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# **REVISED STUDY PLAN**

## **FOR THE**

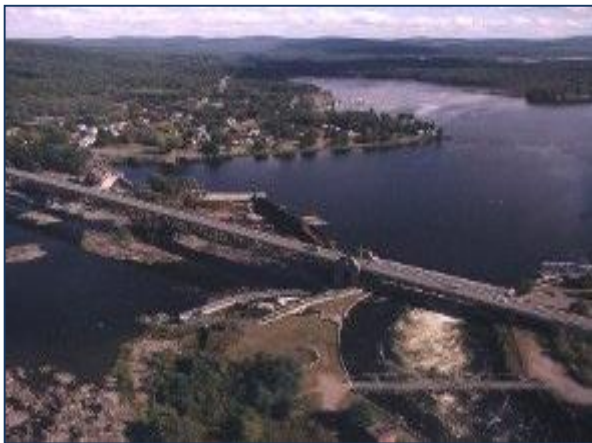
### **TURNERS FALLS HYDROELECTRIC PROJECT (NO. 1889)**

## **AND**

### **NORTHFIELD MOUNTAIN PUMPED STORAGE PROJECT (NO. 2485)**

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*Study 3.3.19 - Evaluate the Use of an Ultrasound Array to Facilitate Upstream Movement to Turners Falls Dam by Avoiding Cabot Station Tailrace*



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**FEBRUARY 2016**

*3.3.19 Evaluate the Use of an Ultrasound Array to Facilitate Upstream Movement to Turners Falls Dam by Avoiding Cabot Station Tailrace*

**Background**

FirstLight submitted a revised study plan (RSP) for Study No. 3.3.19 on August 14, 2013. In its February 21, 2014 Study Plan Determination for Aquatic Studies, FERC required FirstLight to modify Study No. 3.3.19 after consultation with stakeholders. FERC required that FirstLight include in its filing, copies of any comments, a discussion of how comments are addressed, and reasons for not adopting any recommendations. On January 13, 2016, FirstLight provided stakeholders with a draft modified RSP and requested comments on by January 26, 2016. Comments on the draft were received from the USFWS, MADFW, Don Pugh, Karl Meyer, and NMFS, and are attached in [Appendix A](#). As required by FERC, FirstLight responds to comments received on the draft and explains either how those comments were addressed in this updated RSP or why such comments were not adopted. FirstLight's responsiveness summary is attached in [Appendix B](#).

**General Description of Proposed Study**

An evaluation of the use of an ultrasound array to keep shad out of the Cabot Station tailrace and facilitate upstream movement of American shad to Turners Falls Dam was requested by USFWS, NHFG and CRWC.

The location of the proposed array would be in the area of the identified shortnose sturgeon spawning grounds. It would need to be operated during the sturgeon spawning season as the shad upstream migration and sturgeon spawning periods overlap. However shortnose sturgeon do not hear sounds in the frequency proposed for this study so they should not be disturbed by the ultrasound array. Staff from NMFS Protected Resources Division agreed that the ultrasound array proposed for this study would not disturb the shortnose sturgeon (J. Pruden, NMFS). Unlike most other fish species, it has been demonstrated that American shad (*Alosa sapidissima*), are able to detect sound up to 180 kHz ([Higgs et al. 2004](#)). Previously, it was proposed that ultrasound detection in shad involves swim bladder extensions; however, more recent work indicates that the utricle, an organ found in inner ear of some Clupeids, allows detection of ultrasonic stimulation ([Higgs et al. 2004](#)). The researchers speculate that clupeids are able to detect the ultrasonic clicks of one of their major predators, echolocating cetaceans. Evidence from other studies that attempted to produce behavioral avoidance by shad and blueback herring suggests that ultrasound may be effective stimulus ([Plachta & Popper, 2003](#), [Dunning & Gurshin, 2012](#)).

An evaluation of the use of an ultrasound array to deflect shad away from the Cabot Station tailrace and facilitate upstream movement to the Turners Falls Dam will be conducted in the spring of 2016. A potential alternative to the current configuration of fishways at the Turners Falls Project would be to minimize attraction to the Cabot ladder and operate a single fishway facility further upstream. This study would attempt to determine if use of ultrasound technology would be an effective method to minimize shad attraction to the Cabot ladder.

The study plan originally envisioned monitoring telemetered shad at the ultrasound array. However after further discussion with Alden Research Laboratory, Inc. (Alden) and Scientific Solutions, Inc. (SSI), it is now proposed to monitor shad using a DIDSON (Dual Frequency Identification Sonar) camera at the entrance of the Cabot ladder and also use the Cabot and Spillway fish ladder count information to determine the applicability of the ultrasound array to repel shad from entering the Cabot ladder. This approach will allow the sample group to consist of tens of thousands of shad instead of limiting it to a much smaller number of tagged fish. Telemetered shad will however be used in this study to determine if the shad moves

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upstream or back downstream after encountering the ultrasound array. This will be reported as a percentage upstream versus downstream.

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

The goal of this study is to determine if an ultrasound barrier could be used to repel adult shad from the Cabot Station tailrace and guide them into the bypass reach.

The objective of the study would be to establish a high frequency sound (ultrasound) array across the entire Cabot Station tailrace and determine the effect of the ensounded field on upstream migrating shad moving past Cabot Station.

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

In 1992, the Connecticut River Atlantic Salmon Commission (CRASC) developed a draft document titled: *A Management Plan for American Shad in the Connecticut River Basin*.

Management Objectives in the plan include the following:

Specific management objectives in the plan include the following: Achieve and sustain an adult population of 1.5 to 2 million individuals entering the mouth of the Connecticut River annually; achieve annual passage of 40 to 60% of the spawning run (based on a 5-year running average) at each successive upstream barrier on the Connecticut River mainstem; and maximize outmigrant survival for juvenile and spent adult shad.

The Atlantic States Marine Fisheries Commission, Amendment 3 to the Interstate Fishery Management Plan for Shad and River Herring (American Shad Management), approved in 2010, includes an objective to maximize the number of juvenile recruits emigrating from freshwater stock complexes.

Amendment 3 also includes the following recommendations for upstream passage:

- American shad must be able to locate and enter the passage facility with little effort and without stress.
- Where appropriate, improve upstream fish passage effectiveness through operational or structural modifications at impediments to migration.
- Fish that have ascended the passage facility should be guided/routed to an appropriate area so that they can continue upstream migration, and avoid being swept back downstream below the obstruction.

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

In spite of the extensive studies and many successes for some species of fish at some station intakes, as yet there is no one behavioral barrier or deterrent that is effective with all species and life stages of fish. Behavioral barriers are generally still considered experimental.

High frequency sound was used at the James A. Fitzpatrick power plant located on Lake Ontario, and was found to reduce impingement of alewife by more than 80 percent and its use was approved by the regulatory agencies. Similar avoidance by herring species was noted where sound was tested at hydroelectric sites.

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American shad and alewife belong to the same family, Clupeidae, and their reaction to high frequency sound may be similar. Information exists about adult shad avoidance of ultrasound. In field trials in the early 1980s to develop a guidance system for downstream-migrants in the First Level Canal of the Holyoke Canal System, adult shad avoided but were not well guided by an ultrasonic array. However, upstream migrants were guided well and even stopped entirely by the ensonified field ([Kynard & Taylor, 1984](#)). Creating an ensonified field caused adult shad to leave their preferred location in the river upstream of trashracks at Holyoke Dam as long as the sound system was on.

Blueback herring also avoided the ultrasound field and behaved similar to shad in the Holyoke Canal studies ([Kynard & Taylor, 1984](#)). Acoustic barriers have been used for migrating blueback herring on the Savannah River (Richard B. Russell Dam) and Santee River (St. Stephen fish lift) in South Carolina and emigrating blueback herring on the Mohawk River in New York (Crescent Project, FERC No. 4678; Vischer Ferry, FERC No. 4679). Evidence from many studies that attempted to produce behavioral avoidance by adult shad suggests that ultrasound is an effective stimulus ([Carlson & Popper, 1997](#)). Evidence suggests that shad and blueback herring may avoid the tailrace of Cabot Station if an ultrasound field was installed; however, simply repelling shad from the Cabot tailrace is not a satisfactory result, for this behavioral barrier to be successful the fish would also have to keep going upstream, without delay, as opposed to dropping down below Cabot.

### **Project Nexus (18 CFR § 5.11(d)(4))**

Studies to assess potential passage solutions are frequently conducted during relicensing proceedings. This study, coupled with the adult shad radio-telemetry study, can provide the information needed to select an approach to resolve upstream shad passage at the Turners Falls Project.

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

#### **Task 1: Ultrasound Deployment**

##### **1.1.1 Site Visit and Planning Meeting**

Alden and SSI will configure and install the ultrasonic deterrent system at Cabot Station as a method for repelling American shad adults away from the tailrace and the adjacent fish ladder entrance during the spring upstream spawning migration. [Figure 1](#) is the proposed configuration of the array based on site specific bathymetry and velocities. Alden and SSI engineers will attend a site visit and planning meeting to coordinate the installation of the sound system with FirstLight. The site visit will also allow Alden and SSI to take measurements and examine locations for installing transducers, running cables, and storing electronic equipment.

