ENVIRONMENTAL ASSESSMENT
FOR
HYDROPOWER LICENSE

Chittenden Falls Hydroelectric Project
FERC Project No. 3273-024
New York

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

January 2021

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ACRONYMS AND ABBREVIATIONS

APE	area of potential effects
ASMFC	Atlantic States Marine Fisheries Commission
BMP	best management practices
certification	water quality certification
CEQ	Council on Environmental Quality
C.F.R.	Code of Federal Regulations
cfs	cubic feet per second
Commission	Federal Energy Regulatory Commission
CZMA	Coastal Zone Management Act
dbh	diameter at breast height
DO	dissolved oxygen
EA	environmental assessment
ESA	Endangered Species Act
ºF	degrees 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	Information for Planning and Conservation system
kW	kilowatt
mg/L	milligrams per liter
MW	megawatt
MWh	megawatt-hour
National Register	National Register of Historic Places
NEPA	National Environmental Policy Act
NERC	North American Electric Reliability Corporation
New York DEC	New York State Department of Environmental Conservation
New York SHPO	New York State Historic Preservation Officer
NHPA	National Historic Preservation Act
NPCC	Northeast Power Coordinating Council
POR	period of record
REA	Ready for Environmental Analysis
SD1	Initial Scoping Document
SPDES	State Pollution Discharge Elimination System
USGS	U.S. Geological Survey
U.S.C.	United States Code

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1.0 INTRODUCTION

1.1 APPLICATION

On May 31, 2019, Chittenden Falls Hydropower, Inc. (Chittenden Falls Hydro) filed an application for a subsequent license with the Federal Energy Regulatory Commission (Commission or FERC) to continue operating the 755-kilowatt (kW)[1] Chittenden Falls Hydroelectric Project No. 3273 (Chittenden Falls Project or project).[2] The project is located on Kinderhook Creek near the Town of Stockport, Columbia County, New York (figure 1). The project does not occupy federal land. The estimated average annual generation of the project is 2,300 megawatt-hours (MWh). Chittenden Falls Hydro proposes no changes to the project's capacity.

[1] Per section 11.1(i) of the Commission's regulations, the authorized capacity is the lesser of the ratings (in kW) of the generator or turbine units. Therefore, based on the project description in Exhibit A of the license application, and using a conversion factor of 1 horsepower (hp) = 0.75 kW, the total authorized capacity of the project is 755 kW (i.e., Unit 1 rating is 330 kW (turbine rating - 440 hp and generator rating - 400 kW); Unit 2 rating is 125 kW (turbine rating - 178 hp and generator rating - 125 kW); and Unit 3 rating is 300 kW (Unit 3 rating is based on the Commission's January 11, 1995 Amendment Order). *See Chittenden Falls Hydropower, Inc.*, 70 FERC ¶ 62,016 (1995) (reducing the installed capacity of generating unit 3 from 500 kW to 300 kW).

[2] An original license for the project was issued on June 29, 1981, for a term of 40 years, with an effective date of June 1, 1981, and an expiration date of May 31, 2021. *See Chittenden Falls Hydro Power, Inc.*, 15 FERC ¶ 62,395 (1981).

Figure 1: Chittenden Falls Project Location (source: Chittenden Falls Hydro).

1.2 PURPOSE OF ACTION AND NEED FOR POWER

1.2.1 Purpose of Action

The purpose of the Chittenden Falls Project is to provide a source of hydroelectric power. Therefore, under the provisions of the Federal Power Act (FPA), the Commission must decide whether to issue a subsequent license for the project and what conditions should be placed on any license issued. In deciding whether to issue a license for a hydroelectric project, the Commission must determine that the project 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 issued (such as flood control, irrigation, or water supply), the Commission must give equal consideration to the purposes of: (1) energy conservation; (2) the protection, mitigation of damage to, and enhancement of fish and wildlife resources; (3) the protection of recreational opportunities; and (4) the preservation of other aspects of environmental quality.

Issuing a subsequent license for the Chittenden Falls Project would allow Chittenden Falls Hydro to continue to generate electricity at the project for the term of the subsequent license, making electric power from a renewable resource available to its customers.

This environmental assessment (EA) has been prepared in compliance with the National Environmental Policy Act (NEPA)[3] of 1969 to assess the environmental and economic effects associated with operation of the project, alternatives to the project, and makes recommendations to the Commission on whether to issue a subsequent license, and if so, recommends terms and conditions to become a part of any license issued for the project.

In this EA, we assess the environmental and economic effects of: (a) continued project operation as proposed in the application and as specified in the Chittenden Falls Hydroelectric Project Offer of Settlement[4] (Settlement Agreement) (proposed action); (b) the proposed action with additional or modified measures recommended by staff (staff alternative); and (c) the staff alternative including the requirements of the U.S. Department of the Interior's (Interior) preliminary section 18 prescription (staff alternative with mandatory conditions). We also consider the effects of the no-action alternative. The primary issues associated with relicensing the project are the effects of continuing operation on water quality, aquatic habitat, eel passage, threatened and endangered species, and vegetation.

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[3] On July 16, 2020, the Council on Environmental Quality (CEQ) issued a final rule, *Update to the Regulations Implementing the Procedural Provisions of the National Environmental Policy Act* (Final Rule, 85 Fed. Reg. 43,304), which was effective as of September 14, 2020; however, the NEPA review of this project was in process at that time and therefore this EA was prepared pursuant to CEQ's 1978 NEPA regulations.

[4] On April 10, 2020, Chittenden Falls Hydro filed the Chittenden Falls Hydroelectric Project Offer of Settlement (Settlement Agreement), on behalf of itself, the New York State Department of Environmental Conservation, and the U.S. Fish and Wildlife Service.

1.2.2 Need for Power

The Chittenden Falls Project serves the State of New York's power system and contributes in meeting the state's power requirements, resource diversity, and capacity needs. The project has an installed capacity of 755 kW and generates an average of approximately 2,300 MWh per year.

The North American Electric Reliability Corporation (NERC) annually forecasts electrical supply and demand nationally and regionally for a 10-year period. The Chittenden Falls Project is located in the Northeast Power Coordinating Council (NPCC)-New York region of NERC. According to NERC's 2019 long-term reliability assessment report, annual total internal peak demand is expected to range between 31,068 megawatts (MW) and 32,202 MW during the 10-year forecast period from 2020 through 2029. Although anticipated reserve capacity margins (generating capacity in excess of demand) in the region is projected to range from 22.66 percent to 27.18 percent of peak demand during this same period and, thereby, would be above the target capacity margin levels of 15 percent, the project would continue to meet part of existing load requirements as well as maintain stability of the power system.

1.3 STATUTORY AND REGULATORY REQUIREMENTS

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

1.4 PUBLIC REVIEW AND COMMENT

The Commission's regulations (18 C.F.R § 16.8) require an applicant to consult with appropriate resource agencies, tribes, and other entities before filing an application for a license. This consultation is the first step in complying with the Fish and Wildlife Coordination Act, Endangered Species Act (ESA), National Historic Preservation Act (NHPA), and other federal statutes. Pre-filing consultation must be completed and documented according to the Commission's regulations.

1.4.1 Scoping

Before preparing this EA, we conducted scoping to determine what issues and alternatives should be addressed. We issued an initial scoping document (SD1) on December 23, 2019. It was noticed in the *Federal Register* on December 31, 2019. No entities filed comments on SD1; therefore, staff did not prepare a second scoping document.

1.4.2 Interventions

On December 23, 2019, the Commission issued a notice accepting Chittenden Falls Hydro's application for a subsequent minor license for the Chittenden Falls Project. The notice set February 21, 2020, as the deadline for filing interventions, protests, and requests for cooperating agency status. The following entities filed notice of intervention (neither in opposition to the project).

Entity	Date Filed
Interior	February 20, 2020
New York State Department of Environmental Conservation (New York DEC)	February 21, 2020

1.4.3 Comments on the License Application and Settlement Agreement

On February 21, 2020, the Commission issued a Ready for Environmental Analysis (REA) notice requesting comments, recommendations, terms and conditions, and prescriptions. On April 10, 2020, Chittenden Falls Hydro, on behalf of itself, New York DEC, and the U.S. Fish and Wildlife Service (FWS), filed a Settlement Agreement with the Commission. The Settlement Agreement purports to resolve, among the settling parties, various issues associated with issuance of a subsequent license for the project, including project operation, fisheries, and water quality.

In order to allow entities sufficient time to review and comment on the REA Notice and Settlement Agreement, the Commission modified the procedural schedule in an April 13, 2020 Notice of Settlement Agreement, Soliciting Comments, and Modification of Procedural Schedule, and set May 4, 2020, as the deadline for comments, recommendations, terms and conditions, and prescriptions. On April 20, 2020, and May 4, 2020, Interior and New York DEC responded, respectively, in support of the Settlement Agreement. On May 11, 2020, the New York State Council of Trout Unlimited filed comments supporting the Settlement Agreement.

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 NO-ACTION ALTERNATIVE

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

2.1.1 Existing Project Facilities and Project Boundary

The project is located on Kinderhook Creek near the Town of Stockport, Columbia County, New York. Approximately 1.2 miles downstream of the project, Kinderhook Creek joins Claverack Creek to form Stockport Creek, which flows about 2 miles before joining the Hudson River.

The Chittenden Falls Project includes an approximately 4-foot-high, 350-foot-long concrete gravity dam built immediately upstream of a natural cascade known as Chittenden or Rossman Falls. The spillway of the dam is 320 feet long with a crest elevation of 59.6 feet[5] and is topped with 2-foot-high wooden flashboards.

The project impoundment created by the dam is about 3,600 feet long with a surface area of about 18 acres and a storage capacity of 63 acre-feet at a normal pool elevation of 61.6 feet.

The project includes two powerhouses located at opposite banks of the river. The powerhouse on eastern bank or east powerhouse is approximately 50 feet long and 30 feet wide and contains two vertical Francis turbines with a rated capacity of 440 horsepower (i.e., 330 kW) for Unit 1 and 178 horsepower (133 kW) for Unit 2. The rated capacities of the Unit 1 and Unit 2 generators are 400 kW and 125 kW, respectively. Water from the impoundment is conveyed to the east powerhouse via an 8-foot-wide, 22-foot-long concrete intake structure fitted with an 8-foot-wide by 8-foot-high steel headgate on the east side of the dam. From the intake, water passes through an 8-foot-wide, 118-foot-long concrete and wooden power canal connecting to a 7.5-foot-diameter, 45-foot-long steel penstock to the powerhouse. A 9.7-foot-wide, 18.6-foot-long trash rack with 2-inch clear bar spacing is located at the entrance to the penstock. Immediately upstream of the trash rack and located on the west wall of the power canal is a 5.3-foot-wide, 4-foot-deep concrete overflow weir that discharges into the bypassed reach and is used for passing debris. Flow from the east powerhouse is returned to the main river channel through a tailrace approximately 25 feet wide and 120 feet long to a point approximately 320 feet downstream of the dam, resulting in a 320-foot-long bypassed reach that ranges in width from 137 feet to 295 feet.

[5] All elevations herein are referenced to the National Geodetic Vertical Datum of 1929.

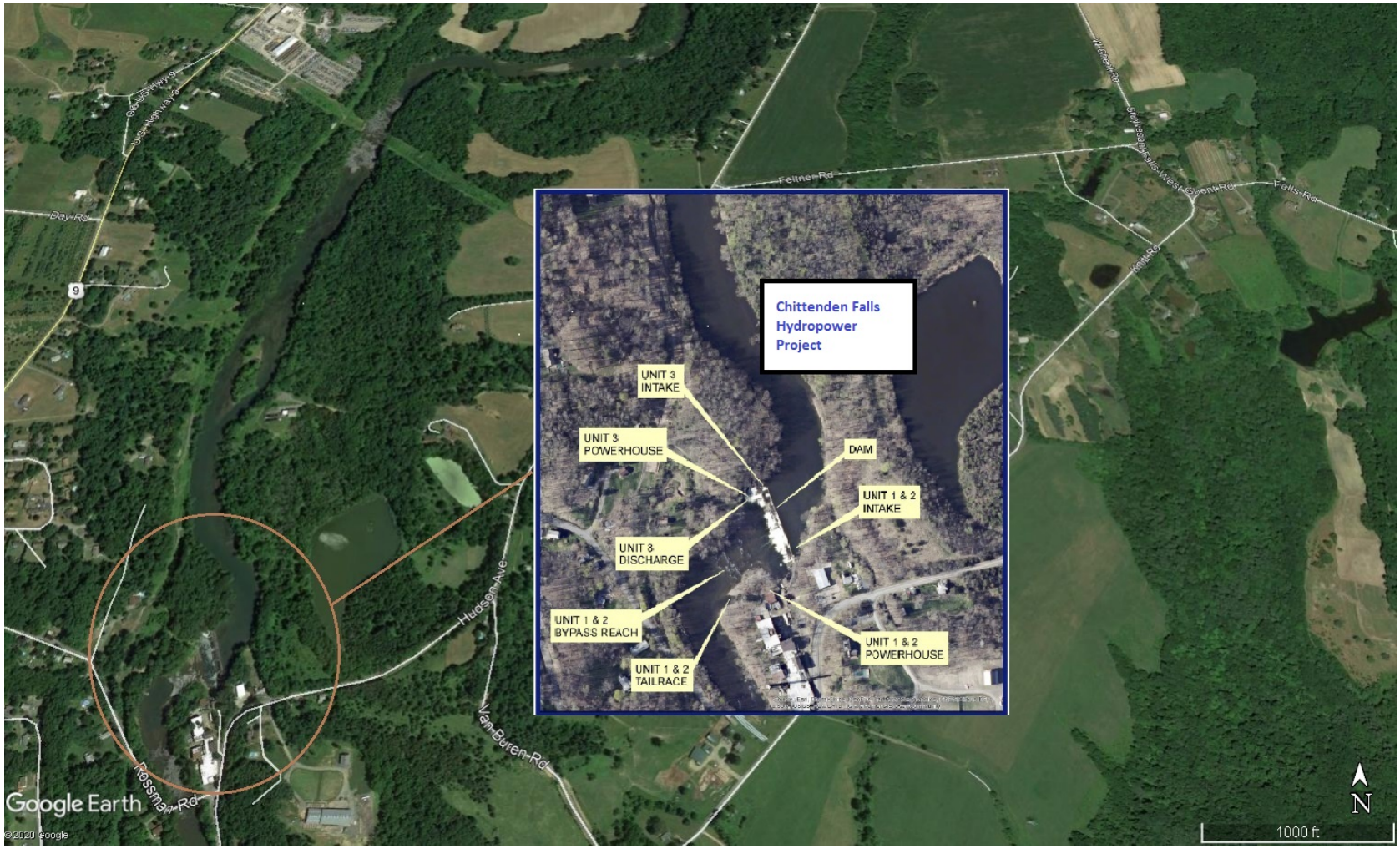

Figure 2: Chittenden Falls Project Location and Facilities (source: Google Earth and Chittenden Falls Hydro, as modified by staff).

The west powerhouse is about 12 feet long by 8 feet wide and includes a vertical adjustable propeller turbine with a rated capacity of 300 kW for the turbine-generator unit (Unit 3). Water is conveyed to the west powerhouse via an 8-foot-wide, 10-foot-long intake structure with an 8-foot-wide by 8-foot-high steel headgate on the west side of the dam. From the intake structure, water passes through an 8-foot-wide, 12-foot-long trash rack with 2-inch clear bar spacing and then through a 6-foot-diameter, 62-foot-long steel penstock to the powerhouse. A 3-foot-wide concrete overflow weir is located next to the trash rack for debris management. Flow from the west powerhouse discharges at the toe of the waterfall.

Power from the east powerhouse is transmitted through two 480-volt, 40-foot-long generator leads to a transformer yard where it is first stepped up to 2,300 volts and then through separate transformers to 13.2 kilovolts (kV). Power from the west powerhouse is transmitted via a 2,300-volt generator lead to the transformer yard where it is stepped up to 13.2 kV. A 50-foot-long, 13.2-kV transmission line connects the transformer yard to a utility pole where the project interconnects with the grid.

The existing project boundary of the Chittenden Falls Project encloses the dam, reservoir, power canal, both powerhouses, tailrace, and access roads. The project boundary encloses a total of approximately 26 acres. Chittenden Falls Hydro holds title or rights to all lands within the project boundary. There are no project recreation facilities within the project boundary or required pursuant to the current license.

2.1.2 Project Safety

The Chittenden Falls Project has been operating for more than 39 years under the existing 1981 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 relicensing process, the Commission staff will evaluate the continued adequacy of the proposed project 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 subsequent license term 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.

2.1.3 Existing Project Operation and Environmental Measures

The Chittenden Falls Project is operated in a run-of-river mode, with outflow from the project approximating inflow on an instantaneous basis. The project impoundment is maintained at a normal pool elevation of 61.6 feet (i.e., top of the flashboards). The pool

elevation is measured by a pressure transducer and monitored via a programmable logic controller that regulates turbine flows based on the pond elevation to ensure that the project operates in run-of-river mode. The project is fully automated but monitored daily by an on-site operator and does not have remote operation capabilities. However, it can be monitored remotely through an online interface and security cameras for surveillance purposes.

The minimum and maximum hydraulic capacities of the east powerhouse are 20 cubic feet per second (cfs) and 200 cfs, respectively (the operating range of Unit 1 is 56 cfs to 145 cfs, and the operating range of Unit 2 is 20 cfs to 55 cfs), whereas Unit 3 in the west powerhouse has a fixed hydraulic capacity of 170 cfs. The project is operated with the east powerhouse (Units 1 and 2) having the priority over the west powerhouse (Unit 3). In other words, Unit 3 is operated when river flows are above the maximum hydraulic capacity of the east powerhouse and there is excess flow to satisfy the hydraulic capacity of Unit 3.

The project releases a minimum flow of 15 cfs into the bypassed reach through two notches in the flashboards or spill over the flashboards, as required by Article 23 of the current license.[6] Flows in excess of the minimum flow are diverted through the turbines based on specific river flows and the operating range of each unit. River flows in excess of the maximum hydraulic capacity of the east powerhouse, but less than the hydraulic capacity of Unit 3 (i.e., flows between 216 cfs and 369 cfs), spill over the dam. When Unit 3 is operating, the bypassed reach minimum flow is satisfied by Unit 3 discharges.[7]

At high flows, the flashboards are designed to fail or trip when the pool elevation reaches 63.6 feet (or 2 feet above the flashboards). With flashboards down, and water levels rising above 63.6 feet, the project is shut down and the operator closes the headgate of each intake structure to prevent damage to the intake and project equipment. The project is not operated for purposes of flood control.

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[6] *See Chittenden Falls Hydropower, Inc.*, 49 FERC ¶ 62,216, at Art. 23 (1989). Each notch consists of a 1-foot-high by 2.5-foot-wide opening in the top of the flashboards at each end of the project dam, with each notch discharging approximately 7.5 cfs of flow downstream into the bypassed reach.

[7] *See id.*

2.2 APPLICANT'S PROPOSAL

2.2.1 Proposed Project Facilities

As described in the Settlement Agreement, Chittenden Falls Hydro proposes to install new fish passage and protection infrastructure, including an eel ladder,[8] and a downstream eel passage system at each powerhouse consisting of seasonal trash racks with a 0.75-inch clear spacing and a submerged orifice-style bypass pipe to provide a non-turbine route of passage for downstream migrating eels that are excluded by the 0.75-inch trash racks.

2.2.2 Proposed Project Operation and Environmental Measures

As described in the Settlement Agreement, Chittenden Falls Hydro proposes the following operation and environmental measures:

Aquatic Resources

- Operate the project in a run-of-river mode and maintain the impoundment elevation at or above the dam crest or top of the flashboards (when in place) (section 3.1 of the Settlement Agreement);

- Provide a continuous minimum flow of 25 cfs, or inflow if less, to the bypassed reach, to protect and enhance this habitat and ensure the bypassed reach remains adequately watered (section 3.2 of the Settlement Agreement);

- Develop a stream flow and water level monitoring plan to ensure compliance with run-of-river operation and provide verification of impoundment water levels and minimum flows into the bypassed reach (section 3.5 of the Settlement Agreement);

- Develop a water quality survey plan to conduct additional water quality monitoring in the bypassed reach, including the deployment of an additional (second) data logger to provide a replicate set of data to verify any potentially anomalous dissolved oxygen (DO) readings as were observed during the 2019 water quality study when a single logger was deployed; the additional water quality monitoring would occur during the first available study season (June 1 through October 15) following approval of the plan by New York DEC and FWS (section 3.6 of the Settlement Agreement);

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[8] The location and operation season of the eel ladder would be determined in consultation with New York DEC and FWS during the design phase.

- Install and operate an eel ladder at the project to provide upstream passage for American eel (section 3.3.1.2.1 of the Settlement Agreement);

- Install and operate a downstream eel passage system[9] from September 1 through November 15 of each year to improve the downstream passage of American eel (section 3.3 of the Settlement Agreement);

- Develop a trash rack installation and monitoring plan (section 3.3.1.1 of the Settlement Agreement);

- Develop and submit an eelway operation and maintenance plan that includes a description of the project and its fisheries, an implementation schedule for the eelways,[10] and operation and maintenance procedures (section 3.3.1.3 of the Settlement Agreement); and

- Undertake post-licensing field measurements or engineering calculations to ensure the constructed eelways meet the FWS fish passage engineering design criteria[11] for approach velocities, attraction and conveyance flows, and plunge pool depths, to confirm that hydraulic conditions are appropriate for successful eel passage; and make reasonable modifications to the design,

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[9] The Settlement Agreement contains separate measures for installing seasonal trash racks with a 0.75-inch clear spacing (section 3.3.1.1 of the Settlement Agreement) and a downstream eel passage (bypass) structure (section 3.3.1.2.2 of the Settlement Agreement). Because the intent of these measures is the same—to protect adults eels during their seasonal downstream migration towards the ocean—we consider and analyze these measures herein as a single measure to install and operate a 'downstream eel passage system.'

[10] Throughout this document, the proposed upstream eel ladder and downstream eel passage systems are collectively referred to as "eelways" because these structures would be specifically designed to pass American eel.

[11] https://www.fws.gov/northeast/fisheries/pdf/USFWS-R5-2019-Fish-Passage-Engineering-Design-Criteria-190622.pdf

location, and/or flows associated with the eelways if required by FWS and New York DEC (section 3.3.1.2 of the Settlement Agreement).[12]

Terrestrial Resources and Threatened and Endangered Species

- Implement a proposed Invasive Plant Species Management Plan filed with the Settlement Agreement (section 3.8 and Appendix B of the Settlement Agreement); and

- Implement a proposed Northern Long-eared Bat and Bald Eagle Protection Plan filed with the Settlement Agreement (section 3.9 and Appendix A of the Settlement Agreement).

2.2.3 Modifications to Applicant's Proposal – Mandatory Conditions

Section 18 Fishway Prescriptions

Interior's preliminary section 18 prescription (Appendix B) would require Chittenden Falls Hydro to provide upstream and downstream passage for American eels as described above in section 2.2.2, and in section 3.3 of the Settlement Agreement, with one exception—the prescription does not specify the type of downstream eel bypass system required, only that the design is to be based on consultation with FWS. Interior also requests a reservation of authority to prescribe fishways at the project under section 18 of the FPA during the term of any new license issued by the Commission.

