Relicensing Study 3.3.1

CONDUCT INSTREAM FLOW HABITAT ASSESSMENTS IN THE BYPASS REACH AND BELOW CABOT STATION

Initial Study Report Summary

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

Prepared for:

FirstLight™
GDF SUEZ

Prepared by:

Kleinschmidt
GOMEZ AND SULLIVAN ENGINEERS

SEPTEMBER 2014

1.1 Study Summary and Consultation Record to Date

The purpose of this study is to assess the potential effects of a range of discharges from Turners Falls Dam, Station No. 1, and Cabot Station on wetted area and aquatic habitat suitability in the bypass reach and below Cabot Station. The study area for the Turners Falls Hydroelectric Project instream flow study comprises five separate reaches that are being evaluated using a variety of methods given their varying hydraulic and habitat characteristics. The first four study reaches (Reach 1-4) extend approximately 14 miles downstream from the Turners Falls Dam to the Route 116 Sunderland Bridge. The fifth reach (Reach 5) starts at the Route 116 Sunderland Bridge and extends downstream 22 miles.

Reach 1. Upper Bypass Reach. This reach is approximately one mile long, and extends downstream from the Turners Falls Dam to the confluence with the Station No. 1 tailrace. Instream flow methods in Reach 1 include a one-dimensional (1-D) Physical Habitat Simulation (PHABSIM) model and an empirical flow demonstration ("BOBSAR").

Reach 2. Lower Bypass Reach. This reach is approximately two miles long, and extends downstream from the Station No. 1 tailrace to an island complex (Rawson Island) and natural ledge drop known as "Rock Dam." Instream flow methods in Reach 2 include 1-D PHABSIM between Station No. 1 to just upstream from Rawson Island, and two-dimensional (2-D) hydraulic modeling in the lower portion of the reach where flow bifurcates around Rawson Island.

Reach 3. Tailrace Reach. The tailrace reach extends downstream approximately 1.75 miles from the Rock Dam/Rawson Island complex to USGS Gage No. 01170500 at Montague. Instream flow methods in Reach 3 include 2-D hydraulic modeling.

Reach 4. Downstream Reach. This reach is approximately nine miles long and extends from the Montague gage downstream to the Route 116 Sunderland Bridge. Instream flow methods in Reach 4 include 1-D PHABSIM modeling.

Reach 5. This reach extends downstream approximately 22 miles from the Route 116 Sunderland Bridge to a natural hydraulic control located in the vicinity of the Dinosaur Footprints wilderness reservation in Holyoke. The hydraulic modeling approach in this reach will rely on the Hydrologic Engineering Centers River Analysis System (HEC-RAS) model that is being developed as part of Study 3.2.2 (*Hydraulic Study of Turners Falls Impoundment, Bypass Reach and below Cabot Station*) along with Delphi-developed habitat suitability index (HSI) criteria for any state or federally listed mussels found there.

FirstLight initiated habitat and hydraulic data collection in Reaches 1-3 in 2014. A summary description of the field data collection techniques employed and plans for 2014 and 2015 activities, as well as a summary of consultation to date, is provided below.

1.2 Study Progress Summary

Task 1: Consult with Agencies and Interested Stakeholders to Determine Study Area, Study Reaches, and Habitat Suitability Index Curves

The consultation documents described below are included in Appendix A to this Initial Study Report (ISR) summary.

FirstLight consulted with the stakeholders throughout the development of the study plan, and provided a record of consultation in the RSP (see RSP Section 3.9, *Matrix of Comments and Responses*), which was submitted to the Federal Energy Regulatory Commission (FERC) on August 14, 2013. Since issuance of

the Study Plan Determination Letter (SPDL) on February 21, 2014, FirstLight has consulted with the stakeholders to further define the study approach.

On **March 28, 2014**, FirstLight emailed three documents to United States Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), United States Geological Survey Conte Lab (USGS), Massachusetts Division of Fish and Wildlife (MDFW), Massachusetts Natural Heritage and Endangered Species Program (NHESP), Connecticut River Watershed Council (CRWC), Trout Unlimited (TU), The Nature Conservancy (TNC), American Whitewater Association (AWWA), New England Flow (NE FLOW), Appalachian Mountain Club (AMC) and Karl Meyer for review and comment:

- Meeting notes from November 12, 2013 stakeholder meeting;
- Method for coding bedrock substrates found in the study area; and
- Draft method for conducting the Reach 1 empirical flow habitat assessment (braided riffle area).

Emailed comments were received from the CRWC (April 14, 2014), TNC (April 14, 2014) and MDFW (April 22, 2014). FirstLight provided responses to these comments via email on **May 5, 2014**.

On **June 6, 2014**, FirstLight emailed an addendum to the habitat suitability information regarding lamprey incubation and zone of passage, freshwater mussel host fish species criteria, and water level logger locations. Emailed comments were received from Karl Meyer (June 19, 2014), CRWC (June 20, 2014), and letter (July 3, 2014) was received from the USFWS.

On July 11, 2014, FirstLight emailed responses to these comments and provided information on the data collection schedule for the study. On July 14, 2014, Karl Meyer emailed additional comments.

Concurrent consultation occurred with the NHESP. On **March 13, 2014**, NHESP filed a letter requesting additional data collection and/or analysis for yellow lampmussel in Reach 3 of the bypass. Teleconferences with FirstLight, FERC, and NHESP were held on **May 6** and **May 15, 2014**. FERC issued meeting minutes and agreements of the May 15, 2014 teleconference.

The correspondence occurred in order to resolve issues related to this study plan, as outlined in FERC's SPDL. The issues where FERC determined additional consultation or modification of the study plan was warranted are summarized below:

- *Habitat Suitability Index (HSI) Development for Sea Lamprey*: FirstLight revised the HSI criteria for sea lamprey as recommended by USFWS, attached as Figure 1.

- *Transects at Shad Spawning Sites*: As recommended by FERC, FirstLight will place transects in representative spawning habitat within the project-affected areas of Reach 5 utilizing existing shad spawning data, in consultation with the technical study team.

- *Host Fish Habitat Modeling*: FERC recommended FirstLight evaluate project effects on the primary host fish of all state-listed mussels present in the project-affected area. FirstLight provided a proposed approach to stakeholders on June 6, 2014 (Appendix A). No additional comments were received on this proposal.

- *Velocity Profiles for Mussels:* FirstLight will collect mean column and benthic velocity data at representative transects at all three calibration flows in Reaches 4 and 5 to validate mean column velocities and any simulated benthic velocities, as recommended by FERC.

- *Water Surface Level Monitoring Locations:* FirstLight installed additional water level loggers to validate/calibrate the proposed models in this study, as recommended by FERC. The locations were selected by the hydraulic modeling team and installed in places that would best facilitate model calibration.

- *Temperature Modeling for Mussels:* FERC recommends against collecting temperature data, modeling temperature, or including temperature in persistent habitat analyses for state-listed mussels as part of this study. FirstLight intends to collect temperature data as part of Study 3.2.1, *Water Quality Monitoring Study*.

- *Transect Locations for Mussels:* FirstLight proposes to identify transect locations in Reach 4 in consultation with the technical study team. All representative habitat types will be represented, as determined in the field by consensus of the technical study team.

Task 2: Method for Assessing State and Federally Listed Mussels

Under Task 3 in RSP 3.3.16 *Habitat Assessment, Surveys and Modeling of Suitable Habitat for State-Listed Mussel Species in the Connecticut River below Cabot*, FirstLight will develop quantitative binary HSI criteria for all state-listed mussel species documented in the 35-mile reach between Cabot Station and Dinosaur Footprints Reservation.

The field surveys for mussels in these areas were completed in 2014. The binary HSI criteria will be developed in Fall/Winter 2014, and then the screening level assessment tasks (2a) will occur after the field data for the respective reaches is complete.

Task 3: Field Data Collection

Reach 1 (Upper Bypass) and Reach 2 (Lower Bypass). FirstLight surveyed 11 cross-sectional habitat transects at three calibration flows from July 21-26, 2014. Each transect was located between cell boundary pairs that were established during the September 2013 site visit with agencies and stakeholders. Headpin and tailpins were located on the river banks above the 10,000 cfs water elevation, field blazed and geo-referenced with GPS. Four additional hydraulic transects were located as necessary to enhance modeling by defining backwatering and water surface profiles.

Habitat Data Collection – At each of the 11 habitat transects, FirstLight collected microhabitat data (*i.e.*, water depth, water velocity, water surface elevation, and substrate information) in accordance with the techniques described in the RSP. Field data were collected at three calibration flow targets (approximately 120, 700, and 4,000 cfs) released from the Turners Falls Dam. The low flow was released via the Turners Falls fishway and it was supplemented with discharge from Fall River (gaged at approximately 60 cfs) and leakage from Station No.1 (gaged at approximately 98 cfs). The mid- and high flows were released through the spillway fishway and Bascule Gate number 4.

Stream bed and bank cross-sectional profiles were surveyed during the low flow release (Photo 1). Bed elevation (to the nearest 0.01 foot) and substrate data were collected at intervals along each transect. All bed and bank elevations were surveyed to a common datum (*i.e.*, pre-established benchmarks). Temporary staff gages were established to monitor river stage during data collection both throughout the study area and on Fall River. Physical habitat data were collected with standard instream flow and stream gauging equipment (*e.g.*, autolevels and electronic velocity meters).

Hydraulic Data Collection – Velocity data were collected with an Acoustic Doppler Current Profiler (ADCP) or with a digital flow meter (Photo 2 – 3) at all habitat transects at both the low- and mid-calibration flow. The ADCP was used to collect physical and hydraulic data in Reaches 1 and 2 in non-

wadable run or pool type habitats and to provide an estimate of calibration flow discharge. The ADCP was attached to a floating platform, tethered to the transect line, and drawn laterally across the stream channel to collect water velocity, depth, and discharge information throughout the water column.

In wadable areas, the velocity meter probe was attached to a topset wading rod that enabled measurements to be taken at 60 percent of total water depth (at stations less than 2.5 feet deep) and at 20 and 80 percent of total water depth (at stations greater than 2.5 feet deep). In non-wadable and/or turbulent water, a velocity meter was deployed from a boat-mounted USGS stationing rig mounted on a 14 foot raft that was used to traverse the transect during data collection. Surveyors typically collected three replicates of time-averaged velocity readings at stations where water depth was less than 2.5 feet and six time-averaged velocity readings (three replicates each at 20 and 80 percent of water depth) at stations where water depth was greater than 2.5 feet.

Water surface elevations were surveyed at each transect at each of the three calibration flows concurrent with associated microhabitat data collection.

Photo 1. Bed profile and water velocity data collection on a wadable transect at low flow.

Photo 2. Raft and stationing rig used for bed profile and water velocity data collection in unwadable areas.

Photo 3. Velocity data collection with an ADCP unit.

Reach 3. Water level recorders were installed from May 15-16, 2014 at 20 locations throughout the reach, plus one barometric pressure recorder; the sensors were programmed to collect data on 5-minute intervals and are still in place at the time of this report. The locations were selected by the hydraulic modeling team and installed in places that would best facilitate model calibration. During this time, two recorders were vandalized and reinstalled. One logger is buried in substrate and will be removed during low water conditions.

Depth and velocity data were collected using an ADCP at approximately 30 transects during a flow scenario of 8,500 cfs from Cabot Station and 120 cfs in the bypass reach (July 22-23, 2014).

On July 24, 2014, and August 28, 2014 depth and velocity data were collected using an ADCP during a flow scenario of 4,500 cfs from Cabot Station and 700 cfs in the bypass reach.

Bathymetry, topography, and habitat data were collected in wadable and walkable areas on July 1, 2014 using an RTK GPS upstream of Rock Dam. This survey is not complete, and is expected to be completed during the 3rd quarter of 2014. In deeper areas above Rock Dam, bathymetry data were collected using an ADCP on July 24-25, 2015. More bathymetry data will be collected during the third quarter of 2014 in the remainder of Reach 3 below Rock Dam.

Task 4: Hydraulic Modeling (Reaches 1-4)

FirstLight plans to complete hydraulic modeling in Reaches 1-4 in 2015. Survey data are presently being reviewed and entered into a format for use in modeling.

Task 5: Hydraulic Modeling (Reach 5)

FirstLight plans to complete hydraulic modeling in Reach 5 in the 4th quarter of 2015.

Task 6a: Habitat Modeling (Reaches 1-4)

FirstLight plans to complete habitat modeling in Reaches 1-4 4th quarter of 2014. Habitat modeling will commence following preparation of calibrated hydraulic models. FirstLight plans to review habitat modeling results for Reaches 1-3 in consultation with agencies and stakeholders in late 2014, and collectively will use the data to target flows for the empirical flow demonstration in the upper portion of Reach 1.

Task 6b: Persistent Potential Habitat Modeling (Reach 4 (if necessary) and 5, mussels only)

FirstLight plans to complete persistent potential habitat modeling in Reach 4 in the 1st quarter of 2015, if necessary. Persistent potential habitat modeling in Reach 5 for mussels will be undertaken in the 4th quarter of 2015.

Task 7: Habitat Time Series (Reaches 3 and 4)

FirstLight plans to undertake this task in the 4th quarter of 2015.

Task 8: Persistent Habitat Analysis and Mapping (Reach 3) and Dual Flow Analysis (Reach 4)

FirstLight plans to undertake this task in the 4th quarter of 2015.

Task 9: Study Report

FirstLight plans to provide a progress report to the stakeholders describing the initial results of habitat and hydraulic modeling in Reaches 1-3 by the 2nd quarter of 2015. This report will be used to guide additional scoping of work to be performed in Reach 1 and Reaches 4-5. FirstLight plans to provide a report of completed instream flow study activities in the ISR by the 4th quarter of 2015. A final instream flow study report is due to the Commission by March 1, 2016 (see Study Plan Determination Letter, Appendix C).

1.3 Variances from Study Plan and Schedule

The schedule for this study has deviated from the RSP. As described above, most of the field data collection for Reaches 1-3 has occurred in 2014, and remaining field data collection for Reaches 1, and 4-5 is proposed to occur in 2015, after stakeholder consultation. The reporting schedule is described above.

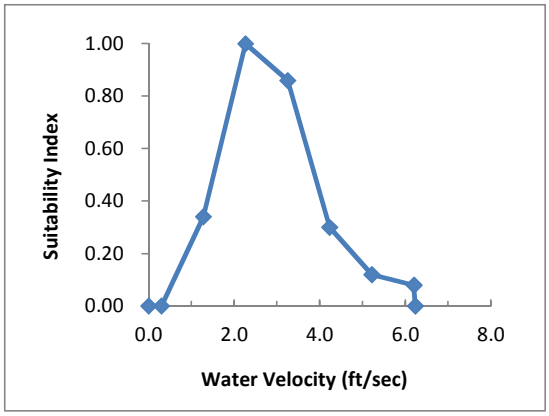
1.4 Remaining Activities

FirstLight anticipates that data analysis and reporting related to Reaches 1-3 will take place throughout the remainder of 2014 and early 2015. Scoping and stakeholder consultation for the Reach 1 (BOBSAR) and Reach 4 - 5 habitat and hydraulic assessments will take place prior to the 2015 field season. FirstLight anticipates completing Tasks 2 and 4-8 in 2014 and 2015.

Figure 1: Habitat Suitability Index, Sea Lamprey- Spawning & Incubation
Species: Sea lamprey
Lifestage: Spawning and Incubation

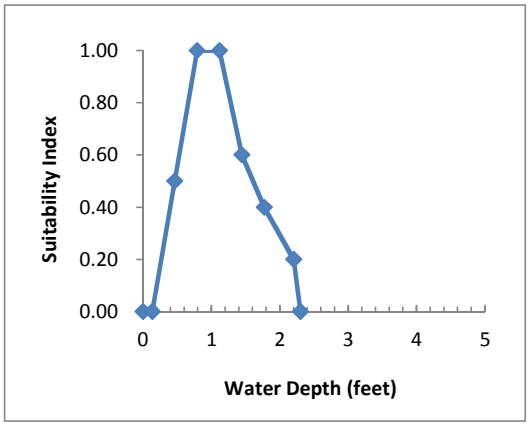
Velocity

Velocity	SI Value
0.00	0.00
0.30	0.00
1.28	0.34
2.26	1.00
3.25	0.86
4.23	0.30
5.22	0.12
6.20	0.08
6.23	0.00



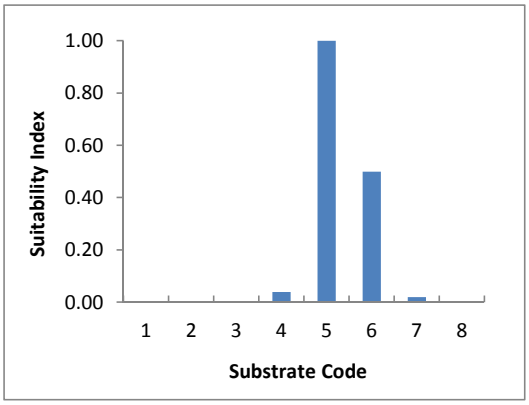
Depth

Depth	SI Value
0.00	0.00
0.13	0.00
0.46	0.50
0.79	1.00
1.12	1.00
1.44	0.60
1.77	0.40
2.20	0.20
2.30	0.00



Substrate

Substrate	SI Value	Type
1	0.00	Detritus/Organic
2	0.00	Mud/soft clay
3	0.00	Silt
4	0.04	Sand
5	1.00	Gravel
6	0.50	Cobble/rubble
7	0.02	Boulder
8	0.00	Bedrock



Source: Habitat Suitability Index for Sea Lamprey redds
Kynard and Horgan 2013
Revised depth and substrate per USFWS July 3, 2014 letter, extrapolated from Yergeau, 1983

Appendix A
Consultation Record from FERC SPDL through Initial Study Report Summary.