##### **1.1.2 Sound Field Modeling**

To determine the quantity and placement of sound transducers needed to produce the desired sound deterrent field in the vicinity of the Cabot Station tailrace and fish ladder entrance, SSI will develop and execute a predictive model to estimate the sound pressure fields of an initial transducer configuration and alternative configurations. Available data from existing and/or past applications of ultrasonic deterrents at water intakes will be used to identify frequency and sound pressure levels that have the greatest potential to repel upstream migrating shad from Cabot Station. Previous reviews of available information by Alden for other clients indicate that signal frequencies of 120 to 130 kHz and a minimum sound pressure level of 160 dB are required for effective deterrence of American shad. The goal will be to create a sound field that effectively repels shad from the Cabot Station and fish ladder entrance without impeding fish from continuing upstream into the bypass reach. The sound field model will utilize the nominal beam radiation pattern of the International Transducer Corporation ITC- 3046 transducer and will be based on

a simple ray trace method assuming iso-velocity (uniform sound velocity throughout the water column) and geometric spreading.

### **Sound System Assembly and Calibration**

Alden has a functional ultrasonic deterrent system (six transducers, cables, and amplifiers) that has been configured for operation as a behavioral deterrent for field evaluations at water intakes where target species include American shad, blueback herring, and alewife. SSI will assemble the components of Alden's system and initially test its operation and the output of each transducer at their lab facilities in New Hampshire. The sound system configuration installed at Cabot Station is expected to consist of three to five ITC-3046 transducers operating at a nominal frequency between 120 and 130 kHz. A single Instruments, Inc. L6 Power Amplifier will be used to drive the transducers either in a parallel configuration or in a burst sequential transmission (dependent on power amplifier limitations and study objectives). Alternate power amplifier configurations may be investigated depending on the ability to achieve the desired transducer source levels with the L6 amplifier. A PC-based (Labview) software application will be developed to generate drive signals and wavetrain sequences for automation of the sound system operation during the field evaluation.

Based on previous applications and research of ultrasonic deterrents with Alosine species, Alden will provide guidance to SSI regarding signal parameters such as the number and type of waveforms, pulse duration, and pulse repetition rate.

After assembly and initial operational testing and calibration is completed, the sound system will be bench tested by SSI in one of Alden's laboratory flumes prior to deployment at Cabot Station. The bench test will include a functional test of all hardware components to include verification of the transducer source levels as well as a software functionality test. SSI will provide Alden and FirstLight with written instructions and practical training for the operation of the sound system.

#### **1.1.3 Installation and Field Measurements**

Alden and SSI staff, with assistance from FirstLight, will install the sound system at Cabot Station at least one week prior to the initiation of the field evaluation of shad responses, which is currently scheduled for May 1, 2016. Alden will design and fabricate the transducer mounting systems. The design for the mounts will be developed in consultation with FirstLight. Additionally, a post-installation checkout of the sound system operation will be conducted by Alden and SSI and will include measurement of the sound pressure field in the Cabot Station tailrace and river channel. Sound will be measured at a low and a high generation, if there is not much difference, then there would be no need to measure other flows, otherwise a third flow will be measured. The sound field will be measured by suspending a hydrophone from a drifting boat and using a battery powered portable data acquisition system to record the voltage signals from the hydrophone. The measurement system will be synchronized to a GPS clock; a hand-held GPS will be used to record the position of the drifting boat during the survey. The duration of the field work to conduct the system installation and the sound field measurements is assumed to be five days. The installation and field measurements will be completed by April 29, 2016.



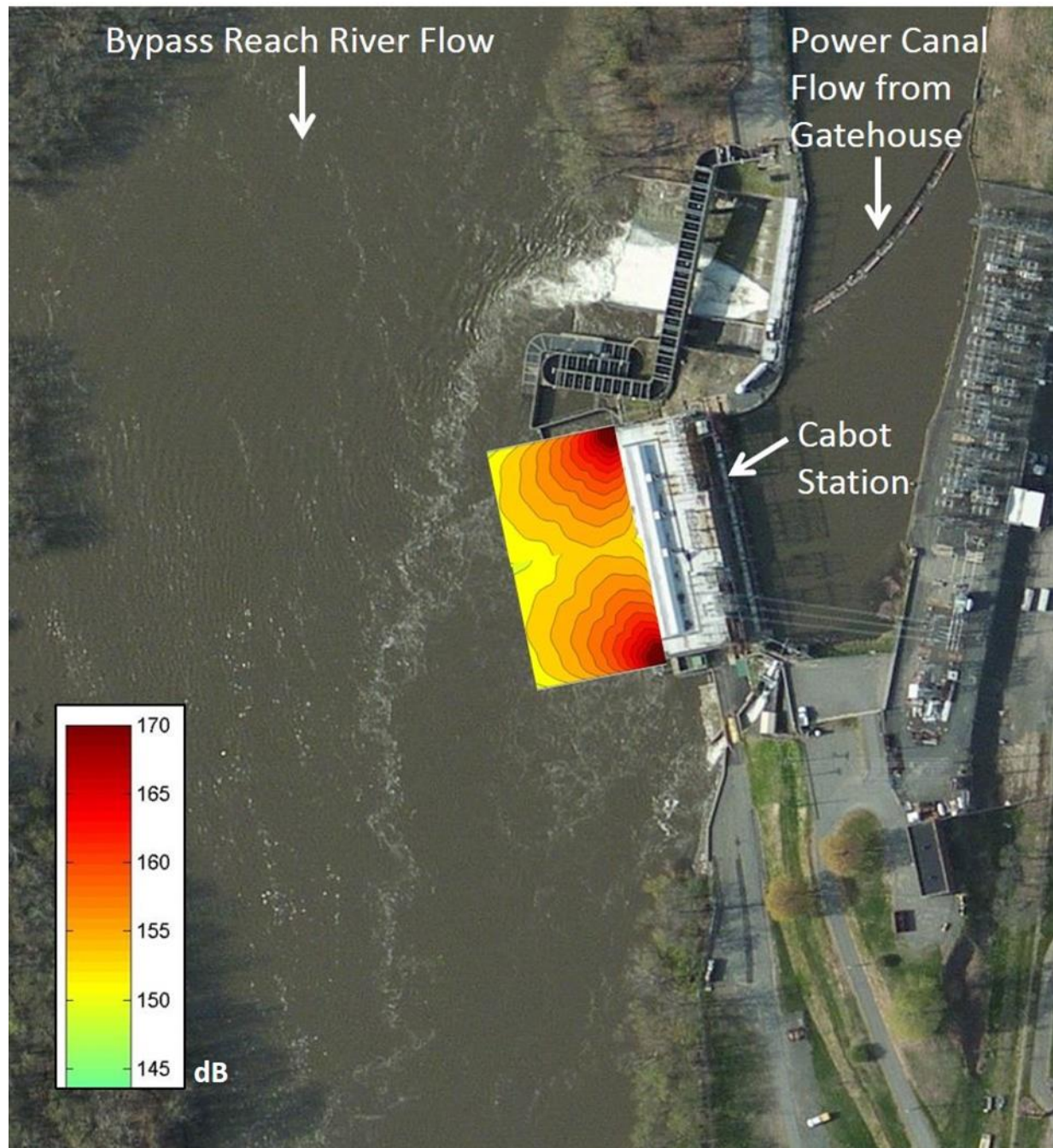


Figure 1. The proposed configuration of the array based on site specific bathymetry and velocities with projected sound pressure levels (dB). The actual configuration will be mapped before the start of the study.

## Task 2: Field Study

This study would establish a high frequency sound (ultrasound) array across the entire Cabot Station tailrace and determine the effect of the ensonified field on upstream migrating shad moving by Cabot Station. Bypass reach test flows during the study will include flows of 1,500 cfs, 2,500 cfs and 4,400 cfs. These flows will be released depending on river flow conditions. When possible, flows will alternate with the array on for one day then off for one day at 1,500 cfs, followed by one day on and one day off at 2,500 cfs, then one day on and one day off at 4,400 cfs. This sequence will be repeated throughout the study depending on river flow. The field study will include two components: a) DIDSON count of shad entering the Cabot fish ladder and b) detection of telemetered adult shad to determine their movements after they encounter the sound field.

A DIDSON camera will collect continuous data on the number of shad entering the Cabot ladder; however, since American shad move largely during daylight hours the DIDSON data analysis will be limited to the period the shad are likely to migrate. Two test treatments, array on and array off will be evaluated to determine the effectiveness of the ultrasound array at existing flow conditions. Testing for at least four weeks is planned. The ultrasound array will be either on or off for one or two full days (for 24 or 48 consecutive hours) to test the barrier.

The DIDSON camera will be tested and installed in an area of low turbulence on the wall in the area of the Cabot fish ladder at mid-depth using a unistrut to facilitate easy removal should cleaning or system maintenance be required. The DIDSON will be oriented perpendicular to the Cabot fishway intake alignment and aimed horizontal providing a large sampling area (beam angle 29° x 14°) at the entrance of the Cabot fish ladder. Data collected by the DIDSON will be written directly to a 5 GB external hard drive. The data is back up to an external hard drive once a week for archiving. It will also be networked and accessible via a Go to My PC account for real time remote status monitoring by the study team.

The Cabot and Spillway fishway entrance PIT readers will be turned on during the study as a back-up to the DIDSON and radio telemetry receivers.

To determine how the shad react to the ultrasound array, FirstLight will tag 118 adult migrating shad in May at Holyoke and release them to continue their upstream migration. As part of an evaluation for their new passage facilities at the Holyoke Dam, HG&E plans to release 182 tagged shad at Holyoke for a total of 290 shad available to encounter the array. Between the two studies and considering the fallback rates of 42% based on the 2015 FirstLight adult shad study which resulted in 125 of the 215 shad radio tagged and released at Holyoke being detected at the Turners Falls Project, it is estimated 100 shad may be detected at the ultrasound array ([Figure 2](#)).

