

Relicensing Study 3.3.5

EVALUATE DOWNSTREAM PASSAGE OF AMERICAN EEL

Initial Study Report Summary

Northfield Mountain Pumped Storage Project (No. 2485)
and Turners Falls Hydroelectric Project (No. 1889)

Prepared for:



Prepared by:



SEPTEMBER 2014

1.1 Study Summary and Consultation Record to Date

The primary goals of this study are to (1) obtain a better understanding of the timing and magnitude of adult, silver-phase American eel migration as it relates to environmental factors and operation of the Turners Falls and Northfield Mountain Projects; and (2) to characterize the potential impacts of the Turners Falls and Northfield Mountain Projects on the outmigration of silver eels. The potential impact of project operations on silver eel outmigrants will be studied using a combination of approaches, including hydroacoustics, radio telemetry, and HI-Z Turb'N tags (balloon tags).

Hydroacoustics will be utilized to monitor the timing, duration, and magnitude of adult eel outmigration at the forebay area of Cabot Station, the Gatehouse, and the Northfield Mountain Project intake (tailrace) from August 1 through October 31 2015 and 2016. As recommended by the Federal Energy Regulatory Commission (FERC) in its February 21, 2014 Study Plan Determination Letter (SPDL), conducting two seasons of hydroacoustic monitoring will allow for year-to-year variability to be addressed and provide more reliable information to understand presence, migration timing, passage route utilization, and entrainment at the Northfield Mountain Project. The proper number, location, and orientation of the split-beam transducers to optimize spatial coverage, as described below under Task 1, was determined in August 2014.

Radio telemetry techniques will be employed to assess downstream passage and migration delays at the Turners Falls and Northfield Mountain Projects. For the Turners Falls Project, the study will determine the proportion of tagged eel passing via spillways, gates, turbines, and the existing fish bypass at Cabot Station and/or Station No. 1. For the Northfield Mountain Project, the study will determine the proportion of tagged eel entrained into the intake. As recommended by FERC in its SPDL, a radio telemetry receiver and antenna will also be deployed in the Northfield Mountain Upper Reservoir to assess entrainment of tagged fish at the Northfield Mountain intake. Data collected at this antenna site will allow for a more accurate determination of entrainment and compliment hydroacoustic and telemetry data collected at the intake/tailrace.

In addition, a radio antenna will be located upstream of the Gatehouse to assess potential passage delay and milling near the Gatehouse. Field testing to ensure the adequacy and reliability of antenna coverage in this area was conducted in August 2014 and is described below under Task 2.

Tagged fish will be tracked from a boat or from shore in river reaches between release sites and 5 km downstream of Cabot Station at least twice per week during and after releases to confirm routes and fates of passed fish, or fish lost to follow-up. Tracking will continue until the tagged eels leave the study area or water temperatures reach 5°C. Movement rates (time between release and passage) of eels passing the projects by various routes will also be quantified. Eels will be collected at the Cabot or Holyoke Canal bypass sampler during the migratory season (late-August to mid-October) and affixed with 90-day battery life transmitters.

Balloon tags will be used to determine rates of survival for fish entrained through representative turbines at Station No. 1 (one of the larger and the smaller turbine) and Cabot Station (one turbine; the turbines are identical), and for those that pass over the dam via the bascule gates and tainter gates. The turbine survival study will be conducted under near best efficiency conditions, which are representative of the typical turbine operating conditions during the August through October 2015 period.

This fieldwork portion of this study will commence in 2015 as FERC requested a one-year delay in schedule due to the timing of the decommissioning of the Vermont Yankee Nuclear Power Plant located upstream of the Northfield Mountain Project.

In FERC’s February 21, 2014 SPDL it states: *“Therefore, as discussed in study 3.3.3 above, we recommend that FirstLight consult with the FWS, MADFW, and the NMFS and establish the typical operating condition of each test turbine evaluated during this study. FirstLight should provide the results of this consultation and file them for Commission approval with the Initial Study Report in September 2014. FirstLight should consider comments received and if recommendations are not adopted, the filing should provide FirstLight’s reasons based on project-specific information. Upon filing of the Initial Study Report, stakeholders are provided an opportunity for comment pursuant to section 5.15(c) of the Commission’s regulations.”*

On September 3, 2014 ([Appendix A](#)) FirstLight sent consultation correspondence to the agencies and stakeholders describing best efficiency conditions and verified that the Cabot units and No. 1 are typically operated at or near best efficiency.