2.3 STAFF ALTERNATIVE

Under the staff alternative, the project would be operated as proposed by Chittenden Falls Hydro and prescribed by Interior, except for the proposed measures to: (1) increase the minimum flow in the bypassed reach from 15 cfs to 25 cfs; (2) develop and implement a water quality survey plan; and (3) Interior's prescribed measure to conduct post-licensing measurements (i.e., approach velocities and plunge pool depths) at any constructed eelways. The staff alternative would also include the following staff-recommended additions or modifications:

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[12] Although the Settlement Agreement and Interior refer to these confirmatory measurements as fishway 'effectiveness studies,' we do not use this term herein because we consider fishway effectiveness studies to involve the marking and releasing of tagged groups of fish and tracking their fates (i.e., passage routes, movement, mortality, etc.) through a project.

- Develop an erosion and sediment control plan to minimize erosion and sedimentation from the construction of the eel passage structures;

- Develop an operation compliance monitoring plan that incorporates the applicant's stream flow and water level monitoring plan, as well as provisions for annual reporting of monitoring data;

- File for Commission approval, a revised eelway operation and maintenance plan that includes all provisions specified by Interior as well as procedures for annual reporting of the plan's provisions to the Commission; and

- Revise the Northern Long-eared Bat and Bald Eagle Management Plan to include measures to protect the endangered Indiana bat.

2.4 STAFF ALTERNATIVE WITH MANDATORY CONDITIONS

We recognize that the Commission is required to include all section 18 fishway prescriptions in any license issued for the project. Therefore, the staff alternative with mandatory conditions includes all staff-recommended measures with the addition of the section 18 prescription regarding post-licensing field measurements to determine if any constructed eelways meet relevant FWS fish passage engineering design criteria.

2.5 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

We considered one alternative[13] to Chittenden Falls Hydro's proposal, decommissioning the project, but eliminated it from further analysis because it is not a reasonable alternative in the circumstances of this case. The alternative is presented in Appendix C.

3.0 ENVIRONMENTAL ANALYSIS

In this section, we present: (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, with historic and current conditions described first. The

[13] Because sections 14 and 15 of the Federal Power Act were waived in the original license issued for the project, neither issuing a non-power license nor federal takeover are applicable alternatives.

existing condition is the baseline against which the environmental effects of the proposed action and alternatives are compared, including an assessment of the effects of proposed 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*.[14]

3.1 GENERAL DESCRIPTION OF THE RIVER BASIN

The Chittenden Falls Project is located on Kinderhook Creek within the Stockport-Kinderhook Creek watershed, one of the larger tributary watersheds of the Lower Hudson River Basin (figure 3). Kinderhook Creek originates in the Taconic Mountain range on the eastern border of New York State. It flows about 43 miles in a southwesterly direction where it joins Claverack Creek to form Stockport Creek that flows about 2 miles to join the Hudson River. The Chittenden Falls Project is located approximately 3 miles upstream from the Hudson River confluence.

The Kinderhook Creek sub-watershed covers approximately 330 square miles, and over 75 percent of the land is forested. The remaining land consists of a mixture of agricultural, residential, and commercial land uses. Elevations in the watershed range from 600 feet to 3,000 feet. Gently sloping land covers 20 to 50 percent of the region, however, more than 50 percent are lowlands. Perennial streams, small lakes, and wetlands occur in headwater and valley areas. Stream gradients range from low to moderate and steep, and the stream channel morphology is generally incised. Two hydroelectric projects are located upstream of the Chittenden Falls Project; the Stuyvesant Falls Hydroelectric Project (FERC No. 2696) and Valatie Falls Project (FERC No. 9886) are located 2.3 miles and 9.5 miles, respectively, upstream of Chittenden Falls.

The weather in the Hudson River Basin is of the humid-continental type, with warm and humid summers and cold and wet winters. Air temperature in the basin ranges from an average low of 16 degrees Fahrenheit (°F) to an average high of 34°F in January, the coldest month, and 62°F to 85°F in July, the warmest month. The average annual rainfall in the region is 40 to 48 inches. (U.S. Climate Data, 2020).

[14] Unless noted otherwise, the sources of our information are the license application filed on May 31, 2019, additional information filed by Chittenden Falls Hydro on November 6, 2019, and January 7, 2020, and the Settlement Agreement.

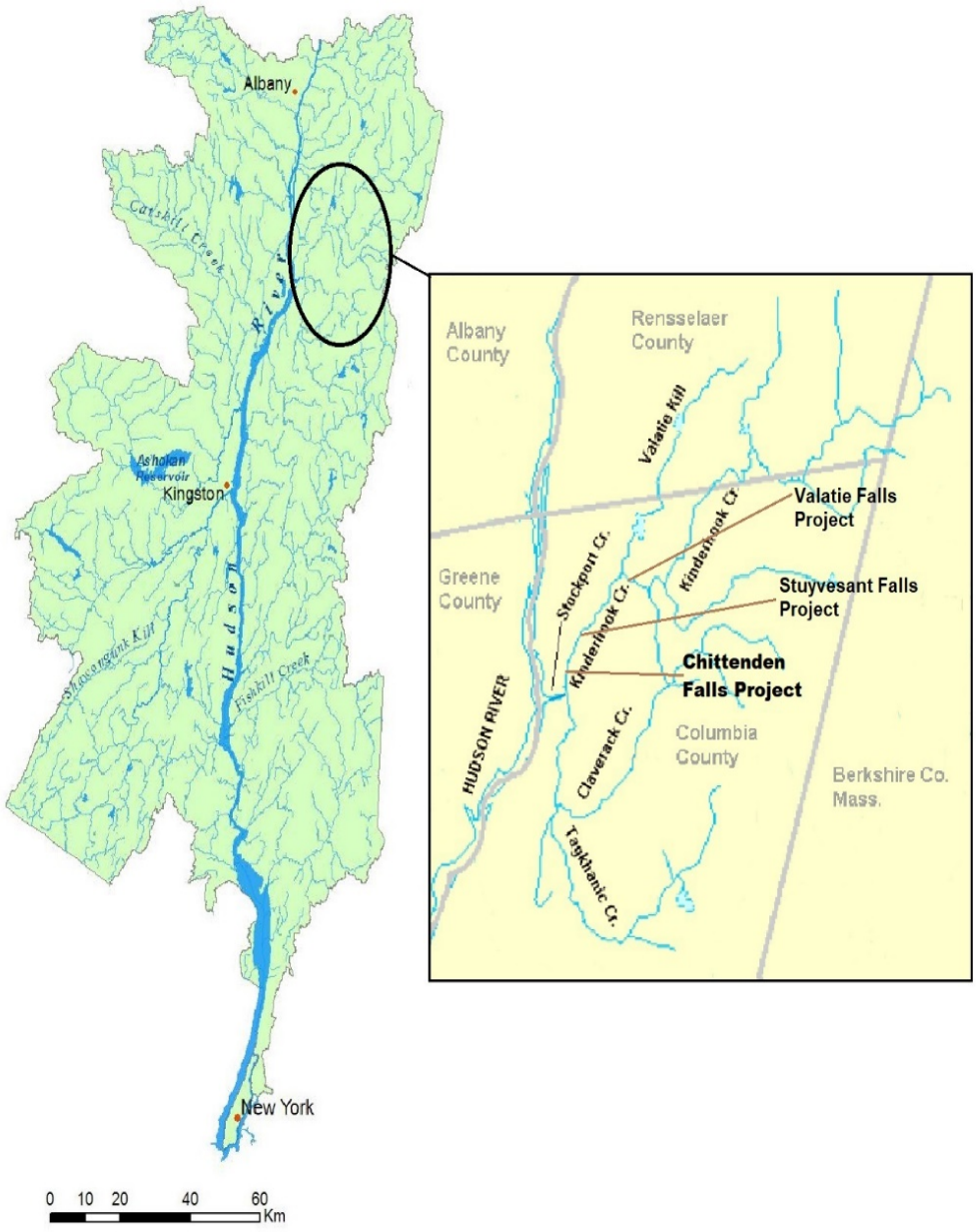

Figure 3: Lower Hudson River Basin within the State of New York and Project Location (Source: New York DEC and Wikipedia, as modified by staff)

3.2 SCOPE OF CUMULATIVE EFFECTS ANALYSIS

According to the Council on Environmental Quality's regulations for implementing NEPA (40 C.F.R. § 1508.7),[15] 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 time, including hydropower and other land and water development activities.

Based on our review of the license application and agency and public comments, we identified water quantity, water quality, and American eel as resources that may be cumulatively affected by the proposed operation and maintenance of the Chittenden Falls Project.

3.2.1 Geographic Scope

Our geographic scope of analysis for cumulatively affected resources is defined by the physical limits or boundaries of the proposed action's effect on the resources and contributing effects from other hydropower and non-hydropower activities within the Lower Hudson River Basin.

The geographic scope for water quantity and quality includes Kinderhook Creek from the Valatie Falls Hydroelectric Project, approximately 9.5 miles upstream of the Chittenden Falls Project, to its confluence with Claverack Creek, located approximately 1.2 miles downstream of the project. We chose this geographic scope because the operation of the Chittenden Falls Project, in combination with other developments and land uses within the Kinderhook Creek sub-watershed, may cumulatively affect water quantity and quality in this reach of Kinderhook Creek. Potential project effects on water resources attenuate downstream of the project and would be indiscernible downstream of the confluence with Claverack Creek.

The geographic scope for American eel includes the Lower Hudson River Basin to the Atlantic Ocean. We chose this geographic scope because the operation and maintenance of the Chittenden Falls Project, in combination with other dams and

[15] As noted earlier in this EA, although the CEQ updated its NEPA regulations on July 16, 2020 (effective September 14, 2020), the NEPA process for this project was ongoing at the time of the update, and therefore, this EA was prepared pursuant to CEQ's 1978 NEPA regulations.

hydroelectric projects in the Lower Hudson River Basin may cumulatively affect American eel migration and mortality.

3.2.2 Temporal Scope

The temporal scope of our cumulative effects analysis in the EA will include a discussion of past, present, and reasonably foreseeable future actions and their effects on water quantity, water quality, and American eel. Based on the potential term of any license issued, the temporal scope will look 30 to 50 years into the future, concentrating on the effects on the resources from reasonably foreseeable future actions. The historical discussion will, by necessity, be limited to the amount of available information for each resource. The quality and quantity of information, however, diminishes as we analyze resources further away in time from the present time.

In section 3.3.2, *Aquatic Resources*, we discuss the cumulative effects of licensing the project on water quantity, water quality, and American eel.

3.3 PROPOSED ACTION AND ACTION ALTERNATIVES

In this section, we discuss the effect 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 effects. We then discuss and analyze the site-specific and cumulative environmental issues.

Only the resources that have the potential to be affected are addressed in this EA. Based on this, we have determined that geology and soils, aquatic (including water quantity, water quality, and fisheries), terrestrial, threatened and endangered species, recreation, aesthetics, and cultural resources may be affected by the proposed action and action alternatives. We have not identified any substantive issues related to land use associated with the proposed action, and therefore, this resource is not addressed in this EA. We present our recommendations in section 5.1, *Comprehensive Development and Recommended Alternative*.

3.3.1 Geology and Soils

3.3.1.1 Affected Environment

The Chittenden Falls Project is located in the Hudson-Mohawk Valley portion of New York's Ridge and Valley physiographic region. Bedrock in the project area is mainly from the Ordovician and Cambrian periods and consists primarily of shale, limestone, and sandstone, which are highly folded sedimentary rocks. Thin, stony Pleistocene till and stratified drift mantle the bedrock. The area was also influenced by glaciation, and glacial till deposits are found in a thin layer on north-south oriented

ridges. The project is located within an area of shale. Shale outcroppings can be seen throughout the project, including the waterfall, stream bed, and stream banks.

Upstream of the project dam, the east side of the river channel (i.e., river left looking downstream) has a moderately gentle topography with a fairly extensive floodplain. On the opposite bank, topography is significantly steeper. Channel banks downstream of the dam are relatively steep for approximately 0.25 mile.

Soils along the eastern bank of the river downstream of the dam and in the east powerhouse area consist of Nassau channery silt loam, which is shallow, very rocky, and derived mainly from local slate or shale. Hudson and Vergennes soils are found on the floodplain along the eastern bank of the impoundment immediately upstream of Chittenden Falls, and consist of silt loam and silty clay loam, moderately deep, with high to moderate available water storage capacity. Soils further upstream along the eastern bank of the impoundment are of Kingsbury and Rhinebeck group and consist of silt loam, and silty clay loam and clay. The western bank of the river both above and below Chittenden Falls is covered by Nassau channery silt loams that are shallow and rocky, and underlain by unweathered bedrock.

3.3.1.2 Environmental Effects

Chittenden Falls Hydro proposes to release a continuous minimum flow of 25 cfs into the bypassed reach, an increase of 10 cfs over the existing minimum flow of 15 cfs, which has the potential to increase erosion in the bypassed reach. In addition, it proposes several construction activities that would affect geology and soil resources: (1) constructing an eel ladder; and (2) constructing a downstream eel passage system at each of the two project intakes that would include downstream plunge pools. Chittenden Falls Hydro states it would employ best management practices (BMPs) for any activities that have the potential to disturb soils or could cause erosion.

Staff Analysis

Substrate in the 320-foot-long bypassed channel consists primarily of exposed bedrock and scattered boulder and cobble with pockets of interstitial fines. The bypassed reach habitat survey conducted by Chittenden Falls Hydro shows only about a 1-inch increase in average water depth when flows in the bypassed reach were increased from 19 cfs to 29 cfs. Considering the channel substrate and small increase in water depth due to the proposed minimum flow, and because the channel is also exposed to higher flows when excess flows spill over the dam and/or are passed through the west powerhouse (more than 56 percent of the time), the proposed increase in minimum flow from 15 cfs to 25 cfs is not likely to cause any additional erosion than what currently occurs under the existing variable flow conditions.

Installation of the proposed eelways (i.e., the installation of the upstream eel ladder and construction of plunge pools and poles for holding the downstream eel bypass structures in place) would result in ground and in-river bed disturbance; however, any effects would be temporary and limited to the period of construction, with minimal effects on geology and soils. Although Chittenden Falls Hydro proposes to employ BMPs, it does not propose any specific measures for controlling erosion and sedimentation related to these activities. A soil erosion and sediment control plan with specific procedures and BMPs would ensure that any effects of proposed ground-disturbing activities would be adequately addressed to reduce or prevent soil erosion and sediment transport from these activities.

3.3.2 Aquatic Resources

3.3.2.1 Affected Environment

Water Quantity

Across a 46-year period of record (POR) from 1929 through 1967 and 2012 through 2018 (years combined), the mean annual flow of Kinderhook Creek at the project was 443 cfs based on pro-rated flow data from the U.S. Geological Survey (USGS) gage (No. 01361000) near Rossman, New York.[16] Flows vary seasonally and generally peak in late March or April due to spring snowmelt and are lowest during the late summer and early fall (August through early October) (figure 4, table 1). The instantaneous minimum and maximum flows observed at the project across the POR were 1 cfs and 18,331 cfs, respectively (table 1).

Any municipal or industrial discharges to surface or ground waters of New York State require a State Pollution Discharge Elimination System (SPDES) permit from New York DEC. There are two SPDES-permitted discharges in the project vicinity, including the Town of Stockport's Water Treatment Plant, located 1,700 feet upstream of the project dam and the King Acres Wastewater Treatment Plant located 1,560 feet downstream of the project dam. There are no known consumptive uses or water withdrawals in the project vicinity.

[16] All project-specific flow data reported herein were pro-rated by multiplying flows at the downstream USGS station No. 01361000 near Rossman, New York, by 0.991 to account for the difference in drainage area between the project and USGS gage.

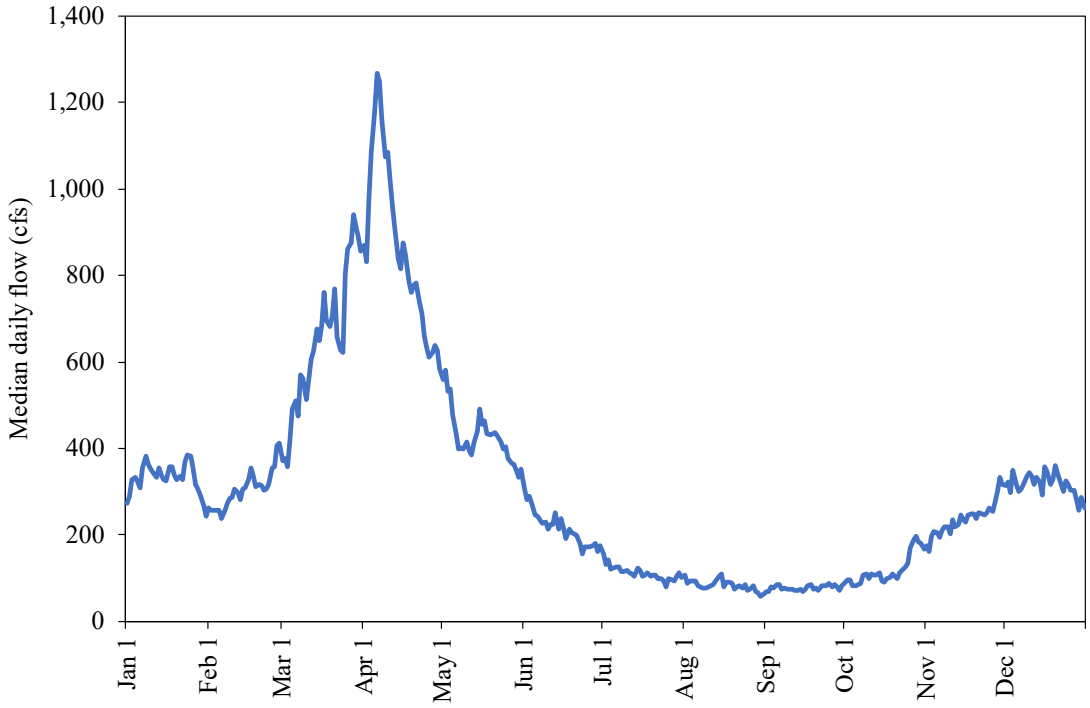

Figure 4: Annual hydrograph of median daily flows at the Chittenden Falls Project based on pro-rated data from USGS gage 01361000 across a 46-year period (1929-1968, 2012-2018) (Source: staff).

Table 1. Estimated mean, minimum, maximum, 90 percent, and 10 percent exceedance flows for the Chittenden Falls Project across a 46-year period of record from January 1929 through December 1967 and January 2012 through December 2018 (Source: staff).

Month	Mean Flow (cfs)	Minimum Flow (cfs)	Maximum Flow (cfs)	90 Percent Exceedance (cfs)	10 Percent Exceedance (cfs)
January	488	18	14,863	109	909
February	450	17	5,569	99	964
March	894	29	10,503	223	1,724
April	1,038	122	6,738	384	1,992
May	555	59	3,468	183	1,075
June	333	27	5,153	84	659
July	198	1	9,631	38	361
August	138	2	5,400	29	275
September	197	1	15,656	28	348
October	192	2	2,566	31	456

November	385	2	6,550	63	859
December	455	15	18,331	111	890
Annual	443	1	18,331	50	1,021

Water Quality

Columbia County, New York has a long history of agricultural activity, which generally peaked in the mid-1800s. Iron mining was also prominent in the county from the mid-1700s to mid-1800s, but largely ceased by the early 1900s.[17] Although agricultural practices still occur today, the region has experienced significant reforestation since the early 1900s, which has likely led to improved water quality of streams in the region. While there is little historical data available to ascertain any long-term trends in water quality, New York DEC considers water quality in lower Kinderhook Creek, where the project is located, to be only slightly impacted and generally supportive of aquatic life and recreational uses, with minor impacts to water quality resulting from nutrient loading from agricultural and other nonpoint sources and increased water temperatures due in part to the removal of riparian buffers and canopy vegetation along the creek.[18]

New York DEC currently classifies project waters as Class C waters and considers fishing to be the best usage of these waters. Project waters support a warm water fishery and are not generally supportive of trout populations. Class C waters are also intended to be suitable for fish, shellfish and wildlife propagation and survival, as well as primary and secondary contact recreation, although other factors may limit the use of Class C waters for contact recreation purposes. Relevant state water quality standards for Class C waters are as follows: (1) daily average DO values shall be no less than 5.0 milligrams per liter (mg/L), and at no time shall DO concentrations be less than 4.0 mg/L, and (2) pH values shall be between 6.5 and 8.5.[19]

Historical water quality information for the project area is limited to discrete monthly samples, collected from May through October, in 1962, 1991, and 1992 at the USGS station (No. 01361000) located 0.3 mile downstream of the project dam.[20] Based

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[17] https://www.kinderhookny.gov/document_center/Planning/Columbia_County_NRI_1_6_19%20(1).pdf

[18] https://www.dec.ny.gov/docs/water_pdf/wilhudskinderhook.pdf

[19] *See* 6 NYSRR § 703.3.

[20] https://www.waterqualitydata.us/portal/

on these data, water temperatures downstream of the project ranged from 49.4°F to 75.2°F across years, DO concentrations were between 8.1 mg/L and 10.9 mg/L, and pH values ranged from 7.0 to 8.6.

Given the limited nature of the existing water quality data for the project area, particularly the bypassed reach, and based on comments received on its draft license application, Chittenden Falls Hydro conducted a water quality monitoring study during the summer of 2019 from June 6, 2019 through October 15, 2019. During the study, continuously recording data loggers were deployed upstream and downstream of the project dam in the impoundment and bypassed reach (with one logger in each location) to measure water temperature and DO at 15-minute intervals. Data were downloaded from the loggers every 2 weeks, during which time spot check measurements of temperature and DO were made with a hand-held YSI meter (at each logger site) for the purposes of determining the need for instrument recalibration and adjusting collected data for any instrument drift that occurred between downloading events (e.g., due to biofouling).

The summer of 2019 was warmer and drier than average. Specifically, air temperatures in the state of New York during July 2019 were nearly 5°F above the long-term average and represented the twelfth warmest July on record, dating back to 1895, whereas air temperatures in August and September were either near or slightly above the long-term average, respectively.[21] Mean monthly flows at the project in July 2019 were slightly higher (219 cfs) than the long-term monthly average (198 cfs, based on the 46-year POR), but mean flows in August (93 cfs) and September (62 cfs) were well below their respective long-term monthly averages—138 cfs for August and 197 cfs for September.

Based on the water quality monitoring study, water temperatures in the project impoundment were highest, generally 70°F to 80°F, during July and August and declined through September and October (Appendix D). DO levels in the impoundment exhibited moderate diel variability and generally ranged from 6.5 mg/L to 10.5 mg/L across the study period, with an overall mean of 8.8 mg/L (Appendix D). The lowest recorded DO value in the project impoundment was 6.3 mg/L, which occurred in mid-August. No vertical profiles of temperature or DO were collected in the project impoundment; however, it is unlikely the impoundment stratifies given its shallow depth (average depth of 5.5 feet when the impoundment is at its normal elevation of 61.6 feet, at the top of the flashboards).

