Relicensing Study 3.3.1

Conduct Instream Flow Habitat Assessments in the Bypass Reach and below Cabot Station

STUDY PLAN

IFIM for MUSSELS– 2017

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

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AUGUST 2017

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1.1 General Description of Proposed Study

Relicensing Study No. 3.3.1 *Instream Flow Studies in the Bypass Reach and below Cabot Station* at the Turners Falls Project (P-1889) (Project) included five river sections, designated as Reaches 1, 2, 3, 4, and 5. The Final Report for Study No. 3.3.1 was filed with FERC on October 14, 2016, with an addendum filed on April 3, 2017. As outlined in the original Revised Study Plan (RSP) for the study, submitted to FERC on August 14, 2013, further evaluation of aquatic mussel habitat in Reach 5 would be completed based on the results of a screening-level analysis. Specifically, if the screening-level analysis indicated that state-listed mussels were potentially impacted by the Turners Falls Project operations, then a more detailed HEC-RAS hydraulic model would be developed to further assess impacts to the listed mussel species.

During the screening-level analysis, supplemental bathymetry and substrate data at transects were collected and this information was added to the existing HEC-RAS 1-D model that had been developed as part of Relicensing Study No. 3.2.2 *Hydraulic Study of Turners Falls Impoundment, Bypass Reach, and Below Cabot* (Study 3.2.2) in Reach 5. Fifteen (15) transects were selected based on the abundance of state-listed mussel species, and as described in the Final Report for Study No. 3.3.1, operational effects were found to have some (though relatively limited) effects on habitat suitability for those species based on binary Habitat Suitability Index (HSI) criteria developed for Relicensing Study No. 3.3.16 *Habitat Assessment, Surveys and Modeling of Suitable Habitat for State-Listed Mussel Species in the Connecticut River below Cabot*.

During consultation with Massachusetts Natural Heritage and Endangered Species Program (NHESP) and the U.S. Fish and Wildlife Service (USFWS), it was determined that they wanted additional data collection and modeling to adequately determine the effects of Project operations on state-listed mussels and host fish in their available habitat in Reach 5. In addition, NHESP and USFWS wanted to determine if Project operations create bed shear stresses that could potentially mobilize the mussel. Hence they requested a shear stress analysis. Therefore, FirstLight is proposing an IFIM study to additionally quantify the relationship between Project operations and aquatic habitat, along with shear stress.

The target mussel species and host fish for the mussels is shown in Table 1.1-1. Note that HSI curves for the host fish includes various guilds that were developed as part of the Relicensing Study 3.3.1 and the mussel binary HSI curves were developed as part of the Delphi process as described later in this study plan.

Table 1.1-1: Target Mussels and Host Fish for Reach 5 Instream Flow Study

Species	Life Stages	Host Fish
Yellow Lampmussel	Juvenile, Adult	Deep Slow Guild, Deep Fast Guild
Eastern Pondmussel	Juvenile, Adult	Deep Slow Guild, Shallow Slow Guild
Tidewater Mucket	Juvenile, Adult	Deep Slow Guild, Deep Fast Guild, Shallow Slow Guild

1.2 Study Goals and Objectives

The goal for this study is to assess the potential effects of Turners Falls Project operations, when combined with water level management at Holyoke Dam on the shear stress and aquatic habitat suitability for state listed mussel resources and host fish (habitat only) between the Route 116 Bridge in Sunderland and the Dinosaur Footprints Reservation in the Connecticut River.

1.3 Resource Management Goals

The primary resource management goal identified is to determine an appropriate flow regime that will protect state listed mussel resources in Reach 5, between the Route 116 Bridge in Sunderland and the Dinosaur Footprints Reservation.