On September 4, 2014 ([Appendix A](#)) National Marine Fisheries Service (NMFS), United States Fish and Wildlife Service (USFWS) and Trout Unlimited (TU) replied and requested graphical depiction of the past 5 years of operational data during the study period (August 15 through October). Data was requested in MW and cfs.

A modified study plan is included in [Appendix B](#).

1.2 Study Progress Summary

Task 1: Evaluate Timing of Downstream Migratory Movements

In order to optimize the split beam transducers spatial coverage of the targeted areas, field testing and calibration was preliminarily performed in August 2014.

Task 2: Assessment of Downstream Passage of American Eel

Field testing of the telemetry arrays was performed on July 15 and 16, 2014. The objective of the preliminary evaluations was to investigate the feasibility of using radiotelemetry methods to monitor locations identified in the Revised Study Plan (RSP). The evaluation included those proposed monitoring locations that span large distances (i.e., wide sections of the river) to ensure that the proposed equipment will detect tagged study fish as they migrate through the study area. The range testing was conducted using a Lotek SRX 400 receiver and 4-element yagi antenna and a test tag with the following parameters:

- Frequency 149.320
- Width - 12mm
- Length - 40mm
- Mass - 8g
- Apparent mass in water - 3.5g

The test tag was deployed using a fishing pole and float to set the depth of the tag at approximately 5 ft. Water quality data were collected at the time of the testing including temperature, dissolved oxygen (DO), pH and conductivity. Conductivity in particular affects the radio signal transmitted by the tag and will affect the range of the monitoring system. The conductivity of the Connecticut River was 139 $\mu\text{S/L}$ at the time of testing (July 15, 2014) and 88 $\mu\text{S/L}$ within the Deerfield confluence (July 16, 2014).

Range testing was conducted at the following location:

- Shearer Farms (RM 127.5),
- Northfield Mountain Project Intake (RM 127),

- Northfield Mountain Project Gill Bank (RM 126.5),
- Turners Falls Impoundment (RM 122),
- Station No. 1 Tailrace (RM 121),
- Rawson Island (RM 120.5),
- Cabot Station Tailrace (RM 120)
- Deerfield River Confluence (RM 119.5), and
- Montague Wastewater (RM 119.5)

The analysis of the range testing is ongoing but a preliminary review revealed that the monitoring stations as proposed in the RSP will be adequate to monitor fish movement through the study area with one exception. An additional monitoring station at the Shearer Farms location will be necessary to monitor the full width of the river. This location will be monitored with two Lotek SRX 400 receivers and yagi antennas.

Though the monitoring location proposed at the Red Cliffe Canoe Club (RM 86.5, upstream of Holyoke Dam) was not tested in the evaluation, given the width of the river at the location (~1200 ft), it is anticipated that an additional receiver station, one on each side of the river, may be required to monitor the full width of the river. This area will be monitored using two Lotek SRX 400 receivers and yagi antennas.

Radio noise information is being collected in 2014 at Cabot Station to help determine which frequencies are best suited for use in the study. The frequencies used in the study (between 148 and 152 Mhz) will be selected to avoid high-noise frequencies, and to coordinate with the TransCanada studies. Noise data collection for this effort is ongoing and it is anticipated that analysis of the data will be completed prior to purchasing tags.

Task 2a: Northfield Mountain Route Selection Study

Range testing was completed as described above.

Task 2b: Turners Falls Dam Route Selection Study

Range testing was completed as described above.

Task 2c: Mobile Tracking

Mobile tracking will occur as part of the field studies, which will commence in 2015.

Task 3: Data Management and Analysis

Data will be collected from the field and analyzed following the completion of field studies.

Task 4: Turbine and Dam Passage Survival

FirstLight has confirmed that near best efficiency conditions are representative of typical operating conditions during the silver eel outmigration season (August-October). Turbine conditions on the dates of testing will be recorded and included in the Final Study Report.