Temperatures in the bypassed reach were similar to those in the project impoundment, as the average temperatures across the study period were 70.1°F in the bypassed reach and 70.2°F in the impoundment. The maximum water temperature

[21] https://www.ncdc.noaa.gov/sotc/national/201913

observed in the bypassed reach (84.9°F in late July) was only slightly higher than the maximum temperature observed in the impoundment (84.1°F, also in late July). DO levels in the bypassed reach generally ranged between 6 mg/L and 10 mg/L and showed strong diel variability in July and early August (Appendix D). There were two instances when DO levels in the bypassed reach fell below the instantaneous state standard of 4.0 mg/L. The first instance occurred on June 25, 2019 when a single (15-minute) reading of 3.91 mg/L was recorded at 12:45 p.m. This low DO reading was likely anomalous because values recorded shortly before and after the reading in question suggested that DO levels were gradually increasing (Appendix D), which would be expected as photosynthesis and associated oxygen production continue through the mid-day hours. This brief dip in DO readings (including the single DO reading below 4.0 mg/L) may have been an anomalous event caused by debris passing by or becoming temporarily lodged near the data logger, which was attached to a cinder block.[22] The second instance of low-DO readings occurred on the evening of July 29, 2019, beginning at 7:00 p.m. and extending overnight through the early morning hours of July 30, 2019 (until 7:30 a.m.). During this period, DO values ranged between 2.0 mg/L and 4.0 mg/L (Appendix D). Because this time period coincides with the period during which DO levels are expected to be lowest (i.e., overnight when respiration and oxygen consumption of aquatic organisms dominates over photosynthesis), it is unlikely that this low DO event was related to instrument error. Nevertheless, July 30, 2019, was the only day, of the 131-day monitoring study, on which the daily average DO levels were below the minimum daily standard of 5.0 mg/L.

Aquatic Habitat

The project impoundment is small (surface area of 18 acres), narrow (200 to 300 feet wide), and riverine in nature. The project dam was built on top of a natural waterfall (Chittenden Falls) that spans the river; as such, the impoundment created by the dam is shallow and has an average depth of 5.5 feet when the impoundment is at its normal elevation (i.e., at the top of the flashboards).

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[22] The water quality data loggers (HOBO model U26) that were deployed contain an optical sensor to measure DO concentrations. Optical DO sensors measure the amount of backscatter the instrument receives from emitted light signals, whereby higher ambient DO concentrations at the sensor's membrane interface (with the water column) result in more backscatter and a greater return strength of the transmitted signal. Thus, when debris blocks, or organisms settle on or colonize, the membrane of the optical sensor, this interferes with the sensor's ability to accurately measure the ambient DO concentration in the water column and results in recorded values that are underestimates of the actual (true) DO levels.

Downstream of the project, aquatic habitat consists of deep pools, runs, bedrock riffles, and rapids. The bypassed reach consists of riffle and run habitats with a ledge substrate and scattered cobble that contains small pockets of interstitial fines. To assess physical habitat in the bypassed reach, a single cross-channel transect was surveyed in a riffle/run habitat as part of the bypassed reach habitat survey. Based on this survey, the wetted width of the bypassed reach under current (baseline) conditions (i.e., with a minimum flow of 15 cfs being released into the bypassed reach) was 125.4 feet, and the wetted perimeter was 167.0 feet. The average and maximum depths along the transect were 0.53 foot and 1.2 feet, respectively. At the downstream end of the bypassed reach, the narrow 25-foot-wide tailrace from the east powerhouse joins Kinderhook Creek.

Fishery Resources

Resident Fish Community

The resident fish community at the project exhibits fairly low diversity, as 19 total species, mostly habitat generalists, were collected during electrofishing surveys (boat and backpack) upstream and downstream of the dam. Community composition is similar upstream and downstream of the project dam and includes common riverine species such as white sucker, tessellated darter, and common carp as well as game species including smallmouth bass, and to a lesser extent, rock bass and largemouth bass (Appendix E). White sucker, dace (eastern blacknose and longnose), and tessellated darter appear to be numerically dominant upstream of the project dam (Appendix E), whereas smallmouth bass, common carp, and sunfish (bluegill and redbreast sunfish) appear to be more prevalent downstream of the project dam (Appendix E), where sampling was concentrated in pool habitats (3.5 to 7 feet deep) within the project's bypassed reach. The upstream fish survey occurred 1.5 miles upstream of the project dam and included habitats (e.g., riffles) that are shallower and have higher velocities than would be expected in the project impoundment. As such, lotic species such as eastern blacknose dace and longnose dace may not be as common in the project impoundment (slower-moving waters) as implied by the upstream fish survey, which was conducted in July 2007 in the bypassed reach of the upstream Stuyvesant Falls Project.[23]

[23] During pre-filing consultation for the Chittenden Falls Project, the resource agencies (FWS and New York DEC) recommended that fish sampling only be conducted downstream of the project dam because existing data (collected in 2007 to support the re-licensing of the upstream Stuyvesant Falls Project, FERC No. 2696) was sufficient for characterizing the upstream fish community at the Chittenden Falls Project. There are no barriers to fish movement (e.g., natural falls or dams) between the project dam and upstream sampling area.

American Eel

The only diadromous fish species found in the project area is the catadromous American eel, as the rapids located 2 miles downstream of the project dam (at the Route 9 bridge) are believed to represent a natural barrier to the upstream migration of anadromous species such as blueback herring and American shad.[24]

Historically, American eels were very abundant in rivers and streams along the U.S. eastern seaboard and often composed more than 25 percent of the total fish biomass in a given river (ASMFC, 2008). However, beginning in the 1970s, eel abundance began declining from historical levels due to a combination of factors, such as overfishing, habitat loss from dams, turbine mortality, changing oceanic conditions, toxins and contaminants, and disease (ASMFC, 2012; ASMFC, 2013). Eel abundance in rivers along the east coast of the United States, including the Hudson River and its tributaries, declined substantially during the 1980s through the early 1990s, but the stock has since stabilized, albeit at historically low levels (ASMFC, 2017). Restoration efforts to recover the depleted stock of American eel are ongoing and include efforts to improve upstream and downstream passage opportunities for eels to increase the number of adults that are able to migrate from fresh and estuarine waters to the ocean to spawn (i.e., increased spawning escapement), which in turn, could help curb further declines in juvenile recruitment and overall stock abundance (ASMFC, 2008).

American eel spawn in the Sargasso Sea and their leaf-like larvae (referred to as leptocephali) drift passively in ocean currents towards the North American coastline. As they near continental waters and exit from the Gulf Stream, young eels metamorphose into 'glass eels' that are transparent, have fins, and are capable of swimming. When glass eels enter estuaries, they are about 1 year old and 2 inches long (Shepard, 2015). Glass eels generally enter the Hudson River estuary during late February or March.[25] As glass eels move upstream, they become pigmented and more robust, and are referred to as 'elvers.' The project dam would be the first dam that eels migrating up the Hudson River and into the project area would encounter, as there are no dams on the mainstem Hudson River downstream of its confluence with Stockport Creek, or below the project dam on either Kinderhook Creek or Stockport Creek.

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[24] Diadromous species migrate between the ocean and freshwater for the purpose of reproduction and include catadromous species such as American eel that reside primarily in fresh or brackish water, but migrate to the ocean to spawn, and anadromous species such as American shad and blueback herring that spend much of their adult lives at sea but return to freshwater to spawn.

[25] https://www.dec.ny.gov/docs/remediation_hudson_pdf/082415eelreport.pdf

As elvers begin putting more energy into growth and less energy towards migration, they enter the primary growth, or 'yellow eel' phase, which is the longest lasting life stage of American eel and can last for 20 to 30 years (at least for females which mature later and at a larger size than males). Although yellow eels often settle into a particular area and establish a home range, upstream movements and excursions still occur throughout this life stage, as some individuals may abandon their home range and move farther upstream due to an environmental trigger (e.g., increased eel density, competition, or an increase in flow) (Welsh and Liller, 2013; Shepard, 2015) or simply due to the fact that some individuals in the population appear to be more exploratory than others (Feunteun, 2003; Lamson et al., 2006).

Towards the end of their residency and growth period in brackish and fresh waters, eels begin maturing and undergo a process referred to as 'silvering' that prepares eels for their migration back to the Sargasso Sea to spawn. Silvering involves an enlargement of the eyes and nostrils, gut resorption, gonadal development, a change in coloration (eels in this stage are referred to as 'silver' eels), and a switch from a more demersal lifestyle (yellow eels) to a more pelagic existence as silver eels. Males being silvering and maturing at smaller sizes and younger ages than females. Many males begin maturing and migrating to the Atlantic Ocean when they reach lengths of 14 to 16 inches and are 4 to 5 years old (ASMFC, 2012; Shepard, 2015). Meanwhile, females do not begin maturing until they reach larger sizes (generally greater than 16 inches). The size and age at maturation for females generally increases with latitude along the eastern seaboard of North America. In the New England and New York region, the mean length and age of maturing females ranges from 19 to 38 inches and 13 to 23 years old (ASMFC, 2012; Shepard, 2015). The downstream migration of silver eels towards the Atlantic Ocean occurs mainly at night and is often triggered by increases in flow associated with rainfall events during the late summer and fall (Haro, 2003). In New York, the downstream migration of silver eels typically occurs from September through November, with a peak in October (figure 5).

Eel surveys conducted at the project by Chittenden Falls Hydro demonstrated that eels, particularly elvers, are abundant downstream of the project dam. A total of 381 elvers, generally ranging in size from 3 to 7 inches,[26] were collected in eel mops[27] deployed downstream of the project dam and checked on a daily basis in 2017 (from May 31 through September 11) and 2018 (from May 1 through September 14). In 2017, peak

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[26] All fish lengths reported herein refer to total length.

[27] Eel mops are devices that mimic sheltering habitat of young eels and are deployed on the streambed to collect glass eels and elvers. For more details and images, see: https://www.dec.ny.gov/docs/remediation_hudson_pdf/eelmop.pdf.

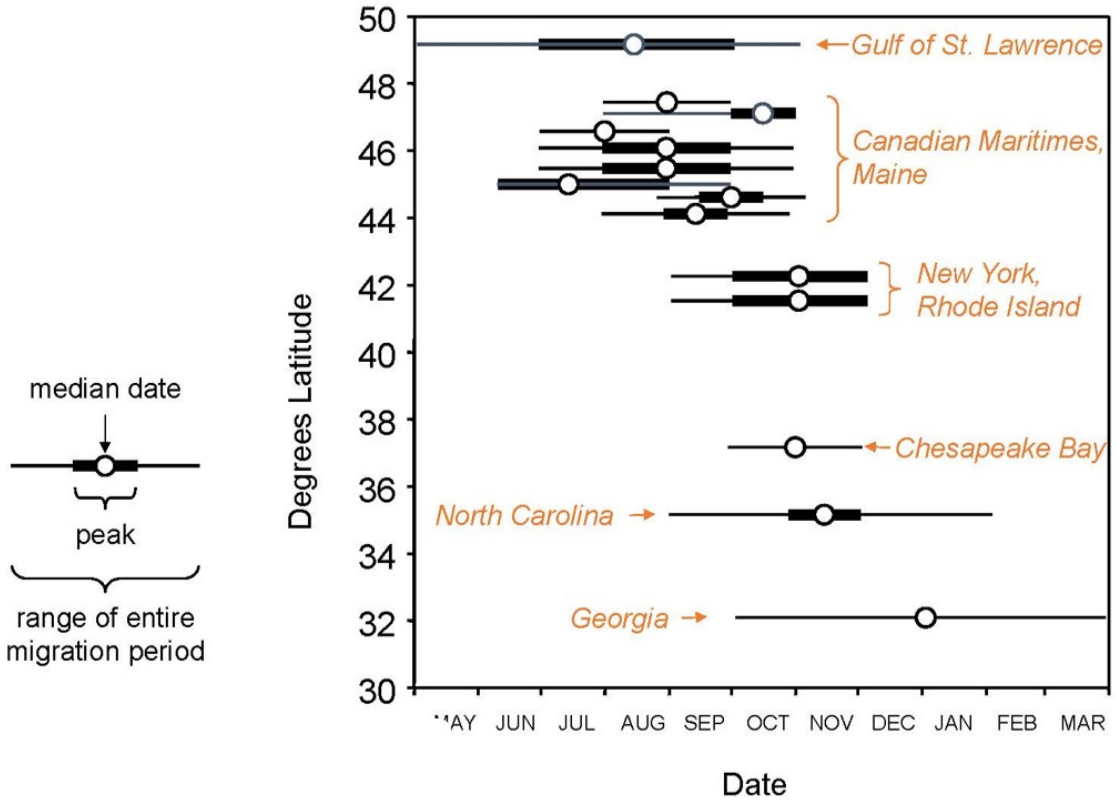

Figure 5: Emigration timing of silver eels along the eastern seaboard of North America (Source: Haro, 2003).

elver abundance at the project occurred in June and July and declined thereafter, but in 2018, peak elver migration to the project area occurred later in the summer (August) and continued at moderate levels through the end of the study period (figure 6). In 2017, eel mops were only deployed in the tailrace of the east powerhouse (two eel mops in total), but in 2018, two additional sites were sampled, including the tailrace of the west powerhouse and eastern toe of the dam (with two eel mops deployed at each site). In 2018, with the exception of May, elver abundance was consistently highest at the west tailrace site. Specifically, 63 percent of all elvers were collected at the west tailrace site in 2018, with the remaining 18 and 19 percent captured at the east tailrace and eastern dam sites, respectively.

The electrofishing survey conducted in the project's bypassed reach in 2017 (described above) also demonstrated that eels are abundant downstream of the project dam. More American eel were captured during this survey than any other species, as eels

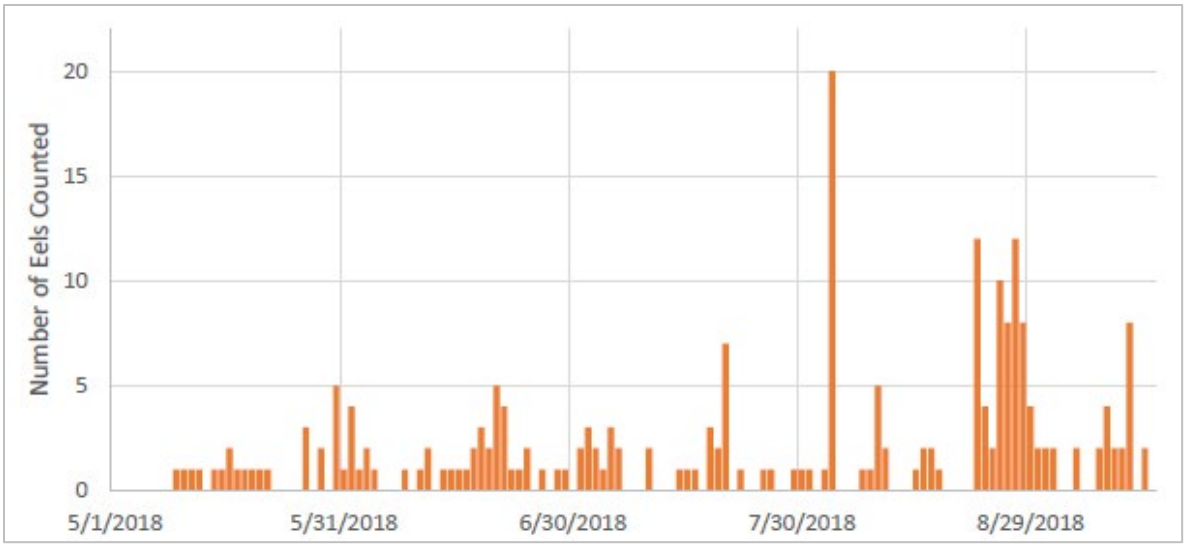

Figure 6: Daily eel counts for the eel mop deployed at the west tailrace site from May 1, 2018 through September 14, 2018 (Source: license application).

comprised nearly a third (31.5 percent) of the total catch (Appendix E) and had a catch per unit effort (CPUE) of 26 eels per hour of electrofishing. Most of the eels captured during the downstream survey were elvers, as the overall mean length of collected eels was 4.8 inches. Electrofishing sampling occurred upstream of the project dam in 2007; during this survey, eels represented just 6.6 percent of the total catch (Appendix E) and had a CPUE of 16.4 eels per hour of electrofishing. The mean length of eels collected during the upstream survey was 9.1 inches, as some yellow eels up to 17.5 inches long were present. Collectively, these electrofishing surveys suggest that American eel are more abundant downstream of the project dam than upstream.

3.3.2.2 Environmental Effects

Mode of Operation

The operation of hydropower projects in a run-of-river mode, whereby the total outflow from a project approximates the inflow to the impoundment, generally provides a more stable upstream and downstream environment than other modes of operation. For example, compared to peaking and storage projects, run-of-river operation minimizes the degree of water level fluctuations and associated erosion and temperature fluctuations in impoundment surface waters (due to shorter water residence times).

Chittenden Falls Hydro proposes to continue operating the project in a run-of-river mode and maintaining the impoundment at or above the dam crest or top of the flashboards (when in place) in order to minimize impoundment fluctuations. Chittenden Falls Hydro proposes to report to the Commission, as part of its streamflow and water level monitoring plan (see below), any instances when the impoundment drops more than 6 inches below the dam crest or flashboards (when in place). Chittenden Falls Hydro

states these limits on the impoundment elevation (i.e., within 6 inches of the dam crest or top of the flashboards, when in place) may be curtailed or suspended for short periods of time upon prior mutual agreement between the licensee and New York DEC. Chittenden Falls Hydro also states that in the event of any operating emergency beyond the control of the licensee, impoundment elevation limits may be curtailed or suspended for the time period necessary to rectify the emergency.

As evidenced by their execution of the Settlement Agreement, New York DEC and FWS support Chittenden Falls Hydro's proposed mode of operation. Interior also recommends, under section 10(j), that the project operate in a run-of-river mode as described in the Settlement Agreement.

Staff Analysis

Continuing to operate the project in a run-of-river mode, as proposed by Chittenden Falls Hydro and recommended by Interior, would minimize impoundment fluctuations and associated water level and flow disruptions to any fish spawning and rearing habitat that exists in the project impoundment or in the vicinity of the tailraces. Maintaining relatively stable impoundment levels would also benefit fish and other aquatic organisms that rely on littoral (shoreline) habitats for feeding, spawning, and cover. By continuing to operate the project in a run-of-river mode, habitat in the project impoundment and tailwaters would be unchanged compared to current conditions.

Effects of Project Operation on Water Quality

For run-of-river projects that have bypassed reaches, but shallow impoundments that are unlikely to stratify, such as the Chittenden Falls Project, water quality concerns often center on the bypassed reach. When such projects are operating below their maximum hydraulic capacity, the bypassed reach typically receives less flow than other downstream areas (e.g., the tailraces). Under these conditions, bypassed reaches are more subject to water temperature fluctuations (due to shallower depths and longer residence times) and potential oxygen depletion during the warm summer months when biological activity (e.g., respiration) is at its seasonal maximum and oxygen saturation is at its seasonal minimum (because warm water cannot hold as much oxygen as cooler waters).

Chittenden Falls Hydro proposes to continue operating the project in a run-of-river mode and to increase the minimum flow in the bypassed reach from 15 cfs to 25 cfs (or project inflow, if less). Chittenden Falls Hydro also proposes to develop a water quality survey plan that would include procedures for conducting additional water quality monitoring in the bypassed reach, including the deployment of an additional (second) data logger in the bypassed reach to provide a replicate set of data to verify any potentially anomalous DO readings as were observed during the 2019 water quality study when a single logger was deployed. This additional water quality monitoring would

occur during the first available study season (June 1 through October 15) following approval of the plan by New York DEC and FWS. The need for additional study periods and any necessary management actions would be determined in consultation with the New York DEC and FWS and based on results of the water quality sampling conducted as part of the water quality survey plan.

As evidenced by their execution of the Settlement Agreement, New York DEC and FWS recommend the development and implementation of a water quality survey plan.

Staff Analysis

Current project operation appears to have little effect on water quality in the vicinity of the project as water temperature and DO values upstream and downstream of the project dam (based on the 2019 water quality monitoring study) were very similar, as described above in section 3.3.2.1, *Affected Environment, Water Quality*. Moreover, water quality in the bypassed reach under the currently required 15-cfs minimum flow is largely consistent with state water quality standards as there was only one day (during the 131-day monitoring period from June 6, 2019 through October 15, 2019) when average DO levels were below the minimum daily standard of 5.0 mg/L. Although there was a second, much briefer (15- to 30-minute) period, when DO levels dropped below 4.0 mg/L (the instantaneous DO standard) on June 25, 2019 (*see* Appendix D), the low DO readings during this event may have been due to instrument error, as described above in section 3.3.2.1, *Affected Environment, Water Quality*. However, even if both instances of low DO readings in the bypassed reach—on June 25, 2019, and July 30, 2019—were not associated with instrument error[28] and instead reflected actual DO levels, the long-term continuous data set collected in the summer of 2019 does not suggest there is a chronic, low DO problem in the bypassed reach under current project operation, as these low DO occurrences were infrequent and short-lived. It is unlikely that such short duration and infrequent events would negatively affect biota in the bypassed reach given that mobile fauna (e.g., fishes) can easily move out of the area if such events occur and no sessile macroinvertebrates, such as freshwater mussels (live mussels, spent shells, or middens),

[28] In the final water quality study report, filed on January 7, 2020 (Accession No. 20200107-5170), Chittenden Falls Hydro states that during both instances of low DO, on June 25, 2019, and July 30, 2019, recorded data had a reasonable probability of being compromised due to instrument error, namely temporary fouling of the optical DO sensor that resulted in recorded DO values that underestimate actual (ambient) DO levels.

were observed downstream of the project dam.[29] Because the water quality monitoring study occurred during a summer that was warmer and drier than average, and therefore represented 'worse than average' conditions for DO, and water quality was found to be largely consistent with state water quality standards under current project operation, there appears to be little benefit to conducting an additional year (or more) of water quality sampling in the bypassed reach as contemplated by the water quality survey plan described in section 3.6 of the Settlement Agreement.

Minimum Flow in the Bypassed Reach

The operation of hydropower projects can result in diversions of water through a powerhouse and away from the natural river channel. Without flow augmentation (e.g., a minimum flow) or substantial leakage, portions of the bypassed reach—the stretch of river between the point of diversion and where the powerhouse discharge re-enters the natural river channel—can become dewatered, thereby potentially reducing habitat suitability and water quality for aquatic resources.

Chittenden Falls Hydro proposes to release a continuous year-round minimum flow of 25 cfs, or inflow, if less, into the bypassed reach to ensure this habitat remains adequately watered and to protect and enhance this potential habitat for fish and macroinvertebrates. The 25-cfs minimum flow would be provided through the notches in the flashboards, the west powerhouse (when operating), the downstream eel passage system (when operating), or some combination thereof. Chittenden Falls Hydro states the proposed 25-cfs minimum flow may be curtailed or suspended for short periods of time based upon prior mutual agreement between the licensee and New York DEC; also, that during any operating emergency or other event beyond the control of the licensee, the minimum flow may be suspended for the time period necessary to rectify such emergencies.

As evidenced by their execution of the Settlement Agreement, New York DEC and FWS support Chittenden Falls Hydro's proposed minimum flow of 25 cfs. Interior also recommends, under section 10(j), that a 25-cfs minimum flow be released into the bypassed reach, as described in the Settlement Agreement.

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[29] Visual surveys for mussels (above the water line, via wading) were conducted at each of the two fish sampling sites in the bypassed reach during the spring electrofishing (May 31-June 1) and summer seining (August 23-24) surveys in 2017. Visual surveys were also conducted in summer 2017 at five additional sites located between the bypassed reach (Kinderhook Creek) and Route 9 bridge (Stockport Creek).

