United States Department of the Interior
OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
5 Post Office Square, Suite 18011
Boston, MA 02109

May 16, 2024

4111

IN REPLY REFER TO:
ER 24/0076 and ER 24/0077

Debbie Anne Reese, Acting Secretary
Federal Energy Regulatory Commission
888 First Street, N.E., Room 1A
Washington, DC 20426

Subject: COMMENTS, RECOMMENDATIONS, TERMS AND CONDITIONS, AND PRESCRIPTIONS
Application Ready for Environmental Analysis
Turners Falls Hydroelectric Project, FERC No. 1889-085; Franklin County, MA; Cheshire County, NH; and Windham County, VT
Northfield Mountain Pumped Storage Project, FERC Number 2485-071; Franklin County, MA; Cheshire County, NH; and Windham County, VT

Dear Acting Secretary Reese:

This letter provides the U.S. Department of Interior's (Department) response to the Federal Energy Regulatory Commission's (FERC or Commission) Notices of Application Ready for Environmental Analysis, issued on February 22, 2024, for the proposed relicensing of the Turners Falls Hydroelectric Project (Turners Falls), owned by FirstLight MA Hydro LLC; and the Northfield Mountain Pumped Storage Project (NMPS), owned by Northfield Mountain LLC. Both LLCs are affiliates of FirstLight Hydro Generating Company (FirstLight, Applicant, or Licensee). Turners Falls and NMPS are located in Franklin County, Massachusetts; Cheshire County, New Hampshire; and Windham County, Vermont.[1]

These comments have been prepared by the Department's National Park Service (NPS), U.S. Fish and Wildlife Service (Service, USFWS) and U.S. Geological Survey (USGS) and are submitted in accordance with provisions of the Fish and Wildlife Coordination Act, as amended (16 U.S.C. 661-667e); the National Environmental Policy Act, as amended (42 U.S.C. 4321-4347); the Federal Power Act (FPA), as amended (16 U.S.C. 791a-828c), and the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 et seq.).

[1] The NMPS project boundary includes the Turners Falls Project impoundment, which serves as the lower reservoir for NMPS.

PROJECT DESCRIPTIONS

The FERC's REA Notices[2] describe the projects as follows:

Turners Falls

The Turners Falls Project consists of: (1) a 630-foot-long, 35-foot-high dam (Montague dam) that includes: (a) four 120-foot-wide, 13.25-foot-high bascule gates; and (b) a 170-foot-long fixed section with a crest elevation of 185.5 feet National Geodetic Vertical Datum of 1929 (NGVD 29); (2) a 493-foot-long, 55-foot-high dam (Gill dam) that includes: (a) three 40-foot-wide, 39-foot-high tainter gates; and (b) 97.3- and 207.5-foot-long fixed sections with crest elevations of 185.5 feet NGVD 29; (3) a 2,110-acre impoundment with a useable storage volume of 16,150 acre-feet between elevations 176.0 feet and 185.0 feet NGVD 29; (4) a 214-foot-long, 33-foot-high gatehouse that includes six 9-foot-wide, 10.66-foot-high gates and nine 9.5-foot-wide, 12.6-foot-high gates; (5) a 2.1-mile-long, 120- to 920-foot-wide, 17- to 30-foot-deep power canal; (6) a 700-foot-long, 100-foot-wide, 16- to 23-foot-deep branch canal; (7) the Station No.1 generating facility that includes: (a) eight 15-foot-wide bays with trashracks with 2.625-inch clear-bar spacing; (b) four 100-foot-long, 13.1- to 14-foot-diameter penstocks; (c) a 134-foot-long, 64-foot-wide powerhouse that contains five turbine-generator units with a total installed capacity of 5.693 megawatts (MW); (d) four 21-foot-long, 6.5-foot-diameter draft tubes; (e) five 40- to 70-foot-long, 2.4-kilovolt (kV) generator leads that connect the turbine-generator units to a generator bus; (f) a 110-foot-long, 2.4-kV generator lead that connects the generator bus to a substation; and (g) a 20-foot-long, 2.4-kV generator lead that connects the substation to three transformers; (8) the Cabot Station generating facility that includes: (a) an intake structure with 217-foot-wide, 31-foot-high trashracks with 0.94-inch and 3.56-inch clear-bar spacing; (b) six 70-foot-long penstocks; (c) a 235-foot-long, 79.5-foot-wide powerhouse that contains six turbine-generator units with a total installed capacity of 62.016 MW; (d) six 41-foot-long, 12.5- to 14.5-foot-diameter draft tubes; (e) six 80- to 250-foot-long, 13.8-kV generator leads that connect the turbine-generator units to a generator bus; (f) a 60-foot-long, 13.8-kV generator lead that connects the generator bus to the powerhouse roof; and (g) a 200-foot-long, 13.8-kV generator lead that connects to a transformer; (9) eight 13.6-foot-wide, 16.7-foot-high power canal spillway gates that are adjacent to Cabot Station; (10) a 16.2-foot-wide, 13.1-foot-high log sluice gate in the Cabot Station forebay with an 8-foot-wide weir for downstream fish passage; (11) a 200 foot-long, 7-foot-diameter drainage tunnel (Keith Drainage Tunnel) and headgate; (12) a 955-foot-long, 5-foot-diameter lower drainage tunnel; (13) an 850-foot-long, 16 foot-wide, 10-foot-high fishway (Cabot fishway); (14) a 500-foot-long, 10-foot-wide, 10-foot-high fishway (Spillway fishway); (15) a 225-foot-long, 16-foot-wide, 17.5-foot-high fishway (Gatehouse fishway); and (16) appurtenant facilities.

Northfield Mountain Pumped Storage

The Northfield Mountain Pumped Storage Project consists of: (1) a 1-mile-long, 30-foot-wide, 30- to 140-foot-high main dam that includes: (i) an intake structure with two 7-foot-wide, 9-foot-high sluice gates and an 8 foot-diameter outlet pipe; and (ii) a 589-foot-long, 2-foot-

[2] FERC Accession Number: 20240222-3011 (Turners Falls Project); FERC Accession Number: 20240222-3014 (Northfield Mountain Pumped Storage Project).

diameter low-level outlet pipe; (2) a 425-foot-long, 25-foot-high dike (North dike); (3) a 2,800-foot-long, 45-foot-high dike (Northwest dike); (4) a 1,700-foot-long, 40-foot-long dike (West dike); (5) a 327 foot-long, 10- to 20-foot-high gravity dam; (6) an ungated 550-foot-long, 6-foot-high spillway structure with a 20-foot-long notch at an elevation of 1,005.0 feet National Geodetic Vertical Datum of 1929 (NGVD 29); (7) a 286-acre impoundment (upper reservoir) with a useable storage volume of 12,318 acre-feet between elevations 938.0 feet and 1,000.5 feet NGVD 29; (8) a 2,110-acre impoundment (lower reservoir or Turners Falls impoundment); (9) a 1,890-foot-long, 130-foot-wide intake channel with a 63-foot-long, 9-foot-high submerged check dam and two 6-foot-wide, 2.75-foot-high sluice gates and two 18-foot-wide stoplogs; (10) a 200-foot-long, 55-foot-wide, 80-foot-high pressure shaft; (11) an 853-foot-long, 31-foot-diameter penstock; (12) two 22-foot-diameter, 100- to 150-foot-long penstocks; (13) four 340-foot-long, 9.5- to 14-foot-diameter penstocks; (14) a 328-foot-long, 70-foot-wide powerhouse that contains four reversible pump turbine-generator units with a total installed capacity of 1,166.8 megawatts (MW); (15) four 25-foot-long, 11-foot-diameter draft tubes that transition to a 20-foot-long, 17 foot-diameter draft tube; (16) a 5,136-foot-long, 33-foot-wide, 31-foot-high horseshoe-shaped tailrace tunnel; (17) 35-foot-long, 40-foot-high trapezoid-shaped stoplogs with 74.3- to 99.5-foot-wide, 48-foot-high trashracks with 6-inch clear-bar spacing; (18) four 26-foot-long, 13.8-kilovolt (kV) generator leads that connect the turbine-generator units to four transformers; (19) two 3,000-foot-long, 345-kV transmission lines; and (20) appurtenant facilities.

PROJECT PROPOSALS

In the Amended Final License Application (AFLA) for the projects (FERC Accession No. 20201204-5120; Exhibit E, Appendix B), FirstLight proposes to (1) provide seasonally-based flows to the Turners Falls bypass reach; (2) limit maximum flows below Cabot Station during certain hours of the day to protect Puritan tiger beetles; (3) implement ramping rates at Cabot Station to protect shortnose sturgeon (*Acipenser brevirostrum*); (4) maintain the current operating range of the Turners Falls Impoundment (TFI); (5) limit the rate of rise in the TFI to protect state-listed odonates; (6) provide variable releases below Turners Falls Dam (TFD) for recreation and ecological conservation purposes; (7) increase the operating range of the NMPS upper reservoir to between 1004.5 and 920 feet NGVD29; and (8) implement upstream and downstream fish passage enhancements (Attachment A, Table 1; FERC Accession No. 20201204-5120, Volume 2 of 5, Part 1 of 4, Tables 2.2.1.2-2 and 2.2.1.2-4).

BACKGROUND

FirstLight filed a Flows and Fish Passage (FFP) Settlement Agreement (FFP Agreement) with the FERC on March 31, 2023 (FERC Accession Number 20230331-56002019), and a Recreation Settlement Agreement (RSA) on June 12, 2023 (FERC Accession Number 20230612-5219) (collectively, the Agreements). The FFP Agreement was signed by the USFWS on March 24, 2023; and the RSA was signed by the NPS on May 15, 2023, and filed together with the proposed Recreation Management Plan (RMP). Wherever the Agreements differ from the Amended Final License Application (FERC Accession No. 20201204-5120), our comments reflect proposals in the Agreements.

NATIONAL PARK SERVICE COMMENTS

The RSA and RMP include a number of mitigation measures and enhancements that will provide for improved recreational access including upgrades to ensure Americans with Disabilities Act (ADA) compliance, and various land protection measures, including permanent protection of a portion of the New England National Scenic Trail that lies within the NMPS Project boundary. The RSA and RMP are supported by the NPS.

The FFP Agreement provides for whitewater boating releases below Turners Falls Dam (TFD), among other measures related to recreation, with conditions that defer to biological and species protection, and is supported by the NPS.

U.S. FISH AND WILDLIFE SERVICE COMMENTS

FFP AGREEMENT

Shortly after submitting the AFLA, FirstLight re-initiated settlement negotiations that had stalled in the fall of 2018. Different resource area groups met separately to work towards settlement agreements. The Department, through the USFWS, actively participated in the FFP group, which reached consensus on settlement provisions in March of 2023. That agreement, filed with the Commission by FirstLight on March 31, 2023, was signed by the USFWS, the National Marine Fisheries Service (NMFS), the Massachusetts Division of Fisheries and Wildlife (MADFW), The Nature Conservancy, American Whitewater, Appalachian Mountain Club, Crab Apple Whitewater, Inc., New England FLOW, and Zoar Outdoor (FERC Accession Number 20230331-56002019). The fish passage measures contained in the FFP Agreement, include:

Turners Falls Downstream Passage and Protection Measures

- Modify the existing downstream fish bypass facility at Turners Falls to increase bypass efficiency and minimize entrainment into Cabot Station.
- Install a new exclusionary trashrack to prevent entrainment into the Station 1 forebay.
- Construct a plunge pool at the base of the Bascule Gate 1 to minimize injury and mortality of fish passing over in spill.

Turners Falls Upstream Passage Measures

- Remove the existing spillway fish ladder, install a new fish lift at the spillway, and retire the Cabot fish ladder.
- Provide interim eel passage at Turners Falls until the new spillway fish lift is operational and eel siting studies have been completed.
- Install permanent upstream eel passage facilities based on the results of eel siting studies.

NMPS Entrainment Protection Measures

- Install a seasonal barrier net at the NMPS intake to prevent entrainment during the fish passage season.

Effectiveness Testing of Passage & Protection Measures at both Projects

- Develop and implement studies to test the effectiveness of newly modified/constructed fish passage facilities relative to identified performance standards.

Adaptive Management Measures

- Implement adaptive management measures (AMMs) at newly modified/constructed passage facilities, if deemed necessary based on results of effectiveness testing.

The major differences between the AFLA proposed fish passage measures and fish passage provisions in the FFP Agreement are (1) implementation timeframes, (2) the conversion of the ultrasound array from a dedicated measure to a potential adaptive management measure, and (3) downstream passage and protection improvements at Cabot Station (Table 2). In addition, the FFP Agreement includes identified performance standards against which effectiveness study results will be evaluated, and passage facility-specific AMMs to help achieve performance goals, if necessary.

The main change between the AFLA proposed flow measures and the flow provisions in the FFP Agreement is the adoption of stabilized flows below Cabot Station from June 1 through November 30, with a specified number of hours allocated on a seasonal basis for allowable deviations from stabilized flows. Other key changes include modified minimum flows in the bypass reach, a higher minimum flow below Cabot Station in the winter, and modifications to the variable flow release amounts and schedule for recreation and ecological conservation purposes (Table 3).

The Department supports the FFP Agreement and recommends the Commission include license conditions that are consistent with it, such that all of the terms and conditions within Appendices A and B of the agreement are enforced by the FERC (FERC Accession Number 20230331-56002019).

In addition, to the extent that any of the FFP Agreement Appendices A and B draft license articles[3] are not incorporated as express license articles, or the FERC determines the proposed license articles are not enforceable, the Department requests that the FERC specifically identify each proposed license article[4] which is not enforceable in its licensing order. Any FFP agreement term and condition not so expressly identified by the FERC as unenforceable will be deemed, by all Parties, as enforceable by the FERC. The Department expects that the agreement of the Parties to consult with one another before undertaking various actions before the FERC (i.e., certain amendment applications) will be enforced by the FERC to the extent of requiring evidence of compliance before accepting such applications. Retention of settlement terms such as these, as enforceable license conditions, is a necessary, and bargained-for, part of the agreement.

The Department's supporting rationale for our recommendations provided pursuant to sections

[3] FFP Agreement Appendices A and B are formatted as draft license articles (FERC Accession Number 20230331-56002019).
[4] Refer to Footnote 3.

10(j) and 10(a) of the FPA are contained herein.

COMMENTS AND RECOMMENDATIONS

All referenced tables and figures are provided in Attachment A to this letter.

Turners Falls: Bypass Flows

The Turners Falls bypass reach is 2.6 miles-long. There is one tributary, Falls River, that enters approximately 0.17 miles below TFD. Station No. 1 discharges into the bypass reach approximately 0.8 miles below TFD. There are two additional hydropower projects located 0.3 miles (Turners Falls Hydro; FERC No. 2622) and 0.5 miles (Milton Hydro; non-jurisdictional) downstream of TFD along the Turners Falls canal. Pursuant to existing water exchange agreements between FirstLight and those project owners, those projects only operate when canal flows exceed 15,000 cubic feet per second (cfs).

The bypass reach contains aquatic and riparian habitat for state listed plants and odonates; aquatic habitat for state listed freshwater mussels; spawning habitat for the state and federally listed shortnose sturgeon; and spawning and rearing habitat for other migratory fish including American shad (*Alosa sapidissima*), blueback herring (*Alosa aestivalis*), sea lamprey (*Petromyzon marinus*), and American eel (*Anguilla rostrata*). The bypass reach also is an important migratory corridor for fish seeking to continue their upstream migrations and contains habitat that supports various life stages of resident riverine fishes.

FirstLight undertook an instream flow study to assess impacts of current operations on aquatic resources within the Turners Falls project-affected area, including the bypass reach (Study 3.3.1: FERC Accession No. 20161017-5012; FERC Accession No. 20170403-5617 [Addendum 1]; FERC Accession No. 20180501-5129 [Addendum 4]; FERC Accession No. 20190301-5112 [Addendum 5]).

The study broke the bypass reach into three segments: Upper Bypass Reach; Lower Bypass Reach; and Tailrace Reach (the Tailrace Reach includes the lowermost 0.75 miles of the bypass reach). The Upper Bypass Reach was further broken into three channels (left, center, and right) and two 'zones' (the lower zone sitting between the confluence of the three Upper Bypass Reach (Reach 1) channels and Station 1).[5] Zone of passage analysis in Reach 1 focused on the left and center channels while the right channel was assessed for habitat suitability, as were the Lower Bypass Reach (Reach 2) and the Tailrace Reach (Reach 3). Steady state hydraulic analyses were performed for Reach 1/right channel and Reach 2 to determine how flow influenced habitat suitability for a suite of species and life stages.

Table 4 summarizes existing bypass flow requirements and those stipulated in the FFP Agreement, by season and bypass reach location. Table 5 provides a summary of synthesized data from Study 3.3.1, showing the percent of maximum Weighted Usable Area (WUA)

[5] This reach includes a third 'zone' sitting between the TFD and where the river splits into the three channels. This zone was not assessed as part of Study 3.3.2 but was analyzed in the context of rare plants as part of Study 3.5.1 (FERC Accession No. 20160302-5043).

provided under the FFP Agreement flows in the bypass reach for three migratory species: American shad, sea lamprey, and shortnose sturgeon.[6] Sea lamprey was the only anadromous species analyzed for Reach 1/right channel; however, the supplemental hydraulic analysis, based on updated habitat suitability index curves recommended by the agencies, did not extrapolate out to the FFP Agreement flows, so that location is not included in Table 5. Higher flows likely result in marginally suitable velocities for lamprey: the highest flow assessed (2,000 cfs) only provides 47 percent of the maximum WUA (121,903 square feet [ft^2] at 750 cfs), which is somewhat lower than the lowest FFP Agreement flow (2,290 cfs) during the lamprey spawning period.

Across lower Reach 1 and Reach 2, FFP Agreement flows provide an average of 84 percent of maximum WUA for spawning sea lamprey; 73 percent of maximum WUA for spawning shad; 88 percent of maximum WUA for juvenile shad; 96 percent of maximum WUA for spawning sturgeon; 100 percent of maximum WUA for sturgeon eggs and larvae; and 73 percent of maximum WUA for sturgeon fry (Table 5).

For resident riverine species, the percent of maximum WUA provided varied by species, life stage, and location (Table 6).[7] Generally, the high flows provided in the spring lowered the suitability of spawning habitat, likely due to excessive velocities, primarily in Reach 1 (upper and lower). The exception is for walleye (*Sander vitreus*), where FFP Agreement flows provide greater than 95 percent of maximum WUA in reaches 1 and 2 (Table 6). Likewise, high spring flows lower suitability for juvenile fallfish (*Semotilus corporalis*); and juvenile and adult longnose dace (*Rhinichthys cataractae*), walleye, and tessellated darter (*Etheostoma olmstedi*) in Reach 1, though as flows decrease from May through June, habitat suitability generally increases (Table 6). The percent of maximum WUA provided by the lower FFP Agreement flows from July 1 through March 31 in Reach 1 Right Channel is greater than 73 percent for juvenile fallfish, greater than 83 percent for juvenile/adult longnose dace, greater than 98 percent for juvenile walleye, and 100 percent for tessellated darter (Table 6). During this same time period, the percent of maximum WUA in the Lower Right Channel is greater than 71 percent for juvenile and adult fallfish and white sucker; but substantially lower for juvenile and adult longnose dace, walleye, and tessellated darter (Table 6).

Across all seasons and FFP Agreement flows, the percent of maximum WUA in Reach 2 exceeds 80 percent for juvenile and adult fallfish and juvenile walleye, with lower suitability values for juvenile and adult longnose dace (63 percent and 69 percent, respectively), white sucker (63 percent), tessellated darter (58 percent); and adult walleye (40 percent) (Table 6).

Table 7 explains the primary driver(s) of the FFP Agreement flows, and the relative benefit of FFP Agreement flows over those currently required: over 16 times more flow in the spring; from 11 to 25 times the flow in the early summer; 18 times the flow in the summer and early fall; and 15 times the flow over the winter. These flows provide greater than 70 percent of maximum WUA for all life stages of the federally endangered shortnose sturgeon as well as spawning

[6] Some values in Table 5 are estimates based on figures and tables contained in Study 3.3.1 reports (FERC Accession No. 20161017-5012 and FERC Accession No. 20180501-5129 [Addendum 4]).
[7] Some values in Table 6 are estimates based on figures and tables contained in the Study 3.3.1 report (FERC Accession No. 20161017-5012).

habitat for anadromous sea lamprey and American shad in the spring and juvenile shad in the summer and fall. Additionally, it provides from 53 to 81 percent of maximum WUA for resident riverine fish species from summer through early spring.

While not explicitly analyzed in Study 3.3.1, the Department notes the FFP Agreement flows also will benefit the anadromous blueback herring (*Alosa aestivalis*) and the catadromous American eel (*Anguilla rostrata*).

The Department supports the Turners Falls bypass flows proposed in the FFP Agreement and requests the FERC include Section 10(j) Recommendations 1 and 2 in any new license issued for the Project.

Minimum Flow Below Cabot Station

Under the new operational protocol outlined in the FFP Agreement flow provisions, there are periods of time when FirstLight will be allowed to deviate from passing the Naturally Routed Flow (NRF)[8] from Cabot Station, such as the limited hours of flexible operations during summer and fall; and the biologically less active winter period. Under the FFP Agreement, during periods when peaking is allowed, FirstLight must pass seasonally varying minimum flows below Cabot Station to protect aquatic resources. The Department supports the minimum flows below Cabot Station proposed in the FFP Agreement and requests the FERC include Section 10(j) Recommendation 3 in any new license issued for the Project.

Cabot Station Ramping Rates

Under the new operational protocol outlined in the FFP Agreement flow provisions, there are periods of time when FirstLight will be allowed to deviate from passing the NRF from Cabot Station. The FFP Agreement requires FirstLight to initiate a ramping protocol during two time periods: from April 1 to June 30 (up- and down-ramping); and from July 1 to August 15 (up-ramping only). The ramping rate of 2,300 cfs per hour equates to bringing one Cabot Station unit online per hour. The spring ramping is intended to minimize behavioral impacts to spawning shortnose sturgeon and American shad, and state listed odonates during metamorphosis when larvae leave water and undergo their final molt into an adult. The summer ramping is to protect emerging odonates. The summer ramping is only required for the first three years, until FirstLight permanently transitions to the default NRF operating mode, as the limited number of hours allowed for flexible operations during that time period are not expected to adversely impact emerging odonates.

The Department supports the ramping rates below Cabot Station proposed in the FFP Agreement and requests the FERC include Section 10(j) Recommendation 4 in any new license issued for the Project.

[8] From December 1 through June 30, the NRF is defined as the hourly sum of the discharges from 12 hours previous as reported by the: Vernon Hydroelectric Project (FERC No. 1904), Ashuelot River United States Geological Survey gauge (USGS, Gauge No. 01161000), and Millers River USGS gauge (Gauge No. 01166500). From July 1 through November 30, the NRF is defined as the hourly sum of the discharges averaged from 1 to 12 hours previous as reported by the: Vernon Hydroelectric Project, Ashuelot River USGS gauge, and Millers River USGS gauge.

Variable Releases from TFD and Below Station No. 1

The new operational protocol outlined in the FFP Agreement flow provisions includes variable releases from TFD and below Station No. 1. These releases are intended to provide recreational boating opportunities as well as introduce natural flow variability to the bypass reach, with the number of releases, schedule of releases, and quantity of flows released generally crafted to align with the patterns of naturally occurring flow events within the Connecticut River. Therefore, we anticipate the variable releases will not adversely affect, and are expected to benefit, the aquatic and riparian resources within the Turners Falls bypass reach.

The Department supports the variable releases from TFD below Station No. 1 proposed in the FFP Agreement and requests the FERC include Section 10(j) Recommendation 5 in any new license issued for the Project.

Turners Falls: Below-Cabot Station Flows

There are approximately 10 miles of unimpounded river below Cabot Station. An additional 15 river miles are hydraulically affected both by the downstream Holyoke Dam (FERC No. 2004) and inflows from the Turners Falls Project and the Deerfield River. Cabot Station currently operates as a daily peaking facility. Normal operations under the current license consist of alternating between generating during peak energy demand periods and releasing a minimum flow while refilling the headpond for the next generation cycle. The required minimum flow is 1,400 cfs and the maximum hydraulic capacity of both stations (Cabot and Station No. 1) combined is just under 16,000 cfs. Approximately 0.64 miles downstream of the Cabot tailrace, the Deerfield River enters the Connecticut River. Deerfield River flows reflect peaking operations of a number of hydropower projects, with base flows of approximately 240 cfs and peak flows of approximately 1,500 cfs.

This project-affected reach (PAR) contains riparian and aquatic habitat for state listed plants and odonates; aquatic habitat for state listed freshwater mussels, including the state endangered and federally at-risk yellow lampmussel (*Lampsilis cariosa*); spawning habitat for the state and federally endangered shortnose sturgeon; spawning and rearing habitat for other migratory fish, including American shad, blueback herring, sea lamprey, and American eel; and riparian habitat to support all life stages of the state endangered cobblestone tiger beetle (*Cicindela marginipennis*), and the state endangered and federally threatened Puritan tiger beetle (*Cicindela puritana*).

FirstLight undertook an instream flow study to assess impacts of current operations on aquatic resources within the Turners Falls project-affected area, including the PAR downstream of Cabot Station (Study 3.3.1: FERC Accession No. 20161017-5012; FERC Accession No. 20170403-5617 [Addendum 1]; FERC Accession No. 20180501-5129 [Addendum 4]; FERC Accession No. 20190301-5112 [Addendum 5]).

The study broke the PAR into three segments: Reach 3; Reach 4; and Reach 5.[9] A two dimensional (2-D) hydraulic model was used for Reach 3 and a one dimensional (1-D) hydraulic

[9] Reach 5 was only assessed for state listed freshwater mussels and four habitat guilds used as surrogates for host fish species.

model was used for reaches 4 and 5. Steady state and dual flow analyses were performed to determine how flow influenced the quantity and persistence of suitable habitat for a suite of species and life stages. For Reach 3, the 2-D model also allowed determination of spatial shifts in suitable habitat.

Table 8 summarizes existing PAR flow requirements and those stipulated in the FFP Agreement, by season. Table 9 provides a summary of synthesized data from Study 3.3.1, showing the percent of persistent maximum WUA provided under the FFP Agreement flows in the PAR for three migratory species: American shad, sea lamprey, and shortnose sturgeon.[10] Where a WUA range is shown, it reflects the default FFP Agreement flow provisions requiring FirstLight to pass the naturally routed flow (NRF) during that time period. Passing the NRF reduces, dampens, and moderates flow fluctuations to mimic naturalized flows, which results in a more natural gradient of habitat availability and increases habitat persistence. During periods when FirstLight is allowed to deviate from passing the NRF, WUA would revert to the lower of the base/peak combination, which varies by species and life stage.

Implementation of the FFP Agreement flow provisions (i.e., higher bypass flows, higher minimum flows, and seasonal naturally routed flows below Cabot Station) provides more persistent habitat relative to current conditions for all three species and life stages. Single values represent the persistent habitat under peaking conditions, which is the lower of the base flow/peak flow combination.

Table 10 provides a summary of synthesized data from Study 3.3.1 (FERC Accession Number 20161017-5012; FERC Accession Number 20180501-5129 [Addendum 2; Addendum 3]; FERC Accession Number 20190930-5159 [Addendum 7]) showing the percent of persistent maximum WUA provided under the FFP Agreement flows in the PAR for yellow lampmussel. Similar to results for the migratory fish evaluated, results indicate the FFP Agreement flow provisions provide more persistent habitat relative to current conditions for both life stages, with the largest increases seen in Reach 3 for adults and Reach 4 for juveniles. In addition to these quantitative analyses, FirstLight provided figures portraying the spatial shifts in suitable habitat that occur in Reaches 3 and 5 (FERC Accession Number 20180501-5129 [Addendum 2; Addendum 3]).

FirstLight also analyzed the relationship between flow and habitat for species guilds, used as surrogates for host fish species of yellow lampmussel and two other state listed mussels. Table 11 provides a summary of synthesized data from Study 3.3.1 (FERC Accession Number 20161017-5012; FERC Accession No. 20170403-5617 [Addendum 1]; FERC Accession Number 20180501-5129 [Addendum 2; Addendum 3]) showing the percent of persistent maximum WUA provided under the FFP Agreement flows in the PAR for the Deep Slow Guild.[11,12] Results indicate the FFP Agreement flow provisions provide substantially more persistent habitat relative to current conditions in Reaches 4 and 5. In Reach 3, the overall

[10] Some values in Table 5 are estimates based on figures and tables contained in Study 3.3.1 reports (FERC Accession No. 20161017-5012 and FERC Accession No. 20180501-5129 [Addendum 4]).
[11] Of the habitat guilds evaluated, the Deep Slow Guild represents host fish species common to all three target mussel species and had 4 (Reach 4) to 7 (Reach 5) times the amount of WUA for yellow lampmussel relative to the other guilds.
[12] Percent maximum WUA was estimated from the WUA versus Flow figures provided in Study 3.3.1 Addendum 1 and 2 reports.

amount of habitat declines under FFP Agreement flows, likely due to increased bypass flows causing velocities to exceed suitability criteria. However, the overall amount of Deep Slow Guild habitat in Reach 3 represents 13 and 3.7 percent of the habitat in Reaches 4 and 5, respectively.

FFP Agreement flow provisions also will benefit the cobblestone (CTB) and Puritan tiger beetles (PTB). Table 12 summarizes the results comparing the availability and persistence of habitat provided under current operations versus the FFP Agreement flow provisions for adult PTB at Rainbow Beach (Northampton, MA) based on historical operations and modeled FFP flows for four representative water years. The data show that passing the NRF with limited deviations for flexible operations (i.e., peaking from Cabot Station) provides much longer periods of time at the 50 and 70 percent adult habitat exceedance (Table 12). Figure 1 graphically portrays the difference in habitat persistence for the month of August, 2016. This increased habitat persistence more closely aligns with a natural (i.e., unregulated) freshwater riverine hydrograph. The reduction in persistence of 100 percent habitat availability is due to the increase in base flows provided under the FFP Agreement, which calls for passing the NRF[13] versus the current, licensed base flow of 1,433 cfs (Figure 2[14]). In addition to August, the month of November was also included in the analysis for PTB larvae, due to documented activity of that life stage into December (Gwiazdowski, 2021). Table 13 provides results only for 100 percent habitat availability because at lesser habitat exceedance levels there was no difference between the current operations and FFP flow scenarios.

This same analysis was conducted for CTB using the same flow/operations data, but with elevation data from Montague Beach (Turners Falls, MA) rather than Rainbow Beach. Trends were similar, with substantially longer periods at the 50 and 70 percent habitat exceedance under FFP flows (Table 14). Figure 3 graphically portrays the difference in habitat persistence for the month of August, 2016. As with PTB, the reduction in persistence of 100 percent habitat availability for CTB is due to the increase in base flows provided under the FFP Agreement, which calls for passing the NRF versus the current, licensed base flow of 1,400 cfs (Figure 2).

The Department supports the flow stabilization protocol below Cabot Station, including allowable deviations for flexible operations, proposed in the FFP Agreement and requests the FERC include Section 10(j) Recommendation 6 in any new license issued for the Project.

Cabot Station Emergency Gate Use

The Turners Falls Canal has a side spillway comprised of ten gates: eight are used for managing canal flows (i.e., the spill gates) and the other two are used to provide attraction water to the Cabot fish ladder. The spill gates are used on an intermittent basis to pass debris or flow in the event of an unplanned outage of Cabot Station. Total discharge capacity of the spill gates is 12,000 cfs. Water passed through the spill gates discharges in close proximity to one of the two documented shortnose sturgeon spawning areas within the Turners Falls project boundary. During pre-filing consultation, potential impacts of emergency gate discharges on sturgeon

[13] Based on historical flow data from the USGS Montague gage (01170500), mean flow in August is 3,613 cfs which equates to an NRF of roughly 3,000 cfs after subtracting out flow from the Deerfield River.
[14] To analyze habitat impacts, the flows in Figure 2 were adjusted to account for the difference in drainage area between Montague Beach and Rainbow Beach.

spawning and early life stage (ELS) rearing habitat were assessed (Study 3.3.12; FERC Accession Number 20160302-5039).

Results revealed at least one spill gate was at least partially open approximately 60 percent of the time, with discharges greater than 1,500 cfs occurring 1.1 percent of the time. The duration of spill events exceeding 1,500 cfs ranged from less than 10 minutes to 13.2 hours, with a median duration of 55 minutes (FERC Accession Number 20160302-5039). Spill gate usage occurred over a variety of bypass flows and Cabot generation levels. Over the time period analyzed, there were 26 events when at least four spill gates were open during the months of April, May, and June. Only nine of the 26 events were due to an emergency situation (e.g., high canal water level) (FERC Accession Number 20160302-5039).

Various flow scenarios were run through a hydraulic model to determine how spill gate discharge affected velocities and shear stress within and near the spawning area and downstream rearing shoals (FERC Accession Number 20160302-5039). Model output revealed the largest areas of high velocity (i.e., exceeding the 1 to 4 fps velocity range suitable for spawning sturgeon) occurred during high spill gate discharge levels (i.e., 5,000 and 8,000 cfs) (FERC Accession Number 20160302-5039). Results showed that the amount and location of potential sediment mobilization varied, depending on bypass flow, spill gate discharge, and Cabot generation (FERC Accession Number 20160302-5039).

Abrupt increases in velocity, extended periods of velocities exceeding those preferred by sturgeon, and sediments mobilized upstream of the spawning area all have the potential to impact spawning behavior and early life stages.

The Department defers recommended conditions regarding the emergency gate use to the NMFS, as the lead federal agency on issues related to shortnose sturgeon.

Turners Falls Impoundment Water Level Management

The current license requires the Project to maintain water levels in the TFI between elevation 176.0 feet and 185.0 feet NGVD29. FFP Agreement provision A190 maintains this operational band, but adds an upramping protocol that limits the rate of rise to less than 0.9 feet per hour from May 15 to August 15 from 8:00 am to 2:00 pm, to protect state listed odonates (Table 15) known to occur in the TFI during the emergence and eclosure period (Study 3.3.10; FERC Accession Number 20161228-5079).

The Department often seeks to minimize headpond operational bands to reduce potential impacts to riparian habitat and littoral spawning fish species. However, in this case, the headpond also is the lower reservoir of the NMPS Project. Pumped storage projects, by definition, alternately store and release large amounts of water, which results in fluctuating water levels within the upper and lower reservoirs. Further, the FFP Agreement provisions require substantially increased flows to the bypass reach and stabilized flows below Cabot Station. These factors support the need for a limited operational band to both manage NMPS operations and meet flow requirements below TFD.

In its June 12, 2023, response to FFP Agreement comments expressing concern over TFI water levels dewatering littoral habitat and impacting recreational boating, FirstLight provided supporting documentation, including modeling of operating scenarios using water years 2000 to 2014, for conditions provided in the Agreement in Principle (AIP; FERC Accession Number 20220318-5004). Those model results indicate that future TFI water levels will be similar to baseline conditions and higher than baseline during the period June 1 to November 30 (FERC Accession Number 20230612-5216). Therefore, recreational boating should not be adversely impacted and littoral habitat should not be dewatered more often than has historically occurred.

For the reasons discussed above, the Department supports this FFP Agreement proposal and requests the FERC include Section 10(j) Recommendation 7 in any new license issued for the Project.

Project Operation, Monitoring, and Reporting Plan

The flow related measures stipulated in the FFP Agreement and recommended herein will require vigilant monitoring and management of project operations to ensure compliance. FFP Agreement provision A200 calls for the Licensee to develop a Project Operation, Monitoring, and Reporting Plan, in consultation with the Service and other agencies, that includes a description of how the Licensee will comply with operational requirements, including bypass reach and below-Cabot Station flow protocols, and TFI water level management. Agreement provision A200 also requires documenting and categorizing allowable deviations from operational requirements.

The Department supports this FFP Agreement proposal and requests the FERC include Section 10(a) Recommendation 1 in any new license issued for the Project.

Bald Eagle Protection Plan

Bald eagles (*Haliaeetus leucocephalus*) occur within the Turners Falls and NMPS project areas; they have nested on islands within TFI and roost in trees along the Connecticut River. FirstLight undertook a Baseline Study of Terrestrial Wildlife and Botanical Resources (Study 3.4.1; FERC Accession Number 20160302-5042). Results of that survey documented three eagle nests within the Turners Falls project-affected area: two upstream and one downstream of TFD. More recent data documents three to four pairs of eagles nesting within the Turners Falls and NMPS project areas annually (personal communication, Jesse Leddick, September 18, 2023).

FFP Agreement provisions A400 (for Turners Falls) and B300 (for NMPS) require the Licensee to implement the Bald Eagle Protection Plans (BEPPs) submitted concurrently with the FFP Agreement (FERC Accession Number 20230331-56002019). The BEPP describes protection measures FirstLight will undertake prior to tree clearing or construction activities within the project boundaries or immediately adjacent to the project boundaries, including: surveying for eagle nests; performing tree clearing or construction activities in accordance with the National Bald Eagle Management Guidelines, if nests are discovered; and prohibiting tree clearing and construction activities during the nesting season pursuant to the National Bald Eagle Management Guidelines.

The Department supports these FFP Agreement proposals and requests the FERC include Turners Falls Section 10(j) Recommendation 8 and NMPS Section 10(j) Recommendation 1 in any new license issued for the Project.

Bat Protection Measures

The northern long-eared bat (NLEB; *Myotis septentrionalis*) was listed as federally threatened under the Endangered Species Act by the USFWS on April 2, 2015 (USFWS 2015). The species was reclassified as endangered on November 29, 2022, with the rule becoming effective March 31, 2023 (USFWS 2022a). NLEBs typically roost singly or in maternity colonies underneath bark or in cavities or crevices of live trees and snags (USFWS 2022b).

During the first phase of relicensing, FirstLight undertook studies to provide information on the type and quantity of wetland, riparian, and upland habitat potentially affected by project operations (Studies 3.4.1 and 3.5.1, FERC Accession Number 20160302-5042; and Study 3.4.2, FERC Accession Number 20150914-5188). Based on results of the botanical survey portions of those studies, over 1,500 acres of project lands are forested (Table 16). Therefore, potentially suitable habitat exists for NLEBs, and routine or other maintenance activities involving tree clearing could negatively impact NLEB habitat.

In the AFLA (FERC Accession No. 20201204-5120; Exhibit E, Appendix D) and the FFP Agreement (FERC Accession Number 20230331-56002019, provisions A410 and B310) FirstLight proposes to minimize project-related impacts to NLEB by cutting trees equal to or greater than 3 inches in diameter at breast height within the Northfield Mountain Pumped Storage and Turners Falls Project boundaries only between November 1 and March 31, unless they pose an immediate threat to human life or property (hazard trees).

The Department supports the Applicant's proposal to avoid tree removal activities during the bat active season of April 1 through October 31 and requests the FERC include Turners Falls Section 10(j) Recommendation 9 and NMPS Section 10(j) Recommendation 2 in any new license issued for the Project.

Turners Falls Canal Drawdown

FirstLight conducts annual drawdowns of the Turners Falls canal to conduct inspections of the civil works and perform maintenance or repair activities. The drawdowns last up to one week and result in isolated pools and extensive dewatered areas within the canal. The drawdowns used to occur in July but were moved to September/October to better align with ISO-New England's peak electrical demand period of June through mid-September. Aquatic habitat within the canal is utilized by resident riverine and migratory fishes, freshwater mussels, reptiles, and amphibians.

As part of the license proceedings, FirstLight undertook a study to assess impacts of these drawdowns on aquatic species inhabiting the canal (Study 3.3.18, FERC Accession Numbers 20140916-5028 and 20150914-5191). Electrofishing and seining surveys conducted in 14 pools (11 hydraulically connected and three isolated) during the 2014 drawdown documented 22

species of fish (FERC Accession Numbers 20140916-5028). Migratory species observed include sea lamprey, American eel, and American shad. Initial surveys were conducted the day of, and the day following, the drawdown. A second survey took place the day before the canal was refilled. Sampling analysis revealed survivability decreased between the two sampling events, with lower survival in isolated pools (77 percent down to 38 percent) relative to connected pools (74 percent down to 58 percent) (FERC Accession Numbers 20140916-5028). Survivability also varied with fish species, with higher mortality among the families Clupeidae (i.e., juvenile shad), Percidae, and Cyprinidae (FERC Accession Numbers 20140916-5028). While no American eel mortalities were observed over the course of the study, dead sea lampreys were documented during the initial and final surveys (FERC Accession Numbers 20140916-5028).

Quadrat sampling also was undertaken in select areas within the canal, documenting two species of freshwater mussels, one fish species (juvenile sea lamprey), and one species of amphibian (mudpuppy; *Necturus maculosus*). No dead mussels or lampreys were documented, but two of the three mudpuppies were dead (FERC Accession Numbers 20140916-5028).

