10 Old Stage Road
Wendell, MA 01379

Aug 29, 2013

Revised Study Plan Comments
FERC Nos. 1889 and 2485

Kimberly D. Bose, Secretary
FERC
888 First Street, NE
Washington, DC 20426

Dear Secretary Bose,

Following are comments of Donald Pugh concerning FirstLight's revised study plans dated August 14, 2013.

3.3.1 *Conduct Instream Flow Habitat Assessment in the Bypass Reach and below Cabot Station*

Habitat Suitability Index Criteria

Figure 3.3.1-5 shows seven shad spawning locations. Study plan 3.3.6 states that there are fifteen previously identified shad spawning locations. All locations should be plotted.

Table 3.3.1-2, Sea lamprey incubation and zone of passage should be added to Reaches 1 and 2.

Burbot (*Lota lota*) may be able to be included in a guild but their specific life history may require HSI criteria. It is a state species of special concern and has been identified as inhabiting the bypass reach. Late winter spawning and warm weather habitat needs are different from guild species.

In addition to using HSI criteria for host species of fish for an evaluation of mussel habitat, the model should develop a measure of shear stress for the bypass reach. The fact that state listed species have not been identified in this reach may be due to their rarity, the extent of sampling, and the minimum flow requirements. The presence of other mussel species indicates that with improved conditions state listed species could be expected to colonize the bypass reach.

As the locations of shad spawning are significant, transects in the IFIM study should be located at each spawning location in reaches 4 and 5. After the shad spawning survey is completed and spawning locations identified, a transect should be placed at each location.

3.3.2 *Evaluate Upstream and Downstream Passage of Adult American Shad*

Methodology

Task 2: Study Design and Methods

Location of telemetry antennas and receivers and description of receivers and antenna arrays is generally acceptable but there appears to be no capability to detect multiple frequencies with the Lotek receivers. All receivers should be able to detect all frequencies and codes **simultaneously**. Between fish tagged for FirstLight and TransCanada there will likely be over 500 tagged fish on multiple channels. Cycling through frequencies and antennas is likely to miss fish with the probability of missed detections increasing with the number of fish tagged.

The Sigma Eight tags cannot have their frequency programmed in the field (pers. com. Cam Grant).

The study plan does not include:

- Description of fish transport methods – tank, salt, $0^2$, etc.
- Location and number of video cameras in the spillway
- The number of replicates for each of the three day test flows is not described. Each of the three bypass flows during the sturgeon spawning period should be done for three days each (4 replicates = 36 days) alternating between flows after each three day period. After sturgeon spawning, the two lower flows should alternate for four days each until the end of the passage season.
- Where and how frequently water temperatures will be taken should be described as temperature is one of the variables that is proposed to be analyzed in relation to fish passage. Temperature should be recorded at least every two hours.

Manual tracking should occur twice a week. Mortality is likely to occur downstream of the Cabot station beyond the detection zone of the fixed antenna locations. To avoid the need for specific turbine mortality, as complete as possible collection of data for down running fish is necessary.

Task 3: Evaluation of Mortality

Mortality of tagged fish should be assessed at all telemetry locations and during mobile tracking and not just at the tailraces of Cabot Station and Station #1, the spillway and deep holes.

Task 5: Reporting

The report details are very superficial.

The report should include but not be limited to:

- Release numbers, locations and dates
- Fish vitals (length and sex)
- River temperature at Northfield, canal, bypass, and below Cabot Station
- Details of all manual tracking detections

* Movement times for all fish radio telemetry and PIT antenna – station to station
* Graphic description of movements of all fish

Turners Falls

- Upstream passage efficiency (proportion of fish passing upstream of the dam) for:
  - Fish detected at the Montague Waste Water Treatment Plant (MWWTP)
    - Fish in the tailrace at Cabot Station
    - Fish detected at the base of the Turners Falls dam
- Fishway attraction effectiveness – proportion of fish entering each of the three fishways that pass the fishway
- Behavior of fish that do not pass the project
- Number of forays fish made into each fishway
  - Successful and unsuccessful
- Number of forays upstream from MWWTP
- Number of forays into the bypass reach at each flow
- Analysis of how project operations affect upstream movement and entry into fishways