Task 5: Reporting

A final report will be completed in March 2017 per the Federal Energy Regulatory Commission's Study Plan Determination Letter.

1.3 Variances from Study Plan and Schedule

To date there are no variances from the RSP.

1.4 Remaining Activities

- Conduct field studies in 2015 and repeat hydroacoustic monitoring (Task 1) and analysis of data in 2016.
- File Final Study Report.

Appendix A

Consultation Record

Consultation Correspondence

Appendix A

September 3, 2014

To: John Warner, Melissa Grader, Ken Sprankle, William McDavitt, Jessica Pruden, Don Pugh, Andrea Donlon, Katie Kennedy, Ken Hogan, Mark Wamser, John Howard, Robert Stira

From: Chris Tomichek

Subject: Operational Conditions During Turbine Survival Testing

Study Plans 3.3.3, *Evaluate Downstream Passage of Juvenile American Shad* and 3.3.5 *Evaluate Downstream Passage of American Eels* both include turbine survival testing. FirstLight proposed to conduct this study “at or near best efficiency conditions.” FERC’s February 21, 2014 Study Plan Determination Letter points out that FirstLight did not indicate that this is the typical operational scenario for the turbines during the outmigration season (August 15 through October). FERC indicated to ensure data collected through the turbine juvenile shad/adult eel survival study are representative of typical turbine operating conditions during the outmigration that FirstLight consult with the FWS, MADFW, and the NMFS and establish the typical operating condition of each test turbine evaluated during the out-migration season. FERC required FirstLight to provide the results of the consultation and file them for FERC approval with its Initial Study Report on September 15, 2014.

FirstLight typically runs the Cabot units (all 6 units are identical) at an output of 10.3 Mw. There are some exceptions when units could be run at less than 10.3 Mw, but they are uncommon. One exception would be at times of low river flow just before the minimum flow releases are switched to Station No. 1. At times like this, operators may decide to run one unit at Cabot at less than 10.3 Mw rather than put No. 1 units online, depending on other factors.

At No.1 Station, the units are run either fully on or off. At times when available flow exceeds Cabot’s capacity, if the units at No. 1 are run, they are run at full output. Individual units are not run at intermediate outputs. Individual units may be turned off at extremely low river flow, when inflow to the Turners Project is less than the required minimum flow.

This email is to confirm that FirstLight typically operates their Units at or near best efficiency conditions. We would greatly appreciate your feedback by September 9, 2014. Please let me know if you have any comments or questions.

September, 4, 2014

To: John Warner, Melissa Grader, Ken Sprankle, Jessica Pruden, Don Pugh, Andrea Donlon, Katie Kennedy, Ken Hogan, Mark Wamser, John Howard, Robert Stira, Chris Tomichek

From William McDavitt

Subject: Re: Operational Conditions During Turbine Survival Testing

Chris,

It would be good to present "typical turbine operating conditions" during the outmigration season with some graphs and a narrative and then some sort of graphical depiction and narrative of the operating conditions during the study would be quite helpful. Being able to understand the operating conditions during the study and how far off of 'typical' these conditions are is information that I would find helpful in my evaluation. Being able to discern bias in the results, positively or negatively, is information that I think would be helpful for all stakeholders.

-Bill

September, 4, 2014

To: John Warner, William McDavitt, Ken Sprankle, Jessica Pruden, Don Pugh, Andrea Donlon, Katie Kennedy, Ken Hogan, Mark Wamser, John Howard, Robert Stira, Chris Tomichek

From Melissa Grader

Subject: Re: Operational Conditions During Turbine Survival Testing

To be a little more specific, we would either like to have actual operational data for Cabot Station for the past 5 years (hourly) for the outmigration season (Aug. through November) so that we can evaluate how often the station is operating at 10.3 MW versus other generation levels - or, if you want to crunch the numbers, then just provide us with graphical representations of those data.

This would be to better understand what you mean by "typically."

Thanks!

September, 4, 2014

To: John Warner, William McDavitt, Ken Sprankle, Jessica Pruden, Melissa Grader, Andrea Donlon, Katie Kennedy, Ken Hogan, Mark Wamser, John Howard, Robert Stira, Chris Tomichek

From Don Pugh

Subject: Re: Operational Conditions During Turbine Survival Testing

Data in cfs and MW, please.