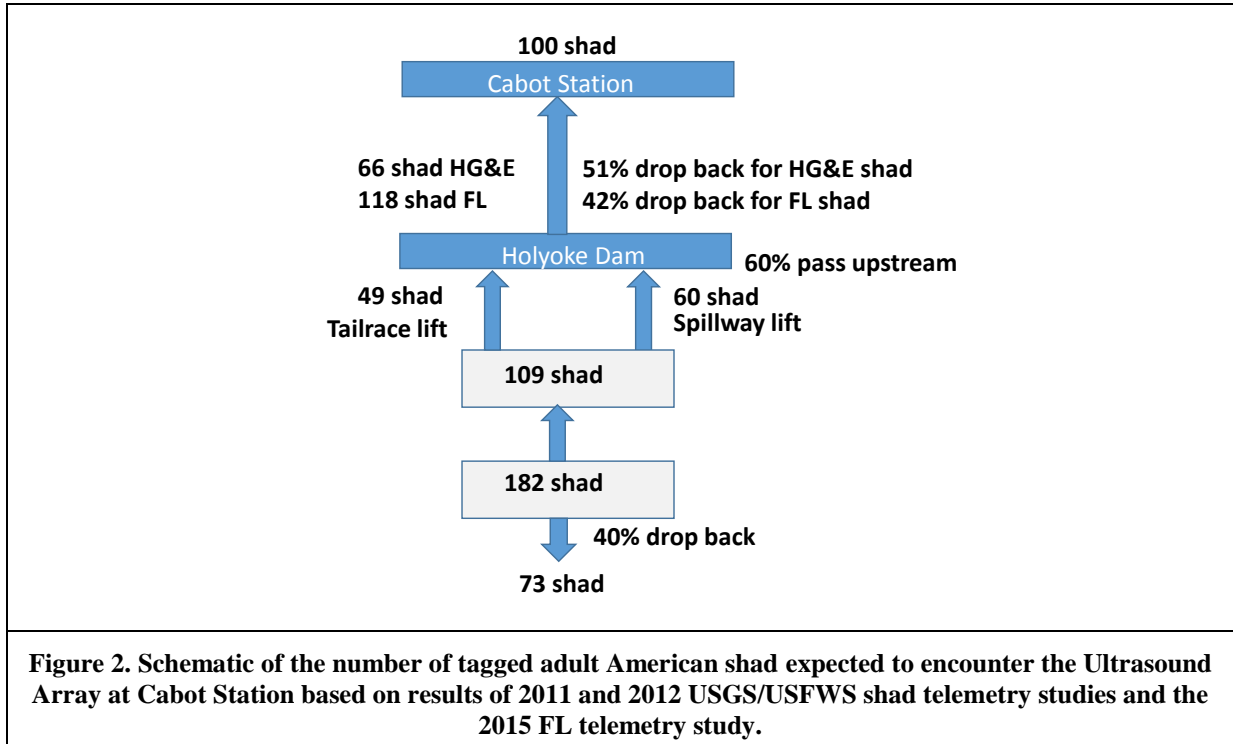
A total of 118 adult shad will be collected from the Holyoke Dam fish lift; a radio and a PIT tag will be inserted in each fish and released upstream of the Holyoke Dam. These 118 shad will be released in four batches at least 5 days apart. Actual release dates will be flexible and responsive to the shad run timing and river flow conditions.

Each test shad will be double tagged with a radio- and a PIT tag. The radio tags will be appropriate for esophageal implanation and sized approximately as follows: 26 mm length, 9.6 mm diameter, and 4 g weight. PIT tags size parameters will be length ~ 32mm, width ~ 3.65mm, and weight ~ 0.8g (in air).

Radio tags will transmit on several frequencies that are anticipated to range between 2 to 3 frequencies within the 148 to 151 megahertz band. The transmitters will employ a motion sensor and be configured such that the 2-second burst interval will shift randomly to minimize repeated collision of tags on the same

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frequency. The tag life will be no less than 90 days. PIT tags will be inserted intramuscularly. The total length, sex, and condition of each test shad will be recorded.



Tagged shad will be monitored using aerial Yagi antennas and dipoles. Antenna type and size will vary depending on site-specific constraints. All telemetry antennas will be used as either a singular fixed array or grouped together. Prior to the anticipated tagging of American shad, receivers and antennas will be set up at the Project for calibration and to assess the potential for interference due to electrical or mechanical noise sources. Frequencies that produce significant interference will not be used. As necessary, antenna placement, antenna shielding, etc. will be incorporated into the monitor station's installation to eliminate or reduce any uncontrollable effects due to site conditions.

Data-logging receivers will be connected to either singular antennas or multiple antennas grouped together. Date, time of day, tag frequency (*i.e.*, channel), tag pulse code (unique to each tag), signal strength, and detection location (*i.e.*, antenna number) will be stored for each signal reception. Data will be downloaded from receivers periodically.



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Ten receivers are proposed to be set up below, above and at the Cabot Station tailrace ([Figure 3](#)).

Monitoring Station ID	Location
1	Entrance to the Deerfield River (Yagi)
2	Montague Wastewater Treatment Plant (Yagi)
3	Downstream End of Smead Island (Yagi's)
4	Left Side of the Cabot Station Tailrace (Yagi)
5	Right Side of the Cabot Station Tailrace (Yagi)
6	Cabot Ladder Entrance (Dipole)
7	Upstream End of Smead Island (Yagi)
8	Bypass Reach, Downstream of Station 1 (Yagi)
9	Spillway Ladder Entrance (Dipole)
10	Spillway Ladder Vicinity (Yagi)

Environmental (temperature) and operational data<sup>1</sup> will be recorded and reported during each test period and used to analyze the data. The DIDSON counts, passage counts at both the Cabot and Spillway ladders and environmental/operational variables (water temperature, river flow) to understand which conditions if any, affect the results.

Ultrasound testing will be initiated once shad arrive at Cabot Station. After the first week of testing a progress email describing the preliminary results will be provided to stakeholders in case schedule adjustments are needed. The ultrasound array will be tested during the month of May and the schedule will be adjusted based on river conditions.

### Task 3: Study Report

Data collected in Task 1 and 2 will be analyzed to determine the effect of the ensonified field on upstream migrating shad. The number of radio-tagged fish and the number of fish detected with the DIDSON with the field on and off will be reported. The number of shad detected at the Cabot tailrace with the field on and off will be statistically compared with a log linear model ( $p \leq 0.05$ ). The slope of the regression model will indicate the success of the array. Environmental (water temperature, river flow) and operational data will be recorded and reported during each test period to understand which conditions are preferable for guiding migrating fish to the entrances.

A report will be prepared detailing methods, results, a discussion and conclusions. The report will be completed and filed with FERC by September 15, 2016.

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

The cost for the test would be \$200,000 to \$280,000. Costs will be related to rental, installation, and operation of the ultrasound system, analysis of data, and production of a final report.

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

American shad migrate up the river when water temperatures are generally between 12 and 20°C; spawning occurs from 14 to 23°C when river flow is generally declining from the spring peak with shad arriving at Cabot Station in early to mid- May. The ultrasonic array and shad monitoring equipment will be deployed,

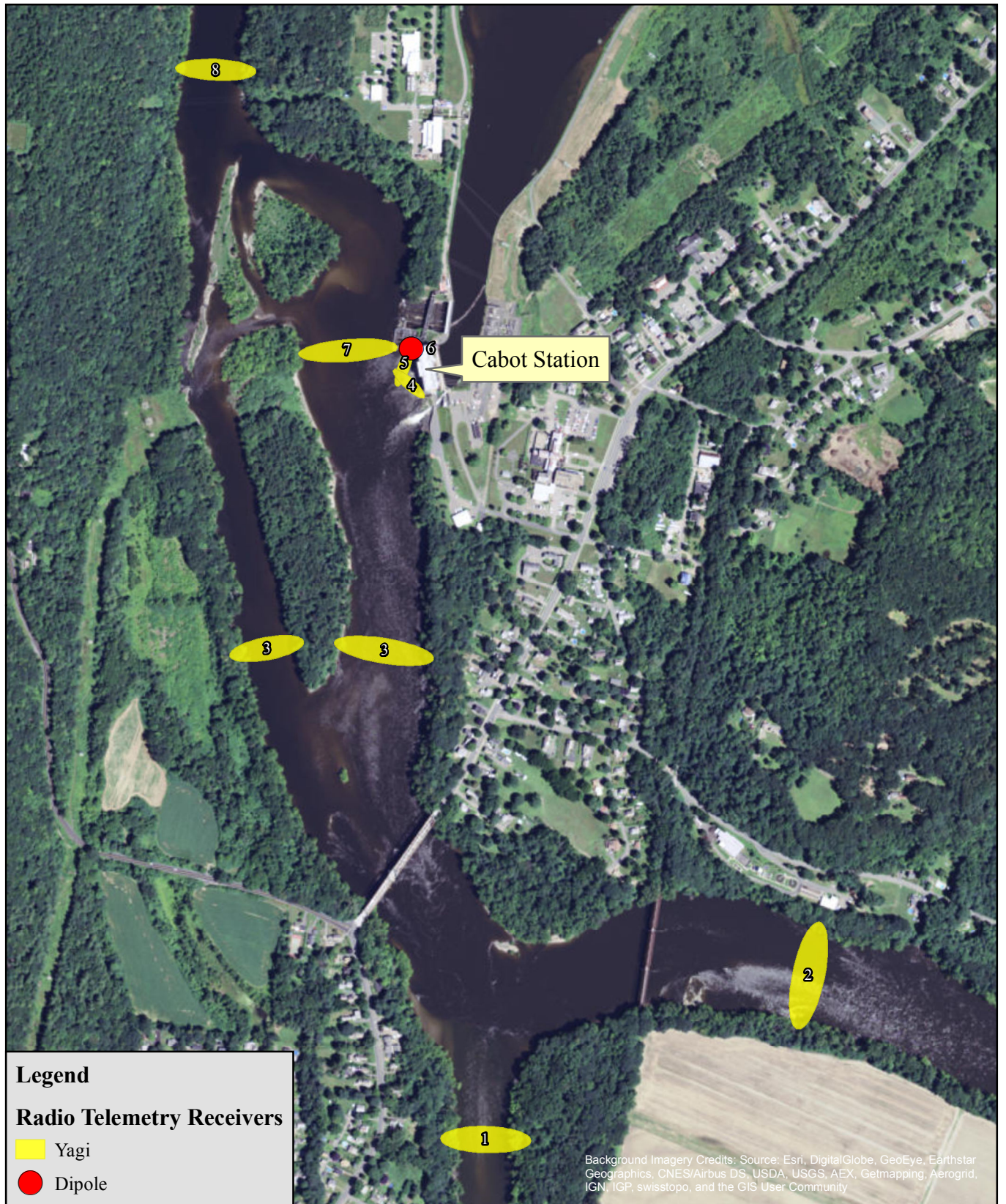
<sup>1</sup> Operational data will include: hourly Montague USGS gage flows, Cabot Station hourly discharges, Station No. 1 hourly discharges, Turners Falls Dam spill flow.