Downstream:

- Approach route and route of passage
- Analysis of delay at each barrier (gatehouse, station #1, Cabot Station, and dam)
- Proportion of fish that use:
  - Bypass, Cabot Station, Station #1, or pass over the dam in spill
  - Survival of fish using each route
- Overall successful project passage

Northfield Mountain:

- Number of fish within the Northfield zone of influence
- Number of fish entrained
- Delay at the Northfield project
- Description of movement patterns in the vicinity of Northfield Mountain
- Number of fish detected at stations upstream of Northfield

Study Schedule

The study plan recommends that a second year of study be conditioned based on the results of the 2014 study. How the results of those studies would determine the need for a second year of study is not described. A specific set of criteria should be listed that FirstLight feels would justify not doing a second year of study.

The study should be done in 2014 and 2015. Evaluation of a single year of river conditions is not sufficient to understand fish movement and behavior in a complex river environment. Environmental conditions vary year to year in any river and a one year study cannot capture this variation.

Table 3.3.2-1, Telemetry stations:

Cabot Station Tailrace

Figure 3.3.2-2 and the proposed antenna location will not be able to discern fish in the immediate area of the Cabot entrance. It will be important to know if fish are approaching the fishway but not entering (as detected by PIT tags) and how many times they do this prior to entry or not entering.

Radio telemetry with multiple droppers is needed at bypass entrance and extending down the sluice to ensure detection of bypassed fish. Based upon the burst frequency, length, slope and drop of the sluice, water velocity and volume of bypass flow, four antennas would be needed with spacing biased toward the start of the sluice. Testing of the detection range may indicate the need to have antennas on both sides of the sluice.

Station #1 Tailrace – FirstLight recommends only one antenna at Station #1 using detection power to determine if fish are delayed at the station. An antenna that is capable of detecting fish on the far side of the river is likely be a 6 or 9 element yagi. As detection is extended by additional elements the field of detection is narrowed especially at the antenna. Too narrow a field at the station tailrace will not sufficiently identify fish holding at the station's discharge. Two antenna as listed below should be used at this location.

- Radio telemetry to identify fish in close proximity to the tailrace
- Radio telemetry upriver of Station 1 to identify when fish pass the station

Spillway Ladder

- PIT antenna at the second turn pool exit as well as the first

NMPSS Upper reservoir – the depth of the intake area (48') precludes detection of radio tags of fish near the bottom. Dropper antennas can detect tags in close proximity but have limited range. At the Muddy Run project droppers were used during the downstream eel trials and no eels were detected on droppers while many were detected by yagi antennas. The unreliability of full detection by droppers indicates that an antenna is necessary in the upper reservoir.

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3.3.3 *Evaluate Downstream Passage of Juvenile Shad*

Existing Information

The report states that downstream migration occurs in the evening until 23:00. The period of downstream movement is longer. O'Leary and Kynard state: "The daily migration pattern of American shad was similar in the 3 years; between 71 and 87% of the fish moved in the afternoon and late evening (1400-2400 hours), and movement peaked between 1800 and 2200 hours (Figure 4)."

Figure 4 (O'Leary and Kynard) shows in 1981 and 1982 ~16% of the fish pass at 02:00. The paper notes episodic downstream passage of schools of juvenile shad.

Task 2: Evaluate Route of Passage

All receivers should be able to detect all frequencies and codes **simultaneously**. Both FirstLight and TransCanada will be tagging juvenile shad during the fall. Information at FirstLight projects can be augmented by collecting data from fish tagged by

TransCanada. Cycling through frequencies and antennas is likely to miss fish with the probability of missed detections increasing with the number of fish tagged. Additionally, both projects will be releasing American eels with telemetry tags. Assuming that the antennas and receivers will be used for both studies, the number of tags and frequencies will require increase the need to cycle through multiple frequencies further increasing the likelihood of missed detections.