Staff Analysis

To evaluate how physical habitat in the bypassed reach changes as a function of flow, Chittenden Falls Hydro conducted a habitat survey in the bypassed reach in July and August of 2019. During this survey, wetted width and wetted perimeter were measured along a single cross-channel transect in the bypassed reach (riffle/run habitat) at various flows.[30] Although the target flows were 15 cfs (the current minimum flow), 25 cfs (the proposed minimum flow), 35 cfs, and 150 cfs, actual flow releases during the survey were 19, 29, 35, and 159 cfs, respectively.[31]

Nearly the entire width of the bypassed reach remained watered at the lowest flow tested (19 cfs, representative of existing conditions); and there was little change, just a 2.2-foot increase, in wetted width as flows in the bypassed reach were increased to 159 cfs (the highest flow tested) (table 2, Appendix D. There were little appreciable differences in average water depth (less than a 3-inch difference) or wetted perimeter (less than a 5-foot difference) between the highest and lowest flows tested (table 2). There was very little difference in average water depth (0.96 inch), wetted width (2.4 inches), or wetted perimeter (3.6 inches) between the existing and proposed minimum flows (table 2).

Continuing to release a minimum flow of 15 cfs would ensure that riffle habitats in the bypassed reach remain wetted. Because they are the shallowest downstream habitat, if riffle areas (such as the survey transect) remain wetted at 15 cfs, so would other downstream habitats (pools and runs) adjacent to riffle areas. In addition, water quality in the bypassed reach is largely consistent with state standards under the current 15-cfs minimum flow (see above). Therefore, given the minimal gain in aquatic habitat that would be expected to occur in the bypassed reach if minimum flows were increased by 10 cfs (from 15 cfs to 25 cfs) and the fact that water quality in the bypassed reach appears to be supportive of aquatic life under the existing 15-cfs minimum flow, there appears to be little benefit to aquatic resources (e.g., resident fish) by increasing the minimum flow in the bypassed reach to 25 cfs, as proposed by Chittenden Falls Hydro and recommended by Interior.

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[30] Wetted perimeter is the total linear distance of the streambed and banks that are in contact with (covered by) water at a given flow, whereas wetted width is simply the width of the channel that is wetted at a given flow.

[31] Flows in the bypassed reach were estimated by subtracting turbine flow, based on wicket gate settings, from the total (pro-rated) outflow from the project based on data from USGS gage No. 01361000.

Table 2. Physical habitat measurements made along a cross-channel transect in the bypassed reach, under various flows, as part of the bypassed reach habitat survey conducted in July and August of 2019 (Source: license application, as modified by staff).

Target Flow (cfs)	Actual Flow (cfs)	Average Depth (feet)	Wetted Width (feet)	Wetted Perimeter (feet)
15	19	0.53	125.4	167.0
25	29	0.61	125.6	167.3
35	35	0.67	127.2	168.2
150	159	0.71	127.6	171.9

Stream Flow and Water Level Monitoring

Chittenden Falls Hydro proposes to develop and maintain a stream flow and water level monitoring plan containing provisions that would allow independent verification, by New York DEC and FWS, of project operation requirements such as run-of-river operation and minimum flows in the bypassed reach. All monitoring equipment required by the plan would be calibrated and operational within 6 months of the Commission's approval of the plan. Chittenden Falls Hydro would maintain hourly records of impoundment elevations and minimum flows, which would be available for inspection, upon request by New York DEC, within 10 business days at the project site, or within 30 business days of the licensee's receipt of written requests for such records by New York DEC.

As evidenced by their execution of the Settlement Agreement, New York DEC and FWS support Chittenden Falls Hydro's proposed stream flow and water level monitoring plan.

Staff Analysis

Compliance monitoring plans, such as the proposed stream flow and water level monitoring plan, can help ensure that environmental measures are being met and achieving their intended purpose. Chittenden Falls Hydro's proposed stream flow and water level monitoring plan would aid compliance with any operational or environmental

measures contained in the Settlement Agreement that are required by any subsequent license issued for the project.

Upstream Passage of American Eel

While some dams may not represent a complete barrier to the upstream migration of American eel due to the species' climbing ability (particularly small eels), dams can limit the ability of eels to access portions of their historical freshwater feeding and growth habitats, which may ultimately affect growth rates, sex ratios, and the potential reproductive output (fecundity) of silver eels from a river system.

As described in section 3.3.1.2.1 of the Settlement Agreement, Chittenden Falls Hydro proposes to install an eel ladder at the project to provide upstream passage for American eel. The design of the ladder, as well as its location and season (dates) of operation, would be determined in consultation with FWS and New York DEC.[32] The eel ladder would be installed and operational within 12 months of the applicant receiving all necessary regulatory approvals, including approval from FWS and New York DEC.

As evidenced by their execution of the Settlement Agreement, New York DEC and FWS support Chittenden Falls Hydro's proposed installation and operation of an eel ladder. Interior's preliminary fishway prescription for upstream eel passage for American eel (*see* Appendix A) is consistent with section 3.3.1.2.1 of the Settlement Agreement.

Staff Analysis

The project dam appears to be a partial impediment to the upstream migration of American eel in Kinderhook Creek, as the relative abundance (CPUE) of eels was nearly two-fold higher downstream of the project dam than upstream (see section 3.3.2.1, *Fishery Resources, American Eel*). As such, an eel ladder, at a location and during a season to be determined in consultation with the resource agencies (FWS and New York DEC), would improve access for eels, particularly elvers, to upstream tributary habitats, which have been shown to constitute important foraging and refuge areas for eels in New York (Machut et al., 2007). Once the required upstream eel passage facility is installed at

[32] Although section 2.2. of the Settlement Agreement states "…an eel ramp would be installed on *river right* [emphasis added]," section 3, which the Settlement Agreement states is the controlling section of the document if discrepancies exist, does not specify a proposed installation location for the eel ladder. Therefore, we interpret Chittenden Falls Hydro's proposal as lacking a proposed installation location for the eel ladder/ramp.

the Stuyvesant Falls Project,[33] the installation and operation of an eel ladder at the Chittenden Falls Project, as proposed by Chittenden Falls Hydro and required by Interior, would provide eels with improved access to tributary habitats within a 9.5-mile-reach of Kinderhook Creek upstream of the project dam to the base of the Valatie Falls Project (FERC Project No. 9886), which currently lacks upstream passage. Enhancing access to these upstream areas could also help reduce crowding and associated competition of eels below the project dam, which is the lowermost dam on the Stockport-Kinderhook creek system. This increased access could in turn increase growth and fecundity, and when combined with the appropriate downstream passage and protection measures (see below), may also increase spawning escapement and reproductive output of silver eels from the system, all of which are consistent with Atlantic States Marine Fisheries Commission's (ASMFC) management goals for American eel (ASMFC, 2008).

Downstream Eel Passage

Although there is considerable variability in turbine mortality rates of eels depending on project-specific operating conditions and turbine specifications (e.g., turbine type, rotation speed, and blade number), eels entrained at hydropower projects generally experience higher turbine (blade strike) mortality than other fish species. The higher mortality of eels is due to their unique body shape as they are relatively long for their weight, compared to other fish species. A common protection measure for eels at hydropower projects in the eastern U.S. is the installation of trash racks with a clear-spacing (0.75-inch or 1-inch) that physically excludes large silver eels during their downstream fall migration and routes them towards a non-turbine route of passage (e.g., a low-level outlet or surface bypass).

As described in sections 3.3.1.1 and 3.3.1.2.2 of the Settlement Agreement, Chittenden Falls Hydro proposes to install a downstream eel passage system that would be operated on a seasonal basis from September 1 through November 15 and consist of, at each powerhouse, seasonal trash racks (e.g., an overlay or trash rack replacement

[33] The licensees of the Stuyvesant Falls Project filed fishway design drawings containing plans to install a rotating cylinder fish lift (Archimedes screw-type device) to provide upstream passage for eels at the project. These design drawings were approved by the Commission. *See Chittenden Falls Hydropower, Inc.*, 153 FERC ¶ 62,139 (2015). However, since that time, the licensees have indicated their intent, in letters filed on February 28, 2020, and March 17, 2020, to file an amendment that removes the "minimum flow turbine" (presumably the rotating cylinder fish lift, which was never installed at the project) from the licensed project works. Thus, the exact type of upstream eel passage structure that would be installed at the Stuyvesant Falls Project and its timeline for construction, are unknown at this time.

system) with a 0.75-inch clear spacing. The face of the trash racks would contain an orifice leading to a pipe that would discharge eels downstream of the project dam into plunge pools with adequate depth. The downstream eel passage system would be installed and operational within 12 months of Chittenden Falls Hydro receiving all necessary regulatory approvals.

As evidenced by their execution of the Settlement Agreement, New York DEC and FWS support Chittenden Falls Hydro's proposed installation and operation of a downstream eel passage system. While Interior's preliminary fishway prescription requires the installation of a downstream eel passage facility that includes seasonal trash racks with a 0.75-inch clear spacing and downstream bypass, the prescription does not specify the type of bypass to be installed. Otherwise, Interior's preliminary prescription for downstream eel passage is consistent with the Settlement Agreement.

Staff Analysis

Currently, silver eels migrating downstream through the project area in the fall either pass through the project's turbines or over the dam (via spill) into the bypassed reach. Based on long-term flow data from the POR, flow through either of the two powerhouses (east or west powerhouse alone) was greater than spillage flows (over the dam) 82 percent of the time from September 1 through November 15. Therefore, given silver eels' tendency to follow the bulk flow during their downstream migration (Jansen et al., 2007), a considerable portion of silver eels likely pass through the powerhouses during their downstream migration under current project operation.

All sizes of silver eels are susceptible to entrainment at the project because the current trash racks have a 2-inch clear spacing, which would not exclude even the largest adult eels (42 inches) reported in New York (Smith et al., 1985). Based on a blade strike model that accounts for the relative flow allocation between the various turbine units and their specific characteristics (e.g., runner speed, diameter, etc.), entrained eels ranging in size from 17.5 inches to 27.5 inches (the maximum size included in the model) would experience turbine mortality of 50.6 percent to 60.2 percent. Some eels, especially large females, are likely longer than 27.5 inches when they migrate downstream towards the ocean (see section 3.3.2.1, *Fishery Resources, American eel*); the expected turbine mortality of these larger individuals is higher than 60.2 percent. In addition to the elongated body shape of eels, the high rotational speeds of the project's turbines, which range from 277 revolutions per minute (rpm) to 455 rpm, likely contribute to the high predicted blade strike (mortality) rates (above 50 percent) for adult eels under current project operation.

A downstream eel passage system, as proposed by Chittenden Falls Hydro and required by Interior, would significantly improve the downstream passage survival of silver eels at the project, by at least 50 percent based on the blade strike model and assuming most eels currently attempt to migrate downstream through the powerhouses

(as discussed above). Although some smaller adults (mainly males) could still be entrained through the proposed 0.75-inch trash racks, the vast majority of females (which are larger than males) would be physically excluded by the proposed trash racks, which would exclude all eels longer than 20 inches (table 3). A bypass structure, the final design of which would be based on consultation between the applicant and FWS and New York DEC, would provide eels with a non-turbine route of downstream passage into plunge pools with appropriate depths. Lastly, because the proposed operation season of the downstream eel passage system (September 1 through November 15) encompasses the reported downstream migration period for silver eels (Haro et al., 2003; see figure 5), the downstream eel passage system would be expected to protect most out-migrating eels in Kinderhook Creek from turbine mortality.

Table 3. Minimum sizes (total length, in inches) of fish species physically excluded by the project's current trash racks (2.0-inch clear spacing) and seasonal trash rack overlays (0.75-inch clear spacing) that would be deployed as part of the downstream eel passage system. Fish exclusion sizes were based on body scaling factors relating body width to fish length as reported in Smith (1985). (Source: staff).

Species	Reported Maximum Length (inches)	Minimum Sizes Excluded From:	
		2.0-Inch Trash Racks	0.75-Inch Trash Racks
Migratory			
American eel	42.0	NE[a]	20.0
Resident			
Common carp	40.0	12.3	4.6
Largemouth bass	26.0	15.0	5.6
White sucker	25.0	14.2	5.3
Smallmouth bass	24.0	15.6	5.9
Fallfish	17.0	15.5	5.8
Rock bass	15.0	12.8	4.8
Yellow perch	12.0	NE	6.6
Pumpkinseed	10.0	NE	6.0
Common shiner	6.0	NE	NE
Cutlips minnow	4.7	NE	NE
Spottail shiner	4.0	NE	NE

Longnose dace	3.9	NE	NE
Tessellated darter	3.6	NE	NE
Eastern blacknose dace	3.5	NE	NE

[a] 'NE' indicates the species is not excluded by the trash rack spacing because the minimum exclusion size is greater than the species' maximum length reported in Smith (1985).

Fish Impingement and Entrainment

The passage of large volumes of water through trash racks and turbines can result in fish impingement and entrainment mortality at hydropower projects. Blade strikes are thought to be the primary source of mortality for fish entrained through hydropower projects (Franke et al., 1997; Pracheil et al., 2016). Fish size plays an important role in entrainment susceptibility and turbine mortality, whereby smaller fish are more likely to be entrained, but experience lower turbine mortality, although the physical properties of turbine units also play a role in turbine mortality (Winchell et al., 2000; Čada et al., 1997; Pracheil et al., 2016).

As described in sections 3.3.1.1 and 3.3.1.2.2 of the Settlement Agreement, Chittenden Falls Hydro proposes to install and operate, on a seasonal basis from September 1 through November 15, a downstream eel passage system consisting of trash rack overlays (or a trash rack replacement system) with 0.75-inch clear bar spacing. As evidenced by their execution of the Settlement Agreement, FWS and New York DEC support Chittenden Falls Hydro's proposal to install seasonal trash rack overlays with a 0.75-inch clear spacing from September 1 through November 15.

Staff Analysis

The trash racks currently in place at the project have a 2-inch clear spacing and would physically exclude, from the turbines, the adults of several species including common carp, white sucker, black bass (smallmouth and largemouth bass), fallfish, and rock bass (table 3). The adults of these species have burst swimming speeds [3.5 feet per second (fps) to 14 fps; table 4] that well exceed the maximum approach velocities of the east (1.9 fps) and west powerhouses (2.1 fps). Therefore, the adult life stages of these species would be able to avoid involuntary impingement under current project operation.

The 0.75-inch trash racks that Chittenden Falls Hydro proposes to install (on a seasonal basis) would also exclude smaller individuals (sub-adults and adults larger than 4.6 inches) of the same species listed above that would be excluded by the 2.0-inch racks (table 3). In addition, the 0.75-inch trash racks would exclude adult pumpkinseed and yellow perch larger than 6.0 inches and 6.6 inches, respectively (table 3). Nevertheless, because the burst swimming speeds of the species and life stages that would be physically

excluded by the 0.75-inch trash racks ranges from 2.5 fps to 5.0 fps[34] (table 4) and exceeds the maximum approach velocities at both powerhouses, there appears to be little risk of impingement mortality at the project under both existing and proposed project operation.

Although numerous species could physically fit through both the 0.75-inch and 2.0-inch trash racks (table 3), juvenile tessellated darter and juvenile shiner species are the only species likely to be entrained because their burst swimming speeds (1.2 fps to 1.3 fps, table 4) are lower than the maximum approach velocities at the powerhouses. However, given their small body size, juveniles of these species in the 2-inch to 3-inch size range should experience high survival through the turbines, exceeding 89 percent based on the blade strike model described above. Therefore, entrainment mortality should be minimal under both the existing and proposed project operation and would not be expected to adversely affect resident fish populations inhabiting the project impoundment.

Eelway Operation and Maintenance

To maintain the effectiveness of fish passage facilities, fishways need to be properly operated and maintained. Most fishways require routine maintenance to ensure they operate effectively.

As described in section 3.3.1.3 of the Settlement Agreement, Chittenden Falls Hydro proposes to submit for approval, to FWS and New York DEC, an eelway operation and maintenance plan. The plan would include a description of the project and its fisheries, an implementation schedule for the eelways, and operation and maintenance procedures. By February 15 of each of the first 3 years following the initial installation and operation of the eelways, the licensee would provide an annual report (eelway operation and maintenance report) to FWS and New York DEC that includes: (1) a summary of the current state of the eelways (e.g., their structures and associated flows), (2) the dates eelways were installed each year (including any deviations or issues), (3) any newly available fisheries data, and (4) any necessary or recommended changes to the eelway operation and maintenance plan.

[34] For this analysis, we assumed the burst swimming speeds of 'sub-adults' excluded from the 0.75-inch trash racks ranged between the upper end of juvenile swimming speeds reported in table 6 and the lower end of adult swimming speeds reported in the table.

Table 4. Burst swimming speeds of juvenile and adult resident fish species present in the project impoundment (Source: staff).

Species	Burst Swimming Speed of Juveniles (fps)	Burst Swimming Speed of Adults (fps)
Common carp	2.6[a]	4.0-14.0[b]
White sucker/fallfish[c]	2.4-3.8[d]	5-10[b]
Smallmouth bass/ largemouth bass	2.0-3.2[a,e,f]	3.5-5.6[g]
Yellow perch[h]	2.5[e,i]	5.5[e,j]
Dace (longnose and eastern blacknose[k])	3.4[l]	4.4[l]
Pumpkinseed/ rock bass[m]	2.6[n]	4.3[o]
Shiners (common and spottail) and cutlips minnow[p]	1.3[g]	4.5[g]
Tessellated darter[q]	1.2[r]	2.64[r]

[a] Katopodis and Gervais, 1991
[b] Bell, 1991
[c] using white sucker as a surrogate species
[d] Peake, 2008
[e] estimated using the relationship in Bell, 1991 that the ratio of sustained to burst swim speeds is 0.5
[f] Kolok, 1992
[g] Peake and Farrell, 2004
[h] using walleye as a surrogate species
[i] Jones et al., 1974
[j] Peake et al., 2000
[k] using longnose dace as a surrogate species
[l] Aedo et al., 2009
[m] using bluegill as a surrogate species for both pumpkinseed and rock bass
[n] Leavy and Bonner, 2009
[o] Webb, 1978
[p] using common shiner as a surrogate species for spottail shiner and cutlips minnow
[q] using greenside darter as a surrogate species
[r] https://www.fs.fed.us/biology/nsaec/fishxing/fplibrary/Layher-1993.pdf

As evidenced by their execution of the Settlement Agreement, FWS and New York DEC support Chittenden Falls Hydro's proposed eelway operation and maintenance plan. While generally consistent with the plan proposed in the Settlement Agreement, Interior's section 18 prescription for an eelway operation and maintenance plan is more detailed and requires that general schedules and procedures be provided for the following: (1) regular maintenance, including debris removal procedures, that would be used to keep the eelways in proper working order; (2) seasonal installation dates as well as operation and maintenance procedures for the eel ladder, including information on the disposition of any captured eels (e.g., release location and methods) and a description of any collection tanks that may be included in the eel ladder design; (3) seasonal installation dates and maintenance procedures for the 0.75-inch trash racks; (4) seasonal operation and maintenance procedures for the downstream eel passage structures (e.g., downstream bypasses) including attraction flows and the status of plunge pools downstream of the eelway exits; and (5) annual reporting[35] and emergency exceptions.

Staff Analysis

An eelway operation and maintenance plan, as proposed by Chittenden Falls Hydro, with the additional provisions and details required by Interior (e.g., including annual reporting beyond the first 3 years the eelways are operational), would help ensure the eel ladder and downstream eel passage system are functioning as designed and serving their intended purpose. In addition, filing the plan with the Commission for approval, and including in the plan, provisions for annual reporting to the Commission of the Interior's requirements (e.g., annual installation dates of the eelways), would help ensure that any eelways required to be installed or constructed at the project would operate during the appropriate times of the year and with the appropriate conveyance and attraction flows.

Trash Rack Installation and Monitoring

As described in section 3.3.1.1 of the Settlement Agreement, Chittenden Falls Hydro proposes to develop a trash rack installation and monitoring plan. The plan would be developed at least 3 months prior to the initial installation of the seasonal trash racks and would include a reporting mechanism for the licensee to notify the resource agencies when the seasonal trash rack installation is completed each year, as well as procedures to be followed if the installation is delayed by weather, flow conditions, or other factors.

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[35] We interpret Interior's annual reporting requirement to apply to the entire term of any subsequent license issued for the project, not just for the first 3 years following installation and operation of the eelways, as proposed by Chittenden Falls Hydro in the Settlement Agreement.

As evidenced by their execution of the Settlement Agreement, FWS and New York DEC support Chittenden Falls Hydro's proposed trash rack installation and monitoring plan. Interior's section 18 prescription for a trash rack installation and monitoring plan is consistent with the plan proposed in the Settlement Agreement, and requires that FWS and New York DEC be consulted regarding any problems with the seasonal installation, operation, and maintenance of the trash racks such as delayed installation due to high flows, recurring problems with ice build-up, or broken trash rack components that cannot be replaced in a timely manner.

Staff Analysis

The development of a trash rack installation and monitoring plan, in consultation with FWS and New York DEC, and filed with the Commission for approval, would help the Commission determine compliance with the required operation periods of any seasonal trash racks required in any subsequent license issued for the project. The plan would also ensure that Chittenden Falls Hydro consults with the resource agencies regarding any potential problems it encounters with the installation and maintenance of any required seasonal trash racks, which could help avoid or more easily rectify such problems in the future.

Eelway Design and Modifications

As described in section 3.3.1.2 of the Settlement Agreement, Chittenden Falls Hydro proposes to undertake post-licensing measurements or engineering calculations to ensure that the eel ladder and downstream eel passage system meet FWS's fish passage engineering design criteria[36] including, but not limited to, velocities, flows, and plunge pool depths. Based on these measurements or calculations, Chittenden Falls Hydro would make reasonable modifications to the design, location, and/or flows associated with the eelways, if required by FWS or New York DEC, in order to protect American eel moving through the project area.

As evidenced by their execution of the Settlement Agreement, FWS and New York DEC support Chittenden Falls Hydro's proposal to conduct post-licensing measurements or engineering calculations to ensure the eelways meet FWS fish passage engineering design criteria; and to require reasonable modifications to the design of the eelways, if necessary, to protect American eels moving through the project area. Interior's section 18 prescription for post-licensing measurements and/or engineering calculations and possible modifications to the eelways (if deemed necessary), are consistent with the Settlement Agreement.

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[36] *Supra* note 14.

Staff Analysis

The post-licensing measurements and/or engineering calculations that Chittenden Falls Hydro proposes, and Interior requires, could be based on, or obtained from the: (1) as-built drawings that would be filed with the Commission for any eelways it authorizes in any subsequent license issued for the project, or (2) annual reports filed under the eelway operation and maintenance plan described above. Specifically, the dimensions of the eelway structures provided in the as-built drawings could be used to calculate the expected velocities (e.g., approach velocities upstream of the seasonal trash racks) and plunge pool depths. Also, verification of the operational flows (e.g., attraction and conveyance flows) required at the eelways could be obtained from the annual operation and maintenance reports filed as part of the eelway operation and maintenance plan, as these reports would include information on the status of the eelways, including their associated flows. Thus, there appears to be little benefit of conducting post-licensing field measurements or engineering calculations of flows, depths, and velocities at the eelways given that this information would be readily available or attainable through other means.

3.3.2.3 Cumulative Effects on Aquatic Resources

Water Quantity

Continuing to operate the project in a run-of-river mode, as proposed by Chittenden Falls Hydro, would not result in any appreciable storage of water, as outflows from the project would approximate inflows. If a total station trip occurs, there would be little disruption in downstream flows, even during low-flow conditions, as spillage (into the bypassed reach) would occur almost immediately under Chittenden Falls Hydro's proposal to maintain the impoundment near the top of the flashboards (the minimum flow would still be provided through the flashboard notches until spillage starts). As such, there is no indication that continuing to operate the project as proposed by Chittenden Falls Hydro would add to any cumulative effects on water quantity that have occurred or may occur in the future due to any new activities in Kinderhook Creek.

