservation of other aspects of environmental quality.

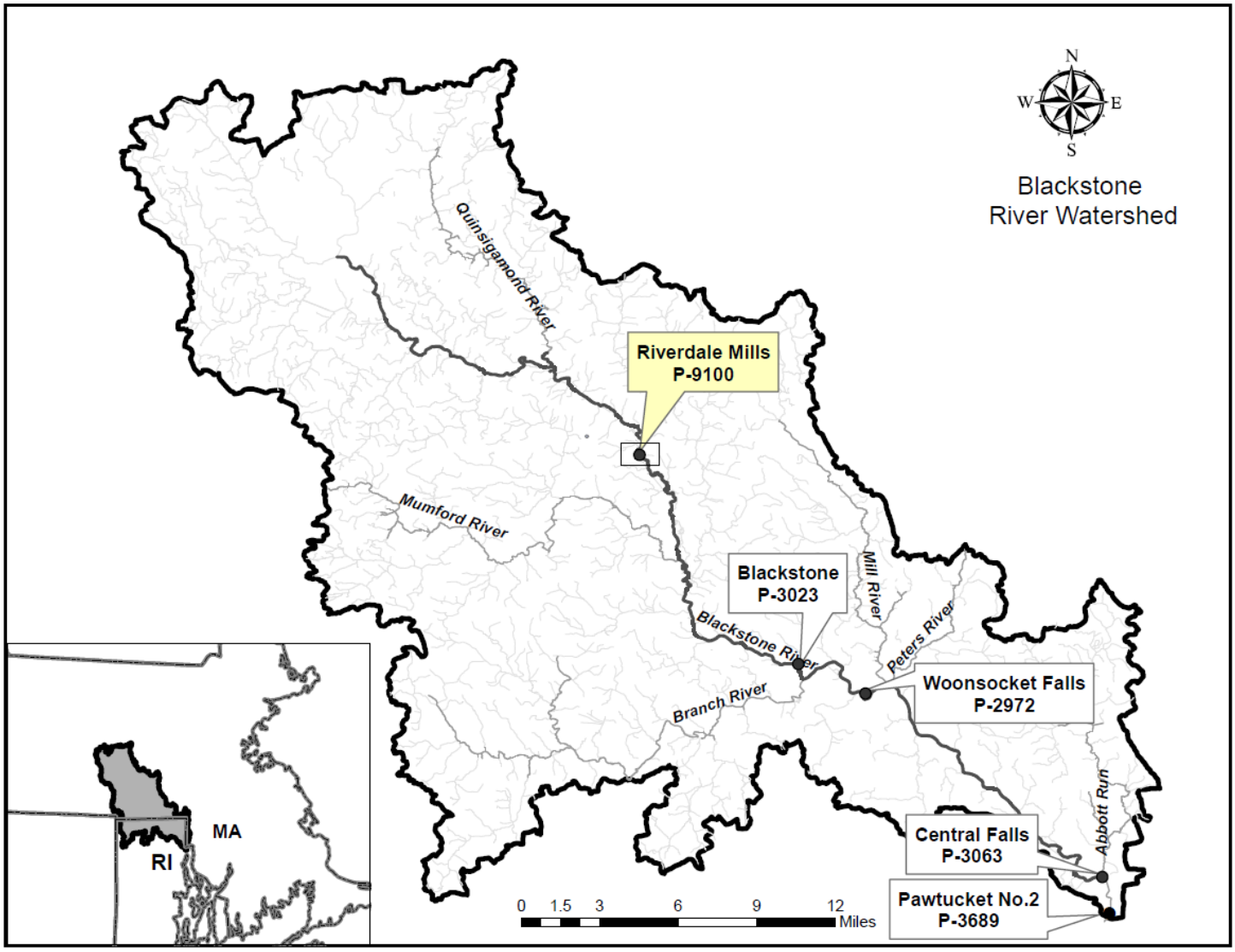

Figure 1. Location of the Riverdale Mills Project and other FERC-licensed hydroelectric projects and exemptions on the Blackstone River. (Source: staff).

Issuing a subsequent license for the Riverdale Mills Project would allow Riverdale Power to continue to generate electricity at the project for the term of the license, making electric power from a renewable resource available to the Riverdale Mills Corporation's on-site manufacturing facility.

This environmental assessment (EA) analyzes the effects associated with continued operation of the project and alternatives to it, and makes recommendations to the Commission on whether to issue a license, and under what terms and conditions to issue a license.

In this EA, we assess the environmental and economic effects of continuing to operate the project: (1) as proposed by Riverdale Power; and (2) as proposed by Riverdale Power with staff-recommended measures. We also consider the effects of the no-action alternative. The primary issues associated with relicensing the project are water quality and minimum flows in the bypassed reach of the Blackstone River, providing recreation opportunities at the project, and protecting cultural resources.

1.2.2 Need for Power

The Riverdale Mills project has an installed capacity of 150 kW and an average annual energy production of about 162 megawatt-hours (MWh) from 2011 through 2015. The project provides power to Riverdale Mills Corporation's on-site wire mesh manufacturing facility.

To assess the need for power, we looked at the needs in the operating region in which the project is located. The Riverdale Mills Project is located within the Northeast Power Coordinating Council's New England region (NPCC-New England) of the North American Electric Reliability Corporation (NERC). NERC annually forecasts electrical supply and demand nationally and regionally for a 10-year period. 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[2] 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 percent in 2019, 17.20 percent in 2020, and 16.36 percent in 2021 through 2028 (NERC, 2018).

Although demand is projected to decrease somewhat in the region, we conclude that power from the project would continue to help meet the regional need for power by

[2] The "anticipated reserve margin" considers the amount of anticipated generation resources relative to net electricity demand. For example, an anticipated reserve margin of 15 percent means that 15 percent of a region's electric generating capacity would be available as a buffer to supply the summer's peak hourly load.

providing a portion of the power needed by the Riverdale Mills Corporation that would otherwise have to come from alternative power sources in the New England region. In addition, 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 subsequent 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). On June 28, 2019, Interior filed a request that the Commission include a reservation of authority to prescribe fishways under section 18 in any license issued for the project.

1.3.1.2 Section 10(j) Recommendations

Under section 10(j) of the FPA, 16 U.S.C. § 803(j)(1), each hydroelectric license issued by the Commission must include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, or enhancement of fish and wildlife resources affected by the project. The Commission is required to include these conditions 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.

On June 27 and June 28, 2019, respectively, the Massachusetts Division of Fisheries and Wildlife (Massachusetts DFW) and Interior filed timely recommendations under section 10(j). These recommendations are summarized in Table 7 and discussed in section 5.3, *Fish and Wildlife Agency Recommendations*.

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 May 11, 2017, Riverdale Power applied to the Massachusetts Department of Environmental Protection (Massachusetts DEP) for section 401 certification for the Riverdale Mills Project. Massachusetts DEP received the request on the same day. On May 10, 2018, Massachusetts DEP denied the application, without prejudice, based on a "lack of sufficient information needed to determine that the project can be operated in a manner that complies with the Massachusetts Water Quality Standards." Massachusetts DEP stated that Riverdale Power needed to conduct a water quality study to analyze dissolved oxygen (DO) and temperature at the project, as requested by Commission staff on February 2, 2018.

Riverdale Power filed a letter with the Commission on December 12, 2018, indicating that it had not conducted the water quality study requested by Commission staff and that it intended to contact Massachusetts DEP to discuss the need for additional information.

On July 1, 2019, Riverdale Power submitted a letter to Massachusetts DEP that requested certification for the project. Riverdale Power stated that it was not submitting "the results of any study since without any violation or evidence of violation, of state water quality standards, we feel strongly that study is not necessary, and should not be required." Massachusetts DEP received the request on July 2, 2019. On October 18, 2019, Massachusetts DEP denied Riverdale Power's request for certification, and stated that Riverdale Power must submit a complete application, including the requisite study results, to obtain any further administrative review by Massachusetts DEP.

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 November 22, 2019, we accessed 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 the bat.

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*. We conclude that licensing the project would have no effect on the northern long-eared bat.

1.3.4 Coastal Zone Management Act

The Coastal Zone Management Act of 1972 (CZMA), as amended, requires review of the project's consistency with a state's Coastal Management Program for 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 Riverdale Mills Project is located on the Blackstone River. The Blackstone River flows south/southeast from the project for approximately 15 miles before it enters Rhode Island, and then continues through Rhode Island before emptying into the Narragansett Bay estuary near Pawtucket, Rhode Island.

On March 13, 2017, Riverdale Power submitted a consistency certification to the Rhode Island Coastal Resources Management Council (Rhode Island CRMC) for compliance with the CZMA. By letter filed on April 3, 2017, Rhode Island CRMC responded that a coastal zone consistency review from the State of Rhode Island is not required for the Riverdale Mills Project because the project is not located within Rhode Island's coastal zone boundary.

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).

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[3] *See* Interior's official list of threatened and endangered species, accessed by staff using the IPaC database (https://ecos.fws.gov/ipac/) on November 22, 2019, and placed into the record for Docket No. P-9100-040 on November 22, 2019.

Our analysis of project effects on cultural resources is presented in section 3.3.5.2, *Cultural Resources, Environmental Effects.* We conclude that licensing the project could have an adverse effect on contributing resources of the Blackstone Canal Historic District, a listed property on the National Register of Historic Places. Adverse effects could occur in the event repairs are needed to maintain the structure and function of contributing resources within the project's area of potential effects (APE), or to fix structural damage that occurs in the course of project operation. To meet the requirements of section 106 of the NHPA, we intend to execute a Programmatic Agreement with the Massachusetts Historical Commission (*i.e.,* the SHPO) for the protection of historic properties from the effects of continued operation and maintenance of the Riverdale Mills Project. The terms of the Programmatic Agreement would ensure that Riverdale Power 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 C.F.R. § 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, staff conducted scoping to determine what issues and alternatives should be addressed. A scoping document was distributed to interested agencies and others and noticed in the *Federal Register* on February 2, 2018. Massachusetts Division of Fisheries and Wildlife (Massachusetts DFW) provided written comments pertaining to the scoping document on March 22, 2018.

1.4.2 Interventions

On May 8, 2019, the Commission issued a notice accepting the application and setting July 7, 2019, as the deadline for filing motions to intervene and protests. The notice was published in the *Federal Register* on May 14, 2019. Massachusetts DFW filed a motion to intervene on May 10, 2019.

1.4.3 Comments on the Application

On May 8, 2019, the Commission issued a notice setting July 7, 2019, as the deadline for filing comments, recommendations, terms and conditions, and prescriptions. Comments and section 10(j) recommendations were filed by Massachusetts DFW and Interior on June 27 and June 28, 2019, respectively.

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 NO ACTION ALTERNATIVE

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

2.1.1 Existing Project Facilities

The Riverdale Mills Project is located on the Blackstone River in the town of Northbridge, Worcester County, Massachusetts, approximately 30 river miles upstream of the mouth of the Blackstone River at Narragansett Bay, near Pawtucket, Rhode Island. The project facilities are shown in Figure 2.

Figure 2. Riverdale Mills Hydroelectric Project facilities (Source: U.S. Geological Survey, 2017, as modified by staff).

The existing Riverdale Mills Project includes a 142-foot-long, 9.5-foot-high concrete and steel dam and spillway that contains five 22-foot-wide, 8.5-foot-high stanchion bays with stop logs, and one 22-foot-wide, 8.5-foot-high hydraulically-operated spillway gate.[4] The dam, with the stoplogs installed, impounds approximately 22 surface acres at a water surface elevation of 258.5 feet msl.

The project includes multiple intake structures that are located underneath the Riverdale Mills Corporation's manufacturing facility (mill building), which is adjacent to the dam.[5] The intake structures include: (1) an unused 8-foot-wide, 8-foot-high western intake structure fitted with two 4-foot-wide, 6-foot-high sluice gates and an 8-foot-wide, 8-foot-high trashrack, and connected to an 8-foot-wide, 212.1-foot-long sluiceway; (2) an unused 8-foot-wide, 8-foot-high middle intake structure fitted with two 4-foot-wide, 6-foot-high sluice gates and an 8-foot-wide, 8-foot-high trashrack, and connected to an 8-foot-wide, 250.4-foot-long sluiceway; and (3) an 18-foot-wide, 8-foot-high eastern intake structure fitted with three 6-foot-wide, 6-foot-high sluice gates and an 18-foot-wide, 8-foot-high trashrack with 1.75-inch bar spacing, that is connected to an 18-foot-wide, 127.5-long sluiceway.

From the impoundment, water is conveyed through the eastern intake structure and sluiceway to a 150-kW Francis turbine-generator unit located in the existing mill building. From the turbine, water flows through a tailrace that includes a 213.6-foot-long arched granite tunnel with a minimum width of 18 feet, and a 1,586-foot-long, 37.5- to 75-foot-wide excavated channel, before emptying into the mainstem of Blackstone River. The project creates an approximately 1,460-foot-long bypassed reach.

The project generator connects to a 75-foot-long, 480-volt indoor generator lead that provides electricity to the Riverdale Mills Corporation manufacturing facility.

There are no fish passage facilities at the project and the project has no formal recreation facilities.

2.1.2 Existing Project Boundary

The current project boundary, as established in the Commission's June 15, 1987 license order, encompasses 54.2 acres, of which approximately 22 acres are water. The project boundary encloses: (1) land and water up to a high-water elevation of 262.35 feet msl; (2) the bypassed reach; (3) the project's dam, intake structures, sluiceways, tailrace,

[4] The license application refers to the spillway gate as a "flood flow modulator."

[5] The mill building is not part of the project.

and generating equipment inside the mill building; and (4) appurtenant facilities. The current project boundary does not include any federal land (Figure 2).