Task 4: Reporting

The report should include but not be limited to:

- Report the volume of spill at each gate throughout the testing period.
- Spill data for the period of out migration should be summarized for the full period of digital records or 15 years whichever is longer so that an analysis of spill potential can be included in an overall project passage analysis.
- Delay at any location should be reported.
- A daily record of Northfield operations during the study period
- A long term history of pumping (number of units per hour) should be provided by month for April through November should be provided in tabular form similar to Tables 2.3-1 and 2.3-2 in the Exelon Muddy Run RSP 3.3 for eels or shad (FERC # 2355).

Table 3.3.3-1
Telemetry stations:

NMPSS Intake

- Area yagi antenna - – the depth of the intake area (48') precludes detection of radio tags of fish near the bottom with just a yagi antenna. As such dropper antennas (as proposed for the adult shad study) should be included to assist full depth coverage

NMPSS Upper reservoir

NMPSS Upper reservoir – the depth of the intake area (48') precludes detection of radio tags of fish near the bottom. Dropper antennas can detect tags in close proximity but have limited range. At the Muddy Run project droppers were used during the downstream eel trials and no eels were detected on droppers while many were detected by yagi antennas. The tags to be used on juvenile shad have less power than the larger tags used on the eels for Muddy Run. The unreliability of full detection by droppers indicates that an antenna is necessary in the upper reservoir.

Gatehouse

An antenna at the gatehouse is needed to assess delay and will provide information as to route of passage through the gatehouse (as a backup to the canal antenna) or, by lack of detection, over spill.

Canal

Radio telemetry with multiple droppers is needed at bypass entrance and extending down the sluice to ensure detection of bypassed fish. Based upon the burst frequency, length, slope and drop of the sluice, water velocity and volume of bypass flow, four antennas would be needed with spacing biased toward the start

of the sluice. Testing of the detection range may indicate the need to have antennas on both sides of the sluice.

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3.3.4 *Evaluate Upstream Passage of American Eel at the Turners Falls Project*

Study Goals and Objectives

The first objective is to identify eel concentrations where they occur in the project area. The first bullet limits locating concentrations to pools and wetted structures.

Task 1: Systematic Surveys

The entrance to the spillway ladder and the lower pools of the fishway should be surveyed.

Task 2: Trap Collections

Stakeholders should be consulted in determining additional trap locations beyond the three listed.

Surveys of eel concentrations should be done in 2015 as conditions in the field may change, the number of eels present will likely change, and the conditions that stimulate eels to move upstream are episodic and can vary the locations of concentration. By surveying a second year the likelihood of surveying when eels are blocked from migrating is increased.

Eel ramps should be covered with plywood to prevent avian predation.

Traps should be check the day after periods of rain or other events that would precipitate eel movement to prevent overcrowding and mortality.

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3.3.5 *Evaluate Downstream Passage of American Eel*

Task 1: Evaluate Timing of Downstream Migratory Movements

The specific dates of hydroacoustic monitoring should be August 1 to October 31.

A second season of study is proposed if the first is not typical. It is unclear what a typical or atypical season is. The study plans require collection of a considerable number of eels for both FirstLight and TransCanada. Insufficient eels to accomplish the 2014 studies would require a second study season. An alternative source of eels should be sought. The outlet of Congamond Lake in Southwick is one location that could be used as the lake has a population of eels and is a part of the Connecticut River drainage.

Task 2: Assessment of Downstream Passage of American Eel

The Sigma Eight tags cannot have their frequency programmed in the field (pers. com. Cam Grant).

Task 2a: Northfield Mountain Route Selection

A single yagi antenna at the intake is insufficient considering the depth of the river at the intake.

Task 2b: Turners Falls Route Selection Study

The specifics of the tags and information on how the mortality sensor work and will be programmed should be provided.

Table 3.3.5-1
Antenna locations:

NMPSS Intake

- Area yagi antenna – the depth of the intake area (48') precludes detection of radio tags of fish near the bottom with just a yagi antenna where eels are likely to be located. As such, dropper antennas (as proposed for the adult shad study) should be included to assist full depth coverage

NMPSS Upper reservoir

NMPSS Upper reservoir – the depth of the intake area (48') precludes detection of radio tags of eels near the bottom. Dropper antennas can detect tags in close proximity but have limited range. At the Muddy Run project droppers were used during the downstream eel trials and no eels were detected on droppers while many were detected by yagi antennas. The unreliability of full detection by droppers indicates that an antenna is necessary in the upper reservoir.