Water Quality

As described above in section 3.3.2.1, *Affected Environment, Water Quality*, water quality conditions at the project under current project operation, including a 15-cfs minimum flow into the bypassed reach, are largely consistent with state water quality standards, as there was only one day during the summer of 2019, which was warmer and drier than average, that DO levels (in the bypassed reach) were below the state's daily average DO standard of 5.0 mg/L. Although Chittenden Falls Hydro proposes to increase the minimum flow in the bypassed reach to 25 cfs, it is unlikely this small increase in flow would improve water quality conditions in the bypassed reach, which are already largely consistent with state water quality standards. Therefore, Chittenden Falls Hydro's

proposal to continue its current mode of operation and increase the minimum flow in the bypassed reach to 25 cfs, should maintain, but may not necessarily enhance, the water quality conditions that exist at the project. As such, the project's contribution to cumulative effects on water quality in Kinderhook Creek would be minimal.

American Eel Migration

Restoration efforts to recover the depleted stock of American eel are ongoing and include efforts to improve upstream and downstream passage opportunities for eels in order to increase the number of adults that are able to migrate from freshwater and estuarine habitats to the ocean to spawn (i.e., increased spawning escapement), which in turn, could help curb further declines in juvenile recruitment and overall stock abundance (ASMFC, 2008). As described in section 3.3.2.2, *Environmental Effects, Upstream Passage of American Eel*, Chittenden Falls Hydro's proposal to install an eel ladder at the project would improve access to growth and feeding habitats upstream of the project dam. In combination with the upstream eelway required to be installed at the Stuyvesant Falls Project, the installation of an eel ladder at Chittenden Falls would increase access, especially for elvers, to an additional 9.5 miles of tributary habitat and would likely increase eel abundance upstream of the projects. When these eels mature into silver eels and attempt to migrate downstream to the ocean to spawn, they would be protected from entrainment mortality by the downstream eel passage systems required to be installed at the Stuyvesant Falls Project and proposed to be installed at the Chittenden Falls Project. As described in section 3.3.2.2, *Environmental Effects, Downstream Passage of American Eel*, the downstream eel passage system proposed to be installed at Chittenden Falls should increase spawning escapement from the Stockport-Kinderhook Creek system by at least 50 percent. Therefore, we conclude that Chittenden Falls Hydro's proposals to install upstream and downstream eelways for American eel at the project, in combination with eel passage and protection activities at nearby hydropower projects, is consistent with ongoing restoration efforts and would result in an overall positive cumulative effect on American eel migration and habitat access in the Hudson River and its tributaries (including Kinderhook Creek).

3.3.3 Terrestrial Resources

3.3.3.1 Affected Environment

The Chittenden Falls Project is located within the Lower New England-Northern Piedmont ecoregion, a diverse community that is locally defined by mixed mesophytic forests and a diverse habitat community (TNC, 2003). Roadways, including paved public roads and project access roads, and unpaved roads, are present in the vicinity of the project. Surrounding land uses are dominated by agriculture and moderate residential development.

Upland habitat surrounding the project facilities is primarily deciduous forest with a shrubby to open understory. Consistent with the hemlock-pine-hardwood forest habitat in the project area, mature trees that are likely to be present include deciduous forest species such as white ash, white and black birch, various oak and hickory species, and red and sugar maple, and coniferous species such as white pine and eastern hemlock. Wildlife in the project area is abundant and the upland and wetland habitat within the project supports a variety of species, including those tolerant of human development and activity (i.e., raccoon, coyote, eastern cottontail rabbit, gray fox, and eastern gray squirrel, and numerous passerine and non-passerine bird species), game species such as white-tailed deer, and species associated with wetland habitat (i.e., various reptile, amphibian, waterfowl and marsh bird species, and mammals such as beaver).

The project boundary encompasses approximately 26 acres and most of the land within the project boundary is open water/riverine, with forested banks transitioning to agricultural and residential land away from the immediate riparian zone. Upstream of the project's dam, moderately gentle topography on the east side of the river channel allows for a fairly extensive floodplain. On the opposite bank, topography is steeper, significantly limiting the lateral extent of the active floodplain. Downstream of the project, channel banks are relatively steep for approximately 0.25 mile, which effectively contain high flows to within the channel boundaries. Past this point, the bank gradient becomes more moderate and overbank flow conditions are possible.

Wetlands and Riparian Habitat

According to the National Wetland Inventory data, riverine and palustrine forested wetlands occur in the project area, with the primary wetland resource being Kinderhook Creek, which is classified as upper perennial, permanently flooded, riverine habitat with an unconsolidated bottom. Of vegetated wetlands within the immediate project area, there is a single palustrine forested wetland that is less than 1 acre in size. This habitat, which can be found in the small mid-channel island within the project impoundment, supports a palustrine, forested, broad leaved deciduous, temporarily flooded wetland community. Riparian habitat within the project area is limited in lateral extent by topography and/or adjacent land use patterns. Tree species present within these riparian habitats include red maple, green ash, and slippery elm. Other species common to riparian forests within the region include basswood, sugar maple, sycamore, cottonwood, boxelder, and silver maple (Knab-Vispo and Vispo, 2010).

Invasive Plant Species

There are over 92 invasive plant species known to occur in Columbia County (Capital Region PRISM, undated). While no invasive species have been officially documented at the project, invasive species that might be present within the project area include autumn olive, black swallow-wort, buckthorns, Canadian thistle, common reed

grass, flowering rush, garlic mustard, giant hogweed, Japanese knotweed, Japanese stiltgrass, lesser celandine, mile-a-minute, mugwort, oriental bittersweet, pale swallow-wort, purple loosestrife, wild parsnip, yellow iris, yellow floating heart, variable-leaf water milfoil, European frogbit, hydrilla, fanwort, Eurasian water milfoil, and curly-leaf pondweed. Based on the degree of development surrounding the project facilities, these species are likely to occur adjacent to project structures and within the edge or understory of adjacent forest habitat. Control methods for these species include a variety of mechanical and chemical treatments, depending on the age and size of the infestation.

Rare and State-listed Species

Bald eagle

The bald eagle (*Haliaeetus leucocephalus*) is protected under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act, which prohibit the "take" of eagle eggs, nests, and offspring, and can also include substantially disturbing normal breeding and feeding activities, except as permitted by regulation. Bald eagles are listed as a threatened species in New York State and are protected under New York State law (New York Natural Heritage Program, 2020a).

Bald eagles typically forage over water and other open habitats. Bald eagles nest in mature trees and snags and on cliffs, rocks, and artificial structures, generally within 1 mile of water. In New York State, nesting activity occurs between December and June (New York Natural Heritage Program, 2020a).

To date, no bald eagle nests have been identified within the project boundary; however, bald eagle breeding activity within New York State has been expanding since the 1980s, and suitable bald eagle breeding habitat exists within the project boundary. Bald eagles are known to occur along Kinderhook Creek during both breeding and wintering periods. At the project, observations of both adult and juvenile eagles occur regularly throughout the year when the river is free of ice.

3.3.3.2 Environmental Effects

In SD1, Commission staff identified three terrestrial resource issues associated with relicensing the Chittenden Falls Project, including the effects of continued project operation and maintenance on: (1) upland habitat and associated wildlife; (2) wetland habitat and associated wildlife; and (3) state-listed species (e.g., bald eagle). SD1 also identified the effects of construction of the proposed eel passage structure on terrestrial resources as a resource issue.

The Commission received no substantive comments regarding the effects of project operation or maintenance on terrestrial resources, other than on Chittenden Falls

Hydro's proposed plans regarding the management of invasive plant species and bald eagles filed with its license application. Therefore, staff analyzed the effects associated with these two plans.

Invasive Plant Species Management Plan

As described in section 3.8 of the Settlement Agreement, Chittenden Falls Hydro proposes to implement an Invasive Plant Species Management Plan, filed as Appendix B of the Settlement Agreement. The Invasive Plant Species Management Plan includes guidelines and BMPs for Chittenden Falls Hydro to follow to minimize the likelihood of spreading invasive plant species, including BMPs for construction or maintenance and training workers about the importance of infestation prevention.

As signatories to the Settlement Agreement, and in letters filed April 20, 2020, and May 4, 2020, respectively, both Interior and New York DEC support implementation of Chittenden Falls Hydro's proposed Invasive Plant Species Management Plan. In a letter filed May 11, 2020, the New York State Council of Trout Unlimited also provided its full support to the measures contained within the Settlement Agreement.

Staff Analysis

Operation and maintenance of the Chittenden Falls Project could result in the introduction or spread of terrestrial and aquatic invasive plant species within the project boundary. However, employing measures to minimize the introduction and spread of invasive plants during operation and maintenance activities, such as those included within the proposed Invasive Plant Species Management Plan, would minimize the introduction or spread of invasive plant species within the project boundary.

Bald Eagle Protection

As described in section 3.7 of the Settlement Agreement, Chittenden Falls Hydro proposes to implement the Northern Long-eared Bat and Bald Eagle Protection Plan, filed as Appendix A of the Settlement Agreement.[37] The plan includes measures to minimize project effects on bald eagles, including: (1) performing tree-clearing and construction activities in accordance with applicable regulations and guidance; (2) prior to tree clearing or construction activities within the project boundary, or in areas adjacent to the project boundary, as a result of activities performed or required by the licensee, observe the area for bald eagle nests, and notify FWS and New York DEC within 72 hours of discovery if a bald eagle nest is discovered within 660 feet of the activity's

[37] Measures within this plan addressing the federally listed threatened northern long-eared bat are evaluated below in section 3.3.4, *Threatened and Endangered Species*.

limit of work; (3) during the nesting season (January 1 through September 30), no tree clearing would occur on property owned by Chittenden Falls Hydro; (4) no removal of overstory trees would occur within 330 feet of any identified nest, year-round; (5) if a visual buffer (e.g., trees, topography, structures, etc.) exists between an identified nest and a proposed construction activity, meaning the activity is not visible from the nest, such activity still should not occur within 660 feet of the nest site, year-round; (6) if no visual buffer exists between an identified nest and a proposed construction activity, meaning an activity may be visible from the nest depending on site conditions, such activity should be at least 0.25 mile from the nest site, year-round; (7) Chittenden Falls Hydro would consult with the New York DEC and the FWS regarding tree clearing or construction activities that cannot meet the conditions of the plan; and (8) Chittenden Falls Hydro would notify New York DEC and FWS within 1 business day regarding any emergency tree clearing or construction activities that were completed in response to, or avoidance of, any public safety concerns outside of Chittenden Falls Hydro's control.

In its 10(j) recommendations, Interior recommends that Chittenden Falls Hydro implement the Bat and Bald Eagle Protection Plan. As a signatory to the Settlement Agreement, and as stated in its May 4, 2020 letter, New York DEC supports implementation of the proposed plan. In a letter filed May 11, 2020, the New York State Council of Trout Unlimited also provided support for the measures within the Settlement Agreement.

Staff Analysis

Bald eagles have been regularly observed at the project and may nest at the project in the future. Project maintenance would result in limited ground disturbance within the project boundary, including the potential removal of trees during periodic maintenance. However, notifying New York DEC and FWS prior to any tree-clearing activities if a bald eagle nest is located at the project, and incorporating measures to minimize habitat disturbance surrounding active nests on project lands, such as those included in the proposed plan, would minimize effects to bald eagles.

3.3.4 Threatened and Endangered Species

3.3.4.1 Affected Environment

According to FWS's Information for Planning and Consultation (IPaC) system, one federally listed species, the endangered Indiana bat,[38] has the potential to occur within the project boundary. In addition, the project is located within the range of the federally listed threatened northern long-eared bat (*Myotis septentrionalis*) (FWS, 2019)

[38] *See* official species list memorandum, filed November 10, 2020.

and both section 3.8 of the Settlement Agreement and Interior's April 30, 2020 letter indicate this species could occur within the project impact area. No critical habitat for any federally listed threatened and endangered species occurs within project-affected lands.

Indiana Bat

The federally endangered Indiana bat is native to the northeastern and midwestern U.S., including New York. This species typically hibernates in caves and abandoned mineshafts from October through April, and forages and roosts between April and August in riparian, bottomland, or upland forest, and old fields or pastures with scattered trees. Males often remain active later into the season, though most hibernate by November. There are 17 known hibernacula in New York State (New York Natural Heritage Program, 2020b). Females congregate in maternity colonies during early May to late June to bear and raise young, in hollow trees that are alive or dead and often exposed to direct sunlight in upland and riparian forests, pastures, and open wetlands (DeGraaf and Yamasaki 2001).

Indiana bats roost in dead standing trees with loose bark; preferred species include shagbark hickory, mature white oaks, and other species with loose bark (DeGraaf and Yamasaki, 2001). Individuals may select several trees in a general area and often use one as a primary roost and others as alternate roosts. Optimum foraging habitat includes mature trees that overhang the water by more than 3 meters.

The Chittenden Falls Project is located in Columbia County, New York, and Indiana bat maternity colonies have been identified in Colombia and neighboring counties (New York Natural Heritage Program, 2020b). No Indiana bat hibernacula are known to exist in Columbia County, but several are known to exist in neighboring counties (two in Albany County, northwest of the project, and seven in Ulster County, southwest of the project) (New York Natural Heritage Program, 2020b). Threats to the survival of Indiana bats include human disturbance (largely at unprotected cave sites), predation by mammals, loss of foraging habitat (particularly old fields and hayfields), collisions at wind energy developments, and natural changes in cave environments that alter conditions. Indiana bats are known to be susceptible to white-nose syndrome,[39] and have experienced severe mortality as a result. White-nose syndrome was first identified at Howes Cave, approximately 40 miles northwest of the Chittenden Falls Project

[39] White-nose syndrome is the main threat to the northern long-eared bat and has caused a precipitous decline in bat numbers (in many cases, 90 to 100 percent) where the disease occurs.

(Blehert et al., 2009), and severe white nose syndrome-related mortality of Indiana bats and other *Myotis* species has occurred within this region since this time (FWS, 2018a).

Northern long-eared bat

FWS listed the northern long-eared bat as threatened on May 4, 2015 (FWS, 2015), and determined on April 27, 2016, that designating critical habitat is not prudent (FWS, 2016a).

The northern long-eared bat is a medium-sized bat species (3 to 3.7 inches in length) with longer ears than other species in the *Myotis* genus (FWS, 2015). The species' range includes 37 states, including most of the central and eastern United States, as well as the southern and central provinces of Canada, coinciding with the greatest abundance of forested areas.

The northern long-eared bat is found in a variety of forested habitats in the summer season. During this time, bats roost singly or in colonies underneath bark, in cavities, or in crevices of both live and dead trees. In the fall season, northern long-eared bats leave their forested habitat to hibernate in caves, mines, and similar habitat. The bats arrive at hibernacula between August and September, enter hibernation between October and November, and emerge from hibernacula between March and April. Hibernacula and surrounding forest habitats play important roles in the bat's life cycle beyond the time when bats are overwintering, including for fall-swarming[40] and spring-staging[41] activities. Reproduction is limited to one pup per year in late spring. As such, bat populations can be slow to rebound from anthropogenic and naturally occurring mortality events.

On January 14, 2016, FWS issued a final 4(d) rule that prohibits the following activities in areas of the country impacted by white-nose syndrome: incidental take within a hibernation site; tree removal within 0.25 mile of a known, occupied

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[40] Fall-swarming occurs between summer and winter hibernation. The purposes of swarming behavior include introduction of juveniles to potential hibernacula, copulation, and gathering at stop-over sites on migratory pathways between summer and winter regions.

[41] Spring-staging occurs 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).

hibernaculum; and cutting or destroying known occupied maternity roost trees, or any other trees within 150 feet of that maternity roost tree, during the pup-rearing season (June 1 through July 31) (FWS, 2016b). On January 5, 2016, FWS developed an optional streamlined consultation framework that allows federal agencies to rely on a programmatic biological opinion on FWS's final 4(d) rule to fulfill section 7(a)(2) consultation requirements for northern long-eared bat (FWS, 2016c).[42]

The Chittenden Falls Project is located in Columbia County, which is within the white-nose syndrome zone and the northern long-eared bat species range (FWS, 2020). There are no known occurrences of northern long-eared bats within the project boundary. However, there are confirmed winter occurrences of northern long-eared bats in Columbia County, and in Greene County, directly to the west of the project (New York DEC, 2018).

3.3.4.2 Environmental Effects

To date, no Indiana or northern long-eared bats, occupied maternity roost trees, or hibernacula have been identified within the project boundary or within 0.25 mile of the project boundary. However, lands within the project boundary may provide suitable summer roosting and feeding habitat, as well as suitable wintering habitat, for both the Indiana bat and the northern long-eared bat. Routine maintenance in the project boundary could involve the removal of trees that provide summer roosting habitat used by both species of bats.

As described in section 3.7 of the Settlement Agreement, Chittenden Falls Hydro proposes to implement the Northern Long-eared Bat and Bald Eagle Protection Plan, filed as Appendix A of the Settlement Agreement. The plan includes the following provisions regarding the northern long-eared bat: (1) if a roost tree or hibernaculum is discovered within or immediately adjacent to the project boundary, Chittenden Falls Hydro must inform FWS and New York DEC within 72 hours of discovery; (2) prior to

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[42] FWS developed a key to help federal agencies determine if they can rely on the streamlined section 7 consultation in the 4(d) rule or if their actions may cause prohibited incidental take that requires separate section 7 consultation (FWS, 2016d). FWS's key considers whether the federal action: (1) may affect the northern long-eared bat; (2) involves the purposeful take of northern long-eared bats; (3) is located inside the white-nose syndrome zone; (4) will occur within a hibernaculum or alter the entrance/environment of a hibernaculum; (5) involves tree removal; (6) involves the removal of hazardous trees; and (7) includes (a) the removal of an occupied maternity roost tree or any trees within 150 feet of a known occupied roost tree from June 1 through July 31, or (b) the removal of any trees within 0.25 mile of a hibernaculum at any time of year.

any tree clearing on property owned by Chittenden Falls Hydro, or as a result of activities performed or required by Chittenden Falls Hydro within or adjacent to the project boundary, Chittenden Falls Hydro would observe the area to be cleared for occupied maternity roost trees, roosting trees, sloughing bark, or dead limbs that can provide northern long-eared bat habitat and, if such occupied trees, occupied bark, or occupied limbs are discovered, Chittenden Falls Hydro would consult with the New York DEC and FWS prior to initiating tree-clearing activities; (3) Chittenden Falls Hydro may remove hazard trees that it has a reasonable basis to believe pose a material threat to human life or property at any time without prior consultation with the New York DEC and FWS and inform New York DEC and FWS if any bats are observed; (4) Chittenden Falls Hydro may remove any trees less than 3 inches in diameter at breast height (dbh) at any time without prior consultation with, or notification to, New York DEC and FWS, so long as the removal would not damage any adjacent trees that are larger in size; (5) Chittenden Falls Hydro may remove suitable roost trees greater than or equal to 3 inches dbh between November 1 and March 31 without prior consultation with or notification to New York DEC and FWS; (6) should Chittenden Falls Hydro find it necessary to remove or be required by the Commission to remove suitable roost trees greater than or equal to 3 inches dbh between April 1 and October 31, Chittenden Falls Hydro would consult with the FWS pursuant to ESA;[43] and (7) should Chittenden Falls Hydro find it necessary to remove, or be required by the Commission to remove, suitable roost trees greater than or equal to 3 inches dbh between April 1 and October 31, Chittenden Falls Hydro would consult with New York DEC and FWS and such action must be approved by New York DEC and FWS.

In its 10(j) recommendations, filed April 30, 2020, Interior recommends that Chittenden Falls Hydro implement the Northern Long-eared Bat and Bald Eagle Protection Plan.[44] As a signatory to the Settlement Agreement, and as stated in its May 4, 2020 letter, New York DEC supports implementation of the proposed plan. In a letter filed May 11, 2020, the New York State Council of Trout Unlimited also provided its full support to the measures contained within the Settlement Agreement.

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[43] The proposed plan notes that currently, an incidental "take" or "taking" is exempted outside of 150 feet from known roosts and 0.25 mile from hibernacula under the FWS 4(d) rule for the northern long-eared bat.

[44] In its April 30, 2020 letter, Interior refers to this plan as the Bat and Bald Eagle Protection Plan. For consistency with the Settlement Agreement, this EA refers to the proposed plan as the *Northern Long-eared* Bat and Bald Eagle Protection Plan.

Staff Analysis

Regarding the northern long-eared bat, seasonal limits on tree-clearing activity for trees 3 inches dbh or larger, consultation with FWS and New York DEC regarding implementation of Chittenden Falls Hydro's proposed plan and certain tree-clearing activities during the northern long-eared bat's active period, and reporting observations of bats during any removal of hazard trees, is likely to minimize effects to this species. Staff concludes that, while continued operation and maintenance of the project may affect the northern long-eared bat, any incidental take that may result from these activities is not prohibited by the final 4(d) rule. Further, in its April 30, 2020 letter, Interior determined that the project is not likely to adversely affect the northern long-eared bat, and no further ESA consultation is required.

While no occupied maternity roost trees or hibernacula have been identified within the project boundary or within 0.25 mile of the project boundary, the endangered Indiana bat has the potential to occur at the project. Although Chittenden Falls Hydro's proposed Northern Long-eared Bat and Bald Eagle Management Plan does not specifically address the Indiana bat, most of the measures contained within the plan would also protect that species. However, the proposed plan currently states that clearing suitable roost trees with a dbh of greater than or equal to 3 inches can occur without consultation between November 1 and March 31 (item 5 above), and if Chittenden Falls Hydro must remove suitable roost trees greater than or equal to 3 dbh between April 1 and October 31 (items 6 and 7 above), it would consult with FWS and New York DEC for approval. For the Indiana bat, FWS recommends that clearing of potential roost trees within the Indiana bat's summer range should occur from October 1 through March 31 (FWS, 2018b). Therefore, because maternity colonies are known to occur within Columbia County, revising the proposed plan to include reference to the Indiana bat, and changing the dates when clearing can occur in item 5 to October 1 through March 31 and in items 6 and 7 to April 1 through September 30 would also minimize effects to Indiana bat. Staff concludes that, with implementation of a revised Bat and Bald Eagle Protection Plan, continued operation and maintenance of the Chittenden Falls Project is not likely to adversely affect the Indiana bat.

3.3.5 Recreation Resources

3.3.5.1 Affected Environment

Recreation

Regional and Local Recreation

The Chittenden Falls Project is located in the northern end of what the New York State Office of Parks, Recreation, and Historic Preservation (New York Parks) calls the Taconic Region. This region offers a variety of recreation opportunities within a

relatively short drive of the project. Within an hour of the project is Taconic State Park, Lake Taghkanic State Park, Beebe Hill State Forest, and Columbia County Park, which provide a variety of recreational activities, including camping, hiking, biking, swimming, fishing, hunting, cross-country skiing, and snowmobile trails (New York Parks, undated). The project is located on Kinderhook Creek, which provides whitewater rafting and kayaking opportunities upstream and downstream of the project. American Whitewater divides the Kinderhook Creek into three distinct reaches, and the Chittenden Falls Project is located within the Valatie to Columbiaville reach, which is the lower portion of Kinderhook Creek. This lower reach starts in the town of Valatie (meaning "Little Falls"), drops over a hundred feet in Stuyvesant (originally Glencadia meaning "creek region of simple pleasures"), and continues to the Route 9 Bridge in Columbiaville. Due to numerous large drops, however, this reach is not run in its entirety. The stretch from Stuyvesant Falls, 2 miles upstream of the project, through Chittenden Falls, is impassable due to the falls, so whitewater rafting and kayaking generally occur on the upper section, above Stuyvesant Falls, and below the project, from Rossman Road to the town of Stockport (American Whitewater, undated).