In addition to mortalities found within wetted habitat, there were multiple dewatered sites containing dead, stranded fish. A total of 766 stranded fish were documented, including six juvenile lamprey and 252 juvenile shad (FERC Accession Number 20150914-5191).

Based on these results, the report concludes the drawdown has little impact to organisms in the canal (FERC Accession Numbers 20140916-5028). The report also identifies potential measures FirstLight could implement to enhance aquatic organism survival during the drawdown: conduct the rate of drawdown similar to the rate used in 2014, and establish boundaries for heavy machinery to travel within the canal (FERC Accession Numbers 20140916-5028).

The Service's November 13, 2015, study report comment letter (FERC Accession Number 20151125-0036) summarized feedback on study report 3.3.18 received from Dr. Boyd Kynard, who has over 30 years of experience researching and monitoring sea lamprey within the Connecticut River watershed. Dr. Kynard's feedback included data from lampreys he collected from the canal during drawdown years 2011 and 2014, indicating no substantive difference in numbers of stranded lamprey between the two years: Dr. Kynard collected 207 juvenile lampreys in 2011 and 254 lampreys in 2014, which suggests the shift in timing of the canal drawdown from September (in 2011) to November (2014) likely would not explain the low numbers of lampreys observed by FirstLight [15] (6) across all stranding sites documented in Study 3.3.18 during the 2014 drawdown (FERC Accession Number 20150914-5191).

Because of the disparate data and conclusions drawn regarding impacts of the drawdown on juvenile sea lamprey, the Service recommended a supplemental, modified study focused on quantifying lamprey abundance and response to drawdowns (FERC Accession Number 20151125-0036). However, the Commission did not support this request (FERC Accession Number 20160115-3036).

Since 1993, volunteer fish rescue efforts during the canal drawdown have taken place; first led by Dr. Boyd Kynard, and more recently, the Connecticut River Conservancy (CRC). During

[15] The 2011 drawdown occurred in July and the 2014 drawdown occurred in late September/early October.

these events, which are held on the first drawdown day, hundreds to thousands of stranded larval and juvenile lampreys are collected and moved.[16] These are all lampreys that have left their burrows and would die from predation or desiccation in the absence of this effort. How many larval lampreys remain burrowed and survive until rewatering of the canal remains unknown. Given the amount of potential suitable habitat within the lower canal and the extent of dewatered habitat during the drawdown, the impact to lamprey rearing within the canal could be substantial.

In 2018, the Connecticut River Atlantic Salmon Commission (CRASC) approved a Connecticut River Anadromous Sea Lamprey Management Plan (CRASC, 2018). The goal of the plan is to restore and/or enhance sea lamprey runs within the Connecticut River watershed. One of the strategies to meet this goal is to protect identified spawning and rearing habitat (CRASC, 2018).

Sea lamprey rearing habitat exists in the canal and is impacted by the annual drawdowns. Moving the drawdown from July to late summer/early fall may provide some desiccation protection and a slower drawdown rate could reduce fish stranding. Also, establishing boundaries for heavy machinery to travel within the canal could reduce direct physical impacts to amphibians, freshwater mussels, and lampreys burrowed in sediments. However, these measures alone are not sufficient to protect sea lamprey stranded outside or within their burrows during the drawdown event. Therefore, the Department requests the FERC include Turners Falls Section 10(j) Recommendation 10 in any new license issued for the Project, which calls for the Licensee to develop a Canal Drawdown Protection Plan. The plan, developed in consultation with the Service and the Massachusetts Division of Fisheries and Wildlife (MADFW), will identify measures to minimize impacts to aquatic organisms within the canal during the annual drawdowns.

Invasive Species

During the first phase of relicensing, FirstLight undertook studies to provide information on the type and quantity of wetland, riparian, and upland habitat potentially affected by project operations (Studies 3.4.1 and 3.5.1, FERC Accession Number 20160302-5042; and Study 3.4.2, FERC Accession Number 20150914-5188).The botanical portion of those studies identified 21 upland invasive plant species within the Turners Falls project-affected area including one early detection species (spotted knapweed; *Centaurea maculosa*) and the remainder listed as non-native invasive plant species by the Massachusetts Invasive Plant Advisory Group (MIPAG) (FERC Accession Number 20160302-5042; Study 3.4.1, Table 4.4-1). Percent coverage of invasive species varied depending on location, with highest concentrations at the most upstream and downstream ends of the TFI. Eight MIPAG listed non-native invasive plant species plus spotted knapweed were documented within the NMPS study area, with most occurrences documented in disturbed habitat and only trace amounts found in forested habitat (Study 3.4.2, FERC Accession Number 20150914-5188).

[16] https://bkriverfish.com/news/; https://www.recorder.com/Upon-canal-draining-in-Turners-Falls-sea-lampreys-get-help-from-environmental-groups-volunteers-36268950#lg=1&slide=6; https://www.facebook.com/connecticutriver/videos/join-crc-bk-riverfish-and-volunteers-at-the-annual-drawdown-of-the-turners-falls/217144527135048/; https://www.youtube.com/watch?v=A6ffGu69iRc

Wetland, riparian, and littoral plant surveys documented five invasive submerged aquatic vegetation (SAV) species within the TFI, including fanwort (*Cabomba caroliniana*), Eurasian milfoil (*Myriophyllum spicatum*), variable leaf milfoil (*Myriophyllum heterophyllum*), curly-leaved pondweed (*Potamageton crispus*), and water chestnut (*Trapa natans*) (FERC Accession Number 20160302-5042; Study 3.5.1, Table 4.2.2-5). These invasive SAV beds are most common within the lower portion of the TFI (FERC Accession Number 20160302-5042; Study 3.5.1). As noted in the study report, the presence of these species may ultimately degrade available habitat for fish and wildlife (FERC Accession Number 20160302-5042; Study 3.5.1).

In the AFLA, FirstLight proposed identical Invasive Plant Species Management Plans (IPSMP) for the Turners Falls and NMPS projects (FERC Accession No. 20201204-5120, Exhibit E, Appendices A and B of Volume 2, Part 3). The stated purpose of the plans is to prevent the introduction and/or spread of invasive species with the project boundaries through implementation of best management practices and supporting the education of those performing construction, maintenance, and/or operational activities with the project boundaries (FERC Accession No. 20201204-5120, Exhibit E, Appendices A and B of Volume 2, Part 3).

Generally, the Department supports the protection measures outlined in Section 3 of the plans as they relate to preventing future establishment or spreading of invasive plant species when performing routine maintenance, construction, or major maintenance activities (FERC Accession No. 20201204-5120, Exhibit E, Appendices A and B of Volume 2, Part 3). However, we recommend adding the following measure to Section 3.2.3:

> Based on post-activity vegetation surveys, if invasive species have been found to outcompete desirable vegetation during reestablishment, the Licensee will treat infestations, as necessary, to eliminate or reduce the invasive infestation(s).

Given the NMPS study results indicating low levels of invasive species outside of already disturbed areas, the Department supports inclusion of the IPSMP for the NMPS project with the addition of the language recommended above, and requests the FERC include NMPS Section 10(j) Recommendation 3 in any new license issued for the Project.

At Turners Falls, the Department recommends including active control measures for specific existing invasive aquatic plant infestations as well as implementation of an early detection and rapid response protocol to minimize potential for establishment of novel invasive plant species. Based on survey results, 41 of the 107 SAV beds had some level of invasive species infestation, with the majority occurring immediately upstream of the Turners Falls Dam (i.e., Barton Cove) (FERC Accession Number 20160302-5042; Study 3.5.1). The Massachusetts Department of Environmental Protection (MADEP) lists Barton Cove as not supporting the designated use of fish, other aquatic life, and wildlife due to impairment caused by invasive species, including curly-leaf pondweed, fanwort, water chestnut, and Eurasian water milfoil.[17] Another segment of the Connecticut River extending from the Turners Falls Dam upstream to the Route 10 bridge in Northfield, MA (excluding Barton Cove) also is listed as not supporting the designated use of fish, other aquatic life, and wildlife due, in part, to water chestnut.[18] Since issuance of MADEP's

[17] Integrated Lists of Waters & Related Reports | Mass.gov (Appendix 15)
[18] Refer to Footnote 11

2018/2020 Integrated List of Waters, water chestnut has become established in the lower portion of the Turners Falls canal.

Water chestnut forms dense mats that displace native species and interfere with recreational activities (Hummel & Kiviat, 2004). The dense mats of vegetation shade out native aquatic plants that provide food and shelter to native fish, waterfowl, and insects; and decomposition of these dense mats reduces dissolved oxygen levels and may kill fish.[19] Because it is an annual plant, it can be effectively controlled if seed formation is prevented, through manual, mechanical, or chemical methods.[20]

For at least the past five years, the CRC has held volunteer water chestnut removal events in Barton Cove.[21] The Service also has assisted with water chestnut control in the Turners Falls canal, using its specialized harvest equipment.[22] While FirstLight has partnered with the CRC and the Service in some of these efforts, it has not codified a commitment to continue them into the future through inclusion in the proposed IPSMP. Ongoing management and control efforts are needed, given the plants presently persist in these areas, and the seed bank could be viable for up to 12 years. Therefore, the Department developed Turners Falls Section 10(j) Recommendation 11, which would require the Licensee to undertake annual water chestnut removal within the lower TFI and canal.

The purpose of an early detection and rapid response (EDRR) program is to find and eradicate new invasive species populations before they spread and cause harm to project facilities, as well as the fish and wildlife resources the FFP Agreement provisions are designed to protect and enhance. Within the Connecticut River watershed, the highly invasive *Hydrilla verticillata* (hydrilla) was first detected near Glastonbury, Connecticut, in 2016.[23] Surveys conducted in 2019 and 2020 found it had spread nearly 70 miles upstream to Agawam, Massachusetts.[24] The species propagates both sexually and vegetatively, with plant fragments able to sprout roots and establish new populations. According to the U.S. Army Corps of Engineers (ACOE), hydrilla impacts ecological health of aquatic ecosystems by forming dense stands underwater that can alter river flow; shade or crowd out all other native aquatic plants; replace habitat of sensitive species; alter water chemistry and pH; cause dramatic swings and reduction in dissolved oxygen levels; increase water temperatures; and negatively affect the diversity and abundance of fish populations.[25] Hydrilla also has negative impacts on recreation, including making it more difficult or even potentially dangerous for both boating and swimming due to the denseness of its growth.[26]

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[19] New York Department of Environmental Conservation water chestnut website. Accessed September 21, 2023.
[20] New York Department of Environmental Conservation water chestnut website. Accessed September 21, 2023.
[21] https://www.reformer.com/local-news/connecticut-river-help-remove-invasive-water-chestnut/article_1719120e-fcdf-565d-9614-37f4f48c0956.html;
https://www.gazettenet.com/Events#!/details/Paddle-with-a-Purpose/5095366/2018-07-19T18;
https://www.facebook.com/events/2292450324415024/2292450337748356/;
https://www.ctriver.org/event/paddle-with-a-purpose-water-chestnut-removal-in-gill-ma-bartons-cove-2022-09-17/
[22] July 2022 Conte Refuge Happenings.pdf (fws.gov). Accessed September 21, 2023.
[23] https://www.nae.usace.army.mil/Missions/Projects-Topics/Connecticut-River-Hydrilla/#:~:text=Hydrilla%20was%20first%20identified%20in,as%20it%20is%20genetically%20distinct.
[24] Refer to Footnote 15.
[25] Refer to Footnote 15
[26] Refer to Footnote 15

The CRC and the Connecticut Agricultural Experiment Station (CAES) have been leaders in educating the public about hydrilla, conducting rigorous monitoring to identify new infestations, and investigating emerging control methods. Given the magnitude of the hydrilla problem in the Connecticut portion of the watershed, the ACOE is undertaking a multi-million dollar project to investigate the plant's growth patterns and water exchange dynamics in the Connecticut River, and evaluate herbicide efficacy in the laboratory in 2023 to inform an operational-scale field demonstration in 2024.[27]

The heaviest hydrilla infestations occur in backwater or low velocity areas, such as those used for boat launches. It follows that a likely point of entry for hydrilla introduction at the Turners Falls Project is through recreational boating. Within the TFI, there are three formal boat launches and one informal kayak/canoe carry-in boat access site (FERC Accession No. 20201204-5120, Exhibit E, Volume 2, Part 2). Without vigilant monitoring, hydrilla could quickly become established in Barton Cove and other low velocity areas within the TFI. Controlling or eradicating established beds could be difficult, given the number of sensitive plant and invertebrate species that inhabit the TFI. Therefore, it is imperative FirstLight include an EDRR program as part of its IPSMP.

Attachment C to this letter provides the Department's modified IPSMP that incorporates the changes to FirstLight's proposed plan as described above. The Department requests the FERC include in any new license issued for the Project, Turners Falls Section 10(j) Recommendation 11, which requires the Licensee to implement the IPSMP upon license issuance.

The IPSMP aligns with purposes of the Silvio O. Conte National Fish and Wildlife Refuge Act,[28] which include:

- to conserve, protect, and enhance the Connecticut River valley populations of Atlantic salmon, American shad, river herring, shortnose sturgeon, bald eagles, peregrine falcons, osprey, black ducks, and other native species of plants, fish, and wildlife;
- to conserve, protect, and enhance the abundance and diversity of native plant, fish, and wildlife species and the ecosystems on which they depend throughout the Connecticut River watershed; and
- to restore and maintain the chemical, physical, and biological integrity of wetlands and other waters within the refuge.

The IPSMP also addresses goals of habitat conservation and recreation identified in the Silvio O. Conte National Fish and Wildlife Refuge (Conte Refuge) 2017 Comprehensive Conservation Plan (CCP).[29] Managing invasive species within the Turners Falls Project boundary will promote biological diversity, integrity, and resiliency of aquatic ecosystems; and promote high quality public recreational opportunities in over a 22-mile stretch of the Connecticut River.

[27] https://www.ctriver.org/get-involved/stopping-an-invasive-species-water-chestnut-2/hyrilla-in-the-ct-river-watershed/

[28] https://www.govtrack.us/congress/bills/102/hr794/text/enr

[29] USFWS. 2017. Silvio O. Conte National Fish and Wildlife Refuge Comprehensive Conservation Plan. United States Fish and Wildlife Service, Hadley, MA. https://www.friendsofconte.org/comprehensive-conservation-plan

A search of the Commission's e-library found many examples where it has approved similar requirements in recent FERC license orders, including the Salina Pumped Storage Project (FERC Number 2524-021),[30] the Eagle Crest Pumped Storage Project (FERC Number 13123-014),[31] the Weed Dam Project (FERC Number 2464-015),[32] the Loup River Project (FERC Number 1256-031),[33] and the Oconto Falls Project (FERC Number 2523-018).[34]

SECTION 10(j) RECOMMENDATIONS FOR THE TURNERS FALLS PROJECT

Pursuant to section 10(j) of the FPA, as amended, and the Fish and Wildlife Coordination Act, the Service recommends the following protection, mitigation, and enhancement measures for fish and wildlife resources be included in any license the Commission issues for the Project.

Recommendation 1 (FFP Provision A110): Minimum Flows below Turners Falls Dam

Upon license issuance, the Licensee shall discharge from the Turners Falls Dam or from the gate located on the power canal ("canal gate") just below the Turners Falls Dam the following seasonal minimum flows.

Date	Minimum Flows below Turners Falls Dam
01/01-03/31[1]	• If the Naturally Routed Flow[4] is ≤ 400 cubic feet per second (cfs), the Minimum Flow below Turners Falls Dam shall be 400 cfs or the NRF, whichever is less. • If the NRF is > 400 cfs, the Minimum Flow below Turners Falls Dam shall be 400 cfs.
04/01-05/31	• If the NRF is ≤ 6,500 cfs, the Minimum Flow below Turners Falls Dam shall be 67 percent of the NRF. • If the NRF is > 6,500, the Minimum Flow below Turners Falls Dam shall be 4,290 cfs.
06/01-06/15[2,3]	• If the NRF is ≤ 4,500 cfs, the Minimum Flow below Turners Falls Dam shall be 67 percent of the NRF. • If the NRF is > 4,500 cfs, the Minimum Flow below Turners Falls Dam shall be 2,990 cfs.
06/16-06/30[3]	• If the NRF is ≤ 3,500 cfs, the Minimum Flow below Turners Falls Dam shall be 67 percent of the NRF. • If the NRF is > 3,500 cfs, the Minimum Flow below Turners Falls Dam shall be 2,280 cfs.
07/01-11/15[1]	• If the NRF is ≤ 500 cfs, the Minimum Flow below Turners Falls Dam shall be 500 cfs or the NRF, whichever is less. • If the NRF is > 500 cfs, the Minimum Flow below Turners Falls Dam shall be 500 cfs.

[30] FERC Accession Number 20151016-3016
[31] FERC Accession Number 20151119-3090
[32] FERC Accession Number 20170207-3028
[33] FERC Accession Number 20170522-3032
[34] FERC Accession Number 20191119-3024

11/16-12/31[1]	• If the NRF is ≤ 400 cfs, the Minimum Flow below Turners Falls Dam shall be 400 cfs or the NRF, whichever is less. • If the NRF is > 400 cfs, the Minimum Flow below Turners Falls Dam shall be 400 cfs.

[1]From November 16 through March 31, the 400 cfs minimum flow below Turners Falls Dam will be provided from the canal gate, having a design maximum capacity of 400 cfs. The Licensee shall open the canal gate to its maximum opening and implement ice mitigation measures, if necessary, to maintain the maximum opening. The Licensee shall monitor canal gate operations to determine if supplemental measures, such as cable-heating the gate, are needed to maintain flows at or as close to 400 cfs as possible.

[2]One of the upstream fish passage adaptive management measures (AMMs) described in Condition 4 of Attachment E calls for increasing the Total Minimum Bypass Flow below Station No. 1 (see Recommendation 2) from June 1 to June 15 from 4,500 cfs to 6,500 cfs. If this AMM is enacted, and if the NRF is ≤ 6,500 cfs, the Minimum Flow below the Turners Falls Dam shall be 67 percent of the NRF, subject to the conditions in Condition 4 of Attachment E. If this AMM is enacted, and if the NRF is > 6,500 cfs, the Minimum Flow below the Turners Falls Dam shall be 4,290 cfs, subject to the conditions in Condition 4 of Attachment E.

[3]The magnitude of the Minimum Flow below Turners Falls Dam from June 1 to June 30 may be modified in the future pending fish passage effectiveness studies (see Condition 4 of Attachment E). If the Licensee conducts fish passage effectiveness studies, in consultation with the Massachusetts Division of Fisheries and Wildlife (MADFW), National Marine Fisheries Service (NMFS), and United States Fish and Wildlife Service (USFWS) and determines that migratory fish are not delayed by passing a greater percentage of the Total Minimum Bypass below Station No. 1 (see Recommendation 2) via Station No. 1 discharges, the Licensee may file for a license amendment to increase the Station No. 1 discharge upon written concurrence of MADFW, NMFS, and USFWS. Prior to filing for a license amendment with the Commission, the Licensee shall consult the Massachusetts Department of Environmental Protection (MADEP) and address any of its comments in the license amendment filing.

[4]From December 1 through June 30, the NRF is defined as the hourly sum of the discharges from 12 Hours previous as reported by the: Vernon Hydroelectric Project (FERC No. 1904), Ashuelot River United States Geological Survey gauge (USGS, Gauge No. 01161000), and Millers River USGS gauge (Gauge No. 01166500). From July 1 through November 30, the NRF is defined as the hourly sum of the discharges averaged from 1 to 12 hours previous as reported by the: Vernon Hydroelectric Project, Ashuelot River USGS gauge, and Millers River USGS gauge. Upon license issuance until 3 years thereafter, the Licensee shall operate the Turners Falls Project based on the NRF computational method from July 1 through November 30 to determine if the Turners Falls Project can be operated in this manner. If the Turners Falls Project cannot be operated in this manner, the Licensee shall consult MADFW, NMFS, and USFWS on alternative means of computing the NRF that are feasible for Turners Falls Project operation and sufficiently dampen upstream hydroelectric project flexible operations.

The Minimum Flow below Turners Falls Dam may be temporarily modified if required by equipment malfunction or operating emergencies reasonably beyond the control of the Licensee. If the Minimum Flow below Turners Falls Dam is so modified, the Licensee shall notify the Commission, MADEP, MADFW, NMFS, and USFWS as soon as possible, but no later than 10 days after such incident. The Minimum Flow below Turners Falls Dam may also be temporarily modified for short periods upon mutual agreement with the Licensee for the Northfield Mountain Pumped Storage Project (FERC No. 2485), MADEP, MADFW, NMFS and USFWS, and upon 5 days' notice to the Commission.

Recommendation 2 (FFP Provision A120): Total Minimum Bypass Flows below Station 1

Upon license issuance, the Licensee shall maintain the Total Minimum Bypass Flows below Station No. 1 as follows:

Date	Total Minimum Bypass Flows below Station No. 1[1]
01/01-03/31	• If the NRF is ≤ 400 cfs, the Total Minimum Bypass Flow below Station No. 1 shall be 400 cfs, or the NRF, whichever is less. • If the NRF is > 400 cfs, the Total Minimum Bypass Flow below Station No. 1 shall be 1,500 cfs, or the NRF, whichever is less.
04/01-05/31	• If the NRF is ≤ 6,500 cfs, the Total Minimum Bypass Flow below Station No. 1 shall be the NRF. • If the NRF is > 6,500 cfs, the Total Minimum Bypass Flow below Station No. 1 shall be 6,500 cfs.
06/01-06/15[2,4]	• If the NRF is ≤ 4,500 cfs, the Total Minimum Bypass Flow below Station No. 1 shall be the NRF. • If the NRF is > 4,500 cfs, the Total Minimum Bypass Flow below Station No. 1 shall be 4,500 cfs.
06/16-06/30[4]	• If the NRF is ≤ 3,500 cfs, the Total Minimum Bypass Flow below Station No. 1 shall be the NRF. • If the NRF is > 3,500 cfs, the Total Minimum Bypass Flow below Station No. 1 shall be 3,500 cfs.
07/01-08/31[3]	• If the NRF is ≤ 500 cfs, the Total Minimum Bypass Flow below Station No. 1 shall be 500 cfs, or the NRF, whichever is less. • If the NRF is > 500 cfs and ≤ 1,800 cfs, the Total Minimum Bypass Flow below Station No. 1 shall be the NRF or 90 percent of the NRF. • If the NRF is > 1,800 cfs, the Total Minimum Bypass below Station No. 1 shall be 1,800 cfs, or 90 percent of the NRF, whichever is less.
09/01-11/15[3]	• If the NRF is ≤ 500 cfs, the Total Minimum Bypass Flow below Station No. 1 shall be 500 cfs, or the NRF, whichever is less. • If the NRF is > 500 cfs and ≤ 1,500 cfs, the Total Minimum Bypass Flow below Station No. 1 shall be the NRF, or 90 percent of the NRF. • If the NRF is > 1,500 cfs, the Total Minimum Bypass below Station No. 1 shall be 1,500 cfs, or 90 percent of the NRF, whichever is less.
11/16-12/31[3]	• If the NRF is < 400 cfs, then the Total Minimum Bypass Flow below Station No. 1 shall be 400 cfs, or the NRF, whichever is less. • If the NRF is > 400 cfs and ≤ 1,500 cfs, the Total Minimum Bypass Flow below Station No. 1 shall be the NRF or 90 percent of the NRF. • If the NRF is > 1,500 cfs, the Total Minimum Bypass below Station No. 1 shall be 1,500 cfs, or 90 percent of the NRF, whichever is less.

[1]From license issuance until 3 years thereafter, Station No. 1 will not be automated. During those 3 years, if Station No. 1 is the only source, other than the Fall River, Turners Falls Hydro, LLC, or Milton Hilton, LLC to provide the additional flow needed to meet the Total Minimum Bypass Flow below Station No. 1, the Licensee shall maintain the Station No. 1 discharge such that the Turners Falls Dam Minimum Flow will be as shown in Recommendation 1, or higher flows, in cases where the additional flow cannot be passed through Station No. 1.

[2]One of the upstream fish passage adaptive management measures (AMMs) described in Condition 4 of the Preliminary Prescription for Fishways (Attachment E) calls for increasing the Total Minimum Bypass Flow below Station No. 1 from June 1 to June 15 from 4,500 cfs to 6,500 cfs. If this AMM is enacted, and if the NRF is ≤ 6,500 cfs, the Total Minimum Bypass Flow below Station No. 1 shall be the NRF, subject to the conditions in Condition

4 of Attachment E. If this AMM is enacted, and the NRF > 6,500 cfs, the Total Minimum Bypass Flow below Station No. 1 is 6,500 cfs, subject to the conditions in Condition 4 of Attachment E.

[3]From July 1 to August 31, when the NRF is greater than 1,800 cfs, the Total Minimum Bypass Flow below Station No.1 shall be 1,800 or 90 percent of the NRF, whichever is less. From September 1 to December 31, when the NRF is greater than 1,500 cfs, the Total Minimum Bypass Flow below Station No. 1 shall be 1,500 cfs or 90 percent of the NRF, whichever is less. From July 1 to December 31, if the Total Minimum Bypass Flow below Station No. 1 shall be reduced by 10 percent, it will not be taken from the Turners Falls Dam Minimum Flow (Recommendation 1).

[4]The amount of flow needed from Station No. 1 from June 1 to June 30 may be modified in the future pending fish passage effectiveness studies. If the Licensee conducts fish passage effectiveness studies, in consultation with the MADFW, NMFS, and USFWS and determines that migratory fish are not delayed by passing a greater percentage of the Total Minimum Bypass Flow below Station No. 1 via Station No. 1 discharge, the Licensee may file for a license amendment to increase the magnitude of Station No. 1 discharge upon written concurrence of MADFW, NMFS, and USFWS. Prior to filing for a license amendment with the Commission, the Licensee shall consult AW, AMC, CAW, MADEP, NEF and ZO and address any comments of those entities in the license amendment filing.

If the Station No. 1 units are used to maintain the Total Minimum Bypass Flow below Station No. 1, and if some or all of the Station No. 1 units become inoperable, the Licensee shall nonetheless provide the balance of the flow needed to maintain the Total Bypass flow below Station No. 1. The settling parties anticipate that this will be provided from either the Turners Falls Dam Minimum Flow (dam or canal gate); Falls River; Turners Falls Hydro, LLC; or Milton Hilton, LLC.

The Total Minimum Bypass Flow below Station No. 1 may be temporarily modified if required by equipment malfunction or operating emergencies reasonably beyond the control of the Licensee. If the Total Minimum Bypass Flow below Station No. 1 is so modified, the Licensee shall notify the Commission, MADEP, MADFW, NMFS, and USFWS as soon as possible, but no later than 10 days after such incident. The total bypass flow below Station No. 1 may also be temporarily modified for short periods upon mutual agreement with the Licensee for the Northfield Mountain Pumped Storage Project (FERC No. 2485), MADEP, MADFW, NMFS, and USFWS, and upon 5 days' notice to the Commission.

Recommendation 3 (FFP Provision A130): Minimum Flows below Cabot Station

Upon license issuance, the Licensee shall maintain Minimum Flows below Cabot Station, or the NRF, whichever is less, as follows.

Date	Minimum Flow below Cabot Station
01/01-03/31	3,800 cfs or the NRF, whichever is less
04/01-05/31	8,800 cfs from midnight to 7:00 pm or the NRF, whichever is less and 6,500 cfs from 7:00 pm to midnight or the NRF, whichever is less.
06/01-06/15	6,800 cfs or the NRF, whichever is less
06/16-06/30	5,800 cfs or the NRF, whichever is less
07/01-08/31[1]	1,800 cfs or 90 percent of the NRF, whichever is less
09/01-11/15[1]	1,500 cfs or 90 percent of the NRF, whichever is less
11/16-11/30[1]	1,500 cfs or 90 percent of the NRF, whichever is less
12/01-12/31	3,800 cfs or NRF, whichever is less

[1]From July 1 to November 30, the Minimum Flow below Cabot Station is 1,800 (07/01-08/31) and 1,500 cfs (09/01-11/30) or 90 percent of the NRF, whichever is less. If the Minimum Flow below Cabot Station is reduced by 10 percent during these periods, it will not be taken from the Turners Falls Dam Minimum Flow (Recommendation 1).

The Minimum Flow below Cabot Station may be temporarily modified if required by equipment malfunction or operating emergencies reasonably beyond the control of the Licensee. If the Minimum Flow below Cabot Station is so modified, the Licensee shall notify the Commission, MADEP, MADFW, NMFS, and USFWS as soon as possible, but no later than 10 days after such incident. The Minimum Flow below Cabot Station may also be temporarily modified for short periods upon mutual agreement with the Licensee for the Northfield Mountain Pumped Storage Project (FERC No. 2485), MADEP, MADFW, NMFS and USFWS, and upon 5 days' notice to the Commission.

Recommendation 4 (FFP Provision A140): Cabot Station Ramping Rates

Upon license issuance until 3 years after license issuance, the Licensee shall ramp Cabot Station as follows.

Date	Cabot Station Ramping Rates[1]
04/01-06/30	Up and Down Ramping at a rate of 2,300 cfs/hour
07/01-08/15	Up Ramping at a rate of 2,300 cfs/hour from 8:00 am to 2:00 pm

Beginning three years after license issuance, the Licensee shall ramp Cabot Station as follows.

Date	Cabot Station Ramping Rate[1]
04/01-06/30	Up and Down Ramping at a rate of 2,300 cfs/hour

[1]If the NRF is greater than the sum of the hydraulic capacity of Cabot Station and Station No. 1 and the Minimum Flow below Turners Falls Dam in effect at the time, the Cabot Station up-ramping rates will not apply.

The Cabot Station Ramping Rates above will take precedence over the Flow Stabilization below Cabot Station (Recommendation 6).

The Cabot Station Ramping Rates may be temporarily modified if required by equipment malfunction or operating emergencies reasonably beyond the control of the Licensee. If the Cabot Station Ramping Rates are so modified, the Licensee shall notify the Commission, MADEP, MADFW, NMFS, and USFWS as soon as possible, but no later than 10 days after such incident. The Cabot Station Ramping Rate may also be temporarily modified for short periods upon mutual agreement with the Licensee for the Northfield Mountain Pumped Storage Project (FERC No. 2485), MADEP, MADFW, NMFS, and USFWS, and upon 5 days' notice to the Commission.

Recommendation 5 (FFP Provision A150): Variable Releases from Turners Falls Dam and Variable Flow below Station No. 1

For recreation and ecological conservation purposes, upon license issuance, the Licensee shall provide variable releases from the Turners Falls Dam and a variable flow below Station No. 1 as shown below.

Variable Releases from Turners Falls Dam

Magnitude of Variable Release from Turners Falls Dam	[1]4,000 cfs, or the NRF, whichever is less
Dates when Variable Releases may occur	[2]July 1 through October 31
[3]Total No. of 2-day events	5 events for a total of 10 Variable Releases, but could potentially be 11 Variable Releases subject to footnote 3
Days of Variable Release for 2 day-events	Saturday and Sunday- must be two consecutive days
Hours of Variable Release	10:00 am to 2:00 pm, 4 hrs/day, Saturday and Sunday
Magnitude of Variable Release from Turners Falls Dam from Saturday at 2:00 pm to Sunday at 10:00 am.	See footnote 4
[5]Up-Ramping Rates at Start of Variable Release	See footnote 5
[6]Down-Ramping Rates at End of Variable Release	See footnote 6

[1]If the NRF< 2,500 cfs during the scheduled variable release (see footnote 2 below relative to scheduling variable releases), there will be no variable release and it will not be rescheduled.

[2]The Licensee shall consult American Whitewater (AW), Appalachian Mountain Club (AMC), commercial outfitters, MADEP, MADFW, National Park Service (NPS), New England FLOW (NE FLOW), and USFWS no later than March 1 annually over the license term to develop a mutually agreeable schedule for the variable releases. When developing the schedule, there will be at least one weekend per month, between July 1 and October 31, when no variable releases are provided.

[3]The Licensee conducts annual canal drawdowns for maintenance purposes resulting in the NRF being passed at the Turners Falls Dam. If the canal drawdown occurs between July 1 and October 31 and the NRF is being passed either on Saturday from 10:00 am - 2:00 pm or Sunday from 10:00 am-2:00 pm, the total number of releases at the Turners Falls Dam shall remain at 10 releases. However, if the canal drawdown does not occur between July 1 and October 31 on Saturday from 10:00 am -2:00 pm or Sunday from 10:00 am -2:00 pm, the Licensee shall provide an additional consecutive day of variable release such that one of the 2-day events is a 3-day consecutive event resulting in a total of 11 releases. The additional day shall either be Friday from 10:00 am - 2:00 pm before the scheduled weekend variable release or Monday from 10:00 am-2:00 pm after the scheduled weekend variable release. If there ends up being one 3-day event, the magnitude of release from Friday at 2:00 pm to Saturday at 10:00 am (or Sunday at 2:00 pm to Monday at 10:00 am), shall be computed as noted in footnote 4.

[4]This flow will be calculated as: [(Variable Flow Release - Minimum Flow below Turners Falls Dam as defined in Recommendation 1)/2]. If there is a 3-day event as noted in footnote 3, the variable flow release from Friday at 2:00 pm to Saturday at 10:00 am (or from Sunday at 2:00 pm to Monday at 10:00 am) will be based on the same calculation.

[5]At the beginning of the variable release, if the NRF is > 4,000 cfs, the Licensee shall up-ramp from the Minimum Flow below Turners Falls Dam as defined in Recommendation 1 to 4,000 cfs in two hours, not to exceed 2,000 cfs/hr. At the beginning of the variable release, if the NRF is between 2,500 and 4,000 cfs, the Licensee shall up ramp at 50 percent of the NRF per hour.

[6]At the end of the variable release, if Turners Falls Dam variable release is between 2,500 and 4,000 cfs, the Licensee shall down ramp at 50 percent of the variable release per hour.

Variable Flow below Station No. 1

Magnitude of Variable Flow below Station No. 1	[1]2,500 cfs, or the NRF, whichever is less
Dates when Variable Flow may occur	[2]July 1 through October 31
Total No. of 2-day events	7 events for a total of 14 Variable Flows
Days of Variable Flow	Saturday and Sunday- must be two consecutive days
Hours of Variable Flow	10:00 am to 2:00 pm, 4 hrs/day
Magnitude of Variable Flow below Station No. 1 from Saturday at 2:00 pm to Sunday at 10:00 am.	See Footnote 3

[1]If the NRF< 2,500 cfs, during the scheduled flow (see footnote 2 below relative to scheduling the flow), there will be no 2,500 cfs flow and it will not be rescheduled.

[2]The Licensee shall consult AW, AMC, commercial outfitters, MADEP, MADFW, NPS, NE FLOW, and USFWS no later than March 1 annually over the license term to develop a mutually agreeable schedule for the variable flow. When developing the schedule there will be at least one weekend per month, between July 1 and October 31, when no variable flow is provided.

[3]From July 1 to August 31, the Total Minimum Bypass Flow below Station No. 1 is defined in Recommendation 2. If the NRF is > 1,800 cfs, the Total Minimum Bypass below Station No. 1 shall be 1,800 cfs, or 90 percent of the NRF, whichever is less. The magnitude of flow below Station No. 1 from Saturday at 2:00 pm to Sunday at 10:00 am from July 1 to August 31 will be computed as follows:

(2,500 cfs + Total Minimum Flow below Station No. 1 as defined in Recommendation 2)/2.

From September 1 to November 15, the Total Minimum Bypass Flow below Station No. 1 is defined in Recommendation 2. If the NRF is > 1,500 cfs, the Total Minimum Bypass below Station No. 1 shall be 1,500 cfs, or 90 percent of the NRF, whichever is less. The magnitude of flow below Station No. 1 from Saturday at 2:00 pm to Sunday at 10:00 am from September 1 to November 15 will be computed as follows:

(2,500 cfs + Total Minimum Flow below Station No. 1 as defined in Recommendation 2)/2.

When implementing the variable releases from the Turners Falls Dam or the 2,500 cfs flow below Station No. 1, the Licensee is still required to maintain the operational requirements in Recommendations 1, 2, 3, 4, 6, and 8.

The above variable release from the Turners Falls Dam and variable flow below Station No. 1 may be temporarily modified if required by equipment malfunction or operating emergencies reasonably beyond the control of the Licensee. If the Turners Falls Dam variable release or variable flow below Station No. 1 are so modified, the Licensee shall notify AW, AMC, commercial outfitters, MADEP, MADFW, NMFS, NPS, NE FLOW, and USFWS as soon as possible. The Turners Falls Dam variable release or variable flow below Station No. 1 may also be temporarily modified for short periods upon mutual agreement with the Licensee for the Northfield Mountain Pumped Storage Project (FERC No. 2485), AW, AMC, commercial outfitters, MADEP, MADFW, NMFS, NPS, NE FLOW and USFWS.

Recommendation 6 (FFP Provision A160): Flow Stabilization below Cabot Station and Allowable Deviations for Flexible Operations

Beginning three years after license issuance, the Licensee shall maintain ±10 percent of the NRF below Cabot Station as follows.

Date	Flow Stabilization below Cabot Station[1]
04/01-05/15[2]	Provide ±10 percent of the NRF below Cabot Station from 7:00 pm to midnight, with allowable deviations up to ±20 percent of the NRF for up to 22 hours total from 04/01-05/15 (the 22 hours will be used from 7:00 pm to midnight).
05/16-05/31[2]	Provide ±10 percent of the NRF below Cabot Station from 7:00 pm to midnight, with allowable deviations up to ±20 percent of the NRF for up to 18 hours total from 05/16-05/31 (the 18 hours will be used from 7:00 pm to midnight).
06/01-06/15[2]	Provide ±10 percent of the NRF below Cabot Station with allowable deviations up to ±20 percent of the NRF for up to 7 hours total from 06/01-06/15.
06/16-06/30[2]	Provide ±10 percent of the NRF below Cabot Station with allowable deviations up to ±20 percent of the NRF for up to 7 hours total from 06/16-06/30.
07/01-08/15[3]	Provide ±10 percent of the NRF below Cabot Station with allowable deviations up to ±20 percent of the NRF for up to 55 hours total from 07/01-08/15.
08/16-08/31[3]	Provide ±10 percent of the NRF below Cabot Station with allowable deviations up to ±20 percent of the NRF for up to 27 hours total from 08/16-08/31.
09/01-10/31[3]	Provide ±10 percent of the NRF below Cabot Station with allowable deviations up to ±20 percent of the NRF for up to 44 hours total from 09/01-10/31.
11/01-11/30[3]	Provide ±10 percent of the NRF below Cabot Station with allowable deviations up to ±20 percent of the NRF for up to 11 hours total from 11/01-11/30.

[1]If the NRF is greater than the sum of the hydraulic capacity of Cabot Station, Station No. 1, and the Minimum Flow below Turners Falls Dam in effect at the time, the Flow Stabilization below Cabot Station will not apply.

[2]From April 1 to June 30, the NRF flow may be reduced by 10 percent or up to 20 percent for select hours. If the NRF is reduced during this period, the flow will be taken from Cabot Station generation.

[3]From July 1 to November 30, the NRF flow may be reduced by 10 percent or up to 20 percent for select hours. If the NRF is reduced during this period, the flow will not be taken from the Turners Falls Dam Minimum Flow.

Beginning three years after license issuance, the Licensee may deviate from the Flow Stabilization below Cabot Station and Cabot Station Ramping Rates (Recommendation 4) for a certain number of hours in July, August, September, October, and November, hereinafter referred to as flexible operations.

The Licensee has restricted discretionary flexible operating capability to respond to elevated energy prices, as defined in paragraph (a) below, from July 1 to November 30, as well as unrestricted capability to respond to emergencies, Independent System Operator-New England (ISO-NE, or its successors*) transmission and power system requirements, and other regulatory requirements as defined in paragraph (b) below.

(a) The Licensee may deviate from the Flow Stabilization below Cabot Station and Cabot Station Ramping Rates (Recommendation 4). The number of hours of flexible operations, which may be used at the discretion of the Licensee, are as follows.

Date	Allowable Deviations from Cabot Station Ramping Rates (FFP Provision A140; Recommendation 4) and Flow Stabilization below Cabot Station
07/01-07/31	20 hours of flexible operations with no more than 7 flexible events per month
08/01-08/31	26 hours of flexible operations with no more than 7 flexible events per month
09/01-09/30	23 hours of flexible operations with no more than 7 flexible events per month
10/01-10/31	20 hours of flexible operations with no more than 7 flexible events per month
11/01-11/30	28 ours of flexible operations with no more than 7 flexible events per month

(b) If compliance with the Flow Stabilization below Cabot and Cabot Station Ramping Rates (Recommendation 4) would cause the Licensee to violate or breach any law, any applicable license, permit, approval, consent, exemption or authorization from a federal, state, or local governmental authority, any applicable agreement with a governmental entity, the Licensee may deviate from the Flow Stabilization below Cabot and Cabot Station Ramping Rates (Recommendation 4) to the least degree necessary to avoid such violation or breach. The Licensee may also deviate from the Flow Stabilization below Cabot and Cabot Station Ramping Rates for the following reasons:

1. To implement Flood Flow Operations as defined in FFP Provision A170.
2. To perform demonstrations of the resources' operating capabilities under ISO-NE or its successors,* rules and procedures such as, maintaining the Licensee's capacity accreditation (or its successor) or its fast start reserve eligibility. The Licensee shall seek to perform these demonstrations at times that will not cause it to deviate from the conditions in Recommendations 1 through 6, with recognition that April 1 to June 30 should be avoided, to the maximum extent possible.
3. To manage the Turners Falls Impoundment to stay within its licensed operating limits in Recommendation 8, with recognition that deviations from April 1 to June 30 should be avoided to the maximum extent possible.
4. If compliance with Recommendations 1 through 6 would cause a public safety hazard or prevent timely rescue.