2.1.3 Project Safety

The Riverdale Mills Project has been operating for more than 32 years under its 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 will evaluate the continued adequacy of the project's facilities under a subsequent license. Special articles will be included in any license issued, as appropriate. Commission staff would continue to inspect the project during the term of any subsequent 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 Existing Project Operation

Riverdale Power produces hydroelectric power at the project for direct consumption on-site at the Riverdale Mills Corporation's manufacturing facility. Article 401 of the 1987 license requires Riverdale Power to operate the Riverdale Mills Project as a run-of-river facility, such that instantaneous outflow equals instantaneous inflow at all times.

The Riverdale Mills Project can generate electricity between the minimum and maximum hydraulic capacities of the turbine-generator unit (approximately 90 and 190.8-cubic-foot per second (cfs), respectively). When river flow is less than or greater than the hydraulic capacity of the project, water is spilled over the dam into the bypassed reach.

There is currently no required minimum instream flow for the 1,460-foot-long bypassed reach, but the bypassed reach remains wetted from spillage over the dam, groundwater, and leakage through the dam. In addition, portions of the bypassed reach are wetted from backwater effects from the tailwater area when the project is generating. Riverdale Power estimates that leakage through the stop logs at the dam is approximately 10 cfs and seepage flow under the dam (through the foundation) is approximately 7 cfs.

Project operation is automated with equipment to maintain appropriate pond levels by adjusting flow through the existing turbine to be consistent with inflow to the impoundment. The control equipment is microprocessor-controlled, with manual supervision by Riverdale Power staff. Electric water level sensors are used to monitor water levels and are used to control the head pond and turbine.

2.2 APPLICANT'S PROPOSAL

2.2.1 Proposed Project Facilities

Riverdale Power does not propose to add any new project facilities or revise the project boundary.

2.2.2 Proposed Operation and Environmental Measures

Riverdale Power proposes to:

- Continue to operate the project in a run-of-river mode, such that outflow approximates inflow at all times to protect aquatic resources;

- Release a continuous minimum flow of 10 cfs into the bypassed reach, some or all of which would be provided through existing leakage through the stop logs at the dam for the protection of fish and aquatic resources; and

- Implement measures from the FWS's 2007 *National Bald Eagle Management Guidelines* to minimize project effects on nesting bald eagles at the project.

2.3 STAFF ALTERNATIVE

Under the staff alternative, the project would be operated as proposed by Riverdale Power except for the proposed measures to: (1) use leakage through the stop logs at the dam to meet the proposed 10-cfs minimum flow; and (2) implement measures from the FWS's 2007 *National Bald Eagle Management Guidelines*.

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

- Release a continuous minimum flow of 10 cfs, or inflow if less, to the bypassed reach through discharge over the spillway of the dam (without counting contributions from existing leakage at the dam as part of the 10 cfs, as proposed by Riverdale Power);

- Develop and implement a post-license water quality monitoring plan to verify that the recommended minimum flow in the bypassed reach maintains a DO level of at least 5 mg/L for the protection of aquatic resources;

- Develop and implement an operation compliance monitoring plan for maintaining and monitoring run-of-river operation and the 10-cfs minimum flow release to the bypassed reach;

- Implement an impoundment refill procedure following emergency and maintenance drawdowns, whereby 90 percent of inflow is passed downstream, and 10 percent of inflow is used to refill the impoundment;

- Improve public access to the project for recreation by: (1) maintaining the existing non-project portage trail as a project recreation facility; (2) installing and maintaining a boat put-in and take-out at the upstream end of the existing portage trail to provide access to and egress from the impoundment, respectively; (3) installing and maintaining a boat put-in at the downstream end of the existing portage trail to provide access to the bypassed reach and the downstream reach of the Blackstone River;

- Install informational and safety signage along the portage trail to inform recreationists about access and safety concerns at the project; and

- Develop and implement an HPMP to protect historic properties that are eligible for or listed on the National Register.

Section 10(j) Measures Not Recommended[6]

The staff alternative does not include the following section 10(j) recommendations:

- Develop a Bald Eagle Protection Plan that includes provisions to: (1) avoid killing, injuring or harassing bald eagles during tree cutting or thinning operations at the project; and (2) minimize project effects on nesting bald eagles at the project;

- Develop and implement an Invasive Plant Species Management Plan to: (a) educate recreation users on ways to reduce the spread of invasive species; (b) implement best management practices, such as identifying invasive species that may be introduced by a given activity, identifying critical control points (locations and times), and implementing measures to prevent the spread of invasive species during routine project operation and maintenance; (c) record incidental observations of invasive species; (d) use only seed and plant materials outside of lawn areas; (e) conduct comprehensive invasive plant

[6] See section 5.3, *Fish and Wildlife Agency Recommendations*, for additional details on the recommendations. As discussed in section 5.3, some of the measures listed below are outside of the scope of section 10(j). Here, we account for all measures that were characterized as section 10(j) recommendations by the resource agencies, but are not being adopted by Commission staff.

species surveys every five years; (f) develop site-specific control/management actions to reduce and eliminate invasive species; and (g) plant and seed areas following invasive species control actions; and

- Develop and implement a Special Status Bat Management Plan that includes measures to avoid and minimize adverse effects to special status bats.

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.[7] 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.[8] This is consistent with NEPA and the Commission's obligation under section 10(a) of the FPA to issue licenses that balance developmental and environmental interests.

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

[8] *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).

Project retirement could be accomplished with or without dam removal.[9] Either alternative would involve denial of the license application and surrender or termination of the existing license with appropriate conditions.

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

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 (aquatic, recreation, *etc.*). 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*.[10]

3.1 GENERAL DESCRIPTION OF THE RIVER BASIN

The Riverdale Mills Project is located at approximately river mile 30 on the Blackstone River. The Blackstone River begins at its headwaters in central Massachusetts at the confluence of the Middle River and Mill Brook and flows in a generally southeast direction for approximately 46 river miles into Rhode Island before emptying into the Narragansett Bay estuary near Pawtucket, Rhode Island. The Blackstone River has a total drainage area of 478 square miles. The Blackstone River

[9] 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.

[10] Unless otherwise indicated, our information is taken from the application for license filed by Riverdale Power on April 27, 2017, and Riverdale Power's November 6, 2017; November 16, 2017; January 12, 2018; January 22, 2018; May 3, 2018; December 12, 2018; March 7, 2019; and September 19, 2019 responses to staff's requests for additional information.

drops 438 feet in elevation over 46 miles from its headwaters to the mouth. The major tributaries that flow into the Blackstone River include Abbott Run, Peters River, Mill River, Branch River, Mumford River, and Quinsigamond River.

The topography of the Blackstone River Basin is largely rolling hills. The streambank of the Blackstone River in the immediate vicinity of the project is steep and primarily consists of exposed rocks. Land in the river basin consists primarily of urban landscapes, historic villages, farmlands, and forests. Land use in Worcester County is primarily forested, with agriculture, and commercial and residential development accounting for the next largest land uses. (Blackstone Heritage Corridor, undated; Google Maps, 2019).

Climate in the river basin varies by season, with cold winters and warm summers. The average temperature is approximately 48 degrees Fahrenheit (°F). On average, monthly summer temperatures are approximately 80°F and monthly winter temperatures are approximately 17°F. Precipitation occurs year-round and is markedly greater in summer months.

According to the U.S. Army Corps of Engineers' *National Inventory of Dams,* there are 21 dams on the Blackstone River, some of which are used for hydropower generation (U.S. Army Corps of Engineers, 2019). There are four hydropower projects on the Blackstone River that operate under a FERC license and one hydropower project that operates under a FERC small hydroelectric power project exemption (see Table 1). The dams on the Blackstone River are also used for flood control, water supply, and/or recreation.

Table 1. FERC-licensed and exempted projects on the Blackstone River.

FERC Project Name	FERC Project Number	FERC Project Type	Capacity (MW)	Approximate River Mile
Pawtucket No. 2	3689	Exemption	1.68	0.0
Central Falls	3063	License	0.82	2.0
Woonsocket Falls	2972	License	1.10	14.0
Blackstone	3023	License	2.00	17.5
Riverdale Mills	9100	License	0.15	30.0

(Source, Staff)

3.2 SCOPE OF CUMULATIVE EFFECTS ANALYSIS

According to the Council on Environmental Quality's regulations that implement the National Environmental Policy Act (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 (federal or non-federal) 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.

During public scoping, neither staff nor other stakeholders identified any resources that could be cumulatively affected by continued project operation. However, based on our review of the license application and other information sources, we have since identified both water quantity and water quality as resources that could be cumulatively affected throughout the Blackstone River Basin by continued operation of the Riverdale Mills Project. We discuss these cumulative effects at the end of section 3.3.1.

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, 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 assessed 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 Blackstone River at the project has a drainage area of 142 square miles and the project dam creates a 22-acre impoundment with an average depth of 4 feet. Monthly average flows range from a low of 144 cfs in August to a high of 529 cfs in March, with

an annual average flow of 278 cfs.[11] The 7Q10 flow[12] at the project is estimated to be 44 cfs.

The current license requires the project to be operated in run-of-river mode where at any given point in time, the sum of outflows from the project approximate the sum of inflows to the project. Flows in the range of 90 to 190.8 cfs, the respective minimum and maximum hydraulic capacities of the project turbine, are used for hydropower generation. Generation flows are released back into the mainstem of the Blackstone River at the end of the 1,460-foot-long bypassed reach.

Flows less than 90 cfs or greater than 190.8 cfs are spilled into the bypassed reach. Currently, there is no requirement for Riverdale Power to release a minimum flow into the bypassed reach. Riverdale Power estimates that leakage through the stop logs at the dam is 10 cfs and flow under the dam (through the foundation) is 7 cfs. Riverdale Power reports that "at times" it releases 0.25 inch of water over the "flood flow modulator section," which is another name Riverdale Power gives to the spillway gate. However, Riverdale Power does not quantify the volume of that flow. Riverdale Power also mentions flow under the "flashboards;" however, this flow is not estimated by Riverdale Power and it is not clear whether this is included in either the stop log or dam foundation leakage estimates.

Other than hydro generation, recreation, and the Riverdale Mill Corporation's cooling water permit, there are no other known water uses within the project boundary. Riverdale Power's cooling water permit allows an average monthly flow of 0.154 million gallons per day (MGD; which equals 0.230 cfs) with a maximum daily flow of 0.190 MGD (0.294 cfs).

Water Quality

The Blackstone River at the project site is designated as a Class B river with a warm water fishery. These waters are designated as a habitat for fish, other aquatic life, and wildlife, including for their reproduction, migration, growth and other critical

[11] These flows are derived from the U.S. Geological Survey gage no. 01110500 that is located about 1 mile upstream of the project's dam at Northbridge, Massachusetts (drainage area of 139 square miles), by adjusting the flows to account for the slightly larger drainage area at the project dam (142 square miles).

[12] The 7Q10 flow is the lowest 7-day average flow that occurs once every 10 years, on average.

functions, and for primary and secondary contact recreation.[13] According to Massachusetts's state water quality standards, DO must not be less than 5.0 milligrams per liter (mg/L) and temperature must not exceed 83 °F in warm water fisheries. The rise in temperature due to a discharge must not exceed 5 °F in rivers and streams designated as warm water fisheries (based on the minimum expected flow for the month). In lakes and ponds, the rise must not exceed 3 °F in the epilimnion (based on the monthly average of maximum daily temperature).

The section of river in which the project is located (an 8.8-mile stretch referred to by Massachusetts DEP as MA51-04) is listed on the Clean Water Act section 303(d) list of impaired waters (Massachusetts DEP, 2017).[14] The following impairments for the state water quality standards are listed: flow regime and physical habitat alterations, fish and aquatic macroinvertebrate bioassessments, cadmium, copper, lead, polychlorinated biphenyls ("PCBs"), dichloro-diphenyl-trichloroethane ("DDT"), *Escherichia coli*, excessive aquatic plant and algal growth, eutrophication, total phosphorous, sedimentation/siltation, turbidity, taste, and odor.

The reservoir is relatively small and shallow, having a storage volume of only about 88 acre-feet and an average depth of 4 feet. At the 7Q10 flow of 44 cfs, which is a relatively uncommon low flow, the reservoir retention time is about 24 hours, meaning that the reservoir water is typically completely replenished in less than 24 hours. For this reason, the reservoir likely does not thermally stratify, but rather maintains a relatively constant water temperature and DO concentration from top to bottom during all seasons of the year.

There are no water quality data available for the bypassed reach, project impoundment, or immediately downstream of the confluence of the bypassed reach and tailrace.[15] Since 2000, the closest known sampling sites for DO and temperature are

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[13] *See* section 4.05 of Title 14 of the Code of Massachusetts Regulations (2013).

[14] MA51-04 extends from Fisherville Dam in Grafton (about 4 miles upstream of the project) to the outlet of the Rice City Pond in Uxbridge (about 4 miles downstream of the project).

[15] In response to a study request from the Massachusetts DEP, Commission staff issued a letter on February 2, 2018 requiring Riverdale Power to conduct a water quality survey for both water temperature and DO in the project impoundment, bypassed reach, and immediately below the confluence of the bypassed reach and project tailrace from July 1 through September 30, 2018. Riverdale Power did not conduct the study, and filed a letter on December 12, 2018 stating that it intends to "continue discussions with the

located approximately 1 miles upstream and approximately 1 mile downstream of the dam. The upstream site is a riverine location that is not inundated by the project's reservoir. The downstream site is located downstream of the project's bypassed reach. Both of these locations, are therefore, located beyond the influence of the project.