From:	Jason George
To:	"Tom Christopher"; "Andrea Donlon"; "Melissa Grader"; "peter.hazelton@state.ma.us"; "kkennedy@tnc.org"; "micah_kieffer@usgs.gov"; "Jesse Leddick"; "Bill McDavitt"; "karlm@crocker.com"; "Jessica Pruden"; "don.pugh@yahoo.com"; "sims@honors.umass.edu"; "Caleb Slater"; "Ken Sprankle"; "brett_towler@fws.gov"; "John Warner"; "Misty-Anne Marold"; "Bob Nasdor"
Cc:	"Howard, John"; "Brandon.Kulik@KleinschmidtUSA.com"; "glemay@gomezandsullivan.com"; "Stira, Robert"; "Tom Sullivan"; "Mark Wamser"
Subject:	FirstLight Turners Falls IFIM - follow-up to November 2013 study team meeting
Date:	Friday, March 28, 2014 3:33:00 PM
Attachments:	2013-11-12 Turners Falls IFIM agency meeting notes.pdf Turners Falls IFIM Study - Bedrock Coding Memo.pdf DRAFT Method for Conducting the Reach 1 Assessment - Stakeholder Copy.pdf

---

Dear FirstLight IFIM Study Stakeholders,

Attached are the meeting notes from our last meeting on this study, held on November 12, 2013. As a follow-up to this meeting, we have developed two documents which detail methods proposed for the following specific elements of this study:

Method for coding bedrock substrates found in the study area

Draft method for conducting the reach 1 empirical flow habitat assessment (braided riffle area)

Please submit any comments you may have on the attached within two weeks, or by April 14, 2014. Please address technical comments to Brandon Kulik (Brandon.Kulik@KleinschmidtUSA.com).

Since the last meeting, FERC issued its Study Plan Determination Letter on February 21, 2014 in which the Instream Flow Study Plan was approved with modifications. FirstLight is currently investigating the modifications to the study plan which may require further consultation, including specific HSI criteria for sea lamprey and related HSI criteria for primary host fish of state-listed mussels of concern in the project-affected area. We anticipate distributing draft recommendations on these subjects for your review and input in the near future.

Additionally, in response to your comments and as directed by the FERC Study Plan Determination Letter, FirstLight plans to install over 20 water level loggers in Reach 1-3 in order to ensure the accuracy of modeled conditions. The specific locations of the logger deployment will be determined in the field, and your previous comments regarding logger placement will be considered. Once installed, a map showing the locations will be provided to you.

Finally, we anticipate that additional consultation will be required to conduct the work in the downstream reaches in 2015. We look forward to working with you to make this a successful study.

Jason George
Gomez and Sullivan Engineers, PC
41 Liberty Hill Road, PO Box 2179

Gomez and Sullivan
Engineers and Environmental Scientists
41 Liberty Hill Road, PO Box 2179
Henniker, NH 03242
603-428-4960
FAX 603-428-3973

MEETING MINUTES

Meeting Date: November 12, 2013

Attendees: See attached sign in sheet

Re: Turners Falls IFIM Study- Study Team meeting - review of site visit, methodologies, and substrate code

All attendees met at the FirstLight Northfield Visitor's Center. Mark W. welcomed everyone and opened the meeting.

1. *Review Site Visit*

   Brandon K. led a discussion summarizing the outcome of the September 10-11, 2013 site visit (*notes detailing the site visit were provided*), in which the participants (most of whom were at today's meeting) viewed the study area on foot, to confirm study area boundaries, set 1-D model cell boundaries, and made other site-specific adjustments to the overall study plan based on direct observation and group discussion. Maps and aerial photos of each reach, overlaid with cell boundaries and transects were projected on a screen during the presentation.

2. *Approach for Reaches 1-3*

   The study area extends from the Turners Falls dam downstream to the confluence with the Deerfield River near the USGS gage. This area is divided into three distinct study reaches (*numbered consecutively from upstream to downstream*) with boundaries located at points where significant sources of flow such as tributaries or project discharges enter the river. At Melissa Grader's request, the review progressed from downstream to upstream, consistent with the order in which the site visit was conducted.

   Reach 3. This reach extends from the lower study area boundary upstream to the upstream end of the braided channel and Rawson Island complex and also defined by Rock Dam. The geomorphology of this reach is highly alluvial, with some bedrock outcrops, and is primarily riffle and run. This study area is influenced by both Cabot Station discharge and also collective flow releases from the Turners Falls dam as well as Station No. 1. Cabot Station is located at approximately the midpoint of this reach, and station flows are passed downstream but also backwater upstream to Rock Dam and into the braided channels under some conditions. These circumstances will be modeled using a 2-D model. Gary L. summarized the major data collecting and modeling approaches to be employed in this reach.

   Bill McDavitt asked why we broke reach two and three where we did – implying that it may be worth renaming the 2-D portion of reach 2 as part of reach 3. Brandon responded that it is worth differentiating where we have designated it since it will be easier to break out the area that is influenced by Cabot backwater. After some discussion, everyone agreed that we should keep the Cabot backwater influence limit as the reach 2-3 break.

   Reach 2. This reach extends from the Reach 3 boundary upstream to the discharge of Station No. 1. The stream geometry in this reach is primarily bedrock controlled, and is comprised of a large pool at the downstream end, and a run/riffle complex in the upper end. The lowermost segment of this reach will be represented by a 2-D model to account for the hydraulic where the channel braid bifurcations occur. The remainder of the reach will be represented by a traditional

1-D PHABSIM model. The study team broke this section up into a series of contiguous longitudinal cells (Cells A-K), based on the channel characteristics observed during the September walkover. Within each cell the channel characteristics are considered to be reasonably homogenous so that habitat within a cell can be represented by one transect within the cell. In a few limited cases, a repeating pattern of channel geometry was observed. In such cases the transect data from one similar cell will be used to represent habitat in the other similar cell to avoid redundancy. This scheme resulted in a total of 11 cells and nine transects.

Bill McDavitt was wondering if the angle of Station No. 1 entry would impact the model results in transect T9.

Reach 1. This reach extends from the Reach 2 boundary upstream to the Turners Falls dam. The stream channel of this reach is also bedrock controlled. It includes a large plunge pool immediately below the dam. The pool has two outlets, the primary one is a relatively well-defined channel (river right) that follows the right bank around a 90 degree outside river bend. It has numerous riffles and elevation breaks created by bedrock seams; the other outlet is less well defined, and cascades through bedrock and rubble micro-braids. Both channels converge and discharge to a pool that backwaters from just slightly above Station No. 1. A run extends from this pool to the Station No. 1 discharge.

The study team agreed that the plunge pool can be characterized by a bathymetric survey, and that the outlet channels would be difficult to accurately model. Instead, the team will jointly perform an empirical evaluation of demonstration flows that will be released to the reach from the dam and fishway. The specific flows will be targeted by the study team after reviewing IFIM model output from reaches 2 and 3. The team will collect empirical data in the two stream channels at each demonstration flow, and review and discuss the observations using applicable Habitat Suitability Criteria (HSC) and zone of passage criteria. First Light will draft a proposed plan to detail specifics for team review. Run habitat at the downstream end of Reach 1 will be modeled, using two 1-D PHABSIM transects. The team located cell boundaries as in Reach 2.

There was some discussion on what to do for the plunge pool area, with some confusion that a 2D hydraulic model would be implemented. Tom explained that at this time a 2-D model is contemplated to assess fish passage flows. For habitat, simply a bathymetry and topography survey is proposed to understand how wetted area changes with flow. John Warner mentioned that while he understands that the IFIM study doesn't have to understand pool hydraulics, the fish passage studies may need to address how the different bascule/tainter gates will impact pool velocities during passage seasons, and that we will have a discussion about this at a later date.

Melissa was wondering if there was an empirical data component to the braided riffle BOBSAR approach. Brandon explained that there would be an element of empirical data collection, probably with in-field transects and/or designated spot measurement locations chosen. Mark explained that we need to more clearly define our data collection and study objectives relative to this reach. **[Action Item –Circulate a study plan for the BOBSAR to stakeholders]**. In general, the group agreed that there will be more of an empirical approach to the braided riffle study area, rather than any modeling or simulation work.

John Warner mentioned that while we will use reach 2 and 3 results to inform reach 1 work, there is also the possibility that the reach 1 and reach 2/3 results may require looking at flows outside of those that reach 2/3 would initially suggest.

Melissa was wondering if the 1D model in reach 1 will be able to account for the backwater from Station No. 1. She was wondering if a 2D model would be needed. Tom explained that a 1D model can handle the backwater, and the only reason you would need a 2D model is if you were concerned about flow splits or other phenomena not easily explained in a 1D model.

Don was wondering how we would be tying all of the water surface elevations and bed elevations together in the 1D model. Tom and Brandon explained that the transect surveys will be surveyed into the same datum.

John Warner asked about how the Station No. 1 flows will be addressed in the 1D model portion of reach 1. Tom explained that Station No. 1 will essentially be modeled as a tributary where the backwater induced by the station flows will carry through both the reach 2 and reach 1 one-dimensional modeling.

Bill, Andrea and others had questions about why no habitat transect was going to be placed in cell M (the long pool upstream of Station No. 1 and downstream of the "elbow" area in the river). There was a discussion about the characteristics of that reach versus the area that is clearly a pool upstream of the bridge. The group thought that we should split cell M into two sections, with the split occurring about ~300 feet upstream of the bridge. Everyone agreed that T11 should be a habitat transect, with cell M being split into two cells. Everyone agreed that the pool portion of cell M does not need a transect (hydraulic or habitat).

3. *Substrate Coding*

Since the last meeting, GSE and Kleinschmidt had developed standardized substrate coding definitions, using the Wentworth scale to define particle sizes as a means to boulder distinguish boulder, cobble, gravel, etc. in the field. One issue that the team discussed during the September site visit is how to site-specifically rate habitat suitability in the bedrock controlled parts of the study area.

The group recognized that the available HSC that they team has selected are adequate overall other than that they consistently rate the suitability of bedrock as zero; this is based on the common definition of bedrock as a smooth featureless surface with few crevasses or refugia. However, portions of the study area dominated by bedrock differ from this description, as portions of the bedrock in this instance are comprised of folds and striations that provide a degree of refuge and foraging for aquatic organisms, and therefore, do not function as classically defined bedrock.

Katie suggested that we simply substitute boulder coding for folding bedrock in the field. Bill McDavitt mentioned that hydraulically that the folded bedrock probably acts more like cobble from a roughness standpoint. Katie was concerned with changing the HSI that have been established at this point, since we are essentially changing the coding for all bedrock (even the non-folded bedrock). John Warner and others suggested that we come up with a consistent method for identifying what the bedrock acts more like.

The team felt that such types of bedrock should be assigned a suitability value greater than zero, and discussed three alternatives:

A. Treat all crevassed-type bedrock as "Boulder" and assign the resulting HSC index value for a given species and lifestage,
B. Develop classifications for types of bedrock and assign new HSC values to each, possibly corresponding to those ranging from bedrock to cobble, or
C. A photo-based classification of Bedrock with unique HSC values for each. Under this scheme FirstLight would:
    a. Submit "field guide" definitions and photos of each bedrock sub-category to a committee of stakeholder. The stakeholder committee would agree on categories and proposed SI values.

[Action Item: It was agreed that Kleinschmidt would develop a first draft for group review.]

4. *Implications of Vermont Yankee Nuclear Power Plant Closure*

   Mark led a discussion about the upcoming FERC and agency meeting scheduled for November 25, 2013, to evaluate potential changes to scope and schedule for certain studies, resulting from the announcement regarding the closure of Vermont Yankee nuclear plant. The group concurred that this study scope would not be affected by the Vermont Yankee issue.

5. *Provisional Schedule*

   Mark stated that currently, FirstLight anticipates that the field data collection phase for the IFIM study would occur in early summer 2014. The study would have to be coordinated among other concurrent efforts to avoid conflicts and at times when flow control for each calibration flow set can be maintained. Model results would be made available in late summer so that results can be reviewed and discussed, and a subsequent Reach 1 flow demonstration can be scheduled. The study effort for Reaches 4 and 5 is dependent on completion of the freshwater mussel survey so that the locations of transects etc. can be better defined to account for that habitat assessment factor.

   There was some discussion about whether FERC should be cc'd on the study development process. Mark explained that the stakeholders will be informed on further developments or changes to any agreed-upon study plans, as well as those that don't have enough specifics in the existing study areas.

   The group agreed that FERC should be copied on some of the IFIM study plans as they are further developed. There may be some benefit to getting FERC onboard to help make the case why flows should be steady in the Connecticut River (and maybe the Deerfield) during the IFIM study collection.

SIGN-IN SHEET

11/12/13

Meeting in Northfield Visitors Center, Northfield, MA
Re: IFIM Study

Name	Affiliation	Email
Mark Wamser	Gomez + Sullivan	mwamser@gomezandsullivan.com
Jason George	"	
Gary Lemay	"	
Tom Sullivan	"	
BRANDON KULIK	KLEINSCHMIDT ASSOCIATES	brandon.kulik@kleinschmidtusa.c
John Howard	FirstLight	
Tom Christopher	NEFLOW	tom.christopher@comcast.net
Norm Sims	AMC	sims@honors.umass.edu
Andrea Donlon	CRWC	adonlon@ctriver.org
KARL MEYER	JOURNALIST	karlm@crocker.com
JESSE LEDDICK	MADFW - NHESP	jesse.leddick@state.ma.us
Bill McDavitt	NMFS	william.mcdavitt@noaa.gov
Bob Stirz	FirstLight	
DON PUGH		don.pugh@yahoo.com
Bob Nasdor	AMERICAN WHITEWATER	BOB@AMERICANWHITEWATER.ORG
Katie Kennedy	TNC	kkennedy@tnc.org
Ken Sprankle	USFWS	Ken_sprankle@fws.gov
Melissa Grader	USFWS	Melissa_grader@fws.gov
John Warner	USFWS	john_warner@fws.gov
Caleb Slater	MADFW	caleb.slater@state.ma.us
Jess Pruden	NMFS - via phone	

MEMORANDUM

DATE: March 28, 2014

TO: Turners Falls Instream Flow Study Team

FROM: Brandon Kulik

RE: TURNERS FALLS IFIM STUDY BEDROCK SUBSTRATE CODING

The purpose of this memo is to recommend potential refinements to the classification of bedrock substrates and habitat suitability rating for use in the Turners Falls IFIM study.

The study team conducted a site visit to reaches 1, 2 and 3 (from Turners Falls Dam to Cabot tailrace) of the IFIM study on September 10-11, 2013. The focus of the site visit was study area orientation, to select transects, and refine study methods described in the Revised Study Plan (*see site visit summary notes*). During the site visit, the attendees observed that bedrock substrate is extensive, and dominates a significant portion of reaches 1 and 2. The bedrock substrate includes smooth as well as tilted and broken surfaces.

At the November 12, 2013 study team meeting, participants reviewed and discussed the results of the September 10-11, 2013 site visit; one issue that was identified for further development was suitability coding of bedrock substrates. Habitat Suitability Criteria (HSC) selected by the study team generally classifies bedrock as having low habitat suitability. This is because ordinary smooth bedrock lacks crevasses and pockets to shelter fish from high velocities, predators etc., prevents aquatic vegetation to anchor, or provides little opportunity for aquatic insects to anchor or burrow.

Variation in substrates

Photo Plate 1 illustrates a range of commonly occurring substrate conditions throughout reaches 1 and 2. Bedrock occurs in both complex forms, including folds, striations and crevasses (Photo 1) as well as in smooth, flat surfaces (Photo 2), sometimes overlain with boulder or cobble fragments, chiefly from broken or eroding rock materials (Photo 2a). In some instances these bedrock areas are extensive (Photo 3).

Other common substrates include boulder, cobble and gravel (Photos 4 through 6). In some locations, bedrock is overlain with patches of these other substrates (Photos 3a through 5).

Recommendation

A field coding and model application protocol for substrate suitability should be straightforward so that it can be efficiently and consistently interpreted by field technicians and objectively applied to the model analysis in the office. We recommend the following approach.

There appear to be four types of bedrock conditions that may provide differing levels of habitat suitability. These are smooth bedrock (“Type 1”), complex bedrock (“Type 2”), bedrock densely overlain with smaller substrates such as cobble/boulder (“Type 3”), and bedrock sparsely overlain with smaller substrates such as cobble/boulder (“Type 4”).

Type 1. Smooth bedrock. This condition lacks sufficient cover, crevasses or other features that provide shelter or foraging opportunities for fish and is consistent with a low suitability rating. We do not recommend altering the suitability rating for this type of substrate.

Type 2. Complex Bedrock. This condition provides a degree of shelter; based on the size and geometry of the folds and striations, the variability appears to generally mimic boulder-sized substrates (See photos 1 and 1a). For that reason we suggest assigning the same suitability rating to this type of bedrock for a given species as would be assigned if it was boulder substrate.

Type 3. Bedrock densely overlain with smaller substrates. This condition provides shelter and foraging opportunity (see photos 3a and 4). In situations where overlying substrates are abundant (*i.e. greater than 50% of the stream bottom*) we recommend classifying the substrate as if it was the dominant smaller material and assigning the same suitability rating to this type of dominant smaller substrate present for a given species.

Type 4. Bedrock sparsely overlain with smaller substrates. This condition provides limited shelter and foraging opportunity (see photos 2a and 5). In situations where overlying substrates are sparse *(i.e. less than 50% of the stream bottom*) we recommend classifying the substrate as if it was the dominant bedrock material (type 1 or type 2) and assigning the same suitability rating to this type of dominant material present for a given species.

PHOTO PLATE 1. COMMON SUBSTRATES FOUND AT TURNERS FALLS

1. Complex bedrock (reach 1)

1a. Complex bedrock (reach 2)

2. smooth bedrock

2a. Smooth Broken bedrock (reach 1)

3. Bedrock expanse

3a. Bedrock expanse covered by boulder/cobble

TYPES OF BEDROCK SUBSTRATES FOUND AT TURNERS FALLS *(continued)*

4. Bedrock/Boulder/Cobble

4.a Cobble

5. Smooth bedrock overlain with cobble

5.a cobble

6. Gravel

Gravel

DRAFT Method for Conducting the Reach 1 Empirical Flow Habitat Assessment

March 28, 2014

The study area will include the fluvial channel portion of the bypassed reach of the Connecticut River that extends from the outlet of the plunge pool below the Turners Falls Dam downstream to the backwatered riverine pool (see Figure 1). Aquatic habitat in this area includes a complex braiding of shallow riffles and runs, defined by bedrock outcrops, rubble, and other smaller substrates.

1.0 PROPOSED METHODOLOGY

FirstLight proposes to conduct this study in a phased approach.

1.1 PHASE 1. IFIM FLOW ASSESSMENT

FirstLight will first perform the IFIM study in reaches 2 and 3, and the lowermost portion of Reach 1 as described in the Revised Study Plan. The study team will then evaluate these data to define a flow range of interest to evaluate in this study area, and propose a series of flow increments within that range for empirical observation.