*ISO-NE, or its successors, (or another recognized entity with responsibilities for regional energy and capacity supply) requirements are circumstances when ISO-NE requires the Licensee to be fully available and, if necessary, responsive.

The Flow Stabilization below Cabot Station may be temporarily modified if required by equipment malfunction or operating emergencies reasonably beyond the control of the Licensee. If the Flow Stabilization below Cabot Station is so modified, the Licensee shall notify the Commission, MADEP, MADFW, NMFS, and USFWS as soon as possible, but no later than 10 days after such incident. The Flow Stabilization below Cabot Station may also be temporarily modified for short periods upon mutual agreement with the Licensee for the Northfield Mountain Pumped Storage Project (FERC No. 2485), MADEP, MADFW, NMFS, and USFWS, and upon 5 days' notice to the Commission.

Recommendation 7 (FFP Provision A190): Turners Falls Impoundment Water Level Management

Upon license issuance, the Licensee shall operate the Turners Falls Impoundment, as measured at the Turners Falls Dam, as follows:

a) Maintain water levels between elevation 176.0 feet and 185.0 feet National Geodetic Vertical Datum of 1929 (NGVD29).

b) Limit the rate of rise of the Turners Falls Impoundment water level to be less than 0.9 feet/hour from May 15 to August 15 from 8:00 am to 2:00 pm. However, if the NRF is greater than the sum of the hydraulic capacity of Cabot Station, Station No. 1, and the Minimum Flow below Turners Falls Dam in effect at the time, the Turners Falls Impoundment rate of rise requirement will not apply.

c) The rate of rise of the Turners Falls Impoundment may be temporarily modified if required by equipment malfunction or operating emergencies reasonably beyond the control of the Licensee. If the rate of rise of the Turners Falls Impoundment is so modified, the Licensee shall notify the Commission, MADEP, MADFW, NMFS, and USFWS as soon as possible, but no later than 10 days after such incident. The rate of rise of the Turners Falls Impoundment may also be temporarily modified for short periods upon mutual agreement with the Licensee for the Northfield Mountain Pumped Storage Project (FERC No. 2485), MADEP, MADFW, NMFS, and USFWS, and upon 5 days' notice to the Commission.

The Licensee may increase the allowable NRF deviation from ±10 percent to ±20 percent to better manage Turners Falls Impoundment water levels. The increased flow deviation is limited by the number of hours shown in the first table of Recommendation 6. This allowance for an increased flow deviation is in addition to the exceptions outlined in paragraphs (a) and (b) of Recommendation 6. As such, the increased flow allowable deviations outlined in this paragraph will not count against any time allotment for exceptions outlined in paragraphs (a) and (b) of Recommendation 6. Similarly, operations meeting the exception criteria outlined in paragraphs (a) and (b) of Recommendation 6 will not count against any time allotment for allowable deviations outlined in this paragraph. Allowable flow deviations in excess of ±10 percent of NRF resulting from conflicting operational requirements will not count against any time allotment for allowable deviations outlined in this paragraph.

Recommendation 8 (FFP Provision A400): Bald Eagle Protection Plan

Upon license issuance, the Licensee shall implement the Bald Eagle Protection Plan dated January 2023 (Attachment B).

Recommendation 9 (FFP Provision A410): Bat Protection Measures

To protect state or federally listed bat habitat during the term of any new license issued for the Project, the Licensee shall avoid cutting trees equal to or greater than 3 inches in diameter at breast height within the Turners Falls project boundary from April 1 through October 31, unless

they pose an immediate threat to human life or property or are otherwise part of an emergency action.

Recommendation 10: Turners Falls Canal Drawdown Aquatic Organism Protection Plan

Within nine months of license issuance, the Licensee shall file with the Commission, for approval, a Turners Falls Canal Drawdown Aquatic Organism Protection Plan, describing measures the Licensee will implement to minimize impacts to aquatic organisms during the annual canal drawdown. The Plan shall be developed in consultation with the USFWS and MADFW. Major elements of the plan shall include the following:

a) Immediate implementation of protection measures identified in study report 3.3.18; including:
    - conducting the annual canal drawdown no earlier than mid-September;
    - drawing down the canal at the rate used in 2014 until the canal drawdown team (discussed below) identifies a permanent rate that sufficiently protects aquatic resources in the canal; and
    - installing cones to identify paths for large machinery to follow while undertaking maintenance work in the canal during the drawdown.

b) Creation of a Canal Drawdown Team comprised of the Licensee and staff from the USFWS, MADFW, and CRC. The purpose of the team is to identify additional measures to minimize stranded and/or dewatered organisms during the drawdown. The team will meet quarterly to discuss information needs, develop studies, evaluate potential measures, etc. Once protective measures have been identified by the team, they will be submitted to the FERC for approval. Upon approval by the FERC, FirstLight shall implement the supplemental measures and the team may be disbanded.

c) Until and unless the measures implemented pursuant to item (b) conflict, the Licensee shall continue to allow public access to the dewatered portion of the canal for scientific and environmental outreach and education activities such as the CRC's fish rescue effort; and maintain communication and coordination with the USFWS' Connecticut River Coordinator.

Recommendation 11: Invasive Plant Species Management Plan

Upon license issuance, the Licensee shall implement the Invasive Plant Species Management Plan provided in Attachment C.[35]

SECTION 10(j) RECOMMENDATIONS FOR THE NORTHFIELD MOUNTAIN PUMPED STORAGE PROJECT

Pursuant to section 10(j) of the FPA, as amended, and the Fish and Wildlife Coordination Act, the Service recommends the following protection, mitigation, and enhancement measures for fish and wildlife resources be included in any license the Commission issues for the Project.

[35] The ISPMP provided in Attachment C is based on FirstLight's plan, dated January 2023, as modified by the Department.

Recommendation 1 (FFP Provision B300): Bald Eagle Protection Plan
Upon license issuance, the Licensee shall implement the Bald Eagle Protection Plan dated January 2023 (Attachment D).

Recommendation 2 (FFP Provision B310): Bat Protection Measures

To protect state or federally listed bat habitat during the term of any new license issued for the Project, the Licensee shall avoid cutting trees equal to or greater than 3 inches in diameter at breast height within the Northfield Mountain Pumped Storage project boundary from April 1 through October 31, unless they pose an immediate threat to human life or property or are otherwise part of an emergency action.

Recommendation 3: Invasive Plant Species Management Plan

Upon license issuance, the Licensee shall implement the Invasive Plant Species Management Plan included in the Amended Final License Application submitted to the FERC on December 20, 2020 (FERC Accession No. 20201204-5120, Exhibit E, Appendix B of Volume 2, Part 3), with the inclusion of the following measure under Section 3.2.3: 2) Based on post-activity vegetation surveys, if invasive species have been found to outcompete desirable vegetation during reestablishment, the Licensee will treat infestations, as necessary, to eliminate or reduce the invasive infestation(s).

SECTION 10(a) RECOMMENDATION FOR THE TURNERS FALLS PROJECT

Recommendation 1 (FFP Provision A200): Project Operation, Monitoring, and Reporting Plan

Within 1 year of license issuance, the Licensee shall file with the Commission, for approval, a Project Operation, Monitoring, and Reporting Plan (Plan) describing how the Licensee will document compliance with the operating conditions. The Plan will include the following:

a) a description of how the Licensee will comply with Minimum Flows below Turners Falls Dam (Recommendation 1), Total Minimum Bypass Flows below Station No. 1 (Recommendation 2), Minimum Flows below Cabot Station (Recommendation 3), Cabot Station Ramping Rates (Recommendation 4), Variable Releases from Turners Falls Dam and Variable Flow below Station No. 1 (Recommendation 5), Flow Stabilization below Cabot Station (Recommendation 6, implementation starting 3 years after license issuance), and Turners Falls Impoundment Water Level Management (Recommendation 8). These are collectively referred to hereinafter as the operating requirements.

b) a provision to file with the Commission, after consultation with the MADEP, MADFW, NFMS, and USFWS, a minimum flow and operation compliance report detailing implementation of the Plan, including any allowable deviations that occurred during the reporting period. For the periods January 1 to March 31 and July 1 to December 31, the compliance report, including any deviations, will be filed with the Commission by March 1 of the following year. For the months of April, May and June, the monthly compliance report, including any deviations, will be filed with the Commission on June 1, July 1, and

August 1, respectively. Upon license issuance until 3 years thereafter, the Licensee shall document on an hourly basis for each day any allowable deviations from the Cabot Station Ramping Rates (Recommendation 4) and demonstrate progress towards meeting the Flow Stabilization below Cabot Station (Recommendation 6). Beginning three years after license issuance until license expiration, the Licensee shall document on an hourly basis for each day any allowable deviations from the Cabot Station Ramping Rates restrictions (Recommendation 4) and Flow Stabilization below Cabot Station restrictions (Recommendation 6). Each day, from April 1 to November 30, the Licensee shall record any allowable deviations in a spreadsheet showing the daily deviations, the reason for the deviation, the number of hours, and scope. The Licensee shall provide the total number of deviations to the MADEP, MADFW, NFMS, and USFWS per the reporting schedule above. Allowable deviations will be tracked as follows:

- Identify Allowable Deviations: The Licensee shall record the NRF, Turners Falls Dam discharge, Station No. 1 discharge, Cabot Station discharge and total Turners Falls Project discharge (below the Cabot Station tailrace) at the top of each hour. Allowable deviations in both the Cabot Station Ramping Rate and Flow Stabilization below Cabot Station requirements will be recorded. At the top of each hour, the Licensee shall record the change in Cabot Station discharge from the previous hour to determine if any deviation has occurred from the agreed upon Cabot Station Ramping Rate. In addition, the NRF (as detailed in paragraph (b) of the "Operational Regime" section) will be compared with the recorded total Turners Falls Project discharge in a given hour to identify if a Flow Stabilization below Cabot Station deviation occurred over the past hour. Any deviation of either the Cabot Station Ramping Rate or total Turners Falls Project discharge within the hour will be counted in one-hour increments.

- Categorize Allowable Deviations: When an allowable deviation is identified it will be categorized as either Regulatory, as detailed in paragraph (b) of Recommendation 6; NRF Allowance, as detailed in paragraph (d) of Recommendation 8; or Discretionary, as detailed in paragraph (a) of Recommendation 6.

The Licensee shall develop the Plan after consultation with MADEP, MADFW, NMFS, and USFWS. The Licensee shall include with the Plan documentation of consultation after it has been prepared and provided to MADEP, MADFW, NMFS, and USFWS. The Licensee shall provide a minimum of 30 days for MADEP, MADFW, NMFS, and USFWS to comment and to make recommendations before filing the Plan with the Commission. If the Licensee does not adopt a recommendation, the filing will include the Licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the Plan. Implementation of the Plan will not begin until the Licensee is notified by the Commission that the Plan is approved. Upon Commission approval, the Licensee shall implement the Plan, including any changes required by the Commission.

Recommendation 2 (FFP Provision A210): Flow Notification and Website

Within 1 year of license issuance, the Licensee shall provide the following information year-round on a publicly available website:

1. On an hourly basis, the Turners Falls Impoundment water elevation, as measured at the Turners Falls Dam, the Turners Falls Dam total discharge, and the Station No. 1 discharge.

2. On an hourly basis, the anticipated Turners Falls Dam total discharge and the anticipated Station No. 1 discharge for a 12-hour window into the future. Should the Licensee deviate from passing the 12- hour previous NRF from December 1 to May 31 or the 12-hour average NRF from June 1 to November 30, it will post the revised flows (in the 12-hour look ahead window) to a website as soon as practicable after they are known. Should the Licensee of the Vernon Hydroelectric Project provide the Licensee with flow data more than 12 hours in advance, the Licensee shall publish the information sooner.

3. Within one month prior to its annual power canal drawdown, the Licensee shall post on its website the starting and ending time/date of the drawdown, which will last at least 4 days. Throughout the duration of the canal drawdown, the NRF, as defined in Recommendation 1, will be maintained below the Turners Falls Dam.

Recommendation 3: Department Notification of Amendments and Appeals

The Department recommends that the Commission include in any license issued for the Project:

> Prior to or at the time of filing with the Federal Energy Regulatory Commission, the Licensee shall serve all representatives of the Department of the Interior on the service list with a copy of any request the Licensee may file for amendment of license, amendment or appeal of any fish and wildlife-related license conditions, or extension of time requests for project construction or implementation of license article provisions.

SECTION 10(a) RECOMMENDATION FOR THE NORTHFIELD MOUNTAIN PUMPED STORAGE PROJECT

The Department recommends that the Commission include in any license issued for the Project:

> Prior to or at the time of filing with the Federal Energy Regulatory Commission, the Licensee shall serve all representatives of the Department of the Interior on the service list with a copy of any request the Licensee may file for amendment of license, amendment or appeal of any fish and wildlife-related license conditions, or extension of time requests for project construction or implementation of license article provisions.

SECTION 18 FISHWAY PRESCRIPTION FOR THE TURNERS FALLS AND NORTHFIELD MOUNTAIN PUMPED STORAGE PROJECTS

A. Reservations of Authority to Prescribe Fishways

In order to allow for the timely implementation of fishways, including effectiveness measures, the Department requests that the FERC include the following condition in any licenses it may issue for the Turners Falls Hydroelectric Project and Northfield Mountain Pumped Storage Project:

> Authority is reserved to the Federal Energy Regulatory Commission to require the Licensee to construct, operate, and maintain, or provide for the construction, operation, and maintenance of such fishways as may be prescribed by the Secretary of the Interior pursuant to Section 18 of the Federal Power Act, consistent with the terms of the FFP Agreement filed with the Commission on March 31, 2023 (FERC Accession Number 20230331-56002019).

B. Preliminary Prescription for Fishways

For the Turners Falls and Northfield Mountain Pumped Storage projects, the Department, through the Service, is preliminarily prescribing, pursuant to Section 18 of the Federal Power Act, 16 U.S.C., Section 811, that such new fishways be designed, constructed, operated, and maintained as are necessary to accomplish safe, timely, and effective upstream and downstream fish passage; and such measures as are necessary to determine the effectiveness of those fishways during the term of the licenses.

Attachment E provides the details of our preliminary prescription, including procedural instructions concerning where and how to file comments, requests for trial-type hearings, and proposed alternative prescriptions.

U.S. GEOLOGICAL SURVEY COMMENTS

As described in the Project Description of the Notice of Application Ready for Environmental Analysis, FirstLight is proposing changes to the current project boundary to exclude the land associated with the USGS Silvio O. Conte Research Laboratory (Conte Lab). Although the property boundary does not affect existing property rights, the Commission generally requires a licensee to maintain sufficient property rights to construct, maintain, and operate their projects, as identified in their specific license. These 20.1 acres of federal property are not required for FirstLight's operations. Therefore, Department supports FirstLight's proposal to remove 20.1 acres of land associated with the Conte Lab from the project boundary.

While the Department supports removal of this federally-owned property from the project boundary, it is important to note that the United States also owns easement rights over portions of FirstLight's property that will remain within the project boundary under the terms of the License Application. The rights granted under this easement (Attachment F) are essential components of the operation and mission of the Conte Lab. The easement area, revised on February 24, 1988, and described in Franklin Country Registry of Deeds, includes four rights granted to the United States: 1) the right to maintain and use an access road from G Street to the federal property, and a service road from the federal property to the Cabot Station fish ladder; 2)

the right to install gates along the roadway with an obligation to "patrol the roadway and arrange for the removal of all unauthorized vehicles"; 3) the right to maintain and use a loading area in front of the lab's Fish Passage Complex; and 4) the right to construct, maintain, repair and use a fishway (i.e., intake) and its appurtenant structures including a bridge to accommodate traffic over the intake.

Thus, despite the removal of the Conte Lab itself from the project boundary, the federal government will continue to own an interest in land within the Project boundary. Project operations will affect that interest, as they require the use of the access road, security gate, and bridge for Project purposes. Although this decision is the Commission's to make, the Department does not believe that the license will interfere with or be inconsistent with the purpose for which this federal property was acquired; indeed the Conte Lab was located precisely so as to be integrated with the nearby Project facilities. Management issues between the licensee and Conte lab are under negotiation and may be resolved, as they have been historically, by agreements between the two. Nonetheless the Department requests that the Commission include the following reservation of authority in the License:

> The Licensee shall implement, upon order of the Commission, such additional conditions as may be identified by the Secretary of the Interior over the term of the license pursuant to the authority provided in Section 4(e) of the Federal Power Act, as necessary for the adequate protection and utilization of land and interests in land under the authority of the Department of the Interior.

Thank you for this opportunity to review and provide comments on this notice. If you have any questions regarding National Park Service comments, please contact Kevin Mendik at kevin_mendik@nps.gov or (617) 320-3496. For questions regarding U.S. Fish and Wildlife Service comments, please contact Melissa Grader, at melissa_grader@fws.gov or (413) 239-2138. Please contact Brett Towler at btowler@usgs.gov or (413) 863-3802 for questions regarding U.S. Geological Survey comments. Please contact me at (617) 223-8565 if I can be of further assistance.

Sincerely,

ANDREW RADDANT

Digitally signed by ANDREW RADDANT
Date: 2024.05.16 10:39:05 -04'00'

Andrew L. Raddant
Regional Environmental Officer

Enclosures

Electronic Distribution: https://ferconline.ferc.gov/FERCOnline.aspx

cc (via email): Service List
FAC/CRFWCO, Ken Sprankle
FAC/ROENG, Jessica Pica
TNC, Katie Kennedy
MANHESP, Jesse Leddick
MADFW, Rebecca Quinones
MADEP, Pam Harvey
CRC, Nina Gordon-Kirsch
NMFS, Chris Boelke
NMFS, Bill McDavitt

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Gwiazdowski, R. (2021). *Survey of distribution and relative density for tiger beetle larvae of the species Ellipsoptera puritana, and Cicindela repanda on Rainbow Beach, Massachusetts, 2021; Including a template Request for Proposal (RFP) for reproducing this survey.* Shrewsbury, MA: Advanced BioConsulting, LLC.

Hummel, M., & Kiviat, E. (2004). Review of world literature on water chestnut with implications for management in North America. *Journal of Aquatic Plant Management*, 17-28.

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USFWS. (2022a November 30). Endangered and Threatened Wildlife and Plants; Endangered Species Status for Northern Long-Eared Bat. *Federal Register*. 87 FR 73488.

USFWS. (2022b). *Species Status Assessment Report for the Northern long-eared bat (Myotis septentrionalis).* Bloomington, MN: U.S. Fish and Wildlife Service.

ATTACHMENT A

TABLES AND FIGURES

Table 1. Fish Passage protection, mitigation, and enhancement (PME) measures proposed by FirstLight in the Turners Falls and NMPS AFLA.

Project	PME Measure	Operational Year
Turners Falls	Cabot Tailrace Ultrasound Array	6
	Replace Spillway Ladder with new Lift	6
	Provide Interim Upstream Eel Passage	2
	Permanent Upstream Eel Passage Facility	10
	Retire Cabot Fish Ladder	5
	Retire Entrance Portions of Gatehouse Ladder in canal	5
	Construct a Plunge Pool below Bascule Gate No. 1 located at the Turners Falls Dam	6
	Construct a Bar Rack at the entrance to the Station No. 1 Forebay	8
NMPS	Install Barrier Net at Lower Reservoir Intake/Tailrace	5

Table 2. Comparison in implementation timing of fish passage PME measures between the AFLA and the FFP Agreement.

Project	PME Measure	Operational Year	
		AFLA	FFP
Turners Falls	Cabot Tailrace Ultrasound Array	6	AMM[A]
	Replace Spillway Ladder with new Lift	6	9
	Provide Interim Upstream Eel Passage	2	1
	Permanent Upstream Eel Passage Facility	10	13
	Retire Cabot Fish Ladder	5	11
	Retire Entrance Portions of Gatehouse Ladder in canal	5	11
	Construct a Plunge Pool below Bascule Gate No. 1 located at the Turners Falls Dam	6	9
	Construct a Bar Rack at the entrance to the Station No. 1 Forebay	8	4[B]
	Rehabilitate Gatehouse Trapping Facility	-	9
	Improve Cabot Station Downstream Fish Passage System	-	4[B]
NMPS	Install Barrier Net at Lower Reservoir Intake/Tailrace	5	7

[A] Adaptive management measure, if needed.

[B] Depending on what quarter the license is issued, this measure may occur in Year 5.

Table 3. Comparison of other (non-fish passage) PME measures between the AFLA and the FFP Agreement.

Project	AFLA PME Measures	FFP Provision
Turners Falls	Provide seasonally-based bypass flows below Turners Falls Dam (TFD).	Same as AFLA, but reduces TFD flow from 670 cfs to 500 cfs for the period 7/1-8/31 to protect state-listed plants, and increases winter flows from TFD from 300 cfs to 400 cfs.
	Maintain below-Cabot Station base flows of 6,800 cfs from 6/1- 6/15 and 5,800 cfs from 6/16-6/30, or the NRF, whichever is less (i.e., bypass flow plus one Cabot unit baseloaded).	Stabilizes flows below Cabot Station to pass the naturally-routed flow (NRF) within +/-10% with allowable deviations up to +/-20% for a set number of hours, which vary seasonally (from 4/1-11/30). These deviations from NRF are for managing TFI elevations. Additionally, provides for set number of hours, which vary seasonally (7/1-11/30), to allow for flexible operations out of Cabot Station. Below-Cabot minimum flow of 3,800 cfs from 12/1-3/31.
	No below-Cabot operational restrictions outside of 6/1 to 6/30 period, when required to baseload one Cabot unit.	
	Limit maximum flow below Cabot Station to no more than 4,600 cfs additional flow from 1 am to 2 pm to protect Puritan tiger beetles.	
	Implement up/down-ramping protocol to protect shortnose sturgeon (4/1-6/30) and state-listed odonates (7/1-8/15).	Up/down ramping protocol the same for first three years after license issuance, then summer ramping restriction removed because of flow stabilization requirement.
	Implement new bypass and below-Cabot flows beginning the 3rd anniversary of the effective date of the new license.	No change relative to compliance purposes.
	Maintain the current operating range of the Turners Falls Impoundment (TFI).	No change.
	Limit the rate of rise in the TFI to protect state-listed odonates.	No change.
	Limit Cabot Canal emergency gate use from April 1-June 15 to 500 cfs if possible.	No change.
	Modify TFD Bascule Gate No. 1 and equip with heaters to provide winter bypass flows.	Provide winter bypass flows from Spillway Ladder AWS system (add heaters, if necessary).
	Provide 4-hour whitewater boating releases ranging from 2,500 cfs to 5,000 cfs below TFD over 8 Saturdays from July through October.	Modified to five, 2-day events of 4,000 cfs for 4 hours each occuring between July 1 through October 31, with up- and down-ramping. Additionally, allow seven, 2-day events of 2,500 cfs for 4 hours each for same time period below Station No. 1.
	No plan proposed.	Requires development of a Project Operation, Monitoring, and Reporting Plan within 1 year of license issuance.
	No flow website proposed.	Provide year-round, hourly flow information via a publicly available website.
	Implement an Invasive Plant Species Management Plan.	Not included in FFP.
NMPS	Operate the upper reservoir between elevations 1004.5 and 920.0 feet NGVD29.	No change.
Turners Falls & NMPS	Implement a Bald Eagle Protection Plan	Minor changes pursuant to FWS consultation.
	Implement a time-of-year tree cutting restriction to protect northern long-eared bats.	No change except to clarify the protocol protects other bat species' habitat as well.

Table 4. Comparison of Turners Falls bypass flows under the current license and those contained in the FFP Agreement.

Current License			FFP Agreement		
Period	**Flow (cfs)**	**Location**	**Period**	**Flow[A] (cfs)**	**Location**
5/1-7/15	200/400	Turners Falls Dam (TFD)	4/1-5/31	6,500	4,290 from TFD; remainder from Station No. 1
7/16-11/15	120	TFD	6/1-6/15	4,500	2,990 from TFD; remainder from Station No. 1
11/16-4/30	0	TFD	6/16-6/30	3,500	2,280 from TFD; remainder from Station No. 1
			7/1-11/15	1,800	500 from TFD; remainder from Station No. 1
			11/16-3/31	1,500	400 from TFD; remainder from Station No. 1

[A] Or the Naturally Routed Flow (NRF), whichever is less; or 90 percent of the NRF (depending on time period).

Table 5. Synthesized data from Study 3.3.1, showing the percent of maximum WUA for three migratory fish species, based on FFP Agreement flows.

Species	Life Stage	Reach/Scenario	Maximum WUA (ft^2)	Max WUA Provided at FFP Flow	Period
Sea Lamprey	Spawning	1 Lower/high backwater	96,870	62%	5/1-5/31
				91%	6/1-6/15
				97%	6/16-6/30
		2	334,029	96%	5/1-5/31
				84%	6/1-6/15
				74%	6/16-6/30
American Shad	Spawning	1 Lower/high backwater	898,488	84%	5/1-5/31
				72%	6/1-6/15
				63%	6/16-6/30
		2	1,487,041	87%	5/1-5/31
				75%	6/1-6/15
				55%	6/16-6/30
American Shad	Juvenile	1 Lower/high backwater	668,444	96%	6/1-6/15
				98%	6/16-6/30
				55%	7/1-11/15
		2	1,094,797	96%	6/1-6/15
				99%	6/16-6/30
				91%	7/1-8/31
				84%	9/1-11/15
Shortnose Sturgeon	Spawning	1 Lower/high backwater	893,383	97%	4/1-5/31
		2	1,485,000	94%	
	Egg/larva	1 Lower/high backwater	1,360,780	100%	5/1-5/31
		2	2,020,278	100%	
	Fry	1 Lower/high backwater	64,776	50%	
		2	250,000	96%	

Table 6. Synthesized data from Study 3.3.1, showing the percent of maximum WUA in the bypass reach for five resident riverine fish species, based on FFP Agreement flows.

			Reach 1/Right Channel		Reach 1 Lower/High backwater		Reach 2	
Species	**Life stage**	**Months Present**	**Maximum WUA (ft2)**	**% Max WUA FFP Flow**	**Maximum WUA (ft2)**	**% Max WUA FFP Flow**	**Maximum WUA (ft2)**	**% Max WUA FFP Flow**
Fallfish	Spawning/Incubation	5/1-5/31	86,628	13%	0	0%	44,809	56%
		6/1-6/15		20%				87%
		6/15-6/30		30%				97%
	Fry	5/1-5/31	66,936	8%	25,172	2%	107,763	27%
		6/1-6/15		12%		6%		54%
		6/15-6/30		24%		14%		70%
	Juvenile	4/1-5/31	83,561	24%	260,011	62%	566,109	51%
		6/1-6/15		32%		80%		81%
		6/15-6/30		40%		93%		94%
		7/1-11/15		83%		74%		95%
		11/16-3/31		<83%		73%		88%
	Adult	4/1-5/31	33,506	39%	549,907	74%	822,519	63%
		6/1-6/15		66%		90%		79%
		6/15-6/30		82%		97%		87%
		7/1-11/15		49%		76%		100%
		11/16-3/31		<49%		76%		94%
Longnose Dace	Juvenile/Adult	4/1-5/31	83,561/74,344	24%/13%	155,504/ 413,608	13%/17%	311,117/ 615,175	19%/27%
		6/1-6/15		32%/21%		40%/54%		54%/75%
		6/15-6/30		40%/26%		77%/85%		83%/95%
		7/1-11/15		83%/98%		28%/19%		89%/82%
		11/16-3/31		<83%/<98%		23%/16%		72%/66%
White Sucker	Spawning/Incubation	4/1-5/31	41,330	8%	0	0%	13,636	45%
	Fry	5/1-5/31	66,936	8%	1,000,248	1%	1,036,376	12%
		6/1-6/15		12%		4%		22%
		6/16-6/30		24%		15%		30%
	Adult/Juvenile	4/1-5/31	0	0%	362,803	8%	436,799	23%
		6/1-6/15				30%		44%
		6/15-6/30				52%		58%
		7/1-11/15				71%		93%
		11/16-3/31				82%		99%
Walleye	Spawning/Incubation	4/1-5/15	86,372	99%	139,817	96%	482,932	95%
	Fry	4/1-5/31	13,105	2%	0	0%	19,515	61%
	Juvenile	4/1-5/31	58,234	5%	870	0%	11,769	78%
		6/1-6/15		13%		0%		79%
		6/15-6/30		21%		2%		79%
		7/1-11/15		98%		24%		100%
		11/16-3/31		<98%		27%		99%
	Adult	4/1-5/31	0	0%	36,453	14%	108,908	35%
		6/1-6/15				20%		35%
		6/15-6/30				18%		36%
		7/1-11/15				16%		46%
		11/16-3/31				19%		50%
Tessellated Darter	Adult/Juvenile	4/1-5/31	38,259	5%	133,736	1%	221,890	13%
		6/1-6/15		5%		29%		39%
		6/15-6/30		17%		74%		73%
		7/1-11/15		100%		22%		91%
		11/16-3/31		<100%		18%		73%

Table 7. Overview of drivers, supporting justification, and relative benefit of FFP Agreement flows over current conditions in the Turners Falls bypass reach.

Period	Driver	Justification	Benefit over current requirement
4/-5/31	Listed species; migratory fish passage; migratory fish habitat	Provides shortnose sturgeon spawning flows below Rock Dam (Kynard & Keiffer 2016); attraction flow for migratory fish (CRASC 2018; CRASC 2022b); an average of 95% of maximum WUA for spawning sturgeon; 100% of maximum WUA for sturgeon eggs and larvae; and 73% of maximum WUA for sturgeon fry; and an average of 86% of maximum WUA for spawning American shad (CRASC 2022a; CRASC 2022b) and 79% of maximum WUA for spawning sea lamprey (CRASC 2018).	Provides 1600% more flow than currently provided.
6/1-6/30	Migratory fish passage; migratory fish habitat	Provides attraction flow to the upstream fish passage facility; and an average of 73% of maximum WUA for spawning American shad (CRASC 2022a; CRASC 2022b); an average of 97% of maximum WUA for juvenile shad (CRASC 2022a; CRASC 2022b); and 84% of maximum WUA for sea lamprey (CRASC 2018).	Provides from 11x to 25x the flow currently provided.
7/1-11/15	Migratory fish habitat; resident riverine fish habitat; listed plant species	Provides 77% of maximum WUA for juvenile shad (CRASC 2022a; CRASC 2022b) and 53% to 81% of maximum WUA for resident riverine fish species, while adequately protecting several state listed plant species below TFD.	Provides 18x the flow currently provided (500% more flow in Reach 1 and 1800% more in Reach 2)
11/16-3/31	Overwinter habitat for resident riverine fishes	Provides 53% to 81% of maximum WUA for resident riverine fish species.	Provides 15x the flow currently provided (400% more flow in Reach 1 and 1500% more in Reach 2).

Table 8. Summary of below-Cabot Station flow requirements under the existing license and flows required pursuant to the FFP Agreement.

Current License		FFP Agreement			
Period	**Flow (cfs)**	**Period**	**Flow Stabilization below Cabot Station[1]**	**Allowable Deviations (i.e., Flexible Operation Allowance)**	**Minimum Flow**
Year-Round	1,400	04/01-05/15[2]	Provide ±10% of the Naturally Routed Flow (NRF) below Cabot Station from 7:00 pm to midnight, with allowable deviations up to ±20% of the NRF for up to 22 hours total from 04/01-05/15 (the 22 hours will be used from 7:00 pm to midnight).	N/A	8,800 cfs from midnight to 7pm or NRF; 6,500 cfs from 7pm to midnight or NRF
		05/16-05/31[2]	Provide ±10% of the NRF below Cabot Station from 7:00 pm to midnight, with allowable deviations up to ±20% of the NRF for up to 18 hours total from 05/16-05/31 (the 18 hours will be used from 7:00 pm to midnight).	N/A	
		06/01-06/15[2]	Provide ±10% of the NRF below Cabot Station with allowable deviations up to ±20% of the NRF for up to 7 hours total from 06/01-06/15.	N/A	6,800 cfs or NRF, whichever is less
		06/16-06/30[2]	Provide ±10% of the NRF below Cabot Station with allowable deviations up to ±20% of the NRF for up to 7 hours total from 06/16-06/30.	N/A	5,800 cfs or NRF, whichever is less
		7/1-7/31	Provide ±10% of the NRF below Cabot Station with allowable deviations up to ±20% of the NRF for up to 55 hours total from 07/01-08/15.[3]	20 hours of flexible operations with no more than 7 flexible events per month	1,800 cfs of 90% of NRF, whichever is less
		8/1-8/15		26 hours of flexible operations with no more than 7 flexible events per month (8/1-8/31)	
		08/16-08/31	Provide ±10% of the NRF below Cabot Station with allowable deviations up to ±20% of the NRF for up to 27 hours total from 08/16-08/31.[3]		
		9/1-9/30	Provide ±10% of the NRF below Cabot Station with allowable deviations up to ±20% of the NRF for up to 44 hours total from 09/01-10/31.[3]	23 hours of flexible operations with no more than 7 flexible events per month	1,500 cfs or 90% of NRF, whichever is less
		10/1-10/31		20 hours of flexible operations with no more than 7 flexible events per month	
		11/01-11/30	Provide ±10% of the NRF below Cabot Station with allowable deviations up to ±20% of the NRF for up to 11 hours total from 11/01-11/30.[3]	28 hours of flexible operations with no more than 7 flexible events per month	
		12/1-3/31			3,800 cfs or NRF, whichever is less

[1]If the NRF is greater than the sum of the hydraulic capacity of Cabot Station and Station No. 1 and the Minimum Flow below Turners Falls Dam in effect at the time, the Flow Stabilization below Cabot Station will not apply.

[2]From April 1 to June 30, the NRF flow may be reduced by 10 percent or up to 20 percent for select hours. If the NRF is reduced during this period, the flow will be taken from Cabot Station generation.

[3]From July 1 to November 30, the NRF flow may be reduced by 10 percent or up to 20 percent for select hours. If the NRF is reduced during this period, the flow will not be taken from the Turners Falls Dam Minimum Flow.

Table 9. Comparison of the amount of persistent habitat provided under current operations and under the FFP Agreement flow provisions for three migratory species present in the project-affected area.

Species	Life Stage	Reach	Percent Maximum WUA Under Current License	Percent Maximum WUA Range Provided under FFP Flows	Period
Shortnose Sturgeon	Spawning	3	39	98	4/1-5/31
	Eggs/Larva		64	99	4/1-5/31
	Fry		64	93	4/1-5/31
	Adult	4	81	81	4/1-5/31
				81-98	6/1-6/15
				81-98	6/15-6/30
				81-100	7/1-11/30
				81-99	12/1-3/31
American Shad	Spawning	3	42	93	5/1-5/31
				79-88	6/1-6/15
				75-85	6/16-6/30
		4	54	90	5/1-5/31
				80-100	6/1-6/15
				74-100	6/16-6/30
	Juvenile	3	55	82-99	7/1-11/15
		4	72	72-94.5	7/1-11/15
Sea Lamprey	Spawning	3	13	57	5/1-5/31
				41-75	6/1-6/15
				35-69	6/16-6/30
		4	18	18-75	5/1-5/31
				18-90	6/1-6/15
				18-96	6/16-6/30

Table 10. Comparison of the amount of persistent habitat provided under current operations and under the FFP Agreement flow provisions for two life stages of the yellow lampmussel present in the Turners Falls project-affected area.

Life Stage	Reach	Percent Maximum WUA Range under Current License	Percent Maximum WUA Provided under FFP Flows	Period
Adult	3	69	99-100	4/1-5/31
			98-100	6/1-6/15
			97-100	6/15-6/30
			90-100	7/1-8/31
			85-99	9/1-11/30
	4	77	92-100	4/1-5/31
				6/1-6/15
				6/15-6/30
			78-88	7/1-8/31
			77-87	9/1-11/30
	5	88	94	4/1-5/31
			94.2-94.5	6/1-6/15
			94	6/15-6/30
			88	7/1-8/31
			88	9/1-11/30
Juvenile	3	80	81-95	6/1-6/15
			86-99	6/15-6/30
			97-100	7/1-8/31
			94-100	9/1-11/30
	4	41	55-75	6/1-6/15
			54-82	6/15-6/30
			41-96	7/1-8/31
			41-95	9/1-11/30
	5	75	81-98	6/1-6/15
			81-99	6/15-6/30
			78-97	7/1-8/31
			75-94	9/1-11/30

Table 11. Comparison of the amount of persistent habitat provided under current operations and under the FFP Agreement flow provisions for the Deep Slow Habitat Guild in the Turners Falls project-affected area.

Life Stage	Reach	Percent Maximum WUA Range under Current License	Percent Maximum WUA Provided under FFP Flows	Period
Deep Slow Guild	3	96	49-77.5	5/1-5/31
			49-77.5	6/1-6/15
			52-82	6/15-6/30
			81-96	7/1-8/31
			87-95	9/1-11/30
	4	31	31-51	5/1-5/31
			31-51	6/1-6/15
			31-56	6/15-6/30
			31-92	7/1-8/31
			31-95	9/1-11/30
	5	15.7	15.7-67	5/1-5/31
			15.7-61	6/1-6/15
			15.7-74	6/15-6/30
			15.7-100	7/1-8/31
			15.7-100	9/1-11/30

Table 12. Comparison of availability and persistence of adult Puritan tiger beetle habitat at Rainbow Beach, Northampton, MA under current operations and under the FFP Agreement flow provisions based on four representative water years.

Persistence/Availability Metric	August	
	Current	FFP Flows
monthly total hours >50% habitat, median	636	733
longest monthly period >50% habitat, median	94 h (4 d)	397 h (17 d)
average length of each period, median	32 h (1 d)	306 h (13 d)
cumulative length of 5 longest periods, median	325 h (14 d)	733 h (31 d)
monthly total hours >70% habitat, median	579	671
longest monthly period >70% habitat, median	71 h (3 d)	244 h (10 d)
average length of each period, median	25 h (1 d)	71 h (3 d)
cumulative length of 5 longest periods, median	273 h (11 d)	629 h (26 d)
monthly total hours at 100% habitat, median	260	67
longest monthly period at 100%, median	50 h (2 d)	17 h (<1 d)
average length of each period, median	11 h (<1 d)	6 h (<1 d)
cumulative length of 5 longest periods, median	133 h (6 d)	46 h (2 d)

Table 13. Comparison of availability and persistence of larval Puritan tiger beetle habitat at Rainbow Beach, Northampton, MA, under current operations and under the FFP Agreement flow provisions, based on four representative water years.

Persistence/Availability Metric	August		November	
	Current	FFP Flows	Current	FFP Flows
monthly total hours at 100 percent habitat, median	683	739	379	436
longest monthly period at 100 percent, median	143 h (6 d)	397 h (17 d)	52 h (2 d)	261 h (11 d)
average length of each period, median	55 h (2 d)	369 h (15 d)	20 h (<1 d)	41 (2 d)
combined length of 5 longest periods, median	500 h (21 d)	739 h (31 d)	201 h (8 d)	420 h (18 d)

Table 14. Comparison of availability and persistence of cobblestone tiger beetle habitat (adult and larval) at Montague Beach, Turners Falls, MA, under current operations and under the FFP Agreement flow provisions, based on four representative water years.

Persistence Metric	August	
	Current	FFP Flows
monthly total hours >50 percent habitat, median	592	693
longest monthly period >50 percent habitat, median	71 h (3 d)	255 h (11 d)
average length of each period, median	26 h (1 d)	82 h (3 d)
cumulative length of 5 longest periods, median	276 h (12 d)	654 h (27 d)
monthly total hours >70 percent habitat, median	499	489
longest monthly period >70 percent habitat, median	64 h (3 d)	110 h (5 d)
average length of each period, median	20 h (<1 d)	29 h (1 d)
cumulative length of 5 longest periods, median	239 h (10 d)	376 h (16 d)
monthly total hours at 100 percent habitat, median	27	3
longest monthly period at 100 percent, median	10 h (<1 d)	3 h (<1 d)
average length of each period, median	5 h (<1 d)	3 h (<1 d)
cumulative length of 5 longest periods, median	24 h (1 d)	3 h (<1 d)

Table 15. State listed and species of greatest conservation need (SGCN) odonate species known to occur within the TFI (FERC Accession Number 20161228-5079; Study 3.3.10, Table 3.1-1, updated based on MADFW Natural Heritage and Endangered Species Program data[1]).