1.4 Existing Information and Need for Additional Information

Initial aquatic habitat mapping associated with the Project relicensing process was performed in 2012, and summarized in a report entitled "*Aquatic Mesohabitat Assessment and Mapping"* that was filed with FERC on January 8, 2013 and is available on FirstLight's relicensing website at http://www.northfieldrelicensing.com. The report includes general mesohabitat mapping results in Reach 5. Additional substrate surveys performed in 2016 found that substrate in much of Reach 5 was predominantly sand, with some silt mixed in along the banks. Gravel became more prominent in the far upstream section of Reach 5, and bedrock was prevalent in far downstream areas. It was also noted during the field survey that the lower reaches of Reach 5 are more influenced by the backwater created by the Holyoke Dam. The mapping also indicated that bedrock is the common substrate in hydraulic control area near the Dinosaur Footprints Reservation and downstream towards Holyoke Dam. Mesohabitats for Reach 5 are shown in Figure 1.4-1.

Per the FERC license for the Holyoke Hydroelectric Project (P-2004), freshwater mussel studies were required over a 12-year period (2003-2014), with interim reports required every four years. The mussel survey area extended from Dry Brook (Sunderland) downstream to the Holyoke Dam, and the final report was filed with FERC on October 1, 2014. The report provides detailed information regarding the presence and relative abundance of mussel species within the reach, with an emphasis on state-listed mussel species. Yellow Lampmussel (*Lampsilis cariosa*), the Eastern Pondmussel (*Ligumia nasuta*), and the Tidewater Mucket (*Leptodea ochracea*) were documented in the study reach, though most state-listed mussels were Yellow Lampmussels, with the other two species only found at one location (as described later in this study plan, these two species were detected at the uppermost transect in the Mitch's Island study reach). The presence/absence of Yellow Lampmussels within the reach, based on the most recent (2009 and 2013) surveys is shown in Figure 1.4-2.

As part of the Turners Falls Project relicensing process, quantitative binary HSI criteria were developed for the three state-listed mussel species (juvenile and adult life stages) documented in the study area using the Delphi technique. Under this method, a panel of mussel experts were assembled and asked to develop and reach consensus on habitat criteria using information from studies conducted in the Connecticut River, other rivers and lakes throughout the range of each species, and from their research and professional experiences. HSI criteria development for the three target mussel species is described in the report for Relicensing Study 3.3.16 *Habitat Assessment, Surveys and Modeling of Suitable Habitat for State-Listed Mussel Species in the Connecticut River below Cabot*; the criteria are contained Table 1.4-1 (end of section).

These data were analyzed as part of a detailed screening analysis, using HEC-RAS modeling which incorporated the binary HSI criteria. The analyses found that, in general, operational effects from the Turners Falls Project on state-listed mussels in Reach 5 were minimal overall, and that the habitat suitability modeling at various flow rates did not appear to correlate with the abundance and presence/absence of the mussel species. The full results are presented in the Final Study Report for Relicensing Study 3.3.1, which was filed with FERC on October 14, 2016.