1.2 PHASE 2. INSTREAM FLOW ASSESSMENT

Prior to conducting field work, FirstLight will consult with the stakeholder team to select applicable aquatic species and lifestages for evaluation. This may include some or all of the same species and life stage Habitat Suitability Criteria (HSC)[1] applied to other study areas, and/or zone of passage considerations[2]. The flow assessment will be comprised of collecting empirical habitat suitability data in the study area at a series of flows at representative transects and/or locations selected in the field by the study team. FirstLight anticipates that approximately four flows may be evaluated; however the study team will make the final determination.

[1] The HSC ranks the suitability of depth, velocity and substrate/cover on a scale from 0.0 (unsuitable) to 1.0 (optimal).

[2] For purposes of this assessment FirstLight recommends zone of passage criteria cited by Bovee (1982) which provides for a minimum water depth of no less than 2/3 the body depth of the largest fish expected to pass the most limiting channel constriction.

Each flow will be provided by opening gates and /or the fishway, to introduce each targeted flow to the plunge pool. The range of flows to be provided has not been identified; however, FirstLight proposes to pass these flows through the fish ladder or Bascule Gate No. 1, which automatically adjusts its position to pass the same flow if the Turners Falls Impoundment elevation fluctuates. Note that the other bascule gates and the taintor gates are not "pond following" gates. To facilitate this, the study will occur at a time when project inflow is relatively stable, and within the range of the station's hydraulic capacity. To the extent that field conditions allow, the assessment will be conducted as a continuous sequential event over one or two consecutive days. Corresponding water surface elevations will be surveyed on transects or referenced by staff gage readings so that changes in wetted area can be documented.

Manual stream flow gaging in the study area will be difficult due to the channel characteristics. As an alternative, each study flow will be determined by gate setting calculations. More specifically, gate rating curves are available to calculate the discharge. The discharge contributed from Fall River will be manually gaged at the time of the study.

Once each evaluation flow is stabilized (verified by monitoring staff gages in Reach 1), the study participants will gather depth, velocity, and wetted substrate data along each pre-established transect and/or reference point(s) throughout the study area. These locations will be mapped and/or geo-referenced using GPS, so that the same location can be measured at each flow and the information transferred to GIS in reports.

During analysis, each resulting recorded HSC variable (depth, velocity and substrate/cover) will be determined for each selected species and lifestage by an index score value at each transect vertical or other reference point according to the following table:

HSI VALUE RANGE	**NARRATIVE VALUE**	**INDEX SCORE**
0.75 - 1.00	High	4
0.50 - 0.74	Good	3
0.25 - 0.49	Fair	2
0.0 – 0.24	Poor	1

The suitability of each vertical along each transect (or other loci selected) will be ranked according to how the prevailing depth, velocity, and substrate/cover measurements in the field

relate to the HSC at each flow. The net habitat score for each transect will be the sum of the index score for each vertical, followed by summing all vertical scores across the transect.

For example, an optimal single vertical with perfect "High" suitability habitat would have a score of 12:

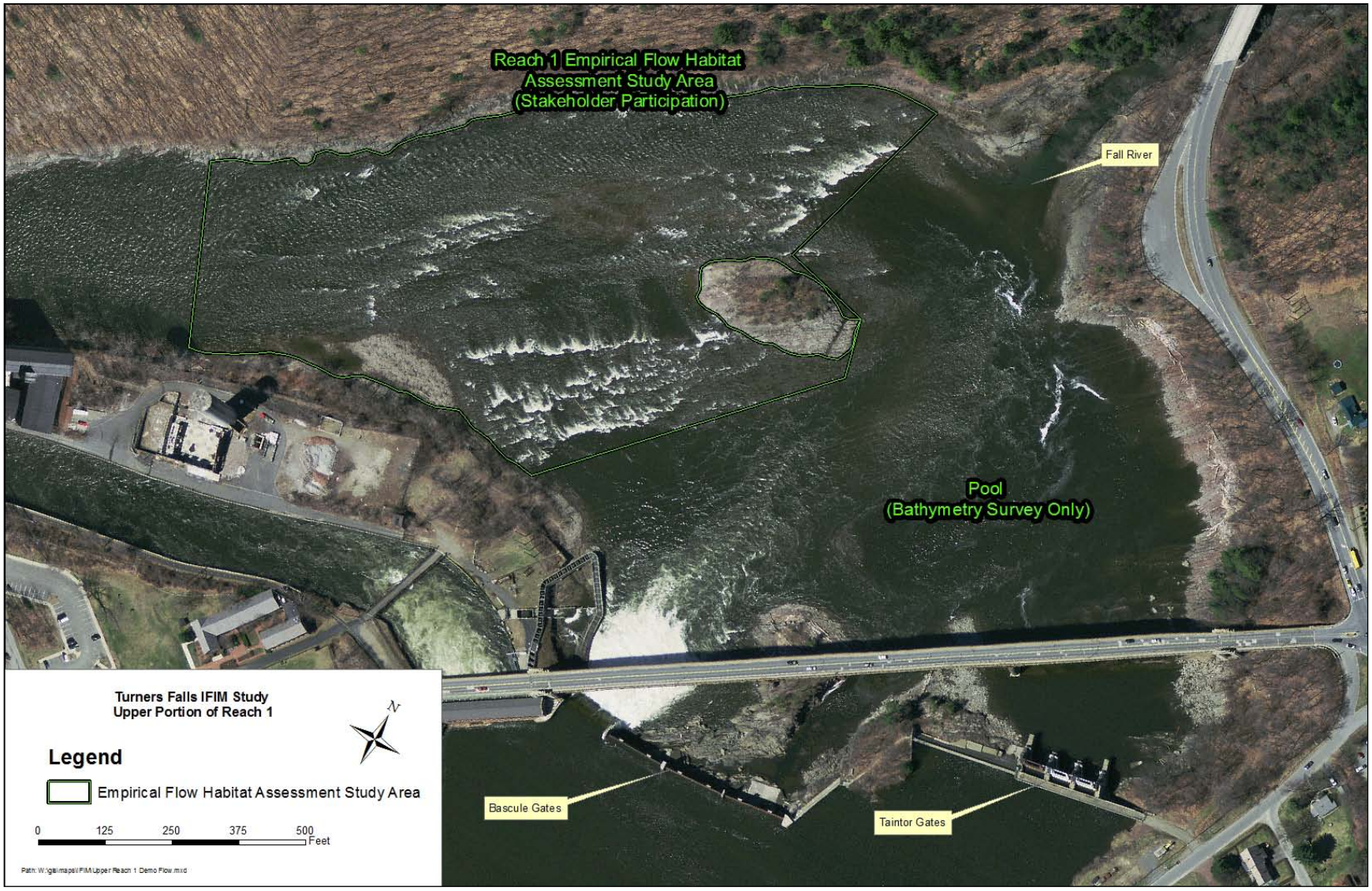
Depth (4) +Velocity (4) + Substrate (4) = 12.

Assuming that there were 25 verticals established across a transect, and if all criteria were theoretically ranked as "High" for the given flow, the resulting transect score would be $12_1 + 12_2 + \ldots 12_{25} = 300$. This would be performed for each agreed-upon species/life stage. Other potential non-transect loci such as non-linear patches of habitat (should they exist), would be similarly rated, but based on spot measurements rather than a linear transect. The rank scores resulting for each transect (or other site) at each flow will be provided in both tabular and graphic form, so that changes in habitat suitability across the flow range of interest can be readily compared and a suitability rating curve across the flow range established. Each transect at each flow will be photo-documented, with photos attached as a report appendix.

REFERENCES

Bovee, K.D. (1982). A guide to stream habitat analysis using the instream flow incremental methodology. (Office of Biol. Service FWS/OBS-82-26). Washington, DC: USFWS, U.S. Dept. of Interior.

Figure 1: Reach 1 Empirical Flow Habitat Assessment Study Area.



From:	Andrea Donlon
To:	"Jason George"; "Tom Christopher"; "Melissa Grader"; peter.hazelton@state.ma.us; kkennedy@tnc.org; micah_kieffer@usgs.gov; "Jesse Leddick"; "Bill McDavitt"; karlm@crocker.com; "Jessica Pruden"; don.pugh@yahoo.com; sims@honors.umass.edu; "Caleb Slater"; "Ken Sprankle"; brett_towler@fws.gov; "John Warner"; "Misty-Anne Marold"; "Bob Nasdor"
Cc:	"Howard, John"; Brandon.Kulik@KleinschmidtUSA.com; glemay@gomezandsullivan.com; "Stira, Robert"; "Tom Sullivan"; "Mark Wamser"
Subject:	RE: FirstLight Turners Falls IFIM - follow-up to November 2013 study team meeting
Date:	Monday, April 14, 2014 2:35:20 PM

Brandon,

Here are comments from CRWC on the attachments sent out by Jason George on 3/28/14.

1. Meeting minutes from November 12, 2013.

The minutes mostly capture the key elements of our discussion. A couple of things I noted in my notes that aren't in the minutes are as follows:

- We discussed coordinating with upstream peaking operations, if possible. Nothing was specifically stated about whether that includes Northfield Mountain, but I guess that remains a question as to what that facility will be doing during some of the IFIM field work days.
- We also heard that water level loggers were going to be pulled out of the river just before Thanksgiving, and re-installed in March (not sure if that happened).

2. Bedrock substrate coding.

As long as the fisheries biologists feel that the complex bedrock in the bypass section of the CT River is functionally equivalent to boulder substrate, this approach seems reasonable. My only suggestion is that the 4 types of bedrock conditions listed in this memorandum be matched with the photos better, for clarity purposes. If Smooth Bedrock is Type 1, there should be a set of photos coded Type 1 with captions underneath. Type 2 photos should be organized together as well. Currently, it is confusing that photos labeled with a 1 are type 2 and vise-versa.

3. Draft method for conducting Reach 1 Empirical Flow Habitat Assessment (aka BOBSAR study plan, I think).

The last sentence says that "Each transect at each flow will be photo-documented, with photos attached as a report appendix." Please correct me if I'm wrong, but I think there are only two transects in Reach 1: T-11 in Cell M (which is going to be split into 2) and T-10 in Cell L. Photo documentation will be very important to document water levels in the braided riffle section of the river, and under this plan there will be no photo documentation because there are no transects. I would recommend that a future draft of this method include proposed photo points for this area. Ideally, it would be great to climb up the mill building brick smoke stack tower to get an aerial view of the entire area to document what the whole area looks like at specific flow points.
In general, I think more details are needed about what you plan to do during the four test flows in the Pool section just below the dam and the braided riffle section.

Andrea

_____

Andrea Donlon, River Steward
CONNECTICUT RIVER WATERSHED COUNCIL, INC.
15 Bank Row
Greenfield MA 01301
Phone: (413)772-2020 x. 205
Fax: (413)772-2090
adonlon@ctriver.org
Become a member today! Join at www.ctriver.org.
CRWC is on Facebook—become a fan

From: Jason George [mailto:jgeorge@gomezandsullivan.com]
Sent: Friday, March 28, 2014 3:34 PM
To: 'Tom Christopher'; 'Andrea Donlon'; 'Melissa Grader'; peter.hazelton@state.ma.us; kkennedy@tnc.org; micah_kieffer@usgs.gov; 'Jesse Leddick'; 'Bill McDavitt'; karlm@crocker.com; 'Jessica Pruden'; don.pugh@yahoo.com; sims@honors.umass.edu; 'Caleb Slater'; 'Ken Sprankle'; brett_towler@fws.gov; 'John Warner'; 'Misty-Anne Marold'; 'Bob Nasdor'
Cc: 'Howard, John'; Brandon.Kulik@KleinschmidtUSA.com; glemay@gomezandsullivan.com; 'Stira, Robert'; 'Tom Sullivan'; 'Mark Wamser'
Subject: FirstLight Turners Falls IFIM - follow-up to November 2013 study team meeting

Dear FirstLight IFIM Study Stakeholders,

Attached are the meeting notes from our last meeting on this study, held on November 12, 2013. As a follow-up to this meeting, we have developed two documents which detail methods proposed for the following specific elements of this study:

1. Method for coding bedrock substrates found in the study area
2. Draft method for conducting the reach 1 empirical flow habitat assessment (braided riffle area)

Please submit any comments you may have on the attached within two weeks, or by April 14, 2014. Please address technical comments to Brandon Kulik (Brandon.Kulik@KleinschmidtUSA.com).

Since the last meeting, FERC issued its Study Plan Determination Letter on February 21, 2014 in which the Instream Flow Study Plan was approved with modifications. FirstLight is currently investigating the modifications to the study plan which may require further consultation, including specific HSI criteria for sea lamprey and related HSI criteria for primary host fish of state-listed mussels of concern in the project-affected area. We anticipate distributing draft recommendations on these subjects for your review and input in the near future.

Additionally, in response to your comments and as directed by the FERC Study Plan Determination Letter, FirstLight plans to install over 20 water level loggers in Reach 1-3 in order to ensure the accuracy of modeled conditions. The specific locations of the logger deployment will be determined in the field, and your previous comments regarding logger placement will be considered. Once installed, a map showing the locations will be provided to you.

Finally, we anticipate that additional consultation will be required to conduct the work in the downstream reaches in 2015. We look forward to working with you to make this a successful study.

Jason George
Gomez and Sullivan Engineers, PC
41 Liberty Hill Road, PO Box 2179
Henniker, NH 03242
Office: (603) 428-4960
Cell: (603) 340-7666

From:	Katie Kennedy
To:	Brandon Kulik
Cc:	"Howard, John"; glemay@gomezandsullivan.com; "Stira, Robert"; "Tom Sullivan"; "Mark Wamser"; Jason George; "Tom Christopher"; "Andrea Donlon"; "Melissa Grader"; peter.hazelton@state.ma.us; micah_kieffer@usgs.gov; "Jesse Leddick"; "Bill McDavitt"; karlm@crocker.com; "Jessica Pruden"; don.pugh@yahoo.com; sims@honors.umass.edu; "Caleb Slater"; "Ken Sprankle"; brett_towler@fws.gov; "John Warner"; "Misty-Anne Marold"; "Bob Nasdor"
Subject:	RE: FirstLight Turners Falls IFIM - follow-up to November 2013 study team meeting
Date:	Monday, April 14, 2014 4:43:57 PM
Attachments:	image004.png

Brandon – Here are my technical comments for the bedrock coding and the methods for Reach 1:

Bedrock coding: I think the description of the four bedrock types and the methods to classify them are thoughtful and sufficient. It may also be useful, as suggested by CRWC, to explicitly align the photos in the memo with these four classes.

Reach 1 Methods: I think these generally look fine. A couple of minor points:

The methods do not state the number of transects/locations, but as I understand it that is still TBD by the "Study Team." I suggest that this is made a bit more explicit.

In terms of the results, I'm assuming that we will be able to see (in some form) not only the final score, but the individual habitat component measures for each transect/location under each flow. Would you also make this more explicit? I just want to be sure that I will be able to view the spatial relationships of the data if needed.

Thank you!
Katie Kennedy

Kathryn D. Mickett Kennedy
Applied River Scientist
kkennedy@tnc.org
(413) 586 2349 (Office)
(413) 588 1959 (Cell)

The Nature Conservancy
Connecticut River Program
136 West Street, Suite 5
Northampton MA 01060

The Nature Conservancy
Protecting nature. Preserving life.

nature.org/ctriver

From: Jason George [mailto:jgeorge@gomezandsullivan.com]
Sent: Friday, March 28, 2014 3:34 PM
To: 'Tom Christopher'; 'Andrea Donlon'; 'Melissa Grader'; peter.hazelton@state.ma.us; Katie Kennedy; micah_kieffer@usgs.gov; 'Jesse Leddick'; 'Bill McDavitt'; karlm@crocker.com; 'Jessica Pruden'; don.pugh@yahoo.com; sims@honors.umass.edu; 'Caleb Slater'; 'Ken Sprankle'; brett_towler@fws.gov; 'John Warner'; 'Misty-Anne Marold'; 'Bob Nasdor'
Cc: 'Howard, John'; Brandon.Kulik@KleinschmidtUSA.com; glemay@gomezandsullivan.com; 'Stira, Robert'; 'Tom Sullivan'; 'Mark Wamser'
Subject: FirstLight Turners Falls IFIM - follow-up to November 2013 study team meeting

Dear FirstLight IFIM Study Stakeholders,

Attached are the meeting notes from our last meeting on this study, held on November 12, 2013. As a follow-up to this meeting, we have developed two documents which detail methods proposed for the following specific elements of this study:

1. Method for coding bedrock substrates found in the study area
2. Draft method for conducting the reach 1 empirical flow habitat assessment (braided riffle area)

Please submit any comments you may have on the attached within two weeks, or by April 14, 2014. Please address technical comments to Brandon Kulik (Brandon.Kulik@KleinschmidtUSA.com).

Since the last meeting, FERC issued its Study Plan Determination Letter on February 21, 2014 in which the Instream Flow Study Plan was approved with modifications. FirstLight is currently investigating the modifications to the study plan which may require further consultation, including specific HSI criteria for sea lamprey and related HSI criteria for primary host fish of state-listed mussels of concern in the project-affected area. We anticipate distributing draft recommendations on these subjects for your review and input in the near future.

Additionally, in response to your comments and as directed by the FERC Study Plan Determination Letter, FirstLight plans to install over 20 water level loggers in Reach 1-3 in order to ensure the accuracy of modeled conditions. The specific locations of the logger deployment will be determined in the field, and your previous comments regarding logger placement will be considered. Once installed, a map showing the locations will be provided to you.

Finally, we anticipate that additional consultation will be required to conduct the work in the downstream reaches in 2015. We look forward to working with you to make this a successful study.

Jason George
Gomez and Sullivan Engineers, PC
41 Liberty Hill Road, PO Box 2179
Henniker, NH 03242
Office: (603) 428-4960
Cell: (603) 340-7666

From:	Slater, Caleb (MISC)
To:	Jason George
Subject:	RE: FirstLight Turners Falls IFIM - follow-up to November 2013 study team meeting
Date:	Tuesday, April 22, 2014 10:02:53 AM
Attachments:	2013-11-12 Turners Falls IFIM agency meeting notes.pdf Turners Falls IFIM Study - Bedrock Coding Memo.pdf DRAFT Method for Conducting the Reach 1 Assessment - Stakeholder Copy.pdf

Jason,

Sorry about the delay- DFW is fine with the methods outlined here.