Appendix B

Modified Study Plan

3.3.5 Evaluate Downstream Passage of American Eel

General Description of Proposed Studies

The USFWS, NHFG, MDFW, NOAA, VTDEC, TU, and CRWC have requested two specific studies regarding downstream passage of adult American eel. The first study request was for a timing evaluation of downstream migratory movements of American eel on the mainstem Connecticut River. The second study request was for an assessment of downstream American eel passage at the Turners Falls Project and Northfield Mountain Projects. The study proposed herein will use radiotelemetry and hydroacoustic methods to investigate the timing of silver phase eel outmigration in the Connecticut River in the Project area and routes of passage through the Projects. Additionally, HI-Z Turb'N tags will be used to empirically determine rates of survival for eels entrained at Station No. 1 and Cabot Station and to determine spill survival over the dam.

Study Goals and Objectives (18 CFR § 5.11(d)(1))

The goals of these studies are to:

1. Better understand migration timing of adult, silver-phase American eel as it relates to environmental factors and operations of the Turners Falls Project and Northfield Mountain Project.
2. Collect information to determine the impact of the Turners Falls Project and Northfield Mountain Project on the outmigration of silver eel in the Connecticut River.

Specific objectives of these studies are to:

1. Characterize the general migratory timing and presence of adult, silver-phase American eel migrating past the Turners Falls Project and Northfield Mountain Project relative to environmental factors and operations.
2. Quantify movement rates and proportion of eel passing downstream via various passage routes at the Turners Falls and Northfield Mountain Projects. For the Northfield Mountain Project, the study will evaluate the proportion of eel entrained into the intake. For the Turners Falls Project, the study will evaluate the proportion of eel passing via the available routes of passage.
3. Evaluate survival of adult silver eel passed at the available routes of passage at the Turners Falls complex.

Resource Management Goals of Agencies/Tribes with Jurisdiction over Resource (18 CFR § 5.11(d)(2))

Based on management plans developed by the ASMFC and the CRASC, the resource management goals identified by the commenting agencies are to:

- Ensure PME measures are commensurate with Project effects and help meet regional fish and wildlife objectives for the basin.
- Conserve, protect, and enhance the habitats for fish, wildlife, and plants that continue to be affected by the Project.

Specific goals with respect to downstream passage of American eel are to:

- Minimize current and potential negative project operation effects that could hinder management goals and objectives.
- Minimize project-related sources of downstream passage injury, stress, and mortality in order to maximize the number of silver eel migrating to the spawning grounds.

Existing Information and Need for Additional Information (18 CFR § 5.11(d)(3))

According to the commenting agencies, data on the timing of downstream migratory movements and rates of American eel in the mainstem Connecticut River are sparse and relatively incomplete. Preliminary data on the presence of “eel-sized” acoustic targets have been collected ([Haro et al., 1999](#)) within the Cabot Station forebay, supported by video monitoring at the Cabot Station downstream fish bypass. This was a short-term study, with acoustic monitoring performed between 17 September and 5 October and video monitoring conducted between 18 September and 22 October. Some daily monitoring of the downstream fish bypass at the Holyoke Dam (canal louver array) was performed in 2004 and 2005 ([Kleinschmidt Associates, 2005; 2006; Normandeau Associates, 2007](#)); these studies also were of relatively short duration (spanning from October 5 to November 10 in 2004 and September 9 to November 11 in 2005) and the sampler was only operated at night

As discussed in the PAD, 2-D and 3-D telemetry studies were conducted at Cabot Station in 1996, 1997, 2002 and 2003. Results of those studies indicate that a significant proportion of eel entering the Cabot forebay become entrained through the Station turbines (90% in 2002, 100% in 2003; [Brown, 2005; Brown et al., 2009](#)). The PAD notes that the study done in 2003 determined that 15 of the 29 test eel were detected at the Hadley Falls Station. However, that study was not designed to assess turbine mortality. The approach velocity at the Cabot Station racks is approximately 2.0 feet per second at maximum hydraulic capacity. At Station No. 1, the racks have 2.6-inch clear spacing and an approach velocity of 1.2 feet per second. The intake at the Northfield Mountain Project has 48-foot-deep trash racks with six-inch clear spacing over the intake and an approach velocity of 3.5 feet per second at full pumping capacity (15,000 cfs).