Species	Status
Hylogomphus abbreviatus	Special Concern
Gomphurus ventricosus	Threatened
Neurocordulia yamaskanensis	SGCN
Stylurus amnicola	Endangered

Table 16. Synthesized summary of vegetation surveys within the Turners Falls and NMPS project areas relative to potential bat habitat.

Habitat Type	NMPS		TF*	
	Acres	Percent of Area	Acres	Percent of Area
Transitional Floodplain Forest	0	0	547.9	7.8
Northern hardwoods-hemlock- white pine forest	127.8	6.4	1,107.9	15.7
Successional Northern Hardwood Forest	666.8	33.2	2.9	.05
Hemlock Ravine	621.5	30.9	0	0
White Pine - Oak Forest	70.1	3.5	0	0

* Turners Falls data includes the shoreline of the Turners Falls Impoundment, the Bypass Reach, and below Cabot Station to the Route 116 Bridge in Sunderland, Massachusetts.

[1] https://www.mass.gov/info-details/list-of-endangered-threatened-and-special-concern-species#dragonflies

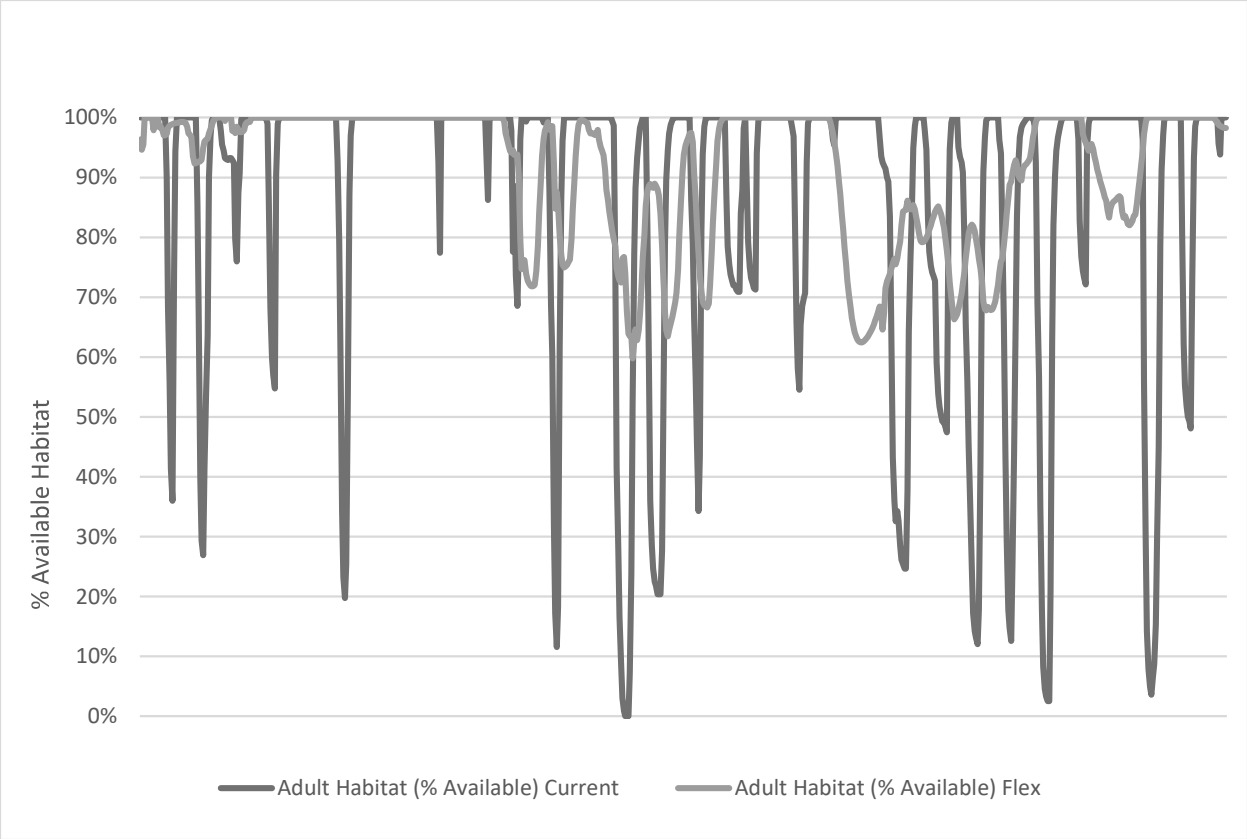

Figure 1. Habitat time series graph portraying historical and estimated adult Puritan tiger beetle habitat at Rainbow Beach (Northampton, MA) under current Turners Falls Project operations ("Current") and under the FFP Agreement ("Flex") flows, based on the water month/year of August 2016.

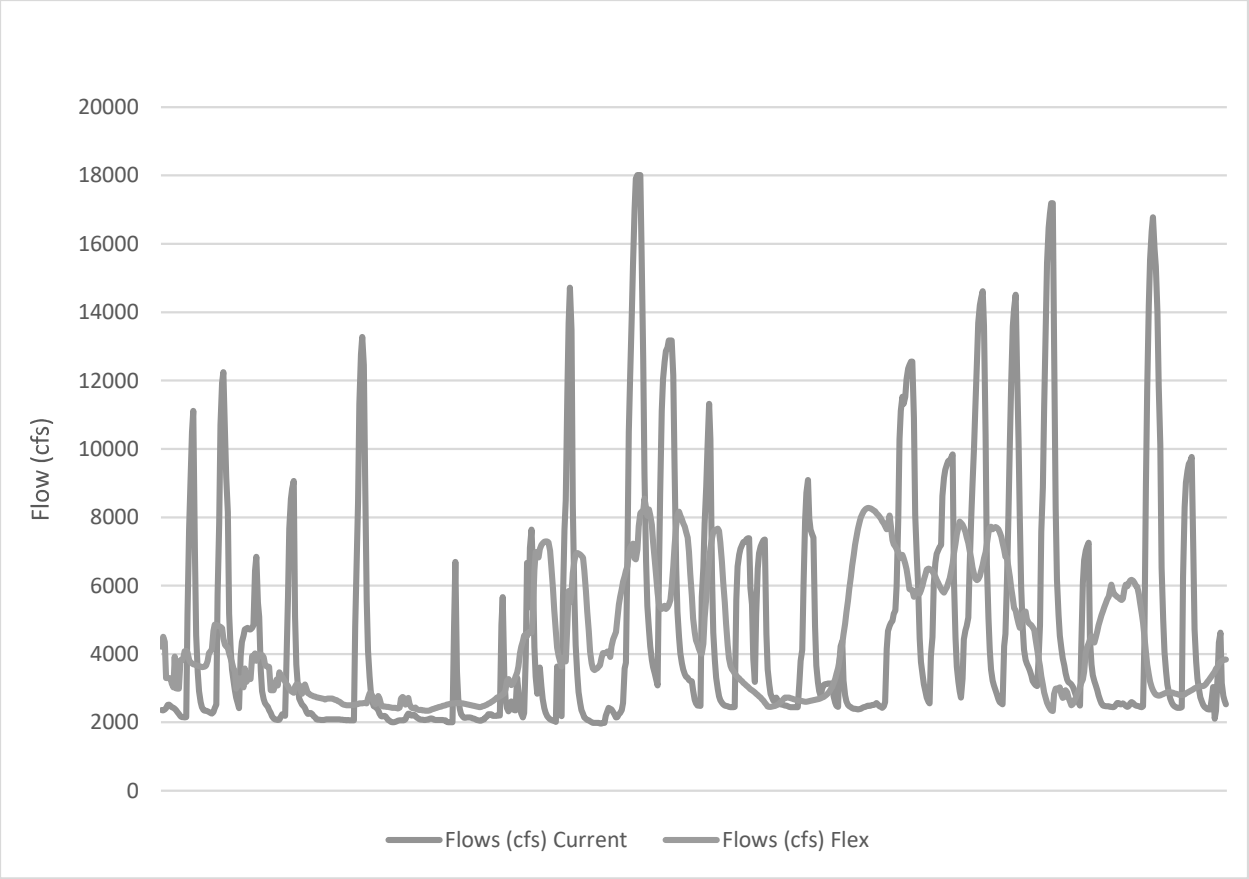

Figure 2. Hydrograph portraying historical flows at Montague Beach under current Cabot Station operations ("Current") and under the FFP Agreement ("Flex") flows, based on the water month/year of August 2016.

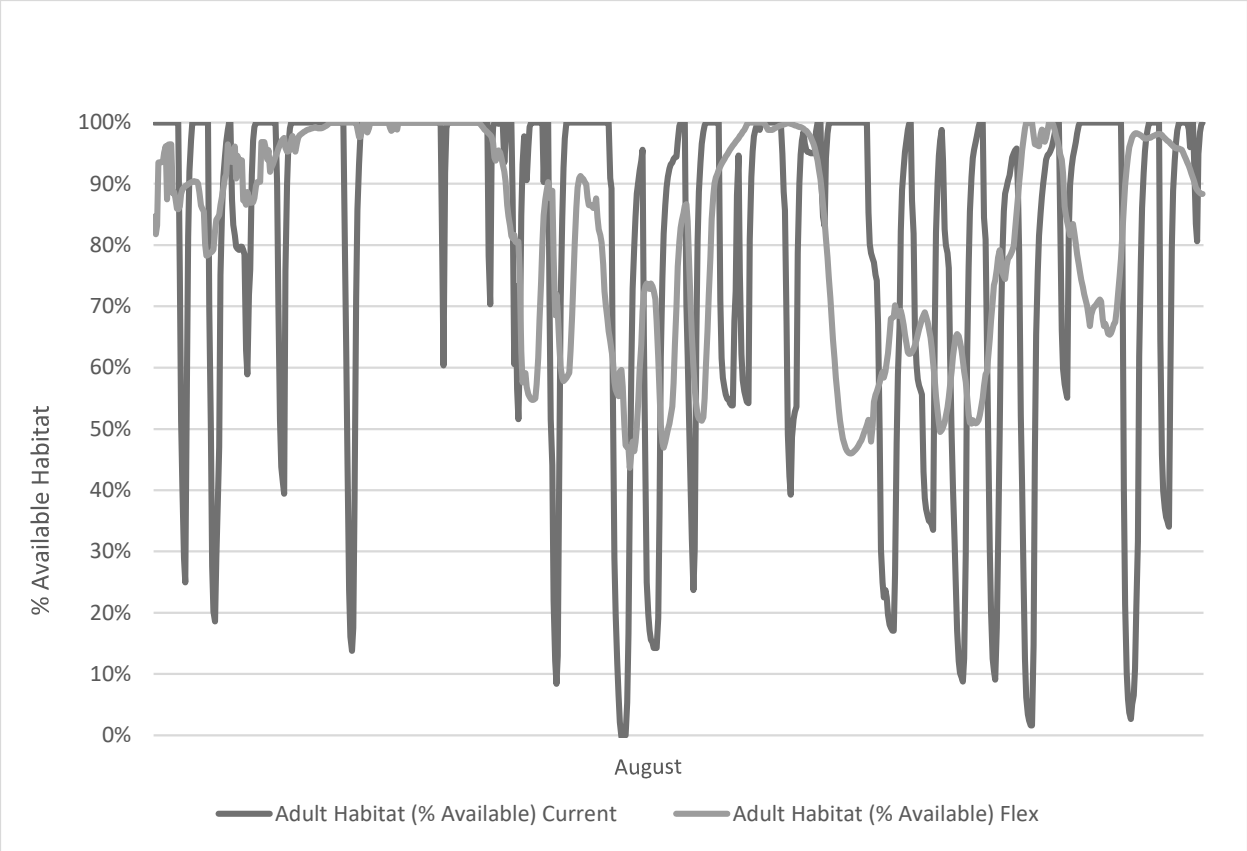

Figure 3. Habitat time series graph portraying historical and estimated cobblestone tiger beetle habitat at Montague Beach (Turners Falls, MA) under current Turners Falls Project operations ("Current") and under the FFP Agreement ("Flex") flows, based on the water month/year of August 2016.

ATTACHMENT B

BALD EAGLE PROTECTION PLAN
FOR THE TURNERS FALLS PROJECT (P-1889)

1 BACKGROUND

The purpose of this plan is to guide the Licensee's management and maintenance of lands at the Turners Falls Hydroelectric Project (Project) over the new license term for the protection of bald eagles.

Although bald eagles have been removed from the endangered species list, bald and golden eagles are still protected under multiple federal laws and regulations including the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act.

Bald eagles winter along the Connecticut River in the Project area. Bald eagles are known to perch in riverbank trees and forage over the Connecticut River in Project vicinity. As part of licensing, several bald eagles, adults and juveniles, have been observed perching or foraging in the Turners Falls Impoundment (TFI) and Northfield Mountain in both 2014 and 2015, and three occupied bald eagle nests were located within the study area. These nests were found downstream on Third Island (below Cabot Station), near Smead Island, Barton Island in Barton Cove, and along the east bank of the TFI across from Stebbins Island in the upper reaches of the TFI. Since the study, the Licensees staff at the Northfield Mountain Visitor Center have provided anecdotal information on two additional eagle nests located within the TFI. One is located in the vicinity of Kidd's Island either on the Island or the eastern shore in the Town of Northfield and one in Turners Falls, on the hillside in the general vicinity of the Turners Falls Airport runway.

2 PROTECTION MEASURES

Given the nature and scope of Project operations, no adverse effects on bald eagles are anticipated. In the event that tree removal or construction activities are necessary at the Project, the Licensee shall implement the conservation measures described below to avoid effects to bald eagles.

Prior to any tree clearing within the Project boundary or areas immediately adjacent to the Project boundary by the Licensee or its contractors, the area to be cleared will be observed for bald eagle nests by the Licensee. If practicable, the Licensee should also survey for nests within 660 feet of the proposed clearing because nests adjacent to clearing may also be indirectly affected. If such nests are discovered, the Licensee shall consult the Massachusetts Division of Fisheries and Wildlife (MDFW) and the United States Fish and Wildlife Service (USFWS) prior to tree-clearing activities and the tree-clearing activities shall be performed in accordance with the applicable regulations and guidance (i.e., the National Bald Eagle Management Guidelines, USFWS 2007, or as amended).

During the nesting season (January 1 through September 30), no tree clearing will occur within 330 feet of, and no construction activities will occur within 660 feet of, any known bald eagle nests by the Licensee or its contractors. The National Bald Eagle Management Guidelines advise against conducting external construction and land clearing activities within 660 feet of bald eagle nests during the breeding season. Additionally, the Guidelines recommend maintaining a year-round buffer between nests and tree clearing of at least 330

feet and a year-round buffer between external construction and nests of either 330 or 660 feet, depending on the construction's size, visibility, and local precedence. For any project-related construction activities, work that requires blasting or other activities that produce extremely loud noises within 1/2 mile of active nests will be avoided. The Licensee shall consult with the MDFW and USFWS regarding tree clearing or construction activities that cannot meet these conditions.

ATTACHMENT C

INVASIVE PLANT SPECIES MANAGEMENT PLAN FOR THE TURNERS FALLS PROJECT (P-1889)

1 PROPOSED MONITORING MEASURES FOR INVASIVE AQUATIC PLANTS

1.1 Updated Baseline Invasive Aquatic Plant Survey

The first full summer following license issuance, the Licensee will conduct an intensive invasive aquatic plant survey of the Turners Falls Impoundment (TFI; from the Turners Falls Dam to Vernon Dam) and the bypass reach (from the Turners Falls Dam to Cabot Station), totaling approximately 22.5 miles.

The survey of the TFI will be conducted by boat in the late summer (August/September) to facilitate identification of any invasive aquatic plants by means of floristic attributes. The survey methodology will include semi-quantitatively documenting the invasive aquatic plants found in the TFI to location, size and percent cover by cover class range (i.e., 2-25%; 25-50%; 50-75%; and 75-100%). Estimates of stand width will be made in three meter intervals (1-3, 3-6, 6-9, and >10 m). Estimates of length will be made to the nearest foot. Each observation of invasive aquatic plants will be assigned a cover descriptor category.

The location of the invasive aquatic plants will be recorded using Geographic Positioning System (GPS) technology for later upload into a GIS map to define baseline or current conditions, and will include Site ID number, the invasive plant species found (color coded in a legend), and the percent cover. The survey of the bypass reach will be conducted by canoe and/or foot and will follow the same methodology as described above.

By February 1 of the year after completing the intensive field survey, the Licensee will provide a report to the United States Fish and Wildlife Service (USFWS), the Massachusetts Natural Heritage and Endangered Species Program (NHESP), and the Massachusetts Department of Environmental Protection (MADEP) for review and comment (including providing the geospatial data in kml/kmz format). The Licensee will meet (remotely or in-person) with USFWS, NHESP, and MADEP to discuss study results, identify areas warranting control work, and determine appropriate control approach(es). The Licensee will update the report (if necessary) and file it with the Federal Energy Regulatory Commission (FERC), along with the consultation record, no later than May 1.

1.2 Early Detection and Rapid Response Protocol (EDRR)

The purpose of the EDRR protocol is to find and eradicate new invasive plant infestations before they spread and cause harm.

Starting the year after completing the updated baseline survey, the Licensee will undertake annual early detection surveys throughout the project area (Vernon Dam to Cabot Station). Surveys will focus on highly aggressive, invasive aquatic species known to occur elsewhere in the watershed. The Licensee will consult with USFWS, NHESP, and MDEP to identify project areas most likely to experience infestations first and to determine the most appropriate survey methodology to use, with the default method following the rapid response guidance provided by the Massachusetts Department of Conservation and Recreation.[1]

[1] MADCR. 2004. Rapid Response Plan for Hydrilla (*Hydrilla verticillata*) in Massachusetts. Massachusetts Department of Conservation and Recreation, Boston, MA. https://www.mass.gov/doc/hydrilla-0/download

Should any new invasive species be detected, the Licensee shall immediately notify the USFWS, NHESP, and MADEP; consult with those agencies on the appropriate rapid response approach(es); and implement rapid response measures identified by the agencies. These early detection surveys and rapid response measures (as needed) will continue annually for the duration of the license.

By February 1 of the year after completing the early detection survey, the Licensee will provide a summary memorandum to the USFWS, NHESP, and MDEP for review and comment (including providing the geospatial data in kml/kmz format if new infestations were detected). The Licensee will meet (remotely or in-person) with USFWS, NHESP, and MDEP to discuss survey results, any control work undertaken, and any modifications to the early detection survey protocol that may be warranted for the upcoming field season. The Licensee will provide a meeting summary to the agencies no later than May 1 and submit the memorandum, including any responses provided by the agencies, to the FERC no later than July 1.

1.3 Cyclical Monitoring of Existing Invasive Aquatic Plants

The purpose of cyclical monitoring is to assess the success of control measures and guide where future control measures should occur. Starting in the fifth year after completing the baseline survey (Section 1.1), the Licensee will conduct targeted monitoring of invasive aquatic plants on a rotating basis. The Licensee will develop a monitoring methodology in consultation with USFWS, NHESP, and MADEP. The TFI and bypass reach will be broken into three sections as follows:

- Section 1 - Vernon Dam to the Rt. 10 Bridge in Northfield, approximately 7.5 miles
- Section 2 - From the Rt. 10 Bridge to the Rt. 2 Bridge in Erving, approximately 7.5 miles
- Section 3 - From the Route 2 (i.e., French King) Bridge to the Turners Falls Dam, approximately 4 miles; and from the Turners Falls Dam to Cabot Station, approximately 2.5 miles

Based on the historic mapping, most invasive aquatic plants are located in Section 3, which includes Barton Cove. Given this, the fifth year after completing the baseline license issuance, the Licensee will conduct a targeted inventory in this reach using the same methods and procedures as outlined above (or as modified via agency consultation). The prioritization of which sections are inventoried in Years 7 and 8 will be discussed with USFWS, NHESP, and MADEP after completing the initial intensive survey. A potential schedule for the targeted monitoring could include:

- Year 6- Section 3
- Year 7- Section 2
- Year 8- Section 1

After Year 8, the cyclical surveys would be repeated in the same sequence as shown above or as agreed upon with USFWS, NHESP, and MDEP, on a five-year rotating basis.[2] By February 1 of the year following a given section survey, the Licensee will provide a summary memorandum of

[2] For example, if Section 3 is always the first in rotation, surveys would occur in years 6, 11, 16, 21, 26, 31, 36, etc.

its findings (including tables, maps, and geospatial data in kml/kmz format) to the USFWS, NHESP and MDFW. The Licensee will meet (remotely or in-person) with USFWS, NHESP, and MDEP to discuss survey results, any control work undertaken the previous year, any modifications to the monitoring protocol that may be warranted for that section or other sections in future surveys, identify areas warranting control work, and determine appropriate control approach(es).

The cyclical section survey memorandum can be combined with the annual early detection report (Section 3.2) and both can be discussed during the same annual agency consultation meeting.

2 CONTROL MEASURES FOR EXISTING INVASIVE INFESTATIONS

The purpose of undertaking active management and control measures is to eradicate, reduce, or contain (as feasible) invasive SAV beds at select locations for certain species where there is a reasonable expectation of success based on the best available science.

Beginning the first summer after license issuance, and continuing annually for the duration of the license,[3] the Licensee shall implement water chestnut control measures at known locations within the TFI and Turners Falls canal. By February 1 of the year following the control work, the Licensee will provide a summary memorandum, including locations, methods, amount and percent of total removed or treated, maps, and geospatial data in kml/kmz format) to the USFWS, NHESP and MDFW. The Licensee will meet (remotely or in-person) with USFWS, NHESP, and MDEP to discuss control work undertaken the previous year, and any recommended modifications to the control approach(es) for the current year. The control activity memorandum can be combined with the annual early detection report (Section 1.2) and both can be discussed during the same annual agency consultation meeting.

Additional locations and/or invasive species may be added to known locations and target species for future control work based on information obtained through the baseline (Section 1.1) and cyclical (Section 1.3) surveys, in consultation with the USFWS, NHESP, and MADEP.

3 ACTIVITIES TO PREVENT THE SPREAD OF INVASIVE PLANTS

The following activities will be performed by the Licensee in order to assist in preventing the establishment, and/or spread, of terrestrial and aquatic invasive plant species.

3.1 Activities Associated with Daily Operations and Routine Maintenance

1. The Licensee will continue to maintain Project grounds in a manner that helps prevent the introduction and spread of invasive plant species within the Project boundary, as provided below.
2. The Licensee will not actively plant any terrestrial plants listed under the noxious weeds in the United States Department of Agriculture Natural Resources Conservation Service

[3] Annual control activities may be reduced, eliminated, or suspended, based on monitoring data and agency concurrence.

Plants Database, which incorporates plants listed by the Massachusetts Invasive Plant Advisory Group.

3. The Licensee will monitor areas of disturbance caused by routine operation or maintenance activities within the Project area to ensure that invasive plant species do not out-compete desirable vegetation during the reestablishment phase. Where invasive species have been found to outcompete desirable vegetation during reestablishment, the Licensee will treat infestations, as necessary, to eliminate or reduce the invasive infestation(s).
4. The Licensee will instruct its work personnel to visually inspect all of the Licensee's exposed boating equipment for attached invasive plant or animal species.
5. The Licensee will clean and dry its boats and trailers that come in contact with the water following removal from the water. The Licensee will remove any visible plants or animals before entering the water or leaving the site. Plants and animals are to be discarded in an upland area.
6. The Licensee will post signage explaining the threats of nonnative aquatic species and steps to prevent the spread at formal and informal recreation sites[4] within the Project area.
7. The Licensee will participate in watershed-scale invasive species management groups and disseminate information and recommendations developed by the group to the public widely.

3.2 Activities Associated with Construction or Major Maintenance

3.2.1 Prior to Construction or Major Maintenance Activities

1. The Licensee will consult with the Massachusetts Department of Fish and Wildlife (MDFW) regarding the best management practices (BMP) to be employed and implement activity specific BMPs to help prevent the introduction and/or spread of invasive plant species within the area associated with the activity to be performed.
2. Workers will clean, drain, and dry boats and trailers that come in contact with the water following removal from the water.
3. Workers will remove visible plants or animals before entering the water or leaving the site. Plants and animals are to be discarded in an upland area.

3.2.2 During Construction

1. Workers will be trained to identify invasive plants and informed of the importance of infestation prevention.
2. Construction equipment will be surveyed and equipment entering the work area will be cleaned/washed before allowing the equipment to enter an invasive-free area.
3. Invasive plants that could potentially be spread by construction equipment or workers will be removed. Along access roads, invasive plants will be identified and controlled to avoid introducing them into invasive-free areas.
4. Gravel and fill will come from invasive-free sources to avoid introducing invasive vegetation to the construction site, whenever practicable.

[4] Recreation sites include boat launches, environmental education facilities, picnic areas, trailheads, etc.

5. Certified invasive-free straw, mulch, fiber rolls, and sediment logs will be used for erosion and sediment control, whenever practicable.

3.2.3 During Seeding and Planting

1. Whenever possible, soil amendments (if any) and mulches will be obtained from invasive-free sources.
2. The Licensee will use only native seed mixes for reseeding disturbed areas, whenever possible.
3. Seeding and planting operations and maintenance will be conducted in a manner to promote vigorous growth of desirable vegetation and discourage invasive species.
4. Bare ground will be seeded as quickly as possible following disturbance.
5. Seeded sites will be monitored for infestation by invasive plant species.
6. Identified invasive plant species at monitored sites will be treated in the first full growing season.
7. Mulch will be used to limit the amount of unwanted seed sources reaching bare soil, whenever possible.
8. The Licensee will ensure that all construction contractors are aware of, and comply with, the terms listed above.

3.2.4 Post Construction

1. The Licensee will monitor any areas of disturbance caused by construction activities on lands owned by the Licensee within the Project boundary as needed to ensure that invasive species have not out-competed desirable vegetation during the reestablishment.
2. Where invasive species have been found to outcompete desirable vegetation during reestablishment, the Licensee will treat infestations, as necessary, to eliminate or reduce the invasive infestation(s).

ATTACHMENT D

BALD EAGLE PROTECTION PLAN
FOR THE NORTHFIELD MOUNTAIN PUMPED STORAGE PROJECT (P-2485)

1 BACKGROUND

The purpose of this plan is to guide the Licensee's management and maintenance of lands at the Northfield Mountain Pumped Storage Project (Project) over the new license term for the protection of bald eagles.

Although bald eagles have been removed from the endangered species list, bald and golden eagles are still protected under multiple federal laws and regulations including the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act.

Bald eagles winter along the Connecticut River in the Project area. Bald eagles are known to perch in riverbank trees and forage over the Connecticut River in Project vicinity. As part of licensing, several bald eagles, adults and juveniles, have been observed perching or foraging in the Turners Falls Impoundment (TFI) and Northfield Mountain in both 2014 and 2015, and two occupied bald eagle nests were located within the study area. These nests were found downstream on Third Island (below Cabot Station), near Smead Island, Barton Island in Barton Cove, and along the east bank of the TFI across from Stebbins Island in the upper reaches of the TFI. Since the study, the Licensees' staff at the Northfield Mountain Visitor Center have provided anecdotal information on two additional eagle nests located within the TFI. One is located in the vicinity of Kidd's Island either on the Island or the eastern shore in the Town of Northfield and one in Turners Falls, on the hillside in the general vicinity of the Turners Falls Airport runway.

2 PROTECTION MEASURES

Given the nature and scope of Project operations, no adverse effects on bald eagles are anticipated. In the event that tree removal or construction activities are necessary at the Project, the Licensee shall implement the conservation measures described below to avoid effects to bald eagles.

Prior to any tree clearing within the Project boundary or areas immediately adjacent to the Project boundary by the Licensee or its contractors, the area to be cleared will be observed for bald eagle nests by the Licensee. If practicable, the Licensee should also survey for nests within 660 feet of the proposed clearing because nests adjacent to clearing may also be indirectly affected. If such nests are discovered, the Licensee shall consult the Massachusetts Division of Fisheries and Wildlife (MDFW) and the United States Fish and Wildlife Service (USFWS) prior to tree-clearing activities and the tree-clearing activities shall be performed in accordance with the applicable regulations and guidance (i.e., the National Bald Eagle Management Guidelines, USFWS 2007, or as amended).

During the nesting season (January 1 through September 30), no tree clearing will occur within 330 feet of, and no construction activities will occur within 660 feet of, any known bald eagle nests by the Licensee or its contractors. The National Bald Eagle Management Guidelines advise against conducting external construction and land clearing activities within 660 feet of bald eagle nests during the breeding season. Additionally, the Guidelines recommend maintaining a year-round buffer between nests and tree clearing of at least 330 feet and a year-

round buffer between external construction and nests of either 330 or 660 feet, depending on the construction's size, visibility, and local precedence. For any project-related construction activities, work that requires blasting or other activities that produce extremely loud noises within 1/2 mile of active nests will be avoided. The Licensee shall consult with the MDFW and USFWS regarding tree clearing or construction activities that cannot meet these conditions.

ATTACHMENT E

PRELIMINARY PRESCRIPTION FOR FISHWAYS FOR THE TURNERS FALLS (P-1889) AND NORTHFIELD MOUNTAIN PUMPED STORAGE (P-2485) PROJECTS

BEFORE THE

UNITED STATES OF AMERICA

FEDERAL ENERGY REGULATORY COMMISSION

Northfield Mountain LLC	)	Northfield Mountain Pumped Storage Project; FERC No. 2485-071
FirstLight MA Hydro LLC	)	Turners Falls Hydroelectric Project; FERC No. 1889-085

UNITED STATES DEPARTMENT OF THE INTERIOR

PRELIMINARY PRESCRIPTION FOR FISHWAYS

PURSUANT TO SECTION 18 OF THE FEDERAL POWER ACT

Submitted this 10th day of May, 2024

by:

AUDREY MAYER Digitally signed by AUDREY MAYER Date: 2024.05.10 11:48:30 -04'00'

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Audrey Mayer

Supervisor

New England Field Office

U.S. Fish and Wildlife Service

United States Department of the Interior

TABLE OF CONTENTS

United States Department of the Interior
Preliminary Prescription for Fishways
Pursuant to Section 18 of the Federal Power Act

1. INTRODUCTION

The United States Department of the Interior (Department) hereby submits its Preliminary Prescription for Fishways (Prescription) for the Northfield Mountain Pumped Storage Project (NMPS; FERC No. 2485-071) and Turners Falls Hydroelectric Project (Turners Falls; FERC No. 1889-085), pursuant to Section 18 of the Federal Power Act (FPA), as amended. The Department is submitting this Prescription to the Federal Energy Regulatory Commission (Commission; FERC) with an index to the supporting administrative record, which will be filed under separate cover. NMPS is owned by Northfield Mountain Limited Liability Company (LLC) and Turners Falls is owned by FirstLight MA Hydro LLC. Both LLCs are affiliates of FirstLight Hydro Generating Company (FirstLight; Applicant). Both projects are currently undergoing relicensing before the Commission. Turners Falls is located on the Connecticut River in Franklin County, Massachusetts; Cheshire County, New Hampshire; and Windham County, Vermont. NMPS is located on the Connecticut River in Franklin County, Massachusetts.

The Department developed its Prescription for Fishways through a review process that included consultation among fisheries biologists from the Department's U.S. Fish and Wildlife Service (Service; USFWS), the National Marine Fisheries Service (NMFS), and the Massachusetts Division of Fisheries and Wildlife (MADFW).

The Department is also filing an Index to the Administrative Record in this proceeding. The Department has considered the record before the Commission as well as scientific evidence not already included in the record before the Commission or publicly available.

2. ADMINISTRATIVE PROCESS, HEARING RIGHTS, AND SUBMISSION OF ALTERNATIVES

This Prescription was prepared, and will be processed, in accordance with the Department's regulations at 43 Code of Federal Regulations (C.F.R.) Part 45. These regulations provide that any party to a license proceeding before the Commission in which the Department exercises mandatory authority is provided both the right to trial-type hearings on issues of material fact and the opportunity to propose alternatives to the terms contained in the Prescription. Therefore, the Department hereby provides notice that any party to the license application process before the Commission may request a trial-type hearing on any issue of fact material to this Prescription pursuant to, and in conformance with, the regulations of the Department at 43 C.F.R. §45.21. Such a request for a trial-type hearing must be filed with the Office of Environmental Policy and Compliance, Department of the Interior, 1849 C Street, NW, Mail Stop 2629, Washington, DC 20240, within 30 days of the filing of this document with the Commission. Should any request for trial-type hearing be filed, other parties may file

interventions and responses thereto within 20 days of the date of service of the request for a hearing 43 C.F.R. §45.22. Trial-type hearings will be conducted, and a Modified Fishway Prescription developed, in accordance with the terms and time limits of 43 C.F.R. Part 45. The Department further provides notice that any party to the license application process before the Commission may submit proposals for alternatives to the terms contained in the Prescription by filing them pursuant to, and in conformance with, the Department's regulations at 43 C.F.R. §45.71. Any such alternative proposals must be filed with the Office of Environmental Policy and Compliance, Department of the Interior, 1849 C Street, NW, Mail Stop 2629, Washington, DC 20240, within 30 days of the date of the submission of this document to the Commission. Finally, the Department will accept and consider any comments on the Prescription filed by any member of the public, state or Federal agency, Tribe, the Applicant, or other entity or person. Comments are due within 30 days of this Prescription being filed with the Commission, and should be sent to:

Audrey Mayer, Supervisor
New England Field Office
U.S. Fish and Wildlife Service
70 Commercial Street, Suite 300
Concord, NH 03301
email: audrey_mayer@fws.gov

Pursuant to, and in conformance with, the Department's regulations at 43 C.F.R. §45.73, the Department will submit its Modified Fishway Prescription, with accompanying analysis, within 60 days after the deadline for filing comments on the Commission's draft NEPA document under 18 CFR 5.25(c). If no alternative proposals or comments on the Prescription are received by the Department and the Department does not submit a Modified Fishway Prescription within the specified deadline, the Service, on behalf of the Department, will file a letter with the Commission confirming this Prescription as the Modified Fishway Prescription.

3. PROJECT OVERVIEW

The following descriptions are from the Final License Applications for the Turners Falls Project and Northfield Mountain Pumped Storage Project (FERC Accession No. 20160429-5414, Exhibit A).

3.1. TURNERS FALLS

The Turners Falls Project consists of two individual concrete gravity dams, referred to as the Gill Dam and Montague Dam, connected by a natural rock island known as Great Island; the approximately 20-mile long Turners Falls Impoundment (TFI) that serves as the lower reservoir for the Northfield Mountain Project; a gatehouse, power canal, and two hydroelectric projects located on the power canal including Station No. 1 and Cabot Station; three fish passage facilities; and a downstream fish passage facility located at the downstream terminus of the power canal.

The Turners Falls Amended Final License Application (AFLA), Exhibit A (FERC Accession No. 20201204-5120), provides a detailed description of the Project and project operations. Turners Falls is the second dam on the river proceeding upstream from the sea. The first dam is the Holyoke Hydroelectric Project (FERC No. 2004). There are nine dams on the Connecticut River upstream of Turners Falls, all FERC-licensed hydroelectric projects. Turners Falls has an authorized installed capacity of 64.21 megawatts (MW) and generates approximately 332,351 megawatt-hours (MWh) annually.

3.2. NORTHFIELD MOUNTAIN PUMPED STORAGE (NMPS)

NMPS is a pumped-storage facility located on the Connecticut River in Massachusetts that uses the TFI as its lower reservoir. The NMPS Project boundary overlaps with Turners Falls Project boundary along nearly the entire perimeter of the TFI, but it does not include the Turners Falls Dam (TFD). The TFI is a shared project feature with the Turners Falls Hydroelectric Project (FERC No. 1889). The tailrace of NMPS is located approximately 5.2 miles upstream of Turners Falls Dam, on the east side of the TFI. The Project's Upper Reservoir is a man-made structure situated atop Northfield Mountain. During pumping operations, water is pumped from the TFI to the Upper Reservoir. When the Northfield Mountain Project is generating, water is passed from the Upper Reservoir through an underground pressure shaft to a powerhouse cavern and then a tailrace tunnel delivers the water back to the TFI. The Northfield Mountain Project consists of a) the Upper Reservoir dam/dikes; b) an intake channel; c) pressure shaft; d) an underground powerhouse; e) a tailrace tunnel, and f) the TFI. A detailed description of the Project and its operations is included in the NMPS AFLA, Exhibit A (FERC Accession No. 20201204-5120; Volume 1 of 5).

NMPS has an authorized installed capacity of 1,166.8 MW. It generates approximately 889,845 MWh of energy annually and consumes approximately 1,189,640 MWh of energy annually.

4. RESOURCE DESCRIPTION

4.1. CONNECTICUT RIVER

The following description of the Connecticut River basin is taken directly from Exhibit E of the Amended Final License Application for the projects (FERC Accession No. 20201204-5120; Volume 2 of 5, Part 1 of 4):

"The Connecticut River and its tributaries drain an area of about 11,250 mi^2, constituting the largest river drainage system in New England. From its origin in the Connecticut Lakes Region near the Canadian border, the 410-mile-long Connecticut River flows southward to form the boundary between NH and VT, then through MA and CT to Long Island Sound (Carr & Kennedy, 2008).

According to the USGS's Watershed Boundary Dataset, the Connecticut River subregion, which

is part of the New England region, is divided into two basins at the Vernon Dam in VT—the Upper Connecticut basin and the Lower Connecticut basin (for the purposes of this document, the Connecticut River subregion may also be referred to as a basin or watershed). The Project boundary falls within the Middle Connecticut subbasin of the Lower Connecticut basin, and almost entirely within the Fall River-Connecticut River watershed within that subbasin (USGS, 2010). Figure 3.1-1 provides an overview of the entire Connecticut River subregion and its major tributaries and mainstem dams, while Figure 3.1-2 shows a close-up of the Middle Connecticut subbasin and tributaries and dams in the Project area.

In MA, the Lower Connecticut River basin covers an area of approximately 2,728 mi^2, occupying all of Franklin and Hampshire Counties, most of Hampden County, the eastern third of Berkshire County, and the western half of Worcester County. In this region, tributary streams entering the Connecticut River from the west originate in the Berkshire Mountains and have steeper gradients than tributary streams originating in the Central Highlands to the east (Simcox, 1992). The Middle Connecticut River subbasin in MA is bordered by the Deerfield River subbasin to the northwest, the Millers River subbasin to the northeast, the Westfield River subbasin to the southwest, and the Chicopee River subbasin to the southeast (Carr & Kennedy, 2008)."

4.2. MIGRATORY FISH OF THE CONNECTICUT RIVER BASIN

4.2.1. Historical Migratory Fisheries Resources

Historically, the Connecticut River Basin was accessible to at least nine species of sea-run migratory fish from Long Island Sound (Noon 2003). Migratory fish can be classified as either anadromous or catadromous. Adult anadromous fish live in the ocean and migrate to freshwater rivers to spawn. Juvenile anadromous fish stay in freshwater habitats for several months to many years before they return to the ocean and grow to maturity. Catadromy is the reverse life history, whereby a fish spends most of its life rearing in estuarine or fresh water before migrating out to sea to spawn. Of the sea-run migratory fish historically present in the Connecticut River Basin, Atlantic salmon (*Salmo salar*), striped bass (*Morone saxatilis*), Atlantic sturgeon (*Acipenser oxyrinchus*), shortnose sturgeon (*A. brevirostrum*), sea lamprey (*Petromyzon marinus*), American shad (*Alosa sapidissima*), alewife (*A. pseudoharengus*), and blueback herring (*A. aestivalis*) are anadromous; and the American eel (*Anguilla rostrat*a) is catadromous.

American shad, shortnose sturgeon, blueback herring, sea lamprey, Atlantic salmon, and American eel were known to ascend the mainstem Connecticut upstream of the Hadley Falls in Massachusetts. Before construction of dams excluded access, these migratory species, with the exception of shortnose sturgeon, were abundant in mainstem and tributary habitat upstream of the Turners Falls Project, providing important ecological roles and fisheries for native Americans and early settlers (Gephard and McMenemy 2004; Noon 2003).

On the Connecticut River, it is believed sea lamprey historically ranged at least as far upstream as Bellows Falls, Vermont, if not farther (Scarola 1987). American shad and blueback herring were known to ascend the river as far as Bellows Falls, Vermont (Gephard and McMenemy 2004), while records document American eels as far upstream as the Connecticut Lakes in New Hampshire (Warfel 1939) and Atlantic salmon as far upstream as Beechers Falls, Vermont (CRASC 1998).

The construction of dams along the mainstem and many of its tributaries during the Industrial Revolution prevented migratory fish from accessing most freshwater habitat in the watershed. By the 1820s Atlantic salmon had disappeared from the river and the population of American shad had been seriously depleted (Jones 1988).