From 2000 through 2004, water quality data was collected by the Massachusetts DEP on multiple occasions upstream and downstream of the project, in an 8.8-mile reach of the Blackstone River (Massachusetts DEP, 2010). In October of 2003, Massachusetts DEP collected water quality samples approximately 3 to 4 miles upstream of the project in response to a sewage spill. DO measurements during the sampling events ranged from 7.7 to 10.5 mg/L, and the maximum water temperature was 58.1 °F. Between June and October of 2003, Massachusetts DEP sampled the Blackstone River on four occasions at the Sutton Street Bridge in Northbridge, approximately 1 mile upstream of the project dam, which is upstream of the project impoundment. During those sampling events, DO ranged from 5.9 to 9.1 mg/L, and the maximum water temperature was 72.32 °F. The U.S. Geological Survey sampled DO at the Sutton Street Bridge once per month from April through September, 2008 and DO concentrations ranged from 7.0 to to 8.4 mg/L.[16] Of the samples taken in 2008, the warmest water temperature occurred in July. The July DO value of 7.8 mg/L was measured when the water temperature was 72.32 °F. Finally, between March 2000 and October 2004, Massachusetts DEP sampled the Blackstone River on 26 occasions upstream of the project impoundment. During these sampling events, mid-morning DO measurements ranged from 7.5 to 13.6 mg/L, and the maximum temperature was 76.64 °F.

Fishery Resources

Out of a total of 37 fish species known to occur within the Blackstone River Basin, there are 13 species of resident fish that have been observed at the project, including yellow perch, smallmouth and largemouth bass, bluegill, pumpkinseed, yellow and brown bullhead, golden shiner, common carp, green sunfish, chain pickerel, white catfish, and white sucker. This list of species is consistent with the warm-water fishery designation

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State to determine what they feel is necessary regarding adequate information to issue a [section 401 water quality certification]."

[16] U.S. Geological Survey, *Water Quality Samples for the Nation, USGS 01110500 Blackstone River at Northbridge, MA, available at* https://nwis.waterdata.usgs.gov/usa/nwis/qwdata/?site_no=01110500&agency_cd=USGS&inventory_output=0&rdb_inventory_output=file&TZoutput=0&pm_cd_compare=Greater%20than&radio_parm_cds=all_parm_cds&format=html_table&qw_attributes=0&qw_sample_wide=wide&rdb_qw_attributes=0&date_format=YYYY-MM-DD&rdb_compression=file&submitted_form=brief_list. Last accessed on December 4, 2019.

under the water quality standards. This species assemblage is best characterized as habitat generalists, and some are considered pollution tolerant, such as common carp, green sunfish, and white sucker. Additionally, with the exception of white sucker, which prefers faster water, these species are expected to occur in slower, impounded sections of a river, as is the case in this section of the Blackstone River.

Although American shad, American eel, alewife, and blueback herring are known to occur further downstream in the Blackstone River, no migratory species have been documented in the project area, as confirmed by Massachusetts DFW and Interior in letters filed on June 27 and June 28, 2019, respectively. There are 13 dams downstream of the project, and Interior states that at least 9 of them serve as barriers to fish passage. The Blackstone River Fisheries Restoration Plan (Narragansett Bay Estuary Program, 2002), developed by the Rhode Island Division of Fish and Wildlife and the Narragansett Bay Estuary Program, consists of several phases for migratory fish restoration in the river basin. This project falls under phase IV of the plan, which is the last phase of the plan. Depending upon the rate at which fish passage is provided at downstream barriers, migratory fish may gain access to the project area.

3.3.1.2 Environmental Effects

Mode of Operation

Riverdale Power proposes to continue operating the project in a run-of-river mode and both Interior and Massachusetts DFW recommend this operational mode (10(j) recommendation 1 from both agencies). Both agencies specify that inflow should equal outflow at all times and that impoundment levels should not be fluctuated for the purpose of generating power. The agencies clarify that run-of-river operation could be temporarily modified for operating emergencies beyond Riverdale Power's control or for short periods after mutual agreement between Riverdale Power, Massachusetts DFW, and FWS, and Massachusetts DEP.

Our Analysis

Continuing to operate the project in a run-of-river mode would result in no change in the amount, schedule, or duration of flow released to the Blackstone River downstream of the project. Run-of-river operation would also continue to minimize the length of time water is retained in the impoundment and help avoid increasing water temperatures in the upper levels of the impoundment from solar heating. This measure would also limit fluctuating water levels, which influence the reproductive success of fish that spawn in near-shore areas (Sammons and Bettoli, 2000), such as largemouth bass and bluegill. By continuing to operate the project in a run-of-river mode, habitat in the impoundment and habitat in the Blackstone River downstream of the project would remain unchanged from current conditions for aquatic organisms, including fish and macroinvertebrates.

Minimum Flow Release

Riverdale Power is proposing to maintain a discharge of 10 cfs to the 1,460-foot-long bypassed reach, but specifies that leakage through the stop logs (estimated at 10 cfs) should be included in the calculation of this flow. Interior and Massachusetts DFW both recommend a continuous minimum flow release of 10 cfs, or inflow if less, in the bypassed reach through discharge over the spillway (10(j) recommendation 2 from both agencies). The agencies specify in their comments that any leakage at the dam should not count toward the 10-cfs minimum flow release.

Our Analysis

The bypassed reach is low-gradient, containing habitat that is dominated by pools and runs/glides, with the only area classified as a riffle occurring just downstream of the dam. The dominant substrates are sand and small gravel, although some cobble and boulders are found near the dam. When the project is generating, flows from the tailrace can create a backwatering effect in the bypassed reach under certain flow conditions.[17]

To support a prior application by Riverdale Power to add a new turbine to the project (no longer a proposal being evaluated), Alden Labs (Alden, 2009) conducted an instream flow habitat analysis of the bypassed reach. Flows evaluated during the study included 3.9 cfs, 8.5 cfs, and 51 cfs, which were provided by releasing 0.6, 1.0, and 3.2 inches of water depth over the spillway, respectively. These flows were verified by discharge measurements at the transect closest to the dam, which was located about 250 feet downstream of the dam. Additionally, an interpolated flow of 30 cfs (estimated as 2.2 inches of depth over the spillway) and an extrapolated flow of 70 cfs (estimated as 4.0 inches of depth over the spillway) were also evaluated. The 70-cfs flow was chosen as the highest flow because it approximates the aquatic base flow (defined as 0.5 cfs per square mile of drainage area). Habitat parameters measured during the study included wetted width and perimeter, water velocity, depth, and substrate at 3 representative transects selected through consultation between Alden Labs, FWS, and Massachusetts DFW. The quantity of suitable habitat over the range of flows was calculated for

[17] The "backwatering effect" occurs when water from the tailrace raises the water surface elevation within a portion of the bypassed reach. This occurs at the Riverdale Mills Project because the water surface elevation at the confluence of the bypassed reach and tailrace is almost equal to the water surface elevation in the lowermost portion of the bypassed reach. Specifically, the water surface elevation at the confluences is only 1 inch to 1 foot lower (depending on the amount of generation and spillage flow) than the lower 1,000 feet of the bypassed reach. The combination of this low gradient section and low water velocities within the bypassed reach can result in water flowing from the tailrace into the lowermost portion of the bypassed reach.

spawning, juvenile, and adult habitat categories for white sucker, fallfish, and common shiner. While fallfish and common shiner have not been documented at the project, they do occur in the Blackstone River Basin and were a species of interest for the resource agencies.

Over the range of flows (3.9 cfs to 70 cfs), water depth increased by 72.0 percent at transect 1, 30.1 percent at transect 2, and 35.9 percent at transect 3; whereas, due to the channel shape, wetted width increased by only 12.8 percent at transect 1, 7.5 percent at transect 2, and 8.8 percent at transect 3 (see Table 2). The highest average velocity across the flows was 1.0 foot per second (fps), and the average velocity did not significantly increase as flows travelled downstream from transect 1 to transect 3, which reflects the low gradient within the bypassed reach.

Table 2. Summary of flow and habitat data for the Riverdale Project bypassed reach.

Transect	Spillway Discharge Depth (in.)	Bypassed Reach Flow (cfs)	Average Depth (ft.)	Average Velocity (fps)	Wetted Width (ft.)	Wetted Perimeter (ft.)
1	0.6	3.9	1.6	0.05	37.3	38.8
	1.0	8.5	2.2	0.28	40.2	42.1
	2.2	30.0	2.8	0.49	41.3	43.2
	3.2	51.0	3.1	0.59	41.7	43.7
	4.0	70.0	3.4	0.73	42.4	44.4
2	0.6	3.9	3.1	0.02	66.5	68.1
	1.0	8.5	3.4	0.04	66.6	69.2
	2.2	30.0	3.7	0.10	66.7	70.6
	3.2	51.0	4.0	0.20	68.9	71.2
	4.0	70.0	4.2	0.30	71.7	72.1
3	0.6	3.9	1.6	0.08	44.6	45.2
	1.0	8.5	1.6	0.18	45.0	45.2
	2.2	30.0	1.8	0.58	46.8	48.1
	3.2	51.0	2.1	0.74	47.6	48.5
	4.0	70.0	2.3	1.00	48.7	49.9

(Source: Alden Labs, 2009 as modified by staff).

Table 3 shows the relationship of flow to fish habitat over a range of flows from 8.5 cfs to 70 cfs. Spawning habitat for all three species, as well as juvenile fallfish habitat decreased substantially at the higher two flows. Habitat for adults of all three species, as well as juvenile white sucker and common shiner showed slight increases at higher flows. Of the flows evaluated, 30 cfs appears to provide the most habitat for white

sucker, fallfish, and common shiner, while 8.5 cfs provides almost as much habitat as 30 cfs. Specifically, at 30 cfs, spawning habitat is maximized, and habitat availability for juveniles and adults is still a high percentage of the maximum observed at 70 cfs. The bolded numbers in Table 3 represent interpolated habitat values corresponding to the agencies' recommended 10 cfs flow. A flow of 10 cfs would provide slightly more habitat than a flow of 8.5 cfs, and also a large percentage of the habitat available at 30 cfs.

Table 3. Amount of suitable habitat for fish species at a range of flows in the bypassed reach.

Species	Flow (cfs)	Spawning Area (100 ft.^{2})	Juvenile Area (100 ft.^{2})	Adult Area (100 ft.^{2})
White sucker	8.5	279	819	819
	10.0	**282**	**820**	**820**
	30.0	384	832	832
	51.0	131	849	849
	70.0	134	873	873
Fallfish	8.5	698	341	788
	10.0	**699**	**342**	**789**
	30.0	709	352	800
	51.0	356	99	817
	70.0	363	101	839
Common shiner	8.5	372	695	788
	10.0	**373**	**696**	**789**
	31.0	384	703	800
	51.0	131	718	817
	70.0	134	738	839

(Source: Alden Labs, 2009 as modified by staff).

Although Riverdale Power proposes a 10-cfs minimum flow to the bypassed reach, Riverdale Power states that leakage through the stop logs at the dam should be counted as part of the 10-cfs minimum flow. At the same time, Riverdale Power estimates that leakage through the stop logs is 10 cfs. However, Riverdale Power provides no documentation to support its leakage estimate.

Among the findings not discussed in Riverdale Power's application or in Alden Lab's flow study report is the fact that the field-verified flows of 3.9, 8.5, and 51 cfs would have included leakage from the dam. As documented in the Alden Lab report, for instance, a flow of 0.6 inch of water over the spillway results in a flow of 3.9 cfs in the bypassed reach. Therefore, at the time of the study, leakage from the dam was not equal

to 10 cfs through the stop logs or 7 cfs through the foundation, as estimated by Riverdale Power.

Based on the data from the Alden Lab report, leakage at the dam is either significantly less than Riverdale Power's estimated 17 cfs total, or varies significantly over time or by season. The fact that 0.6 inch of water over the spillway corresponded to 3.9 cfs of flow in the bypassed reach and 1.0 inch of water corresponded to 8.5 cfs, suggests that total leakage from the dam (including through the stop logs and through the foundation) during the Alden study was only between 0 and 1 cfs. Therefore, leakage from the dam cannot be relied on to provide a significant contribution to a minimum flow of 10 cfs in the bypassed reach, as proposed by Riverdale Power. Additionally, the only way to ensure compliance with a minimum flow requirement that includes leakage, would be to install a gage within the bypassed reach that could be linked to a programmable logic controller, enabling the total bypassed reach flow to meet the minimum flow requirement with supplemental spillage.

Implementing Interior's and Massachusetts DWF's recommendation to release the 10 cfs over the spillway would ensure that a reliable flow is provided to the bypassed reach to support aquatic habitat for fish and other aquatic organisms. The flow could be monitored for compliance using the existing electric water level sensors, which control flow to the turbines and spillway. No additional automated gage would need to be installed in the bypassed reach.

In addition to the relationship between flow and aquatic habitat in the bypassed reach, the location of the flow release could have an effect on water quality in the bypassed reach, particularly on DO concentrations. We discuss this issue below under our analysis of the water quality monitoring recommendation.

Impoundment Refill Procedure

Periodically, the project impoundment is drawn down for maintenance or for emergencies. During these times, run-of-river operation would be temporarily interrupted. Riverdale Power does not describe any protocol that it uses for refilling the impoundment following drawdowns for maintenance or emergency purposes. Massachusetts DFW recommends (10(j) recommendation 5) that the impoundment be refilled under such scenarios by releasing 90 percent of the inflow to the downstream reach and retaining 10 percent of the inflow for the purpose of refilling the impoundment. Massachusetts DFW states that this procedure could be modified on a case-by-case basis with prior approval from the FWS and Massachusetts DFW.

Our Analysis

The procedures that are used to refill an impoundment following a drawdown can significantly affect aquatic habitat and organisms in the impoundment and in the downstream reach. Retaining all inflows to refill the impoundment would adversely affect aquatic resources by dewatering aquatic habitat in the downstream reach and stranding fish and other aquatic organisms. On the other hand, releasing all flows to the downstream reach would adversely affect aquatic life in the impoundment by sustaining the dewatered conditions. Releasing 90 percent of the project impoundment's inflow during impoundment refilling would ensure that downstream flows are kept at or near project inflow levels and that the impoundment is refilled in a timely manner. During average annual flows, we estimate that the refill procedure proposed by Massachusetts DFW would take 38.5 hours to refill the impoundment back to 258.5 feet msl.[18] Minimizing the length of time that the impoundment is drawn down and that flows are reduced downstream would help maintain the existing aquatic habitat for fish and other aquatic species.