To date, no directed studies of eel mortality at Cabot Station or eel entrainment or mortality at either Station No. 1 or the Northfield Mountain facility have been conducted.

Existing research and literature on the American eel relevant to these proceedings includes the following:

Brown, L.S. (2005). Characterizing the downstream passage behavior of silver phase American eel at a small hydroelectric facility. M.Sc. Thesis, Department of Natural Resource Conservation, University of Massachusetts. Amherst, Massachusetts: University of Massachusetts.

Brown, L., A. Haro, and T. Castro-Santos. (2009). Three-dimensional movement of silverphase American eel in the forebay of a small hydroelectric facility. In J. Casselman et al. (Eds.), *Eel at the Edge: Science, Status, and Conservation Concerns* (pages 277-291). Bethesda, MD: American Fisheries Society.

Electric Power Research Institute (EPRI). (2001). Review and documentation of research and technologies on passage and protection of downstream migrating catadromous eel at hydroelectric facilities. EPRI Technical Report No. 1000730, Palo Alto, California 270 pp.

- Haro, A. (2003). Downstream migration of silver-phase anguillideel. Pages 215-222 in: Aida, K., K. Tsukamoto, and K. Yamauchi, eds. *Eel Biology*. Springer, Tokyo.
- Haro, A., D. Degan, J. Horne, B. Kulik, and J. Boubée. (1999). An investigation of the feasibility of employing hydroacoustic monitoring as a means to detect the presence and movement of large, adult eel (Genus *Anguilla*). S. O. Conte Anadromous Fish Research Center Internal Report No. 99-01. Turners Falls, Massachusetts. 36 pp.
- Kleinschmidt Associates. (2005). *Factors influencing the timing of emigration of silver-phase American Eel, Anguilla rostrata, in the Connecticut River at Holyoke MA*. Submitted to the City of Holyoke, Holyoke Gas and Electric Department.
- Kleinschmidt Associates. (2006). *Holyoke Project (FERC No. 2004) silver-phased American eel flow priority plan*. Submitted to the City of Holyoke, Holyoke Gas and Electric Department. 51 pp.
- Normandeau Associates, Inc. (2007). *American eel emigration approach and downstream passage routes at the Holyoke Project, 2006*. Submitted to the City of Holyoke, Holyoke Gas and Electric Department. Final report. Westmoreland, New Hampshire: Normandeau Associates, Inc.,

Project Nexus (18 CFR § 5.11(d)(4))

Project operations may directly or indirectly affect eel outmigration in the fall through entrainment, rate of movement, injury, or mortality. Baseline information related to the timing and passage of outmigrating eel will allow stakeholders to assess project-related effects on eel migratory success and survival.

Methodology (18 CFR § 5.11(b)(1), (d)(5)-(6))

Information will be collected to assess potential impacts to adult eel outmigrants by project operations by a combination of approaches including hydroacoustic and radio telemetry, and the use of HI-Z Turb’N tags. The study objectives will be met by a tasked approach and are anticipated to occur in 2014.

Task 1: Evaluate Timing of Downstream Migratory Movements

The timing, duration, and magnitude of adult eel migration at the Turners Fall Project will be evaluated over a range of existing and operational conditions. Hydroacoustics will be deployed in the forebay area at Cabot Station, at the Gatehouse and the Northfield Mountain Project intake (August through October). An array of split beam transducers will be deployed to provide sufficient coverage of the cross-sectional targeted areas. The exact location and number of transducers, and orientation will be determined prior to the commencement of the survey during reconnaissance and test deployment, but will be established to optimize spatial coverage. To the extent possible, transducers will be mounted in areas of limited turbulence and ambient noise and away from eddies or other hydraulics where fish “milling” would occur. Ideally transducers would be mounted as close to the target area as possible. A summary of the telemetry array range testing and calibration will be included in the ISR.