4.2.2. Present Day Migratory Fisheries Resources

The first fish lift in the United States was built at the Holyoke Project (FERC No. 2004) in 1955 (Haro and Castro-Santos 2012). This was followed by the construction of fish ladders at the next four dams on the Connecticut River: Turners Falls in 1980, Vernon (FERC No. 1904) in 1981, Bellows Falls (FERC No. 1855) in 1982, and Wilder (FERC No. 1892) in 1985 (Figure 4.1). These fish ladders were designed to pass sea-run Atlantic salmon and, in the case of the lower three dams, American shad (Daugherty 1969); however, as summarized in Table 4.1, they also have passed sea lamprey and American eels. The Connecticut River Atlantic salmon restoration program ceased in 2013 and no adult salmon have passed main stem upstream fishways since 2019.

4.3. IMPACTS OF DAMS ON FISH MIGRATIONS

Migratory fish have evolved to require specific conditions in river systems and the relatively recent alteration to many river systems by the construction of dams and other impacts has negatively affected migratory fish populations. Dams can impact both upstream and downstream fish migration in river systems (Limburg and Waldman 2009). Dams not only block or impede fish migration, but also alter the hydrology and aquatic habitat in the river. A recent study estimated the available habitat for American shad prior to dam construction in its native range to be 41 percent greater than current levels of accessibility (Zydlewski, et al. 2021). Where water flow is slowed upstream of dams, lake-like conditions prevail rather than riverine ones. Water flow downstream of dams can be significantly altered (Limburg and Waldman 2009), particularly at peaking hydroelectric projects, with drastic changes in water depth and velocity occurring over short time periods. Depending on the severity and location of blockages and changes to hydrology, migratory fish populations can be severely reduced or extirpated due to dam impacts (Limburg and Waldman 2009).

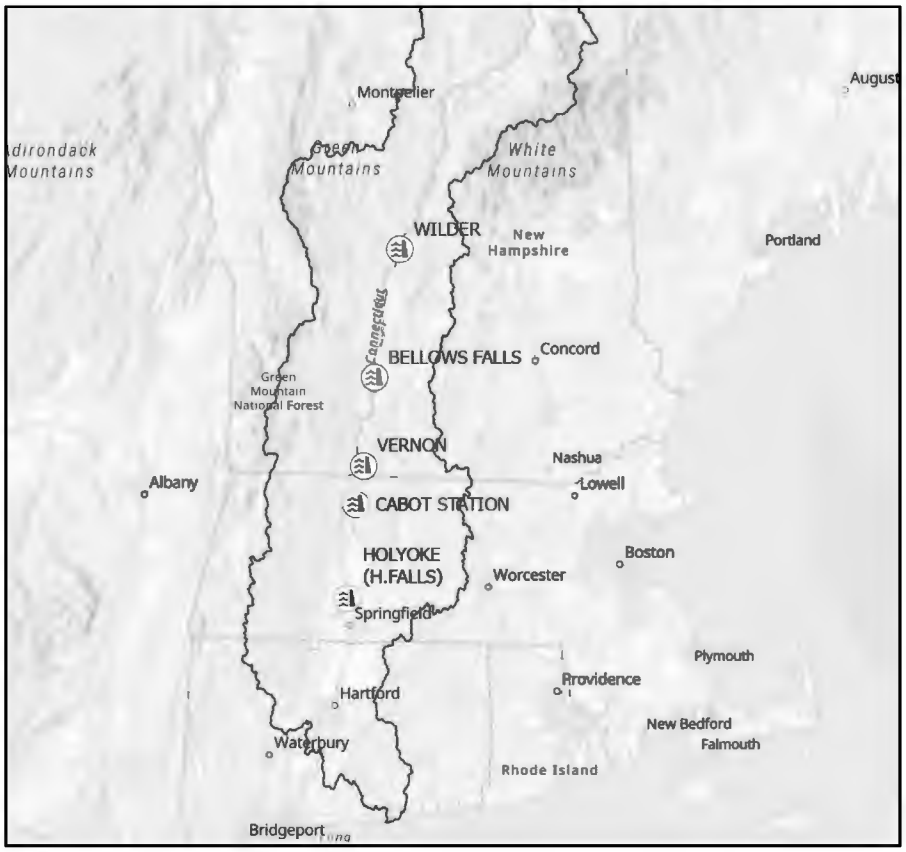

Figure 4.1. Map showing the Connecticut River watershed and location of dams referenced in this document.

The degree to which a given dam is an impediment to the upstream movement of juvenile eels depends on a number of factors, including the height of the dam, its surface, whether the surface is wetted or not, and the size of the eels trying to ascend it. Some upstream barriers may be size selective, as the ability of juvenile eels to scale obstacles decreases as they grow in size (Hitt, Eyler, and Wofford 2012). In general, a high dam with a dry, vertical surface represents the greatest barrier. While some portion of eels trying to ascend a given barrier may be successful, studies have shown that the density of eels tends to be higher downstream of a dam and lower upstream of a dam. On the Merrimack River, Hoover (1938) reported a great discrepancy in eel abundance above and below the Amoskeag Dam in Manchester, New Hampshire, with much higher densities just below the dam, and Sprankle (2002) reported similar findings with catch rates upstream of the Essex Dam in Lawrence, Massachusetts, much lower than downstream of the dam. High densities below barriers due to limited passage success may have the negative effects of altering natural sex ratios, increasing the transmission of parasites and diseases, and increasing intraspecific competition for habitat and food resources (Krueger and Oliveira 1999; Oliveira and McCleave 2000).

Table 4.1. Annual counts of key migratory fish species passing fishways at the first five barriers on the main stem Connecticut River for the time period 2001 through 2021.

Species	Year	Holyoke	Gatehouse	Vernon	Bellows Falls	Wilder
Sea Lamprey	2001	49,306	2,144	3,184		
Sea Lamprey	2002	74,979	10,160	2,201		
Sea Lamprey	2003	53,030		8,048		
Sea Lamprey	2004	59,461	8,418	3,668		
Sea Lamprey	2005	28,134		3,586	229	
Sea Lamprey	2006	17,636	3,005	2,895	256	
Sea Lamprey	2007	39,933	15,438	17,038	705	
Sea Lamprey	2008	57,049	32,035	22,434	2,233	2
Sea Lamprey	2009	18,996	8,297	1,532	100	
Sea Lamprey	2010	39,782		3,179	393	
Sea Lamprey	2011	19,136	2,032	329	74	
Sea Lamprey	2012	14,089	4,503	696		
Sea Lamprey	2013	22,092	6,016	1,002	213	
Sea Lamprey	2014	22,136	5,553	399	212	
Sea Lamprey	2015	22,245	8,436	2,519	971	2
Sea Lamprey	2016	35,249	15,128	5,521	1,619	
Sea Lamprey	2017	21,526	9,223	2,612	1,261	
Sea Lamprey	2018	10,238	4,010	3,124	324	
Sea Lamprey	2019	18,347	3,700	2,315	147	
Sea Lamprey	2020	33,739	17,525	7,290	2,142	
Sea Lamprey	2021	20,150	11,227	7,841	2,183	
American Shad	2001	273206	1540	1616		
American Shad	2002	374534	2870	336		
American Shad	2003	286814		267		
American Shad	2004	191555	2235	653		
American Shad	2005	116511	1581	167	3	
American Shad	2006	154745	1810	133		
American Shad	2007	158807	2248	65		
American Shad	2008	153109	3995	271		
American Shad	2009	160649	3947	16		
American Shad	2010	164439	16768	290		
American Shad	2011	244177	16798	46	1	
American Shad	2012	490431	26727	10715		
American Shad	2013	392967	35494	18220		
American Shad	2014	370506	39914	27706		
American Shad	2015	412656	58079	39771	44	
American Shad	2016	385930	54760	35513	1973	
American Shad	2017	536670	48727	28684		
American Shad	2018	275232	43146	31724	733	
American Shad	2019	314361	22649	12872	3	
American Shad	2020	362423	41252	13897	460	
American Shad	2021	237306	21052	9701	356	

Species	Year	Holyoke	Gatehouse	Vernon	Bellows Falls	Wilder
Atlantic Salmon	2001	24		1	1	
Atlantic Salmon	2002	34		3		
Atlantic Salmon	2003	28		0		
Atlantic Salmon	2004	45		1	1	1
Atlantic Salmon	2005	132		4	3	2
Atlantic Salmon	2006	115		4	0	
Atlantic Salmon	2007	107		5	3	
Atlantic Salmon	2008	83		8	8	4
Atlantic Salmon	2009	59		7	4	1
Atlantic Salmon	2010	42		8	4	2
Atlantic Salmon	2011	71		9	6	3
Atlantic Salmon	2012	28		4	2	2
Atlantic Salmon	2013	69				
Atlantic Salmon	2014					
Atlantic Salmon	2015	13				
Atlantic Salmon	2016	3				
Atlantic Salmon	2017	10		2	1	
Atlantic Salmon	2018	2	2	2	2	
Atlantic Salmon	2019	3	1			
Atlantic Salmon	2020	0				
Atlantic Salmon	2021	0				
American Eel	2001					
American Eel	2002	2				
American Eel	2003					
American Eel	2004					
American Eel	2005	8752				
American Eel	2006	5135				
American Eel	2007	5145				
American Eel	2008	13798				
American Eel	2009	6427				
American Eel	2010	4253				
American Eel	2011	9734				
American Eel	2012	39423				
American Eel	2013	13584				
American Eel	2014	49817		124	35	8
American Eel	2015	20038		1554	60	46
American Eel	2016	38449		-907	-163	
American Eel	2017	19438		581	-158	
American Eel	2018	8562		-7934	-444	
American Eel	2019	27505		2307		
American Eel	2020	17689				
American Eel	2021	12469		15392	256	

For adult alosines (i.e., American shad, blueback herring, and alewife) migrating to spawning habitat, nearly any dam represents a barrier to migration. Alosines are not leaping fish like salmon. They require streaming flow. Therefore, nearly any differential between headwater and tailwater elevation will inhibit their movement. Adult salmonids are able to leap over some instream obstructions if there is a deep enough pool below it. However, most hydropower dams are high enough to preclude even salmon from passing.

For downstream migration, fish respond to river flow and migrate past dams via different routes, including over dam spillways, down bypass channels, and through hydroelectric turbines (Castro-Santos and Haro 2003; Jansen, Winter, Bruijs, and Polman 2007; Kynard and O'Leary 1993). At hydroelectric dams, large volumes of water can direct out-migrating fish into potential hazards while they attempt to pass the project. Fish may be injured or killed via entrainment through a turbine, discharge through a gate or over a spillway with no adequate plunge pool, impingement on screens and racks, and trauma due to changes in barometric pressure (barotrauma). Mortality caused by passing downstream, through turbines, at hydroelectric projects can vary greatly depending on species, size, and life stage (adult or juvenile) of fish as

well as on turbine design, including turbine flow, tip speed, rotational speed, number of blades/buckets, blade spacing, and runner diameter (Franke, et al. 1997). Twelve percent mortality has been observed for American shad (Heisey, Mathur, Fulmer, and Kotkas 2008) and 100 percent mortality for American eel (Carr and Whoriskey 2008). Generally, fish passing through hydroelectric turbines can be injured or killed due to rapid barotrauma, cavitation, strike, grinding, turbulence, and shear stress (Brown, et al. 2014; Cada and Coutant 1997).

4.4. AMERICAN EEL

The American eel serves as an important prey species for many fish, aquatic mammals, and fish-eating birds (USFWS 2015a) and become predators themselves as they grow in freshwater systems (USFWS 2015a). Restoring eels to freshwater habitats restores the historical ecosystem balance. In some rivers, eels are an important host species for successful reproduction of freshwater mussels (USFWS 2015a). In addition, eels support valuable recreational, commercial, and subsistence fisheries (USFWS 2015a).

4.4.1. American Eel Biology and Life History

The American eel is a catadromous species that lives in freshwater and migrates downstream to the Sargasso Sea to spawn before dying. Larval eels are transported by ocean currents to rivers along the eastern seaboard of North America. Historically, American eel were abundant in most East Coast streams, often comprising 25 percent or more of the total fish biomass (Haro, et al. 2000). However, beginning in the 1980s, a substantial decline throughout most of their range has occurred (Haro, et al. 2000).

American eels are panmictic, meaning that there is a single spawning site without mating restrictions, neither genetic nor behavioral, upon the population, and therefore random recombination occurs with each new generation of American eel. Thus, there are no unique adaptations to specific regions within the range of American eel from Canada to the Caribbean (Shepard 2015). The spawning location is east of the Bahamas and south of Bermuda in the center of the gyre known as the Sargasso Sea. After spawning, American eel eggs hatch into "leptocephali," a small transparent, larval stage that is passively transported in ocean currents for about 1 year. Leptocephali eventually metamorphose into “glass eels” which leave ocean currents and swim to coastal waters anywhere from the Caribbean to eastern Canada. Within days of reaching coastal waters, glass eels transform into small, fully developed, pigmented eels. They are often called elvers at this stage, an imprecise term that is generally applied to small eels in fresh water that may be of many sizes and ages.

Juvenile eels are usually referred to as yellow eels. Small yellow eels are sexually indeterminate and cannot be differentiated histologically until reaching a length of about 8 inches. Yellow eel upstream movement generally occurs from dusk to dawn (Verdon, Desrochers, and Dumont 2003) in all months of the year with peak movement dependent on temperature and latitude (Richkus and Whalen 2000).

Upstream movements are to lakes, ponds, and upstream river reaches where they generally encounter fewer yellow eels, less competition, and greater opportunity for eel growth (Lamothe, Gallagher, Chivers, and Moring 2000). Yellow eels in upstream reaches of rivers and inland lakes tend to be older, larger, and female, although it is not known whether eels that will become female tend to move upstream or if the conditions upstream cause eels to become female (Helfman, Facey, Hales, and Bozeman 1987; Oliveira K. 1999). Upstream habitats appear to facilitate the growth and out-migration of the largest and most fecund members of the population, in relation to downstream habitats.

Sexual maturation and silvering begin at ages from 3 years to more than 30 years. Females mature at later ages than males and eels mature at later ages in fresh water, as compared to marine and estuarine waters where growth is more rapid. Age at maturation increases with latitude—for example, silvering in fresh waters of the Chesapeake Bay region occurs at ages from 6 to 16 years (Helfman, Facey, Hales, and Bozeman 1987), but at 8 to 23 years in Canada (Cairns, et al. 2005). The timing of silver eel migration has also been correlated with latitudinal location, occurring in large part in late summer in the north and late winter in the south (Haro A. 2003). For example, silver eels migrate from the St. Lawrence River in large part from August to November, from Connecticut rivers in September through October, and from Georgia rivers from October through March (ASMFC 2012). However, the timing of silver eel migration can also vary based on localized triggers such as weather, photoperiod, temperature, streamflow, and other local environmental conditions (Haro A. 2003) and is an active area of research.

Downstream migration has been commonly perceived as occurring primarily at night. Overall, 81.2 percent of the 293 eel passage events (including yellow eels) at dams on the Shenandoah River occurred during turbine shutdown periods between 1800 and 0600 hours (Eyler, Walsh, Smith, and Rockey 2016). The other 18.8 percent passed during the day or were not detected. Downstream movement from fresh water is accelerated by heavy rains and rises in stream flow (i.e., freshets); two thirds of the 293 eel passage events at dams on the Shenandoah River coincided with high-discharge events (Eyler, Walsh, Smith, and Rockey 2016). Downstream movement of eels has been detected during each month of the year except July, and during day and night (Eyler, Walsh, Smith, and Rockey 2016). Downstream migrants use tidal transport and travel near the surface, but also make vertical movements, especially when encountering dams (Brown, Haro, and Castro-Santos 2009; ASMFC 2012).

4.4.2. Impacts to American Eel Migration

The Connecticut River supports an American eel population. However, dams throughout the basin, particularly in the major tributaries, block access to much of the eel habitat. Historical records document American eels as far upstream as the Connecticut Lakes in New Hampshire (Scarola 1987); however, long-term monitoring data at existing fishways on the main stem, which were designed to pass anadromous species, reveal substantial impediments to eel passage

still exist (Table 4.1).[1]

4.4.3. Current Status of the American Eel Populations

In 2004, the USFWS was petitioned to list American eel under the Endangered Species Act (ESA), but ultimately determined that listing was not warranted (USFWS 2007). The USFWS determined that although the population of American eel had declined and had been extirpated from some areas, it was still widely distributed throughout its historic range and not in immediate threat of extinction. In 2010, the Council for Endangered Species Act Reliability (CESAR) petitioned the USFWS to re-consider listing the American eel under the ESA based on new information (CESAR 2010). The 2010 petition suggested that American eel was currently threatened with extinction due to the present or threatened destruction, modification, or curtailment of its habitat or range, overutilization for commercial and recreational purposes, disease and possibly predation, the inadequacy of existing regulatory mechanisms, as well as global warming, and anthropogenic factors related to electric generation by hydroelectric projects and the spread of swim bladder parasites from ship ballast water (CESAR 2010). In 2015, the USFWS completed the status review and determined that listing was not warranted at this time and that the American eel remains widely distributed throughout its native range (USFWS 2015b).

There is no current formal assessment for American eel abundance available for the Connecticut River. Passage data summarized in Table 4.1 document eels passing upstream of the Wilder Project (FERC No. 1892) in Wilder, Vermont. In addition, Figure 4.2 depicts eel presence recorded from fisheries surveys (circa 1980s onward) undertaken in the watershed.

[1] Currently, the only main stem dam with dedicated eel passage facilities is the Holyoke Project (FERC No. 2004).

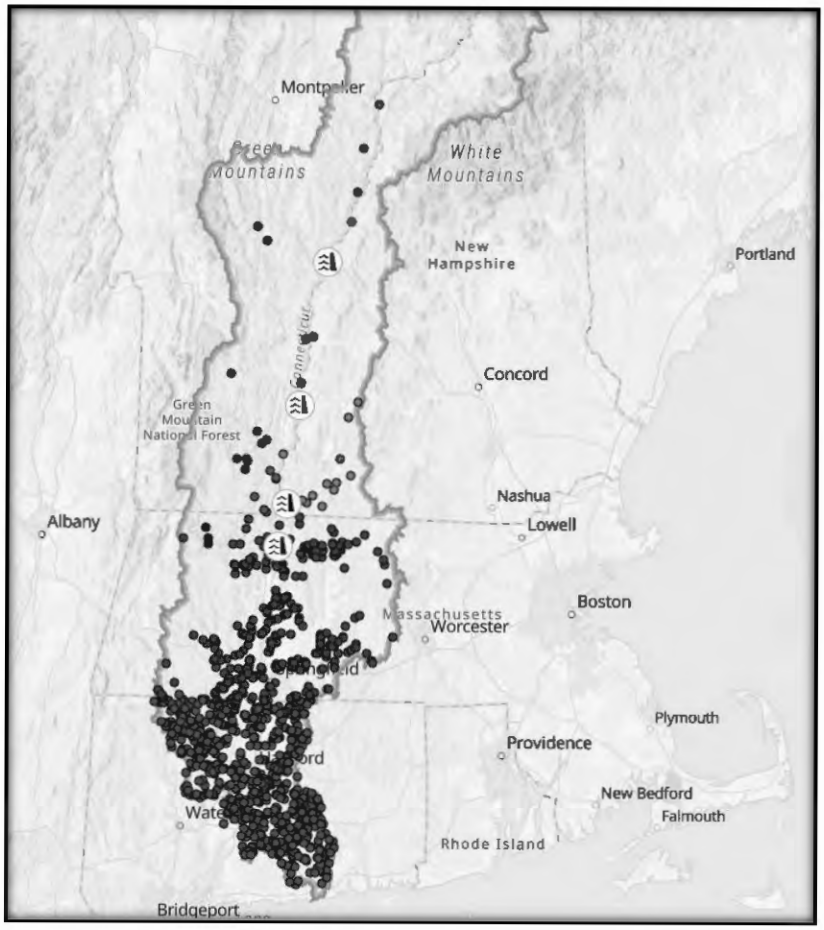

Figure 4.2. Map showing eel presence within the Connecticut River watershed based on fisheries surveys.

4.4.4. Resource Management Goals for American Eel

The Comprehensive Resource Management Plans filed at the Commission for eels are listed in Section 11.1 and other Resource Management Plans referenced herein are listed in Section 11.2; the goals and objectives of these plans are outlined here. The decline of eels and the ecological services they provide is a widely held concern among Atlantic Coast states in the Northeast. Management objectives for American eel are outlined in the Interstate Fishery Management Plan (FMP) for American Eel published by the Atlantic States Marine Fisheries Commission (ASMFC; ASMFC 2000). The FMP's goals are to maintain and enhance the abundance of American eels in inland coastal waters and to contribute to the viability of the adult American eel spawning population at sea. An objective is to provide adequate upstream passage and escapement to inland waters for elvers and juvenile eels, as well as to provide adequate downstream passage and escapement to the ocean for pre-spawn adult eels. Another objective is to restore American eel where they have been extirpated and increase their numbers where they still occur. The FMP identifies the lack of adequate upstream and downstream passage for migrating juvenile and adult eels as an impact on the population.

Since its development in 2000, the FMP has been modified five times. Addendum I (approved 2006) established a mandatory reporting of harvest and effort by commercial fishers and dealers (ASMFC 2006). Addendum II (approved 2008) made recommendations for improving upstream and downstream passage for American eels. The ASMFC recommended special considerations for American eels in Commission hydropower licensing proceedings. These considerations include, but are not limited to, improving upstream passage and downstream passage, and collecting data on both means of passage (ASMFC 2008). In addition, both the 2012 and 2017 Benchmark Stock Assessments (ASMFC 2012; ASMFC 2017a) found that the American eel population in U.S. waters is at or near historically low levels due to a combination of historical overfishing, habitat loss and alteration, productivity and food web alterations, predation, turbine mortality, changing climatic and oceanic conditions, toxins and contaminants, and disease. Addendum III (ASMFC 2013) contains a recommendation that jurisdictions identify opportunities to work within the Commission's review process and with non-Commission dam owners to improve downstream eel passage and to seek opportunities to improve upstream eel passage through obstruction removal and deployment of eel passage structures. Addendum IV (ASMFC 2014) made changes to the commercial fishery, implementing restrictions on the elver and yellow eel commercial fisheries. Addendum V (ASMFC 2018) implemented additional restrictions on the yellow eel fishery and recommended new triggers for evaluating and addressing the coastwide cap for yellow eels.

The Connecticut River Atlantic Salmon Commission (CRASC) developed the Connecticut River American Eel Management Plan (CRASC 2023). The goal of the plan is to "protect, conserve, and enhance American Eel populations for their intrinsic, ecological, economic, recreational, scientific, and educational values and for public use." Plan strategies to achieve stated objectives include improving access to historical rearing habitats by requiring safe, timely, and effective upstream fish passage at known barriers and increasing survival and fitness of out-migrating silver eels by requiring safe, timely, and effective downstream fish passage at known barriers where eel occur upstream. The Service supports the goals, objectives, and strategies identified in the CRASC Eel Plan.

4.4.5. Existing Fish Passage and Restoration Efforts for American Eel

4.4.5.1. Eel Passage at the Turners Falls Project

Upstream

There are three upstream fish passage facilities at the Turners Falls Project: a modified ice harbor fish ladder at the Cabot Station; a second modified ice harbor ladder at the TFD; and a vertical slot ladder at the Turners Falls canal gatehouse. All three ladders were designed to pass anadromous species. Although fish passage is monitored at all three ladders, FirstLight does not count eels. Upstream eel surveys undertaken during the license proceeding revealed 87.7 percent of all eels collected came from the eel ramp trap located in the lower turnpool of the TFD ladder (n=5,235), with another 5.2 percent (n=319) collected from the Cabot ladder ramp trap (FERC Accession No. 20160301-5504). These data document eels are attempting to ascend the

anadromous fish ladders. While the fact that eels have been observed upstream of the Project indicates the ladders provide some level of passage for the species, count data in Table 4.1 suggest substantial drop-back in both modified ice harbor (i.e., lower portion of the Vernon fish ladder) and vertical slot (Bellows Falls ladder) designs. Further, results of a directed study to assess passage efficiency for eels through the Vernon ladder revealed the probability of an eel moving from the release location to the upper extent of the ladder under normal operating conditions was 0.043, with most attrition occurring in the vertical slot section of the ladder (FERC Accession No. 20200324-5162). In contrast, the Holyoke Project, which has dedicated upstream eel passage facilities, consistently passes thousands of fish annually (Table 4.1). There currently are three eel passage facilities at Holyoke: an eel ladder on the South Hadley side of the Hadley Falls Dam; an eel ramp trap in the Holyoke tailrace; and an eel ramp trap located in the upper stilling basin of the Holyoke fish lift's auxiliary water system. There is substantial inter-annual variability in eel usage of each facility, underlying the importance of having multiple routes of upstream passage at a project (Table 4.2).

Table 4.2. Eel count data for the period 2010 through 2022 at the Holyoke Project (Normandeau, 2023).

Year	% Total Spillway*	% Total Stilling Basin	% Total Tailrace	% Total S. Hadley Ladder	Total
2010	13	4	3	77	4,253
2011	53	46	0	0	9,734
2012	51	38	0	11	39,423
2013	4	82	2	6	13,584
2014	1	28	72	0	50,319
2015	<1	18	41	22	20,038
2016	<1	4	48	48.4	38,449
2017	<1	29	40	31	19,438
2018	0	36	57	7	8,431
2019	<1	2	50	49.8	27,505
2020	N/A	3	61	36	17,689
2021	N/A	4	80	16.0	12,945
2022	N/A	17	81	2	8,264

* Note the spillway eel ramp was decommissioned in 2020 due to low usage.

Downstream

Downstream passage facilities at the Turners Falls Project consist of reduced bar spacing on the upper 11 feet of the trashrack at the Cabot Station intake and a uniform acceleration weir to facilitate passage into a log sluice that conveys fish to the tailwater. FirstLight undertook eel migratory timing, routing, rate of movement, and survival studies during the license proceeding. Study results showed eels migrated through the Turners Falls Canal between early August and mid-November during both study years, with largest counts occurring in August of 2015 and in mid-October of 2016 (FERC Accession No. 20170301-5222, at Study 3.3.5, page 4-10). The

routing study evaluated passage over the spillway, through the Station 1 powerhouse, through Cabot Station powerhouse, and through the downstream bypass. Study results showed 87 percent of radio tagged eels with a known state entered the canal while 13 percent passed over TFD. Of eels with a known state that entered the canal, 88 percent passed via the Cabot turbines, 8 percent used the bypass facility, and 4 percent went through Station 1 units (FERC Accession No. 20170301-5222, at Study 3.3.5, page 4-32). Median passage times (from release) were similar for all three canal routes: 96.37 for Cabot Station; 104.9 hours for the bypass facility; and 98.92 hours for Station 1. Median rate of passage for eels using the TFD was 32.67 hours (FERC Accession No. 20170301-5222, at Study 3.3.5, pp 4-25 and 4-30).

Table 4.3. Survival rates through various passage routes at the Turners Falls Project (FERC Accession No. 20170301-5222, at Study 3.3.5, page 4-37).

Station	Number Released	1-hour Survival Rate (90% CI +/-)	48-hour Survival Rate (90% CI +/-)
Cabot Station Unit 2	50	98 (3.3)	96.0 (4.6)
Station No. 1 Unit 2/3	30	62.1 (14.8)	62.1 (14.8)
Station No. 1 Unit 1	30	90.0 (9.1)	90.0 (9.1)
Bascule Gate 1 (combined)	95	86.8 (5.8)	82.9 (5.9)
1,500 cfs	35	88.2 (4.0)	88.2 (4.0)
2,500 cfs	30	85.7 (7.4)	85.7 (7.4)
5,000 cfs	30	86.2 (10.5)	86.2 (10.5)
Bascule Gate 4 (combined)	95	90.5 (4.9)	88.4 (5.4)
1,500 cfs	35	88.6 (8.7)	82.9 (10.5)
2,500 cfs	30	90.0 (9.1)	90.0 (9.1)
5,000 cfs	30	93.3 (7.6)	93.3 (7.6)
Combined Controls	25	100	100

The survival analysis used balloon tag technology (HI-Z Turb'N Tag©; or HI -Z) and assessed mortality through the Cabot Station and Station 1 units, and two of the four bascule gates on the spillway. Table 4.3 summarizes survival estimates of the HI-Z study. Results show relatively high survival through the large (11-foot-diameter [ft.-diam]), slow (97 revolutions per minute [rpm]) Francis turbines at Cabot Station. The smaller (approximately 3- to 4-ft-diam), faster (approximately 200 to 250 rpm) Francis units 2/3 at Station 1 had substantially lower survival. Survival over Bascule Gate 4 was slightly higher (88.4 percent) than over Bascule Gate 1 (82.9 percent). Generally, survival increased as flow increased over Bascule Gate 4, but this same

trend was not evident at Bascule Gate 1 (Table 4.3). HI-Z injury assessment results generally paralleled survival results, with relatively high malady-free rates for Cabot Station; Station 1, Unit 1; and Bascule Gates 1 and 4 passage (0.977 up to 1.000), but a substantially lower malady-free rate for Station 1, Units 2/3 (0.790) (FERC Accession No. 20170301-5222, at Study 3.3.5, Table 5-5).

4.4.5.2. Eel Passage at NMPS Project

Downstream

As stated in the Amended Final License Application (AFLA; FERC Accession No. 20201204-5120, NMPS Volume 1 of 5; Exhibit A, page A-5.), NMPS deployed a fixed-position guide net at the intake of the lower reservoir (i.e., TFI) from 1998 to 2014 to protect outmigrating Atlantic salmon smolts from entrainment. However, since termination of the salmon restoration program[2] the CRASC has not required installation of the guide net. Even when it was deployed, it did not provide entrainment protection for eels, as the two migration seasons do not overlap: the salmon smolt migration season was April 1 to June 15, whereas adult eel downstream migration begins in late summer and ends in late fall.

FirstLight undertook eel routing and rate of movement studies during the license proceeding. The routing study evaluated passage past the NMPS lower intake and downstream through the Turners Falls Project (FERC Accession No. 20170301-5222, at Study 3.3.5, page 4-10).

Study results showed 46 percent of test eels were attracted to the NMPS intake (74 of 161 eels). Of those 74 eels detected at the intake, two resulted in entrainment and 34 transitioned into an unknown state (FERC Accession No. 20170301-5222, at Study 3.3.5, Table 4.4-1). If eels entering an unknown state are assumed to have been entrained, survival past the NMPS Project is estimated to be 77.8 percent. Fish attracted to the intake took a median time of 131.2 hours to escape, 138.7 hours to transition to an unknown state, and 329.3 hours to become entrained (FERC Accession No. 20170301-5222, at Study 3.3.5, Table 4.4-2).

4.4.6. ACTIONS NECESSARY TO ACCOMPLISH RESOURCE MANAGEMENT GOALS FOR AMERICAN EEL

For the reasons outlined in Section 4.4.5, the existing technical fishways at the Turners Falls Project and lack of passage protection at the NMPS Project do not provide safe, timely, or effective fish passage for eels. Lack of efficient upstream fish passage facilities at the Turners Falls Project restricts access to approximately 20 river miles of main stem habitat. Likewise, the lack of entrainment protection at NMPS and ineffective passage and protection at Turners Falls contribute to cumulative mortality of outmigrating, pre-spawn adult eels, which negatively impacts outmigrant production potential of eels reared in upstream habitats.

[2] The Connecticut Department of Energy and Environmental Protection maintains a legacy salmon restoration program in the Connecticut portion of the watershed.

Given the documented presence of eels upstream and downstream of the Projects, dedicated upstream eel passage at Turners Falls and downstream passage or protection at both Projects is warranted. Providing safe, timely, and effective upstream passage will enhance the abundance and distribution of eels in the Connecticut River watershed. Likewise, providing safe, timely, and effective downstream passage and protection will avoid or minimize mortality of silver phase eels as they migrate out of the freshwater system to spawn in the Sargasso Sea.

The resource management goals outlined in Section 4.4.4 will be achieved through enhancing upstream passage for American eels throughout the Connecticut River basin, and increasing survival and escapement of American eels passing barriers and hydroelectric facilities during their downstream spawning migration. The CRASC eel plan (CRASC 2023) establishes an upstream passage performance standard of 95 percent based upon fish present at the entrance of the fishway (or dedicated eelway) for all size classes present; and a downstream passage performance standard of 95 percent for through project survival, inclusive of a less than 5 percent injury rate, and a time to pass of 24 hours or less for fish actively migrating within 1 km of a project facility. For downstream migrating silver eels, the plan calls for 95 percent survival at each hydroelectric project on the river to address cumulative effects of eels having to negotiate multiple hydropower facilities (CRASC 2023). The upstream and downstream passage and protection measures in Section 10 are necessary to achieve identified resource management goals for the species. The performance standards provide a means of verifying that the constructed facilities provide safe, timely, and effective passage for eels and assist in minimizing cumulative impacts to the species in the freshwater environment.

4.5. ALOSINES

4.5.1. Alosine Biology and Life History

Alosines are important forage stocks for other marine species (e.g., cod, striped bass, bait for lobster) (Walter, Overton, Ferry, and Mather 2003; Hall, Jordaan, and Frisk 2012). Depleted alosine stocks have negatively impacted other fisheries (Nelson, Chase, and Stockwell 2003; Ames 2004; Hall, Jordaan, and Frisk 2012; Essington, et al. 2015) and impact freshwater predators (Mattocks, Hall, and Jordaan 2017). Historically, river herring and American shad supported important commercial and recreational fisheries. However, due to declines in stock abundance, many states have implemented bans on the harvest of these species (ASMFC 2007b).

The American shad is the largest member of the herring family, averaging between 17 and 24 inches in length and between 3 and 6 pounds in weight at sexual maturity. The American shad's range extends along the East Coast from the St. Lawrence River in Canada to the St. Johns River in Florida (ASMFC 2020). In the marine environment, the American shad is considered to be pelagic and highly migratory, moving between summer feeding areas and overwintering areas (ASMFC 2010). The species exhibits strong homing to its natal river and is capable of migrating long distances (e.g., 204 miles in the Connecticut River) up unimpeded rivers and streams (MEDMR and MDIFW 2008; CRASC 2022a; SRAFRC 2010). Maturation of American shad in

the Northeast occurs between 3 to 5 years for males, and 4 to 6 years for females (Collette and Klein-MacPhee 2002). Adult shad begin to congregate along the coast, and in estuaries, when temperatures range from 3 to 15°C and spawn when temperatures range between 8 and 26°C (Greene, Zimmerman, Laney, and Thomas-Blate 2009).

American shad require well oxygenated water of 5 milligrams per liter or more for successful spawning and egg and larval development, and generally their spawning habitats are broad shallow water areas of rivers and streams over a clean sand and gravel substrate (Stier and Crance 1985). Shad usually spawn at night or during overcast days. Shad exhibit batch spawning behavior (Greene, Zimmerman, Laney, and Thomas-Blate 2009); in the Connecticut River, female shad were shown to develop and spawn batches of eggs when ready, every few days, for five to six times over the course of a spawning season, with first time spawning females having approximately 300,000 eggs (McBride, Ferreri, Towle, Boucher, and Basilone 2016). In the northern part of their range, shad are capable of spawning more than once and may live up to 10 years (MDMR 2013). Studies show the percentage of repeat spawning occurrence in shad populations increases with latitude (Greene, Zimmerman, Laney, and Thomas-Blate 2009).

Juvenile shad spend the summer in their natal riverine habitat and migrate to the estuary in the fall before entering the ocean (Weiss-Glanz, Stanely, and Moring, 1986). American shad size, schooling behavior, and timing of migration (upstream and downstream) are key factors in designing, locating, and timing the operation of any fishway for the species and have been considered in preparing this Prescription.

The blueback herring is an anadromous fish distributed along the Atlantic coast from Nova Scotia, Canada, to Florida (McBride, Harris, Reid Hyle, and Holder 2010). Adults grow to between 10 and 11 inches long, on average. The onset of spawning is related to temperature, and thus, varies with latitude (MRTC 1997). In the southern part of their range, adults were collected as early as January and as late as April during the spawning runs of 2002 through 2005 (McBride, Harris, Reid Hyle, and Holder 2010). In the Connecticut River watershed, a long-term study assessing the river herring population in the lower river collected blueback herring in spawning areas as early as April 7 and as late as June 17 during the spawning runs of 2017 through 2022 (excluding 2020 due to Covid pandemic safety protocols), with peak catch rates typically occurring in mid-May (Sprankle 2017, 2018, 2019, 2021, 2022).

Adults prefer to spawn in swift flowing sections of freshwater tributaries, channel sections of fresh and brackish tidal rivers, and coastal ponds, over gravel and clean sand substrates, especially in northeastern rivers where alewife and blueback herring coexist (MRTC 1997) (Greene, Zimmerman, Laney, and Thomas-Blate 2009). In the Connecticut River, cove habitats are also known to be utilized for both spawning and rearing habitat. Blueback herring are iteroparous, meaning they do not die after spawning and will return to spawn again. Spawning consists of males and females broadcasting their gametes simultaneously into the water column

and over the substrate (MRTC 1997). Post-spawn adults migrate rapidly downstream after spawning, usually leaving the spawning area within 5 days (Mullen, Fay, and Moring 1986). Larvae begin to feed externally 3 to 5 days after hatching and transform gradually into the juvenile stage. Juveniles remain in freshwater nursery areas feeding mainly on zooplankton (MRTC 1997), growing to a length of 3 to 4 inches before moving downstream to more saline waters and eventually to the sea. In the Connecticut River, a three-year study of juvenile shad and blueback herring outmigration at the Holyoke Project found blueback herring outmigration began as water temperature declined to 21°C and ended when temperatures reached 10°C (O'Leary and Kynard 1986). Blueback herring mature in 3 to 5 years, whereupon they return to their natal streams to spawn (Mullen, Fay, and Moring 1986). Adult blueback herring are strong swimmers, with abilities comparable to alewives adjusted for body size (Castro-Santos 2005). Generally, blueback herring do not leap or jump over obstacles; they use streaming flow to pass impediments. Blueback herring size, schooling behavior, and timing of migration (upstream and downstream) are key factors in designing, locating, and timing the operation of any fishway for this species and have been considered in preparing this Prescription.

4.5.2. Impacts to Alosine Migration

The Connecticut River supports runs of alewife, blueback herring, and American shad, though dams throughout the basin restrict access to much of the historical spawning and rearing habitat, which has been documented as far upstream as Bellows Falls in Vermont for American shad Noon 2003) and blueback herring (Gephard and McMenemy 2004). Although dams on the Connecticut River within the historical range of the species have passage facilities, long-term monitoring data at those fishways reveal substantial impediments to alosine passage still exist (Table 4.1).

4.5.3. Current Status of the Alosine Population

Coast-wide stock assessments for American shad found that stocks are currently at all-time lows and do not appear to be recovering (ASMFC 2007a; ASMFC 2020). The identified causes of the decline include overfishing, inadequate fish passage at dams, predation, pollution, water withdrawal, and habitat loss due to dam construction. The 2017 river herring (alewife and blueback herring) benchmark stock assessment found that of 54 stocks, 16 experienced increasing abundance trends, 2 experienced decreasing abundance trends, 8 experienced stable abundance, 10 experienced no discernible trends in abundance due to high variability, and 18 did not have enough data to assess recent abundance trends (ASMFC 2017b). While there was improvement for some river systems, river herring continue to be depleted on a coastwide basis and near historic lows (ASMFC 2017b).

Alewife and blueback herring were petitioned for listing under the ESA in 2011. Although the National Marine Fisheries Service (NMFS) determined in 2013 that listing was not warranted (NMFS 2013), it committed to partnering with the ASMFC and other stakeholders to develop a comprehensive conservation plan for river herring throughout its entire range. In August of 2017,

NMFS announced the initiation of a new status review of river herring to determine whether listing either species as endangered or threatened under the ESA is warranted (NMFS 2017). In June of 2019, NMFS completed the status review and found that the listing was not warranted. **However, NMFS' Status Review Team acknowledged that alewife are at historical low levels** (NMFS 2019).

While the Connecticut River supports an American shad population, the blueback herring run is severely depressed at present (Figure 4.3). Annual blueback herring passage counts peaked in 1985 at 632,255 but average less than 1,000 fish in recent years. Although mainstem dams within the historical range of both species have fish passage facilities (Figure 4.4), long-term monitoring data reveal substantial variability in American shad passage counts both at a given (mainstem) facility and across facilities (Table 4.1).