Compliance Monitoring

Riverdale Power indicates that the project uses electric water level sensors to maintain pond levels and adjust flow through the turbines to maintain compliance with run-of-river operation, but does not describe the details of its operational compliance methods. Interior and Massachusetts DFW both recommend (10(j) recommendation 4 for both agencies) a plan to monitor and maintain flow releases from the project. The agencies recommend that the plan include a "description and design of the mechanisms and structures that will be used, a protocol for maintaining and calibrating equipment, the level of manual and automatic operation, and an implementation schedule." The agencies also recommend that the plan provide details of how data on project operations would be recorded to verify proper operation and flow releases, and how the data would be maintained for inspection by the Commission and the agencies.

Our Analysis

Although compliance measures do not directly affect environmental resources, they do allow the Commission to verify that a licensee is complying with the environmental requirements of a license.

An operation compliance monitoring plan that incorporates elements of the agencies' recommended flow monitoring and maintenance plan would help Riverdale Power document its compliance with the operational provisions of any subsequent license, and provide a mechanism for reporting deviations. An operation compliance

[18] The estimated time to refill the impoundment to 258.5 feet msl is calculated using 10 percent of the average annual flow of 278 cfs and an impoundment storage capacity of 88.5 acre feet (3,855,054 cubic feet).

monitoring plan would also help the Commission verify that the project is operating in a run-of-river mode and releasing the required minimum flow into the bypassed reach, thereby facilitating administration of the license and assisting with the protection of resources that are sensitive to impoundment fluctuations and deviations from normal operating conditions.

The plan could be developed in consultation with Interior and Massachusetts DFW and include a description of the mechanisms and structures that would be used, a protocol for maintaining and calibrating equipment, and provisions for: (1) monitoring run-of-river operation, minimum flows, and impoundment elevation levels to document compliance with the operational conditions of any subsequent license; (2) standard operating procedures to be implemented (a) outside of normal operating conditions, including during scheduled facility shutdowns, impoundment drawdowns, and impoundment refilling and (b) during emergency conditions such as unscheduled facility shutdowns and maintenance, in order to minimize project effects on environmental resources; (3) reporting deviations to the Commission; and (4) maintaining a log of project operations for inspection.

Water Quality Monitoring

Riverdale Power has neither conducted nor proposes to conduct any water quality monitoring at the project. Interior and Massachusetts DFW recommend (10(j) recommendation 3 for both agencies) that Riverdale Power prepare and file a water quality monitoring plan, within six months from the effective date of any license issued for the project. The goal of the plan would be to determine whether a 10-cfs continuous minimum flow release from the spillway for fish habitat (discussed above as 10(j) recommendation 2) is also adequate to maintain DO levels sufficient to support the resident riverine fish community, which we interpret to mean maintain a DO level of at least 5 mg/L consistent with the state standard. As discussed above in section 1.3.2, *Clean Water Act*, Massachusetts DEP has denied section 401 water quality certification for the project until a water quality survey is completed in the project impoundment, bypassed reach, and below the confluence of the tailrace and the bypassed reach.

Our Analysis

DO is an important indicator of water quality and is required at an adequate concentration to sustain aquatic resources. DO concentrations can change substantially over time and distance based on many factors, including ambient temperature, atmospheric pressure, the content of dissolved solids in the water, and site-specific chemical, physical, and biological reactions.

Low flow conditions can result in low DO concentrations that can be harmful to fish and other aquatic resources, especially during the summer months when warmer

water has less capacity to absorb oxygen. Low flow conditions can also exacerbate low DO concentrations in reaches that are dominated by pools, such as the project impoundment and the project's bypassed reach. First, water velocity is slower in pools than riffles, thereby allowing more time for biological activity in the pools, such as the decomposition of organic matter, to consume DO. Second, pools are by definition areas with greater depth and fewer exposed rocks. These characteristics of pools provide fewer opportunities for the water to become aerated by cascading over and around rocks.

While data from Massachusetts DEP (2010) indicate that DO concentrations upstream and downstream of the project are at or above the current 5 mg/L state standard, no water quality data has been collected in the bypassed reach or the confluence of the bypassed reach and tailrace. The bypassed reach, particularly, receives low flows during the summer months limited to leakage at the dam, because there is no minimum flow requirement and typically most or all of the inflow to the impoundment is used for generation. Although leakage from the dam provides some flow to the bypassed reach even during low-flow conditions, the data from the 2009 Alden Labs study indicates that leakage was between 0 and 1 cfs during the study.

The bypassed reach, being 1,460 feet long, and with an average width of about 50 feet and average depth of about 3 feet, has a volume of approximately 219,000 cubic feet. As discussed above, it is also dominated by pool habitat, which has slower velocities and greater water retention time. If we assume that leakage is the only flow influencing the retention time of the bypassed reach, and that leakage is 1 cfs as the Alden study suggests, then it would take approximately 60 hours (2.5 days) to replenish the water in the bypassed reach via leakage. Under hot summer conditions, this could potentially result in a decrease in DO within the bypassed reach because the retention time is long enough to encompass at least two overnight periods, during which photosynthesis does not occur, oxygen is not produced, and oxygen is still being consumed by fish and other aquatic biota. With 10 cfs spilled at the dam and flowing through the bypassed reach, the retention time would be reduced to 6 hours, thereby reducing the likelihood of reduced DO.

In addition to reducing the retention time, a minimum flow of 10 cfs would provide greater aeration in the bypassed reach relative to existing conditions where leakage is the only source of flow during summer. Spilling the 10 cfs of flow over the dam would create a cascading sheet of water that would be exposed to the air on both sides as it spills and splashes onto the concrete surface immediately downstream of the spillway. In contrast, seepage under the dam (through the foundation) or leakage through the stoplogs would not likely aerate the water to the same extent as spillage over the dam, due to decreased contact with the air before flowing into the bypassed reach. Specifically, seepage under the dam would not contact air because the foundation of the dam is under water. Stoplog leakage could occur in the form of either seepage or spray through cracks between the boards, either of which would result in some aeration to the

water. However, Riverdale Power has not provided any documentation showing that a significant amount of leakage is occurring in the form of spray and, to the extent that leakage from the stoplogs is occurring in the form of seepage, the water would not be exposed to air on both sides. Figure 3 shows that leakage in the stanchion bay located closest to the powerhouse is indeed occurring primarily in the form of seepage, and not in a cascading manner as seen in the second stanchion bay.

Figure 3. Photograph of the Riverdale Mills Project dam. (Source: Blackstone Heritage Corridor, undated).

Post-licensing water quality monitoring in the bypassed reach would provide the data necessary to verify the effectiveness of the recommended 10-cfs minimum flow in maintaining adequate DO and temperature for aquatic life. Monitoring during low-flow conditions would best capture the worst-case conditions for temperature and flow, which would be the purpose of the monitoring. The monitoring would not need to occur over a long period of time or at multiple locations to determine the effectiveness of the recommended 10-cfs minimum flow. An acceptable monitoring plan would consist of daily morning sampling in a single pool within the bypassed reach for a period of two weeks, during typical hot and dry August conditions when the only flow in the bypassed

reach is from the 10-cfs flow over the spillway. If a 10-cfs bypassed reach flow does not provide DO levels sufficient to support the resident fish community in the bypassed reach, which we estimate to be a minimum of 5 mg/L, then the Commission could consider additional measures to improve DO conditions in the reach (*e.g.*, additional minimum flow releases). Developing the water quality monitoring plan in consultation with the agencies would ensure that the DO monitoring occurs during appropriate conditions as described above, and that appropriate sampling methods and protocols are used in order to yield valid data.

Cumulative Effects

Water Quantity

As shown in Table 1, there are several hydroelectric dams on the Blackstone River. The Riverdale Mills Project dam is the most upstream dam on the Blackstone River. While some of the hydroelectric projects on the Blackstone River operate in a run-of-river mode and have minimal effects on water quantity, some alter the natural flow regime either by operating in a store-and-release mode or by bypassing a portion of the historic river channel to route water from the impoundment to the project's turbines. The Clean Water Act section 303(d) list of impaired waters for the Blackstone River includes flow regime and physical substrate habitat alterations as impairments. Additional sources of stream flow alteration in the Blackstone River have been and continue to be industrial processing (including for cooling water), wastewater treatment plants, and municipal water supply.

The Riverdale Project operates in a run-of-river mode and Riverdale Power proposes to continue to operate the project in this mode. However, the project does have a bypassed reach that at times, only receives leakage flows from the dam. If the project is relicensed with conditions requiring run-of-river operation, an operation compliance monitoring plan, and a 10-cfs minimum flow requirement within the bypassed reach, then the effect of the relicensing could be cumulatively beneficial to the flow regime of the Blackstone River by increasing year-round flows to the project's bypassed reach. As discussed above, this could improve aquatic habitat conditions for fish within the bypassed reach.

Water Quality

As described above, the Blackstone River within the reach where the Riverdale Project is located has numerous water quality impairments on the 303(d) list other than flow regime and physical habitat alterations: fish and aquatic macroinvertebrate bioassessments, cadmium, copper, lead, PCBs, DDT, *Escherichia coli*, excessive aquatic plant and algal growth, eutrophication, total phosphorous, sedimentation/siltation, turbidity, taste, and odor. The metals, PCBs, and DDT are attributed to past

contamination from industrial and agricultural activities, some of which could still be leaching into the river from landfills and contaminated sediments within the river basin. Fish and aquatic macroinvertebrates are impaired due to low quality/altered habitat and sedimentation in the river, which affects spawning conditions for fish and reduces the species diversity of both fish and macroinvertebrates. Nutrient-related impairments (*i.e.*, excessive algal growth, eutrophication, phosphorous, *Escherichia coli*, turbidity, taste, and odor) are attributed both to point and non-point sources such as septic and sewer system outflows upstream of the project area, and fertilizer input.

If the project is relicensed with conditions requiring that a 10-cfs minimum flow be released from the spillway into the bypassed reach, then the effect of the relicensing could be cumulatively beneficial to the water quality, particularly DO, of the Blackstone River due to the aerating effect of spilled flow. Higher DO levels could in turn improve conditions for fish and macroinvertebrates. As discussed above, post-licensing water quality monitoring would provide the data necessary to assess the effectiveness of the 10-cfs minimum flow in maintaining adequate DO and temperature for aquatic life at the project; and evaluate the need for additional minimum flows to maintain sufficient DO concentrations for aquatic life at the project.

3.3.2 Terrestrial Resources

3.3.2.1 Affected Environment

The Riverdale Mills Project is located in the Southern New England Coastal Plains and Hills area of the Northeastern Coastal Zone ecoregion (Griffith *et al*., 2009), which is characterized by irregular plains and low hills. Forests in this area range from dry to mesic successional oak and oak-pine, with patches of elm, ash, and red maple, which are typical in forested wetlands in this region. The project vicinity consists primarily of forested uplands and palustrine wetlands influenced by the Blackstone River as well as residential and commercial lands.

Wetlands

According to FWS's National Wetlands Inventory system (FWS, 2017), approximately 10.6 acres of wetland habitat occur within the project boundary, including 4.5 acres of scrub-shrub wetlands, 2.6 acres of forested wetlands, and 3.5 acres of emergent wetlands. These wetlands occur upstream of the dam along the northern shoreline of the impoundment, in river alcoves, and in low gradient backwater areas. A number of wetlands of various classification and size occur downstream of the project but outside of the project boundary. Typical wetland vegetation for this area includes red maple, smooth alder, American elm, and species of dogwood.

Wildlife

Wetland, riparian, and upland habitat around the project area support a variety of wildlife species. Mammals common to the area include red fox, raccoon, striped skunk, eastern chipmunk, red and grey squirrel, coyote, white-tailed deer, Virginia opossum, muskrat, mink, and eastern cottontail rabbits. As many as 260 bird species are known to occur in the area at various times throughout the year, including resident and migratory waterfowl such as mallard, wood duck, Canada goose, black duck, green-winged teal, pintail, great blue heron, common and hooded mergansers, and American widgeon.

The federally protected[19] and state threatened bald eagle has been observed foraging in the project vicinity. One bald eagle nest has been documented adjacent to the project boundary, to the west of the impoundment.

3.3.2.2 Environmental Effects

Wetlands

Riverdale Power proposes to continue to operate the project in a run-of-river mode. Periodically, the project impoundment is drawn down for maintenance or for emergencies. During these times, run-of-river operation would be temporarily interrupted. Riverdale Power does not describe any protocol that it uses for refilling the impoundment following drawdowns for maintenance or emergency purposes.

Interior and Massachusetts DFW recommend under section 10(j) that Riverdale Power continue to operate the project in run-of-river mode, and that the impoundment not be drawn down for the purpose of generating power. In addition, Massachusetts DFW recommends under section 10(j) that after the project impoundment is drawn down for maintenance or emergencies, the impoundment is refilled by releasing 90 percent of the inflow to the downstream reach and retaining 10 percent of the inflow for the purpose of refilling the impoundment.

[19] The bald eagle was delisted from the ESA in 2007, but remains federally protected under the Bald and Golden Eagle Protection Act and Migratory Bird Treaty Act (FWS, 2007a).

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 Blackstone River downstream of the project.

Drawing down the impoundment for maintenance or emergencies would dewater wetlands in the impoundment. The method in which the impoundment is refilled following the drawdown would affect the length of time in which the wetlands were dewatered. Following a drawdown event, wetlands in the impoundment would continue to be dewatered until the impoundment was refilled to 258.5 feet msl. Currently, there is no requirement for Riverdale Power to use a specific procedure for refilling the impoundment after a drawdown. The refill procedure proposed by Massachusetts DFW would result in an average refill time of 38.5 hours.[20]

Dewatering wetlands in the project impoundment on a short-term basis such as 38.5 hours would not be expected to result in long-term impacts to the wetland habitat. Massachusetts DFW's recommendation to release 90 percent of the inflow to the downstream reach would ensure that downstream flows are kept at or near project inflow levels and would avoid dewatering wetlands downstream. The refill procedure proposed by Massachusetts DFW would therefore keep dewatering effects localized and refill the impoundment quickly enough to avoid long-term impacts to wetlands along the impoundment. Overall, we find that the proposed refill procedure would be beneficial to wetlands in the project vicinity.