Data will be recorded and archived continuously; however at the Northfield Mountain intake, only data recorded during 1 hour before and during pumpback mode will be analyzed. Depending on the configuration of the system and the target area, fish moving in the direction of the target area, fish size, or other sampled parameters can potentially be used to identify acoustic targets corresponding to adult eels. Acoustic targets can be filtered by size and supporting data used to apportion the number of fish by size class. Current plans are to have the hydroacoustic expert on site on August 13, 2013.

Data will be recorded by an onsite data logger. Transducers will be inspected and serviced by a qualified technician on a weekly basis, and data will be remotely downloaded and reviewed at least once per week during sampling to qualitatively view trends, and to ensure the system is functioning properly. During analysis, echo data will be analyzed using standard analytical tools such as Echoview ® software, and temporally related to concurrent station operation, water temperature, climatic conditions and Connecticut River flow. Data will be displayed in both tabular and graphic form, and include hourly daily, monthly and full season estimates. To the extent possible data output will also show patterns of spatial distribution of targets in the intake area. Data from the hydroacoustics will provide information on the timing, frequency and magnitude of the migration, as well as estimates of adult eel entering to and existing in the Canal and estimates of the numbers entrained at the Northfield Mountain Project. Eel outmigration through the downstream bypass will be sampled concurrently. Concurrent bypass sampling will be conducted over several discreet events (12 to 18) to ground truth the hydroacoustic data and compare the percent of eels passing via the Cabot sampler and Cabot Station. To address the potential year-to-year variability of downstream silver eel migrations, Task 1 will be conducted for two consecutive study seasons between August 1 and October 31.

Task 2: Assessment of Downstream Passage of American Eel

FirstLight will assess downstream passage and entrainment survival of adult American eel through use of radio-telemetry techniques.

FirstLight will use radio telemetry techniques to monitor adult downstream eel passage at the Turners Falls Project and Northfield Mountain Project. For the Northfield Mountain Project, the study will evaluate the proportion of tagged eel entrained into the intake, as well as in the upper reservoir. For the Turners Falls Project, the study will evaluate the proportion of eel passing via spillways, gates, turbines, and the existing fish bypass at Cabot Station and/or Station No. 1. The route of passage study will be designed with the use of motion sensor telemetry tags that will give researchers an indication of passage-induced mortality.¹ This phase of the study will involve systematic releases of radio-tagged silver phase eels at strategic points above areas of interest to assess general routes of passage (i.e., via spill, fish passageways, or turbines).

Radio transmitters will transmit on several frequencies and are anticipated to range between 2 and 4 frequencies within the 150 to 151 megahertz band and will be uniquely coded to allow for individual fish identification. Transmitters will be supplied by Sigma Eight Inc. and will allow for in-field coding should ambient radio noise preclude the use of any particular frequency and code combination. The transmitters will employ a motion sensor and be configured such that the 2 second burst interval shifts randomly to minimize repeated collision of tags on the same frequency. FirstLight and TransCanada will consult before purchasing tags to ensure all radio telemetry receivers at the Projects can detect them

Emigrating silver phase eels will be collected at the Cabot bypass sampler or the Holyoke Canal bypass sampler. Eels selected for tagging will meet morphometric (e.g., eye diameter relative to body size - Pankhurst Index of approximately 6.5 or greater) criteria to ensure they are migrant silver phased eels. Collections will be made within the migratory season (late August to mid-October), and eels will be tagged and released within 21 days of collection.² In addition, project operation (flows, levels, gate

¹For example, if an eel goes into an immobile state for a period of 36 hours, the tag's code will be programmed to switch signal transmission patterns (e.g., to a different code or different burst rate).

² The timing of collection, tagging, and release will be entirely dependent on migratory patterns and weather/river conditions. All tagged eel will be released at night during inclement weather or with inclement weather pending to increase the likelihood that eel will move soon after release. Though FirstLight will target a seven-day hold period, riverine conditions may not be adequate for release, and therefore hold times may last longer than seven days.

openings, number of units operating and operation level) and environmental conditions (river flow, water temperature, air temperature, and moon phase and precipitation amounts) will be recorded throughout the duration of the studies.