Gatehouse

An antenna at the gatehouse is needed to assess delay and will provide information as to route of passage through the gatehouse (as a backup to the canal antenna) or, by lack of detection, over spill.

Canal

Radio telemetry with multiple droppers is needed at bypass entrance and extending down the sluice to ensure detection of bypassed fish. Based upon the burst frequency, length, slope and drop of the sluice, water velocity and volume of bypass flow, four antennas would be needed with spacing biased toward the start of the sluice. Testing of the detection range may indicate the need to have antennas on both sides of the sluice.

Receivers:

All receivers should be able to detect all frequencies and codes **simultaneously**. Both FirstLight and TransCanada will be tagging American eels during the fall. Information at FirstLight projects can be augmented by collecting data from fish tagged by TransCanada. Cycling through frequencies and antennas is likely to miss fish with the probability of missed detections increasing with the number of fish tagged. Additionally, both projects will be releasing juvenile shad with telemetry tags. Assuming that the

antennas and receivers will be used for both studies, the number of tags and frequencies will increase, adding to loss of detection time if receivers cycle through additional frequencies.

Task 5: Reporting

The report should include:

- Release numbers, locations and dates
- Fish vitals (length, weight, and morphometric criteria)
- River temperature (collected every hour) at Northfield, canal, bypass and below Cabot Station
- Route selection
- Analysis of how project operations affect downstream movement and route selection
- All detections of fish
- Behavior of fish that do not pass the project
- Delay of fish: location and time
- Survival of fish passing each project facility
- A daily record of Northfield operations during the study period
- A long term history of pumping (number of units per hour) should be provided by month for April through November should be provided in tabular form similar to Tables 2.3-1 and 2.3-2 in the Exelon Muddy Run RSP 3.3 for eels or shad (FERC # 2355).

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3.3.6 *Impact of Project Operations on Shad Spawning, Spawning Habitat and Egg Deposition in the Area of the Northfield Mountain and Turners Falls Projects*

Existing Information:

There is no Figure 3.3.1-4 in the study plan.

Task 1: Development of a Detailed Study Plan

Data from the review of project operations at the Cabot Station and the USGS gage locations should be provided to the stakeholders in a digital format. Similarly, the water level data derived from the hydraulic model should be provided to the stakeholders in a manner that is comparable to the discharge data and for the known and potential spawning areas.

The critical component of hydraulic change includes, in addition to the magnitude of change and the corresponding water level fluctuation, the time over which changes take place. The rate of change for events beyond the capacity of the project should also be evaluated to compare to change when flow is within project capacity.

The report says the model will be used to evaluate the magnitude of water level changes. It should also be used to understand the rate of change.

Task 2: Examination of Known Spawning Areas Downstream of Turners Falls Dam

The first sentence states that the field surveys will be based on information from Task 1. Task 1 is a review of historic operation data and water level changes from the hydraulic model. It is not clear how either will inform field surveys.

Phase I surveys should be done three times a week to ensure that all areas are identified.

Spawning could be altered during both increases and **decreases** in flow. Both should be observed.

Egg netting below spawning sites should be done before and after flow changes. The study plan has only one ten minute tow. The number of eggs collected before and after fluctuation changes can be compared to evaluate a change in spawning.

Temperature should be recorded continuously at the upper and lower most spawning sites selected for manipulation evaluation.

Task 3: Examination of Identified Spawning Areas Upstream of Turners Falls Dam

While the HIS curves for shad spawning may be helpful to identify shad spawning areas, the full river upstream of the Turners Falls dam should be surveyed by boat at least twice a week. Radio tagged shad can be used to locate potential shad spawning sites.