Wildlife

Riverdale Power proposes to continue to operate the project in a run-of-river mode and provide a minimum flow of 10 cfs to the bypassed reach. Riverdale Power proposes to include leakage through the stop logs at the dam as part of the 10-cfs minimum flow, and estimates the leakage through the stop logs to be 10 cfs. Interior and Massachusetts DFW recommend under section 10(j) that the licensee release a continuous 10-cfs minimum flow through discharge over the spillway.

Our Analysis

Currently, there is no requirement for Riverdale Power to release a minimum flow from the impoundment to the bypassed reach. When inflow to the project is less than the minimum hydraulic capacity of 90 cfs, the only flows provided to the bypassed reach are from leakage through the dam. During these periods of low flow, habitat in the bypassed

[20] The estimated refill time is calculated using an average annual flow of 278 cfs and an impoundment storage capacity of 88.5 acre feet.

reach can become dewatered. Releasing a continuous minimum flow of 10 cfs to the bypassed reach would provide habitat stability in the bypassed reach and could improve foraging opportunities for aquatic and semi-aquatic wildlife, including waterfowl and some mammals. Providing flow over the spillway rather than using leakage to meet minimum flow requirements would ensure more accurate and reliable flow in the bypassed reach since leakage may vary over time. Stable and consistent flow in the bypassed reach would be expected to improve the overall function of riparian habitat and provide a benefit to wildlife.

Bald Eagles

Riverdale Power proposes to implement measures from the FWS's 2007 *National Bald Eagle Management Guidelines* (FWS, 2007b) to minimize project effects on nesting bald eagles at the project.[21] Massachusetts DFW recommends that Riverdale Power develop a Bald Eagle Protection Plan (10(j) recommendation 6) that includes measures to: (1) avoid killing, injuring, or harassing bald eagles during tree cutting or thinning operations at the project, including those for project operation, infrastructure, and recreational enhancements; and (2) avoid or mitigate for effects on nesting bald eagles at the project.[22]

Our Analysis

Bald eagles are known to occur in the project vicinity, and a nest has been documented adjacent to the project boundary. The project does not appear to be adversely affecting the bald eagle as currently licensed, and the proposed action and action alternatives do not include any construction activities tree clearing, or tree thinning activities that would be expected to adversely affect bald eagles. Also, unlike the Grandfather Falls Project No. 1966 that was referenced by Massachusetts DFW in its June 27, 2019 filing, there are no transmission lines at the Riverdale Mills Project that would require regular vegetation maintenance. Although staff recommends certain

[21] FWS's 2007 *National Bald Eagle Management Guidelines* provide detailed guidance on how to minimize effects to bald eagles, including disturbances to nesting eagles. The guidelines include the following measures to avoid disturbances to nesting eagles: (1) keeping a distance between the activity and the nest (distance buffers), (2) maintaining preferably forested (or natural) areas between the activity and around nest trees (landscape buffers), and (3) avoiding certain activities during the breeding season.

[22] Massachusetts DFW references the March 27, 2019 Bald Eagle Management Plan filed by Wisconsin Public Service Corporation for the Grandfather Falls Project No. 1966, which was required by the Commission's May 17, 2018 license for Project No. 1966. *See Wisconsin Public Service Corporation*, 163 FERC ¶ 62,100 (2018).

recreational improvements in section 5.1.2, *Additional Measures Recommended by Staff*, the measures would not result in any significant ground disturbance or tree removal that would be expected to adversely affect the bald eagle. Because the proposed project does not involve any activities that would adversely affect bald eagle habitat or disturb nesting bald eagles, including any construction or recreational enhancements that would require tree cutting or tree thinning, developing a Bald Eagle Protection Plan and implementing FWS's 2007 *National Bald Eagle Management Guidelines* would not benefit the species.

Invasive Plants

Massachusetts DFW recommends that Riverdale Power develop and implement an Invasive Plant Species Monitoring and Management Plan (10(j) recommendation 7). The plan would include the following measures: (1) educate recreational users on ways to reduce the spread of invasive species; (2) implement "best management practices," such as identifying invasive species that may be introduced by a given project-related activity, identifying critical control points (locations and times), and implementing measures to prevent the spread of invasive species during routine project operation and maintenance activities; (3) record incidental observations of invasive species; (4) use only seed and plant materials outside of lawn areas to those found to be native to the county in the then-current edition of *Vascular Plants of Massachusetts*; (5) conduct a comprehensive survey of invasive plants every 5 years that would be used to develop site-specific control/management actions to reduce the spread of invasive species at the project; and (6) plant and seed areas after implementing invasive species control techniques.

Our Analysis

Non-native invasive plant species are able to out-compete and displace native species, thereby reducing biodiversity and altering compositions of existing native plant and animal communities. Once established, invasive plant species can be difficult to remove from an area. However, mechanical and chemical methods can be used to restrict the abundance of existing populations, allowing for greater vegetation diversity.

No site-specific information regarding the presence or prevalence of invasive plant species has been documented at the project, and there is no evidence that invasive species are currently affecting project operation or other environmental resources. Vegetation maintenance activities at the project are limited because there is no project transmission line. Further, no new significant ground disturbing activities have been proposed that could facilitate the spread of invasive plant species. Therefore, there is no indication that an invasive species monitoring and management plan would benefit environmental resources at the project at this time.

3.3.3 Threatened and Endangered Species

3.3.3.1 Affected Environment

According to the IPaC database, the northern long-eared bat (NLEB) is the only federally listed species that could occur in the project vicinity. The NLEB was listed as a federally threatened species under the ESA on May 4, 2015. Massachusetts has also designated the NLEB as an endangered species. 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.[23] Winter hibernation typically occurs in caves and areas around them and can be used for fall-swarming[24] and spring-staging.[25]

The project is located within the white-nose syndrome buffer zone for this species.[26] Although there is no documentation of NLEB at the project, and no known NLEB hibernacula sites occur within 0.25 mile of the project, upland forest in the project vicinity may provide suitable habitat for NLEB summer roosting and foraging activities.

3.3.3.2 Environmental Effects

Riverdale Power does not propose any measures for the protection of the NLEB. Massachusetts DFW recommends Riverdale Power develop and implement a Special Status Bat Management Plan (10(j) recommendation 8) to identify and implement

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

[24] 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.

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

[26] 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.

measures to avoid and minimize adverse effects to special status bats that may result from future project-related construction or land-clearing activities, during the term of the license.

Our Analysis

The only known special status bat species that could occur at the project is the NLEB. No NLEB hibernacula sites are known to occur in the project vicinity; however, because the project vicinity is largely forested, suitable habitat for summer roosting and foraging could be present. However, project operation and maintenance would not affect NLEB or its habitat because the applicant does not propose, and none of the action alternatives include any tree-clearing activities as part of relicensing. Therefore, there is no information to indicate that a bat management plan is needed to protect potential bat habitat at this time.

Based on this information, we conclude that relicensing the Riverdale Mills Project with any of the measures considered in this EA, would have no effect on the NLEB, and that developing and implementing a Special Status Bat Management Plan would have no benefit to the species.

3.3.4 Land Use and Recreation

3.3.4.1 Affected Environment

Land Use

Worcester County is primarily forested. Agriculture, and commercial and residential development account for the next largest land uses, but these compose only a fraction of the total land. The county contains many lakes that are used for recreation, municipal water supply, and as natural areas. The town of Worcester, located about ten miles northwest of the project, is the largest metropolitan area in the county, with nearly a million residents (Statistical Atlas, 2018). Other large developed areas in the county include the towns of Fitchburg, Leominster, Gardiner, Milford, and Webster. Use of project land is light, with project operation and project maintenance being the primary activities that occur on project land.

The current project boundary for the Riverdale Project as established in the Commission's 1987 License Order[27] encompasses 54.2 acres, of which approximately 22 acres are water. The existing project boundary includes: (1) land and water up to a high-water elevation of 262.35 feet msl; (2) the bypassed reach; (3) the project's dam, intake

[27] *See James M. Knott*, 39 FERC ¶ 62,308 (1987).

structures and sluiceways, tailrace, and generating equipment inside the mill building; and (4) appurtenant facilities.

No federal land exists within or adjacent to the project boundary. However, the project is located within the John H. Chafee Blackstone River Valley National Heritage Corridor, which is supervised by the National Park Service. The 400,000-acre corridor was established by Congress in 1986 to preserve and interpret the history of the Blackstone Valley. The corridor extends from Worcester, Massachusetts to Pawtucket, Rhode Island, and covers much of the Blackstone River Basin. The National Park Service does not own the land within the corridor, but rather serves as the lead management agency in a partnership between itself, the governments of Massachusetts and Rhode Island, local municipalities, nonprofit organizations, and other stakeholders (National Park Service, 2015; 2011).

Statewide Recreation Plan

The 2017 Massachusetts Statewide Comprehensive Outdoor Recreation Plan (SCORP) identifies outdoor recreation as central to the state's economic, environmental, and community values. The SCORP identifies broad goals of using outdoor recreation to improve health and drive economic development in Massachusetts. The SCORP also identifies four goals for improving outdoor recreation in the commonwealth: (1) increase access for underserved populations, especially people with disabilities, teenagers, and senior citizens; (2) support the Statewide Trails Initiative to increase trail networks; (3) increase the availability of water-based recreation; and (4) support the creation and renovation of neighborhood parks (Massachusetts Executive Office of Energy and Environmental Affairs, 2017).

Regional Recreation Opportunities

The Blackstone River Valley contains many opportunities for recreation, including historical sites, fishing, picnicking, and hiking. The Blackstone River and Canal Heritage State Park is located just downstream from the project, and provides water access, hiking, and historic sites. Purgatory Chasm State Reservation provides hiking opportunities a few miles west of the project. The John H. Chafee Blackstone River Valley National Heritage Corridor and the Blackstone Valley National Historic Park encompass much of the project vicinity, and provide historic sites and visitor centers that include information about the local industrial history (National Park Service, 2019). More information on the Blackstone Valley National Historic Park is provided by in section 3.3.5.1, *Cultural Resources, Affected Environment*.

Recreation at the Project

The last FERC Form 80 for the project was submitted by the licensee on January 22, 2008 and indicated that the project received no recreational use. There are no project

recreation facilities and Riverdale Power does not maintain any non-project recreation sites. However, a few private landowners have residences on the shoreline of the impoundment, and access project water for recreation through their land. There are several public parks that offer river access for boating near the project, with the town of Grafton's Mill Villages Park approximately 3.5 miles from the project being the closest upstream. Plummer's Landing within the Blackstone River and Canal Heritage State Park is the closest downstream public park access, and is 0.75 miles from the project.

The current license order requires the licensee to allow public use of the project for recreation.[28] However, in the license application, Riverdale Power states that:

> "permission for access to and from the River on their property will be considered on a case-by-case basis and only upon written request and for specific occasions. Any permission which is granted may be conditioned on appropriate assurances for indemnity against liability, commitment to maintain the access area and the river bank, and other restrictions required for public safety. No blanket permission to use their private property is to be implied or inferred."

Based on this statement, it appears that Riverdale Power is not providing general public access for recreation at the project because of public safety concerns. However, the license application does not discuss the specific safety concerns or why those concerns cannot be mitigated by providing appropriate safety signage at the project.

The licensee does provide the Blackstone River Watershed Association with access to certain land for canoe portage around the dam during an annual canoe race that is sponsored by the Blackstone River Watershed Association. The canoe race runs from Mill Villages Park upstream of the project to the town of Uxbridge downstream of the project. Although Riverdale Power does not provide recreational access over its land

[28] *See* Ordering Paragraph E of the 1987 License, which states that the license is subject to the articles set forth in Form L-15, 54 FPC ¶ 1883 (October 1975), entitled "Terms and Conditions of License for Unconstructed Minor Project Affecting the Interests of Interstate or Foreign Commerce." Article 13 of Form L-15 states that "So far as is consistent with proper operation of the project, the Licensee shall allow the public free access, to a reasonable extent, to project waters and adjacent project lands owned by the Licensee for the purpose of full public utilization of such lands and waters for navigation and for outdoor recreational purposes, including fishing and hunting: *Provided*, That the Licensee may reserve from public access such portions of the project waters, adjacent lands, and project facilities as may be necessary for the protection of life, health, and property."

without permission, the impoundment can be accessed by boaters that paddle downstream on the Blackstone River from private and public river access points.

Even though there are no project recreation facilities, there is a little-used portage route on the east bank of the Blackstone River that is currently outside of the project boundary. The portage trail stretches approximately 350 feet from an informal take-out area upstream of the dam to an informal put-in area just downstream of the dam. Signage indicating "Riverdale Mills Corporation, Private Property, No Trespassing, Authorized Personnel Only" is currently posted on concrete barriers along Quaker Street near the existing portage route. Based on the limited access to the Blackstone River at the project, Commission staff assumes that the portage trail is primarily used during the annual canoe race when the licensee permits public use the land.

3.3.4.2 Environmental Effects

Riverdale Power is not proposing any recreation-related measures. Massachusetts DFW comments that Riverdale Power should allow public access to project land, where appropriate, for fishing and boating, as well as investigate the need for a canoe take out above the dam as well as a portage route and put in below the dam.

Our Analysis

Recreational use of the project is extremely low, which is most likely influenced by the lack of public access to the Blackstone River at the project. Allowing public access to the Blackstone River for recreation, such as for fishing in the impoundment and canoe portage around the dam, would improve recreation opportunities at the project. The existing non-project portage route on the east side of the Blackstone River could provide access from the impoundment to the Blackstone River downstream of the dam. Maintaining the portage as a project recreation facility could improve recreation access to the Blackstone River by formally connecting the upstream and downstream reaches of the Blackstone River at the project. Including a formal take-out at the upstream end of the portage trail near the bridge along Quaker Street would improve access by providing a formal egress for downstream boaters, as well as by providing an access site for hand-carry boaters who wish to boat in the impoundment. A formal put-in at the downstream end of the portage trail would make entering the river there easier for boaters that desire to access the bypassed reach and the Blackstone River downstream of the project.