Task 2a: Northfield Mountain Route Selection Study

Groups of eels will be tagged and released approximately 5 km upstream of the Northfield Mountain tailrace. Tagged eels (n = 72) will be released on 8 nights (4 nights at 3 unit operation and 4 nights at 4 unit operation) with three releases per night (at dusk, two hours later and two hours after that) and 3 tagged fish per release. The proposed telemetry receiver locations and equipment are listed on Table 3.3.5-1. An adaptive release strategy will be used to target eels passing Northfield when pumps are running.

Task 2b: Turners Falls Dam Route Selection Study

Groups of eels will be tagged and released approximately 3 km upstream of the Turners Falls Dam. Groups of eels will be released over various spill conditions including no spill and will be determined based on results of the instream flow study (Study No. 3.3.1). A total of 30 tagged eels will be released at dusk on the day prior to target flow conditions in small multiple batches. The proposed telemetry receiver locations and equipment are listed on [Table 3.3.5-1](#). An additional 30 eels will be released in the canal.

Table 3.3.5-1: Location and types of telemetry receivers proposed for the silver eel emigration study.

Location	RM	Receiver Station
Montague Wastewater	119.5	A Lotek SRX receiver with yagi antenna will monitor the full width of the River
Cabot Station Tailrace	120	Lotek SRX with yagi antenna—to monitor the full river width
Cabot Station Forebay	120	Two radio receivers will monitor the Forebay area; 1) Lotek or Orion with yagi antenna will monitor the full width of the canal immediately upstream of the Cabot station 2) Orion with dipole antenna will monitor the entrance to the Cabot downstream bypass.
Station 1 Forebay	121	A Lotek SRX or Orion with yagi antenna will monitor the full width of the intake canal
Station 1 Tailrace	121	A Lotek SRX or Orion with yagi antenna will monitor the tailrace area. Detection zone will monitor the full width of the bypass reach. A detection power analysis will differentiate those test fish that are attracted to the tailwater from those that continue upstream
Below Turners Falls Dam	122	Two Orion or Lotek SRX receivers with yagi antennas will

Migratory movements of silver eel have been noted after hold periods longer than seven days during several recent radio-telemetry studies at hydroelectric facilities in the northeast [(see FERC projects P-2364 (Abenaki), P-2365 (Anson), P-2325 (Weston)].

		monitor the area below the dam, one on either side of the river bank such that approach to the dam can be differentiated from either the right or left sides of the River
Upstream of Gatehouse	122	One or two Orion receivers with aerial Yagi or dropper antennas to assess migratory delays and milling
Upstream End of the Canal	122	A Lotek or Orion with a yagi antenna will monitor the full width of the canal at a location downstream of the Gatehouse in the upper canal to monitor fish entering the canal from upstream
Turners Falls Impoundment	122	A Lotek with a yagi antenna will monitor the full width of the impoundment
NMPS Gill Bank	126.5	A Lotek with a yagi antenna will monitor the full width of the impoundment
NMPS Intake	127	A Lotek or Orion with a yagi antenna will monitor the intake area
NMPS Upper Reservoir	127	One or two Orion receivers with aerial Yagi or dropper antennas to assess entrainment
Shearer Farms	127.5	A Lotek with a yagi antenna will monitor the full width of the impoundment

Task 2c: Mobile Tracking

Mobile tracking (i.e., via boat, vehicle, or by foot) in river reaches between release sites and 5 km downstream of Cabot Station will be performed at least twice per week and after releases to confirm routes and fates of passed fish, or fish lost to follow-up. Tracking will occur until the tagged eels leave the study area or water temperatures reach 5°C. Movement rates (time between release and passage) of eels passing the projects by various routes will also be quantified.

Tag pulse will likely be programmed at 2 second intervals with a battery life of at least 90 days. Prior to release of tagged eel, FirstLight will perform testing and range verification to minimize overlap of detection fields while maximizing detection range. As needed, beacon transmitters will be employed at strategic locations to provide a repeated data stamp during the study to verify receiver functionality.