Task 5: Data Analysis and Reporting

In addition to a map of all spawning locations, detailed maps of Phase II locations should be provided. Additional information should include:

- The number, dates and times of observations in Phase I
- Results of the Phase I observations
- A description of flow manipulations including change in flow and stage, the time for the effect to be realized (start and end times), and whether the flow was increased or decreased
- # of splashes before, during and after flow manipulation
- #'s of eggs collected before and after flow manipulation
- Behavior of fish during manipulations
- River temperature during study period
- Discharge in 15 minute increments during the period of the study
- Comparison of 2014 fluctuations to prior years fluctuations

Study Schedule

Field survey locations for Phase I can be preliminarily selected prior to the spawning season but the observations should include all spawning sites identified during the survey. The final Phase II sites should be selected in consultation with the stakeholders after the initial field identification of spawning sites. It is important that Phase I data be used to select sites for Phase II to ensure that the sites have a sufficient amount of spawning activity. The sites should have a range of project impact but are limited such

that there is time to collect all necessary data. Stakeholder 'buy-in' of site selection is important so that the report satisfies the goals of the study plan.

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3.3.7 *Fish Entrainment and Turbine Passage Mortality Study*

Task 4: Reporting

A long term history of pumping (number of units per hour) should be provided by month for April through November should be provided in tabular form similar to Tables 2.3-1 and 2.3-2 in the Exelon Muddy Run RSP 3.3 for eels or shad (FERC # 2355).

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3.3.15 *Assessment of Adult Sea Lamprey Spawning within the Turners Falls Project and Northfield Mountain Project Area*

Study Goals and Objectives

The goals and objectives listed in the study plan do not address the first goal and objective in the NOAA study request which was to "…determine whether the operations of the Projects are affecting the success of this activity [spawning] to occur."

Project Nexus

The Green River confluence is with the Deerfield River.

Task 1: Field Data Collection

FirstLight proposed to radio tag and release twenty lamprey at the Rt. 116 bridge and twenty above the Turners Falls dam. In 2008, 56.8% of the lamprey passed at Holyoke passed the Gatehouse fishway. If a similar percent passed in 2014 only ten lamprey would be available to locate spawning areas below Turners Falls. An unknown percent of these fish will ascend tributaries beyond the zone of impact of the project. In order to better assure that some tagged lamprey reach spawning grounds that are with the zone of influence, fifty fish should be tagged for release below Turners Falls. The recommended addition of twenty tagged lampreys to be released above Turners Falls is appropriate.

It is unclear how lamprey redds will be located as the telemetry locations for the adult shad study are not specific to lamprey spawning areas. Manual tracking will be needed to locate fish not at fixed telemetry locations.

Capping of redds in a large river with fluctuating flows has a low likelihood of success and may bias the impact of project operations by mitigating the effect of fluctuating flows. As such, it should be a component of a more complete evaluation of spawning success.

Tracking of tagged lamprey should not be the only means to locate spawning sites. All likely spawning locations should be observed determine if lampreys are using them or not. Knowledge of the range and number of spawning locations can be used to analyze the overall impact of project operations. Mapping of all spawning locations from the Rt. 116 bridge to the Turners Falls dam is needed for: the classification of suitable and unsuitable habitat, presence or absence of redd construction suitable habitat, and active spawning locations as described in the Report section of the study plan.

In addition to capping redds, redds in several zones of impact (closer to and farther away from Cabot station) should be evaluated for the presence of eggs. This can be done in a minimally invasive way by capturing eggs in a net held below a redd while moving rocks in the redd until a few eggs are captured. If no eggs are located the redd is not viable.

During alterations in flow (up and down) caused by project operations, observations of redds with lamprey should be made to determine if redd abandonment occurs as a result of project operations. Redd abandonment would be an obvious effect of project operations.

Task 2: Data Analysis

The proposed methodology for evaluating redd success is inadequate. The definition of success in this plan is limited to the presence or absence of larvae in redds which are capped.

Spawning success cannot be documented solely by the presence of redds or of the condition of redds prior to and after peaking events, unless the redd is destroyed by flow change. Rather, it should be documented with an evaluation of eggs in redds.