Kinderhook Creek also is used for recreational fishing and New York DEC stocks brown trout in Kinderhook Creek at the towns of Chatham, Kinderhook, and New Lebanon, which are all located upstream of the Chittenden Falls Project.

The Hudson River Valley Greenway is currently working toward construction of the Empire State Trail – Albany Hudson Electric Trail (AHET) segment. The AHET Trail will be a shared-use bicycling and pedestrian trail along the former 35-mile Albany-Hudson Electric Trolley corridor from Hudson, New York to Rensselaer, New York, running through Rensselaer and Columbia Counties, including a segment to be located on the northern bank of Kinderhook Creek near the Chittenden Falls Project. While the trail will not cross the project boundary, it will provide views of Chittenden Falls along the segment that crosses Rossman Road, downstream of the project. When complete, the trail, which is currently under construction, will be part of the Empire State Trail,[45] providing a key link between the Capital Region and the Mid-Hudson Valley.

3.3.5.2 Environmental Effects

Recreation

Chittenden Falls Hydro is not proposing any recreation-related protection, mitigation, or enhancement measures for the project. Section 3.4 of the Settlement

[45] The Empire State Trail is currently under construction and when complete will create a 750-mile biking and walking trail from New York City to Canada and from Albany to Buffalo.

Agreement states that recreational opportunities and safe public access on Kinderhook Creek are limited in the vicinity of the project due to public safety concerns and site control limitations; therefore, no recreation facilities are included in the current license. The Settlement Agreement does not propose any recreation facilities, nor does it require Chittenden Falls to monitor recreation use at the project.

No recommendations for access improvements or recreational amenities were received from local, state, or federal entities.

Staff Analysis

The project's impoundment is small and offers no public access. Terrain along the bank of the river in the project area is generally steep, resulting in limited options for safe access. According to Chittenden Falls Hydro, the areas where access can be accomplished safely are currently utilized for project operation and maintenance activities. In addition, multiple land and water-based recreation opportunities exist in and around the project and numerous nearby city and state parks offer a variety of land-based and water-based recreation activities for the public to enjoy. Further, there has not been a demonstrated need or a request by any stakeholders for the addition of recreation facilities at the project. Thus, current recreation access at and near the project appears to be meeting the demand for desired outdoor experiences.

3.3.6 Cultural Resources

3.3.6.1 Affected Environment

Section 106 of the NHPA requires that the Commission take into account the effects of its actions on historic properties and afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on the undertaking.[46] Historic properties are those that are listed or eligible for listing in the National Register of Historic Places (National Register). The regulations implementing section 106 of the NHPA also require that the Commission seek concurrence with the New York State Historic Preservation Officer (New York 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

[46] An undertaking means "a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; and those requiring a Federal permit, license, or approval." 36 C.F.R. § 800.16(y) (2020). Here, the undertaking is the potential issuance of a subsequent license for the Chittenden Falls Project.

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 in the National Register. Cultural resources represent things, structures, places, or archaeological sites that can be either prehistoric or historic in origin. In most cases, cultural resources less than 50 years old are not considered historic.

Areas of Potential Effects

Pursuant to section 106 of the NHPA, the Commission must take into account whether any historic property could be affected by a new license within a project's area of potential effects (APE). The APE is defined as the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. For the Chittenden Falls Project, the APE includes the lands enclosed by the project boundary.

Cultural History Overview

New York's Hudson River Valley was at the forefront of the Industrial Revolution and its nineteenth century waterways were dotted with the sluiceways, penstocks, waterwheels, weirs, minor dams, and turbines that helped power innovation at the time. In 1824, Kinderhook Creek was cited as "one of the best streams for mills in the United States" (Skidmore College, undated). At Chittenden Falls, hydropower has been present since 1809 when George Chittenden developed a paper manufacturing plant on the west bank of the falls on Kinderhook Creek. By 1816, a nail manufacturing plant was developed on the east bank of the falls, and in the 1930s, another paper mill was constructed on the east bank. By the early 1900s, the mills had gone through several owners and the mill on the west bank of the falls had fallen into disrepair. In 1924, the Midvale Paper Board Company, one of the last paper companies to operate in the area, purchased the paper mill on the east side of Chittenden Falls. According to Skidmore College, much of the present structure was built in 1928 by Midvale Paper Board Company. Through the 1960s, the mill was operated by several owners until it was destroyed by a fire in 1962. It then sat empty until it was purchased in 1979 by Paul and Adelaide Eckhoff, who founded the Chittenden Falls Dam Corporation and restored the hydropower facility. The renovations on the east side of the dam were completed in 1981, and a new turbine system was constructed on the west side of the falls in 1988. The Eckhoff Family operated the project through 2006. It then passed through several different owners until Chittenden Falls Hydro purchased the project and developed a partnership to sell the power to Skidmore College (Skidmore College, undated).

Cultural Resources Investigations

Chittenden Falls Hydro completed a review of the New York SHPO's Cultural Resources Information System (CRIS) to identify any potential concerns related to archaeological, historic, or cultural resources that may be affected by relicensing the

project. Results of the CRIS review indicate there are no archaeological, historic, or cultural properties listed for inclusion within or adjacent to the project's APE.

3.3.6.2 Environmental Effects

Project-related effects on cultural resources within the APE can result from modifications to project facilities or project operation; project-related ground-disturbing activities; construction, modification, or maintenance of project recreation facilities and use of such facilities by visitors; project-induced shoreline erosion;[47] and vandalism. Current project operation is not affecting cultural resources within the APE. Chittenden Falls Hydro is not proposing to modify project operation or conduct any project-related land-clearing or land-disturbing activities within the APE that would impact any archaeological site, historic cemetery, architectural resource, or area that has been identified as having moderate to high potential for containing archaeological sites; therefore, Chittenden Falls Hydro is not proposing any protection, enhancement, or mitigation measures for cultural resources.

Chittenden Falls Hydro was designated the non-federal representative to initiate section 106 consultation with the New York SHPO in a notice issued by the Commission on August 9, 2016. By letter filed November 6, 2019, the New York SHPO stated that "no historic properties, including archaeological and/or historic resources, will be affected by this undertaking."[48]

Staff Analysis

In accordance with section 106, Chittenden Falls Hydro consulted with the New York SHPO to determine the effects of project operation on cultural resources. While the Chittenden Falls Project has not been formally evaluated to determine its eligibility for the National Register, hydropower has been produced at the site for over 200 years and the current Chittenden Falls Project is almost 100 years old. While renovations were completed to the 1928 powerhouse on the east side of the dam in 1981, and a new turbine system was constructed on the west side of the falls in 1988, its principal facilities appear

[47] Project-induced shoreline erosion does not include shoreline erosion attributable to flood flows or natural phenomena, such as wind-driven wave action, erodible soils, and loss of vegetation due to natural causes.

[48] The New York SHPO's letter, dated September 5, 2019, is included in Appendix O of Chittenden Falls Hydro's Additional Information Requests and Deficiency Response filed on November 6, 2019.

to retain their integrity in form and function. As such, the project is potentially eligible for listing and, until it has been formally evaluated, should be treated as eligible.

Project effects are adverse when an activity directly or indirectly alters the characteristics of an archaeological or historic property that qualifies it for inclusion in the National Register. If there is an adverse effect, then action must be taken to avoid, mitigate, or lessen the impact. The adverse effect also must be resolved in consultation with the designated SHPO. Although the project may be eligible for listing on the NRHP, Chittenden Falls Hydro proposes to continue to operate the project in a run-of-river mode and proposes very few other modifications. Further, the New York SHPO has determined that no historic properties will be affected by this undertaking. Therefore, no adverse effects are expected, and no protection, mitigation, and enhancement measures are being proposed at this time. However, during the term of any license issued, archaeological or historic resources could be discovered during project-related activities that require ground disturbance. In the unlikely event of an unanticipated discovery, stopping any ground-disturbing activity and consulting with the New York SHPO would ensure these resources are protected.

3.4 NO-ACTION ALTERNATIVE

Under the no-action alternative, the project would continue to operate in its current manner, in a run-of-river mode with a 15-cfs minimum flow into the bypassed reach. The measures proposed by the licensee in the Settlement Agreement would not be required. As such, the project would continue to impede the upstream migration of American eel and result in high turbine mortality (at least 50 percent) of silver eels that migrate downstream through the project's powerhouses.

4.0 DEVELOPMENTAL ANALYSIS

In this section, we look at the Chittenden Falls Project's use of Kinderhook Creek for hydropower purposes to see what effect various environmental measures would have on the project's costs and power generation. Under the Commission's approach to evaluating the economics of hydropower projects, as articulated in *Mead Corp*.,[49] the Commission compares the current project cost to an estimate of the cost of obtaining the same amount of energy and capacity using a likely alternative source of power for the region (cost of alternative power). In keeping with Commission policy as described in *Mead*, 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., for 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 produces power for less than the cost of alternative power. If the difference between the cost of alternative power and total project cost is negative, the project produces 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 DEVELOPMENTAL BENEFITS OF THE PROJECT

Table 5 summarizes the assumptions and economic information we use in our analysis. This information, except as noted, was provided by Chittenden Falls Hydro in its license application and subsequent submittals. We find that the values provided by the applicant are reasonable for the purposes of our analysis. Cost items common to all alternatives include: taxes and insurance costs, net investment (the total investment in

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

power plant facilities remaining to be depreciated), cost for normal operation and maintenance, and licensing cost.

Table 5. Parameters for economic analysis of the Chittenden Falls Project (Sources: Chittenden Falls Hydro and staff).

Parameter	Value
Installed capacity	755 kW
Period of analysis	30 years
Term of financing	20 years
Net investment[a]	$1,344,250
Operation and maintenance[b]	$84,700/year
Relicensing cost	$100,414
Federal income tax rate[c]	21 percent
Local tax rate[c]	3 percent
Interest rate/discount rate[c]	8.00 percent
Cost of alternative power:[d]	
Energy value	$20.59/MWh
Capacity value	$159.70/kW-year

[a] Remaining undepreciated net investment updated to 2020.

[b] Includes insurance costs. Value provided by the applicant was updated to 2020 dollars.

[c] Estimated by staff.

[d] The Cost of Alternative Power is based on the cost of providing the same amount of generation and capacity from a natural gas-fired combined cycle plant, as reported by The U.S. Energy Information Administration (EIA), Annual Energy Outlook 2020, for the Division 2, Mid-Atlantic Region (http://www.eia.gov/outlooks/aeo/index.cfm). The total cost of alternative power is a combination of energy costs and cost for dependable capacity.

4.2 COMPARISON OF ALTERNATIVES

Table 6 compares the installed capacity, annual generation, cost of alternative power, estimated total project cost, and difference between the cost of alternative power and total project cost for each of the alternatives considered in this EA: no action, the applicant's proposal, the staff alternative, and the staff alternative with mandatory conditions.

Table 6. Summary of the annual cost of alternative power and annual project cost for the alternatives for the Chittenden Falls Project (Source: staff).

	No Action	Applicant's Proposal	Staff Alternative	Staff Alternative with Mandatory Conditions
Installed capacity	755 kW	755 kW	755 kW	755 kW
Annual generation	2,300 MWh	1,840 MWh	1,978 MWh	1,978 MWh
Dependable capacity[a]	263 kW	210 kW	226 kW	226 kW
Annual value of project power[b]	$89,355 $38.85/MWh	$71,484 $38.85/MWh	$76,845 $38.85/MWh	$76,845 $38.85/MWh
Total annual project cost (2020)[c]	$218,477 94.99/MWh	$242,107 $131.58/MWh	$240,624 $121.65/MWh	$241,158 $121.92/MWh
Difference between the cost of alternative power and project cost[d]	($129,122) (56.14/MWh)	($170,623) ($92.73/MWh)	($163,778) ($82.80/MWh)	($164,312) ($83.07/MWh)

[a] Staff estimated the dependable capacity based on annual generation.
[b] The value of power for the Chittenden Falls Project is based on the cost of alternative power in the Mid-Atlantic Region, as identified in table 5 above.
[c] All project costs were adjusted to 2020 dollars.
[d] A number in parentheses denotes that the difference between the cost of alternative power and project cost is negative, thus the project cost is greater than the cost of alternative power.

4.2.1 No-action Alternative

Under the no-action alternative, the Chittenden Falls Project would continue to operate as it does now. With an installed capacity of 755 kW and a dependable capacity of 263 kW, the project generates an average of 2,300 MWh of electricity annually. The average annual cost of alternative power would be $89,355, or about $38.85/MWh. The average annual project cost would be $218,477, or about $94.99/MWh. Overall, the project would produce power at a cost that is $129,122, or $56.14/MWh, more than the cost of alternative power.

4.2.2 Applicants' Proposals

Under the applicant's proposal, the project would have an installed capacity of 755 kW, a dependable capacity of 210 kW, and an average annual generation of 1,840 MWh, and would include proposed measures to protect and enhance environmental resources. The individual costs of these measures are in Appendix F. Under this alternative, the average annual project cost would be $242,107, or $131.58/MWh, and the cost of alternative power would be $71,484, or about $38.85/MWh. Overall, the project would produce power at a cost that is $170,623, or $92.73/MWh, more than the cost of alternative power.

4.2.3 Staff Alternative

The staff alternative would include staff-recommended additions, deletions, and modifications to the applicant's proposed environmental protection and enhancement measures (the estimated cost of each is in Appendix F). Under this alternative, the project would have an installed capacity of 755 kW, a dependable capacity of 226 kW, and an average annual generation of 1,978 MWh. The cost of alternative power would be $76,845, or about $38.85/MWh. The average annual project cost for this alternative would be $240,624, or $121.65/MWh. Overall, the project would produce power at a cost that is $163,778, or $82.80/MWh, more than the cost of alternative power.

4.2.4 Staff Alternative with Mandatory Conditions

The staff alternative with mandatory conditions includes staff-recommended measures, as well as conditions imposed on the project under Interior's section 18 prescription. This alternative includes the staff alternative with one additional measure to allow FWS personnel or its designees access to the project site and project records for the purpose of ensuring compliance with the prescription (Appendix F).

The staff alternative with mandatory conditions would have the same energy and capacity attributes as the staff alternative (i.e., installed capacity of 755 kW, dependable capacity of 226 kW, and average annual generation of 1,978 MWh). The cost of alternative power would be $76,845, or about $38.85/MWh, and the average annual project cost would be $241,158, or $121.92/MWh. Overall, the project would produce power at a cost that is $164,312, or $83.07/MWh, more than the cost of alternative power.

4.3 COST OF ENVIRONMENTAL MEASURES

Appendix F presents the cost of each of the environmental enhancement measures considered in our analysis. All costs are in 2020 dollars. We convert all costs to equal annual (levelized) values over a 30-year period of analysis to give a uniform basis for comparing the benefits of a measure to its cost.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 COMPREHENSIVE DEVELOPMENT AND RECOMMENDED ALTERNATIVE

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

Based on our independent review and evaluation of the environmental and economic effects of the proposed action and its alternatives, we selected the staff alternative as the preferred alternative for the Chittenden Falls Project. We recommend this alternative because: (1) issuing a subsequent license for the project would allow Chittenden Falls Hydro to continue to operate the project and provide a beneficial and dependable source of electric energy; (2) generation from the Chittenden Falls Project, with an installed capacity of 755 kW of electric capacity, comes from a renewable resource that does not contribute to atmospheric pollution; (3) the public benefits of this alternative would exceed those of the no-action alternative; and (4) the recommended measures would protect and enhance environmental resources affected by the project.

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

5.1.1 Measures Proposed by the Applicant

Based on our environmental analysis of Chittenden Falls Hydro's proposal in section 3.0, *Environmental Effects*, and the costs presented in section 4.0, *Developmental Analysis*, we recommend the following environmental measures proposed by Chittenden Falls Hydro to protect and enhance environmental resources, and believe these measures would be worth their cost. Therefore, we recommend the following proposed measures in any license issued for the Chittenden Falls Project:

- Operate the project in a run-of-river mode and maintain the impoundment elevation at or above the dam crest or top of the flashboards (when in place) (section 3.1 of the Settlement Agreement);

- Install and operate an eel ladder at the project within 12 months of receiving all necessary regulatory approvals, to provide upstream passage for American eel at the project; the location and operation season of the eel ladder would be determined in consultation with New York DEC and FWS during the design phase; (section 3.3.1.2.1 of the Settlement Agreement);

- Install and operate a downstream eel passage system within 12 months of approval of the final designs by FWS, New York DEC, and the Commission to protect downstream migrating American eels; the system would consist of seasonal trash racks (e.g., an overlay-type system) with 0.75-inch clear spacing that are connected to a downstream conveyance structure (e.g., bypass pipe) that would discharge eels downstream of the dam into a plunge pool with sufficient depth; the system would be operated on a seasonal basis from September 1 through November 15 of each year (section 3.3 of the Settlement Agreement);

- Develop a trash rack installation and monitoring plan in consultation with FWS and New York DEC at least 3 months prior to the initial installation of the seasonal trash racks (section 3.3.1.1 of the Settlement Agreement); and

- Implement the proposed Invasive Plant Species Management Plan filed with the Settlement Agreement (Appendix B of the Settlement Agreement).

5.1.2 Additional Staff-recommended Measures

Under the staff alternative, the project would be operated with Chittenden Falls Hydro's proposed measures, as identified above, and the following additions or modifications:

- Develop an erosion and sediment control plan to minimize erosion and sedimentation during the construction of upstream and downstream eel passage structures;

- Develop and implement an operation compliance monitoring plan that incorporates the applicant's stream flow and water level monitoring plan, as well as provisions for annual reporting of monitoring data to the Commission, to ensure compliance with run-of-river operation and verify minimum flows in the bypassed reach;

- File for Commission approval, a revised eelway operation and maintenance plan that includes the provisions specified by Interior as well as procedures for annual reporting; and

- Revise the proposed Northern Long-eared Bat and Bald Eagle Protection Plan to include provisions for the protection of Indiana bat.

Below, we discuss the basis for our staff-recommended measures and the rationale for modifying Chittenden Falls Hydro's proposal.

Erosion and Sediment Control Plan

Construction activities related to the installation of the proposed upstream eel passage structure near the west powerhouse and the proposed downstream eel passage structure at each intake of the project (i.e., construction of plunge pools and poles for holding the downstream eel passage structure) would involve ground and riverbed disturbance. Although Chittenden Falls Hydro proposes to employ BMPs for these activities, it does not propose any specific measures for controlling potential erosion and sedimentation from such activities. Developing a soil erosion and sediment control plan with specific procedures and BMPs would minimize erosion and sediment transport from these ground and riverbed disturbance activities and, thereby, help protect water quality and aquatic life. We estimate that the levelized cost to develop an erosion and sediment control plan would be $230 and conclude that the benefits of this measure would outweigh the costs.

Project Operation and Water Levels

As described in section 3.1 of the Settlement Agreement, Chittenden Falls Hydro proposes to continue operating the project in a run-of-river mode and maintaining the impoundment at or above the dam crest or top of the flashboards (when in place). Interior also recommends, under section 10(j) of the FPA, that the project be operated in a run-of-river mode, as described in the Settlement Agreement.

Continuing to operate the project in a run-of-river mode, as proposed by Chittenden Falls Hydro and recommended by Interior, would minimize impoundment fluctuations and associated water level and flow disruptions to any fish spawning and rearing habitat that exists in the project impoundment or in the vicinity of the tailraces. Maintaining relatively stable impoundment levels would also benefit fish and other aquatic organisms that rely on littoral (shoreline) habitats for feeding, spawning, and cover. Therefore, we recommend that Chittenden Falls Hydro operate the project in a run-of-river mode, as proposed in the Settlement Agreement. There are no costs associated with this measure because it reflects Chittenden Falls Hydro's current mode of project operation.

Stream Flow and Water Level Monitoring Plan (Operation Compliance Monitoring Plan)

As described in section 3.5 of the Settlement Agreement, Chittenden Falls Hydro proposes to develop a stream flow and water level monitoring plan to allow independent verification, by New York DEC and FWS, of required impoundment levels (run-of-river operation) and minimum flows in the bypassed reach. All monitoring equipment required by the plan would be calibrated and operational within 6 months of the Commission's approval of the plan.

It is the Commission's responsibility to ensure compliance with the operation and environmental measures it requires in any license it issues for a hydroelectric project. Although Chittenden Falls Hydro states it would provide, upon request by New York DEC, project records of impoundment levels and bypassed reach flows—to ensure compliance with project operation requirements—the plan contains no provisions or procedures for reporting such data to the Commission (e.g., on an annual basis), which is necessary to allow the Commission to determine compliance with the operation and environmental requirements of any license issued for the project. Therefore, to ensure compliance with the operation and environmental measures we are recommending—run-of-river operation and a 15-cfs minimum flow in the bypassed reach—Chittenden Falls Hydro should develop and file, for Commission approval, within 12 months of license issuance, an operation and compliance monitoring plan. The operation and compliance monitoring plan should incorporate all elements from Chittenden Falls Hydro's proposed stream flow and water level monitoring plan; in addition, the plan should contain provisions for reporting to the Commission, on an annual basis, recorded impoundment elevations and bypassed reach flows, as well as an annual summary of all unplanned short-term (i.e., less than 3-hour) deviations from the operational requirements (e.g., run-of-river operation and 15-cfs minimum flow) specified in any license issued for the project. We estimate that the levelized annual cost to develop and implement an operation compliance monitoring plan would be $689 and conclude that the benefits of the plan would outweigh the costs.

Upstream Passage of American Eel

As described in section 3.3.1.2.1 of the Settlement Agreement, Chittenden Falls Hydro proposes to install and operate an eel ladder at the project to provide upstream passage for American eel at the project. Interior's section 18 fishway prescription for upstream eel passage is consistent with the upstream passage measures proposed in the Settlement Agreement.

As discussed in section 3.3.2.2, *Environmental Effects, Upstream Passage of American Eel*, the project appears to impede the upstream migration of American eel as the relative abundance of eels was nearly two-fold higher downstream of the project dam than upstream. To pass upstream of the project under existing conditions, eels would

have to ascend wetted surfaces of the project dam or nearby bank areas. As such, the installation and operation of an eel ladder, at a location and during a season to be determined in consultation with the resource agencies (FWS and New York DEC), would improve access to additional growth and feeding habitats upstream of the project; specifically, an additional 9.5 miles of tributary habitat once the required upstream eelway at the Stuyvesant Falls Project is operational. We estimate that the levelized annual cost to install, operate, and maintain the eel ladder would be $6,763 and conclude that the benefits of the eel ladder would outweigh the costs.

Downstream Passage of American Eel

As described in section 3.3 of the Settlement Agreement, Chittenden Falls Hydro proposes to install and operate a downstream eel passage system. The system would consist of seasonal trash racks (e.g., an overlay-type system) with 0.75-inch clear bar spacing that are connected to a downstream conveyance structure (e.g., bypass pipe) that would discharge eels downstream of the dam into a plunge pool; the system would be operated on a seasonal basis from September 1 through November 15 of each year. Although Interior's section 18 prescription does not specify what type of downstream eel bypass structure would be installed, the prescription is otherwise consistent with the provisions for downstream eel passage provided in the Settlement Agreement.