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calibrated and tested by late April, prior to the arrival of adult shad to the study area. The study is anticipated to conclude by June 2016.

Study reporting will be conducted in accordance with FirstLight's Process Plan and Schedule (18 CFR § 5.6(d)(1)), as provided in the PAD, and the FERC's SD1.



**Northfield Mountain Pumped Storage Project (No. 2485)  
and Turners Falls Hydroelectric Project (No. 1889)**  
Relicensing Study 3.3.19

**Figure 3: Proposed Telemetry  
Sites for Ultrasound Array  
Study**



0 375 750 1,500 Feet

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Path: W:\gis\studies\3\_3\_19\maps\Proposed Telemetry Sites.mxd



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**Appendix A**  
**Stakeholder Comments**



Hi Chris et al,

As one of the requesters for an ultrasound study at Cabot Station, here are my comments, suggestions and observations for ways to gain the best applicable results from **Study 3.3.19-Evaluate the Use of an Ultrasound Array to Facilitate Upstream Movement to Turners Falls Dam by Avoiding Cabot Station Tailrace.**

Unfortunately, FirstLight has not provided Stakeholders with any preliminary findings from the telemetry data gathered in Study 3.3.2, which would be a great help in addressing any changes or improvements needed for a successful 3.3.19 Ultrasound Study.

As stated in their Study Determination Letter under **Discussion and Staff Recommendations**, FERC was very clear that 3.3.2 information on: (1) “delay,” (2) “bypass flows,” and (3) “effects of Station 1 operations on upstream shad migrations,” be brought over and included in the design recommendations for 3.3.19:

“These evaluation data can be used to inform the methods and design of this study (e.g., ultrasound array design, layout, and placement; array testing at appropriate bypass flows) (section 5.9(b)(6)).”

FERC further stated in their SD Letter to FirstLight, “The amended study 3.3.19 should address stakeholder comments and recommendations. If FirstLight does not adopt a recommendation, FirstLight should provide its reasoning based on project-specific circumstances (e.g. Study 3.3.2 results).”

Revised Study Plan 3.3.19 ignores FERC’s guidance on the inclusion and application of “bypass flows” and “effects of Station 1 operations on upstream shad migrations” in its design. Neither key issue is addressed in their proposal. Bypass flows, which are key to any application of acoustic guidance to keep shad moving upstream in the Bypass, are not included at all. Stakeholders originally requested this Study be done for two years, with bypass flows tested throughout.

Further, the only mention of Station 1 is in a footnote, without any reference to testing its effects “on upstream shad migration operations.” FirstLight merely notes that hourly data on discharges at that site will be included—with no insight on how that data would be applicable if fish are not monitored for migratory delay, with and without flows, emanating from that site.

Since the thrust of the Study is aimed at getting fish up through the Bypass, I question why just three monitoring sites are suggested to be deployed upstream of Cabot Station itself.

- Sonic guidance at Cabot should be deployed in such a way that it encourages upstream movement as much as possible—and avoids biasing fish movements toward downstream retreat. It should also be deployed in a way that, when in ON mode, it also ensonnifies the entrance to Cabot Ladder, as the thrust of the study is to have fish avoid the power canal.

- Ensonification should **NOT** be engaged in two hour increments, as this would likely be a source of stress and disorientation for fish. Employ the tests in 24 hour cycles, one full day on, one full day off.
- Data should also be provided on the hourly operation and number of gates open at the Emergency Spill Gates off the Canal at Cabot.
- I'd suggest removing the monitor upstream of the mouth of the Deerfield and **placing it at the Rock Dam pool**, a site where shad--and anglers have a historic presence in the Bypass. The agencies, as well as the anglers, are concerned with finding out where fish gather and stall in this reach on their way northern MA, VT, and NH.
- Another monitor needs to be placed at Station 1, another known fishing site. I interviewed a fisherman there last year with Station 1 running. There were scores of fish visible, treading water in the outflow. He flatly said there are "always shad here" when Station 1 is generating.
- Station 1 should be monitored and switched On and Off in tandem with the Cabot ensonification to highlight impacts, false attraction, drop-backs to Rock Dam and elsewhere, and delays.
- Flow data, hours and number of units in operation, and any interruptions in flow at Station 1 should be included in the Study.
- **On August 21, 1975, Mr. Colton H. Bridges**, Deputy Director of the Massachusetts Division of Fisheries and Wildlife made this sworn statement at a Federal Power Commission hearing in Boston: "Without a spillway fish passage facility, fish approaching Turners Falls during periods of spill will be attracted to the base of the dam and those isolated pools located immediately below it, and when spill ceases these fish will remain in the area and be subject to the same conditions that exist below Holyoke without the spillway fish collecting facility, i.e., migration delay and mortality due to lack of flow, increased water temperatures, and decreasing oxygen content." **Several more** monitors need to be deployed at the Dam and the Spillway entrance to capture the early, freshet aggregation of fish there—as this is what's at the core of this study.
- Given that this study will only have one sampling season, it is vitally important that it has enough reach to be applicable for informing a hydro-relicensing that may remain in place for two decades. **One month** testing and data collection is needed **at minimum**.

- Further, given the “drop out” rate for handled fish, the number of tagged fish included from FirstLight’s consultants should be **doubled to 200**, in order to have an acceptable sample entering the project reach.
- Test flows from May 15<sup>th</sup> through mid-June: two weeks at **5,000 CFS**; third week at **4,000 CFS**. The final week should be at a minimum of **2,500 CFS**—which, as FL has indicated in their response to a new Stakeholder Study suggested at the Rock Dam for shortnose sturgeon spawning: **2,500 CFS is the absolute minimum, uninterrupted flow** necessary through the Bypass from April 25 – May 22, in order to not interfere with the spawning of a federally endangered species at Rock Dam. In their response, FL cited “Kynard” et al. Minimum flows to keep SNS embryos and eggs motile, watered, and viable are required there throughout the month of June.

End of comments.

Thanks Chris and everyone for your work on improving this study.

Best,  
Karl Meyer

10 Old Stage Road  
Wendell, MA 01379

January 27, 2016

Mr. John Howard  
FirstLight Hydro Generating Company  
North Field Mountain Station  
99 Millers Falls Road  
Northfield, MA 01360

Re: Draft Revised Ultrasound Study Plan

Dear Mr. Howard

Following are comments regarding the revised draft ultrasound study plan (Study 3.3.19)

#### Task 1: Ultrasound Deployment

##### Installation and Field Measurements

Due to the possibility of entrained air affecting the power and distance of the ultrasound field, the measurement of the sound pressure field should be done at three levels of Cabot Station discharge.

#### Task 2: Field Study

As the potential use of ultrasound at the Cabot Station would be continuous, the experimental periods should be for several days of continuous operation followed by a similar (or shorter) period when the system is not operated. The length of the ensonification tests should be four weeks. This period of time is necessary to ensure that the tagged fish released below the Holyoke dam (over a four week period in May) will have time to reach the Cabot Station.

As the goal of diverting shad from the Cabot Station and into the bypass, during the period of the study the bypass flow should resemble likely flows under the new license. The first two weeks of study a continuous flow of 4,000 cfs should be provided in the bypass. During the second two weeks, 2,500 cfs should be continuously provided.

Based upon analysis of the plots for the 2010 and 2012 whole river telemetry study by the USGS and the USFWS, 100 shad tagged in the Holyoke flume will not be adequate to ensure that 100 shad reach the Cabot Station.

Two groups of shad will provide fish for the ultrasound study. Holyoke Gas & Electric is planning to release 182 radio and PIT tagged shad below the Holyoke dam to evaluate their passage facilities. It is anticipated that 40% of those will drop out of the study and not approach the dam (109 shad to the dam). During 2011 and 2012, 60% of the shad tagged in the lower river that reach the dam passed.

The fish that will be tagged for the Holyoke study will have already passed the dam once and therefore have less energy and reduced migration motivation. A reasonable expectation is that passage efficiency will be 10% less than fish that passed during the whole river study and that 59 shad will pass Holyoke from those released below the dam ( $109 * (0.60 * 0.90)$ ).