Caleb

Caleb Slater, PhD
Anadromous Fish Project Leader
Massachusetts Division of Fisheries and Wildlife
PLEASE NOTE NEW FIELD HEADQUARTERS ADDRESS (Phones and Emails have not changed.)
Mass. Division of Fisheries & Wildlife
100 Hartwell Street, Suite 230
West Boylston MA 01583
508-389-6331
www.mass.gov/masswildlife

From: Jason George [mailto:jgeorge@gomezandsullivan.com]
Sent: Friday, March 28, 2014 3:34 PM
To: 'Tom Christopher'; 'Andrea Donlon'; 'Melissa Grader'; Hazelton, Peter (FWE); kkennedy@tnc.org; micah_kieffer@usgs.gov; Leddick, Jesse (FWE); 'Bill McDavitt'; karlm@crocker.com; 'Jessica Pruden'; don.pugh@yahoo.com; sims@honors.umass.edu; Slater, Caleb (FWE); 'Ken Sprankle'; brett_towler@fws.gov; 'John Warner'; Marold, Misty-Anne (FWE); 'Bob Nasdor'
Cc: 'Howard, John'; Brandon.Kulik@KleinschmidtUSA.com; glemay@gomezandsullivan.com; 'Stira, Robert'; 'Tom Sullivan'; 'Mark Wamser'
Subject: FirstLight Turners Falls IFIM - follow-up to November 2013 study team meeting

Dear FirstLight IFIM Study Stakeholders,

Attached are the meeting notes from our last meeting on this study, held on November 12, 2013. As a follow-up to this meeting, we have developed two documents which detail methods proposed for the following specific elements of this study:

1. Method for coding bedrock substrates found in the study area
2. Draft method for conducting the reach 1 empirical flow habitat assessment (braided riffle area)

Please submit any comments you may have on the attached within two weeks, or by April 14, 2014. Please address technical comments to Brandon Kulik

(Brandon.Kulik@KleinschmidtUSA.com).

Since the last meeting, FERC issued its Study Plan Determination Letter on February 21, 2014 in which the Instream Flow Study Plan was approved with modifications. FirstLight is currently investigating the modifications to the study plan which may require further consultation, including specific HSI criteria for sea lamprey and related HSI criteria for primary host fish of state-listed mussels of concern in the project-affected area. We anticipate distributing draft recommendations on these subjects for your review and input in the near future.

Additionally, in response to your comments and as directed by the FERC Study Plan Determination Letter, FirstLight plans to install over 20 water level loggers in Reach 1-3 in order to ensure the accuracy of modeled conditions. The specific locations of the logger deployment will be determined in the field, and your previous comments regarding logger placement will be considered. Once installed, a map showing the locations will be provided to you.

Finally, we anticipate that additional consultation will be required to conduct the work in the downstream reaches in 2015. We look forward to working with you to make this a successful study.

Jason George
Gomez and Sullivan Engineers, PC
41 Liberty Hill Road, PO Box 2179
Henniker, NH 03242
Office: (603) 428-4960
Cell: (603) 340-7666

From:	Brandon Kulik
To:	Katie Kennedy
Cc:	"Howard, John"; glemay@gomezandsullivan.com; "Stira, Robert"; "Tom Sullivan"; "Mark Wamser"; Jason George; "Tom Christopher"; "Andrea Donlon"; "Melissa Grader"; peter.hazelton@state.ma.us; micah_kieffer@usgs.gov; "Jesse Leddick"; "Bill McDavitt"; karlm@crocker.com; "Jessica Pruden"; don.pugh@yahoo.com; sims@honors.umass.edu; "Caleb Slater"; "Ken Sprankle"; brett_towler@fws.gov; "John Warner"; "Misty-Anne Marold"; "Bob Nasdor"
Subject:	RE: FirstLight Turners Falls IFIM - follow-up to November 2013 study team meeting
Date:	Monday, May 05, 2014 10:35:31 AM
Attachments:	image002.png

Dear FirstLight IFIM Study Participants,

Pursuant to Jason George's email of March 28, 2014 , The Nature Conservancy and Connecticut River Watershed Council circulated comments pertaining to the following two documents from:

1. Method for coding bedrock substrates found in the study area
2. Draft method for conducting the reach 1 empirical flow habitat assessment (braided riffle area)

Thanks for your prompt review and input. Here are our responses:

***Katie Kennedy (TNC) comments**:*

bedrock coding and the methods for Reach 1:

Bedrock coding: I think the description of the four bedrock types and the methods to classify them are thoughtful and sufficient. It may also be useful, as suggested by CRWC, to explicitly align the photos in the memo with these four classes. **We concur, and will re-organize the photos along with the narrative**

Reach 1 Methods: I think these generally look fine. A couple of minor points:

The methods do not state the number of transects/locations, but as I understand it that is still TBD by the "Study Team." I suggest that this is made a bit more explicit.

That is correct. The flow demonstration transects are strictly for empirical

measurements at points of interest and will be collectively selected by the study team attendees at the time of the flow demonstration. These transects are not part of the PHABSIM flow model and therefore have no computational relationship to the PHABSIM model transects.

In terms of the results, I'm assuming that we will be able to see (in some form) not only the final score, but the individual habitat component measures for each transect/location under each flow. Would you also make this more explicit? I just want to be sure that I will be able to view the spatial relationships of the data if needed.

As noted in the study plan, the individual habitat suitability scores will be derived from empirical transect measurements (depth, velocity etc) that will recorded in the field at each demonstrated flow. We anticipate that the contributing raw data and resulting scoring for each locus along each transect will be included in tabular and graphic form in the ensuing report.

***Andrea Donlon comments from CRWC**:*

1. Meeting minutes from November 12, 2013.

The minutes mostly capture the key elements of our discussion. A couple of things I noted in my notes that aren't in the minutes are as follows:

- *We discussed coordinating with upstream peaking operations, if possible. Nothing was specifically stated about whether that includes Northfield Mountain, but I guess that remains a question as to what that facility will be doing during some of the IFIM field work days.).* **FirstLight will notify TransCanada in advance of the field work, but they have no authority to limit TransCanada's peaking operations from Vernon. FirstLight will strive to manage operations so as to provide the stable flows needed during the IFIM data collection period.**
-
- *We also heard that water level loggers were going to be pulled out of the river just before Thanksgiving, and re-installed in March (not sure if that happened).* **Although not germane to the IFIM study, water level**

loggers in the Turners Falls Impoundment were installed before the spring runoff in March, with the exception of the water level logger near the French King Bridge—this one could not be installed due to safety concerns.

2. *Bedrock substrate coding.*

As long as the fisheries biologists feel that the complex bedrock in the bypass section of the CT River is functionally equivalent to boulder substrate, this approach seems reasonable. My only suggestion is that the 4 types of bedrock conditions listed in this memorandum be matched with the photos better, for clarity purposes. If Smooth Bedrock is Type 1, there should be a set of photos coded Type 1 with captions underneath. Type 2 photos should be organized together as well. Currently, it is confusing that photos labeled with a 1 are type 2 and vise-versa. **See comments above**

3. *Draft method for conducting Reach 1 Empirical Flow Habitat Assessment (aka BOBSAR study plan, I think).*

The last sentence says that "Each transect at each flow will be photo-documented, with photos attached as a report appendix." Please correct me if I'm wrong, but I think there are only two transects in Reach 1: T-11 in Cell M (which is going to be split into 2) and T-10 in Cell L. Photo documentation will be very important to document water levels in the braided riffle section of the river, and under this plan there will be no photo documentation because there are no transects. **The transects to which you are referring are part of the PHABSIM model; however, the flow demonstration transects are not, and they will be collectively selected by the study team attendees at the time of the flow demonstration. These flow demonstration transects have no direct computational relationship to the PHABSIM model. They are strictly for empirical measurements at points of interest specifically in the braided stream section below the large pool outlet that your comment refers to. The empirical flow demonstration approach was chosen for this braided channel area as an alternative to modeling, explicitly because it would be difficult to accurately model**.

I would recommend that a future draft of this method include proposed photo

points for this area. Ideally, it would be great to climb up the mill building brick smoke stack tower to get an aerial view of the entire area to document what the whole area looks like at specific flow points

It is unlikely that we will photograph the flow demonstration study from the smoke stack tower due to safety concerns, and also because of its distance away from the stream channel. In our experience, the most revealing information from flow demonstration photos is invariably the changes in close-up microhabitat details such as micro chutes, eddies and other localized hydraulics that change at various flows. These would probably not be perceptible from a photo taken from the perspective of a distant tower.

In general, I think more details are needed about what you plan to do during the four test flows in the Pool section just below the dam and the braided riffle section.

The pool below the dam is wide shallow banked, and has complex outlets. As stated in the PHABSIM study plan, a bathymetric survey will be conducted in the pool immediately below the dam to characterize its volume, and the outlet bed elevations will be surveyed to provide insight as to how they control water elevations and also how water discharges from each outlet to the braided riffles.

The pool below the braided riffle section is relatively deep, with uniform banks and a straightforward hydraulic control. The study team concluded that it was unnecessary to model or analyze this pool because this pool is inherently insensitive to incremental flow changes. It was evident during the September 2013 site visit that the hydraulics are relatively static compared to riffles and runs. i.e pool depth and mean column velocities do not vary significantly at flows of interest. The chief value of the pool is to serve as refuge and resting area when fish elect to leave adjacent riffle/run habitat. It was evident to the biologists on the site visit that this habitat service will exist throughout the flow range of interest in the study and thus data collected in the pool would not likely yield useful decision data.

We appreciate you taking the time to review the materials and providing comments.

Sincerely,

Brandon Kulik

Brandon H. Kulik
Senior Fisheries Scientist
Kleinschmidt
Pittsfield, Maine
207-487-3328

From: Katie Kennedy [mailto:kkennedy@TNC.ORG]
Sent: Monday, April 14, 2014 4:44 PM
To: Brandon Kulik
Cc: 'Howard, John'; glemay@gomezandsullivan.com; 'Stira, Robert'; 'Tom Sullivan'; 'Mark Wamser'; Jason George; 'Tom Christopher'; 'Andrea Donlon'; 'Melissa Grader'; peter.hazelton@state.ma.us; micah_kieffer@usgs.gov; 'Jesse Leddick'; 'Bill McDavitt'; karlm@crocker.com; 'Jessica Pruden'; don.pugh@yahoo.com; sims@honors.umass.edu; 'Caleb Slater'; 'Ken Sprankle'; brett_towler@fws.gov; 'John Warner'; 'Misty-Anne Marold'; 'Bob Nasdor'
Subject: RE: FirstLight Turners Falls IFIM - follow-up to November 2013 study team meeting

Brandon – Here are my technical comments for the bedrock coding and the methods for Reach 1:

Bedrock coding: I think the description of the four bedrock types and the methods to classify them are thoughtful and sufficient. It may also be useful, as suggested by CRWC, to explicitly align the photos in the memo with these four classes.

Reach 1 Methods: I think these generally look fine. A couple of minor points:

The methods do not state the number of transects/locations, but as I understand it that is still TBD by the "Study Team." I suggest that this is made a bit more explicit.

In terms of the results, I'm assuming that we will be able to see (in some form) not only the final score, but the individual habitat component measures for each transect/location under each flow. Would you also make this more explicit? I just want to be sure that I will be able to view the spatial relationships of the data if needed.

Thank you!
Katie Kennedy

Kathryn D. Mickett Kennedy
Applied River Scientist
kkennedy@tnc.org

The Nature Conservancy
Connecticut River Program
136 West Street, Suite 5

(413) 586 2349 (Office)
(413) 588 1959 (Cell)

Northampton MA 01060

nature.org/ctriver

From: Jason George [mailto:jgeorge@gomezandsullivan.com]
Sent: Friday, March 28, 2014 3:34 PM
To: 'Tom Christopher'; 'Andrea Donlon'; 'Melissa Grader'; peter.hazelton@state.ma.us; Katie Kennedy; micah_kieffer@usgs.gov; 'Jesse Leddick'; 'Bill McDavitt'; karlm@crocker.com; 'Jessica Pruden'; don.pugh@yahoo.com; sims@honors.umass.edu; 'Caleb Slater'; 'Ken Sprankle'; brett_towler@fws.gov; 'John Warner'; 'Misty-Anne Marold'; 'Bob Nasdor'
Cc: 'Howard, John'; Brandon.Kulik@KleinschmidtUSA.com; glemay@gomezandsullivan.com; 'Stira, Robert'; 'Tom Sullivan'; 'Mark Wamser'
Subject: FirstLight Turners Falls IFIM - follow-up to November 2013 study team meeting

Dear FirstLight IFIM Study Stakeholders,

Attached are the meeting notes from our last meeting on this study, held on November 12, 2013. As a follow-up to this meeting, we have developed two documents which detail methods proposed for the following specific elements of this study:

3. Method for coding bedrock substrates found in the study area
4. Draft method for conducting the reach 1 empirical flow habitat assessment (braided riffle area)

Please submit any comments you may have on the attached within two weeks, or by April 14, 2014. Please address technical comments to Brandon Kulik (Brandon.Kulik@KleinschmidtUSA.com).

Since the last meeting, FERC issued its Study Plan Determination Letter on February 21, 2014 in which the Instream Flow Study Plan was approved with modifications. FirstLight is currently investigating the modifications to the study plan which may require further consultation, including specific HSI criteria for sea lamprey and related HSI criteria for primary host fish of state-listed mussels of concern in the project-affected area. We anticipate distributing draft recommendations on these subjects for your review and input in the near future.

Additionally, in response to your comments and as directed by the FERC Study Plan Determination Letter, FirstLight plans to install over 20 water level loggers in Reach 1-3 in order to ensure the accuracy of modeled conditions. The specific locations of the logger deployment will be determined in the field, and your previous comments regarding logger placement will be considered. Once installed, a map showing the locations will be provided to you.

Finally, we anticipate that additional consultation will be required to conduct the work in the downstream reaches in 2015. We look forward to working with you to make this a successful study.

Jason George
Gomez and Sullivan Engineers, PC
41 Liberty Hill Road, PO Box 2179
Henniker, NH 03242
Office: (603) 428-4960
Cell: (603) 340-7666

From:	Jason George
To:	"Andrea Donlon"; "Melissa Grader"; "peter.hazelton@state.ma.us"; "kkennedy@tnc.org"; "micah_kieffer@usgs.gov"; "Jesse Leddick"; "Bill McDavitt"; "karlm@crocker.com"; "Jessica Pruden"; "don.pugh@yahoo.com"; "Caleb Slater"; "Ken Sprankle"; "brett_towler@fws.gov"; "John Warner"; "Misty-Anne Marold"; "Bob Nasdor"; "Tom Christopher"; "sims@honors.umass.edu"
Cc:	"Howard, John"; "Brandon Kulik"; "glemay@gomezandsullivan.com"; "Stira, Robert"; "Tom Sullivan"; "Mark Wamser"
Subject:	RE: FirstLight Turners Falls IFIM - HSI and status update
Date:	Friday, June 06, 2014 10:03:00 AM
Attachments:	WaterLevelLoggers - Reach 3 Upper1.pdf WaterLevelLoggers - Reach 3 Lower1.pdf 2014-06-06 Turners Falls HSI addendum.pdf

Dear FirstLight IFIM Study Stakeholders,

Attached is a memo describing our approach to the outstanding habitat suitability assessments for lamprey incubation and zone of passage and freshwater mussel host fish species. Also attached is a map showing the water level loggers installed in Reach 3. Additional water level loggers will be installed in Reaches 1 and 2 during the test flows to validate/calibrate the proposed models in this study.

The field data collection for this study is in the final planning stages and we anticipate being in the field throughout the summer, with most of the data collected after the fishways close in mid-July.

Please respond within two weeks, or by June 20, 2014, with any comments, questions or concerns regarding the attached materials. Thank you.

Jason George
Gomez and Sullivan Engineers, PC
41 Liberty Hill Road, PO Box 2179
Henniker, NH 03242
Office: (603) 428-4960
Cell: (603) 340-7666

From: Jason George [mailto:jgeorge@gomezandsullivan.com]
Sent: Friday, March 28, 2014 3:34 PM
To: 'Tom Christopher'; 'Andrea Donlon'; 'Melissa Grader'; 'peter.hazelton@state.ma.us'; 'kkennedy@tnc.org'; 'micah_kieffer@usgs.gov'; 'Jesse Leddick'; 'Bill McDavitt'; 'karlm@crocker.com'; 'Jessica Pruden'; 'don.pugh@yahoo.com'; 'sims@honors.umass.edu'; 'Caleb Slater'; 'Ken Sprankle'; 'brett_towler@fws.gov'; 'John Warner'; 'Misty-Anne Marold'; 'Bob Nasdor'
Cc: 'Howard, John'; 'Brandon.Kulik@KleinschmidtUSA.com'; 'glemay@gomezandsullivan.com'; 'Stira, Robert'; 'Tom Sullivan'; 'Mark Wamser'
Subject: FirstLight Turners Falls IFIM - follow-up to November 2013 study team meeting

Dear FirstLight IFIM Study Stakeholders,

Attached are the meeting notes from our last meeting on this study, held on November 12, 2013. As a follow-up to this meeting, we have developed two documents which detail methods proposed for the following specific elements of this study:

1. Method for coding bedrock substrates found in the study area
2. Draft method for conducting the reach 1 empirical flow habitat assessment (braided riffle area)

Please submit any comments you may have on the attached within two weeks, or by April 14, 2014. Please address technical comments to Brandon Kulik (Brandon.Kulik@KleinschmidtUSA.com).

Since the last meeting, FERC issued its Study Plan Determination Letter on February 21, 2014 in which the Instream Flow Study Plan was approved with modifications. FirstLight is currently investigating the modifications to the study plan which may require further consultation, including specific HSI criteria for sea lamprey and related HSI criteria for primary host fish of state-listed mussels of concern in the project-affected area. We anticipate distributing draft recommendations on these subjects for your review and input in the near future.

Additionally, in response to your comments and as directed by the FERC Study Plan Determination Letter, FirstLight plans to install over 20 water level loggers in Reach 1-3 in order to ensure the accuracy of modeled conditions. The specific locations of the logger deployment will be determined in the field, and your previous comments regarding logger placement will be considered. Once installed, a map showing the locations will be provided to you.