As discussed in section 3.3.2.2, *Environmental Effects, Downstream Passage of American Eel*, eels of all sizes can pass through the 2.0-inch trash racks that are currently in place during the downstream migration season, thereby subjecting eels to a turbine mortality rate of at least 50 percent. The installation of trash racks with a smaller (0.75-inch) spacing would physically exclude eels larger than 20.0 inches and essentially eliminate turbine mortality of egg-bearing females. The downstream eel bypass, to be designed in consultation with the resource agencies and based on FWS's fish passage engineering design criteria, would provide a suitable route of downstream passage for physically excluded eels. As such, the installation and operation of Chittenden Falls Hydro's proposed downstream eel passage system could significantly increase spawning escapement of eels from Kinderhook Creek (by at least 50 percent), which is consistent with ASMFC's management goals of protecting silver eels during their downstream migration to the ocean to increase spawning escapement from river systems. We estimate the levelized annual cost to install, operate, and maintain the downstream eel passage system is $19,287 and that the benefits of the passage system would outweigh the cost.

Eelway Operation and Maintenance Plan

As described in section 3.3.1.3 of the Settlement Agreement, Chittenden Falls Hydro proposes to submit to FWS and New York DEC, for approval, an eelway operation and maintenance plan that would include a description of the project and its fisheries, an implementation schedule for the eelways, and operation and maintenance procedures. By February 15 of each of the first 3 years following the initial installation

and operation of the eelways, the licensee would provide an annual report (eelway operation and maintenance report) to FWS and New York DEC that includes: (1) a summary of the current state of the eelways (e.g., their structures and associated flows), (2) the dates eelways were installed each year (including any deviations or issues), (3) any newly available fisheries data, and (4) any necessary or recommended changes to the eelway operation and maintenance plan. While generally consistent with the plan proposed in the Settlement Agreement, Interior's section 18 prescription for an eelway operation and maintenance plan is more detailed and requires that general schedules and procedures be provided for the following: (1) regular maintenance, including debris removal procedures, that would be used to keep the eelways in proper working order; (2) seasonal installation dates as well as operation and maintenance procedures for the eel ladder, including information on the disposition of any captured eels (e.g., release location and methods) and a description of any collection tanks that may be included in the eel ladder design; (3) seasonal installation dates and maintenance procedures for the 0.75-inch trash racks; (4) seasonal operation and maintenance procedures for the downstream eel passage structures (e.g., downstream bypasses) including attraction flows and the status of plunge pools downstream of the eelway exits; and (5) annual reporting and emergency exceptions.

As discussed in section 3.3.2.2, an eelway operation and maintenance plan, as proposed by Chittenden Falls Hydro, with the additional provisions and details required by Interior (e.g., including annual reporting beyond the first 3 years the eelways are operational), would help ensure the eel ladder and downstream eel passage system are functioning as designed and serving their intended purpose. In addition, filing the plan with the Commission for approval, and including in the plan, provisions for annual reporting to the Commission of Interior's requirements (e.g., annual installation dates of the eelways), would help ensure that any eelways required to be installed or constructed at the project would operate during the appropriate times of the year and with the appropriate conveyance and attraction flows. We estimate that the levelized annual cost to develop and implement an eelway operation and maintenance plan, as required by Interior and with staff's recommended modifications, would be $919 and conclude the benefits of the plan would outweigh the costs.

Trash rack installation and monitoring plan

As described in section 3.3.1.1 of the Settlement Agreement, Chittenden Falls Hydro proposes to develop a trash rack installation and monitoring plan. The plan would be developed at least 3 months prior to the initial installation of the seasonal trash racks and would include a reporting mechanism for the licensee to notify the resource agencies when the seasonal trash rack installation is completed each year, as well as procedures to be followed if the installation is delayed by weather, flow conditions, or other factors. Interior's section 18 prescription for a trash rack installation and monitoring plan is consistent with the plan proposed in the Settlement Agreement, and requires that FWS

and New York DEC be consulted regarding any problems with the seasonal installation, operation, and maintenance of the trash racks such as delayed installation due to high flows, recurring problems with ice build-up, or broken trash rack components that cannot be replaced in a timely manner.

The development of a trash rack installation and monitoring plan would help the Commission determine compliance with the required operation periods of any seasonal trash racks required in any subsequent license issued for the project. The plan would also ensure that Chittenden Falls Hydro consults with the resource agencies regarding any potential problems it encounters with the installation and maintenance of any required seasonal trash racks, which could help avoid or more easily rectify such problems in the future. We estimate that the levelized annual cost to develop and implement a trash rack installation and maintenance plan would be $460 and conclude the benefits of the plan would outweigh the costs.

Invasive Plant Species Management Plan

Several aquatic and terrestrial invasive plant species are likely to occur at the Chittenden Falls Project. The Invasive Plant Species Management Plan, filed with the Settlement Agreement, includes measures to prevent the introduction and spread of terrestrial and aquatic invasive plant species, including employing BMPs during construction or maintenance activities and training workers about the importance of infestation prevention. We estimate that the levelized annual cost to implement the Invasive Plant Species Management Plan would be $855 and conclude that the benefits of the measure would outweigh the costs.

Bat and Bald Eagle Protection Plan

Maintenance of the project has the potential to clear forested habitat, and thus impact wintering habitat for the federally listed endangered Indiana bat, the threatened northern long-eared bat, and nesting habitat for the state-listed threatened bald eagle. Suitable summer and wintering habitat for both the Indiana bat and the northern long-eared bat exists within the project boundary, and bald eagles have been observed at and near the project during the breeding season. The proposed Northern Long-eared Bat and Bald Eagle Protection Plan, filed with the Settlement Agreement, includes provisions to notify New York DEC and FWS, and limit tree-clearing activities near the project during breeding and wintering if northern long-eared bats or bald eagle nests are observed. The plan does not, however, include measures for the protection of the endangered Indiana bat. Revising the plan to address the Indiana bat would minimize effects to this species. We estimate that the levelized annual cost to implement a revised Bat and Bald Eagle Protection Plan would be $855 and conclude that the benefits of the measure would outweigh the costs.

5.1.3 Measures Not Recommended by Staff

Water Quality Survey Plan

As described in section 3.6 of the Settlement Agreement, Chittenden Falls Hydro proposes to develop, in consultation with New York DEC and FWS, a water quality survey plan. The plan would include procedures for conducting additional water quality monitoring in the bypassed reach, including the deployment of two data loggers to provide a replicate set of data to verify any potentially anomalous DO readings as were observed during the 2019 water quality study when a single logger was deployed. The additional water quality monitoring would occur during the first available study season (June 1 through October 15) following approval of the plan by New York DEC and FWS.

As described in section 3.3.2.1, *Affected Environment, Water Quality*, there was only one instance in the entire water quality data set—a brief 1-hour period on June 25, 2019—that instrument error (possible fouling of the optical DO sensor) may have caused anomalously low DO readings in the bypassed reach. Otherwise, the data set appears to be robust and largely free of instrument error bias. For instance, the data set lacks erratic readings or large 'jumps' in DO values following downloading and cleaning events that would be indicative of instrument error. Given that the water quality monitoring data set appears to be robust and was collected during a warm and dry summer, representative of 'worse than average' conditions, there appears to be little benefit to collecting additional water quality monitoring data as contemplated by Chittenden Falls Hydro's proposed water quality survey plan. Therefore, we have no basis for recommending the development of a water quality survey plan and conclude the benefits of the plan would not be worth the levelized annual cost of $2,298.

Minimum Flow in the Bypassed Reach

As described in section 3.2 of the Settlement Agreement, Chittenden Falls Hydro proposes, and Interior recommends, that the minimum flow in the bypassed reach be increased from 15 cfs to 25 cfs. Chittenden Falls Hydro states that a 25-cfs minimum flow, or inflow if less, would keep the bypassed reach adequately watered and that results from the bypassed reach habitat survey demonstrate that a 25-cfs flow adequately meets the management goals of the parties to the Settlement Agreement (namely, FWS and New York DEC), but does not specify what those management goals are or why they would not be met under the existing 15-cfs minimum flow. Meanwhile, Interior states a 25-cfs minimum flow would protect fish and wildlife and macroinvertebrate habitat, and that studies conducted by Chittenden Falls Hydro provide adequate justification for this flow, but it does not elaborate upon, or provide any further details to support these claims.

As discussed in section 3.3.2.2, *Environmental Effects, Minimum Flow in the Bypassed Reach*, nearly the entire width of the bypassed reach remains watered under the

existing 15-cfs minimum flow, as there was little change, just a 2.2-foot increase in wetted width of the bypassed reach, under the highest flow tested (159 cfs) compared to existing conditions (15-cfs minimum flow). Moreover, there was less than a 1-inch difference in average water depths between the existing (15 cfs) and proposed (25 cfs) minimum flows. As such, there would be very minimal gains in aquatic habitat in the bypassed reach under the proposed 25-cfs minimum flow compared to the current 15-cfs minimum flow, which appears to be fully supportive of aquatic life as water quality conditions in the bypassed reach are largely consistent with state standards under existing conditions (as discussed above). Moreover, the resource agencies did not identify any aquatic species of concern, or management interest, in the bypassed reach, that may benefit from the proposed 25-cfs minimum flow. Therefore, we have no basis for recommending a 25-cfs minimum flow and conclude the benefits of this measure would not be worth a loss in generation of 138 MWh and an equivalent levelized annual cost of $2,245.

Post-licensing Measurements/Engineering Calculations for Constructed Eelways

As described in section 3.3.1.2 of the Settlement Agreement, Chittenden Falls Hydro proposes to undertake post-licensing measurements or engineering calculations to ensure that the eel ladder and downstream eel passage system meet FWS's fish passage engineering design criteria including, but not limited to, velocities, flows, and plunge pool depths. Based on these measurements or calculations, Chittenden Falls Hydro proposes to make reasonable modifications to the design, location, and/or flows associated with the eelways, if required by FWS or New York DEC, in order to improve the performance of the eelways at protecting American eel moving through the project area. Interior's section 18 prescription requiring post-licensing measurements and/or engineering calculations and possible modifications to the eelways (if deemed necessary) is consistent with the Settlement Agreement.

The post-licensing measurements and/or engineering calculations that Chittenden Falls Hydro proposes, and Interior requires, could be based on, or obtained from the: (1) as-built drawings that would be filed with the Commission for any eelways it authorizes for the project, or (2) annual reports filed under the eelway operation and maintenance plan described above. Specifically, the dimensions of the eelway structures provided in the as-built drawings could be used to calculate the expected velocities (e.g., approach velocities upstream of the seasonal trash racks) and plunge pool depths. Also, verification of the operational flows (e.g., attraction and conveyance flows) required at the eelways could be obtained from the annual operation and maintenance reports filed as part of the eelway operation and maintenance plan, as these reports would include information on the status of the eelways, including their associated flows. Thus, there appears to be little benefit of conducting post-licensing field measurements or engineering calculations of flows, depths, and velocities at the eelways given that this information would be readily available or attainable through other means. Therefore, we

have no basis for recommending the post-licensing field measurements or engineering calculations proposed by Chittenden Falls Hydro and conclude the benefits of this measure are not worth the levelized annual cost of $543.

Any structural or operational modifications to the eelways, as contemplated by the Settlement Agreement and Interior, based on the proposed post-licensing measurements and engineering calculations, would need to be approved by the Commission prior to the commencement of such actions. Therefore, we do not recommend that any structural or operational modifications be made to any constructed eelways without prior Commission approval.

5.2 UNAVOIDABLE ADVERSE EFFECTS

Some entrainment mortality of resident fishes is likely unavoidable. However, given the relatively low approach velocities at the project (less than 2.1 fps), most entrainment mortality would be limited to juveniles of weaker swimming species (e.g., shiners and darters). Because these small-bodied individuals would experience high turbine survival (exceeding 90 percent), we expect the long-term impact of entrainment would have minimal consequences for the resident fish communities in Kinderhook Creek.

5.3 FISH AND WILDLIFE AGENCY RECOMMENDATIONS

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

Section 10(j) of the FPA states that whenever the Commission believes 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 will attempt to resolve any such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of the agency.

In response to our February 21, 2020 notice soliciting comments, recommendations, terms and conditions, and prescriptions, Interior filed three section 10(j) recommendations for the project on April 30, 2020. Table 7 lists the recommendations filed subject 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 to be 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 Chittenden Falls Project (Source: staff).

Recommendation	Agency	Within the Scope of Section 10(j)	Levelized Annual Cost	Recommend Adopting?
Operate the project in a run-of-river mode and maintain the impoundment at or above the crest of the dam or top of the flashboards (when installed).	Interior	Yes	$0	Yes
Provide a continuous minimum flow of 25 cfs, or inflow, whichever is less, into the bypassed reach to protect fish, wildlife, and macroinvertebrate habitat.	Interior	Yes	$2,245	No
Implement the Bat and Bald Eagle Protection Plan filed with the Settlement Agreement.	Interior	Yes	$855	Yes

We are making a preliminary determination that FWS's section 10(j) recommendation for a 25-cfs minimum flow (see table 11 above) is inconsistent with the comprehensive development and public interest standards of sections 10(a) and 4(e) of the FPA.

As discussed in section 3.3.2.2, *Environmental Effects, Minimum Flow in the Bypassed Reach*, Interior's recommended 25-cfs minimum flow would provide only very minimal gains in aquatic habitat in the bypassed reach compared to the existing 15-cfs minimum flow; specifically, just a 2.4-inch increase in wetted width and a 0.96-inch increase in average depth. Moreover, water quality conditions (including DO levels) in the bypassed reach under the existing 15-cfs minimum flow appear to be fully supportive of aquatic life as they are largely consistent with state water quality standards, as described in section 3.3.2.1, *Affected Environment, Water Quality.*

We concluded, in section 5.1.3 above, that the benefits associated with the 25-cfs minimum flow proposed in the Settlement Agreement, and recommended by Interior under section 10(j), would be minimal and not be worth the levelized annual cost of the measure, which is $2,245.

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 13 qualifying comprehensive plans that are applicable to the Chittenden Falls Project, located in New York. No inconsistencies were found.

A list of qualifying comprehensive plans relevant to the Chittenden Falls Project is in Appendix G.

6.0 FINDING OF NO SIGNIFICANT IMPACT

If the Chittenden Falls Project is relicensed with our recommended measures, the project would operate while providing enhancements and protective measures for fish and wildlife resources and endangered species in the project area.

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

7.0 LITERATURE CITED

The literature cited in this EA are presented in Appendix H.

8.0 LIST OF PREPARERS

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

APPENDIX A

STATUTORY AND REGULATORY REQUIREMENTS

Federal Power Act

Section 18 Fishway Prescription

Section 18 of the FPA, 16 U.S.C. § 811, states that the Commission is to require the construction, operation, and maintenance by a licensee of such fishways as may be prescribed by the Secretaries of the U.S. Department of Commerce or the Interior. On April 30, 2020, Interior timely filed a preliminary fishway prescription for the project and requested that the Commission include a reservation of authority to prescribe fishways under section 18 in any license issued for the project. Interior's preliminary fishway prescription (Appendix B) is consistent with the fishways proposed by Chittenden Falls Hydro, which are summarized in section 2.2.2, *Proposed Project Operation and Environmental Measures*.

Section 10(j) Recommendations

Under section 10(j) of the FPA, 16 U.S.C. § 803(j), 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 April 30, 2020, Interior timely filed recommendations under section 10(j), as summarized in table 11, in section 5.3, *Fish and Wildlife Agency Recommendations.* In section 5.3, we also discuss how we address agency recommendations and comply with section 10(j).

Clean Water Act

Under section 401(a)(1) of the Clean Water Act, 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 a project would comply with applicable provisions of the Clean Water Act, or a waiver of the certification by the appropriate state agency. The failure to act on a request for certification within a reasonable period of time, not to exceed one year, after receipt of the request constitutes a waiver.

On March 5, 2020, Chittenden Falls Hydro applied to New York DEC for a section 401 certification for the Chittenden Falls Project. New York DEC received the application on the same day.[50] New York DEC has not yet acted on the certification request. The certification is due by March 5, 2021.

Endangered Species Act

Section 7 of the ESA, 16 U.S.C. § 1536, requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or result in the destruction or adverse modification of the critical habitat of such species. On October 7, 2020, Commission staff requested an official species list for the project through the FWS IPaC system.[51] The official species list indicates that one federally listed species has the potential to occur in the project area: the endangered Indiana bat (*Myotis sodalist*). In addition, the project is located within the range of the northern long-eared bat (*Myotis septentrionalis*), and as discussed in section 3.3.4, *Threatened and Endangered Species*, other information in the project record demonstrates that this species could occur within the project impact area.

An analysis of project effects on Indiana bat and northern long-eared bat is presented in section 3.3.4, *Threatened and Endangered Species*, and staff's recommendations are included in section 5.1, *Comprehensive Development and Recommended Alternative*. Based on the available information, we recommend that Chittenden Falls Hydro revise the proposed Northern Long-eared Bat and Bald Eagle Management Plan to include measures to protect the Indiana bat and conclude that relicensing the project, with a revised Bat and Bald Eagle Management Plan,[52] is not likely to adversely affect the Indiana bat.

For the northern long-eared bat, incidental take that may result from continued operation and maintenance of the Chittenden Falls Project is not prohibited under the

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[50] On May 1, 2020, Chittenden Falls Hydro filed a copy of its March 5, 2020 email sent to New York DEC requesting certification along with its certification application.

[51] *See* official species list memorandum, filed November 10, 2020.

[52] A Northern Long-Eared Bat and Bald Eagle Management Plan is included in Appendix A of the Settlement Agreement, filed on April 10, 2020.

final 4(d) rule.[53] Staff's conclusion is consistent with Interior's letter, dated April 22, 2020, that states that, based on the measures outlined in Chittenden Falls Hydro's Northern Long-Eared Bat and Bald Eagle Management Plan, any take that may occur incidental to the Chittenden Falls Project is not prohibited under the final 4(d) rule. Therefore, no further consultation under the ESA is required regarding the northern long-eared bat.

Coastal Zone Management Act

Under section 307(c)(3)(A) of the Coastal Zone Management Act (CZMA), 16 U.S.C. § 1456(3)(A), the Commission cannot issue a license for a project within or affecting a state's coastal zone unless the state 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 6 months of its receipt of the applicant's certification.

On March 31, 2020, Chittenden Falls Hydro requested that the New York State Department of State Coastal Management Program review the consistency certification for the Chittenden Falls Project. Chittenden Falls Hydro has not received a response to date. Therefore, the agency's concurrence is conclusively presumed by its failure to act within 6 months of its receipt of the applicant's certification.

National Historic Preservation Act

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

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

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[53] On January 14, 2016, FWS issued a final 4(d) rule regarding the northern long-eared bat that prohibits the following activities in areas of the country impacted by white-nose syndrome: incidental take within a hibernation site; tree removal within 0.25 mile of a known, occupied hibernaculum; and cutting or destroying known occupied maternity roost trees, or any other trees within 150 feet of that maternity roost tree, during the pup-rearing season (June 1 through July 31) (FWS, 2016a).

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.

Commission staff designated Chittenden Falls Hydro as its non-federal representative for the purposes of conducting section 106 consultation under the NHPA on August 9, 2016. Pursuant to section 106, and as the Commission's designated non-federal representative, Chittenden Falls Hydro consulted with the New York State Office of Parks, Recreation, and Historic Preservation, which functions as the New York SHPO, to identify historic properties, determine National Register eligibility, and assess potential adverse effects on historic properties within the project's area of potential effects.

By letter dated September 5, 2019, and included in Appendix O of Chittenden Falls Hydro's November 6, 2019 Additional Information Requests and Deficiency Response, the New York SHPO states that "no historic properties, including archaeological and/or historic resources, will be affected by this undertaking." Based on the information provided and comments from the New York SHPO, we conclude that relicensing the project would not adversely affect any historic properties.

APPENDIX B

U.S. DEPARTMENT OF INTERIOR'S SECTION 18 PRELIMINARY FISHWAY PRESCRIPTIONS

11 PRELIMINARY PRESCRIPTION FOR FISHWAYS

Pursuant to Section 18 of the FPA, as amended, the Secretary of the Department, as delegated to the Service, proposes to exercise his authority to prescribe the construction, operation, and maintenance of such fishways as deemed necessary, subject to the procedural provisions contained above.

The Service's Preliminary Prescription addresses a number of issues and concerns related to fish restoration and passage that have been raised by the applicant and State resource agencies. These issues were resolved during settlement negotiations.

Fishways shall be constructed, operated, and maintained to provide safe, timely, and effective passage for American eel at the Licensee's expense. Other fish species found in the watershed above the Project will likely benefit as well.

To ensure the immediate and timely contribution of the fishways to the ongoing and future fish enhancement programs in Kinderhook Creek and the Hudson River, the following are included and shall be incorporated by the Licensee to ensure the effectiveness of the fishways pursuant to Section 1701(b) of the 1992 National Energy Policy Act (P.L. 102-486, Title XVII, 106 Stat.
3008).

11.1 Operational Flows

Upstream and downstream fishways shall be operated during the designated operational period at all times and under all river flows up to the maximum capacity of the fishways.[1]

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[1] The maximum hydraulic capacity under which each fishway can operate will be determined during the final design phase.

Scheduling

11.1.1 Construction Schedule

The timely installation of the prescribed fishway structures, facilities, or devices is a measure directly related to those structures, facilities, or devices and is necessary to ensure the effectiveness of such structures, facilities, or devices. Therefore, the Service's Preliminary Prescription includes the express requirement that the Licensee (1) notify, and (2) obtain approval from, the Service for any extensions of time to comply with the provisions included in the Service's Preliminary Prescription. The installation of the fishway structures and other measures should comply with the following schedule (Chittenden Falls Hydropower, Inc. 2020, Sections 2.2 and 3.3):

Structure/Measure	Implementation Deadline
Fish Exclusion	Within 1 year of the effective date of the subsequent license, 90% designs should be filed with the Service; initial designs need to be filed in time to meet this goal; implementation shall occur within 1 year of Commission approval of the designs
Downstream Passage Facility subsequent	Within 1 year of the effective date of the license, 90% designs should be filed with the Service; initial designs need to be filed in time to meet this goal; implementation shall occur within 1 year of Commission approval of the designs
Eel Ladder	Within 1 year of the effective date of the subsequent license, 90% designs should be filed with the Service; initial designs need to be filed in time to meet this goal; implementation shall occur within 1 year of Commission approval of the designs

11.1.2 Operational Schedule

Regarding the timing of seasonal fishway operations, fishways shall be maintained and operated, at the Licensee's expense, to maximize fish passage effectiveness throughout

the fish passage season for American eel. The eel ladder shall be operated seasonally for a time period to be established by the Service and the NYSDEC during design consultation. The downstream fishway will be operated from September 1 through November 15 (Chittenden Falls Hydropower, Inc. 2020, Sections 2.2 and 3.3).