During the whole river study, 48.5% of the shad tagged and released in the lower river that passed Holyoke reached the Cabot Station. Assuming the 10% reduction in passage efficiency, of the 59 shad that pass Holyoke, 26 ( $59 * (0.485 * 0.90)$ ) will reach the Cabot Station. As such, an additional 74 shad tagged in the Holyoke flume will need to reach the Cabot Station to provide 100 fish for ultrasound testing.

During the whole river study shad were tagged in the Holyoke flume. For fish tagged in the months of April and May, 39.7% of these fish reached the Cabot Station. To ensure that 74 of the fish tagged in the flume will reach Cabot Station, 187 shad will need to be tagged and released at Holyoke ( $74 / 0.397$ ).

To reduce potential tag collisions at the Cabot Station, shad in the Holyoke flume should be tagged in four batches. Telemetry and PIT equipment should be operational when the first fish from HG&E or FirstLight is tagged and should continue operating until early July or until no tagged fish remain above the Turners Falls dam. Extending the period of radio and PIT detection will augment information collected in the 2015 upstream shad study.

PIT tags should be 32mm to ensure better detection. Only fit fish with less than 20% scale loss on each side should be tagged.

PIT tag antennas should be operational at the entrance and exit of the Cabot, Spillway and Gatehouse ladders. As there were problems with the spillway ladder entrance antennas in 2015, an additional antenna should be located in the first straight run of the Spillway ladder to detect shad that enter the ladder.

The additional radio antennas at the dam (note under Figure 2) should detect fish in the vicinity of the dam and in close proximity to the spillway entrance. An antenna should also be located at Station #1 to detect any delay caused by the operation of Station #1 and to detect fish movement in the bypass.

### Task 3: Study Report

I assume that the proposed comparison of shad during ensonification and no ensonification will be at the 0.05 level and not at the 0.5 level.

Thank you for the opportunity to comment. I can be reached at the above address, 978 544 7438, or [don.pugh@yahoo.com](mailto:don.pugh@yahoo.com).

Sincerely,

A handwritten signature in black ink, appearing to read 'Donald Pugh', with a stylized flourish at the end.

Donald Pugh

cc: John Warner, USFWS  
Ken Sprankle, USFWS  
Robert Kubit, MADEP  
Andrea Donlan, CRWC  
Chris Tomichek, Kleinschmidt

Melissa Grader, USFWS  
Caleb Slater, MADFW  
Bill McDavitt, NOAA  
Karl Meyer  
Mark Wamser, Gomez and Sullivan





# United States Department of the Interior

## FISH AND WILDLIFE SERVICE

New England Field Office  
70 Commercial Street, Suite 300  
Concord, NH 03301-5087  
<http://www.fws.gov/newengland>



In Reply Refer To: FERC Nos. 1889 and 2485  
FirstLight Power Resources/GDF Suez  
Connecticut River  
COMMENTS ON REVISED STUDY PLAN  
EVALUATE USE OF ULTRASOUND ARRAY

January 29, 2016

Mr. John Howard  
First Light Power Resources, Inc.  
99 Millers Falls Road  
Northfield, MA 01360

Dear Mr. Howard:

This regards the U.S. Fish and Wildlife Service's (Service) review of the *Revised Study Plan – Study 3.3.19 – Evaluate the Use of an Ultrasound Array to Facilitate Upstream Movement to Turners Falls Dam by Avoiding Cabot Station Tailrace*, dated January 2016, and received in this office by email on January 13, 2016.

### Background

The proposed study was requested by the Service and other entities in order to evaluate the potential use of ultra-high frequency sound to dissuade upstream migrating American shad from being attracted to the Cabot Station discharge and adjacent Cabot Station fish ladder, and facilitate farther upstream migration to the Turners Falls Dam. The potential outcome of this evaluation, if highly successful, could be the reconfiguration of upstream passage facilities at the project, from a two fishway facility (with a fish ladder at Cabot Station and another at the dam) to a single fishway located at the dam. The advantage of this configuration would be to eliminate the need to pass fish at Cabot Station into the canal, after which fish would need to traverse the canal and enter and pass another fishway at the canal gatehouse. A single, well designed and sited fishway at the dam could improve overall upstream passage efficiency past the project.

### General Description of Proposed Study

This section identifies that the study is to evaluate the use of an ultrasound array to dissuade shad “away from the Cabot Station tailrace and facilitate upstream movement to the Turners Falls Dam.” We concur with this study purpose. However, the study plan does not address the other key factors of Cabot Station generation flows versus bypass reach flows that will likely affect shad behavior. Without an assessment of the interaction of spillage versus generation flows, the study may indicate that the array scares shad away from the tailrace, but would not demonstrate that those fish readily move past the station to the dam, and behavior under various flow conditions (bypass reach flow in relation to Cabot Station discharge and/or other sources of flow/discharge). If shad stall in the Cabot Station vicinity outside of the array influence or return downstream, there would be no benefit of the array.

First Light Power Resources (FL) also proposed to evaluate fishway counts from the Cabot Station and spillway ladders with the timing of operations of the ultrasonic field. The use of fishway counts to infer a response from sonic treatments would require certain important assumptions. At this point, we have seen no results from the radio tagging study conducted in 2015, therefore it is unclear what variables (generation at Cabot Station, generation at Station #1, spill) affect shad passage through the project area without an ultrasonic array. There are a myriad of combinations of these variables that shad likely respond to, therefore these variables will have to be factored into any analysis of array response based on fishway counts. In addition, it will not be easy to tie the array status (on/off) with passage counts due to the extended period of time it takes for shad to pass each ladder and the nighttime holdover of shad in the ladders. Relating spillway ladder counts to array status is further aggravated by the long distance to, and associated delay in, movement upstream to the dam. Therefore, assessing the response to ensonification treatments based on fishway counts will be very challenging.

### Methodology - Task 2 – Field Study

#### ***Number of Radio-tagged Shad***

We agree that 100 shad reaching Cabot Station should provide sufficient data to assess the ultrasonic array. However, based on past telemetry results, it is not clear that the release of only 100 shad upstream of Holyoke coupled with tagged shad releases below Holyoke Dam by Holyoke Gas and Electric (HGE) as part of the evaluation of new passage measures at the Holyoke Project (FERC No. 2004) will result in 100 radio-tagged shad reaching Cabot Station. Based on the results of past studies, additional tagged fish releases may be needed to be sure that at least 100 tagged shad reach Cabot Station.

Ideally, results from the large 2015 shad telemetry study would be available at this time to use in framing up this study, including determining the appropriate number of fish to release to guarantee 100 tagged shad. In the absence of that data, FL based its proposal on two calculations.

- (1) HGE will release 182 tagged shad below Holyoke. Of those, there will be approximately a 40 percent dropback rate, leaving 110 shad attempting to pass Holyoke fishways, of

which 60 percent will be successful passing one of the fish lifts. That would (theoretically) yield 66 HGE-tagged shad passing upstream of Holyoke Dam.

- (2) FL will release 100 shad in the Holyoke fish passage exit flume and into the headpond. FL assumes a 30 percent to 60 percent fall back of those fish, resulting in 30 to 60 fish available to move upstream.

FL believes that collectively, these releases should result in at least 100 shad reaching Cabot Station.

As part of our review of this proposal, we performed the following analysis based on data from studies conducted by Ted Castro-Santos (of the U.S.G.S. Conte Lab) and Ken Sprankle (of the Service) in 2011 and 2012:

- (1) Based on results of the USGS/Service studies, 49 percent of the shad that pass Holyoke would be expected to reach Cabot Station. This would mean that 33 of the 66 HGE-tagged fish would continue upstream to the Turners Falls Project.
- (2) The above calculation assumes fish tagged at Holyoke that are then transported downstream below Holyoke and return to pass the Holyoke fishway a second time perform at the same level as fish that pass Holyoke only once. If the loss of energetic condition of fish from repeat passage were factored in, the actual expected success in reaching Cabot Station would likely be lower.
- (3) Of the 100 shad FL proposed to tag and release upstream of Holyoke Dam, only 39.7 percent of those fish (based on USGS/Service data on early run fish [April/May]) would likely make it to Cabot Station. Using that percentage, only 40 of the 100 shad released above Holyoke will reach Cabot Station.
- (4) Based on numbers derived from the above, a combined total of 73 or fewer shad from these two release groups would likely reach Cabot Station.
- (5) To get 100 shad to Cabot Station, FL will need to release enough shad from the Holyoke exit flume to yield 67 or more shad to Cabot Station. Using a 39.7 percent success rate to reach Cabot Station, a total of 169 or more shad would need to be tagged and released.

Based on a conversation on January 20, 2016 between John Warner of my staff and Chris Tomichek of Kleinschmidt Associates, FL believes that 100 tagged shad will make it to Cabot Station with the proposed release schedule. But, Ms. Tomichek also offered the following justifications as to why study objectives could still be met, even if 100 or more tagged shad do not reach Cabot Station:

- (1) FL sees the DIDSON camera as the primary method of monitoring fish entry into the ensonified field.
- (2) FL considers radiotelemetry as a secondary method, used to assess behavior of fish in the area of the ensonified field and discern whether shad will pass the station if the tailrace is ensonified or just stall near Cabot Station outside the ensonified area. FL does not see this as a repeat of the full 2015 telemetry study to assess all variables to passage or fishway effectiveness.
- (3) FL sees this study as a pilot, proof-of-concept study, with the objective to observe whether the ultrasound array clearly excludes shad from the Cabot Station tailrace and fishway.