Based on aerial photographs and Exhibit G of the license application, access to project water is possible along the east bank where Quaker Street meets a footbridge over the river. The existing portage trail crosses this area, traveling from just upstream of the footbridge to just below the dam. Providing signage at the project would inform the public about recreational access, clarify which areas of the project are closed to the public because they are closely related to industrial operations at the mill, and describe any

safety hazards.[29] This in turn could increase recreational use of the project and mitigate concerns about public safety.

3.3.5 Cultural Resources

3.3.5.1 Affected Environment

Section 106 of the NHPA requires that the Commission take into account the effects of its actions on historic properties and afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on the undertaking.[30] Historic properties are those that are listed or eligible for listing on the National Register. The regulations implementing Section 106 of the NHPA also require that the Commission seek concurrence with the SHPO on any finding involving effects or no effects on historic properties, and consult with interested Indian tribes or Native Hawaiian organizations that attach religious or cultural significance to historic properties that may be affected by an undertaking. In this document, we also use the term "cultural resources" for properties that have not been determined eligible for listing on the National Register. Cultural resources represent things, structures, places, or archaeological sites that can be either prehistoric or historic in origin. In most cases, cultural resources less than 50 years old are not considered historic.

Area of Potential Effect

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 area of potential effect (APE) could be 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)).

Riverdale Power did not define an APE in its license application. The standard, Commission-defined APE for this project would include all lands within the project

[29] Land owned by Riverdale Mills on the western shore adjacent to the project is used for industrial purposes and would not be safe for recreational access.

[30] An undertaking means "a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; and those requiring a Federal permit, license, or approval." 36 C.F.R. § 800.16 (2019). Here, the undertaking is the potential issuance of a new license for the Riverdale Mills Project.

boundary and lands outside the project boundary where historic properties could be affected by the project.

Pre-contact Period

The earliest inhabitants of the region and throughout North America were the Paleoindian people, who rapidly colonized the continent in pursuit of large game (Martin, 1973). The hallmark of the Paleoindian tradition is the fluted spear point, which was presumably used to hunt large game. In Massachusetts, the Paleoindian period dates from approximately 13,000 to 10,000 B.P., when much of the landscape was still tundra and/or woodlands. Paleoindian people living in the region are characterized as highly mobile hunters and gatherers reliant mainly on the caribou that were abundant at that time. They crafted their tools out of fine-grained, colorful rocks obtained from a limited number of sources in the region, and they camped in locations typically removed from present day water bodies (Spiess *et al.*, 1998).

The Archaic period (ca. 10,000 - 3,000 B.P.) represents the longest cultural period in the region. This timeframe is indicative of persistent cultural adaptations over several millennia. This period is subdivided into the Early, Middle, and Late Archaic periods. Although Early and Middle Archaic people probably continued a nomadic hunter and gatherer lifestyle, their subsistence and settlement patterns were different from those of the Paleoindian people. This distinction is suggested by the location of most Early and Middle Archaic sites along present-day water bodies and the presence of food remains of aquatic species, particularly fish (Robinson, 1992).

The close of the Late Archaic period is characterized by a transition to the Susquehanna Tradition, which is widespread in New England. The people of the Susquehanna Tradition appear to have been more focused on a terrestrial economy than a marine economy (Sanger, 1979).

The Late Archaic period was followed by the Woodland period in southern New England. This period saw the introduction of pottery manufacturing and use, increased use of marine food resources, and the spread of agriculture. Woodland period sites are common along the coast and the interior along waterways, especially rivers, ponds, and lakes. The presence and nature of artifact forms, and certain types of stone recovered from Woodland period sites, indicate trade and communication with peoples far to the north, south, and west. By the end of the period, historical and archaeological evidence suggest horticulture was practiced in southern New England. The Woodland period ends with European contact around 450 years ago. At this time, most of the artifacts attributable to pre-contact inhabitants of Massachusetts disappear from the archaeological record (Binzen *et al*., 2001).

Post-contact Period

At the time of European contact, the upper Blackstone River valley was settled by the Nipmuc, and Algonquin-speaking people. The Nipmuc population rapidly declined after contact with Europeans due to disease and conflict, and they were largely displaced by Europeans following King Phillip's (Metacomet) War of 1675-1676 (National Park Service, 2015).

European settlement of the Northbridge area began in 1667 when English pioneers received a grant of eight square miles from the Nipmuc chief. The land was attractive to the settlers for pasture. An iron works was established in 1727 in the village of Whitinsville by 1729, but the area remained largely agricultural in nature until the early 1800s, when cotton mills began to open to take advantage of the water power provided by the Blackstone, West, and Mumford rivers (Massachusetts Department of Conservation and Recreation [Massachusetts DCR] *et al*., 2007).

By 1740, the earliest grist and saw mills were constructed at the same point on the western bank of the Blackstone River where the project is currently located (Town of Northbridge, 2019). The mill pond that forms the project impoundment was created by the construction of a dam around 1740. A new mill was built in 1814 to power a wooden grist and saw mill owned by David and Henry Dunn on the eastern bank of the Blackstone River. The mill was rented, and then sold in 1822, to Silvanus Holbrook. It burned down in 1826 (Gosselin, 2019).

Between 1824 and 1828, the Blackstone Canal was constructed parallel to the Blackstone River to connect Providence, Rhode Island with Worcester, Massachusetts (National Park Service, undated). The canal provided reliable water transportation along the industrialized Blackstone River Valley, which was largely unnavigable due to dams, falls, and the elevation drop of the river. The Blackstone Canal ran immediately adjacent to the west side of the Riverdale Mill; the Blackstone River is on the east side of the mill. The presence of the canal, along with the junction of the Providence Road and the Central Turnpike, made Northbridge a regional transportation hub. However, the canal system fell out of use by 1848 due to the construction of rail lines in the region (Worcester Historical Museum, 2006).

Silvanus Holbrook built a new one-story mill out of stone in 1852 on the west bank of the Blackstone River. This new mill was constructed over the Blackstone Canal, and was leased to Harvey Waters, who initially produced scythes for harvesting, but converted to making bayonets after the outbreak of the Civil War. Waters' lease ended in 1865, and the new owner Paul Whitin removed the machinery and enlarged the mill by adding a second story made of brick along with a five-story brick tower (Gosselin, 2019).

By the time of the Civil War, the population of Northbridge had shifted from being dispersed rurally to living in the industrial mill villages of Rockdale, Riverdale,

Linwood, and Whitinsville that were growing along the Blackstone and Mumford Rivers. Growth continued until a textile industry depression in 1923. The mill made textiles after the Civil War, but closed after the textile depression of 1923 (Massachusetts DCR et al., 2007). World War II brought a brief resurgence in manufacturing to the area, but industry and the population declined after the war (Massachusetts DCR *et al*., 2007).

The Riverdale Mills Corporation purchased the mill in 1979, and refurbished it for the production of wire mesh for fencing, lobster traps, and other applications. The dam was refurbished in 1985 (Blackstone Heritage Corridor, undated; Riverdale Mills Corporation, 2018).

Cultural Resource Investigations

The project lies within the Blackstone River Valley National Historic Park, which was established in 2014 to preserve, protect, and interpret the industrial heritage of the Blackstone River Valley. The Blackstone River Valley National Historic Park includes several historic districts (including the Blackstone Canal Historic District and the nearby Whitinsville Historic District in Northbridge), the Blackstone River and its tributaries, and the Blackstone Canal (National Park Service, 2018).

Riverdale Power did not conduct any archeological surveys as part of the relicensing process for the project. In a letter filed on April 29, 2016, the Massachusetts SHPO commented that the Blackstone Canal and the Riverdale Mills complex, including the mill, warehouse, pond, sluice gates, and bridge are listed in the National Register as contributing properties to the Blackstone Canal Historic District. The proposed project boundary includes portions of the Blackstone Canal (*i.e.*, the sluiceway described in section 2.1.1, *Existing Project Facilities*) and portions of the Riverdale Mills complex (*i.e.*, the pond (impoundment), sluice gates, and bridge. The turbine-generator is located in the Riverdale Mills Corporation's manufacturing facility, which is located on the Blackstone Canal and includes portions of the original mill building (see Figure 4). The historic warehouse is not located within the project boundary.[31]

[31] The warehouse structure is located approximately 25 feet from the project boundary on the west side of the impoundment.

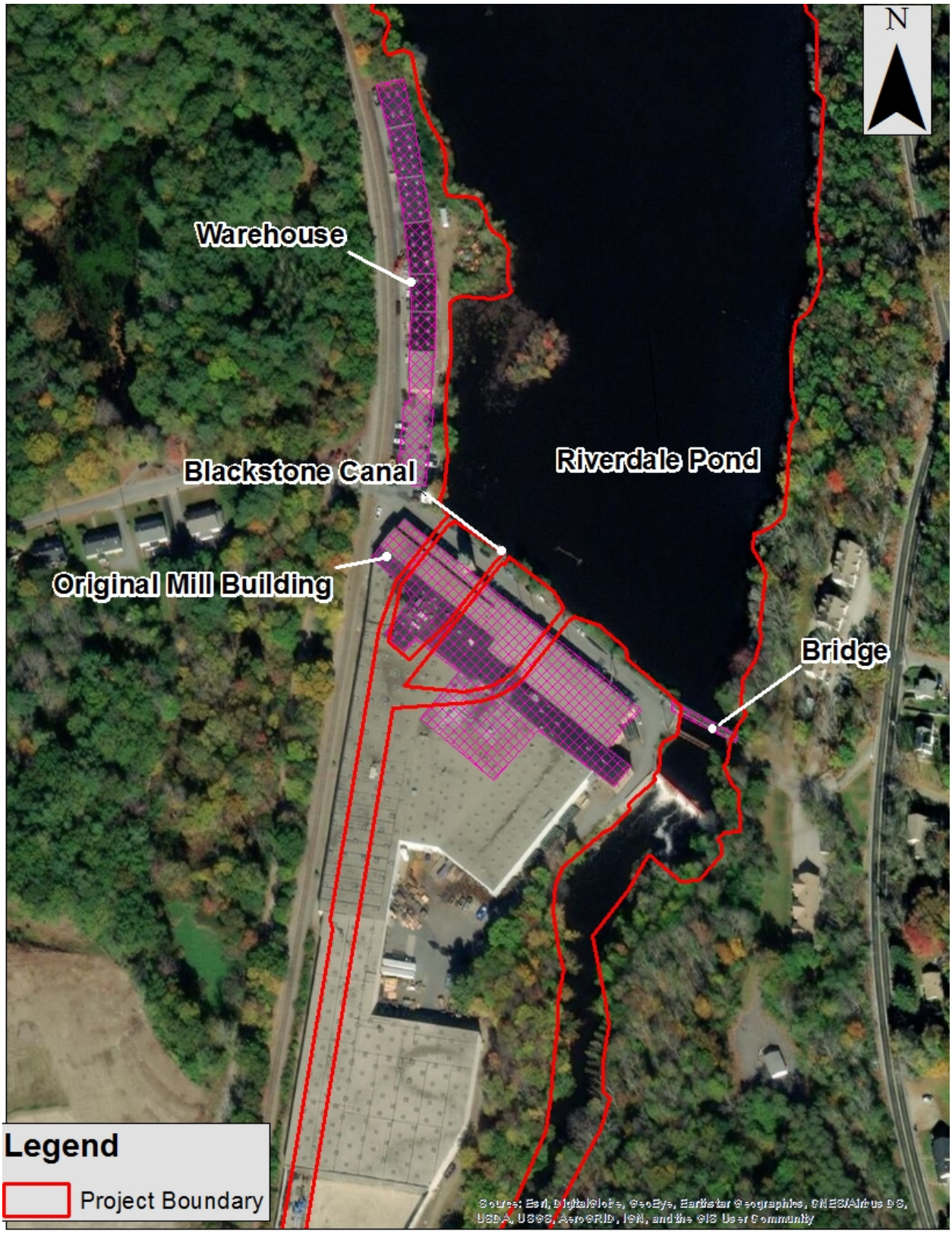

Figure 4. Contributing Resources to the Blackstone Canal Historic District (Source: Staff).

3.3.5.2 Environmental Effects

In a December 29, 2016 letter, the Massachusetts SHPO made a determination of "no historic properties affected" for the project because Riverdale Power proposed no changes to project operation or project facilities.

Our Analysis

The APE includes the existing project boundary along with any land or properties outside of the project boundary where the project may affect historic properties. The project boundary includes portions of the Blackstone Canal and the Riverdale Mills complex, as discussed above and shown in Figure 4. Although the historic mill building is not included in the project boundary, the turbine-generator is located inside the mill building and therefore could affect the historic property. Accordingly, the historic mill building is also included in the APE. In contrast, the historic warehouse is located outside of the project boundary in an area that would not be affected by the project, and therefore is not included in the APE.

Continued operation and maintenance of the project could have adverse effects on the contributing resources of the Blackstone Canal Historic District identified above, 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 contributing resources within the APE (*i.e.,* the Blackstone canal, mill, sluicegates, pond, and bridge), or to fix structural damage that occurs in the course of project operation. Failure to maintain individual contributing resources to the Blackstone Canal Historic District could have adverse effects on the integrity of the historic property. It is also possible that unknown historic resources may be discovered during project operation or other project-related activities that require ground disturbance.

Developing and implementing an HPMP, in consultation with the Massachusetts SHPO, would ensure that measures are in place to protect historic properties in the APE from adverse effects related to the operation and maintenance of project facilities. An HPMP would also ensure that any previously undiscovered archaeological resources within the APE are not adversely affected by the project during the term of any subsequent license.