The presence of eggs in redds in areas that are highly impacted by peaking flows should be compared to redds in low impact areas to determine there is a difference. Similar or a significant difference in the frequency of redds with eggs in the high and low impact areas would be an indicator of project impact on spawning success.

Similarly the number of incidence of redd abandonment observed during flow changes can be compared between high and low impact areas.

Task 3: Report

The report should also include:

- Locations of all telemetry detections
- Discharge and stage during all observations of redds during fluctuations
- Continuous river temperature
- A statistical analysis of before and after events
- Maps of all suitable spawning locations
- Maps of all redds located during the study

3.3.18 *Impacts of the Turners Falls Canal Drawdown on Fish Migration and Aquatic Organisms*

Task 1: Conduct Aquatic Organism Survey of Canal During 2014 Drawdown

The description of the day of sampling is unclear. If the drawdown begins before midnight it is correct. Surveying should begin at daylight of the first morning after the drawdown starts.

The method of systematically traversing each of the zones in a meander survey fashion is contradictory and not a clear description of a survey technique.

All live fish collected by electrofishing or seining should be moved to a suitable tank with continuously flowing water as soon as possible after collection until they can be returned to the river.

The location of sub-sampling quadrates should be mapped with GPS.

Habitat types in each zone should be mapped with GPS so that the expansion of sub-samples can be accurately completed.

Dissolved oxygen should be measured in zone 7 after the canal is initially drained, mid-way through the drawdown, and at the end of the last day of the drawdown.

Depending on where the Keith Drainage Tunnel is located (no location description is provided) temperature and dissolved oxygen should also be measured downstream of the tunnel as well as at the upper and lower end of zone 7.

As the pools change over time, additional surveys of the size, water temperature and dissolved oxygen in pools in zones 1 to 6 should be made at least two times in addition to the initial survey. One survey should be the last day prior to refilling.

A task for Reporting is not included. A report should be completed.

It should include but not be limited to:

- Temperature, DO and turbidity data from all samples
- Map and area of habitats within each zone
- Map and area of all pools during each of the three monitoring periods
- Map of quadrate locations
- Description of survey methods during the initial evaluation
- List and number of fish species stranded
- Results of electrofishing and seining.
- Counts of mussels and ammocoetes in each quadrate
- Expansion of sub-sample quadrates to total mussels and ammocoetes in each zone
- Summary of Task 2 consultation
- Plans for mitigation that will be tested in 2015

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

Task 1: Ultrasound Deployment

FirstLight should provide:

- Details on the equipment to be used and how it will be deployed
- Intensity of ultrasound
- A description and a graphic of the expected field of ensonification
- Flows in the bypass during the trials

Testing should occur with two hour on and three or more hour off segments two times during the day beginning after 9:00 and before 11:00 to ensure that sufficient shad are present in the tailrace when the first and last 'on' tests begin.

Testing should occur two days per week for at least four weeks. As the Cabot ladder is the primary route for fish passage at the project limiting testing to two days a week balances the need to evaluate ultrasound and fish passage.

Hydroacoustics should be evaluated in 2014 and, if it is feasible, employed to assess how the population of fish responds to ultrasound. This will allow evaluation of a larger population of fish than the telemetry fish or video monitoring (below).

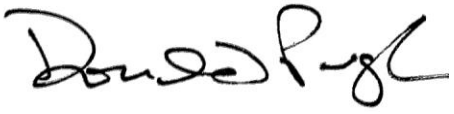
Video monitoring should be installed at the entrance to the Cabot fishway both inside the fishway and outside the entrance. This will provide data on fish that are not radio tagged as the number of radio tagged fish at the Cabot tailrace could be very limited.

Testing should be done with two bypass flows: 2,500 and 6,300 cfs.

In addition to the telemetry locations described in the adult shad study, an antenna and receiver should be located in the area of the Conte lab flume discharge to assess shorter movements upstream than might not continue to Rawson Island.

Thank you for the opportunity to comment on the proposed study plans. I can be reached at the above address, don.pugh@yahoo.com, or at 978 544 7438 if there are any questions.

Sincerely,



Donald Pugh

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