Finally, we anticipate that additional consultation will be required to conduct the work in the downstream reaches in 2015. We look forward to working with you to make this a successful study.

Jason George
Gomez and Sullivan Engineers, PC
41 Liberty Hill Road, PO Box 2179
Henniker, NH 03242
Office: (603) 428-4960
Cell: (603) 340-7666

MEMORANDUM

TO: Turners Falls Project Instream Flow Study Stakeholders

FROM: Brandon Kulik

DATE: June 6, 2014

RE: **INSTREAM FLOW STUDY: HABITAT SUITABILITY CRITERIA**

FirstLight met with study team members on May 8, 2013 to discuss and refine study-specific Habitat Suitability Criteria (HSC). Based on those discussions, FirstLight issued a memo on May 30, 2013, recommending additional HSC for the IFIM study at Turners Falls.

The purpose of this memo is to continue to resolve a few HSC details resulting from subsequent consultation, culminating in the FERC study plan determination letter (February 21, 2014). The two outstanding issues are:

1. further consultation regarding lamprey incubation and zone of passage
2. freshwater mussel host fish species criteria

HSI Development for Sea Lamprey (FERC SPD letter, B-7)

> *"The National Marine Fisheries Service (NMFS) requests that FirstLight add sea lamprey incubation criteria to reaches 1 and 2. Both NMFS and Donald Pugh suggests FirstLight add sea lamprey zone of passage criteria to reaches 1 and 2."*

> *" we do not recommend any specific changes to the HSI criteria or HSI application at this time. If the technical study team cannot reach consensus on specific HSI criteria for sea lamprey or other species, FirstLight should proceed with the study as described in the study plan and file the Initial Study Report as required by section 5.15(c) of the Commission's regulations. After comments and responses to comments on the Initial Study Report are received, we would make a determination regarding any outstanding issues including the need for additional data analysis based on alternative HSI criteria."*

Host Fish Habitat Modeling (FERC SPD letter, B-10)

> *"we recommend FirstLight evaluate project effects on the primary host fish of all state-listed mussels present in the project-affected area in addition to the proposed evaluation of tessellated darter. Previous mussel surveys and proposed surveys in study 3.3.16 - Habitat Assessment, Surveys and Modeling of Suitable Habitat for State listed Mussel Species would determine which state-listed mussel species are present in the project-affected area. FirstLight should develop HSI curves for these host fishes in a collaborative manner as described above"*

Sea lamprey incubation. Adult lamprey ascend rivers as water temperature exceeds 4^{o} C, and spawning commences when the temperature of the water is about 10° C and is completed by the time it has warmed to about 20°-21° C (Bigelow and Schroeder, 1953). HSC for the spawning lifestage of this species provided by NOAA on May 23, 2013 (Kynard and Hogan, 2013) are currently incorporated into the study. These HSC relate to the behavior of adults selecting nesting sites, and fertilizing and burying eggs. Because the incubation lifestage is non mobile and utilizes the same habitat, it follows that flows suitable for spawning should also be suitable for incubation, and thus the same criteria apply.

Sea lamprey zone of passage. *"Adults can manage rapids easily by alternatively swimming and attaching to stones. They can surmount nearly vertical barriers of 5 or 6 ft…by creeping up the face with the suctorial disc*" (Scott and Crossman, 1973). Mosier and Mesa (2009) note that *"When confronted with rapid current velocities, adult Pacific lampreys orient into the current and use their oral disk to attach to the substrate, presumably resting between bouts of burst swimming. This … is most pronounced in current velocities greater than 60 cm/s (2 ft/s)... Consequently, the best surfaces for lamprey attachment are probably smooth and nonporous.*"

This is consistent with empirical observations made by Maine Department of Marine Resources at numerous riverine locations (*Gail Wippelhauser, Maine DMR, personal communication*), and can also be observed in a movie clip of adult lamprey in the Millers River, MA (https://www.youtube.com/watch?v=TFH-CiuCEPQ) (*Mike Trainor, Massachusetts Division of Marine Fisheries, personal communication*) The conclusion is that depth and velocity are not likely limiting factors. Of greater importance is availability of suitable substrates (*i.e.* large cobble and boulder) for the fish to sequentially attach to. Given the nature of the geology in the bypass reach, suitable substrate is not likely a limiting factor. We also note that additional zone of passage analyses will be conducted in Reach 1 (see DRAFT Method for Conducting the Reach 1 Empirical Flow Habitat Assessment, March 28, 2014).

Freshwater mussel host fish. The state-listed mussel species include yellow lampmussel, eastern pondmussel and tidewater mucket. Their habitat preferences and potential host fish are shown below (excerpted from Table 3.3.1-3 of the Revised Study Plan). The Revised Study Plan proposes to develop Category I mussel habitat suitability criteria for state or federally-listed freshwater mussels through a combination of literature review and by convening a panel of credentialed mussel biology experts who will provide input to developing specific HSI criteria. FirstLight is presently pursuing this effort and expects this to provide the necessary HSC for the target mussel species. In the event that Category I HSC curves cannot be developed, FirstLight will pursue an alternative approach using host fish species habitat suitability as a surrogate.

State-listed Mussel Species	Preferred Habitat	Host Fish
Yellow Lampmussel	It has been found in shallow water and areas more than 30 feet deep, usually in slow to moderate flow conditions. Within its core range in Massachusetts, it exhibited a distinct preference for sand and fine gravel substrates, and it was proportionately more abundant in shallow sandbars than it was in nearby areas that were deeper and had a rocky or muddy substrate.	White perch; yellow perch; possibly striped bass; potential species include banded killifish, chain pickerel, white sucker, smallmouth bass, largemouth bass
Eastern Pondmussel	The eastern pondmussel inhabits a wide variety of habitats in the southern part of the watershed. It exhibits no distinct preference for substrate, depth or flow conditions.	Unknown: anadromous or coastal
Tidewater Mucket	Coastal freshwaters. Inhabits muddy, sandy and gravelly substrates. Prefer depositional areas with slow currents. Healthy populations exist in sandbar habitats near islands in the mainstem Connecticut River. Found in water depths of one to > 25 feet.	White perch; banded killifish; striped bass possible but not tested.

From Nedeau, 2008.

Certain known fish hosts (America shad, white sucker) (noted in RSP Table 3.3.1-3) for which standalone HSC are proposed will provide an index of habitat suitability. However some fish hosts do not have standalone HSC. At the May 8, 2013 consultation meeting, the study team discussed inclusion of four habitat use guilds to account for habitat use for various species for which no standalone HSC are available[1]. Table 1 below shows how this scheme can account for mussel fish host habitat suitability for all mussel species potentially found in the study area, inclusive of state listed and non-listed species.

[1] These follow the classic "s*hallow slow", "shallow fast", "deep slow"* and *"deep fast"* categories.

Table 1. Turners Falls Instream Flow Study. Proposed habitat use guilds for common mussel host fish species (after Nedeau, 2008), and other fish species (*from Revised Study Plan Table 3.3.1-3*).

Deep Slow Guild		
Host Species	**Life stage**	**related mussel species**
White perch	J,A	YL*, EE, EF, TF, TM*
Yellow perch	J,A	YL*, EE
Brook trout[2]	J,A	EE
carp	J,A	EF
bluegill	J,A	EF

Deep Fast Guild		
Host Species	**Life stage**	
Striped bass[1]	A	YL*, AF, TM*
carp	J,A	EF

Shallow Fast Guild		
Host Species	**Life Stage**	**related mussel species**
Mottled sculpin	J,A	EE
Slimy sculpin	J,A	TF
Brook trout[1]	J,A	EE
Shiner and dace spp.	J,A	TF

Shallow Slow Guild		
Host Species	**Life stage**	
Banded killifish	J,A	YL*
Chain pickerel	J,A	YL*
Smallmouth bass	J,A	YL*, EE
Largemouth bass	J,A	YL*, EE, TF
Three spine stickleback	J,A	EE, EF
pumpkinseed	J,A	EE, EF, TF
redbreast	J,A	EE
Black crappie	J,A	EE
Brook trout[1]	J,A	EE
carp	J,A	EF
bluegill	J,A	EF

LEGEND: YL =yellow lampmussel; EE =eastern elliptio; TF = triangle floater; AF = alewife floater; EF = eastern floater, TM = tidewater mucket. An asterisk (*) indicates state listed status. J = juvenile lifestage; A = adult lifestage

[2] Not known to reside in the study area

LITERATURE CITED

Bigelow, HB. and W.C. Schroeder, 1953. Fishes of the Gulf of Maine. Fishery Bulletin 74F of the Fish And Wildlife Service**,** Vol.53, Contribution No. 592, Woods Hole Oceanographic Inst., U. S. Gov. Printing Office – Washington. 577 p.

Kynard B. and M. Horgan. 2013. Habitat suitability index for sea lamprey redds. Unpublished manuscript. 5 pp.

Mosier, M.L. and M.G. Mesa, 2009. Passage considerations for anadromous lampreys. pp. 1-10. Am. Fish. Soc. Symposium 72:000–000, 2009. American Fisheries Society, Bethesda, MD.

Scott, W.B. and E.J Crossman, 1973. Freshwater fishes of Canada. Bulletin 184. Fish. Res. Bd. Can. Ottawa. 966 p.

Site No. = 3-16
Right Channel, Rawson Island, Mid-Island
SN 10486372

Site No. = 3-18
Rawson Island, Upper Middle Channel
SN 10486573

Site No. = 3-19
Rawson Island Right Channel, Upper Riffle
SN 10486580

Site No. = 3-14
Lower end of Rawson Island, Middle Channel
SN 10486589

Site No. = 3-13
Far right channel downstream Rawson Island
SN 10486363

Site No. = 3-12
Downstream tip of Rawson Island
SN 10486583

Site No. = 3-17
Above Rock Dam, Right Bank
SN 10486572

Site No. = 3-20
Head of Rock Dam Pool, cabled to big rock
SN 10486581

Site No. = 3-15
Pool Below Rock Dam
SN 10486576

Site No. = 3-11
Lower Bypass, U/S of Conte Launch
SN 10486574

Turners Falls IFIM Study
Reach 3 Logger Locations
Upper Part of Reach 3

N

Legend

Water Level Logger

0 250 500 750 1,000 Feet

Path: W:\gis\studies\3_3_1\maps\WaterLevelLoggers - Reach 3 Upper.mxd

Site No. = 3-10
Smead Island Channel, Upper channel
SN 10486586

Site No. = 3-11
Lower Bypass, U/S of Conte Launch
SN 10486574

Site No. = 3-8
Smead Island Channel, Midway down channel
SN 10486571

Site No. = 3-9
Across from Cabot
In between islands
SN 10486370

Site No. = 3-7
Conte Launch, Just D/S
SN 10486577

Site No. = 3-4
General Pierce Bridge, Right Bank, Just U/S
SN 10486593

Site No. = AIR
Air Pressure Logger
SN TBD

Site No. = 3-6
Cabot Station
SN 10486588

Site No. = 3-5
Downstream of Cabot Station, Main channel, RL
SN 10486584

Site No. = 3-3
General Pierce Bridge, Left Bank, Just D/S
SN 10486585

Site No. = 3-2
Deerfield River Mouth, RB
SN 10486578

Site No. = 3-1
Bike Path Bridge, RB, just u/s of bridge
SN 10486594

Turners Falls IFIM Study
Reach 3 Logger Locations
Lower Part of Reach 3

N

Legend

- Water Level Logger

0 250 500 750 1,000 Feet

Path: W:\gis\studies\3_3_1\maps\WaterLevelLoggers - Reach 3 Lower.mxd

From:	Karl Meyer
To:	"Jason George"; "Andrea Donlon"; "Melissa Grader"; peter.hazelton@state.ma.us; kkennedy@tnc.org; micah_kieffer@usgs.gov; "Jesse Leddick"; "Bill McDavitt"; "Jessica Pruden"; don.pugh@yahoo.com; "Caleb Slater"; "Ken Sprankle"; brett_towler@fws.gov; "John Warner"; "Misty-Anne Marold"; "Bob Nasdor"; "Tom Christopher"; sims@honors.umass.edu
Cc:	"Howard, John"; "Brandon Kulik"; glemay@gomezandsullivan.com; "Stira, Robert"; "Tom Sullivan"; "Mark Wamser"
Subject:	RE: FirstLight Turners Falls IFIM - HSI and status update
Date:	Thursday, June 19, 2014 8:22:22 PM
Attachments:	2009 BelowCNTERockdm.JPG 2010 FshqRockDm.JPG

Dear Jason and Brandon,

Please find my formal comments below, as well as two attached photos. Thank you.

Best,
Karl Meyer

Karl Meyer, M.S., Environmental Science
85 School Street, # 3
Greenfield, MA 01301

June 19, 2014

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
88 First Street, N.E.
Washington, DC 20426

Stakeholder reply to: Jason George; Brandon Kulik
Gomez and Sullivan Engineers, PC

Stakeholder Comments RE: FERC P-1889-081 and P-2485-063:

These comments pertain to my input as a Stakeholder and participant in FirstLight IFIM Study Team in helping determine Habitat Study Criteria for target species in the By Pass Reach of the Connecticut River—Reaches 1 – 4 in the SPD.

They are specific to a memo from Brandon Kulik to Instream Flow Study Team Stakeholders dated June 6, 2014; as well as a request for Stakeholder Comments sent out by Jason George on June 6, 2014 regarding:

1. further consultation regarding lamprey incubation and zone of passage
2. freshwater mussel host fish species criteria

My comments:

Expand Water Level Logger Coverage in the pool below the Rock Dam, or move the currently proposed WLL to the east side of the pool to capture the essential zone of passage and incubation habitat that is unique to this section of the pool below Rock Dam.

In the PDF sent for Water Level Loggers—Reach 3 Upper1, Site No. = 3-15 Pool Below Rock Dam BN 10486576, the WLL placement is on the far west side of the pool. Anyone who has spent time examining the site understands that this unique pool and it essential habitat characteristics are to be found on the eastern side of this pool. Looking at the aerial shot, it is the area closest to Conte Lab, where the whitewater spreads furthest downstream through natural notches in the rock. This is the area that is most often fished, and likely offers best passage in this section during times of high—as well as low, flows.

Most visitors and fishermen will have witnessed sea lamprey using this cleft area of Rock Dam as water levels fall. I have seen many attached to the rock face, awaiting the impulse for their next burst toward the top. The fishermen are here because this is where the fish find passage. Please see attached photos from 2009 and 2010.

In the 2010 photo the gentlemen with the net has landed a shad.

The 2009 photo shows the sandy, cobbled, lower end of the pool below Rock Dam, which essential habitat for state-listed Yellow Lamp Mussel, as well as being critical spawning habitat for the federally endangered Shortnose sturgeon. (If you look closely, you might notice that one fisherman is a Conte Lab Researcher.)

Thus, Water Level Logger placement at this site, as opposed to the far western end of the pool, is the critical factor.

Further, through snorkeling and shoreline observation I have personally witnessed yellow perch, smallmouth bass and American shad using this habitat—all either host species, or potential host species for Massachusetts' endangered Yellow Lamp Mussel.

Thus, by placing a new Water Level Logger at this site, you are capturing essential information on which to base critical decisions for the survival of at least two endangered species.

End of Formal Comments

Thank you for this opportunity to participate in improving license requirements and protecting the Connecticut River ecosystem for future generations.

Sincerely,
Karl Meyer, M.S.

Please note: photos could not be included with FERC E-Comment. They were sent directly to Mr. George and Mr. Kulik along with these comments. Made available upon request.

From: Jason George [mailto:jgeorge@gomezandsullivan.com]
Sent: Friday, June 06, 2014 10:03 AM
To: 'Andrea Donlon'; 'Melissa Grader'; peter.hazelton@state.ma.us; kkennedy@tnc.org; micah_kieffer@usgs.gov; 'Jesse Leddick'; 'Bill McDavitt'; karlm@crocker.com; 'Jessica Pruden'; don.pugh@yahoo.com; 'Caleb Slater'; 'Ken Sprankle'; brett_towler@fws.gov; 'John Warner'; 'Misty-Anne Marold'; 'Bob Nasdor'; 'Tom Christopher'; sims@honors.umass.edu
Cc: 'Howard, John'; 'Brandon Kulik'; glemay@gomezandsullivan.com; 'Stira, Robert'; 'Tom Sullivan';

'Mark Wamser'
Subject: RE: FirstLight Turners Falls IFIM - HSI and status update

Dear FirstLight IFIM Study Stakeholders,

Attached is a memo describing our approach to the outstanding habitat suitability assessments for lamprey incubation and zone of passage and freshwater mussel host fish species. Also attached is a map showing the water level loggers installed in Reach 3. Additional water level loggers will be installed in Reaches 1 and 2 during the test flows to validate/calibrate the proposed models in this study.

The field data collection for this study is in the final planning stages and we anticipate being in the field throughout the summer, with most of the data collected after the fishways close in mid-July.

Please respond within two weeks, or by June 20, 2014, with any comments, questions or concerns regarding the attached materials. Thank you.

Jason George
Gomez and Sullivan Engineers, PC
41 Liberty Hill Road, PO Box 2179
Henniker, NH 03242
Office: (603) 428-4960
Cell: (603) 340-7666

From: Jason George [mailto:jgeorge@gomezandsullivan.com]
Sent: Friday, March 28, 2014 3:34 PM
To: 'Tom Christopher'; 'Andrea Donlon'; 'Melissa Grader'; 'peter.hazelton@state.ma.us'; 'kkennedy@tnc.org'; 'micah_kieffer@usgs.gov'; 'Jesse Leddick'; 'Bill McDavitt'; 'karlm@crocker.com'; 'Jessica Pruden'; 'don.pugh@yahoo.com'; 'sims@honors.umass.edu'; 'Caleb Slater'; 'Ken Sprankle'; 'brett_towler@fws.gov'; 'John Warner'; 'Misty-Anne Marold'; 'Bob Nasdor'
Cc: 'Howard, John'; 'Brandon.Kulik@KleinschmidtUSA.com'; 'glemay@gomezandsullivan.com'; 'Stira, Robert'; 'Tom Sullivan'; 'Mark Wamser'
Subject: FirstLight Turners Falls IFIM - follow-up to November 2013 study team meeting

Dear FirstLight IFIM Study Stakeholders,

Attached are the meeting notes from our last meeting on this study, held on November 12, 2013. As a follow-up to this meeting, we have developed two documents which detail methods proposed for the following specific elements of this study:

1. Method for coding bedrock substrates found in the study area
2. Draft method for conducting the reach 1 empirical flow habitat assessment (braided riffle area)

Please submit any comments you may have on the attached within two weeks, or by April 14, 2014. Please address technical comments to Brandon Kulik

(Brandon.Kulik@KleinschmidtUSA.com).