- (4) If the results of this study are promising, FL understands that a larger, more comprehensive study would likely be needed before conclusions are made relative to fish passage facility changes.

We agree that the study is intended to first and foremost determine whether or not an ultrasound array is a sufficiently effective method of deterring shad from entering the Cabot Station tailrace and fishway entrance area. And as appropriate, to warrant further study of its possible use as a long-term measure in conjunction with changes to fish passage facilities at the project.

However, given the unavailability of 2015 telemetry data (thus necessitating the reliance on past limited-scope studies) and the uncertainty that the DIDSON camera will be 100 percent effective in the turbulent tailrace/fishway entrance area, we believe increasing the number of radio-tagged fish is a prudent measure to assure we get enough information in this study year to draw conclusions on effectiveness of the array. Therefore, we recommend FL release 169 shad upstream from Holyoke Dam to augment numbers reaching Cabot Station. We note that if the 2015 results are disseminated prior to the start of this study in May 2016 and those results indicate that a far higher percentage of shad tagged at Holyoke are likely to reach Cabot Station, we would agree to reducing the required release numbers.

### ***Spill Flow Releases During the Study***

The study plan states that treatments will occur at “existing flow conditions.” As with the 2015 upstream shad study, it is necessary to understand the response of shad under a range of flow conditions likely to occur during the shad migration season, including discharges to the bypass reach, as existing bypass flow requirements during the shad upstream migration season are anticipated to be substantially increased under a new license. As in the 2015 shad studies, treatment releases from the Turners Falls Dam should be incorporated into the study plan to determine if shad can be “guided” to the bypass reach under a range of spill conditions. Without planned treatment flow releases, bypass flows would likely be well below future spill flow requirements and therefore shad responses to ensonification may not be representative of post-license conditions. Based on the preliminary Reach 2 instream flow study data, we recommend, at a minimum, releases of 2,500 and 4,400 cfs be evaluated, as these flows are likely within the range of future spring flows and match releases used in the 2015 telemetry study.

### ***Study Timing and Duration***

Shad releases are proposed to occur in two batches, with 50 released in the first week of May and 50 the second week of May. As with previous study designs, releases of radio-tagged fish should be staggered in multiple groups to: (1) reduce the incidence of some unforeseen issue(s) with tagged fish or study conditions (e.g., high flow event); (2) provide an increased period temporal coverage of data observations; (3) improve the likelihood of capturing a better representation of operational and test spill flow conditions; and (4) reduce the likelihood of tag collisions on radio receivers. Based upon the tagged fish movement plots from the USGS/Service study, we recommend four release groups, at an interval no less than five days apart in order to meet the evaluation goals.

We also recommend that the actual release dates be flexible and responsive to the shad run timing and river flow conditions so that all releases are not made in extremely high or extremely low flows. It is noted on page 7 that ultrasound testing will be initiated once shad arrive at Cabot Station. The sentence does not specify arrival of radio-tagged shad. The study proposal should be clear that initiation of the study should occur once radio-tagged shad are present, in order to monitor fish responses to the ultrasound array .

The proposed plan notes a two-week study period, but based on recommendations and rationale provided here, we believe a period of four study weeks would be required to obtain data necessary to document tagged shad responses to ensonification treatments in the context of dam spill flow treatments into the bypass reach and in relation to varied Cabot Station turbine operations over time. Beyond that, the Service recommends that the conclusion of radio-telemetry monitoring should be based on when tagged shad have arrived at Cabot Station and either passed upstream or returned downstream so that data on behavior at Cabot Station and the array can be gathered on all tagged fish that reach Cabot Station. The duration of the DIDSON monitoring is not identified in the study plan, but should be extended through at least the same period as the telemetry study or run longer to provide additional data on untagged shad.

The ensonification treatments are proposed to be largely scheduled as a full day on or off with some days when ensonification is turned on and off every 2 hours. We recommend that all ensonification treatments be set as full days on or off.

All radio antennas will need to be calibrated to ensure complete coverage and should probably include some redundancy, as outages will create real problems for data analysis. PIT tag antennas should be located at the fishway entrances and exits and an additional antenna should be placed in the lower run of the spillway ladder as the spillway fishway entrance antenna had poor efficiency in 2015.

We support the proposal to provide weekly updates on study progress. This suggests that the telemetry and DIDSON data can be analyzed near real-time, so that we can assess the range of test conditions evaluated and the effectiveness of the array under tested conditions. We request that FL confirm if this interpretation is correct.

There is no figure showing the placement and detection field of the proposed DIDSON, only a reference that it will be used to count the number of shad entering Cabot Station fishway. FL should include a figure showing the placement and detection field (in three dimensions) for this unit. The Service has concerns regarding the ability of the DIDSON being able to "see" fish in the turbulent area below the Cabot Station fishway entrance, an area where there can be a lot of bubbles that may obscure fish targets. We acknowledge that this might be difficult to determine until the DIDSON is deployed and tested.

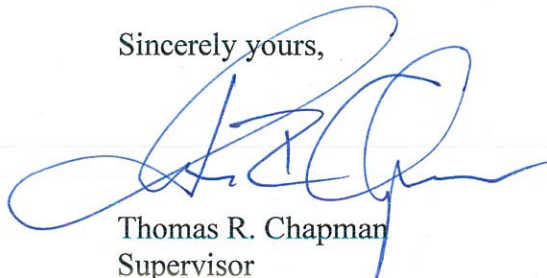


Mr. John Howard  
January 29, 2016

6

Thank you for this opportunity to comment. If you have any questions regarding these comments, please contact John Warner of this office at 603-223-2541.

Sincerely yours,

A handwritten signature in blue ink, appearing to read 'T. Chapman', with a large, stylized loop at the end.

Thomas R. Chapman  
Supervisor  
New England Field Office

Mr. John Howard  
January 29, 2016

7

cc: Mr. Mark Wamser  
Gomez and Sullivan Engineers, PC  
P.O. Box 2179  
Henniker, NH 03242  
FERC-Secretary  
RO/Engineering, Brett Towler  
CRC, Ken Sprankle  
NMFS, Bill McDavitt  
NMFS-Orono, Jeff Murphy  
MA DFW, Caleb Slater  
MA DEP, Bob Kubit  
TU, Don Pugh  
CRWC, Andrea Donlon  
TNC, Katie Kennedy  
Reading File  
ES: JWarner:1-29-16:(603)223-2541



**MassWildlife**

*Commonwealth of Massachusetts*

# **Division of Fisheries & Wildlife**

Jack Buckley, *Director*

February 1, 2016

Mr. John Howard  
FirstLight Hydro Generating Company  
North Field Mountain Station  
99 Millers Falls Road  
Northfield, MA 01360

Re: Ultrasound Study Plan

Dear Mr. Howard

Following are comments regarding the revised draft ultrasound study plan (Study 3.3.19)

## **Task 1: Ultrasound Deployment**

### **Installation and Field Measurements**

Due to the possibility of entrained air affecting the power and distance of the ultrasound field, the measurement of the sound pressure field should be done at three levels of Cabot Station discharge.

## **Task 2: Field Study**

As the potential use of ultrasound at the Cabot Station would be continuous, the experimental periods should be for several days of continuous operation followed by a similar (or shorter) period when the system is not operated. The length of the ensoulification tests should be four weeks. This period of time is necessary to ensure that the tagged fish released below the Holyoke dam (over a four week period in May) will have time to reach the Cabot Station.

As the goal of diverting shad from the Cabot Station and into the bypass, during the period of the study the bypass flow should resemble likely flows under the new license. The first two weeks of study a continuous flow of 4,400 cfs should be provided in the bypass. During the second two weeks, 2,500 cfs should be continuously provided.

The Division has concerns regarding the ability of the DIDSON to be able to identify targets in the turbulent area below the Cabot Station fishway entrance- therefore the Division believes that the PIT/ratiotelemetry portion of the study may be of vital importance.

Based upon analysis of the plots for the 2010 and 2012 whole river telemetry study by the USGS and the USFWS, 100 shad tagged in the Holyoke flume will not be adequate to ensure that 100 shad reach the Cabot Station.

We know that shad are lost at various point during migration and that more shad will need to be tagged. An analysis by Trout Unlimited (comment letter dated 1/27/16) has suggested the number should be 187 while a similar analysis by the USFWS (comment letter dated 1/29/16) has concluded that 167 will be necessary.

To reduce potential tag collisions at the Cabot Station, shad in the Holyoke flume should be tagged in four batches. Telemetry and PIT equipment should be operational when the first fish from HG&E or FirstLight is tagged and should continue operating until early July or until no tagged fish remain above the Turners

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Division of Fisheries and Wildlife

Field Headquarters, One Rabbit Hill Road, Westborough, MA 01581 (508) 389-6300 Fax (508) 389-7

Falls dam. Extending the period of radio and PIT detection will augment information collected in the 2015 upstream shad study.

PIT tags should be 32mm to ensure better detection. Only fit fish with less than 20% scale loss on each side should be tagged.

PIT tag antennas should be operational at the entrance and exit of the Cabot, Spillway and Gatehouse ladders. As there were problems with the spillway ladder entrance antennas in 2015, an additional antenna should be located in the first straight run of the Spillway ladder to detect shad that enter the ladder.

Thank you for the opportunity to comment.

Sincerely,

A handwritten signature in black ink, appearing to read "Caleb Heitz". The signature is fluid and cursive, with a long horizontal stroke extending to the right.