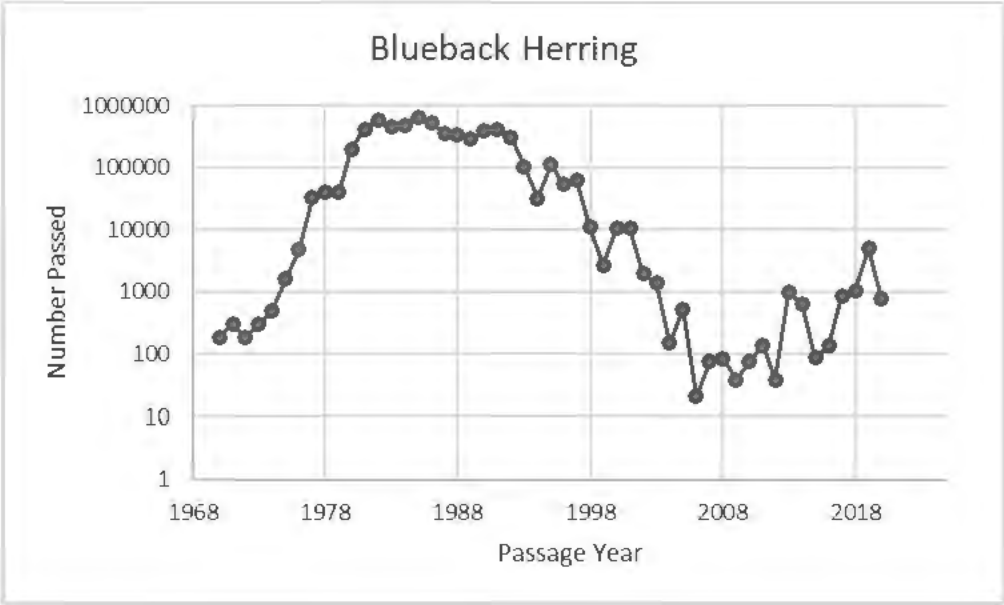

Figure 4.3. Number of blueback herring passing the Holyoke Project (FERC No. 2004) from 1970 through 2020.

4.5.4. Resource Management Goals for Alosines

The Comprehensive Resource Management Plans filed at the Commission for alosines are listed in Section 11.1 and other Resource Management Plans referenced herein are listed in Section 11.2; the goals and objectives of these plans are outlined here. The decline of alosines and the ecological services they provide is a widely held concern among Atlantic Coast states in the Northeast. Management objectives for American shad and river herring are outlined in the FMP for anadromous alosine stocks of the eastern United States (ASMFC 1985) **and the FMP's** amendments (ASMFC 2009; ASMFC 2010; ASMFC 1999).

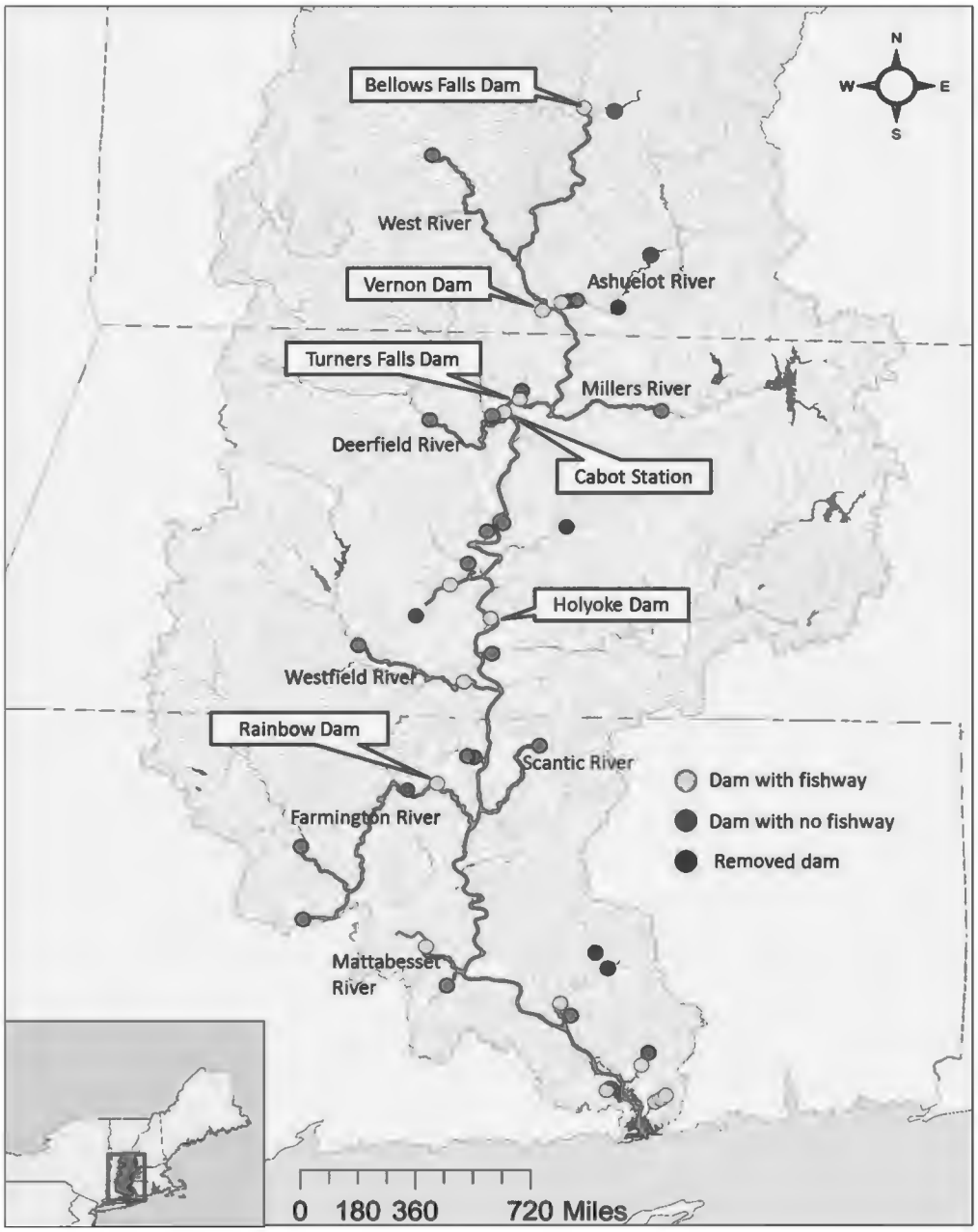

Figure 4.4. The current range of American shad (green line) in the Connecticut River basin. (CRASC 2022a)

The goal of Amendment 2 to the FMP is to enhance and restore United States east coast migratory spawning stocks of, among other alosines, alewife and blueback herring in order to achieve stock restoration and maintain sustainable levels of spawning stock biomass (ASMFC 2009). Objectives of Amendment 2 include preventing further declines in river herring abundance. The FMP states that much of the reduction in river herring stocks along the Atlantic Coast is related to degradation of spawning and nursery habitat by anthropogenic activities, including dam construction (ASMFC 2009). The protection, restoration, and enhancement of river herring habitat is deemed critical for preventing further declines in river herring abundance

and to restoring healthy, self-sustaining populations to the East Coast of the United States (ASMFC 2009). One strategy identified in the FMP is for each state to develop a plan to improve the quality of, and restore adequate access to, river herring habitat within its area of jurisdiction (ASMFC 2009). Actionable recommendations in the FMP include pursuing installation of passage facilities where dam removal is not feasible and enhancing survival at dams during emigration (ASMFC 2009).

The goal of Amendment 3 to the FMP is to protect, enhance, and restore Atlantic Coast migratory stocks and critical habitat of American shad in order to achieve levels of spawning stock biomass that are sustainable, can produce a harvestable surplus, and are robust enough to withstand unforeseen threats (ASMFC 2010). Objectives include maximizing the number of juvenile shad recruits emigrating from freshwater stock complexes and restoring and maintaining shad spawning stock biomass and age structure to achieve maximum juvenile recruitment (ASMFC 2010). Identified strategies to achieve these objectives include restoring and maintaining access to historical spawning and nursery habitat and achieving river-specific restoration targets for shad populations as specified in the recent shad assessment or in existing stock-specific restoration plans (ASMFC 2010).

Per a requirement of Amendment 3 to the FMP, the CRASC developed a habitat plan for the Connecticut River that quantifies potential shad habitat within the watershed, assesses current accessibility of those habitats, identifies threats to shad habitat, and recommends actions to mitigate those threats (CRASC 2022b). Two identified threats relate to hydropower: barriers to upstream and downstream migration; and hydropower impoundment elevation and discharge flow fluctuations (CRASC 2022b).

The CRASC also developed the Connecticut River American Shad Management Plan (CRASC 2022a). Plan goals are to restore and maintain a naturally reproducing American shad population to its historical range in the Connecticut River basin; provide and maintain recreational fisheries to the four basin states and the traditional in-river commercial fisheries for the species in Connecticut; and provide for the diverse ecological benefits derived from all life stages of shad in freshwater, estuarine, and marine habitats (CRASC 2022a). The shad management plan (CRASC 2022a) contains seven population objectives, including river reach-specific population targets and an overall Connecticut River American shad population target of 1.7 million entering the mouth of the Connecticut River annually. The plan also identifies fish passage performance standards intended to help achieve restoration goals (CRASC 2022a).

Another river-specific management plan was developed by the CRASC for river herring (CRASC 2004). Objectives of the Management Plan for River Herring in the Connecticut River include: 1) achieve and sustain annual passage of 300,000 – 500,000 adults at the Holyoke fish passage facility; 2) achieve annual passage of 40-60% of the spawning run at each successive upstream barrier on the Connecticut River from Holyoke to Bellows Falls, Vermont; 3)

maximize outmigrant survival for juveniles and spent adult river herring; 4) support tributary restoration programs (fish passage, barrier removal, and broodstock trap-and-transport); and 6) enhance, restore, and maintain river herring habitat in the Connecticut River basin.

Additionally, the Connecticut Department of Energy and Environmental Protection (CTDEEP) developed the Connecticut River American Shad Sustainable Fishing Plan Update (CTDEEP 2017). The plan describes methods for monitoring the shad fishery and stock structure using a stop light style approach. By monitoring fish passage, juvenile recruitment, and pre-spawn adult escapement, the CTDEEP will determine if management action is necessary to maintain the sustainability of the shad fishery (CTDEEP 2017).

4.5.5. Existing Fish Passage and Restoration Efforts for Alosines

4.5.5.1. Alosine Passage at the Turners Falls Project

Upstream Adult

There are three upstream fish passage facilities at the Turners Falls Project: a modified ice harbor fish ladder at the Cabot Station; a second modified ice harbor ladder at the TFD; and a vertical slot ladder at the Turners Falls canal gatehouse. Fish using the Cabot Ladder pass into the Turners Falls Canal and then use the Gatehouse entrance(s) and gallery (or flume) to enter the Gatehouse Ladder. Fish using the Spillway Ladder use a flume that also connects to the Gatehouse Ladder.

Passage is monitored at all three fish ladders. Based on passage counts for the period of record, an average of 6 percent of the shad that pass the Holyoke Project subsequently pass Turners Falls (CRASC 2022a). One hundred percent efficiency would not be expected, given that there is suitable spawning habitat between the two projects; however, directed studies have documented poor efficiency of both the Cabot and Spillway ladders and attraction to the Gatehouse entrance(s) (FERC Accession No. 20130415-5053, Volume 2, Appendix E).

In addition, during the license proceeding FirstLight assessed passage efficiency of the three ladders and route-specific migration rates using a combination of Passive Integrated Transponder (PIT) and radio telemetry tagged fish and monitoring detections at in-river, far field, and near field locations, as well as within the ladders (Study 3.3.2; FERC Accession No. 20161014-5112). Fish passage through the Project area is very complex, with interplay among quantity of bypass flow (spill and Station 1 discharge) and project flow (Cabot discharge), time of day, and passage route. Figure 4.5 provides a modified spokes model to portray raw data results for the upstream component of the study. The diagram shows attrition at most spokes (or nodes) along the upstream migration route(s): of the 140 dual-tagged fish entering the project area, 6.4 percent passed into the TFI (FERC Accession No. 20161014-5112, Table 4.2-3).

Efficiencies of the Spillway, Cabot, and Gatehouse ladders were 13.6 percent, 7.8 percent, and 56.3 percent, respectively (FERC Accession No. 20161014-5112, Table 4.2-3). Adding PIT

tagged only fish to the analysis further increases passage rate to 15.5 percent at Cabot Ladder and 32.7 percent at Spillway Ladder (FERC Accession No. 20161014-5112, p. 4-63 and p. 4-70). The results likely under-represent passage efficiencies, given known deficiencies of radio-telemetry studies such as tag loss, handling and/or tagging related effects, and telemetry receiver detection efficiencies.

In addition to low rates of passage, fish experience migratory delay at the Project, with fish taking, on average, 7.55 hours to arrive at the Cabot ladder entrance from the Montague Wastewater Treatment Plant (WWTP) located 0.5 mile downstream. Once in the ladder, fish may take another 30 to 40 hours trying to ascend the ladder before falling back to the river (FERC Accession No. 20161014-5112, p. 5-3). For fish moving up the bypass reach to pass via the Spillway Ladder, the average migration rate was 96 hours (FERC Accession No. 20161014-5112, p. 5-4). For fish entering the Gatehouse Ladder from the canal, modeled movement rate ranged from 3.4 hours at a flow of 3,519 cfs to 365 hours at 12,242 cfs ((FERC Accession No. 20161014-5112, p. *ii*).

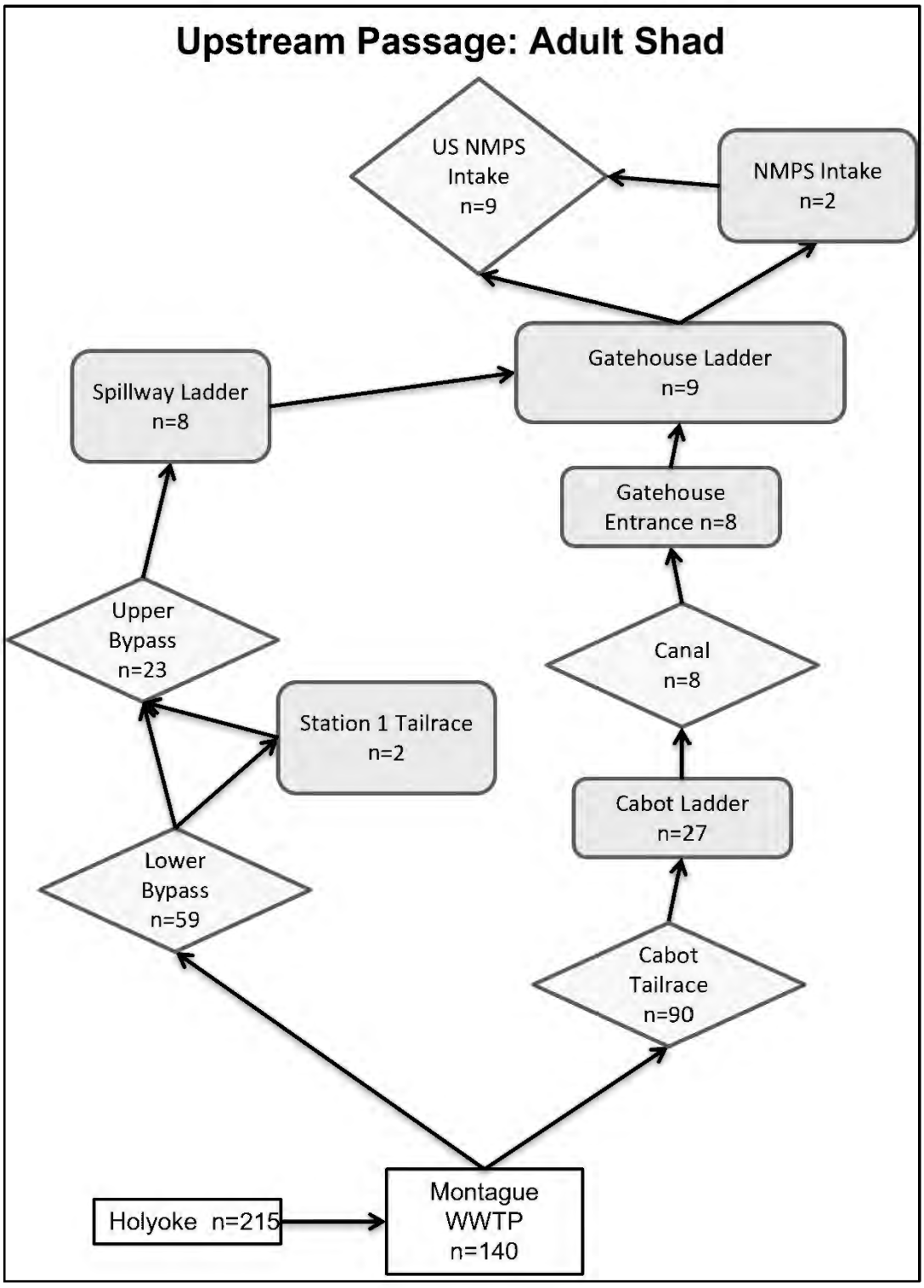

Figure 4.5. Spokes model based on results of Study 3.3.2, showing the number of dual tagged shad detected at key locations as fish move upstream through the Turners Falls Project area (FERC Accession No. 20161014-5112, Table 4.2-3).

Downstream Adult

Downstream passage facilities at the Turners Falls Project consist of reduced bar spacing on the

upper 11 feet of the trashrack at the Cabot Station intake and a uniform acceleration weir to facilitate passage into a log sluice that conveys fish to the tailwater.[3] FirstLight undertook adult shad routing, rate of movement, and survival studies during the license proceeding.

For tagged fish migrating back downstream, data analysis indicated a 0.74 probability of shad moving into the canal and a 0.26 probability of fish moving over the spillway (FERC Accession No. 20161014-5112, p. 4-85). Of fish that entered the canal, 45 percent used the Cabot downstream bypass, 32 percent passed through Cabot Station, 5 percent passed via an unknown route, and the remainder entered an unknown state (FERC Accession No. 20161014-5112, p. 4-88). The time-to-event analysis revealed 50 percent of the fish were detected in Cabot tailrace within 23 hours of entering the canal, with Cabot Station transitions occurring more quickly than fish bypass transitions (FERC Accession No. 20161014-5112, p. 4-88).

Five fish emigrating through the canal were attracted to the Station 1 forebay (FERC Accession No. 20161014-5112, p. 4-88), with four of the five fish able to escape the area within 14 hours (FERC Accession No. 20161014-5112, Figure 4.6.13-3).

Route-specific mortality was not directly assessed in Study 3.3.2, but was estimated as part of Study 3.3.19 *Ultrasound Array Control and Cabot Station Shad Mortality Study: 2019 Study Report* (FERC Accession No. 20200331-5287). The objective of the adult shad mortality component of the study was to investigate rates of immediate and latent survival for emigrating post-spawn shad using radio telemetry. Detections of released dead radio tagged fish were used to partition true survival from fish known to be dead and those that emigrated (FERC Accession No. 20200331-5287, p. 4-23). Cumulative survival of shad was 65.5 percent through the powerhouse and 89 percent through the downstream fish bypass (FERC Accession No. 20200331-5287, p. 4-24). Survival was not assessed for spillway or Station 1 passage.

Downstream Juvenile

Downstream passage facilities at the Turners Falls Project consist of reduced bar spacing on the upper 11 feet of the trashrack at the Cabot Station intake and a uniform acceleration weir to facilitate passage into a log sluice that conveys fish to the tailwater. FirstLight undertook juvenile shad migration timing, passage routing, rate of movement, and survival studies during the license proceeding, through a combination of hydroacoustic, radio telemetry, and Hi-Z tagging methodologies (Study 3.3.3; FERC Accession Number 20161014-5114).

The hydroacoustic data detected approximately 1.66 million juvenile shad targets in the vicinity of the Cabot Station from August 1 to November 14, 2015 (FERC Accession Number 20161014-5114, page *ii*). The Cabot downstream fish passage facility includes a bypass sampler and analysis of concurrent sampling of juvenile shad during the hydroacoustic study revealed

[3] The log sluice also conveys debris raked from the trashrack back to the river.

approximately 43 percent of juvenile shad used the bypass while 57 percent became entrained in Cabot Station (FERC Accession Number 20161014-5114, page *ii*). Results of the radio telemetry passage routing study were inconclusive; only five of 183 tagged shad released into TFI were detected passing the project (two via the TFD and five through Cabot Station) and only 2 percent of tagged control fish survived through the 7-day observation period (FERC Accession Number 20161014-5114, pages 5-1 and 5-2).

HI-Z technology was used to assess injury and mortality rates through the Cabot Station and Station 1 units, and two of the four bascule gates on the spillway. Table 4.4 summarizes results of the study. Results show relatively high survival through the large (11-foot-diameter [ft.-diam]), slow (97 revolutions per minute [rpm]) Francis turbines at Cabot Station. The smaller (approximately 3- to 4-ft-diam), faster (approximately 200 to 250 rpm) Francis units 1 and 2/3 at Station 1 had substantially lower survival. Survival over the bascule gates ranged from 47.7 percent to 73.6 percent, with lowest survival rates at the middle test flow of 2,500 cfs. HI-Z injury rates ranged from a low of 0.087 through Cabot Station Unit 2 to a high of 0.463 at a flow of 1,500 cfs over Bascule Gate 4.

Table 4.4. Summary of juvenile shad survival and injury rates through different passage routes at the Turners Falls Project. Values in parentheses represent the 90 percent confidence intervals. (FERC Accession Number 20161014-5114, Tables 5-1 and 5-3).

	Cabot Station	Station 1 Unit 2/3	Station 1 Unit 1	Bascuale Gate 1			Bascule Gate 4		
				1,500 cfs	2,500 cfs	5,000 cfs	1,500 cfs	2,500 cfs	5,000 cfs
Survival	0.95(0.033)	0.678(0.082)	0.766(0.079)	0.694(0.110)	0.477(0.114)	0.756(0.102)	0.642(0.110)	0.590(0.112)	0.736(0.067)
Injury	0.087	0.154	0.25	0.19	0.382	0.347	0.463	0.45	0.439

The results of Study 3.3.3 support the need for improved alosine fish passage at the Project.

4.5.5.2. Shad Passage at the NMPS Project

As stated in the NMPS AFLA (FERC Accession No. 20201204-5120, NMPS Volume 1 of 5; Exhibit A, page A-5.), NMPS deployed a fixed-position guide net at the intake of the lower reservoir (i.e., TFI) from 1998 to 2014 to protect outmigrating Atlantic salmon smolts from entrainment. However, since termination of the salmon restoration program[4] the CRASC has not required installation of the guide net. When the barrier net was deployed, it did not provide entrainment protection for juvenile shad, as the two migration seasons do not overlap: the salmon smolt migration season was April 1 to June 15, whereas juvenile shad downstream migration begins in late summer and ends in late fall. Although the smolt and adult shad migrations do overlap and several studies assessed effectiveness of the net for salmon smolts, no directed studies were undertaken to determine its effectiveness for adult shad.

[4] The Connecticut Department of Energy and Environmental Protection maintains a legacy salmon restoration program in the Connecticut portion of the watershed.

Upstream and Downstream Adult

Study 3.3.2 assessed upstream passage efficiency at NMPS. Of the 142 FirstLight tagged fish that passed or were released into the TFI, 100 were detected at the receiver upstream of the NMPS intake. Of those 100 fish, 32 percent were detected at the NMPS intake receiver. No fish were detected at the Upper Reservoir receiver, indicating no entrainment at the NMPS intake (FERC Accession No. 20161014-5112, Tables 4.2-3, 4.2-4, 4.2-5). However, there was no examination of radio tag retention of tagged shad and subsequent tag detection in the upper reservoir, leading to uncertainty in the probability to detect tags in the upper impoundment. FirstLight utilized a time-to-event analysis to quantify delay for fish moving past the NMPS intake area. Results reveal approximately 50 percent of fish attracted to the intake escaped within 20 hours (FERC Accession No. 20161014-5112, p. 4-79) and 50 percent of the fish took roughly 100 hours to travel from lower TFI up to the Shearer Farms receiver (FERC Accession No. 20161014-5112, Table 4.6.10-4).

Attraction to the NMPS intake was found to be lower (18 percent) during downstream migration than during upstream migration, with shorter escape times (75 percent escaping within 20 hours) (FERC Accession No. 20161014-5112, p. 4-83). Fish moved through the NMPS project area more quickly relative to upstream migration rate, with approximately 50 percent detected downstream of the NMPS intake within 25 hours and 75 percent detected within 100 hours (FERC Accession No. 20161014-5112, p. 4-83). While there was evidence of milling at the NMPS intake, no entrainment was documented (FERC Accession No. 20161014-5112, p. 4-79).

Downstream Juvenile

FirstLight undertook juvenile shad migration timing, passage routing, rate of movement, and survival studies during the license proceeding, through a combination of hydroacoustic and radio telemetry methodologies[5] (Study 3.3.3; FERC Accession Number 20161014-5114). While the hydroacoustic study detected juvenile shad targets at the intake transducers, excessive milling of fish in front of the NMPS intake prohibited using the data to estimate entrainment levels (FERC Accession Number 20161014-5114, page 4-2). Results of the radio telemetry passage routing study were insufficient to draw firm conclusions on entrainment rates at NMPS. Of 129 tagged shad released 1.5 miles upstream of the NMPS intake, 77 were detected at a receiver located 0.5 miles upstream of the intake, and 32 were detected at a receiver located 0.66 miles downstream of the intake, resulting in a passage rate of 41.6 percent. However, only three fish were detected at the Upper Reservoir receiver and another 21 fish were last detected at the NMPS intake. Low survival and tag retention of control fish, the physical effect of the tags on shad swimming behavior, and less than full receiver coverage in the upper reservoir all contribute to the difficulty in explaining the fate of undetected fish (FERC Accession Number 20161014-5114, page 5-4).

While definitive conclusions were not able to be drawn, Study 3.3.3 did verify juvenile shad are

[5] No HI-Z studies were conducted at the NMPS Project.

attracted to the NMPS intake and some of those fish are entrained into the Upper Reservoir. These results support the need for alosine entrainment protections measures at the Project.

4.5.6. Actions Necessary to Accomplish Resource Management Goals for Alosines

For the reasons outlined in Section 4.5.2, the existing technical fishways at the Turners Falls Project and lack of entrainment protection measures at NMPS do not provide safe, timely, or effective passage past the projects. Lack of efficient upstream fish passage facilities at the Turners Falls Project impedes access to over 50 river miles of alosine spawning and rearing habitat.[6] Providing safe, timely, and effective upstream passage will enhance the abundance of alosines in the Connecticut River watershed by providing enhanced access to historical spawning and rearing habitat. Likewise, providing safe, timely, and effective downstream passage and protection will avoid or minimize mortality of alosines when they migrate downstream. In order to enhance and restore the shad and river herring populations to the Connecticut River, the upstream and downstream passage and protection measures in Section 10 are necessary. This is consistent with regional and watershed-specific fishery management goals (ASMFC 2009; ASMFC 2010; ASMFC 1999; CRASC 2022a; CRASC 2004).

5. FISH PASSAGE MEASURES PROPOSED BY THE APPLICANT

The AFLA filed by FirstLight for Turners Falls and NMPS contains proposed Protection, Mitigation, and Enhancement (PME) Measures (FERC Accession No. 20201204-5120, Volume 2 of 5, Part 1 of 4, Tables 2.2.1.2-2 and 2.2.1.2-4), including upstream and downstream passage facilities (Table 5.1).

Table 5.1. Protection, mitigation, and enhancement measures Proposed by FirstLight in the Turners Falls and NMPS AFLA.

Project	PME Measure	Operational Year
Turners Falls	Cabot Tailrace Ultrasound Array	6
	Replace Spillway Ladder with new Lift	6
	Provide Interim Upstream Eel Passage	2
	Permanent Upstream Eel Passage Facility	10
	Retire Cabot Fish Ladder	5
	Retire Entrance Portions of Gatehouse Ladder in canal	5
	Construct a Plunge Pool below Bascule Gate No. 1 located at the Turners Falls Dam	6
	Construct a Bar Rack at the entrance to the Station No. 1 Forebay	8
NMPS	Install Barrier Net at Lower Reservoir Intake/Tailrace	5

[6] Twenty miles of habitat to the base of the Vernon Dam (FERC No. 1904) and an additional 31 miles of habitat to the base of the Bellows Falls Dam (FERC No. 1855).

6. FISH PASSAGE ALTERNATIVES CONSIDERED

Shortly after submitting the AFLA, FirstLight re-initiated settlement negotiations that had stalled in the fall of 2018. Different resource area groups met separately to work towards settlement agreements. The Department, through the USFWS, actively participated in the Flows and Fish Passage (FFP) group, which reached consensus on settlement provisions in March of 2023. That agreement, filed with the Commission by FirstLight on March 31, 2023, was signed by the USFWS, the National Marine Fisheries Service (NMFS), the Massachusetts Division of Fisheries and Wildlife (MADFW), The Nature Conservancy, American Whitewater, Appalachian Mountain Club, Crab Apple Whitewater, Inc., New England FLOW, and Zoar Outdoor (FERC Accession Number 20230331-56002019). The fish passage measures contained in the Flows and Fish Passage Agreement, described in more detail in Section 10, include:

Turners Falls Downstream Passage and Protection Measures

- Modify the existing downstream fish bypass facility at Turners Falls to increase bypass efficiency and minimize entrainment into Cabot Station.
- Install a new exclusionary trashrack to prevent entrainment into the Station 1 forebay.
- Construct a plunge pool at the base of the Bascule Gate 1 to minimize injury and mortality of fish passing over in spill.

Turners Falls Upstream Passage Measures

- Remove the existing spillway fish ladder, install a new fish lift at the spillway, and retire the Cabot fish ladder.
- Provide interim eel passage at Turners Falls until the new spillway fish lift is operational and eel siting studies have been completed.
- Install permanent upstream eel passage facilities based on the results of eel siting studies.

NMPS Entrainment Protection Measures

- Install a seasonal barrier net at the NMPS intake to prevent entrainment during the fish passage season.

Effectiveness Testing of Passage & Protection Measures at both Projects

- Develop and implement studies to test the effectiveness of newly modified/constructed fish passage facilities relative to identified performance standards.

Adaptive Management Measures

- Implement adaptive management measures (AMMs) at newly modified/constructed passage facilities if deemed necessary, based on results of effectiveness testing.

Table 5.2. Comparison in implementation timing of PME measures between the AFLA and the FFP Agreement.

Project	PME Measure	Operational Year	
		AFLA	FFP
Turners Falls	Cabot Tailrace Ultrasound Array	6	AMM[A]
	Replace Spillway Ladder with new Lift	6	9
	Provide Interim Upstream Eel Passage	2	1
	Permanent Upstream Eel Passage Facility	10	13
	Retire Cabot Fish Ladder	5	11
	Retire Entrance Portions of Gatehouse Ladder in canal	5	11
	Construct a Plunge Pool below Bascule Gate No. 1 located at the Turners Falls Dam	6	9
	Construct a Bar Rack at the entrance to the Station No. 1 Forebay	8	4[B]
	Rehabilitate Gatehouse Trapping Facility	-	9
	Improve Cabot Station Downstream Fish Passage System	-	4[B]
NMPS	Install Barrier Net at Lower Reservoir Intake/Tailrace	5	7

[A] Adaptive management measure, if needed.

[B] Depending on what quarter the license is issued, this measure may occur in Year 5.

The major differences between the AFLA proposed fish passage measures and fish passage provisions in the FFP Agreement are: 1) implementation timeframes; 2) the conversion of the ultrasound array from a dedicated measure to a potential adaptive management measure; and 3) downstream passage and protection improvements at Cabot Station (Table 5.2). In addition, the FFP Agreement and this Prescription include identified performance standards which effectiveness study results will be evaluated against, and passage facility-specific AMMs to help achieve performance goals, if necessary.

The Department supports these changes to FirstLight's AFLA proposal. As described in Section 7.1, the decision to prioritize the implementation of downstream passage enhancements at Cabot Station was based on shad population modeling, and will ensure that the large numbers of adult shad that will be passed upstream of Turners Falls after the new Spillway Lift becomes operational will have safe, timely, and effective downstream passage through the project. The AFLA proposal included entrainment abatement measures at Station No. 1 but did not address documented entrainment and mortality through Cabot Station (Section 4.4.5.1 and Section 4.5.5.1). The Cabot Station downstream fish passage system upgrades required pursuant to Prescription Condition 1 will be designed to achieve the identified performance goals.

The AFLA also did not include performance goals or an adaptive management protocol. These elements, together with rigorous effectiveness testing, ensure there are clear efficiency targets identified, effectiveness testing to assess whether those targets are being achieved, and AMMs to implement should study results reveal they are needed to help achieve performance goals.

The ultrasound array was removed as an initial measure and moved to an AMM because it may not be needed to prevent delay of upstream migrating shad at Cabot Station, given the substantially higher flows the bypass reach will receive during the upstream migration season (FERC Accession Number 20230331-56002019, Appendix A, Article A110). Should effectiveness testing reveal delay at Cabot Station even with higher bypass flows, there are identified AMMs to address the issue, including the Tier 2 measure of implementing a behavioral barrier near the Cabot tailrace (Condition 4).

In response to the FFP Agreement filed by FirstLight on March 31, 2023 (FERC Accession Number 20230331-56002019), the FERC issued a notice soliciting comments (FERC Accession Number 20230407-3020). Over 75 comments were received by the FERC. The Department's response to those comments, as they relate to fish passage provisions detailed in the FFP Agreement, is provided in Section 7.

7. RESPONSIVENESS SUMMARY TO COMMENTS RECEIVED ON THE FFP AGREEMENT

In response to the FFP agreement filed by FirstLight (FERC Accession Number 20230331-56002019), the FERC issued a notice soliciting comments (FERC Accession Number 20230407-3020). Over 75 comments were received by the FERC. Seventeen of the 75 submittals contained no specific comments on the settlement agreement. The remaining comments centered around ten general topic areas: 39 percent of respondents believe the timeframe for implementing fish passage measures is too long; 32 percent of respondents question the effectiveness of the NMPS barrier net; 39 percent of respondents expressed concern that the barrier net would not prevent entrainment of non-target species and life stages; 11 percent of respondents believe there should be no prohibition on the agencies exercising their reserved fish passage authority under section 18 of the Federal Power Act until Year 25 of the new license; nine percent of respondents question the adequacy of the identified adaptive management measures; and one percent of respondents each identified the operational period of the NMPS barrier net, passage delays caused by NMPS operations, the prohibition on restricting NMPS pumping, lack of effective passage for non-target species, and the inefficiency of technical fishways as areas of concern. Below we address each topic area.

7.1 FISH PASSAGE IMPLEMENTATION TIMEFRAME

The FFP Agreement requires downstream fish passage and protection measures in the Turners

Falls canal to be operational within four years of license issuance,[7] the NMPS barrier net to be operational within seven years of license issuance, and the Turners Falls spillway fish lift and bascule gate plunge pool to be operational within nine years of license issuance. The Department determined this schedule was reasonable based on the following:

1. The Connecticut River American Shad Management Plan and Addendum (CRASC 2022a) contains population objectives, including: a minimum population of shad returning to the mouth of the river; an adult stock structure consisting of an average 15 percent repeat spawner component for each sex; a 1:1 sex ratio; and a diverse age structure. The population size is based on available mainstem and tributary habitat, and the stock structure metrics are intended to address the substantial decline in the percentage of repeat spawners from 49 percent in the late 1950s (Walburg and Nichols 1967) (Limburg, Hattala, and Kahnle 2003) to a mean of 5 percent for the period 2006-2015; and the reduction of the age-6 cohort (males) and loss of older cohorts (both sexes) over recent decades (ASMFC 2007a).
2. To understand and inform potential management strategies to meet identified objectives, a peer-reviewed model (Stich, Sheehan, and Zydlewski 2019) was programmed to run a suite of passage settings specific to the Connecticut River (CRASC 2022a). Run scenarios evaluated combinations of upstream passage efficiencies, downstream passage efficiencies, and passage delays relative to responses in run size at the river mouth, upstream of Turners Falls Dam, and upstream of Vernon Dam; and the repeat spawner component at the river mouth (CRASC 2022a). Results of the model analysis highlight the importance of high downstream passage efficiency/survival (CRASC 2022a).
3. The Turners Falls Project is hydraulically and operationally complex, with a dam and a long power canal with multiple hydropower stations on it. Two of those stations fall under the Turners Falls Project: Cabot Station and Station Number 1. This results in multiple points of attraction to upstream migrants and is the reason why there are fish ladders both at the Cabot Station tailrace and the spillway. Although relicensing studies documented passage issues at both ladders, the Cabot ladder has the added complication of migration delay within the power canal and attraction issues at the canal gatehouse entrance. For these reasons, the Department has agreed to require FirstLight replace the Spillway ladder and retire the Cabot ladder once the new Spillway lift is operational. This would make undertaking upstream and downstream passage improvements at the Turners Falls Project concurrently difficult; closing the canal will route all flow over the spillway, which will constrain dewatering the work area for constructing the Bascule Gate 1 plunge pool.
4. Based on items 1 through 3, above, the Department determined downstream passage and protection measures in the Turners Falls canal should precede upstream fish passage enhancements.
5. The amount of time between implementing downstream passage within the Turners Falls canal and implementing upstream passage at Turners Falls is largely based on the protocol

[7] Or Year 5, if the license is issued after the first quarter.

requiring effectiveness studies followed by implementation of agreed-to adaptive management measures (AMMs), should study results reveal passage facilities are not meeting identified performance standards. Downstream passage will be operational either in Year 4 (if the license is issued in the first or second quarters) or Year 5 (if it is issued after the second quarter). The first year of operation will be a shakedown year, followed by effectiveness testing in Years 6 and 7 (to allow for a late license issuance and implementation in Year 5). Reports providing the results will be provided the spring following each year of testing and consultation on any needed AMMs will occur. Should AMMs be deemed necessary, they would be implemented in Years 8 and/or 9, followed by second-round effectiveness testing in Years 10 and 11. The intent of this protocol is to identify and rectify passage problems that hinder achievement of performance standards before new upstream passage facilities are in place and passing many more fish upstream that then need to pass through the project on their downstream outmigration. By the time upstream passage is implemented (Year 9), one round of effectiveness testing and potentially the first round of AMMs will have been completed.

6. Regarding the timing of NMPS barrier installation, the FFP Agreement and this Prescription call for implementation to occur between the Turners Falls canal downstream passage and protection measures and the upstream fish passage measures at Turners Falls. This will allow for protection from entrainment at NMPS in advance of the much larger numbers of shad that will be passed upstream once the new Spillway Lift is operational. Similarly, numbers of eels able to successfully ascend the Turners Falls fish ladders currently likely is low, as explained in Section 4.4.5.1. Many more eels will be passed at Turners Falls once interim upstream eel passage is provided (starting in Year 1), with those eels reaching maturity and outmigrating from 7 to 20 years later.[8]
7. The FFP Agreement and this Prescription state implementation dates as 'no later than.' This allows flexibility for FirstLight to complete implementation of a given passage facility/measure in advance of the identified dates.

7.2. EFFECTIVENESS OF NMPS BARRIER NET

A number of commenters stated the barrier net is untested technology. A barrier net has been in place at the Ludington Pumped Storage Project (LPSP; FERC No. 2680) since 1989. As part of the subsequent license proceeding for LPSP, a phased study was undertaken to identify entrainment abatement and engineering alternatives and assess the feasibility of identified entrainment abatement technologies and engineering alternatives (FERC Accession 20151202-5217). That study report provides a comprehensive review of barrier net installations throughout the country and a summary of their effectiveness. At all evaluated sites, barrier nets met specified entrainment reduction standards (which varied by site). Based on the findings, the barrier net was carried forward to the detailed feasibility assessment (FERC Accession 20151202-5217).

[8] Estimated maturation range based on documented maturation ranges of 6 to 16 years from the Chesapeake Bay region (Helfman, Facey, Hales, and Bozeman 1987) and 8 to 23 years from Canada (Cairns, et al. 2005).

Some commenters suggested aquatic filter barriers (AFB) would be more effective than a barrier net. The main benefit of an AFB over a barrier net is its ability to prevent entrainment of fish eggs and larvae. To date, this technology has only been deployed at cooling water intake structures. The LPSP study assessed AFB technology and determined it should be carried forward to the detailed feasibility assessment; however, it was not considered for further evaluation, given the required size (estimated at 15-miles-long), anticipated bio-fouling and debris issues, visual and recreational impacts, and permitting issues (FERC Accession 20151202-5217). Many of these issues are potential concerns at NMPS also. Based on the stated design flow for an AFB of 0.02 fps (FERC Accession 20151202-5217), a conservative average Connecticut River depth of 20 feet, and a maximum NMPS discharge of 20,000 cfs, the calculated length of AFB required would be 9.5 miles long.

For the reasons identified above, the Department determined a properly designed barrier net is the best alternative to achieve entrainment abatement goals at NMPS.

The LPSP was issued a new (subsequent) license by the FERC on June 6, 2019. The license requires the development of a plan to conduct fish entrainment abatement technology reviews, to occur a minimum of every 10 years throughout the term of the license (FERC Accession Number 20191205-5028). This information will be available to for consideration when determining which AMMs to implement, should they be needed.