Since the last meeting, FERC issued its Study Plan Determination Letter on February 21, 2014 in which the Instream Flow Study Plan was approved with modifications. FirstLight is currently investigating the modifications to the study plan which may require further consultation, including specific HSI criteria for sea lamprey and related HSI criteria for primary host fish of state-listed mussels of concern in the project-affected area. We anticipate distributing draft recommendations on these subjects for your review and input in the near future.

Additionally, in response to your comments and as directed by the FERC Study Plan Determination Letter, FirstLight plans to install over 20 water level loggers in Reach 1-3 in order to ensure the accuracy of modeled conditions. The specific locations of the logger deployment will be determined in the field, and your previous comments regarding logger placement will be considered. Once installed, a map showing the locations will be provided to you.

Finally, we anticipate that additional consultation will be required to conduct the work in the downstream reaches in 2015. We look forward to working with you to make this a successful study.

Jason George
Gomez and Sullivan Engineers, PC
41 Liberty Hill Road, PO Box 2179
Henniker, NH 03242
Office: (603) 428-4960
Cell: (603) 340-7666

From:	Andrea Donlon
To:	"Jason George"; "Melissa Grader"; peter.hazelton@state.ma.us; kkennedy@tnc.org; micah_kieffer@usgs.gov; "Jesse Leddick"; "Bill McDavitt"; karlm@crocker.com; "Jessica Pruden"; don.pugh@yahoo.com; "Caleb Slater"; "Ken Sprankle"; brett_towler@fws.gov; "John Warner"; "Misty-Anne Marold"; "Bob Nasdor"; "Tom Christopher"; sims@honors.umass.edu
Cc:	"Howard, John"; "Brandon Kulik"; glemay@gomezandsullivan.com; "Stira, Robert"; "Tom Sullivan"; "Mark Wamser"
Subject:	RE: FirstLight Turners Falls IFIM - HSI and status update
Date:	Friday, June 20, 2014 3:20:25 PM

Jason,

Here are CRWC's comments on your June 6 mailing.

Habitat Suitability Criteria memo dated 6/6/14. CRWC has no comment on this memo, and will look to fisheries agencies to more closely review the material.

Logger locations: The FERC study plan determination said to determine number and location of loggers AFTER consultation with technical study team. It sounds from your email that the loggers have already been installed. Here are my comments on the locations:

Upper part of reach 3 logger locations:

- Site No. 3-11 could potentially be moved upstream 500-750 feet to get a better sense of the backfilling of this section when Cabot is releasing.
- I see Karl's comments regarding sites No. 3-15 and 3-17. I am guessing that you went for the other side because loggers on the side closest to the canal are likely to be visually spotted and torn out by visitors to the area. If so, then I wonder if you could do actual field measurements on scattered days to make comparison curves that would allow the data at 3-15 and 3-17 be used to approximate the water levels in the more interesting spots in these areas.

Lower part of reach 3 logger locations:

- Site No. 3-5 could be moved upstream about 250 feet to capture the middle between Cabot and the General Pierce bridge. I don't have a map of the sturgeon spawning areas, but certainly those areas should be targeted.
- Or possibly add a logger on the eastern bank of Smead Island in the middle of the island.

Will we have an opportunity to comment on the loggers in reaches 1 and 2 before they are installed?

Andrea

_____

Andrea Donlon, River Steward
CONNECTICUT RIVER WATERSHED COUNCIL, INC.
15 Bank Row
Greenfield MA 01301
Phone: (413)772-2020 x. 205
Fax: (413)772-2090
adonlon@ctriver.org

Become a member today! Join at www.ctriver.org.
CRWC is on Facebook—become a fan

From: Jason George [mailto:jgeorge@gomezandsullivan.com]
Sent: Friday, June 06, 2014 10:03 AM
To: 'Andrea Donlon'; 'Melissa Grader'; peter.hazelton@state.ma.us; kkennedy@tnc.org; micah_kieffer@usgs.gov; 'Jesse Leddick'; 'Bill McDavitt'; karlm@crocker.com; 'Jessica Pruden'; don.pugh@yahoo.com; 'Caleb Slater'; 'Ken Sprankle'; brett_towler@fws.gov; 'John Warner'; 'Misty-Anne Marold'; 'Bob Nasdor'; 'Tom Christopher'; sims@honors.umass.edu
Cc: 'Howard, John'; 'Brandon Kulik'; glemay@gomezandsullivan.com; 'Stira, Robert'; 'Tom Sullivan'; 'Mark Wamser'
Subject: RE: FirstLight Turners Falls IFIM - HSI and status update

Dear FirstLight IFIM Study Stakeholders,

Attached is a memo describing our approach to the outstanding habitat suitability assessments for lamprey incubation and zone of passage and freshwater mussel host fish species. Also attached is a map showing the water level loggers installed in Reach 3. Additional water level loggers will be installed in Reaches 1 and 2 during the test flows to validate/calibrate the proposed models in this study.

The field data collection for this study is in the final planning stages and we anticipate being in the field throughout the summer, with most of the data collected after the fishways close in mid-July.

Please respond within two weeks, or by June 20, 2014, with any comments, questions or concerns regarding the attached materials. Thank you.

Jason George
Gomez and Sullivan Engineers, PC
41 Liberty Hill Road, PO Box 2179
Henniker, NH 03242
Office: (603) 428-4960
Cell: (603) 340-7666

From: Jason George [mailto:jgeorge@gomezandsullivan.com]
Sent: Friday, March 28, 2014 3:34 PM
To: 'Tom Christopher'; 'Andrea Donlon'; 'Melissa Grader'; 'peter.hazelton@state.ma.us'; 'kkennedy@tnc.org'; 'micah_kieffer@usgs.gov'; 'Jesse Leddick'; 'Bill McDavitt'; 'karlm@crocker.com'; 'Jessica Pruden'; 'don.pugh@yahoo.com'; 'sims@honors.umass.edu'; 'Caleb Slater'; 'Ken Sprankle'; 'brett_towler@fws.gov'; 'John Warner'; 'Misty-Anne Marold'; 'Bob Nasdor'
Cc: 'Howard, John'; 'Brandon.Kulik@KleinschmidtUSA.com'; 'glemay@gomezandsullivan.com'; 'Stira, Robert'; 'Tom Sullivan'; 'Mark Wamser'
Subject: FirstLight Turners Falls IFIM - follow-up to November 2013 study team meeting

Dear FirstLight IFIM Study Stakeholders,

Attached are the meeting notes from our last meeting on this study, held on November 12, 2013.

As a follow-up to this meeting, we have developed two documents which detail methods proposed for the following specific elements of this study:

1. Method for coding bedrock substrates found in the study area
2. Draft method for conducting the reach 1 empirical flow habitat assessment (braided riffle area)

Please submit any comments you may have on the attached within two weeks, or by April 14, 2014. Please address technical comments to Brandon Kulik (Brandon.Kulik@KleinschmidtUSA.com).

Since the last meeting, FERC issued its Study Plan Determination Letter on February 21, 2014 in which the Instream Flow Study Plan was approved with modifications. FirstLight is currently investigating the modifications to the study plan which may require further consultation, including specific HSI criteria for sea lamprey and related HSI criteria for primary host fish of state-listed mussels of concern in the project-affected area. We anticipate distributing draft recommendations on these subjects for your review and input in the near future.

Additionally, in response to your comments and as directed by the FERC Study Plan Determination Letter, FirstLight plans to install over 20 water level loggers in Reach 1-3 in order to ensure the accuracy of modeled conditions. The specific locations of the logger deployment will be determined in the field, and your previous comments regarding logger placement will be considered. Once installed, a map showing the locations will be provided to you.

Finally, we anticipate that additional consultation will be required to conduct the work in the downstream reaches in 2015. We look forward to working with you to make this a successful study.

Jason George
Gomez and Sullivan Engineers, PC
41 Liberty Hill Road, PO Box 2179
Henniker, NH 03242
Office: (603) 428-4960
Cell: (603) 340-7666

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 No. 1889 July 3, 2014
FirstLight Power Resources/GDF Suez
Connecticut River
COMMENTS ON INSTREAM FLOW STUDY PLAN

Mr. Jason George
Gomez and Sullivan Engineers, PC
41 Liberty Hill Road, P.O. Box 2179
Henniker, NH 03242

Dear Mr. George:

This responds to your email correspondence submitted on behalf of FirstLight Power Resources (FirstLight), dated March 28, 2014 and June 6, 2014, regarding resolution of a few outstanding details of the Instream Flow Habitat Assessment for the relicensing of the Tuners Falls Project, located on the Connecticut River in Massachusetts. We have reviewed the submitted materials and offer the following comments.

Coding Bedrock Substrates

The proposed bedrock coding is acceptable.

Reach 1 Empirical Assessment Methodology

The U.S. Fish and Wildlife Service (Service) has concerns with FirstLight's proposed methodology for Reach 1. As proposed, it appears there will be no way to translate the results to an overall Weighted Usable Area (WUA) to flow relationship because the assessment will be at discrete transects and/or non-linear areas that are not related to the rest of Reach 1. Typically, transects are located in a representative mesohabitat type and the linear extent of that type would be measured so the Service would be able to translate the transect data to a spatial area covering the entire mesohabitat. In this case, we will only have data on the suitability of a particular spot or transect.

Although Reach 1 is very heterogeneous with respect to mesohabitats as well as hydraulically complex, we believe it should still be possible to identify polygons that could represent the different habitats and then locate a transect in each of those polygons. This would allow us to extrapolate and calculate a WUA for that habitat at a given flow.

Without this quantitative measure, the study results for Reach 1 would only let us know how flow affects a particular transect, with no context for what that means for the reach as a whole or for use in the evaluation of flow needs throughout the bypass reach. For example, in the attached Powerpoint, on Slide 2 we have identified some hypothetical transect locations. If study results were to show that a flow of 200 cfs maximized the suitability of T6 and a flow of 600 cfs maximized suitability of T1, there would be no context as to how much habitat each transect represented and therefore, the relative value represented by either transect.

In Slide 3, we have suggested a first cut attempt to identify different habitat polygons which then theoretically would each have a transect placed in them. This would allow for an approximate calculation of area for each habitat and therefore a WUA-to-flow relationship.

Sea Lamprey Habitat Suitability Index Criteria

Spawning Curves

As we stated in our August 29, 2013 comments on the August 14, 2013 Revised Study Plan (RSP), the RSP correctly indicated that FirstLight has initiated consultation on the Habitat Suitability Index (HSI) curves, but that this consultation had not concluded. We had previously noted on a conference call that we would recommend changes to the lamprey spawning curves based on review of other lamprey data. However, discussion of HSI criteria was suspended, as FirstLight and the other parties addressed other study issues, and the lamprey spawning criteria was never resolved.

The HSI criteria proposed in the RSP is based on data from Kynard and Horgan (2013).[1] We reviewed those data and consulted directly with Dr. Boyd Kynard regarding the data they had collected. We also reviewed the Master's Thesis: Population demography, riverine movement and spawning habitat of the sea lamprey, *Petromyzon marinus*, in the Connecticut River (Yergeau 1983).[2]

Yergeau (1983) identified different substrates, velocities and depths utilized by spawning sea lamprey in the Fort River and Deerfield River. Larger substrates and higher depths and velocities were utilized in the Deerfield River (which has a much larger watershed than the Fort River). Given the size of the Connecticut River, the spawning data from the Deerfield River would be

---

[1] Kynard, B. and M. Horgan. 2013. Habitat suitability index for sea lamprey redds. Unpublished manuscript. 5 pp

[2] Yergeau, K.M. 1983. Population demography, riverine movement and spawning habitat of the sea lamprey, *Petromyzon marinus*, in the Connecticut River. M.Sc. thesis. University of Massachusetts, Amherst, Massachusetts. 634 pp.

more representative of the Connecticut River and should be considered in establishing HSI criteria for lamprey spawning for use in this study.

Lamprey redds on the Deerfield River had depths ranging from 8 inches to 26 inches, with the greatest frequency of redds occurring at depths between 12 and 16 inches. Extrapolating the depth curves from Yergeau (1983), we recommend modifying the HSI criteria as follows:

Depth	SI Value
0.0	0.00
0.13	0.00
0.46	0.50
0.79	1.00
1.12	1.00
1.44	0.60
1.77	0.40
2.20	0.20
2.30	0.00

For substrate, Yergeau (1983) found spawning in the Deerfield River on substrates from 2 inches to 7 inches in diameter. Though less frequently used than gravel, significant spawning was observed on larger substrates. The 4-to-7-inch sizes observed at Deerfield River redds correspond to Substrate Code 6–Cobble/Rubble. Extrapolating from Yergeau (1983), we recommend that the HSI for Cobble/Rubble be changed to 0.50.

We recommend using the proposed HSI criteria with our recommended modifications as the initial criteria for use in this study. However, after the lamprey spawning study has been completed, the HSI criteria for lamprey spawning should be revisited and updated, as appropriate, based on collected redd data on the mainstem Connecticut River, for use in the Instream Flow Habitat Assessment.

Incubation Curves

The National Marine Fisheries Service requested that the HSI criteria for lamprey include incubation curves. FirstLight is not proposing incubation HSI curves, arguing that the spawning curves should cover/be protective of incubating eggs. The Service believes this is a reasonable assumption and would support characterizing the spawning curves as a spawning and incubation curve.

Zone of Passage

Some stakeholders requested that FirstLight include Zone of Passage (ZOP) curves. FirstLight is not proposing to add ZOP curves, arguing that lamprey are not depth or velocity constrained in movement so long as there is suitable substrate to latch onto; FirstLight's position is that suitable substrate is likely not a limiting factor in Reaches 1 and 2.

We do not necessarily agree that lamprey can move through any reach regardless of depth or velocity. Clearly, there needs to be some water, and velocity cannot exceed their burst swimming speed capability. That being said, since Reaches 1 and 2 already have shad as a target species for ZOP, lamprey should be covered as well, as the passage seasons essentially overlap (i.e., if a defined flow provides suitable ZOP for shad, it should offer ZOP to lamprey as well).

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

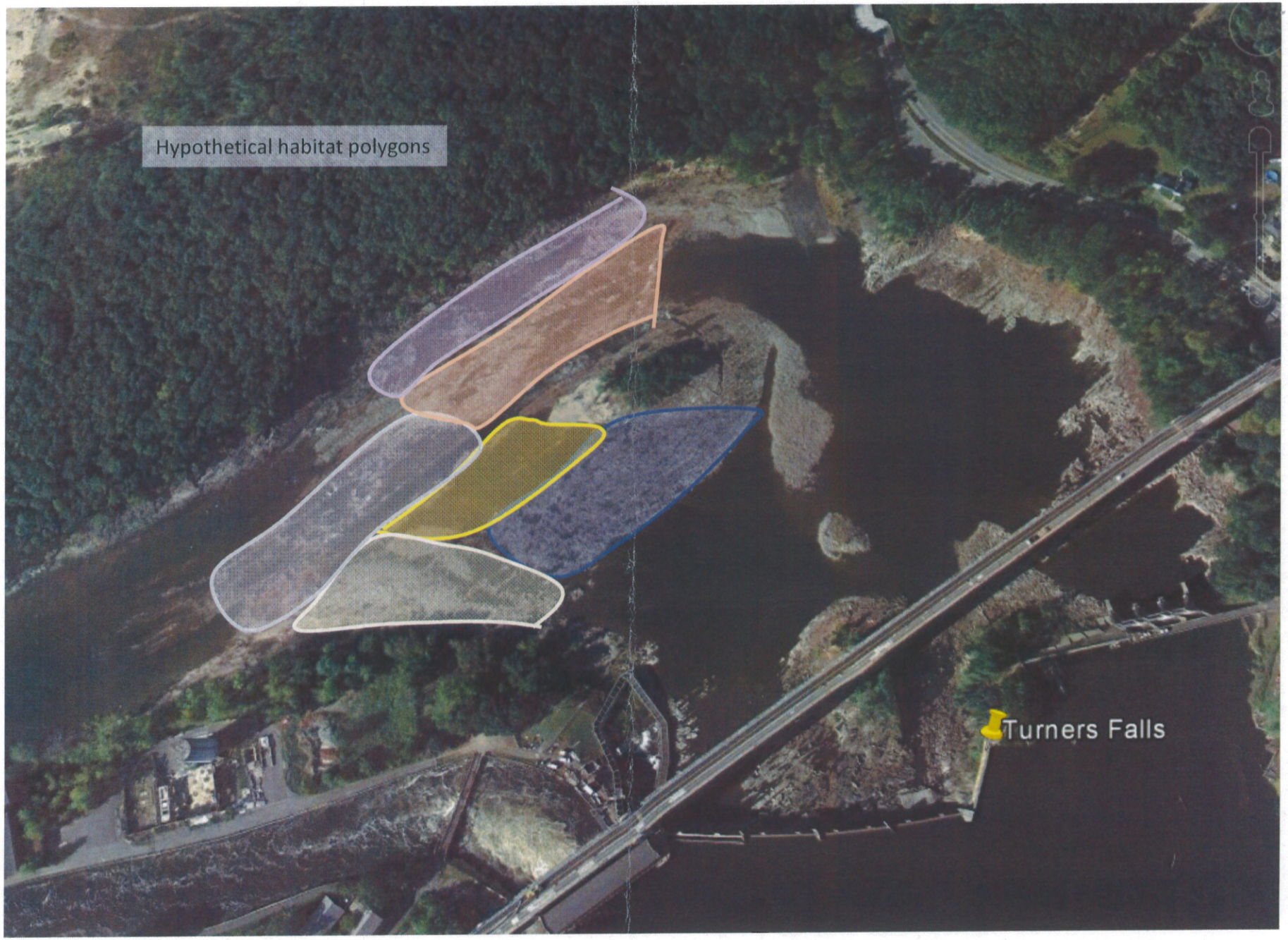
Sincerely yours,

Thomas R. Chapman
Supervisor
New England Field Office

Attachments

cc: John Howard
FirstLight Power Resources
CRC, Ken Sprankle
NMFS, Bill McDavitt
NMFS, Jess Pruden
MA DFW, Caleb Slater
MA DEP, Bob Kubit
TU, Don Pugh
CRWC, Andrea Donlon
TNC, Katie Kennedy
Reading File
ES: JWarner:7-3-14:(603)223-2541


Lines represent theoretical transect locations
and ovals represent Zone of Passage locations
T5
T6
T1
T4
T2
T3
Turners Falls


Hypothetical habitat polygons
Turners Falls

of redds, proximity to available overhead cover and spatial relationship to pools or riffles.