11.2 Operational Procedures

The Licensee shall keep the fishways in proper order and shall keep fishway areas clear of trash, logs, and material that would hinder passage. Anticipated maintenance shall be performed sufficiently before a migratory period such that fishways can be tested and inspected, and will operate effectively prior to and during the migratory periods. The Licensee will develop an Eelway Operation and Maintenance Plan (EOMP), in consultation with the Service and the NYSDEC, to document regular maintenance activities and emergency procedures (Chittenden Falls Hydropower, Inc. 2020, Section 3.3.1.3). The EOMP, which is due within 12 months of the effective date of the subsequent license, will include general schedules and procedures for the following:

- Seasonal installation, operation, and maintenance of an eel ladder, release of any captured eels upstream of the dam, and any collection tanks that may be included in the eel ladder design;
- Seasonal installation (see Section 11.8.1 for dates of operation) and maintenance of 3/4”- clear-spaced trashracks or the equivalent (e.g., an overlay type system);
- Seasonal operation and maintenance of downstream fish passage structures including attraction flows and plunge pools downstream of the fishway exits; and
- Annual reporting and emergency exceptions.

11.3 Effectiveness Monitoring

Immediately following completion of construction, the Licensee shall conduct studies to monitor the effectiveness of the fish exclusion and downstream passage facilities (Chittenden Falls Hydropower, Inc. 2020, Section 3.3.1.2.2.1) and the eel ladder (Chittenden Falls Hydropower, Inc. 2020, Section 3.3.1.2.1.1) by confirming that hydraulic conditions are appropriate for successful passage. These studies will include velocity measurements in the vicinity of the screen, along with measurements of attraction and conveyance flows and plunge pool depths.

11.4 Modifications to Fishway Facilities

11.4.1 Modifications to Fish Exclusion and Downstream Passage Facilities

The Licensee shall modify the fish exclusion and downstream passage facilities to improve their effectiveness if deemed necessary by the Service in consultation with the NYSDEC and the Licensee based on the results of the effectiveness monitoring. Such modifications may include, but are not limited to, attraction and conveyance flow velocities and volumes, structures directing conveyance flows, passage pipes, and plunge pool design.

11.4.2 Modifications to Eel Ladder

The Licensee shall modify the eel ladder to improve its effectiveness if deemed necessary by the Service in consultation with the NYSDEC and the Licensee based on the results of the effectiveness monitoring. Such modifications may include, but are not limited to, attraction and conveyance flows, ladder components and substrate, ladder slope, entrance locations and design, and exit sluices.

11.5 Inspection

The Licensee shall provide personnel of the Service, and other Service-designated representatives, access to the Project site and to pertinent Project records for the purpose of inspecting the fishways to determine compliance with the Fishway Prescription.

11.6 Consultation

The Licensee shall develop, in consultation with, and submit for approval by, the Service, all functional and final design plans and construction schedules for the fishways or modifications to the fishways described herein according to the timelines identified in Section 11.8.

11.7 Fish Passage Facilities

As described in the Settlement Agreement (Chittenden Falls Hydropower, Inc. 2020), the Licensee shall implement the final design plans approved by the Service for the fish passage systems. As indicated above, the Licensee shall submit its final design plans to the Service and the NYSDEC for review and approval.

11.7.1 Fish Exclusion and Guidance

Within 1 year after the effective date of the subsequent license, the Licensee shall file 90% design plans of the fish exclusion devices with the Service for review and approval. Earlier consultation will be necessary in order for the 90% designs to be timely filed. The exclusion devices (3/4”-clear-spaced trashracks) shall be installed within 1 year of approval of the designs by the Commission. Seasonal overlays must be in place for the entirety of the downstream eel passage season, defined as September 1 through November 15.

The NYSDEC and the Service will be consulted regarding any problems with the seasonal installation, operation, and maintenance of the trashracks. Circumstances requiring agency consultation may include delayed installation due to high flows, recurring problems with ice build-up, broken trashrack components that cannot be replaced in a timely manner, or other unforeseen problems. CFH will prepare a Trashrack and Fishway Installation and Monitoring Plan for the Project in consultation with the Service and the NYSDEC (Chittenden Falls Hydropower, Inc. 2020).

11.7.2 Downstream Eel Passage

Within 1 year after the effective date of the subsequent license, the Licensee shall file 90% design plans of the downstream eel passage facilities with the Service for review and approval. Earlier consultation will be necessary in order for the 90% designs to be timely filed. The downstream eel passage facilities shall be installed within 1 year of approval of the designs by the Commission. The downstream eel passage facilities must be functional for the entirety of the downstream eel passage season, defined as September 1 through November 15. The designs should include appropriate attraction and conveyance flows and adequate plunge pools to ensure eel survival.

The NYSDEC and the Service will be consulted regarding any problems with the seasonal installation, operation, and maintenance of the downstream fish passage facilities.

Circumstances requiring agency consultation may include delayed installation due to high flows, recurring problems with ice or debris build-up, or other unforeseen problems. CFH will prepare an Eelway Operation and Monitoring Plan for the Project in consultation with the Service and the NYSDEC (Chittenden Falls Hydropower, Inc. 2020).

11.7.3 Upstream Eel Passage

Within 1 year after the effective date of the subsequent license, the Licensee shall file 90% design plans of the eel ladder with the Service for review and approval. Earlier

consultation will be necessary in order for the 90% designs to be timely filed. The ladder shall be installed within 1 year of approval of the designs by the Commission. The eel ladder must be functional for the entirety of the upstream eel passage season, to be defined by the Service and the NYSDEC during design consultation. The designs should include appropriate attraction flows and an appropriate release location to ensure passage effectiveness and to avoid fallback over the dam or through the turbines.

The NYSDEC and the Service will be consulted regarding any problems with the seasonal installation, operation and maintenance of the eel ladder. Circumstances requiring agency consultation may include delayed installation due to high flows, recurring problems with ice or debris build-up, or other unforeseen problems. CFH will prepare an Eelway Operation and Monitoring Plan for the Project in consultation with the Service and the NYSDEC (Chittenden Falls Hydropower, Inc. 2020).

11.7.4 Exceptions

"The Licensee may curtail or suspend fish protection and downstream movement measures for short periods upon prior mutual agreement between the Licensee, the USFWS, and the NYSDEC. In the event of any operating emergency beyond the control of the Licensee, the Licensee may curtail or suspend fish protection and downstream movement measures for only the time period necessary to rectify such an operating emergency. The Licensee shall notify the FERC, the USFWS, and the NYSDEC as soon as possible, but no later than ten (10) business days after any such operating emergency. The Licensee shall notify the FERC in writing within ten (10) business days after any such operating emergency, or by any period as established by the FERC." (Chittenden Falls Hydropower, Inc. 2020).

APPENDIX C

ALTERNATIVE CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

Project Decommissioning

As the Commission has previously held, decommissioning is not a reasonable alternative to relicensing in most cases.[54] Decommissioning can be accomplished in different ways depending on the project, its environment, and the particular resource needs.[55] For these reasons, the Commission does not speculate about possible decommissioning measures at the time of relicensing, but rather waits until an applicant actually proposes to decommission a project, or a participant in a relicensing proceeding demonstrates that there are serious resource concerns that cannot be addressed with appropriate license measures and that make decommissioning a reasonable alternative.[56]

Chittenden Falls Hydro 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.

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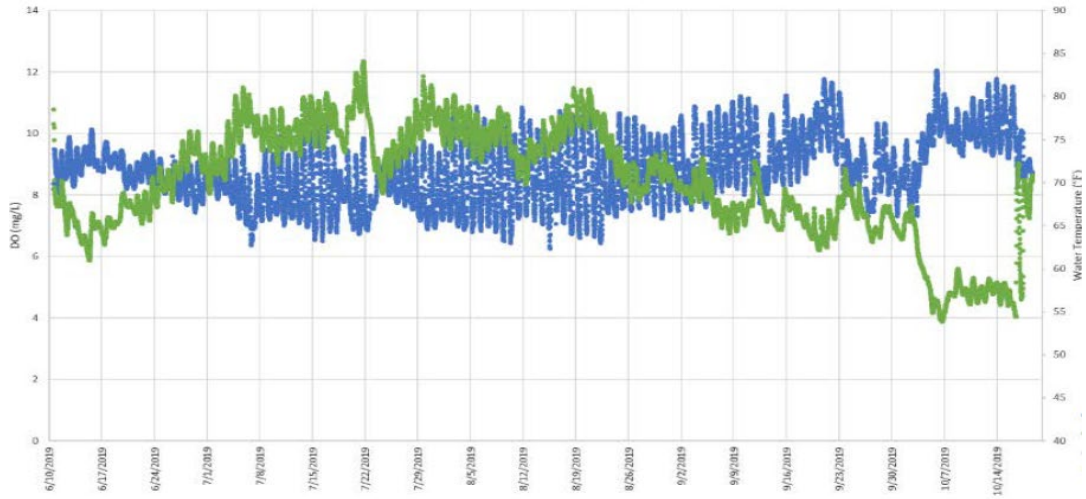
[54] *See, e.g.*, *Eagle Crest Energy Co*., 153 FERC ¶ 61,058, at P 67 (2015); *Public Utility District No. 1 of Pend Oreille County*, 112 FERC ¶ 61,055, at P 82 (2005); *Midwest Hydro, Inc*., 111 FERC ¶ 61,327, at PP 35-38 (2005).

[55] In the unlikely event that the Commission denies relicensing a project or a licensee decides to surrender an existing project, the Commission must approve a surrender "upon such conditions with respect to the disposition of such works as may be determined by the Commission." 18 C.F.R. § 6.2 (2020). 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.

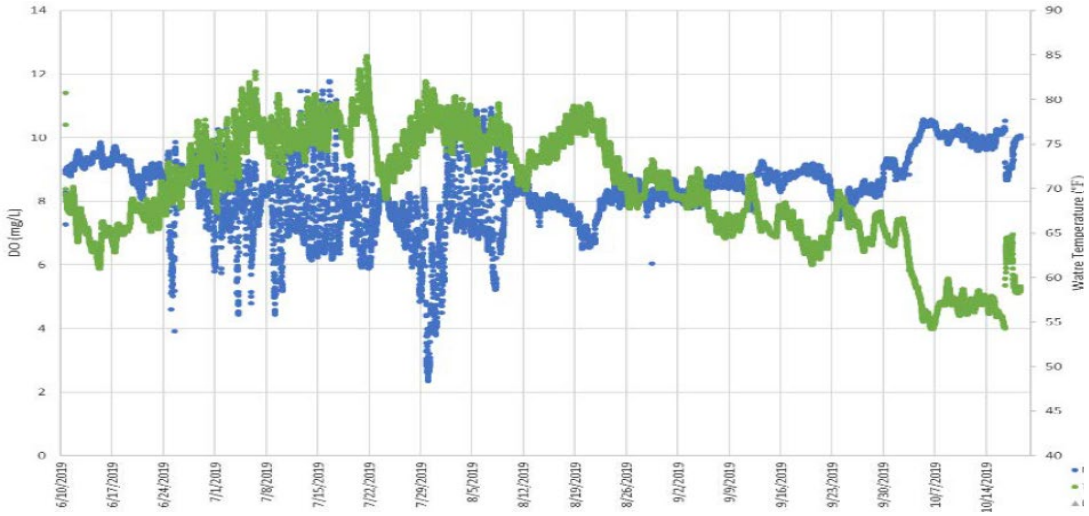
[56] *See generally Project Decommissioning at Relicensing*; Policy Statement, FERC Stats. & Regs., Regulations Preambles (1991-1996), ¶ 31,011 (1994); *see also City of Tacoma, Wash.,* 110 FERC ¶ 61,140 (2005) (finding that unless and until the Commission has a specific decommissioning proposal, any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

APPENDIX D

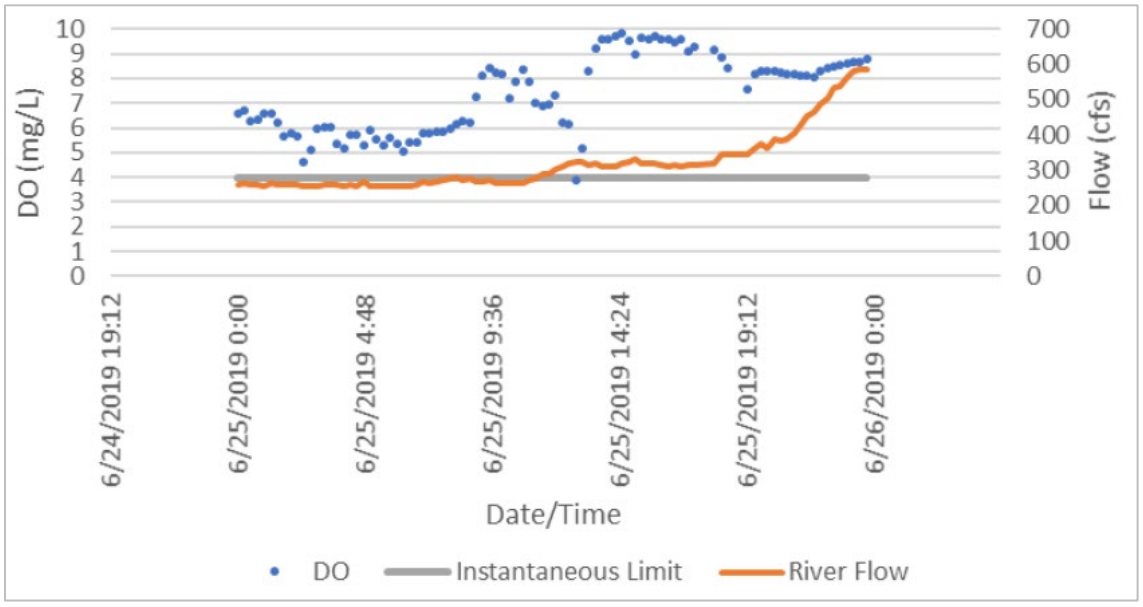
WATER QUALITY DATA AND HABITAT SURVEY PHOTOS



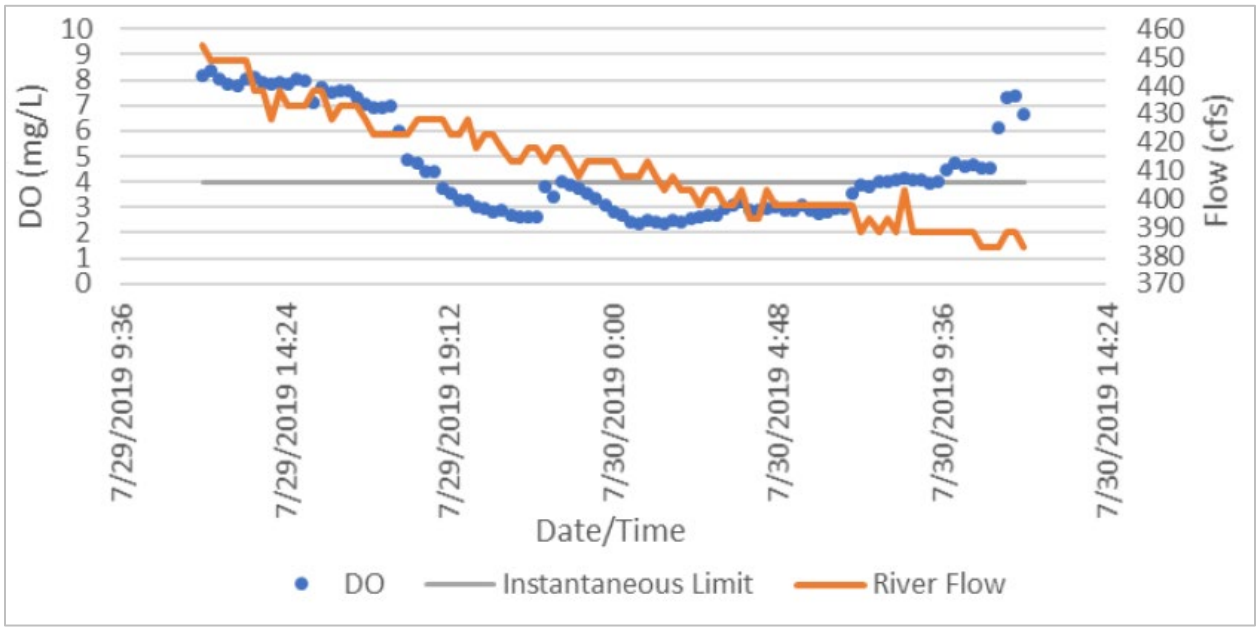
Water temperatures (green line) and DO levels (blue line) recorded at 15-minute intervals in the project impoundment from June 6, 2019 through October 15, 2019 (Source: license application).



Water temperatures (green line) and DO levels (blue line) recorded in the project's bypassed reach at 15-minute intervals from June 6, 2019 through October 15, 2019 (Source: license application).



DO concentrations (blue dots) recorded at 15-minute intervals in the project's bypassed reach and river flows (orange line) on June 25, 2019. The solid gray line depicts New York State's instantaneous water quality standard for DO (4.0 mg/L) (Source: license application).



DO concentrations (blue dots) recorded at 15-minute intervals in the project's bypassed reach and river flows (orange line) on the evening of July 29, 2019 through the morning of July 30, 2019. The solid gray line depicts New York State's instantaneous water quality standard for DO (4.0 mg/L) (Source: license application).

159 cfs

35 cfs

29 cfs

19 cfs

Photos of the bypassed reach under various flow releases that were tested as part of the habitat survey conducted on July 19, 2019 (159 cfs) and August 9, 2019 (remaining flows of 19, 29, and 35 cfs). The approximate location of the surveyed transect (same location for all flows) is represented by the yellow dashed line in the bottom-left panel (Source: license application, as modified by staff).

APPENDIX E

FISH COMMUNITY COMPOSITION

Fish community composition upstream of the project dam based on boat and backpack electrofishing surveys (2.8 total hours of electrofishing across gear types) conducted downstream of the Stuyvesant Falls Project (FERC No. 2696) on July 12, 2007 (Source: Stuyvesant Falls final license application).

Species	Number Caught	Percent Composition
White sucker	177	25.3
Eastern blacknose dace	168	24.0
Tessellated darter	150	21.5
Longnose dace	59	8.4
American eel	46	6.6
Smallmouth bass	44	6.3
Common shiner	17	2.4
Largemouth bass	13	1.9
Pumpkinseed	9	1.3
Cutlips minnow	5	0.7
Spottail shiner	4	0.6
Common carp	2	0.3
Fallfish	2	0.3
Rock bass	2	0.3
Yellow perch	1	0.1

Fish community composition downstream of the dam (in the project's bypassed reach) based on boat and backpack electrofishing surveys (2.0 total hours of electrofishing across gear types) on May 31, 2017 and June 1, 2017 (Source: license application, as modified staff).

Species	Number Caught	Percent Composition
American eel	52	31.5
Smallmouth bass	24	14.5
White sucker	19	11.5
Common carp	18	10.9
Spotfin shiner	11	6.7
Tessellated darter	9	5.5
Bluegill	8	4.8
Redbreast sunfish	7	4.2
Pumpkinseed	6	3.6
Largemouth bass	3	1.8
Northern hog sucker	3	1.8
Rock bass	2	1.2
Spottail shiner	2	1.2
Longnose dace	1	0.6

APPENDIX F

COST OF ENVIRONMENTAL MEASURES

Enhancement/Mitigation Measures	Entity	Capital Cost[a]	Annual Cost[a]	Levelized Annual Cost
Develop an erosion and sediment control plan for eel passage facilities construction.	Staff	$2,500	$0	$230
Operate the project in a run-of-river mode and maintain the impoundment elevation at or above the dam crest or top of flashboards (when in place).	Chittenden Falls Hydro, FWS, New York DEC, Interior, Staff	$0	$0	$0[b]
Provide a continuous minimum flow of 25 cfs into the bypassed reach	Chittenden Falls Hydro, FWS, New York DEC, Interior	$0	$2,841[c]	$2,245
Develop a stream flow and water level monitoring plan, to ensure compliance with run-of-river operation and verify minimum flows in the bypassed reach.	Chittenden Falls Hydro, FWS, New York DEC	$7,500	$0	$689

Enhancement/Mitigation Measures	Entity	Capital Cost[a]	Annual Cost[a]	Levelized Annual Cost
Develop and implement an operation compliance monitoring plan that incorporates the applicant's stream flow and water level monitoring plan, as well as provisions for annual reporting of monitoring data to the Commission, to ensure compliance with run-of-river operation and verify minimum flows in the bypassed reach.	Staff	$7,500	$0	$689
Develop, within 3 months of license issuance, a water quality survey plan that contains provisions for an additional water quality monitoring to help explain potential anomalies in the water quality data collected in the summer of 2019.	Chittenden Falls Hydro, FWS, New York DEC	$25,000[d]	$0	$2,298
Install and operate an eel ladder to provide upstream passage for American eel. The installation location and operation season of the ladder would be determined in consultation with New York DEC and FWS.	Chittenden Falls Hydro, FWS, New York DEC, Interior, Staff	$5,021	$7,976[e]	$6,763

Enhancement/Mitigation Measures	Entity	Capital Cost[a]	Annual Cost[a]	Levelized Annual Cost
Install and maintain, at each powerhouse, a downstream eel passage system that consists of seasonal trash racks with a 0.75-inch clear spacing and a downstream bypass that would be operated from September 1 through November 15 of each year.	Chittenden Falls Hydro, FWS, New York DEC, Interior, Staff	$40,166	$19,741[f]	$19,287
Develop and implement an eelway operation and maintenance plan within 12 months of license issuance.	Chittenden Falls Hydro, FWS, New York DEC, Interior	$10,000	$0	$919
File an eelway operation and maintenance plan, for Commission approval, that includes all of Interior's specified plan provisions as well as procedures for annual reporting of the plan's provisions (e.g., timing of seasonal installation of the eelways) to the Commission.	Staff	$10,000	$0	$919

Enhancement/Mitigation Measures	Entity	Capital Cost[a]	Annual Cost[a]	Levelized Annual Cost
Develop a trash rack installation and operation plan at least 3 months prior to the initial installation of the seasonal trash racks associated with the downstream eel passage system.	Chittenden Falls Hydro, FWS, New York DEC, Staff	$5,000	$0	$460
Undertake post-licensing measurements or engineering calculations to ensure the constructed eelways meet the FWS fish passage engineering design criteria for approach velocities, attraction and conveyance flows, and plunge pool depths	Chittenden Falls Hydro, FWS, New York DEC, Interior	$0	$3,000[g]	$543
Implement the proposed Invasive Plant Species Management Plan filed with the Settlement Agreement.	Chittenden Falls Hydro, FWS, New York DEC, TU, Staff	$5,000	$500	$855
Implement the proposed Northern Long-eared Bat and Bald Eagle Protection Plan filed with the Settlement Agreement.	Chittenden Falls Hydro, FWS, New York DEC, TU	$5,000	$500	$855

Enhancement/Mitigation Measures	Entity	Capital Cost[a]	Annual Cost[a]	Levelized Annual Cost
Revise the proposed Northern Long-eared Bat and Bald Eagle Protection Plan filed with the Settlement Agreement to include measures to protect the Indiana bat.	Staff	$5000	$500	$855

[a] Sources: staff and Chittenden Falls Hydro. Costs provided by the applicant are indexed to 2020 dollars
[b] No additional costs because this is a continuing measure.
[c] Cost is based on an estimated loss of 138 MWh in generation.
[d] Includes the cost of developing and implementing the water quality survey plan.
[e] Cost includes a loss of 46 MWh in generation associated with this measure.
[f] Cost includes a loss of 276 MWh in generation associated with this measure.
[g] Staff assumes that the post-licensing evaluation to continue for first 3 years after implementation.

APPENDIX G

LIST OF COMPREHENSIVE PLANS

Adirondack Park Agency. n.d. New York State wild, scenic, and recreational rivers system field investigation summaries. Albany, New York.

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APPENDIX H

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APPENDIX I

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