**From:** William McDavitt - NOAA Affiliate [<mailto:william.mcdavitt@noaa.gov>]

**Sent:** Thursday, February 11, 2016 10:40 AM

**To:** Chris Tomichek <[Chris.Tomichek@KleinschmidtGroup.com](mailto:Chris.Tomichek@KleinschmidtGroup.com)>

**Cc:** Warner, John <[john\\_warner@fws.gov](mailto:john_warner@fws.gov)>; Melissa Grader <[Melissa\\_Grader@fws.gov](mailto:Melissa_Grader@fws.gov)>; Ken Sprankle <[Ken\\_Sprankle@fws.gov](mailto:Ken_Sprankle@fws.gov)>; Don Pugh <[don.pugh@yahoo.com](mailto:don.pugh@yahoo.com)>; Andrea Donlon <[adonlon@ctriver.org](mailto:adonlon@ctriver.org)>; Jeff Murphy - NOAA Federal <[Jeff.Murphy@noaa.gov](mailto:Jeff.Murphy@noaa.gov)>; Caleb Slater <[caleb.slater@state.ma.us](mailto:caleb.slater@state.ma.us)>; Brett Towler <[brett\\_towler@fws.gov](mailto:brett_towler@fws.gov)>; Katie Kennedy <[kkennedy@tnc.org](mailto:kkennedy@tnc.org)>; Bob Kubit <[Robert.Kubit@state.ma.us](mailto:Robert.Kubit@state.ma.us)>; Boyd Kynard <[kynard@eco.umass.edu](mailto:kynard@eco.umass.edu)>; Ted Castro-Santos <[tcastrosantos@usgs.gov](mailto:tcastrosantos@usgs.gov)>; Stephen Kartalia <[stephen.kartalia@ferc.gov](mailto:stephen.kartalia@ferc.gov)>; Mark Wamser <[mwamser@gomezandsullivan.com](mailto:mwamser@gomezandsullivan.com)>

**Subject:** Re: USFWS comments on the ultrasonic array plan

Chris,

Thank you for this opportunity to comment.

The revised study plan for study 3.3.19 needs more information under Task 3: Study Report. Please list the specific environmental and operational data that will be recorded and presented. Reporting river temperature and the transit time each fish took while swimming from Holyoke to Turners Falls could provide some context for how much energy a given fish has expended upon its arrival at Turners Falls.

The Task 3 section has a sentence that reads "The number of shad detected at the Cabot tailrace with the field on and off will be statistically compared ( $p \leq 0.5$ )." This sentence needs more clarification. Presumably the number of radio-tagged fish with the field on and off will be reported, as well as the number of fish detected with the DIDSON, but this should be stated explicitly. Which statistical test will be used? Is 0.5 a typo, as I assume you mean 0.05? The study plan should be more explicit in explaining what sort of outcome would be needed to indicate that the ultrasound array successfully deterred fish from entering the fishway.

FERC's February 21, 2014 Study Plan Determination for Study 3.3.19 states "We recommend that Firstlight evaluate the study 3.3.2 results, consider the recommendations from stakeholders .... and make any necessary modifications to its study 3.3.19 proposed methodology" The revised study plan as submitted contains essentially no information from study 3.3.2 because that study has not been completed. While recognizing the difficulty in planning bypass flows, this revised study plan should better explain how bypass flows, Cabot station generation and short term predictions (e.g. 1-4 days) of Connecticut River flows will be used to make decisions as the study is occurring.

Sincerely,

-Bill

**Bill McDavitt**

Environmental Specialist

Integrated Statistics, Inc.



Under contract to National Marine Fisheries Service  
Greater Atlantic Regional Fisheries Office  
55 Great Republic Drive  
Gloucester, MA 01930  
978-675-2156  
[William.mcdavitt@noaa.gov](mailto:William.mcdavitt@noaa.gov)

On Thu, Feb 11, 2016 at 10:00 AM, Chris Tomichek  
<[Chris.Tomichek@kleinschmidtgroup.com](mailto:Chris.Tomichek@kleinschmidtgroup.com)> wrote:

Good Morning

The revised Ultrasound Array plan is attached and comments from USFWS, MDFW, Don Pugh and Karl Meyer have been addressed. Between the time we first sent out the plan and now, we were have been able to calculate drop back of radio tagged adult American shad released at Holyoke in 2015. Of the 215 radio tagged shad released at Holyoke 125 shad (58%) were detected at the Turners Falls Project for a drop back rate of 42%.

We plan to file this plan with FERC early next week so would appreciate any final comments in short order.

Regards,

Chris

**Chris Tomichek**

**Senior Manager**

**Fisheries and Aquatic Resources**

Office: [860.767.5069](tel:860.767.5069)

[www.KleinschmidtGroup.com](http://www.KleinschmidtGroup.com)

**From:** Warner, John [[mailto:john\\_warner@fws.gov](mailto:john_warner@fws.gov)]  
**Sent:** Friday, February 12, 2016 1:19 PM  
**To:** Chris Tomichek <[Chris.Tomichek@KleinschmidtGroup.com](mailto:Chris.Tomichek@KleinschmidtGroup.com)>  
**Cc:** Melissa Grader <[Melissa\\_Grader@fws.gov](mailto:Melissa_Grader@fws.gov)>; Ken Sprankle <[Ken\\_Sprankle@fws.gov](mailto:Ken_Sprankle@fws.gov)>; Don Pugh <[don.pugh@yahoo.com](mailto:don.pugh@yahoo.com)>; Andrea Donlon <[adonlon@ctriver.org](mailto:adonlon@ctriver.org)>; William McDavitt - NOAA Affiliate <[William.McDavitt@noaa.gov](mailto:William.McDavitt@noaa.gov)>; Jeff Murphy - NOAA Federal <[Jeff.Murphy@noaa.gov](mailto:Jeff.Murphy@noaa.gov)>; Caleb Slater <[caleb.slater@state.ma.us](mailto:caleb.slater@state.ma.us)>; Brett Towler <[brett\\_towler@fws.gov](mailto:brett_towler@fws.gov)>; Katie Kennedy <[kkennedy@tnc.org](mailto:kkennedy@tnc.org)>; Bob Kubit <[Robert.Kubit@state.ma.us](mailto:Robert.Kubit@state.ma.us)>; Boyd Kynard <[kynard@eco.umass.edu](mailto:kynard@eco.umass.edu)>; Ted Castro-Santos <[tcastrosantos@usgs.gov](mailto:tcastrosantos@usgs.gov)>; Stephen Kartalia <[stephen.kartalia@ferc.gov](mailto:stephen.kartalia@ferc.gov)>; Mark Wamser <[mwamser@gomezandsullivan.com](mailto:mwamser@gomezandsullivan.com)>  
**Subject:** Re: USFWS comments on the ultrasonic array plan

Chris - We have a few comments on the re-draft.

The fish number calculation still seems off:

-- HGE releases 182 fish, of which 109 of those fish return to Holyoke dam or tailrace (based on 40% dropback) - 109  
- USGS data shows that 60% of the fish below Holyoke will pass upstream - 66  
- USGS data shows 49% tagged fish put below that pass Holyoke will make it to Cabot - or 33 fish will get to Turners

- FL releases of 100 fish upstream of the lift in the exit flume, of which 58% will arrive at Cabot  
-- = 58

-  $33 + 58 = 91$ ... so thats closer to 100 using 58% versus the USGS study % of 39% but it is not 125 and that is all on averages so theres no free-board for variation. So, we are concerned that could yield quite a bit fewer than the target 100 fish to Cabot. Adding enough additional fish to assure we at least see 100 would be prudent to assure that the data is sufficient to draw conclusions.

On the flow releases - we are fine with the 3 proposed bypass flow releases, and know releases will be flow dependent (based on last year for sure), but we would like to see a schedule - at least conceptually - on a sequence -- We think one day on/ one day off at flow #1, then switch to flow #2 - one day on/one day off etc makes sense to try to get multiple bypass flows evaluated with similar total river flows and therefore generation. Then repeat that sequence throughout the study (assuming flows are available to have spill and generation -- If things change, then we revert to daily adjustments)

Thanks -- JW

On Thu, Feb 11, 2016 at 10:00 AM, Chris Tomichek  
<[Chris.Tomichek@kleinschmidtgroup.com](mailto:Chris.Tomichek@kleinschmidtgroup.com)> wrote:

Good Morning

The revised Ultrasound Array plan is attached and comments from USFWS, MDFW, Don Pugh and Karl Meyer have been addressed. Between the time we first sent out the plan and now, we were have been able to calculate drop back of radio tagged adult American shad released at Holyoke in 2015. Of the 215 radio tagged shad released at Holyoke 125 shad (58%) were detected at the Turners Falls Project for a drop back rate of 42%.

We plan to file this plan with FERC early next week so would appreciate any final comments in short order.

Regards,

Chris

**Chris Tomichek**

**Senior Manager**

**Fisheries and Aquatic Resources**

**Office: 860.767.5069**

**[www.KleinschmidtGroup.com](http://www.KleinschmidtGroup.com)**

10 Old Stage Road  
Wendell, MA 01379

February 12, 2016

Mr. James Donohue  
FirstLight Hydro Generating Company  
North Field Mountain Station  
99 Millers Falls Road  
Northfield, MA 01360

Re: Draft Revised Ultrasound Study Plan dated 2/11/16

Dear Mr. Donohue

Following are comments regarding the revised draft ultrasound study plan dated 2/11/16(Study 3.3.19)

#### Task 1: Ultrasound Deployment

##### Installation and Field Measurements

The response to my comment in the letter dated January did not address the issue of the possibility of entrained air affecting the power and distance of the ultrasound field. As it is important to understand the area of impact during ensonification and as the entrained air is not likely to be similar at all discharge levels, the measurement of the sound pressure field should be done at three levels of Cabot Station discharge.