Task 3: Data Management and Analysis

Data from hydroacoustic timing studies (Task 1) will be collected in the field and transferred to an electronic format. All data entry will be assured for quality. These data will be processed with Myriax Echoview or similar software. The data will be reduced by applying an intensity threshold that is representative of the target size and analyzed with an α , β -tracking algorithm, which identifies the series of echoes that were returned by an individual fish over successive pings. The tracking results will be reviewed on the echogram and exported as a database containing time, target strength, and 3-D positional information for each fish detected. An expansion factor will be calculated for each individual eel as a function of its effective beam width at the range it was observed. This effective beam width depends on the acoustic beam pattern and the size of the target. The expansion factor compensates for this differential detection probability.

Data from the adult eel telemetry study (Task 2) will be collected regularly from the field during the study periods (i.e., at 2 to 3 day intervals). Data will be archived and entered into an MS Access or MS Excel database for sorting and post-processing. All data entry will be reviewed for quality assurance. To the extent possible, routes of passage will be determined. Route determinations will be based on the sequence of individual eel detections at the antenna arrays. Additionally, route-specific survival will be determined

by analysis of the sensor tag data, which will indicate whether an eel has resumed typical migratory behavior after passing downstream or has not survived passage.

Task 4: Turbine and Dam Passage Survival

HI-Z Turb’N tags will be used to empirically determine rates of survival for eels entrained at Station No. 1 and Cabot Station and spill survival over the dam. As currently envisioned, a total of 150 tagged (Hi-Z and radio tagged) eels will be released into turbines. The tagged eels will be proportionally allocated by the number of different turbine types at Station No. 1 and Cabot Station. All six turbines at Cabot Station are similar type and hydraulic capacity so testing will be conducted at one turbine at Cabot Station as a representative unit. Data for that unit will be extrapolated to calculate a total station survival rate. Station No. 1 has five Francis style turbines. Four of the five turbines are similar in speed, hydraulic capacity (490 to 560 cfs) and one is smaller (140 cfs). Testing will be conducted at two turbines at Station No. 1 (at one to represent the four larger units and at the smaller capacity unit). Like Cabot, the data for the representative unit will be extrapolated to calculate a total survival rate for all four units and combined with the data for the smaller unit for a total station survival rate. Tests will be conducted by injecting tagged eel into the selected turbines at Cabot and No. 1 Stations at or near best efficiency hydraulic capacity conditions for each test unit which are representative of the typical turbine operating conditions during the August-October period. Fish will be recovered from the tailrace, examined for injuries and held for 48 hours to determine latent mortality. An additional 125 fish will be released above the dam to determine mortality due to passage at the bascule and tainter gates.

Task 5: Reporting

The hydroacoustic, radio telemetry and HI-Z Turb’N tag data will be analyzed relative to passage route(s) timing, frequency, magnitude and survival. Telemetry data from each fish will be portrayed graphically including movement and timing through the project area with passage route selection identified. Movements will be analyzed relative to environmental and operational parameters. For the entrainment task, survival through each turbine or spill gate tested will be calculated based on the number of tagged fish injected into a turbine or gate that are alive. All injuries will be reported. Total through-project survival will be calculated based on study results of the survival study, other related studies as well as operations data. This information will be compiled into a report and will include the methods used, results, a discussion and conclusions. It will include release numbers, locations and dates, fish length, weight, and morphometric criteria, river temperature at NMPS, canal, bypass and below Cabot Station,

Data use to develop the report will be made available to stakeholders upon request in digital form.

Level of Effort and Cost (18 CFR § 5.11(d)(6))

FirstLight believes the proposed level of effort is adequate to accurately assess the potential effects of the Projects on downstream passage and timing of adult eel in the investigation area. The estimated cost for this study is approximately between \$400,000 and \$500,000.

Study Schedule (18 CFR § 5.11(b)(2) and (c))

This fieldwork portion of this study will commence in 2015 as FERC requested a one-year delay in schedule due to the timing of the decommissioning of the Vermont Yankee Nuclear Power Plant located upstream of the NFMPS Project. FirstLight proposes to provide Stakeholders with a study report supplement to summarize downstream adult eel monitoring results in February 2016. Task 1, or the hydroacoustic component of this study, will be repeated from August 1 to October 31, 2016. FirstLight will file the Final Report on or before March 1, 2017 as indicated in the SPDL.