To meet the requirements of section 106 of the NHPA, the Commission intends to execute a Programmatic Agreement with the Massachusetts SHPO and federally recognized tribes 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 Riverdale Power 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 Blackstone 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.*,[32] 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 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.*, operation, maintenance, and environmental measures); and (4) the difference between the cost of alternative power and total project cost. 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 4 summarizes the assumptions and economic information we use in our analysis for the project. This information was provided by Riverdale Power in its license application or estimated by staff. We find that the values provided by Riverdale Power are reasonable for the purposes of our analysis. Cost items common to all alternatives

[32] *See Mead Corporation, Publishing Paper Division*, 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.

include: taxes, net investment (the total investment in power plant facilities remaining to be depreciated), relicensing costs, and normal operation and maintenance cost.

Table 4. Parameters for economic analysis of the Riverdale Mills Project.

Parameters	**Values (2019 dollars)** [a]	**Sources**
Period of analysis	30 years	Staff
Term of financing	20 years	Staff
Escalation rate	0 percent	Staff
Alternative energy value	$54.86/MWh[b]	Staff
Federal tax rate	21 percent	Staff
Local tax rate	8.0 percent	Staff
Interest rate	7 percent	Staff
Discount rate	7 percent[c]	Staff
Net remaining investment	$0	Riverdale Power
Relicensing cost	$54,000	Riverdale Power
Annual operation and maintenance cost	$27,000	Riverdale Power

(Source: Staff and Riverdale Power)

[a] Values provided by Riverdale Power in 2016 dollars were converted to 2019 dollars using the United States Department of Labor Consumer Price Index.

[b] Source: Energy Information Administration using rates obtained from Annual Energy Outlook 2017 at http://www.eia.gov/outlooks/aeo/index.cfm.

[c] Assumed by staff to be the same as the interest rate.

4.2 COMPARISON OF ALTERNATIVES

Table 5 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, Riverdale Power's proposal, and the staff alternative.

Table 5. Summary of the annual cost of alternative power and annual project cost for the three alternatives for the Riverdale Mills Project.

	No Action	Riverdale Power's Proposal	Staff Alternative
Installed capacity (MW)	0.15	0.15	0.15
Annual generation (MWh)	162	140[a]	140[a]
Annual cost of alternative power ($ and $/MWh)	$8,887 54.86	$7,684[b] 54.86	$7,684[b] 54.86
Annual project cost ($ and $/MWh)	$30,001 185.19	$50,460 360.43	$30,880 220.48
Difference between the cost of alternative power and project cost ($ and $/MWh)	($21,113)[c] (130.33)	($42,780)[c] (305.57)	($23,196)[c] (165.62)

(Source: Staff)

[a] The loss of generation under Riverdale Power's proposal and the staff alternative is associated with releasing a continuous minimum flow of 10 cfs, or inflow if less, over the spillway into the bypassed reach.

[b] The lost generation is reflected as a higher project cost, rather than a lower power value.

[c] 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 0.15 MW and generate an average of 162 MWh of electricity annually. The average annual cost of alternative power would be $8,887, or about $54.86/MWh. The average annual project cost would be $30,001, or about $185.19/MWh. Overall, the project would produce power at a cost that is $21,113, or $130.33/MWh, more than the cost of alternative power.

4.2.2 Riverdale Power's Proposal

Table 6 lists all environmental measures, and the estimated cost of each, considered for the Riverdale Mills Project. Under Riverdale Power's proposal, the Riverdale Mills Project would have an installed capacity of 0.15 MW and generate an average of 140 MWh of electricity annually. The average annual cost of alternative power would be $7,684, or about $54.86/MWh. The average annual project cost would be $50,460, or about $360.43/MWh. Overall, the project would produce power at a cost that is $42,780, or $305.57/MWh, more than the cost of alternative power.

4.2.3 Staff Alternative

The staff alternative is based on Riverdale Power's proposal with staff modifications, deletions, and additional measures, as shown in Table 6. The staff alternative would have an installed capacity of 0.15 MW and an average annual generation of 140 MWh. The cost of alternative power would be $7,684, or about $54.86/MWh. The average annual project cost would be $30,880, or about $220.48/MWh. Overall, the project would produce power at a cost that is $23,196, or $165.62, more than the cost of alternative power.

4.3 COST OF ENVIRONMENTAL MEASURES

Table 6 gives the cost of each of the environmental enhancement measures considered in our analysis. We convert all costs to equal annual (levelized) values over a 30-year period of analysis to give a uniform basis for comparing the benefits of a measure to its cost.

Table 6. Cost of environmental mitigation and enhancement measures considered in assessing the effects of operating the Riverdale Mills 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.	Riverdale Power, Interior, Massachusetts DFW, Staff	$0	$0	$0

Enhancement/Mitigation Measures	Entity	Capital cost	Annual cost[a]	Levelized annual cost[b]
Aquatic Resources				
Release a continuous minimum flow of 10 cfs into the bypassed reach, some or all of which would include existing leakage through the stop logs at the dam.	Riverdale Power	$34,000	$20,910	$21,030[c]
Release a continuous minimum flow of 10 cfs, or inflow if less, from the impoundment to the bypassed reach through discharge over the spillway of the dam.	Interior, Massachusetts DFW, Staff	$0	$1,200 (22 MWh in lost generation)	$1,200
Develop and implement a post-license water quality monitoring plan to verify that the recommended flow in the bypassed reach maintains DO levels sufficient to support aquatic resources (*i.e.*, a DO concentration of at least 5 mg/L).	Interior, Massachusetts DFW, Staff	$2,000	$0	$250
Develop and implement an operation compliance monitoring plan for maintaining and monitoring run-of-river operation and the minimum flow release from the project.	Interior, Massachusetts DFW, Staff	$5,000	$0	$630

Enhancement/Mitigation Measures	Entity	Capital cost	Annual cost[a]	Levelized annual cost[b]
Implement an impoundment refill procedure following emergency and maintenance drawdowns, whereby 90 percent of inflow is passed downstream and 10 percent of inflow is used to refill the impoundment.	Interior, Massachusetts DFW, Staff	$0	$0	$0[d]
Terrestrial Resources				
Implement measures from the FWS's 2007 *National Bald Eagle Management Guidelines* to minimize project effects on nesting bald eagles at the project.	Riverdale Power	$5,000	$0	$630
Develop and implement a Bald Eagle Protection Plan.	Massachusetts DFW	$5,000	$0	$630
Develop and implement an Invasive Plant Species Management Plan.	Massachusetts DFW	$5,000	$0	$630
Develop and implement a Special Status Bat Management Plan.	Massachusetts DFW	$5,000	$0	$630

Enhancement/Mitigation Measures	Entity	Capital cost	Annual cost[a]	Levelized annual cost[b]
Recreation Resources				
Improve public access to the project for recreation by: (1) maintaining the existing non-project portage trail as a project recreation facility; (2) installing and maintaining a boat put-in and take-out at the upstream end of the existing portage trail to provide access to and egress from the impoundment, respectively; (3) installing and maintaining a boat put-in at the downstream end of the existing portage trail to provide access to the bypassed reach and the downstream reach of the Blackstone River.	Staff, Massachusetts DFW	$5,000	$0	$630
Install informational and safety signage along the existing portage trail to inform recreationists about access and safety concerns at the project.	Staff	$1,500	$190	$190
Cultural Resources				
Develop and implement an HPMP to protect historic properties that are eligible for or listed on the National Register.	Staff	$5,000	$0	$630

(Source: Staff)

[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] The cost of this measure includes the cost of: (1) lost generation associated with the minimum flow; and (2) installing and maintaining a staff gage in the bypassed reach to verify compliance with a 10-cfs minimum flow that includes leakage.

[d] Staff assumed that the recommended impoundment refill procedure would have minimal cost because it would be implemented on rare occasions for emergency and maintenance drawdowns.

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. We recommend this alternative because: (1) issuing a subsequent license for the project would allow Riverdale Power to continue operating its project as a dependable source of electrical energy; (2) the 0.15 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 staff-recommended measures would protect and enhance fish and wildlife resources, and cultural and historic resources.

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

5.1.1 Measures Proposed by Riverdale Power

Based on our environmental analysis of Riverdale Power'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 Riverdale Power 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, such that outflow approximates inflow at all times to protect aquatic resources.

5.1.2 Additional Measures Recommended by Staff

In addition to Riverdale Power's proposed measure noted above, we recommend including the following additional measures in any license that may be issued for the Riverdale Mills Project.

- Release a continuous minimum flow of 10 cfs, or inflow if less, to the bypassed reach through discharge over the spillway of the dam (without counting contributions from existing leakage at the dam as part of the 10 cfs, as proposed by Riverdale Power);

- Implement an impoundment refill procedure following emergency and maintenance drawdowns, whereby 90 percent of inflow is passed downstream and 10 percent of inflow is used to refill the impoundment;

- Develop and implement an operation compliance monitoring plan for maintaining and monitoring run-of-river operation and the 10-cfs minimum flow release to the bypassed reach;

- Develop and implement a post-license water quality monitoring plan to verify that the recommended minimum flow in the bypassed reach maintains DO levels of at least 5 mg/L at all times for the purpose of protecting aquatic resources;

- Improve public access to the project for recreation by: (1) maintaining the existing non-project portage trail as a project recreation facility; (2) installing and maintaining a boat put-in and take-out at the upstream end of the existing portage trail to provide access to and egress from the impoundment, respectively; (3) installing and maintaining a boat put-in at the downstream end of the existing portage trail to provide access to the bypassed reach and the downstream reach of the Blackstone River;

- Install informational and safety signage along the portage trail to inform recreationists about access and safety concerns at the project; and

- Develop an HPMP in consultation with the Massachusetts SHPO to protect historic properties that are eligible for or listed on the National Register.

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

Minimum Flow Release

The current license does not require Riverdale Power to release a minimum flow into the bypassed reach. Riverdale Power estimates that leakage through the stop logs at the dam is 10 cfs and flow under the dam (through the foundation) is 7 cfs. Riverdale Power proposes to maintain a minimum flow of 10 cfs in the bypassed reach, but specifies that leakage through the stop logs at the dam should be included in the calculation of this flow. Interior and Massachusetts DFW both recommend, under section 10(j), a continuous minimum flow release of 10 cfs, or inflow if less, but specify that the flow should be provided through discharge over the spillway and that any leakage at the dam should not count toward the 10-cfs minimum flow release.

As discussed in section 3.3.1.1, *Aquatic Resources, Environmental Effects*, 10 cfs provides an adequate amount of suitable habitat for aquatic resources in the bypassed reach. However, based on a flow study conducted in 2009, Riverdale Power's 10-cfs leakage estimate appears to be significantly more than the actual amount of leakage to the bypassed reach. Therefore, leakage from the dam cannot be relied on to provide a significant contribution to a continuous minimum flow of 10 cfs in the bypassed reach.

Implementing Interior's and Massachusetts DWF's recommendation to release the 10 cfs over the spillway would ensure that a reliable flow is provided to the bypassed reach to support aquatic habitat for fish and other aquatic organisms. In addition, 10 cfs of flow that is spilled over the dam is more likely to absorb oxygen and increase DO concentrations than water that leaks through the stop logs or dam foundation. This is due to the increased contact spilled water has with air, compared to leakage through the dam foundation and leakage that seeps through cracks in the stoplogs. Staff concludes that the providing a reliable flow to the bypassed reach by releasing 10 cfs over the spillway would be worth the estimated levelized annual cost of $1,200. Riverdale Power's proposal to include leakage through the stoplogs as part of the proposed 10-cfs minimum flow would have a higher estimated levelized annual cost of $21,030 because a new automated flow gage would need to be installed, operated, and maintained in the bypassed reach to ensure that the combined leakage and spill flow equals at least 10 cfs. Therefore, because providing the 10-cfs minimum flow via spillage over the dam would provide greater benefits at a smaller cost than the release method proposed by Riverdale

Power, we recommend that any new license issued for the Riverdale Mills Project require a continuous minimum flow of 10 cfs, or inflow if less, to be released to the bypassed reach through discharge over the spillway.

Impoundment Refill Procedure

Periodically, the project impoundment is drawn down for maintenance or for emergencies. During these times, run-of-river operation would be temporarily interrupted. Riverdale Power does not describe any current protocol that it uses for refilling the impoundment following drawdowns for maintenance or emergency purposes. Massachusetts DFW recommends, under section 10(j), that the impoundment be refilled under such scenarios by releasing 90 percent of the inflow to the downstream reach and retaining 10 percent of the inflow for the purpose of refilling the impoundment.

Releasing 90 percent of the project impoundment's inflow during impoundment refilling would ensure that downstream flows are kept at or near project inflow levels and that the impoundment is refilled in a timely manner. Minimizing the length of time that the impoundment is drawn down and that flows are reduced downstream would help maintain the existing aquatic habitat for fish and other aquatic species. Implementing this procedure would have no cost and we recommend that it be included in any license issued for the Riverdale Mill Project.

Operation Compliance Monitoring

Riverdale Power indicates that the project uses electric water level sensors to maintain pond levels and adjust flow through the turbines to maintain compliance with run-of-river operation, but does not describe the details of its operational compliance methods. Riverdale Power also does not describe how it would monitor and maintain compliance with the minimum flow released to the bypassed reach. Interior and Massachusetts DFW both recommend, under section 10(j), a plan to monitor and maintain flow releases from the project.

An operation compliance monitoring plan would help Riverdale Power document its compliance with the operational provisions of any subsequent license, and provide a mechanism for reporting deviations. An operation compliance monitoring plan would also help the Commission verify that the project is operating in a run-of-river mode and releasing the required minimum flow into the bypassed reach, thereby facilitating administration of the license and assisting with the protection of resources that are sensitive to impoundment fluctuations and deviations from normal operating conditions.