Since sea lamprey redds were measured at several locations in 2 different streams, a one-way analysis of variance (SPSS Program, Nie et al. 1975) was utilized to determine if there were significant differences between the means of parameters sampled at different locations and years. This program computed the mean of each parameter for each study area and calculated an F-value, which was used to determine if a significant difference existed between the means. Analysis of covariance was also performed for the Fort River and Deerfield River data with water temperature as the covariate. This is because temperature has been reported as a decisive factor in determining the onset of spawning with sea lamprey.

RESULTS

Sea lamprey spawning was first observed in the Fort River during both years. In 1981, spawning was observed from June 3 to June 25. Redd characterization was conducted from June 4 to June 25, 1981 on the Fort River and from June 23 to June 26, 1981, on the Deerfield

Yergeau, L.M. [illegible] M.Sc. Thesis
Population Demography, Riverine Movement
and Spawning Habitat of the Sea Lamprey
in the [illegible]

River. Spawning in 1982 was observed from June 23 to June 29. Nest sampling was limited to June 24-27 on the Fort River and June 28 on the Deerfield River. A period of heavy rain followed on June 29, which increased river flow and depth significantly. Many nests were abandoned or washed away and dead lampreys were observed throughout the study sites. The high water lasted approximately one week and no lampreys were observed on redds after the flooding subsided.

Sea lampreys commenced building redds in 1981 on June 4 when water temperatures increased to 19.0°C. Thermograph records for 1981 in the Fort River indicated sea lampreys spawned over a temperature range of 15-23°C (June 3 to June 25). In 1982, sea lamprey in the Fort River commenced spawning at 14.0°C but at a later date, June 22. Maximum spawning activity occurred during decreasing flows (1300-30 cfs, 36.8-0.85 m^3/s) and increasing water temperatures (16.5-18.5°C). No spawning was observed at water temperatures exceeding 24.5°C. In 1981, spawning activity decreased when river flow dropped in the Fort River below 21 cfs (0.59 m^3/s). In 1982 on the Deerfield River, spawning activity ceased when flow increased to 2,670 cfs (75.61 m^3/s).

The location of concentrations of redds in all study areas was similar. The majority of nests in both rivers

were located slightly upstream from a riffle area and downstream from a pool section, e.g., in the transition zone between riffle and pool.

One hundred-seventy two redds were sampled from the Fort River and 72 redds from the Deerfield River. Completed redds varied in size from 12 cm to 155 cm in length and from 13 cm to 175 cm in width (Figure 14). The average length and width of redds sampled from the Fort River and Deerfield River were very similar (Table 2). Mean substrate size sampled from the Deerfield River (9.4 cm) was significantly larger than the Fort River samples (6.9 cm) ($p < 0.05$, Figure 14).

Comparisons of the mean velocity and depth measured 1m above the redd, at the upper-edge and tailspill area presented in Table 2. The Deerfield River study site was generally deeper than the Fort River sites although the tailspill depths were similar due to the larger size of available gravel on the Deerfield river. The velocity and depth of the Deerfield River were variable due to the sudden fluctuation of river discharge regulated by the upstream hydropower facilities. When river discharge changed abruptly, lampreys would often abandon redds or construct new redds in an area that would later be exposed or washed away.

The location of redds within an area depended on the

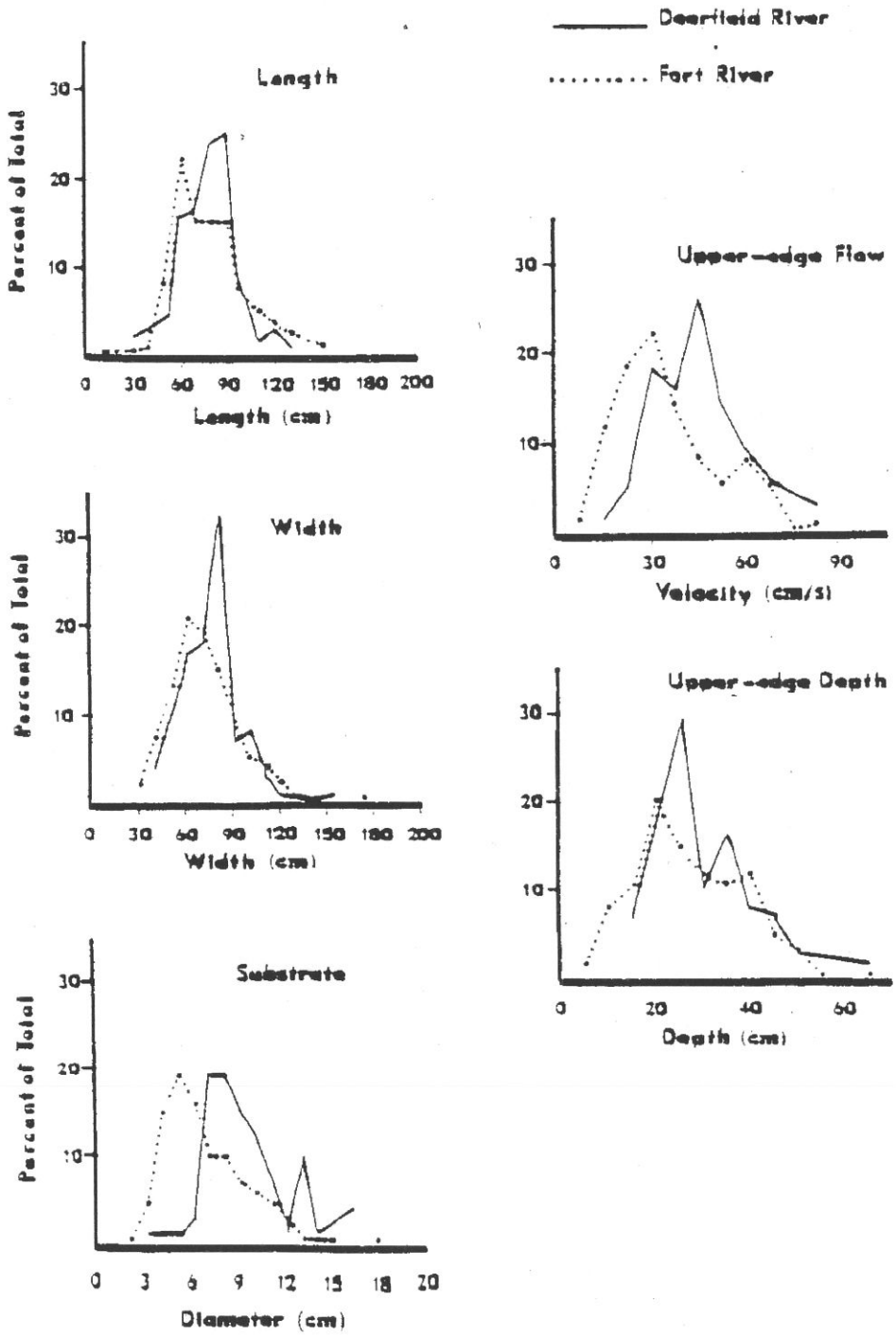

Deerfield River
Fort River
Length
Percent of Total
Length (cm)
Upper-edge Flow
Velocity (cm/s)
Width
Width (cm)
Upper-edge Depth
Depth (cm)
Substrate
Diameter (cm)

Table 2. Comparison of means of variables from nest surveying between the Fort River (n=172) and Deerfield Rivers (n=72).

Variable	Fort River (± s.error)	Deerfield River (± s.error)	Significance
Length of redd	84.4 ± 1.84 cm	84.5 ± 2.79 cm	ns
Width of redd	76.1 ± 1.84 cm	78.4 ± 2.70 cm	ns
Average substrate	6.8 ± 0.21 cm	9.4 ± 0.44 cm	s ($p < .05$)
Upper-edge depth	28.9 ± 0.88 cm	31.2 ± 1.50 cm	ns
Pit depth	36.4 ± 0.82 cm	37.4 ± 1.42 cm	ns
Tailspill depth	19.9 ± 0.78 cm	21.1 ± 1.27 cm	ns
Above redd flow	1.13 ± 0.46 ft/s	1.40 ± 0.05 ft/s	ns
Upper-edge flow	1.18 ± 0.42 ft/s	1.46 ± 0.07 ft/s	ns
Tailspill flow	1.54 ± 0.50 ft/s	1.77 ± 0.07 ft/s	ns

1 ft/s = 0.3048 m/s

velocity of the current. Circular or oval redds were constructed parallel in length to the river current, usually upstream from a riffle. A gradient of velocity existed going downstream from the measurement taken 1m above the redd to the tailspill section (Table 2). The slowest current was present 1m above the redd which was closest to a pool section. Current at the upper-edge of the redd most closely represented conditions actually present before spawning activity commenced, because depths and velocities were modified due to the construction of the pit and deposition of substrate at the tailspill area. For these reasons, the upper-edge depths and velocities were chosen to best characterize depth and water velocity of redds (Figure 14).

Analysis of variance revealed a highly-significant difference ($p<0.01$) between upper-edge depth for years and zones with the Fort River data (Table 3). Although these differences between zones for depth are significant, the zones are not significantly different for upper-edge flow (Table 3) and can be combined to compare with the upper-edge flow at redds in the Deerfield River. A non-significant difference was calculated for upper-edge flow between years for the Deerfield River data (Table 4). This may be primarily due to the variable flow, regulated by upstream hydropower facilities.

From:	Brandon Kulik
To:	Jason George; "Tom Christopher"; "Andrea Donlon"; "Melissa Grader"; peter.hazelton@state.ma.us; kkennedy@tnc.org; micah_kieffer@usgs.gov; "Jesse Leddick"; "Bill McDavitt"; karlm@crocker.com; "Jessica Pruden"; don.pugh@yahoo.com; sims@honors.umass.edu; "Caleb Slater"; "Ken Sprankle"; brett_towler@fws.gov; "John Warner"; "Misty-Anne Marold"; "Bob Nasdor"
Cc:	"Howard, John"; glemay@gomezandsullivan.com; "Stira, Robert"; "Tom Sullivan"; "Mark Wamser"
Subject:	FirstLight Turners Falls IFIM - follow-up to November 2013 study team meeting
Date:	Friday, July 11, 2014 2:46:51 PM
Attachments:	response to stakeholder comments on FirstLight IFIM study materials July 2014.docx

Dear FirstLight IFIM Study Stakeholders,

Thank you for your providing comments pertaining to the FirstLight IFIM study materials distributed on June 6, 2014.

Attached is a table summarizing comments provided by you, matched with FirstLight's responses to each comment received on the materials provided, and other outstanding issues raised in your comments.
As a general matter, all of this correspondence will ultimately be filed with FERC as an appendix to the study report.

As you may be aware, FirstLight will be conducting a whitewater boating evaluation in the bypass reach on July 19, 20 and 21. The field data collection for the instream flow study in reaches 1 through 3 is scheduled to begin on July 22 and last approximately 5-6 days, weather permitting.

Thank you

Brandon H. Kulik
Senior Fisheries Scientist
Kleinschmidt
Pittsfield, Maine
207-487-3328

Stakeholder Comment Summary	FirstLight Response
Karl Meyer, M.S., Environmental Science: June 19, 2014	
Expand Water Level Logger Coverage in the pool below the Rock Dam, or move the currently proposed WLL (Site 3-15) to the east side of the pool to capture the essential zone of passage and incubation habitat that is unique to this section of the pool below Rock Dam.	The water level logger at Site 3-15 (Pool Below Rock Dam) was placed to avoid the high recreation use on the western side of the river, which is easily accessible from Cabot Woods trail. We wanted to avoid having any fishermen getting their gear snagged on the logger, which could move the logger or cause someone to purposefully move out it of the way. Any water level loggers that are moved must be re-surveyed, and any data collected after the unit is moved is unusable. The purpose of logger 3-15 is to document the water surface elevation in the pool. Because the pool surfaces are flat, the logger as it currently sits will capture fluctuations representative of the entire pool. Coupled with the other data such as bed substrates, bathymetry and velocity collected throughout Reach 3, the western end of the pool below Rock Dam will be completely represented in the study area. The hydraulic model being developed for Reach 3 will cover the entire reach.
Andrea Donlon, Connecticut River Watershed Council: June 20, 2014	
Logger locations: The FERC study plan determination said to determine number and location of loggers AFTER consultation with technical study team. It sounds from your email that the loggers have already been installed. Will we have an opportunity to comment on the loggers in reaches 1 and 2 before they are installed?	The water level loggers have been installed in reach 3 to capture a wide range of flow conditions. The locations were selected by the hydraulic modeling team and installed in places that would best facilitate model calibration. Reach 2 water loggers will be installed prior to the 1-D data collection at the direction of the hydraulic modeling team. No loggers have been explicitly placed for reach 1 work. As part of study plan 3.3.8 (CFD modeling), however, five water level loggers have been placed throughout the plunge pool area. The purpose of these loggers is to assess CFD boundary condition water surface elevations. The data from the CFD loggers, however, may also serve the function of the proposed reach 1 water level loggers, pending stakeholder review of the logger placement. Please review and provide comment if the currently deployed loggers will not provide sufficient coverage for the purpose of the IFIM reach 1 study. Additional loggers may be placed prior to or during any reach 1 field work, whenever that occurs.
Upper part of reach 3 logger locations: • Site No. 3-11 could potentially be moved upstream 500-750 feet to get a better sense of the backfilling of this section when Cabot is releasing. • I see Karl's comments regarding sites No. 3-15 and 3-17. I am guessing that you went for the other side because loggers on the side closest to the canal are likely to be visually spotted and torn out by visitors to the area. If so, then I wonder if you could do actual field measurements on scattered days to make comparison curves that would allow the data at 3-15 and 3-17 be used to approximate the water levels in the more interesting spots in these areas.	Site 3-11 was moved further upstream on June 13, 2014 because the initial installation was damaged due to high debris load at this site. See above comment regarding placement of logger 3-15. Given the flat water surface profile of the pool, we anticipate little to no difference in water surface elevation between the eastern and western edges of the pool below rock dam. Again, the hydraulic model being developed for Reach 3 will cover the entire reach. Additionally, we will be collecting water surface elevations during the velocity calibration and validation collection that should serve this purpose.
Lower part of reach 3 logger locations: • Site No. 3-5 could be moved upstream about 250 feet to capture the middle between Cabot and the General Pierce bridge. I don't have a map of the sturgeon spawning areas, but certainly those areas should be targeted. • Or possibly add a logger on the eastern bank of Smead Island in the middle of the island.	The hydraulic model being developed for Reach 3 will cover the entire reach. Reach 3, including the sturgeon spawning area, will be evaluated using the 2-D model. In addition to the water level loggers we have already placed, the velocity calibration and validation data collection efforts will result in water surface elevation information throughout the reach.
Thomas Chapman, USFWS: July 3, 2014	
Coding Bedrock Substrates - The proposed bedrock coding is acceptable.	FirstLight concurs.
Reach 1 Empirical Assessment Methodology The Service has concerns with FirstLight's proposed methodology for Reach 1 and recommends identifying polygons to represent the different habitats in that reach and then locating a transect in each of those polygons, thus allowing calculation of a Weighted Usable Area (WUA) for that habitat at a given flow. Slides were provided to suggest a method to identify different habitat polygons which then theoretically would each have a transect placed in them, allowing for an approximate calculation of area for each habitat and therefore a WUA-to-flow relationship.	First Light is open to the USFWS's more quantitative approach as an option. However, keeping in mind that the goal of the flow demonstration is to empirically evaluate potential flow recommendations based on outcomes from the PHABSIM model conducted further downstream, a consequence would be that the requested quantitative results would not be available to flow demonstration participants until well after the flow demonstration. This is because WUA data will need to be computed and processed and reported (an office exercise). Thus, this type of decision information would not be available at the time that the participants are observing the demonstration flow. However the decision whether or not to adopt this approach can be collaboratively determined by consensus of the assessment team at the time of the flow demonstration.

Stakeholder Comment Summary	FirstLight Response
Sea Lamprey Habitat Suitability Index Criteria – Spawning Curves The Service provided modifications to the depth and substrate suitability criteria for sea lamprey spawning and recommend using their proposed modifications as the initial criteria for use in this study. However, after the lamprey spawning study has been completed, the HSI criteria for lamprey spawning should be revisited and updated, as appropriate, based on collected redd data on the mainstem Connecticut River, for use in the Instream Flow Habitat Assessment.	The sea lamprey habitat suitability criteria provided in the Revised Study Plan has been revised, as recommended. These criteria will be revisited and updated, as appropriate after completion of relicensing study no. 3.3.15 *Assessment of Adult Sea Lamprey Spawning within the Turners Falls Project and Northfield Mountain Project Area.*
Sea Lamprey Habitat Suitability Index Criteria - Incubation Curves The National Marine Fisheries Service requested that the HSI criteria for lamprey include incubation curves. FirstLight is not proposing incubation HSI curves, arguing that the spawning curves should cover/be protective of incubating eggs. The Service believes this is a reasonable assumption and would support characterizing the spawning curves as a spawning and incubation curve.	FirstLight concurs.
Sea Lamprey Habitat Suitability Index Criteria – Zone of Passage Some stakeholders requested that FirstLight include Zone of Passage (ZOP) curves. FirstLight is not proposing to add ZOP curves, arguing that lamprey are not depth or velocity constrained in movement so long as there is suitable substrate to latch onto; FirstLight's position is that suitable substrate is likely not a limiting factor in Reaches 1 and 2. We do not necessarily agree that lamprey can move through any reach regardless of depth or velocity. Clearly, there needs to be some water, and velocity cannot exceed their burst swimming speed capability. That being said, since Reaches I and 2 already have shad as a target species for ZOP, lamprey should be covered as well, as the passage seasons essentially overlap (i.e., if a defined flow provides suitable ZOP for shad, it should offer ZOP to lamprey as well).	FirstLight agrees that a ZOP critieria for shad can serve as a surrogate for ZOP to lamprey

From:	Karl Meyer
To:	"Jason George"; "Andrea Donlon"; "Melissa Grader"; peter.hazelton@state.ma.us; kkennedy@tnc.org; micah_kieffer@usgs.gov; "Jesse Leddick"; "Bill McDavitt"; "Jessica Pruden"; don.pugh@yahoo.com; "Caleb Slater"; "Ken Sprankle"; brett_towler@fws.gov; "John Warner"; "Misty-Anne Marold"; "Bob Nasdor"; "Tom Christopher"; sims@honors.umass.edu
Cc:	"Howard, John"; "Brandon Kulik"; glemay@gomezandsullivan.com; "Stira, Robert"; "Tom Sullivan"; "Mark Wamser"; "Ken Hogan"
Subject:	RE: FirstLight Turners Falls IFIM - HSI and status update
Date:	Monday, July 14, 2014 10:39:37 AM

Dear Jason,

I note in your response to having a Water Level Logger placed on the east side of the pool below Rock Dam that there is some potential for small variation in pool levels between the west side and the east. This comes from your reply to Andrea Donlon, who also suggested further adjustments could be made to accommodate gathering important information in these habitats, including suggestions for WLLs 3-15 and 3-17.