7.3. OPERATIONAL PERIOD OF NMPS BARRIER NET

One commenter questioned why the operational period for the NMPS barrier net (June 1 through November 15) differs from the operational period for downstream fish passage at the Turners Falls Project (April 4 through November 15). Operational timing of upstream passage at the mainstem dams on the Connecticut River are linked. The CRASC sends out annual notification letters for each facility, identifying operational dates. The Holyoke fish lift begins operating April 1 for alosines, with Turners Falls ladders opening 3 days later (or after 50 fish pass Holyoke, whichever is earlier), and the Vernon fish ladder opens 3 days after Turners Falls (FERC Accession Number 20230227-5174). At all three projects (Holyoke, Turners Falls, and Vernon) downstream passage project operations are initiated once upstream passage facilities are opened (FERC Accession Number 20230227-5174). This concurrent operation is needed at Turners Falls because study results documented substantial milling between the lower canal, Cabot Forebay, and the downstream bypass area as shad attempt to migrate upstream through the Turners Falls canal (Study 3.3.2; FERC Accession No. 20161014-5112, page 4-73). Those fish need the downstream bypass to be operational to provide an alternative to entrainment into the Cabot Station turbines should they be unable to reach the Gatehouse ladder.

After passing upstream of Turners Falls, shad continue their upstream migration and initiate spawning activity once temperatures become suitable. After spawning, adult shad begin moving

downstream. While substantial inter-annual variability in water temperature exists, generally, peak spawning occurs from mid-May to mid-June. Therefore, adult shad upstream of Turners Falls typically will be outmigrating in June which aligns with the specified operational period for the barrier net.

Relative to adult shad that outmigrate prior to June 1, results from Study 3.3.2 (FERC Accession No. 20161014-5112) revealed attraction to the NMPS intake was found to be relatively low (18 percent) during downstream migration, with 75 percent escaping within 20 hours (FERC Accession No. 20161014-5112, p. 4-83). Fish moved through the NMPS project area relatively quickly, with approximately 50 percent detected downstream of the NMPS intake within 25 hours and 75 percent detected within 100 hours (FERC Accession No. 20161014-5112, p. 4-83).

We note that Condition 10 of this prescription allows for modifying operational periods, based on new information and after consultation with FirstLight. Should migration timing shift due to changing air and water temperatures, or results of effectiveness studies scheduled to take place in Years 10 and 11 indicate barrier net deployment should occur earlier than June 1, the Department would consult with FirstLight and determine whether the new information necessitates modifying the operational period for the NMPS barrier net.

7.4. ENTRAINMENT OF SHAD EGGS AND LARVAE AND RESIDENT RIVERINE FISHES

Many commenters raised concerns regarding the barrier net's inability to protect eggs and larvae of shad and other species or juveniles and adults of resident riverine fishes outside of the net deployment period.

The FFP Agreement and this Prescription are intended to address diadromous fish passage for target species including alosines (American shad and blueback herring) and American eel. The NMPS barrier net, designed in consultation with U.S. Fish and Wildlife Service fish passage engineers, will be required to achieve performance standards. The net's effectiveness will be assessed via directed studies, with any identified problems addressed through the AMMs. This will result in protection of juvenile and adult alosines and adult eels.

The entrainment of early life stages (ELS; i.e., eggs and larvae) will not be prevented by the barrier net, given the net mesh size (3/4 inch on the bottom and 3/8 inch on top). As detailed in section 7.2, an AFB net has been used at cooling water intake structures to prevent entrainment of ELS, but that technology does not appear feasible at a large, pumped storage facility located on a navigable waterway where recreation occurs and biofouling and debris loading are issues. In order to compensate for the unavoidable loss of alosine ELS at the Project, FirstLight will fund compensatory management efforts intended to offset the loss of adult equivalents.

The period of net deployment should reduce entrainment of juvenile and adult resident riverine

fishes relative to current conditions. The risk of entrainment will vary based on the fish species, and their respective habitat preferences and life history characteristics.

7.5. MIGRATORY DELAY DUE TO NMPS OPERATIONS

One commenter referred to results from Study 3.3.2 (FERC Accession No. 20161014-5112) in expressing concern over migratory delays caused by NMPS operations. As detailed in section 4.2.2.2, above, results of Study 3.3.2 revealed approximately 50 percent of fish attracted to the intake escaped within 20 hours (FERC Accession No. 20161014-5112, p. 4-79) and 50 percent of the fish took roughly 100 hours to travel from lower TFI up to the Shearer Farms receiver (FERC Accession No. 20161014-5112, Table 4.6.10-4).

Attraction to the NMPS intake was found to be lower (18 percent) during downstream migration than during upstream migration, with shorter escape times (75 percent escaping within 20 hours) (FERC Accession No. 20161014-5112, p. 4-83). Fish moved through the NMPS project area more quickly relative to upstream migration rate, with approximately 50 percent detected downstream of the NMPS intake within 25 hours and 75 percent detected within 100 hours (FERC Accession No. 20161014-5112, p. 4-83).

While delay has been documented, Study 3.3.2 took place under a 'no-protection' condition. Once a barrier net is in place, migration delay should be reduced because outmigrating shad will be prevented from accessing the NMPS intake area where velocities (during pumping operations) are highest.

Effectiveness studies of the barrier net will take place in Years 10 and 11. The reason for the delay in initiating studies (when the net itself will be operational by June 1 of Year 7) is because passage studies at NMPS will be integrated into the effectiveness studies of the new Spillway Lift at Turners Falls, allowing for a more robust assessment (i.e., more test fish in better condition, larger geographic study area, etc.). Should performance standards fail to be met, consultation will occur to determine appropriate AMMs to implement and subsequently test.

7.6. COMMITMENTS REGARDING NMPS PUMPING RESTRICTIONS

One commenter expressed concern with the FFP Agreement provision committing the Department to not seek NMPS pumping restrictions as a measure to help achieve performance standards. This commitment should not prevent achieving identified performance standards for the following reasons:

- The FFP Agreement and provisions in this Prescription include: 1) Department consultation at the 30, 60, 90, and 100 percent barrier net design stages; 2) identified performance standards; 3) effectiveness studies to assess if those standards are being achieved; 4) AMMs that can be implemented to improve performance if standards are not being met; and 5) development of a Fish Passage Facility Operation and Maintenance

Plan (FOMP).

- The design of the barrier net will consider swim speeds of target species and life stages relative to pumping velocities at NMPS. If the net velocities are at or below the target species' thresholds, there should be no need to implement pumping restrictions.
- The two identified AMMs (FERC Accession Number 20230331-56002019, page B-3) represent categories of potential modifications. There are a number of possible measures within each of those AMM categories and one or more measures within a category could be needed to address identified performance issues.
- A similar barrier net has been successfully used at the LPSP for over 30 years. The operations and maintenance protocols developed for LPSP will help inform development of the FOMP for NMPS.

7.7. ADEQUACY OF ADAPTIVE MANAGEMENT MEASURES

Seven commenters raised concerns regarding the adequacy of the adaptive management measures (AMMs) associated with the NMPS barrier net. As detailed in Section 7.6, the two identified AMMs (FERC Accession Number 20230331-56002019, page B-3) represent categories of potential modifications. There are a number of possible measures within each AMM category and one or more of those could be needed to address identified performance issues.

7.8. PROHIBITION ON EXERCISING RESERVATION OF SECTION 18 FISHWAY PRESCRIPTION AUTHORITY UNTIL YEAR 25

Eight respondents had concerns with the FFP Agreement provision reflecting agreement by the USFWS and NMFS not to exercise any reserved authority to prescribe fishways under section 18 of the FPA before Year 25 of any new license issued for the projects. After each new fish passage facility is completed there will be a 1-year shakedown period to ensure it is operating correctly, followed by two years of effectiveness studies to assess if a given facility is achieving the identified performance goals, and then implementation of AMMs to improve performance if standards are not being met. There are multiple rounds of implementing and studying the effectiveness of AMMs, should facilities continue to fall short of performance goals. Given study results will not be available until the spring following the year of testing, Round 2 AMM effectiveness testing results will be provided in Year 20 for upstream and downstream facilities at Turners Falls, and in Year 19 for the barrier net at NMPS. Therefore, the delay, if additional improvements are needed, would be 5 to 6 years, depending on the project. This assumes the overall schedules are not adjusted due to unforeseen issues such as protracted design consultation, permitting or construction delays, etc. In summary, the 25-year period is the approximate time it will take to work through the agreed-upon adaptive management protocol.

7.9. PASSAGE FOR NON-FISH SPECIES

One commenter identified the need to provide passage through the Turners Falls Project for non-fish species. The FFP Agreement addresses fish passage; flows for fishery, ecological

conservation, and recreation purposes; and protected, threatened, and endangered species associated with the NMPS and Turners Falls projects. Neither document was intended to cover all resource issues (e.g., erosion, invasive species, etc.). As noted in Section 8, the Department's statutory authority pursuant to this prescription is limited to requiring fishways, as defined in Section 1701(b) of the National Energy Policy Act of 1992, P.L. 102-486, Title XVII, §1701(b), 106 Stat. 3008.

7.10. INEFFICIENCY OF TECHNICAL FISHWAYS

One respondent stated fish ladders have an efficiency of approximately 10 percent. Generally, technical fishways are designed to pass target fish species and life stages in order to facilitate completion of certain life history functions. Factors considered in the design of the passage facilities include the size, swimming ability, and overall number of fish to be passed, typically based on the amount of suitable spawning and rearing habitat upstream of the barrier. Some fishways designed for target species also pass non-target fish species. Fish passage design criteria are constantly evolving based on results of effectiveness testing, research, etc. The goal is to make each facility as effective as possible for the species/life stages and number of fish it was designed to pass.

On the Connecticut River, studies have documented substantial variability in performance among the upstream passage facilities at the Holyoke, Turners Falls, and Vernon projects. Based on the most recent adult American shad study data available, the Holyoke fish lift had an efficiency of 44 percent (FERC Accession Number 20171024-5129); the Turners Falls Cabot, Spillway, and Gatehouse ladders had efficiencies of 15.5 percent, 32.7 percent, and 56.3 percent, respectively[9] (FERC Accession No. 20161014-5112); and the Vernon fish ladder had an overall efficiency of 41 percent (FERC Accession Number 20170228-5202, Study 21). However, long term passage count data indicate average passage efficiencies of 10.7 percent at Turners Falls and 56.5 percent at Vernon (Table 7.1).

The fish passage improvements prescribed in this document are intended to substantially increase efficiency at the Turners Falls Project, with a goal of passing 75 percent of adult shad arriving 500 meters below Cabot Station into the TFI.

[9] The noted efficiencies are based on PIT-only and dual tag data for the Cabot and Spillway ladders and dual tag data for the Gatehouse ladder.

Table 7.1. American shad annual passage count data for the first three dams on the Connecticut River, for the years 2012 through 2022.

Year	Holyoke Dam Passed	Turners Falls Dam Passed	% Passed TF	Vernon Dam Passed	% Passed Vernon
2012	490,431	26,727	5.4	10,386	38.9
2013	392,967	35,293	9.0	18,220	51.6
2014	370,506	39,914	10.8	27,706	69.4
2015	412,656	58,079	14.1	39,771	68.5
2016	385,930	54,069	14.0	35,513	65.7
2017	536,670	48,727	9.1	28,684	58.9
2018	275,232	43,146	15.7	31,724	73.5
2019	314,361	22,649	7.2	12,872	56.8
2020	362,423	41,252	11.4	13,897	33.7
2021	237,306	21,052	8.9	9,701	46.1
2022	190,352	23,576	12.4	13,763	58.4
Mean	360,803	37,680	10.7	22,022	56.5

8. STATUTORY AUTHORITY

Section 18 of the FPA, 16 USCS §811, states in pertinent part:

> *"The Commission shall require the construction, maintenance, and operation by a Licensee at its own expense of ...such fishways as may be prescribed by the Secretary of the Interior or the Secretary of Commerce, as appropriate."*

Section 1701(b) of the National Energy Policy Act of 1992, P.L. 102-486, Title XVII, §1701(b), 106 Stat. 3008, states:

> *"The items which may* ***constitute a 'fishway' under S****ection 18 [16 USCS §811] for the safe and timely upstream and downstream passage of fish will be limited to physical structures, facilities, or devices necessary to maintain all life stages of such fish, and project operations and measures related to such structures, facilities, or devices necessary to ensure the effectiveness of such structures, facilities, or devices for such fish."*

The Prescription herein is issued under authority delegated to the Regional Director from the Secretary of the Interior, the Assistant Secretary for Fish, Wildlife, and Parks, and the Director of the USFWS pursuant to Section 18 of the FPA. (See 64 Stat. 1262; 209 Departmental Manual 6.1; 242 Departmental Manual 1.1A).

9. RESERVATION OF AUTHORITY TO PRESCRIBE FISHWAYS

The Department, pursuant to Section 18 of the FPA, herein requests that the Commission include the following reservation of authority in any license issued for the Project:

Authority is reserved to the Federal Energy Regulatory Commission to require the Licensee to construct, operate, and maintain, or provide for the construction, operation, and maintenance, of such fishways as may be prescribed by the Secretary of the Interior during the term of the license pursuant to Section 18 of the Federal Power Act, consistent with the terms of the FFP Agreement filed with the Commission on March 31, 2023 (FERC Accession Number 20230331-56002019).

10. SECTION 18 PRESCRIPTION FOR FISHWAYS – TERMS AND CONDITIONS

Pursuant to Section 18 of the Federal Power Act, as amended, the Secretary of the Department of the Interior, as delegated to the U.S. Fish and Wildlife Service, hereby exercises their authority to prescribe the construction, operation, and maintenance of such fishways as deemed necessary, subject to the procedural provisions contained above.

To ensure the immediate and timely contribution of the fish passage facilities and measures to fish restoration and enhancement in the Connecticut River, the following are included and shall be complied with 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).

10.1. CONDITION 1: TURNERS FALLS FISH PASSAGE FACILITIES AND CONSULTATION (FFP AGREEMENT ARTICLE A300)

The Licensee shall implement the following fish passage measures on the schedule specified. When due dates cited in this and other articles are in "years after license issuance," this shall mean on the appropriate date in the specified calendar year after license issuance, regardless of the quarter in which the license is issued. For example, "Year 1 after license issuance" begins on the first January 1 following license issuance.

Upstream Fish Passage

(a) Construct a Spillway Lift at the Turners Falls Dam to be operational no later than April 1 of Year 9 after license issuance.
(b) Rehabilitate the Gatehouse Trapping facility (sampling facility) to be operational no later than April 1 of Year 9 after license issuance.
(c) Retire, either by removal or retaining in place, the Cabot Ladder and the power canal portions of the Gatehouse Ladder within 2 years after the Spillway Lift becomes operational.
(d) Install and operate interim upstream eel passage in the vicinity of the existing Spillway Ladder within 1 year of license issuance and continue operating it until permanent upstream eel passage facilities are operational. The Licensee shall consult MADFW, NMFS, and USFWS on the location and design of the interim eelway(s).

(e) Conduct up to 2 years of eelway siting studies after the Spillway Lift becomes operational, using a similar methodology to relicensing Study 3.3.4 for both years. Based on the siting survey results, design, construct, operate, and maintain up to two permanent upstream eel passage facilities at the Turners Falls Project no later than 3 years after completing the final siting survey. The Licensee shall consult MADFW, NMFS, and USFWS on the location of the two permanent upstream eel passage facilities. The final eelway siting will take into account the ability to maintain the eelway(s) in light of spillage conditions at the Turners Falls Project. The Licensee will not be required to place any eelways at the foot of any active spillway structures.

Downstream Fish Passage

(a) Within 4 years[10] of license issuance, replace the existing Cabot Station trashrack structure with a new full depth trashrack with 1-inch clear spacing. The new trashracks will have multiple openings for fish passage, including openings on the top and bottom of the water column. The Licensee will attempt to maximize the hydraulic capacity of these openings within the constraints of the conveyance mechanisms. The Licensee will base detailed design alternatives on the following conceptual design; however, the Parties will remain flexible on design alternatives as necessary to meet fish passage goals.

The new trashrack will have multiple surface entrances including a.) between Cabot Units 2 and 3; b.) between Cabot Units 4 and 5; and c.) at the right wall of the intake (looking downstream) at Cabot Unit 6. The openings will be 3-feet-wide by 2-feet-tall and will connect to the existing trash trough located behind the racks. Each opening at the top of the trashrack will have an approximate hydraulic capacity of 24 cfs, and the existing trash trough will convey a total hydraulic capacity of approximately 72 cfs from these openings. The new trashrack will have an additional entrance near the bottom at the left wall of the intake (looking downstream) at Unit 1. This entrance will be approximately 3-feetwide by 3-feet-tall and will connect to a vertical pipe to safely convey fish to the existing trash trough or log sluice. This entrance will be sized to provide a velocity that attracts fish to the bypass relative to the turbine intakes (approximately 5 feet-per-second). In addition to the entrances integral to the new trashrack structure, fish will be conveyed via a new uniform acceleration weir (UAW) and log sluice. The log sluice will be resurfaced to limit turbulence and injury to migrants. A steel panel (or equivalent) will be provided below the UAW to exclude migrants from being delayed in the space below the UAW. Total flow

[10] Relative to the Cabot Intake Protection and Downstream Passage Conveyance and the Station No. 1 Bar Rack, the times cited are from license issuance based on the time needed to complete construction. The actual first year of operation of these two facilities will depend on when the license is issued. If the License is issued in quarter 1 (Q1, Jan 1-Mar 31) then these two facilities will be operational no later than April 1 of Year 4 after license issuance; if it is issued in Q2 then these two facilities will be operational no later than August 1 of Year 4 after license issuance; and if it is issued after Q2 then these two facilities will be operational no later than April 1 of Year 5 after license issuance.

from all downstream passage components at Cabot Station will be 5 percent (685 cfs) of maximum hydraulic station capacity (13,728 cfs). The conveyance at each bypass entrance will be determined during the design phase.

(b) Within 4 years[11] of license issuance, construct a ¾-inch clear-spaced bar rack at the entrance to the Station No. 1 branch canal.

(c) Construct a plunge pool downstream of the Turners Falls Dam Bascule Gate No. 1 as part of the construction of the Spillway Lift, to be operational no later than April 1 of Year 9 after license issuance.

Consultation

For any new fish passage facility, the Licensee shall consult and obtain approval from MADFW, NMFS, and USFWS on the facility design and on operation and maintenance procedures. The Licensee shall consult MADFW, NMFS, and USFWS at the 30%, 60%, 90% and 100% design plan milestones. The Licensee shall file the 100% design plans with the Commission, along with documentation of consultation with MADFW, NMFS, and USFWS. If any fish passage adaptive management measures (AMMs) are implemented as discussed in Conditions 3 and 4 and require facility design and operation and maintenance procedures, then the Licensee shall follow the same consultation process as the initial fish passage build-out.

The Commission reserves the right to require changes to the design plans. Implementation of the design plans will not begin until the Licensee is notified by the Commission that the design plans are approved. Upon Commission approval, the Licensee shall implement the design plans, including any changes required by the Commission.

10.2. CONDITION 2: TURNERS FALLS SCHEDULE OF INITIAL EFFECTIVENESS TESTING, CONSULTATION PROCESS ON EFFECTIVENESS TESTING, STUDY PLANS, AND FISH PASSAGE PERFORMANCE GOALS (FFP AGREEMENT ARTICLE A310)

Schedule of Initial Effectiveness Testing

The Licensee shall complete construction of each fish passage facility, operate the fish passage facility for one season (shakedown year), and then conduct representative and quantitative fish passage effectiveness testing per the schedule in Table 10.2.1.

Consultation Process on Effectiveness Study Plans

For any initial fish passage effectiveness studies and any subsequent fish passage effectiveness studies required after implementing any AMMs described in Conditions 3 and 4, the Licensee shall provide the effectiveness study plans to MADFW, NMFS, and USFWS and request comments on the study plans within 30 days. The Licensee shall consult MADFW, NMFS, and USFWS and obtain their approval on the study plans before conducting the effectiveness

[11] Refer to Footnote 10

studies. The Licensee shall file the effectiveness study plans with the Commission, along with any consultation records.

Table 10.2.1. Schedule for initial effectiveness testing of Turners Falls fish passage facilities.

Facility	Operational/Shakedown Date	Initial Effectiveness Study Years and Locations to be Tested
Cabot Rack and Downstream Conveyance	Year 4 after license issuance[12]	Years 6-7, the Cabot Downstream Fish Passage Structure and Station No. 1 Rack will be tested.
Station No. 1 Bar Rack	Year 4 after license issuance[13]	
Turners Falls Dam Plunge Pool	Year 9 (by April 1st) after license issuance	Years 10-11, the Turners Falls Plunge Pool and Spillway Lift will be tested.
Spillway Lift	Year 9 (by April 1st) after license issuance	
Rehabilitate Gatehouse Trapping Facility (Sampling Facility)	Year 9 (by April 1st) after license issuance	Not Applicable
Retire Cabot Ladder and Portions of Gatehouse Ladder	No later than Year 11 after license issuance (tied to within 2 years after the Spillway Lift becomes operational).	Not Applicable
Permanent Eel Passage Structure(s)	Year 13 after license issuance	Year 14, the internal efficiency of the permanent eel passage structure(s) will be tested.

Fish Passage Performance Goals

The Licensee shall compare the effectiveness study results to the following fish passage performance goals:

Downstream Passage

- 95 percent of juvenile American shad arriving 500 meters upstream of the Turners Falls Dam survive migration past the Turners Falls Project within 24 hours.
- 95 percent of adult American shad arriving 1 kilometer upstream of the Turners Falls Dam survive migration past the Turners Falls Project within 24 hours.

[12] Refer to Footnote 10
[13] Refer to Footnote 10

- 95 percent of American eel arriving 1 kilometer upstream of the Turners Falls Dam survive migration past the Turners Falls Project within 48 hours of a flow event. The definition of what constitutes a flow event shall be determined by the Licensee in consultation with MADFW, NMFS, and USFWS during effectiveness study plan development.

The downstream passage at the Turners Falls Project is project wide and will include all routes of passage (e.g., spill, fish bypass, and turbine passage).

Upstream Passage

- 75 percent of the adult American shad arriving 500 meters below Cabot Station successfully pass into the TFI within 48 hours. The 75 percent passage efficiency for American shad will be based on the first 90 percent of the American shad run. The effectiveness testing will be conducted over the entire adult American shad run, but the 75 percent passage efficiency goal will be based on the first 90 percent of the run as determined by the Licensee as *a posteriori* analysis of run counts. The Licensee will determine where and how run counts will occur in consultation with MADFW, NMFS, and USFWS during effectiveness study plan development. The Licensee, MADFW, NMFS, and USFWS will revisit whether the 75 percent passage efficiency goal is achievable or should be reduced, and whether the 48-hour time-to-pass goal is achievable or should be increased, after implementing the first (Tier 1) and second (Tier 2) round of AMMs as described in Condition 3.
- An internal passage efficiency of 95 percent within the permanent passage structure(s) for American eel. The 95 percent internal efficiency assumes it is possible for the Licensee to successfully tag up-migrating eels. The Licensee shall consult MADFW, NMFS, and USFWS on the appropriate size American eel, based on available technology, to test the internal efficiency.

10.3. CONDITION 3: TURNERS FALLS DOWNSTREAM FISH PASSAGE – INITIAL EFFECTIVENESS STUDIES, ADAPTIVE MANAGEMENT MEASURES AND SUBSEQUENT EFFECTIVENESS STUDIES (FPP AGREEMENT ARTICLE A320)

Initial Effectiveness Studies – Years 6 and 7

The Licensee shall conduct initial effectiveness testing in Years 6 and 7 after license issuance (see Condition 2) to evaluate the fish passage survival and time-to-pass of the newly constructed Station No. 1 bar rack and Cabot Rack and Conveyance Structure and compare the findings at individual components (e.g., Cabot Station and Station No. 1) to the performance goals in Condition 2. The Licensee shall develop reports by February 1 of Years 7 and 8 for adult American shad and by April 1 of Years 7 and 8 for juvenile American shad and adult American eel summarizing the survival study findings and provide it to MADFW, NMFS, and USFWS. The Licensee shall consult MADFW, NMFS, and USFWS on the effectiveness study

results and determine what, if any, adaptive management measures (AMMs) may be implemented from Table 10.3.1. The Licensee will target any AMMs to those locations where fish passage performance goals are not achieved. The Licensee shall file a report with the Commission to include the effectiveness testing report and documentation of any AMMs agreed to by the Licensee, MADFW, NMFS, and USFWS, along with any consultation records. If warranted, the Licensee shall consult MADFW, NMFS, and USFWS on when to implement the Round 1 AMMs at Station No. 1 and/or Cabot Station.

Effectiveness Testing of Round 1 AMMs at Station No. 1 and/or Cabot Station and Initial Effectiveness Testing at Turners Falls Dam Plunge Pool - Years 10 and 11

The Licensee shall conduct Round 1 AMM effectiveness testing at Station No. 1 and/or Cabot Station and initial effectiveness testing of the Turners Falls Dam plunge pool in Years 10 and 11 after license issuance. The Licensee shall:

- Compare the effectiveness study results to the performance goals in Condition 2.
- Provide the effectiveness study report to MADFW, NMFS, and USFWS by February 1 of Years 11 and 12 for adult American shad and by April 1 of Years 11 and 12 for juvenile American shad and adult American eel summarizing the survival study findings.
- Consult MADFW, NMFS, and USFWS to determine what, if any AMMs may be implemented from the Table 10.3.1 and target AMMs to those locations where passage performance goals are not achieved.
- File the effectiveness study report and documentation of any AMMs with the Commission.

If warranted, the Licensee shall consult MADFW, NMFS, and USFWS on when to implement any Round 2 AMMs at Station No. 1 and/or Cabot Station and Round 1 AMMs at the Turners Falls Dam plunge pool.

Effectiveness Testing of Round 2 AMMs at Station No. 1 and/or Cabot Station and Round 1 AMMs at Turners Falls Dam Plunge Pool - Years 14 and 15

The Licensee shall conduct Round 2 AMM effectiveness testing at Station No. 1 and/or Cabot Station and Round 1 AMMs at the Turners Falls Dam plunge pool in Years 14 and 15 after license issuance. The Licensee shall follow the same consultations steps bulleted above; however, the Licensee shall provide the effectiveness study report to MADFW, NMFS, and USFWS by February 1 of Years 15 and 16 for adult American shad and by April 1 of Years 15 and 16 for juvenile American shad and adult American eel.

If warranted, the Licensee shall consult MADFW, NMFS, and USFWS on when to implement any Round 3 AMMs at Station No. 1 and/or Cabot Station and Round 2 AMMs at the Turners Falls Dam plunge pool.

Effectiveness Testing of Round 3 AMMs at Station No. 1 and/or Cabot Station and Round 2 AMMs at Turners Falls Dam Plunge Pool- Years 18 and 19

The Licensee shall conduct Round 3 AMM effectiveness testing at Station No. 1 and/or Cabot Station and Round 2 AMMs at the Turners Falls Dam plunge pool in Years 18 and 19 after license issuance. The Licensee shall follow the same consultations steps bulleted above however, the Licensee shall provide the effectiveness study report to MADFW, NMFS, and USFWS by February 1 of Years 19 and 20 for adult American shad and by April 1 of Years 19 and 20 for juvenile American shad and adult American eel.

Table 10.3.1. Turners Falls Downstream Adaptive Management Measures. Specified timing is years after license issuance.

Adaptive Management Measure (if needed)	Timing
Turners Falls Dam • Modify the bascule gate setting(s) and resultant spill (rate, location). Station No. 1 • Install a behavioral barrier. Cabot Station • Modify the downstream passage conveyance design to reduce impact velocities and shear stresses (e.g., pump-back system; gradient reduction; piping, lining); • Modify the downstream passage conveyance design to increase water depth; • Modify the area of flow convergences of the trash trough, Uniform Acceleration Weir, eel pipe, and sluiceway; • Modify the area of flow convergence of the sluiceway and the receiving waters in the Connecticut River (e.g., adjustable lip, velocity control, and plunge pool depth)	Initial Effectiveness Testing at Cabot Station and Station No. 1: **Years 6-7.** Initial Effectiveness Testing at Turners Falls Dam Plunge Pool and Round 1 Effectiveness Testing for any AMMs implemented at Cabot Station and/or Station No. 1 (if needed): **Years 10-11.** Round 2 AMM Effectiveness Testing at Cabot Station and/or Station No. 1 (if needed) and Round 1 Effectiveness Testing at Turners Falls Dam Plunge Pool (if needed): **Years 14-15** Round 3 AMM Effectiveness Testing at Cabot Station and/or Station No. 1 (if needed) and Round 2 Effectiveness Testing at Turners Falls Dam Plunge Pool (if needed): **Years 18-19**

10.4. CONDITION 4: TURNERS FALLS UPSTREAM FISH PASSAGE INITIAL EFFECTIVENESS STUDIES, ADAPTIVE MANAGEMENT MEASURES AND SUBSEQUENT EFFECTIVENESS TESTING (FFP AGREEMENT ARTICLE A330)

Initial Effectiveness Testing of Adult American Shad - Years 10 and 11

The Licensee shall conduct initial effectiveness testing in Years 10 and 11 after license issuance (see Condition 2) to evaluate upstream fish passage efficiency and time-to-pass at the Cabot Station tailrace, Rawson Island, Station No. 1 tailrace, and at the Spillway Lift through the Gatehouse Ladder exit and compare the findings to the performance goals in Condition 2. The Licensee shall develop a report by February 1 of Years 11 and 12 for adult American Shad

summarizing the effectiveness study findings and provide it to MADFW, NMFS, and USFWS. The Licensee shall consult MADFW, NMFS, and USFWS on the effectiveness study results and determine what, if any, Tier 1 adaptive management measures (AMMs) from Table 10.4.1 may be implemented.

The Licensee's implementation of Tier 1 AMMs, if warranted, will be informed by the initial effectiveness testing results. While the overall passage efficiency goal is 75 percent in 48 hours, there are four locations (or nodes) of interest where the Licensee can provide enhancements as part of the AMMs for upstream passage efficiency, including Cabot Station, Rawson Island, Station No. 1, and the Spillway Lift. If the individual passage efficiency at all four locations is 90 percent or higher, or if the overall passage efficiency goals are met, no Tier 1 AMMs will be implemented. If the individual passage efficiency at any of the four locations is less than 90 percent, the Licensee shall target Tier 1 enhancements to achieve an individual location passage efficiency of 90 percent or higher. However, if the Licensee, MADFW, NFMS, and USFWS agree that improvements can be made at other nodes that would improve the overall passage efficiency a comparable amount as an enhancement to achieve an individual location/node to at least 90 percent, then that enhancement can be implemented.

If warranted, the Licensee shall consult MADFW, NMFS and USFWS on when to implement the Tier 1 AMMs.

Tier 1 Adaptive Management Measures Effectiveness Testing of Adult American Shad - Years 13 and 14

The Licensee shall conduct Tier 1 AMM effectiveness testing in Years 13 and 14 after license issuance and conduct the following:

- The Licensee shall compare the effectiveness study results to the performance goals in Condition 2.
- The Licensee shall provide the effectiveness study report to MADFW, NMFS, and USFWS by February 1 of Years 14 and 15.
- At the election of the Licensee, the Licensee may provide the effectiveness study report to an Independent Peer Review Panel (IPRP) of experts to evaluate the study results. The IPRP will consist of one member selected by the Licensee, one member selected collectively by MADFW, NMFS, and USFWS, and one member selected jointly by the Licensee, MADFW, NMFS, and USFWS. After the IPRP's review of the effectiveness study findings, the IPRP will evaluate the ability to achieve the upstream fish passage performance goals in Condition 2 and provide a summary report of its findings to the Licensee, MADFW, NMFS, and USFWS within 3 months of receiving the effectiveness study report.
- If the 75 percent passage efficiency/48-hour time-to-pass performance goal is not met, the Licensee shall consult MADFW, NMFS, and USFWS to determine whether the 75

percent passage efficiency goal is achievable or should be reduced, and/or the 48-hour time-to-pass goal is achievable or should be increased. Any modifications to the 75 percent passage efficiency/48-hour time-to-pass must be agreed to by the Licensee, MADFW, NMFS, and USFWS.

- The Licensee shall consult MADFW, NMFS, and USFWS to determine what, if any, AMMs will be implemented.
- The Licensee shall file the effectiveness study report and documentation of any AMMs with the Commission.

If warranted, the Licensee shall consult MADFW, NMFS, and USFWS on when to implement either the remaining Tier 1 AMMs and/or Tier 2 AMMs.

Tier 1 and/or Tier 2 Adaptive Management Measures Effectiveness Testing of Adult American Shad - Years 18 and 19

The Licensee shall conduct any Tier 1 and/or Tier 2 AMM effectiveness testing in Years 18 and 19 after license issuance and conduct the following:

- The Licensee shall compare the effectiveness study results to the performance goals in Condition 2.
- The Licensee shall provide the effectiveness study report to MADFW, NMFS, and USFWS by February 1 of Years 19 and 20.
- The Licensee shall file the effectiveness study report and documentation of any AMMs with the Commission.

Effectiveness Testing of Juvenile American Eel- Year 14

The Licensee shall conduct effectiveness testing in Year 14 after license issuance to evaluate the internal efficiency of the permanent eelway structure(s) and compare the findings to the performance goals in Condition 2.

Table 10.4.1 Turners Falls Upstream Adaptive Management Measures – Tier 1 and 2. Specified timing is years after license issuance.

Adaptive Management Measure (if needed)	Schedule
Tier 1	
<u>Cabot Tailrace and Rawson Island Nodes</u> • Upon license issuance, the Total Minimum Bypass Flow below Station No. 1 from June 1 to June 15 is 4,500 cfs (see Article A120). This AMM includes increasing the Total Minimum Bypass Flow below Station No. 1 from June 1 to June 15 to 6,500 cfs until 90% of the American Shad run enter the Spillway Lift, upon which the Total Minimum Bypass Flow below Station No. 1 will revert to 4,500 cfs. If this adaptative management measure is enacted and after two years of effectiveness testing, it improves the fish passage efficiency and time-to-pass goals, this change may be implemented throughout the remainder of the license, subject to other adaptive management measures. However, even after this change, the 6,500 cfs will revert to 4,500 cfs when 90% of the adult American Shad run enter the Spillway Lift before or within the June 1 to 15 period. The indicator as to when the 90% of the adult American Shad run passes will be determined using a predictive model to be developed by the Licensee in consultation with MDFW, NMFS, and USFWS. The Licensee shall file with the Commission the predictive model results within 6 months of license issuance and it will be updated and/or refined with data collected over intervening years. If this change is implemented, from June 1 to June 15, the Minimum Flow below the Turners Falls Dam (Article A110) must be 4,290 cfs or the NRF, whichever is less; and the Total Minimum Bypass Flow below Station No. 1 (Article A120) must be 6,500 cfs or the NRF, whichever is less. <u>Station No. 1 Node</u> • Shift the distribution of the Total Minimum Bypass Flow below Station No. 1 (Article A120) to increase the Total Minimum Flow below Turners Falls Dam (Article A110) from April 1 to June 30 until 90% of the adult American Shad run enter the Spillway Lift, upon which it will revert back to the flow requirements in Articles A110 and A120. The Total Minimum Bypass Flow below Station No. 1 remains the same from April 1 to June 30 as described in Article A120. <u>Spillway Lift</u> • Adjust the new plunge pool release and/or bascule gate operation and/or, • Adjust the new fish lift attraction water and entrance conditions and/or, • Adjust the timing and frequency of lift operations and/or; • Adjust the entrance gate.	Years of Initial Effectiveness Testing: **Years 10-11** Time Needed to Implement AMM(s): **Year 0** since all Tier 1 AMMs are operational Years of Post AMM Effectiveness Testing: **Years 13-14**

Table 10.4.1 Turners Falls Upstream Adaptive Management Measures – Tier 1 and 2 (continued)

Adaptive Management Measure (if needed)	Schedule
Tier 2	
Cabot Tailrace Node • Install a behavioral barrier near the Cabot Station tailrace to guide fish upstream for passage at the Turners Falls Dam. If this AMM is implemented, then the Total Minimum Bypass Flow below Station No. 1 (Article A120) will be reduced from 6,500 cfs to 4,500 cfs (Tier 1 AMM) from June 1 to June 15 for the period of testing the Tier 2 measures. At the end of Tier 2 testing (and provided that the 6,500 cfs extension is not needed to significantly improve passage efficiency or time-to-pass at Rawson Island) either the increased flow of 6,500 cfs (June 1 to June 15) will be implemented or the behavioral barrier but not both unless it is demonstrated that both are needed to make a substantial improvement in passage efficiency or time-to-pass. Rawson Island Node • If it is determined that the river channel adjacent to Rawson Island is inhibiting upstream fish passage, then constructing a zone of passage is an AMM. Prior to conducting any work associated with this AMM, the Licensee shall consult MDFW, NMFS, USFWS, recreational boating and Tribal interests and the Massachusetts Natural Heritage and Endangered Species Program (NHESP) on the design of the zone of passage. If the zone of passage is constructed, then the Total Minimum Bypass Flow below Staton No. 1 will be reduced from 6,500 cfs to 4,500 cfs (Tier 1 AMM) from June 1 to June 15 for the period of testing the Tier 2 measures. At the end of Tier 2 testing (and provided that the 6,500 cfs extension is not needed to significantly improve passage efficiency or time-to-pass at Rawson Island) the 6,500 cfs will be reduced back to 4,500 cfs. Station No. 1 Node • Install a behavioral barrier near the Station No. 1 tailrace to guide fish upstream for passage at the Turners Falls Dam. If this AMM is implemented, then the Turners Falls Dam Spill/Sum of Fall River, Turners Falls Hydro, LLC, Milton Hilton, LLL and Station No. 1 flow split will be returned to the 67%/33%, respectively, from April 1 to June 30. At the end of Tier 2 testing, either the increased Turners Falls Dam Minimum Flow component of the flow split used in Tier 1 will be implemented or the behavioral barrier but not both unless it is demonstrated that both are needed to make a substantial improvement in passage efficiency or time to pass. Turners Falls Dam/Fish Lift Node • Internal structural modifications to improve hydraulics for fish movement, as necessary.	Time Needed to Implement AMM(s): **Year 15-16** Shakedown: **Year 17** Years of Post AMM Effectiveness Testing: **Years 18-19**

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10.5. CONDITION 5: TURNERS FALLS FISHWAY OPERATING PERIODS* (FFP AGREEMENT ARTICLE A340)

The Licensee shall operate the fishways during the following periods:

Upstream eel passage	May 1 to November 15
Upstream anadromous	April 4 to July 15
Downstream passage	April 4 to November 15

*Future refinement of the timing on an annual or permanent basis may be made by the MADFW, NMFS, and USFWS based on new information and after consultation with the Licensee.

10.6. CONDITION 6: TURNERS FALLS FISH PASSAGE FACILITIES OPERATION AND MAINTENANCE PLAN (FFP AGREEMENT ARTICLE A350)

The Licensee shall develop and implement a Fish Passage Facilities Operations and Maintenance Plan (FOMP). The FOMP shall detail how and when the fishways will be operated and describe routine maintenance activities that will occur both during and outside of the fish passage season. The FOMP will include a provision to provide annual fishway Operation and Maintenance (O&M) reports that summarize the status of the fish passage facilities, identify needed repairs or equipment replacement, etc. The O&M report shall be submitted to the MADFW, NMFS, and USFWS by January 31 annually. The FOMP shall be developed in consultation with and require approval by the MADFW, NMFS, and USFWS prior to submitting the final FOMP to the FERC for approval.

The FOMP shall be completed no later than 6 months after license issuance for the interim upstream eel passage which will be placed into service within one year of license issuance per Condition 1, and for existing fish passage facilities (i.e., Cabot downstream fish bypass; Cabot Ladder; Spillway Ladder; and Gatehouse Ladder). Thereafter, the same FOMP shall be amended by the Licensee within 6 months prior to the following:

- Any fish passage structures are placed into service, as outlined in the schedule in Condition 1;
- Any AMM's are placed into service, as outlined in the schedule in Conditions 3 and 4; and,
- Any operational or facilities modifications resulting from new information obtained from operation of the fish passage facilities pursuant to the annual O&M reports.

FOMP provisions dealing with facilities that are decommissioned over the term of the license may be dropped from revisions of the FOMP after decommissioning.

10.7. CONDITION 7: NMPS FISH INTAKE PROTECTION AND CONSULTATION (FFP AGREEMENT ARTICLE B200)

Intake Protection

The Licensee shall install a barrier net in front of the NMPS lower reservoir (i.e., TFI) tailrace/intake, having 3/8-inch mesh on the top and ¾-inch mesh on the bottom. The barrier net design shall be based on the conceptual design in the Amended Final License Application filed with the Commission in December 2020, as modified through consultation with MADFW, NMFS, and USFWS, from June 1 to November 15* to protect out-migrating American shad and adult American eel, to be operational no later than June 1 of Year 7 after license issuance.