The plan could be developed in consultation with Interior and Massachusetts DFW and include a description of the mechanisms and structures that would be used, a protocol for maintaining and calibrating equipment, and provisions for: (1) monitoring run-of-

river operation, minimum flows, and impoundment elevation levels to document compliance with the operational conditions of any subsequent license; (2) standard operating procedures to be implemented (a) outside of normal operating conditions, including during scheduled facility shutdowns, impoundment drawdowns, and impoundment refilling and (b) during emergency conditions such as unscheduled facility shutdowns and maintenance, in order to minimize project effects on environmental resources; (3) reporting deviations to the Commission; and (4) maintaining a log of project operations for inspection.

We recommend that Riverdale Power develop an operation compliance monitoring plan and conclude that the benefits of the plan would outweigh the estimated levelized annual cost of $630.

Water Quality Monitoring

DO is an important indicator of water quality and is required at an adequate concentration to sustain aquatic resources. While data from Massachusetts DEP and the U.S. Geological Survey indicate that DO concentrations upstream and downstream of the project are greater than 5 mg/L, consistent with current state standards, no water quality data has been collected in the bypassed reach or the confluence of the bypassed reach and tailrace.

Interior and Massachusetts DFW both recommend, under section 10(j), that a post-licensing water quality monitoring plan be developed to determine whether a minimum flow release of 10 cfs maintains DO levels sufficient to support the resident riverine fish community, which we interpret to mean a DO concentration of at least 5 mg/L at all times consistent with the state standard. As discussed above in section 1.3.2, *Clean Water Act*, Massachusetts DEP has denied section 401 water quality certification for the project until a water quality survey is completed in the project impoundment, bypassed reach, and below the confluence of the tailrace and the bypassed reach.

As discussed in section 3.3.1.1, *Aquatic Resources, Environmental Effects*, DO concentrations can change substantially over time and distance based on many factors, including ambient temperature, atmospheric pressure, the content of dissolved solids in the water, and site-specific chemical, physical, and biological reactions. The bypassed reach, particularly, receives low flows during the summer months because there is no minimum flow requirement and typically most or all of the inflow to the impoundment is used for generation. Under existing leakage-only conditions, we estimate that the retention time of water in the bypassed reach is 60 hours. The combination of low flows, warmer temperatures, and a relatively long retention time spanning many days could result in low DO concentrations that could be harmful to fish and other aquatic resources. However, as noted above, we estimate that providing a minimum flow of at least 10 cfs via spilling water over the spillway would reduce the bypassed reach flow retention time

to about 6 hours, which we expect will result in DO concentrations of at least 5 mg/L at all times.

Developing and implementing a post-licensing water quality monitoring plan in consultation with resource agencies would provide the data necessary to evaluate project-specific DO and temperature conditions, and verify the effectiveness of the recommended 10-cfs minimum flow in providing a bypassed reach DO concentration of at least 5 mg/L. Conducting the monitoring on a daily basis during August, at a single pool location for a period of two weeks, would capture the worst-case conditions for temperature and flow. If the monitoring reveals that a 10-cfs spill release does not provide at least 5 mg/L in the bypassed reach, then additional measures could be considered to enhance DO as needed. Staff concludes that the estimated levelized annual cost of $250 for the water quality monitoring plan is warranted in order to ensure the protection of water quality and aquatic resources at the project.

Recreational Access and Signage

Riverdale Power is not proposing any recreation-related measures. Massachusetts DFW recommends that Riverdale Power allow public access to project land for fishing and boating, and investigate the need for a canoe take out above the dam as well as a portage route and a canoe put in below the dam.

Riverdale Power is not currently providing general public access for recreation. Riverdale Power references public safety concerns, but does not discuss any specific safety concerns in the license application or why any such concerns cannot be mitigated with appropriate measures.

Recreational use of the project is extremely low, which is most likely influenced by the lack of public access to the Blackstone River at the project. Allowing public access to the Blackstone River for recreation, such as for fishing in the impoundment and canoe portage around the dam, would ensure that recreation opportunities are provided at the project and the recreation along the Blackstone River is not adversely affected by the project. Operating and maintaining the existing non-project portage route as a project recreation facility could improve recreation access to the Blackstone River by formally connecting the upstream and downstream reaches of the Blackstone River at the project. Including a formal put-in and take-out at the upstream end of the portage trail near the bridge along Quaker Street would improve access by providing a formal egress for downstream boaters, as well as by providing an access site for hand-carry boaters who wish to boat in the impoundment. A formal put-in at the downstream end of the portage trail would make entering the river there easier for boaters that desire to access the bypassed reach and the Blackstone River downstream of the project. Staff concludes that the benefits of this measure for recreation outweigh the estimated levelized annual cost of $630.

Providing safety and informational signage at the project would improve recreational use and ensure public safety by providing information about recreational access, clarify which areas of the project are closed to the public because they are closely related to industrial operations at the mill, and describe any safety hazards. Placing the signs near the footbridge, where the portage trail meets Quaker Street, would ensure that the public is informed about recreation opportunities and safety concerns at the project. In addition, directional signs placed at the ends of the portage trail (*i.e.*, at the staff-recommended boat put-in and take-out areas), would inform boaters on where to enter and exit the Blackstone River. Staff concludes that the benefits of the safety and informational signage to public recreation and safety would outweigh the estimated levelized annual cost of $190.[33]

Cultural Resources

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 Blackstone Canal Historic District 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 general landscaping and yard maintenance within the APE. We recommend that Riverdale Power develop and implement an HPMP in consultation with the Massachusetts SHPO to protect the historic properties in the APE that are eligible for or listed on the National Register. We estimate that the annual levelized cost of developing an HPMP would be $630, and conclude that the benefits of an HPMP outweigh the cost.

5.1.3 Measures Not Recommended

Some of the measures proposed by Riverdale Power and recommended by other interested parties would not contribute to the best comprehensive use of Blackstone River water resources, do not exhibit sufficient nexus to the project environmental effects, or would not result in benefits to non-power resources that would be worth their cost. The following discussion includes the basis for staff's conclusion not to recommend such measures.

[33] To the extent that a subsequent license includes measures for providing improved public access and safety signage at the project, a revised public safety plan would likely need to be filed with the Commission.

Bald Eagles

The federally protected and state threatened bald eagle has been observed foraging in the project vicinity and one bald eagle nest has been documented adjacent to the project boundary, west of the impoundment.

Riverdale Power proposes to implement measures from the FWS's 2007 *National Bald Eagle Management Guidelines* to minimize project effects on nesting bald eagles at the project. Massachusetts DFW recommends, under section 10(j), that Riverdale Power develop a Bald Eagle Protection Plan that includes provisions to: (1) avoid killing, injuring or harassing bald eagles during tree cutting or thinning operations at the project; and (2) avoid or mitigate for effects on nesting bald eagles at the project.

Bald eagles are known to occur in the project vicinity under existing conditions. However, Riverdale Power has not proposed any changes to project operation or project facilities that would affect bald eagles. Neither the proposed project nor the additional staff recommended measure to improve put-in and take-out areas associated with an existing portage route would result in significant ground disturbance, or any tree cutting or tree thinning activities. Therefore, we have determined that construction, operation, and maintenance of the project would have no effect on bald eagles or their habitat. For this reason, there would not be a benefit associated with implementing FWS's 2007 *National Bald Eagle Management Guidelines* or with developing a Bald Eagle Protection Plan, and staff does not recommend either measure.

Invasive Plants

Massachusetts DFW recommends, under section 10(j) that Riverdale Power develop and implement an Invasive Plant Species Management Plan to: (1) educate recreation users on ways to reduce the spread of invasive species; (2) implement best management practices; 3) record incidental observations of invasive species; (4) use only native seed and plant materials outside of lawn areas; (5) conduct comprehensive invasive plant species surveys every five years that would be used to develop site-specific control/management actions to reduce and eliminate invasive species; and (6) plant and seed areas after implementing invasive species control techniques.

No new ground disturbing activities have been proposed that could facilitate the spread of invasive plant species. Further, vegetation maintenance at the project is limited because there is no transmission line at the project. Because there is no evidence that invasive species are currently affecting project operation or other environmental resources, we do not recommend the development and implementation of an Invasive Plant Species Monitoring and Management Plan. We estimate that the annual levelized cost of developing and implementing the plan would be $630, and conclude that the benefits do not outweigh the cost.

Special Status Bats

Massachusetts DFW recommends, under section 10(j), that Riverdale Power develop and implement a Special Status Bat Management Plan to identify and implement measures to avoid and minimize adverse effects to special status bats that may result from future project-related construction or land-clearing activities.

The only known special status bat species that could occur at the project is the NLEB. However, the proposed project does not include any construction activities or tree clearing activities that would affect NLEB or its habitat during the term of a license. Because the project would have no effect on the NLEB, we do not recommend the development and implementation of a Special Status Bat Management Plan.

Notification of Future Amendments to Project

Interior recommends that Riverdale Power be required to notify Interior if it files with the Commission an amendment or appeal of any fish and wildlife-related license conditions or if it files an extension of time request for project construction or implementation of license articles.

For significant amendments related to fish and wildlife resources, the Commission's regulations require a licensee to consult with Interior while preparing the amendment application. For other amendments, appeals, and requests for extensions of time, Interior can receive notification of any filings and issuances through the Commission's eSubscription service. Because existing Commission regulations and services allow Interior to be informed of amendments, appeals, and requests for extensions of time, we do not recommend that this measure be included in any license that is issued for the project.

5.1.4 Conclusion

Based on our review of the agency and public comments filed for 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 Riverdale Mills Project, as proposed by Riverdale Power with the additional staff-recommended measures, would be best adapted to a plan for improving the Blackstone River Basin.

5.2 UNAVOIDABLE ADVERSE IMPACTS

Although fish kills have not been documented at the project and fish entrainment has not been studied or raised as an issue at the project, some fish likely pass through and would continue to pass through the project's turbine and could be injured or killed.

5.3 FISH AND WILDLIFE AGENCY RECOMMENDATIONS

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

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

In response to our May 8, 2019, notice accepting the application to relicense the project and soliciting motions to intervene, protests, comments, recommendations, preliminary terms and conditions, and preliminary fishway prescriptions, Interior filed four section 10(j) recommendations on June 28, 2019, and Massachusetts DFW filed 8 section 10(j) recommendations on June 27, 2019. Table 7 lists the recommendations filed pursuant to section 10(j), and indicates whether the recommendations are included under the staff alternative, as well as the basis for our preliminary determinations concerning measures that we consider inconsistent with section 10(j). Environmental recommendations that we consider outside the scope of section 10(j) have been considered under section 10(a) of the FPA and are addressed in the specific resource sections of this document.

Table 7. Analysis of fish and wildlife agency recommendations for the Riverdale Mills Project.

Recommendation	Agency	Within scope of section 10(j)?	Levelized Annual Cost	Recommend Adopting?
Operate the project in a run-of-river mode.	Interior and Massachusetts DFW	Yes.	$0	Yes.
Release a continuous minimum flow of 10 cfs, or inflow if less, from the spillway into the bypassed reach.	Interior and Massachusetts DFW	Yes.	$1,200	Yes.

Recommendation	Agency	Within scope of section 10(j)?	Levelized Annual Cost	Recommend Adopting?
Develop and implement a post-license water quality monitoring plan to verify that the recommended minimum flow in the bypassed reach maintains DO levels sufficient to support the resident riverine fish community.	Interior and Massachusetts DFW	Yes.	$250	Yes.
Develop and implement a plan for maintaining and monitoring flow releases from the project.	Interior and Massachusetts DFW	Yes.	$630	Yes.
Implement an impoundment refill procedure for emergency and maintenance drawdowns whereby 90 percent of inflow is passed downstream and 10 percent of inflow is used to refill the impoundment.	Massachusetts DFW	Yes.	$0	Yes.
Develop and implement a Bald Eagle Protection Plan.	Massachusetts DFW	No, there is no nexus between a project effect on fish and wildlife and the recommended measure.	$630	No.
Develop and implement an Invasive Plant Species Management Plan.	Massachusetts DFW	No, there is no nexus between a project effect on fish and	$630	No.

Recommendation	Agency	Within scope of section 10(j)?	Levelized Annual Cost	Recommend Adopting?
		wildlife and the recommended measure.		
Develop and implement a Special Status Bat Management Plan.	Massachusetts DFW	No, this is not a specific fish and wildlife measure. The provisions of this measure are generic and uncertain. In addition, there is no nexus between a project effect on fish and wildlife and the recommended measure.	$630	No.

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 7 comprehensive plans that are applicable to the Riverdale Mills Project. No inconsistencies were found.

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Massachusetts Department of Fish and Game. 2006. Comprehensive wildlife conservation strategy. West Boylston, Massachusetts. September 2006.

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6.0 FINDING OF NO SIGNIFICANT IMPACT

If the Riverdale Mills Project is issued a subsequent license as proposed with the additional staff-recommended measures, the project would continue to operate as it does today, while providing enhancements to aquatic resources, and protection of cultural and historic resources in the project area.

Based on our independent analysis, we find that the issuance of a license for the Riverdale Mills 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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8.0 LIST OF PREPARERS

Amy Chang – Terrestrial Resources, Wetlands, ESA (Wildlife Biologist, B.S., Biology, M.S., Environmental Science and Policy).

Amanda Gill – Cultural Resources (Archaeologist; B.S., Archaeological Sciences; M.A., Applied Archaeology).

Robert Haltner – Terrestrial Resources, Wetlands, ESA (Wildlife Biologist; B.S., Biological Sciences).

Stephen Kartalia – Aquatic Resources (Fisheries Biologist; B.S., Biology; M.S., Fisheries Biology).

Nicholas Palso – Recreation, Land Use, Aesthetics, and Cultural Resources; (Environmental Protection Specialist; B.S., Wildlife Biology; M.P.A, Masters of Public Administration; Ph.D., Recreation, Park, and Tourism Management).

Michael Watts – Project Coordinator, Need for Power, Engineering, and Developmental Analysis (Civil Engineer; B.S., Civil Engineering).