Given that the EAST side of this pool has been long verified as a known gathering, spawning and incubation site for the state- and federally-endangered Connecticut River shortnose sturgeon (see Dr. Boyd Kynard's book, **Life History and Behaviour of the Connecticut River Shortnose and other sturgeons,** as well as USGS Researcher Micah Kieffer's presentation to Stakeholders during site visits in 2013), I want to reiterate—along with Andrea Donlon, that these areas need special coverage.

This is the only documented natural spawning pool used by the Connecticut River's only federally endangered migratory fish for millennia. That spawning/gathering/incubation site has been studied for decades, but without the benefit of detailed, real-time flow calibrations and information being collected for the current FERC relicensing process. It would be irresponsible not to gather this information to protect a public resource. I'm sure that NMFS, USFWS, and Mass. Div. of FW would agree. Many stakeholders have witnessed the inundation and rapid de-pauperization of this habitat during ramping and cut-off operation of the TF dam.

Therefore, I'd like to suggest a simple, collectable solution that might provide key, relevant information:

Simply take a series of time-stamped photos, calibrated with flows taken at the nearby WLLs at 3-15 and 3-17, as well as 3-14 and 3-20:

1. from below the east side of Rock Dam pool documenting the flows over the Rock Dam and its cleft ridge, across to the island.

2. standing above the east side of the Rock Dam looking downstream to the east-side sand-becomes-cobble end of the SNS spawning pool—as this is critical spawning and incubation habitat identified by Kynard, Kieffer et al.

Cost: minimal to nil. Time expended: very little.

These real time exposures will lend to a better understanding of this critical habitat, and address data gaps that have been inaccessible during the long-term studies of SNS at this site.

Thank you. And please update my contact information to: karlmeyer1809@verizon.net

Best,
Karl Meyer
M.S. Environmental Science

From: Jason George [mailto:jgeorge@gomezandsullivan.com]
Sent: Friday, June 06, 2014 10:03 AM
To: 'Andrea Donlon'; 'Melissa Grader'; peter.hazelton@state.ma.us; kkennedy@tnc.org; micah_kieffer@usgs.gov; 'Jesse Leddick'; 'Bill McDavitt'; karlm@crocker.com; 'Jessica Pruden'; don.pugh@yahoo.com; 'Caleb Slater'; 'Ken Sprankle'; brett_towler@fws.gov; 'John Warner'; 'Misty-Anne Marold'; 'Bob Nasdor'; 'Tom Christopher'; sims@honors.umass.edu
Cc: 'Howard, John'; 'Brandon Kulik'; glemay@gomezandsullivan.com; 'Stira, Robert'; 'Tom Sullivan'; 'Mark Wamser'
Subject: RE: FirstLight Turners Falls IFIM - HSI and status update

Dear FirstLight IFIM Study Stakeholders,

Attached is a memo describing our approach to the outstanding habitat suitability assessments for lamprey incubation and zone of passage and freshwater mussel host fish species. Also attached is a map showing the water level loggers installed in Reach 3. Additional water level loggers will be installed in Reaches 1 and 2 during the test flows to validate/calibrate the proposed models in this study.

The field data collection for this study is in the final planning stages and we anticipate being in the field throughout the summer, with most of the data collected after the fishways close in mid-July.

Please respond within two weeks, or by June 20, 2014, with any comments, questions or concerns regarding the attached materials. Thank you.

Jason George
Gomez and Sullivan Engineers, PC
41 Liberty Hill Road, PO Box 2179
Henniker, NH 03242
Office: (603) 428-4960
Cell: (603) 340-7666

From: Jason George [mailto:jgeorge@gomezandsullivan.com]
Sent: Friday, March 28, 2014 3:34 PM
To: 'Tom Christopher'; 'Andrea Donlon'; 'Melissa Grader'; 'peter.hazelton@state.ma.us'; 'kkennedy@tnc.org'; 'micah_kieffer@usgs.gov'; 'Jesse Leddick'; 'Bill McDavitt'; 'karlm@crocker.com'; 'Jessica Pruden'; 'don.pugh@yahoo.com'; 'sims@honors.umass.edu'; 'Caleb Slater'; 'Ken Sprankle'; 'brett_towler@fws.gov'; 'John Warner'; 'Misty-Anne Marold'; 'Bob Nasdor'
Cc: 'Howard, John'; 'Brandon.Kulik@KleinschmidtUSA.com'; 'glemay@gomezandsullivan.com'; 'Stira,

Robert'; 'Tom Sullivan'; 'Mark Wamser'
Subject: FirstLight Turners Falls IFIM - follow-up to November 2013 study team meeting

Dear FirstLight IFIM Study Stakeholders,

Attached are the meeting notes from our last meeting on this study, held on November 12, 2013. As a follow-up to this meeting, we have developed two documents which detail methods proposed for the following specific elements of this study:

1. Method for coding bedrock substrates found in the study area
2. Draft method for conducting the reach 1 empirical flow habitat assessment (braided riffle area)

Please submit any comments you may have on the attached within two weeks, or by April 14, 2014. Please address technical comments to Brandon Kulik (Brandon.Kulik@KleinschmidtUSA.com).

Since the last meeting, FERC issued its Study Plan Determination Letter on February 21, 2014 in which the Instream Flow Study Plan was approved with modifications. FirstLight is currently investigating the modifications to the study plan which may require further consultation, including specific HSI criteria for sea lamprey and related HSI criteria for primary host fish of state-listed mussels of concern in the project-affected area. We anticipate distributing draft recommendations on these subjects for your review and input in the near future.

Additionally, in response to your comments and as directed by the FERC Study Plan Determination Letter, FirstLight plans to install over 20 water level loggers in Reach 1-3 in order to ensure the accuracy of modeled conditions. The specific locations of the logger deployment will be determined in the field, and your previous comments regarding logger placement will be considered. Once installed, a map showing the locations will be provided to you.

Finally, we anticipate that additional consultation will be required to conduct the work in the downstream reaches in 2015. We look forward to working with you to make this a successful study.

Jason George
Gomez and Sullivan Engineers, PC
41 Liberty Hill Road, PO Box 2179
Henniker, NH 03242
Office: (603) 428-4960
Cell: (603) 340-7666

Commonwealth of Massachusetts

Division of Fisheries & Wildlife

MassWildlife

Wayne F. MacCallum, *Director*

March 13, 2014

Honorable Kimberly D. Bose
Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, DC 20426

ADDITIONAL INFORMATION & COMMENTS
Northfield Mountain Pumped Storage Project No. 2485
Turners Falls Hydroelectric Project No. 1889
Additional Information Regarding Documented Presence of State-listed Mussel Species in the Project Area

Dear Secretary Bose,

The Massachusetts Division of Fisheries and Wildlife (the "Division") is the agency responsible for the protection and management of the fish and wildlife resources of the Commonwealth of Massachusetts. The Natural Heritage & Endangered Species Program of the Division is responsible for the regulatory protection of imperiled species and their habitats, as codified under the Massachusetts Endangered Species Act (M.G.L. c.131A) and its implementing regulations (321 CMR 10.00), and collects and manages information on the occurrence, abundance, distribution and conservation needs of rare species and significant natural communities in Massachusetts. This information is collected through field surveys, reviews of the scientific literature and research by staff biologists and cooperators around the state.

The Division would like to offer the following, additional information regarding the presence of state-listed mussel species within the Connecticut River, which is relevant to the "Study Plan Determination for Aquatic Studies - Turners Falls Hydroelectric Project and Northfield Mountain Pumped Storage Project" issued by the Federal Energy Regulatory Commission (FERC) on February 21, 2014 (the "Study Plan Determination").

Additional Information:

The Division's database includes a recent occupancy record of Yellow lampmussel (*Lampsilis cariosa*) within the Bypass Reach (Reach 3) of the project area, which was not detected in recent surveys conducted by the applicant. This is based on a record of observation, submitted to the Division and verified by Division biologists, as further described below:

Species Observed:	Yellow lampmussel (*Lampsilis cariosa*), state-listed as Endangered
Date Observed:	August 4, 2007
Location:	Eastern shoreline of Rawson's Island, near Rock Dam
Coordinates:	72.5806◦ W, 42.5954◦ N

Division of Fisheries and Wildlife
100 Hartwell Street, Suite 230, West Boylston, MA 01583 (508) 389-6300 Fax (508) 389-7890
An Agency of the Department of Fish and Game

Action Requested:

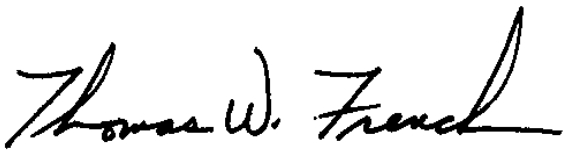
The Division requests that the additional occurrence of Yellow lampmussel supplement data collected during recent surveys conducted by the applicant in Reaches 1 through 3, future surveys to be conducted by the applicant in Reach 4 pursuant to Study Plan 3.3.16, and recent surveys conducted in Reach 5 by Holyoke Gas and Electric (FERC Project No. 2004).

In particular, the Division requests that the additional occurrence of Yellow lampmussel inform study elements of Study Plan 3.3.1 as required by FERC in the Study Plan Determination, as summarized below.

Study Plan	Study Element	Summary of Study Plan Determination	Action Requested
3.3.1	Evaluation of all State-listed Mussels	Model habitat persistence in reaches with documented occurrences of state-listed mussel species.	Add habitat persistence modeling for yellow lampmussel within Reach 3.
3.3.1	1D vs. 2D Modeling for Mussels	Conduct 1D modeling in reaches with documented occurrences of state-listed mussel species, for use in modeling habitat persistence.	2D data will be collected within Reach 3 pursuant to Study Plan 3.3.1. We recommend 2D modeling of habitat persistence for Yellow lampmussel in Reach 3, given that 2D modeling would not require additional data collection and would provide a better assessment of habitat persistence.
3.3.1	Velocity Profiles	Collect mean column and benthic velocity data at representative transects at three calibration flows in Reaches 4 and 5 to validate mean column velocities and simulated benthic velocities.	Amend study to collect data at representative transects (or at locations as otherwise appropriate to 2D data collection methodologies) to validate mean column and simulated benthic velocities in Reach 3. Given that data collection for Reach 3 will occur in 2014, we recommend timely reassessment of field methods, as appropriate, to collect this data.
3.3.1	Host Fish Habitat Modeling	Persistent habitat should be modeled for primary hosts of all state-listed mussels present in project area.	Amend study to include modeling of habitat persistence for primary host fishes within Reach 3.

Thank you for this opportunity to provide additional information and comments. If we can be of further assistance or provide any additional information on this matter, please contact Jesse Leddick, Endangered Species Review Biologist, at jesse.leddick@state.ma.us or (508) 389-6386.

Sincerely,



Thomas W. French, Ph.D.
Assistant Director for the Natural Heritage & Endangered Species Program
Massachusetts Division of Fisheries and Wildlife

MEETING MINUTES

Nick Ettema
Fisheries Biologist
Federal Energy Regulatory Commission
888 First Street, NE
Washington, DC 20246
202-502-6565

Meeting Location: Telephone Conference
Meeting Date: May 15, 2014, 2:00-3:00 pm
Participants: John Howard, FirstLight Hydro Generating Company (FirstLight)
Mark Wamser, Gomez and Sullivan Engineers (consultant to FirstLight)
Peter Hazelton, Massachusetts Division and Fish and Wildlife (MADFW)
Misty-Anne Marold (MADFW)
Jesse Leddick (MADFW)
Ken Hogan, Federal Energy Regulatory Commission (FERC or Commission)
Nick Ettema, (FERC)

Re: Meeting minutes for the telephone conference between Commission Staff, Massachusetts Division of Fisheries and Wildlife, and FirstLight Hydro Generating Company, regarding yellow lampmussel in Reach 3.

On May 15, 2014, Ken Hogan and Nick Ettema of the Commission's staff participated in a telephone conference with representatives of Massachusetts Division of Fisheries and Wildlife (MADFW) and FirstLight Hydro Generating Company (FirstLight) to discuss the new information pertaining to the discovery of a state-listed mussel in study reach 3 in 2007, a segment of the Turners Falls Project's bypassed reach. The mussel was located just below Rock Dam, a natural feature located in the Turners Falls bypass channel. This new information was outlined in Fisheries and Wildlife's filing on March 13, 2014. The parties above participated in an initial telephone conference regarding this information on May 6th (Memo filed on May 7, 2014). Commission staff hosted this meeting to facilitate a discussion on how the discovery of a state-listed mussel in the bypassed reach may affect FirstLight's study plan implementation, specifically, Study 3.3.1 – *Instream Flow Habitat Assessment*. A summary of the meeting was filed on July 8, 2014.

Background

In its March 13, 2014 filing, Fisheries and Wildlife submitted four requests for additional data collection and/or analysis for yellow lampmussel in reach 3[1] of the bypass: (1) model habitat persistence for yellow lampmussel in reach 3; (2) utilize the 2-dimensional (2-D) model instead of a 1-D model in reach 3 to model habitat persistence for yellow lampmussel; (3) directly collect representative data to validate mean column and benthic velocity measurements at different flows; and (4) model habitat persistence for primary host fish in reach 3.

[1] The physical limits of Reach 3 are defined in Study No. 3.3.1. Reach 3 starts just above Rock Dam, a natural rock feature in the bypass channel, to just below the Deerfield River confluence on the Connecticut River.

FirstLight's Response

In light of the new information, FirstLight intends to model habitat persistence for yellow lampmussel in reach 3 (item 1 above) and use the 2-D model (item 2) to accomplish this task. FirstLight also plans to model habitat for primary host fish of state-listed mussels in all study reaches as required by the study plan determination (item 4).

In order to model suitable habitat for mussels or other species in reach 3, FirstLight intends to collect hydraulic data including velocity measurements at two (2) flows[2] per Study 3.3.1 – *Conduct Instream Flow Habitat Assessments in the Bypass Reach and below Cabot Station*. FirstLight explained that it plans to use an Acoustic Doppler Current Profiler (ADCP) to measure water velocity at 2 different flows in reach 3. The ADCP would collect velocity data at different depths and then calculate the mean column velocity at each data collection point. These mean column velocity data would be used to help calibrate the 2-D model. Relative to item 3, once the model is calibrated, FirstLight indicated that benthic velocity, shear stress and other important hydraulic variables could then be calculated and modeled from the mean column velocity values at each point. In short, FirstLight's approach involves calculating benthic velocity and other hydraulic variables using a modeled mean column velocity. This approach is different from Fisheries and Wildlife's request to directly collect benthic velocity at different flows in reach 3 and to use that data to specifically model benthic velocities in reach 3 under various flows.

FirstLight noted that while the ADCP automatically calculates a mean column velocity, the device does record discrete measurements of velocity for the entire vertical profile, including a benthic velocity. As such, direct measurements of benthic velocity at two different flows would be available.

Discussion

Provided that FirstLight furnishes a copy of all ADCP velocity data collected in reach 3, with suitable explanatory information to allow the use of the data (i.e., column headers names, explanations, time intervals of collection, linking files to link velocity point data with location data, etc.), to Fisheries and Wildlife, Fisheries and Wildlife found FirstLight's intended approach to calculate benthic velocities and other hydraulic variables using the modeled mean column velocity, would be acceptable. Fisheries and Wildlife indicated that it would use the ADCP data to verify FirstLight's calculated modeled results of benthic velocity in reach 3.

During the conference call Fisheries and Wildlife also requested that the benthic velocity data collected in reaches 4 and 5 (required by the study plan determination), be made available to the DELPHI team tasked with developing habitat suitability criteria in study 3.3.16 – *Habitat Assessment, Surveys, and Modeling of Suitable Habitat for State-Listed Mussel Species in the CT River below Cabot Station*. Fisheries and Wildlife stated that this data may be useful to refine the suitability criteria the DELPHI is charged to develop. FirstLight noted this data would not be available until after field data collection occurs in 2015, but it did not object to providing the data or applying it to the suitability criteria. Thus, an assessment of yellow lampmussel habitat in Reach 3 will not be possible in 2014 as habitat suitability criteria will not be available until 2015.

[2] Per Study Plan 3.3.1 (page 3-107), the approximate calibration flow is listed as 2,500 cfs to 9,000 cfs. The two calibration flows will be collected under approximately steady flow conditions, as safety and hydrologic conditions allow.

Summary

FirstLight will collect hydraulic data and evaluate project effects on yellow lampmussel and its host fish in reach 3 using methodology described in the approved study plan. FirstLight will apply any DELPHI-developed habitat suitability criteria (pursuant to study 3.3.16) for yellow lampmussel to reach 3 and conduct 2-D modeling of habitat persistence based on these suitability criteria in 2015 after the criteria is established. All velocity data will be made available to Fisheries and Wildlife and/or the DELPHI team for their use.

Given the provisions of section 5.15 of the Commission's regulations, Fisheries and Wildlife found this approach for evaluating suitable habitat in reach 3 for yellow lampmussel to be acceptable.