*Future refinement of the timing on an annual or permanent basis may be made by the MADFW, NMFS, and USFWS based on new information and after consultation with the Licensee.

Consultation

The Licensee shall consult and obtain approval from MADFW, NMFS, and USFWS on the barrier net design and on operation and maintenance procedures. The Licensee shall consult MADFW, NMFS, and USFWS at the 30%, 60%, 90%, and 100% design plan milestones. The Licensee shall file the 100% design plans with the Commission, along with documentation of consultation with MADFW, NMFS, and USFWS.

The Commission reserves the right to require changes to the design plans. Implementation of the design plans must not begin until the Licensee is notified by the Commission that the design plans are approved. Upon Commission approval, the Licensee shall implement the design plans, including any changes required by the Commission.

10.8. CONDITION 8: NMPS INITIAL INTAKE PROTECTION EFFECTIVENESS TESTING AND FISH PASSAGE PERFORMANCE GOALS (FFP AGREEMENT ARTICLE B210)

Initial Effectiveness Testing

The Licensee shall complete construction of the NMPS barrier net, operate the barrier net for one season (shakedown year), and conduct representative and quantitative effectiveness testing in Years 10 and 11 after license issuance to evaluate the downstream fish passage survival and time-to-pass compared to the performance goals below.

Consultation Process on Effectiveness Study Plans

For any initial fish passage effectiveness studies and any subsequent fish passage effectiveness studies required after implementing any AMMs described in Condition 9, the Licensee shall provide the effectiveness study plans to MADFW, NMFS, and USFWS and request comments on the study plans within 30 days. The Licensee shall consult MADFW, NMFS, and USFWS and obtain their approval on the study plans before conducting the effectiveness study. The

Licensee shall file the effectiveness study plans with the Commission, along with any consultation records.

Fish Passage Performance Goals

The Licensee shall compare the effectiveness study results to the following fish passage performance goals:

- 95 percent of juvenile American shad arriving 500 meters upstream of the NMPS lower reservoir tailrace survive migration past the NMPS lower reservoir tailrace within 24 hours.
- 95 percent of adult American shad arriving 1 kilometer upstream of the NMPS lower reservoir tailrace survive migration past the NMPS lower reservoir tailrace within 24 hours.
- 95 percent of American eel arriving 1 kilometer upstream of the NMPS lower reservoir tailrace survive migration past the NMPS lower reservoir tailrace within 48 hours of a flow event. The definition of what constitutes a flow event shall be determined by the Licensee in consultation with MADFW, NMFS, and USFWS during effectiveness study plan development.

10.9. CONDITION 9: NMPS DOWNSTREAM FISH PASSAGE – INITIAL EFFECTIVENESS STUDIES, ADAPTIVE MANAGEMENT MEASURES, AND SUBSEQUENT EFFECTIVENESS STUDIES (FFP AGREEMENT ARTICLE B220)

Initial Effectiveness Studies - Years 10 and 11

The Licensee shall conduct initial effectiveness testing in Years 10 and 11 after license issuance (Condition 8) to evaluate the fish passage survival and time-to-pass of the newly constructed barrier net and compare the findings to the performance goals in Condition 8. The Licensee shall develop a report by February 1 of Years 11 and 12 for adult American shad and by April 1 of Years 11 and 12 for juvenile American shad and adult American eel summarizing the survival study findings and provide it to MADFW, NMFS, and USFWS. The Licensee shall consult MADFW, NMFS, and USFWS on the effectiveness study results and determine what, if any, adaptive managements measures (AMMs) may be implemented from Table 10.9.1. The Licensee shall file a report with the Commission to include the effectiveness testing report and documentation of any AMMs agreed to by the Licensee, MADFW, NMFS, and USFWS, along with any consultation records. If warranted, the Licensee shall consult MADFW, NMFS, and USFWS on when to implement any Round 1 AMMs.

Effectiveness Testing of Round 1 AMMs – Years 14 and 15

The Licensee shall conduct Round 1 AMM effectiveness testing in Years 14 and 15 after license issuance. The Licensee shall:

- Compare the effectiveness study results to the performance goals in Condition 8.
- Provide the effectiveness study report to MADFW, NMFS, and USFWS by February 1 of Years 15 and 16 for adult American shad and by April 1 of Years 15 and 16 for juvenile American shad and adult American eel.
- Consult MADFW, NMFS, and USFWS to determine what, if any AMMs may be implemented from Table 10.9.1.
- File the effectiveness study report and documentation of any AMMs with the Commission.

If warranted, the Licensee shall consult MADFW, NMFS, and USFWS on when to implement any Round 2 AMMs.

Effectiveness Testing of Round 2 AMMs - Years 17 and 18

The Licensee shall conduct Round 2 AMM effectiveness testing in Years 17 and 18 after license issuance. The Licensee shall follow the same consultations steps bulleted above; however, the Licensee shall provide the effectiveness study report to MADFW, NMFS, and USFWS by February 1 of Years 18 and 19 for adult American shad and by April 1 of Years 18 and 19 for juvenile American shad and adult American eel.

Table 10.9.1. NMPS downstream adaptive management measures. Specified timing is years after license issuance.

Adaptive Management Measure (if needed)	Timing
Northfield Mountain Intake/Tailrace • Alter the arrangement and size of the net panels (e.g. extend depth of the smaller panels). • Improve maintenance measures for the net.	Initial Effectiveness Testing of Barrier Net: **Years 10-11.** Round 1 AMM Effectiveness Testing (if needed): **Years 14-15** Round 2 AMM Effectiveness Testing (if needed): **Years 17-18**

10.10. CONDITION 10: NMPS FISHWAY OPERATING PERIODS* (FFP AGREEMENT ARTICLE B230)

The Licensee shall operate the barrier net for downstream passage from June 1 to November 15.

*Future refinement of the timing may be made by the MADFW, NMFS, and USFWS based on new information and after consultation with the Licensee.

10.11. CONDITION 11: NMPS FISH PASSAGE FACILITY OPERATION AND MAINTENANCE PLAN FOR BARRIER NET (FFP AGREEMENT ARTICLE B240)

The Licensee shall develop and implement a Fish Passage Facilities Operations and Maintenance Plan (FOMP) for the barrier net. The FOMP shall detail how and when the barrier net will be operated and describe routine maintenance activities that will occur both during and outside of the downstream fish passage season. The FOMP will include a provision to provide annual fishway Operation and Maintenance (O&M) reports that summarize the status of the barrier net, identify needed repairs or equipment replacement, etc. The O&M report shall be submitted to the MADFW, NMFS, and USFWS by January 31 annually. The FOMP shall be developed in consultation with and require approval by the MADFW, NMFS, and USFWS prior to submitting the final FOMP to the FERC for approval.

The FOMP shall be completed no later than 6 months prior to the barrier net being placed into service, as outlined in the schedule in Condition 7. Thereafter, the same FOMP shall be amended by the Licensee within 6 months prior to the following:

- Any AMM's are placed into service, as outlined in Condition 9; and,
- Any operational or facility modifications resulting from new information obtained from operation of the barrier net pursuant to the annual O&M reports.

10.12. CONDITION 12: REVISION OF SECTION 18 FISHWAY PRESCRIPTION

The Secretary of the Department reserves the right, consistent with the terms of the FFP Agreement filed with the Commission on March 31, 2023 (FERC Accession Number 20230331-56002019), after notice and opportunity for comment, to require changes in the Project and its operation through revision of this Section 18 Fishway Prescription to protect and enhance fish passage at the Project. The Secretary also reserves the right to modify these conditions, if necessary, and consistent with the terms of the Settlement Agreement (FERC Accession Number 20230331-56002019), to respond to any significant changes that warrant a revision of this Prescription.

10.13. CONDITION 13: AGENCY ACCESS AND INSPECTION

The Licensee shall provide USFWS personnel and other USFWS-designated representatives, timely access to the fish passage facilities at the Projects and to pertinent Project operational records for the purpose of inspecting the fishways to determine compliance with this Prescription.

10.14. CONDITION 14: FISHWAY MAINTENANCE AND REPAIR

The Licensee shall keep the fishways in proper order and shall keep the trashracks and fishway areas clear of leaves, trash, logs, and any material that can increase impingement and cause injury or hinder passage. Anticipated maintenance shall be performed when necessary, in

accordance with the Fishway Operation and Maintenance Plans (see Condition 6 and Condition 11), and the fishway will operate effectively during the identified migratory periods.

10.15. CONDITION 15: EXCEPTIONS

In the event of any operating emergency beyond the control of the Licensee, the Licensee may curtail or suspend fish exclusion and/or passage measures for only the time period necessary to rectify such an emergency. The Licensee shall notify the USFWS as soon as possible, but no later than 5 business days after any such operating emergency. The Licensee shall notify the Commission in writing within 10 days after any such operating emergency, or by any period as established by the Commission.

10.16. CONDITION 16: APPROVAL OF EXTENSIONS

The Licensee shall (1) notify, and (2) obtain approval from, the USFWS for any extensions of time to comply with the provisions included in the USFWS's Prescription.

11. REFERENCES CITED

11.1. COMPREHENSIVE RESOURCE MANAGEMENT PLANS FILED AT THE COMMISSION

The following published regional resource management plans recognized by the Commission's Licensing Process contain management goals that pertain to alosines and American eel:

Atlantic States Marine Fisheries Commission. 1999. Amendment 1 to the Interstate Fishery Management Plan for shad and river herring. (Report No. 35). April 1999.

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

Atlantic States Marine Fisheries Commission. 2000. Technical Addendum 1 to Amendment 1 of the Interstate Fishery Management Plan for shad and river herring. February 9, 2000.

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Connecticut River Atlantic Salmon Commission. 2023. Connecticut River American Eel Management Plan. Sunderland, Massachusetts. June 30, 2023.

11.2. INDEX TO THE ADMINISTRATIVE RECORD

Evidence to support the USFWS's Prescription for Fishways is contained in the Administrative Record before the Commission, and in the citations to the extant record provided herein:

Ames, E. P. (2004). *Atlantic Cod Stock Structure in the Gulf of Maine.* American Fisheries Society.

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11.3. DOCUMENTS FOR INCLUSION IN THE ADMINISTRATIVE RECORD

Filed under a separate cover.

11.4. OTHER REFERENCES CITED IN THE DECISION DOCUMENT

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* * * * *

Any written inquiries, comments, or other correspondence related to this Prescription for the Project should be sent to:

Supervisor, New England Field Office

U.S. Fish and Wildlife Service

70 Commercial Street, Suite 300

Concord, NH 03301

ATTACHMENT F

1988 EASEMENT

The Following Is Certified To Be A True Copy Of The Record In 2222-
Book 2222 Page 154 Franklin County Mass. Registry of Deeds
Date 4/1/85 Attest Walter T. Kwiatkowski

154

EASEMENT

WESTERN MASSACHUSETTS ELECTRIC COMPANY (the "Grantor"), a corporation duly established under the laws of the Commonwealth of Massachusetts and having its usual place of business at 174 Brush Hill Avenue, West Springfield, Hampden County, Massachusetts in consideration of Twenty-Nine Thousand Seven Hundred Forty ($29,740) Dollars grants to the United States of America, acting by and through the Secretary of the Interior (the "Grantee"), the following non-exclusive, permanent easement rights, in common with the Grantee, its successors and assigns and all others entitled thereto, to be exercised solely for the following purposes at the Grantee's sole cost and risk over a portion of certain premises located in the town of Montague (Turners Falls), Franklin County, Massachusetts, as more particularly described on Exhibit A, which is attached hereto and made a part hereof, with the improvements authorized by this Easement Agreement to be located approximately as shown on a Plan entitled "United States Department of the Interior, Fish and Wildlife Service, Northeast Anadromous Fish Research Laboratory, Western Massachusetts Electric Company Tracts" prepared by Roger R. Tornstrom, Supervisor, Land Surveyor, Office of Realty, dated December 12, 1986, with a last revision date of February 25, 1988, recorded in the Franklin County Registry of Deeds at Plan Book 69 , Page 80 (the "Plan"). The areas identified upon the Plan as the locations for the improvements to be

constructed thereon pursuant to this Easement Agreement are referred to herein as the "Easement Area". The rights granted hereby are specifically limited to the Easement Area unless otherwise expressly provided herein. The Easement rights hereby granted by the Grantor to the Grantee are as follows:.

1. Roadway

The right to construct, maintain, repair and use a Roadway in the location identified on the Plan as the "Access Road" and the "Service Road" (collectively, the "Roadway") that may be improved up to a width of twenty-five (25) feet, subject to the following conditions:

(a) The Grantee shall construct the Access Road portion of the Roadway in the location shown on the Plan running from G Street to the entrance road of the Grantee's proposed Research Laboratory shown on the Plan. This portion of the Roadway shall be reasonably acceptable to the Grantor and it shall be uniform in design and material, be improved to a minimum width of ten (10) feet and surfaced with gravel.

(b) The Grantee shall construct a Service Road reasonably acceptable to the Grantor in the location shown on the Plan connecting the Access Road to the Grantor's Cabot Station Fish Ladder. This portion of the Roadway shall be uniform in design and material, be improved to a minimum width of ten (10) feet and surfaced with gravel.

(c) The Grantee shall construct and maintain a guard rail system reasonably acceptable to the Grantor in the

location shown on the Plan along the easterly shoulder of the Roadway from the northerly end of the retaining wall of the Grantor's Cabot Station Fish Ladder to the G Street entrance gate to be constructed by the Grantee.

(d) The Grantee shall provide for snow removal and sanding along the Roadway to the extent deemed necessary or appropriate by the Grantee for its use of the Roadway, including without limitation the Access Road and the Service Road. The Grantee shall not have any obligation to provide for snow removal and sanding to satisfy the requirements of the Grantor, and the Grantor shall not have any obligation to provide for snow removal and sanding along the Roadway to satisfy the requirements of the Grantee.

2. Gates

The right to construct, maintain, repair and use gates along the Roadway, subject to the following conditions:

(a) The Grantee shall install at least four (4) gates along the Access Road and Service Road at the locations shown on the Plan.

(b) Each gate shall be of suitable size and design to prevent vehicle access to the Roadway and shall have a double-lock system so that each party may install its own locks and have continuous access along the Roadway.

(c) At the close of each day during which the Grantee's laboratory facilities are open, the Grantee shall patrol the Roadway and arrange for the removal of all unauthorized vehicles from the Easement Area. If the Grantor

elects to allow public access for additional periods, it shall notify the Grantee's personnel at the laboratory and the Grantor shall be responsible for removal of vehicles when it closes the Easement Area to public use.

3. Loading Area

The right to construct, maintain, repair and use a surfaced area approximately sixty (60') feet by eighty (80') feet at the location shown on the Plan for loading and unloading of materials at the Grantee's Fish Passage Complex. This area shall be separated from the Service Road by means of chain link fencing at least six (6) feet in height, with a gate to allow vehicle access to and from the Service Road.

4. Fishway

The right to construct, maintain, repair and use a fishway at the location shown on the Plan from the Grantor's power canal into the Grantee's property abutting the Easement Area on the west. The fishway shall consist of the following:

(i) A twenty (20') foot by thirty-five (35') foot concrete pad at the shore of the canal;

(ii) A one hundred (100') foot log boom to be located in the power canal only during the period of April to November;

(iii) Six (6') foot tall chain link fencing separating the inlet area and facilities from the Easement Area and a gate to allow vehicle access to such facilities;

(iv) An inlet structure for the fishway and water supply line;

(v) Trash racks and screens at the entry point of the inlet structure;

(vi) An overhead crane for cleaning screens associated with the inlet structure;

(vii) A twenty-five (25') foot floating platform with removable vertical screens to be located in the power canal and operated intermittently to divert downsteam migrant fish into the inlet structure. The platform shall be anchored to the inlet structure at the corner of the south wall and by a cable to a point approximately fifty-four (54') feet upstream at the north end of the inlet structure;

(viii) An eight (8') foot by one hundred two (102') foot concrete fishway located approximately nine hundred (900') feet north of the Grantor's Cabot Station Fishway running westerly to the Grantee's lands adjacent to the Easement Area. The fishway will be designed to use not more than thirty (30) cfs of canal water during operations;

(ix) A six (6') foot diameter water supply line running from the power canal to the Fish Passage Complex. The supply line shall be designed to use no more than two hundred (200) cfs of canal water during operations; and

(x) A bridge to accomodate the passage of the fishway beneath the Service Road. The bridge shall meet at least HS-20 loading, be twenty-two (22') feet wide, have concrete approach ramps, use heavy duty bridge grating, and include guard rails.

The Grantee's exercise of these rights shall be subject at all times to the following:

(a) The use of the Grantor's power canal to transport water to the Grantee's intake facilities shall be subject to such conditions and requirements for reimbursement as the parties may from time to time agree upon.

(b) The Grantee shall install and maintain monitoring devices that will continuously measure the quantity of water flowing through the inlet structure, and

make such measurements available to the Grantor at least monthly during the periods the Grantee takes water from the Grantor's power canal.

(c) Upon notice from the Grantor that the Grantee's use of the intake structure or associated facilities adversely affects the Grantor's compliance with its obligations concerning the minimum flow of waters or migration of fish within its power canal as determined by the Grantor in its reasonable discretion, the Grantee shall immediately undertake mitigation measures (including but not limited to removal of all facilities from the power canal and cessation of use of the waters of the power canal) to eliminate the adverse effect. The Grantee shall reimburse the Grantor for all costs reasonably incurred to alter its business operations or otherwise accommodate each such adverse effect.

5. Turn-Around Area

The right to construct, maintain, repair and use a surfaced turn-around area in the location shown on the Plan at the southerly portion of the Easement Area adjacent to the Grantor's Cabot Station Fishway Trap. The turn-around area shall be approximately 50' x 60' to allow nineteen (19) foot long fish haul trucks to turn around and maneuver in the area of the fish trap to be constructed by the Grantee. As part of its construction of the turn-around area, the Grantee shall install a retaining wall along the easterly edge of the turn-around area.

6. Gravel Parking Area

The right to construct, maintain, repair and use a gravel parking area in the location shown on the Plan approximately one hundred twenty-five (125) feet wide and seventy (70') feet deep, located between the Roadway and the Fish Passage Complex. The Grantee shall have the further right to construct, maintain, repair and use a visitor walkway and awning in the location shown on the Plan within five (5') feet of and parallel to the westerly boundary of the Gravel Parking Area.

7. Upstream Migrant Fish Trap

(a) The right to construct, maintain, repair and use a fish trap consisting of a hopper, guides, hoist and hoist superstructure to be located at the northerly end of the Grantor's fish ladder in the location shown on the Plan.

(b) The right to modify the Grantor's counting station by means of a three (3') foot by thirteen (13') foot addition to allow relocation of the viewing window. The Grantee shall have the further right to install and obligation to maintain control facilities for its upstream migrant fish trap within a five (5') foot by seven (7') foot portion of the walls of the counting station at a location to be selected by the Grantor.

8. Fish Transport Flume

The right to construct, maintain, repair and use a seven (7) foot wide by six (6) foot deep concrete fish transport flume at the location shown on the Plan within a

strip of land thirty-five (35') feet in width running from the Grantor's existing fish ladder to the Grantee's Burrows Ponds southerly of the Fish Passage Complex. Interconnection with the Grantor's fish ladder shall be by means of facilities and at a location approved by the Grantor in its sole discretion.

9. Water Discharge Facilities

The right to construct, maintain, repair and use the following facilities within a one hundred (100') foot wide strip of land in the location designated as Area 10M1 on the Plan:

(i) One (1) fifty-four (54") inch diameter buried pipe.

(ii) Riprap within an area approximately one hundred thirty (130') feet long by thirty (30') feet widening to eighty (80') feet wide to establish an outfall ditch at the Connecticut River end of the discharge pipe that is suitable for vehicle passage.

10. Utilities

The right to construct, maintain, repair and use underground communications and domestic water distribution facilities within the Easement Area at locations to be mutually agreed to by the Grantor and the Grantees.

BY ACCEPTANCE of this easement, the Grantee, for itself and on behalf of the successors and assigns, hereby agrees that the following conditions shall apply to its exercise of the rights granted herein:

(a) The Grantee shall undertake no work within the Easement Area until such work has been approved in writing by

the Grantor, which approval shall not be unreasonably delayed or withheld. The Grantor shall provide its response to each such request for its approval within thirty (30) days following the receipt by the Grantor of each request for approval submitted by the Grantee. It is the specific intention of the parties that the Grantor shall have the right to condition its consent to assure that the Grantee's exercise of the rights granted herein do not materially, adversely affect the Grantor's improvements and facilities and the use, repair, maintenance, replacement and operation thereof now or in the future installed by the Grantor within the Easement Area for its business purposes. As a condition to any approval, the Grantee shall submit detailed plans of the work and a description of work procedures. The Grantor's approval of any work or work procedure merely indicates its consent to the proposed activity and does not constitute a representation or warranty concerning the suitability, prudency, effectiveness or propriety of the proposed activity.

(b) The Grantee shall acquire all permits, authorizations or other consents that may be required by any Federal, state or local governmental body.

(c) All work undertaken by the Grantee shall be in compliance with all applicable Federal, state and local laws, ordinances, rules, regulations and orders.

(d) Following completion of any work in the Easement Area, the Grantee shall restore the surface of the lands substantially to the condition existing prior to Grantee's exercise of any rights granted herein.

(e) Once constructed, the Grantee shall maintain all facilities in good, safe and lawful condition.

(f) In the event of erosion or washout within the Easement Area due to the exercise of the rights granted herein, the Grantee shall repair same or in the alternative request that such work be performed by the Grantor, in which case the Grantee shall reimburse the Grantor for all costs reasonably incurred for such restoration.

(g) Upon notice from the Grantor that its business requires all or any portion of the Grantee's facilities to be altered or relocated, and upon the Grantor conveying adequate easement rights together with its agreement to reimburse the Grantee for its reasonable costs, the Grantee shall promptly make such alteration or relocation in full cooperation with the Grantor.

(h) The Grantee shall exercise the easement rights granted herein in such a way as to avoid interference with the Grantor's canal, electrical or other facilities now or hereafter installed within the Easement Area and shall not, except with written permission of the Grantor, build any structure or other improvement, excavate, fill, flood, grade, pave, plant trees or shrubbery within the vicinity of the

Grantor's facilities, or attach anything to the Grantor's facilities. The Grantor may, without liability to the Grantee, correct, remove or dispose of any improvements, excavation, filling, flood, grading, paving or planting that violates the conditions of this Easement.

(i) Nothing contained herein shall be construed as binding the Grantee to expend in any one fiscal year any sum in excess of appropriations made by congress or administratively allocated for the purpose of this document for the fiscal year, or to involve the Grantee in any contract or other obligation for the further expenditure of money in excess of such appropriations or allocations, however, this shall not in any way limit the right of the Grantor to seek legal redress for any actions of the Grantee which may adversely affect its property, facilities and/or power generation activities.

EXCEPTING AND RESERVING to the Grantor, its successors and assigns, (i) the rights to enter upon, use and otherwise have access to the Easement Area for its business purposes (including but not limited to the right to establish access driveways to any roadways constructed within the Easement Area, the rights of ingress and egress for the Grantor's personnel or members of the public, materials, equipment and vehicles over all roadways constructed within the Easement Area, the turn-around area, and any parking areas), (ii) the right to approve and condition all construction activities of

the Grantee affecting a strip of land fifteen (15') wide, the center line of which is shown on the Plan as "Proposed Underground Power-Line", generally along the westerly line of the Service Road approximately from the southerly end of the Access Road to a point easterly of the Grantee's abutting property, and (iii) the rights to flow water by means of flooding, seepage, percolation or otherwise over, under and across the Easement Area from time to time to such extent as may be caused by the Grantor's operation, maintenance, reconstruction, repair or other lawful activities conducted in its operation of its hydroelectric generating facilities presently licensed by the Federal Energy Regulatory Commission as Project No. 1889. Nothing herein shall restrict or otherwise alter the Grantor's rights to maintain, repair, reconstruct and otherwise use its power canal or by means of flooding or flowing of water, ice or other materials to deposit such water, ice or other materials along, over, under and across the Easement Area.

The rights granted herein shall be binding upon and inure to the benefit of the Grantor and the Grantee, their successors and assigns.

IN WITNESS WHEREOF, the said WESTERN MASSACHUSETTS ELECTRIC COMPANY has caused its corporate seal to be affixed and these presents to be signed and acknowledged in its name and behalf by Harrie R. Nims one of its Vice Presidents and C. Thayer Browne its Treasurer as of the 25th day of May, 1988.

166

WESTERN MASSACHUSETTS ELECTRIC COMPANY

By _____
Harrie R. Nims,
Its Vice President

By _____
C. Thayer Browne
Its Treasurer

By _____
Cheryl N. Grisé
Its Assistant Clerk

STATE OF CONNECTICUT)
) ss. MERIDEN MAY 25, 1988
COUNTY OF NEW HAVEN)

On this 25TH day of MAY, 1988 before me, the undersigned officer, personally appeared Harrie R. Nims, who acknowledged himself to be one of the Vice Presidents of Western Massachusetts Electric Company, a corporation, and that he, as such officer, being authorized so to do, executed the foregoing instrument for the purposes therein contained, by signing the name of the corporation as the free act and deed of said corporation.

In Witness Whereof, I hereunto set my hand and official seal.

Barbara C. Bartalotta
Notary Public BARBARA C. BARTALOTTA
My Commission Expires: MARCH 31, 1991

STATE OF CONNECTICUT)
) ss.
COUNTY OF)

On this 25TH day of May, 1988, before me, the undersigned officer, personally appeared C. Thayer Browne, who acknowledged himself to be the Treasurer of Western Massachusetts Electric Company, a corporation, and that he, as such officer, being authorized so to do, executed the foregoing instrument for the purposes therein contained, by signing the name of the corporation as the free act and deed of said corporation.

In Witness Whereof, I hereunto set my hand and official seal.

Maureen J. Rothwell
Notary Public
My Commission Expires: 3/31/91

2,25/47

EXHIBIT A

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
OFFICE OF REALTY

TRACT DESCRIPTION

OF THE

WESTERN MASSACHUSETTS ELECTRIC COMPANY TRACTS

(10,R,M,M-1)

FRANKLIN COUNTY, MASSACHUSETTS

NORTHEAST ANADROMOUS FISH RESEARCH LABORATORY

CONTAINING 25.64 ACRES

REPORT PREPARED BY
Roger R. Tornstrom
Land Surveyor
December, 1986

Revised February, 1988

DESCRIPTION

OF THE

WESTERN MASSACHUSETTS ELECTRIC COMPANY TRACTS

(10,R,M,M-1)

FRANKLIN COUNTY, MASSACHUSETTS

The hereinafter-described four (4) tracts of land are located in the Commonwealth of Massachusetts, Franklin County, Town of Montague, situate approximately 1.5 miles southwesterly of Turners Falls, being a portion of the land conveyed to the Western Massachusetts Electric Company, a Massachusetts corporation, from the Turners Falls Power and Electric Company, a Massachusetts corporation, in a Deed dated December 30, 1942, recorded in Book 856, Page 174, on file at the Registry of Deeds of said County and Commonwealth at Greenfield, and being more particularly described as follows:

TRACT 10

BEGINNING at Corner 194, a standard USF&WS aluminum monument set and marked, "COR. 194 TR. 10 W.M.E.C. 1986", from which the center line intersection of 15th and "G" Streets, bears N 54° 01'E, 3,609 feet, more or less; thence S 16° 54' W, along land of the WESTERN MASSACHUSETTS ELECTRIC COMPANY TRACT (10R), 347.44 feet to Corner 193, a standard USF&WS aluminum monument set and marked, "COR. 193 TR. 10 W.M.E.C. 1986"; thence S 04° 16' W, along land of the WESTERN MASSACHUSETTS ELECTRIC COMPANY TRACT (10R), 175.00 feet to Corner 211, a standard USF&WS aluminum monument set and marked, "COR. 211 TR. 10 W.M.E.C. 1986"; thence S 04° 16' W, along land of the WESTERN MASSACHUSETTS ELECTRIC COMPANY TRACT (10M), 507.39 feet to Corner 205, a standard USF&WS aluminum monument set and marked, "COR. 205 TR.10 W.M.E.C. 1986"; thence S 04° 16 'W, along land of the WESTERN MASSACHUSETTS ELECTRIC COMPANY TRACT (10M), 100.47 feet to Corner 204, a standard USF&WS aluminum monument set and marked, "COR. 204 TR. 10 W.M.E.C. 1986"; thence S 04° 16' W, along land of the WESTERN MASSACHUSETTS ELECTRIC COMPANY TRACT (10M), 30.00 feet to Corner 199, a standard USF&WS aluminum monument set and marked, "COR. 199 TR.10 W.M.E.C. 1986"; thence S 01° 43' W, along land of the WESTERN MASSACHUSETTS ELECTRIC COMPANY TRACT (10M), 101.02 feet

to Corner 197, a standard USF&WS aluminum monument set and marked, "COR. 197 TR.10 W.M.E.C. 1986"; thence S 02° 24' E, along land of the WESTERN MASSACHUSETTS ELECTRIC COMPANY TRACT (10M), 103.59 feet to Corner 203, a standard USF&WS aluminum monument set and marked, "COR. 203 TR. 10 W.M.E.C. 1986"; thence S 87° 36' W, along land of the WESTERN MASSACHUSETTS ELECTRIC COMPANY TRACT (10M), 127.09 feet to Corner 174, a standard USF&WS aluminum monument set and marked, "COR. 174 TR. 10 W.M.E.C. 1986"; thence N 35° 20' W, along land of the WESTERN MASSACHUSETTS ELECTRIC COMPANY TRACT (10M-1), 100.00 feet to Corner 172, a standard USF&WS aluminum monument set and marked, "COR. 172 TR. 10 W.M.E.C. 1986"; thence N 59° 15' W, along other lands of the Western Massachusetts Electric Company, 193.68 feet to Corner 171, a standard USF&WS aluminum monument set and marked, "COR. 171 TR. 10 W.M.E.C. 1986"; thence N 62° 02' W, along other lands of the Western Massachusetts Electric Company, 166.63 feet to Corner 170, a standard USF&WS aluminum monument set and marked, "COR. 170 TR. 10 W.M.E.C. 1986"; thence N 71° 43' W, along other lands of the Western Massachusetts Electric Company, 311.79 feet to Corner 169, a standard USF&WS aluminum monument set and marked, "COR. 169 TR. 10 W.M.E.C. 1986"; thence N 08° 56' W, along other lands of the Western Massachusetts Electric Company, 111.66 feet to Corner 168, a standard USF&WS aluminum monument set and marked, "COR. 168 TR. 10 W.M.E.C. 1986"; thence N 33° 51' E, along other lands of the Western Massachusetts Electric Company, 184.74 feet to Corner 167, a standard USF&WS aluminum monument set and marked, "COR. 167, TR. 10 W.M.E.C. 1986"; thence N 15° 36' W, along other lands of the Western Massachusetts Electric Company, 134.74 feet to Corner 166, a standard USF&WS aluminum monument set and marked, "COR. 166 TR. 10 W.M.E.C. 1986"; thence N 06° 52' E, along other lands of the Western Massachusetts Electric Company, 202.01 feet to Corner 165, a standard USF&WS aluminum monument set and marked, "COR. 165 TR. 10 W.M.E.C. 1986", thence N 45° 48' E, along other lands of the Western Massachusetts Electric Company, 183.37 feet to Corner 164, a standard USF&WS aluminum monument set and marked, "COR. 164 TR. 10 W.M.E.C. 1986"; thence N 49° 58' E, along other lands of the Western Massachusetts Electric Company, 407.88 feet to Corner 163, a standard USF&WS aluminum monument set and marked, "COR. 163 TR. 10 W.M.E.C. 1986", thence N 57° 47' E, along other lands of the Western Massachusetts Electric Company, 283.42 feet to Corner 162, a standard USF&WS aluminum monument set and marked, "COR. 162 TR. 10 W.M.E.C. 1986"; thence S 54° 52' E, along other lands of the Western Massachusetts Electric Company, 241.69 feet to the PLACE OF BEGINNING, containing 20.0 acres, more or less.

TRACT 10R

Being a right-of-way, from the terminus of "G" Street to the WESTERN MASSACHUSETTS ELECTRIC COMPANY TRACT (10), through other lands of the Western Massachusetts Electric Company, the said right-of-way is more particularly described as follows:

BEGINNING at Corner 211, a standard USF&WS aluminum monument, also being Corner 211, of the WESTERN MASSACHUSETTS ELECTRIC COMPANY TRACT (10); thence N 04° 16' E, along land of the WESTERN MASSACHUSETTS ELECTRIC COMPANY TRACT (10), 175.00 feet to Corner 193, a standard USF&WS aluminum monument; thence N 16° 54' E along land of the WESTERN MASSACHUSETTS ELECTRIC COMPANY TRACT (10), 347.44 feet to Corner 194, a standard USF&WS aluminum monument; thence N 54° 52' W, along land of the WESTERN MASSACHUSETTS ELECTRIC COMPANY TRACT (10), 45.49 feet to Corner 235, a standard USF&WS aluminum monument set; thence N 45° 39' E, along other lands of the Western Massachusetts Electric Company, 420.45 feet to Corner 237, a standard USF&WS aluminum monument set; thence N 58° 25' E, along other lands of the Western Massachusetts Electric Company, 1,402.79 feet to Corner 238, a standard USF&WS aluminum monument set; thence N 71° 09' E, along other lands of the Western Massachusetts Electric Company, 270.50 feet to Corner 242, a standard USF&WS aluminum monument set; thence N 88° 51' E, along other lands of the Western Massachusetts Electric Company, 392.50 feet to Corner 221, a standard USF&WS aluminum monument set and marked, "COR. 221 W.M.E.C. TR.10R 1986," thence N 40° 16' E, along other lands of the Western Massachusetts Electric Company, in part, and land of Unknown Owners, in part, 1,238.10 feet to Corner 220, a standard USF&WS aluminum momument set and marked, "COR. 220 TR. 10R 1986", the said monument is also on the northwesterly edge of "G" Street and the southwesterly edge of 15th Street; thence S 49° 44' E, along the southwesterly edge of 15th Street, passing on line, a drill hole set in a large rock at 16.0 feet, continuing a total distance of 60.0 feet to Corner 219, a drill hole set in a large rock; thence N 40° 16' E, along the southeasterly edge of "G" Street, 60.0 feet to Corner 218, a 4" x 4" concrete monument found; thence S 49° 46' E, along land of Unknown Owners, passing on line, a 4" x 4" concrete monument found at 109.6 feet, continuing a total distance of 134.3 feet, more or less, to Corner 222, on the westerly normal operating water level of the power canal; thence Southwesterly, along the meanders of the westerly normal operating water level of the power canal, 4,200 feet, more or less, to Corner 223; thence N 85° 44' W, leaving the power canal, passing on line at 7 feet, more or less, a standard USF&WS aluminum monument set and marked, "W.C. 212 W.M.E.C. TR. 10R 1986", and along land of the WESTERN MASSACHUSETTS ELECTRIC COMPANY TRACT (10M), 52.0 feet, more or less, to the PLACE OF BEGINNING.

TRACT 10M

BEGINNING at Corner 211, a standard USF&WS aluminum monument marked, "COR. 211 TR. 10 W.M.E.C. 1986", being Corner 211, of the WESTERN MASSACHUSETTS ELECTRIC COMPANY TRACT (10R); thence S 85° 44' E, along land of the WESTERN MASSACHUSETTS ELECTRIC COMPANY TRACT (10R), 52.0 feet, more or less, to Corner 223, at the westerly normal operating water level of the power canal, from which a standard USF&WS aluminum monument marked, "W.C. 212 TR. 10R W.M.E.C. 1986", bears N 85° 44' W, 7 feet, more or less; thence Southerly, along the meanders of the westerly normal operating water level of the power canal, 533 feet, more

or less, to Corner 198, from which a standard USF&WS aluminum monument set and marked, "W. COR. 198 TR. 10M 1987" bears S 80° 09' W, 5 feet, more or less; thence S 80° 09' E, into the power canal, 100.00 feet to Corner 1010; thence S 08° 50' W, 100.02 feet to Corner 1011; thence N 80° 09' W, 100.00 feet to Corner 191, at the westerly normal operating water level of the power canal, from which a standard USF&WS aluminum monument set and marked, "W. COR. 191 TR. 10M 1987", bears N 80° 09' W, 2 feet, more or less; thence Southerly, along the westerly normal operating water level of the power canal, 920 feet, more or less, to Corner 1012, at the northerly edge of the wasteway; thence Westerly, along the northerly edge of the wasteway, 74 feet, more or less, to Corner 1013, being 20 feet, easterly of the east edge of the fishladder; thence Southerly, parallel to and 20 feet easterly, of the east edge of the fishladder, 148 feet, more or less, to Corner 1014, at the center line of the attraction water supply channel; thence Westerly, along the center line of the attraction water supply channel, 160 feet, more or less, to Corner 1015, at the easterly ordinary low water line of the Connecticut River; thence Northerly, along the easterly ordinary low water line of the Connecticut River, 148 feet, more or less, to Corner 196; thence N 36° 31' E, along other land of the Western Massachusetts Electric Company, 176.01 feet to Corner 180, a standard USF&WS aluminum monument set and marked, "COR. 180 TR. 10M 1987"; thence N 05° 11' E, along other land of the Western Massachusetts Electric Company, 395.70 feet to Corner 176, a standard USF&WS aluminum monumnet set and marked, "COR. 176 TR. 10M 1987"; thence N 22° 27' W, along other land of the Western Massachusetts Electric Company, 113.05 feet to Corner 174, a standard USF&WS aluminum monument marked, "COR. 174 TR. 10 W.M.E.C. 1986"; thence N 87° 36' E, along land of the WESTERN MASSACHUSETTS ELECTRIC COMPANY TRACT (10), 127.09 feet to Corner 203, a standard USF&WS aluminum monument marked, "COR. 203 TR. 10 W.M.E.C. 1986"; thence N 02° 24' W, along land of the WESTERN MASSACHUSETTS ELECTRIC COMPANY TRACT (10), 103.59 feet to Corner 197, a standard USF&WS aluminum monument marked, "COR. 197 TR. 10 W.M.E.C. 1986"; thence N 01° 53' E, along land of the WESTERN MASSACHUSETTS ELECTRIC COMPANY TRACT (10), 101.02 feet to Corner 199, a standard USF&WS aluminum monument marked, "COR. 199 TR. 10 W.M.E.C. 1986"; thence N 04° 16' E, along land of the WESTERN MASSACHUSETTS ELECTRIC COMPANY TRACT (10) passing on line, two (2) standard USF&WS aluminum monuments at 30.00 feet and marked, "COR. 204 TR. 10 W.M.E.C. 1986" and at 130.47 feet and marked, "COR. 205 TR. 10 W.M.E.C. 1986", continuing a total distance of 637.86 feet to the PLACE OF BEGINNING, containing 5.16 acres, more or less.

TRACT 10M-1

BEGINNING at Corner 174, a standard USF&WS aluminum monument marked, "COR. 174 TR. 10 W.M.E.C. 1986", being Corner 174, of the WESTERN MASSACHUSETTS ELECTRIC COMPANY TRACTS (10,M); thence S 54° 40' W, along other land of the Western Massachusetts Electric Company, 191 feet, more or less, to Corner 1016, at the easterly ordinary low water line of the Connecticut River, from which a standard USF&WS aluminum monument set as a witness and

marked, "W. COR. 1016 MON. 175 TR. 10M1 1987", bears N 54° 40' E, 5 feet, more or less; thence Northwesterly, along the meanders of the easterly ordinary low water line of the Connecticut River, 104 feet, more or less, to Corner 1017, from which a standard USF&WS aluminum monumnet set as a witness and marked, "W. COR. 1017 MON. 173 TR. 10M1 1987" bears N 54° 40' E, 18 feet, more or less; thence N 54° 40' E, along other land of the Western Massachusetts Electric Company, 203 feet, more or less, to Corner 172, a standard USF&WS aluminum monument marked, "COR. 172 TR. 10 W.M.E.C. 1986"; thence S 35° 20' E, along land of the WESTERN MASSACHUSETTS ELECTRIC COMPANY TRACT (10), 100.00 feet to the PLACE OF BEGINNING, containing 0.48 acres, more or less.

The above-described four (4) tracts of land, containing, in the aggregate, 25.64 acres, more or less, are delineated on a map tracing designated WESTERN MASSACHUSETTS ELECTRIC COMPANY TRACTS (10,R,M,M-1) bearing date of December 12, 1986, revised February 25, 1988 of record in the files Department of the Interior. A print from that map tracing is attached.

Franklin ss. Rec'd for Record 3 Hr. 24 Min. P M. May 25, 1988