#### Task 2: Field Study

Flows in bypass should be continuous and split evenly between the three proposed flows. Flows should not change during the on or off period and should be similar for each on/off period.

The period of testing should be at least 48 hours to ensure that at least one full passage day occurs under both the on and off conditions.

While this study is an evaluation of the effect of ultrasound at the Cabot station, including PIT antennas at the top of the Cabot and Spillway ladders and at the entrance and exit of the Gatehouse ladder will, for a very minimal additional effort, provide supplemental data to the 2015 upstream shad study. This is especially important as no results from that are available by which to judge the completeness of that studies results (except rate of passage from Holyoke flume to Cabot). For the same reason, collection of telemetry and PIT data should continue until the ladders are shut down.

Figure 2, showing the number of shad available from the HG&E release, incorrectly assumes that all 109 shad that arrive at Holyoke will pass. Results from the whole river study indicate that 60.7% of lower river released shad that arrive at Holyoke pass. As such, 66 shad from the HG&E release will pass the dam. Using the 0.58 rate of shad tagged at the Holyoke lift, if 100 shad are tagged at the lift 106 would

be expected to arrive at Cabot. Several considerations suggest that more than 100 shad be tagged at the Holyoke lift.

- The new configuration of the Holyoke spillway lift entrance is an untested condition
- Fish that will be tagged for the HG&E study will have already passed the lift will have lower energy reserves and potentially be less capable to pass a second time
- The arrival percent at Cabot for flume tagged shad in 2011 and 2012 during the months of April and May was lower, 48.5%

Considering these factors, the calculation of the number of fish passing the lift should be the lower of the 2011 and 2012 rates (0.481). The rate of passage from Holyoke to Cabot should conservatively be estimated as the average of the 2011/2012 and 2015 studies, 0.5325. To ensure that 100 shad arrive at Cabot, 135 shad should be tagged at the Holyoke lift.

$$\begin{aligned} 109 * 0.481 &= 52 \text{ shad pass} \\ 52 * 0.5325 &= 28 \text{ shad to Cabot} \\ 72 \text{ needed from Holyoke lift tagged shad} \\ 72/0.5325 &= 135 \text{ shad to tag at Holyoke lift} \end{aligned}$$

Thank you for the opportunity to comment. I can be reached at the above address, 978 544 7438, or [don.pugh@yahoo.com](mailto:don.pugh@yahoo.com).

Sincerely,

A handwritten signature in black ink, appearing to read "Donald Pugh". The signature is fluid and cursive, with the first name "Donald" and last name "Pugh" clearly distinguishable.

Donald Pugh

cc: John Warner, USFWS  
Ken Sprankle, USFWS  
Melissa Grader, USFWS  
Caleb Slater, MADFW  
Robert Kubit, MADEP  
Bill McDavitt, NOAA  
Andrea Donlan, CRWC  
Karl Meyer  
Chris Tomichek, Kleinschmidt  
Mark Wamser, Gomez and Sullivan

REVISED STUDY PLAN

**Appendix B**  
**Response to Stakeholders Comments**

Commenter	Comment	Response
USFWS	Request initiation of the study once radio tagged shad are present	Since primary method of detection is the DIDSON, plan is to begin study once either tagged or untagged shad arrive at Cabot
	Spillway fishway entrance had poor efficiency in 2015, add additional antennae	Spillway fishway entrance had good efficiency in 2015, the Gatehouse PIT antennae was the problem
	Assume radio telemetry and DIDSON data will be analyzed near real-time	We plan to sub sample DIDSON data and spot check the telemetry data, but having data in real time is well beyond the scope of the study.
	Recommend 169 shad be tagged unless the 2015 results indicate a higher percentage of tagged fish released from Holyoke reach Cabot Station	The 2015 results indicated that 58% of the fish tagged at Holyoke reached Cabot Station. Thus only 118 shad will be tagged for this study
	At a minimum, releases of 2,500 and 4,400 cfs into the bypass reach during the study	Propose releases of 1,500, 2,500, and 4,400 cfs.
	PIT tag antennas should be located at the fishway entrances and exits.	We agree to provide PIT tag antennae at the fishway entrances as a backup detection measure. Since this is an assessment of the Ultrasound Array and not fishway efficiency there is no need for PIT tag antennas at the exits.
	Releases of tagged shad in four groups at an interval no less than five days apart.	Agreed
	DIDSON should operate through the study	Agreed
	Ensonification treatments should be a full day on or off	Agreed
	Actual release dates be flexible and responsive to the shad run timing and river flow conditions	Agreed
	Add additional tagged fish	Agreed
	Add alternating flow schedule	Agreed
	Placement of the DIDSON	The DIDSON will be deployed and tested to determine best placement in area of the Cabot fishway entrance.
MADFW and Don Pugh	Due to the possibility of entrained air affecting the power and distance of the ultrasound field, the measurement of the sound pressure field should be done at three levels of Cabot Station discharge.	Plan is to run Cabot Station as needed during this period. Based on typical Cabot Generation in May this should generate a variety of discharge levels. Requested flow to the bypass reach will affect Cabot generation.
	The test period should be four weeks	Agreed
	Releases of tagged shad in four groups at an interval no less than five days apart.	Agreed
	Recommend 187 or 169 shad be tagged to reach 100 at Cabot Station	The 2015 results indicated that 58% of the fish tagged at Holyoke reached Cabot Station. Thus if 118 shad are tagged and combined with those tagged for the HG&E study 100 shad will be expected to reach Cabot Station.
	Releases of tagged shad in four batches.	Agreed
	Run the array for several days	We plan on and off scenarios for 1-2 days at a time.

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	The first two weeks of study a continuous flow of 4,400 cfs should be provided in the bypass. During the second two weeks, 2,500 cfs should be continuously provided.	Flow in the bypass reach will be based on flow in the river (i.e. <i>in 2015 low flows in early May were followed by high flows</i> ) however we plan to test 4,400, 2,500 and 1,500 cfs flows to the bypass reach during the study.
	PIT tags should be 32mm to ensure better detection	Agreed
	PIT tag antennas should be located at the fishway entrances and exits.	We agree to provide PIT tag antennae at the fishway entrances as a backup detection measure. Since this is an assessment of the Ultrasound Array and not fishway efficiency there is no need for PIT tag antennas at the exits.
	Spillway fishway entrance had poor efficiency in 2015, add additional antennae	Spillway fishway entrance had good efficiency in 2015, the Gatehouse PIT antennae was the problem
Don Pugh	An antenna should also be located at Station #1 to detect any delay caused by the operation of Station #1 and to detect fish movement in the bypass.	This study is to test the UltraSound Array at Cabot Station, shad movement study was conducted in 2015.
	The measurement of the sound pressure field should be done at three levels of Cabot Station discharge.	Sound will be measured at a low and a high generation, if there is not much difference, then there would be no need to measure other flows.
	Assume that the proposed comparison of shad during ensonification and no ensonification will be at the 0.05 level and not at the 0.5 level.	Typo Corrected
Karl Meyer	FirstLight has not provided Stakeholders with any preliminary findings from the telemetry data gathered in Study 3.3.2	Findings from Study 3.3.2 other than drop-back rates are not available yet.
	Data should also be provided on the hourly operation and number of gates open at the Emergency Spill Gates off the Canal at Cabot.	This is a study to test the applicability of the Ultrasound array at Cabot Station, shad movement study was conducted in 2015
	Station 1 should be monitored and switched On and Off in tandem with the Cabot ensonification to highlight impacts, false attraction, drop-backs to Rock Dam and elsewhere, and delays.	This is a study to test the applicability of the Ultrasound array at Cabot Station
	I'd suggest removing the monitor upstream of the mouth of the Deerfield and <b>placing it at the Rock Dam pool</b> , a site where shad--and anglers have a historic presence in the Bypass.	This is a study to test the applicability of the Ultrasound array at Cabot Station
	Ensonification should <b>NOT</b> be engaged in two hour increments, as this would likely be a source of stress and disorientation for fish. Employ the tests in 24 hour cycles, one full day on, one full day off.	Agreed
	<b>One month</b> testing and data collection is needed <b>at minimum</b> .	Agreed
Bill McDavitt	List the specific environmental and operational data that will be recorded and presented	Agreed
	Presumably the number of radio-tagged fish with the field on and off will be reported, as well as the number of fish detected with the DIDSON, but this should be stated explicitly	Agreed

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	Which statistical test will be used?	A log linear model ( $p < 0.05$ )
	Study plan should be more explicit in explaining what sort of outcome would be needed to indicate that the ultrasound array successfully deterred fish from entering the fishway	Agreed
	FERC recommended that FirstLight evaluate the study 3.3.2 results and make any necessary modifications to its study 3.3.19 proposed methodology. The revised study plan as submitted contains essentially no information from study 3.3.2 because that study has not been completed.	Although it was envisioned that the information from Study 3.3.2 would be used to design this study, the actual analysis (which encompassed close to 800 adult PIT and radio tagged adult American shad and over 40 radio telemetry and PIT receivers at a variety of flow releases, in addition to reporting on all adult shad tagged and released as part of the TransCanada relicensing studies that traversed through the Project area) is still in process. In order to conduct this study in 2016, FirstLight must proceed before the evaluation of the Study 3.3.2 results is complete.
	this revised study plan should better explain how bypass flows, Cabot station generation and short term predictions (e.g. 1-4 days) of Connecticut River flows will be used to make decisions as the study is occurring	Agreed