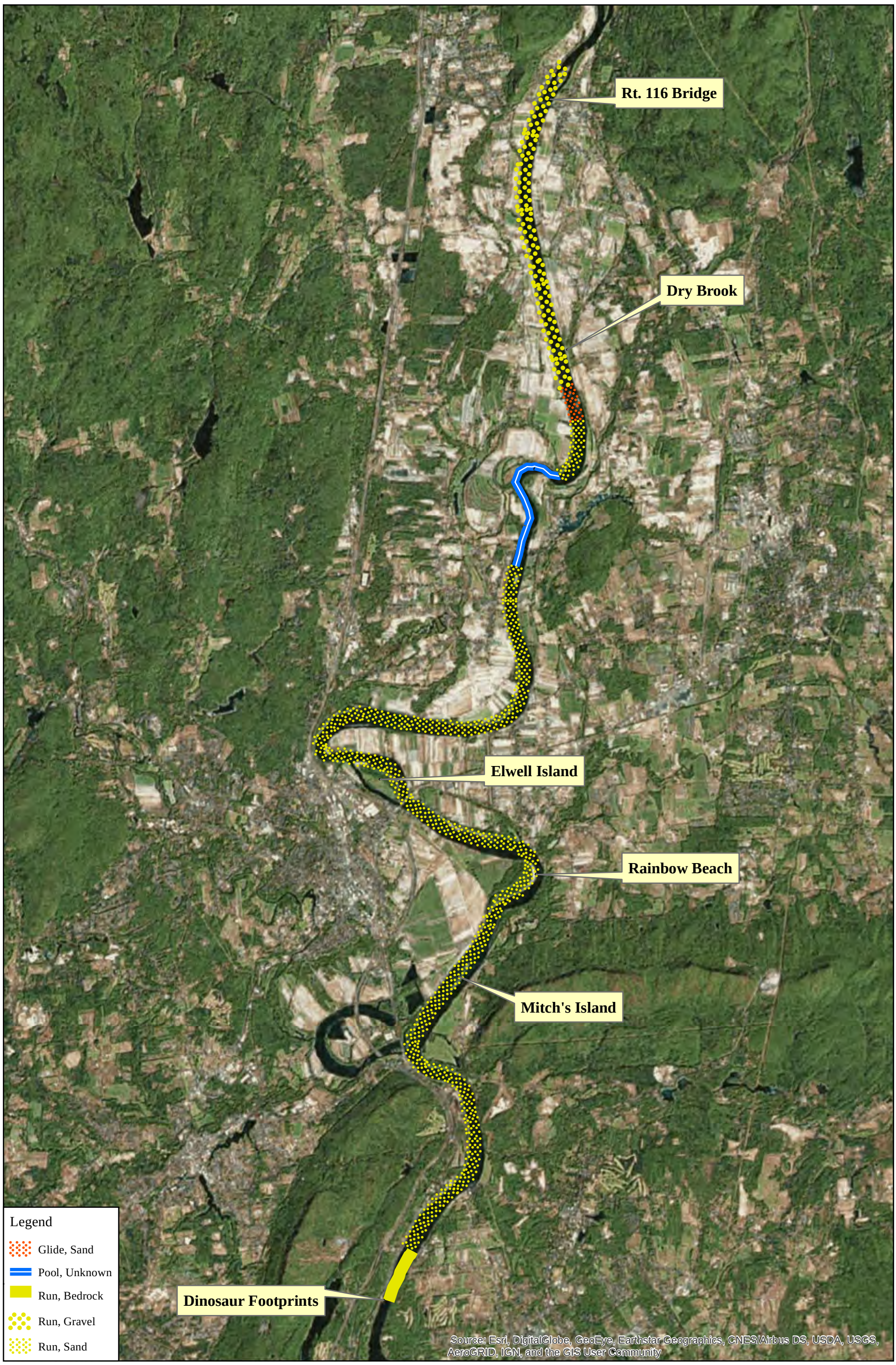
Habitat verification data (depth, velocity, and substrate) were collected by FirstLight in 2016 at 15 transects located in areas with variable abundances of state-listed mussels (Figure 1.4-3). As shown on Figure 1.4-3

and described later, at several of the 15 transects depth, velocity, substrate, water surface elevation (WSEL) and flow data were collected. FirstLight proposes to use these data, along with additional data collection, to assess habitat (for mussels and host fish) and shear stress (for mussels) as part of its proposed instream flow study.

Following its review of the reports for Relicensing Studies 3.3.16 and 3.3.1, NHESP and USFWS stated that additional analysis is required to evaluate mussel habitat relative to Project operations in Reach 5. FirstLight provided a draft study plan to NHESP and USFWS on January 17, 2017 for performing an enhanced screening-level analysis, which would assess mussel habitat using currently-available datasets, including the field data collected by FirstLight in Reach 5. Comments provided by NHESP and USFWS on February 27, 2017 indicated a need for additional hydraulic data collection, essentially requiring a full-scale instream flow study.

Table 1.4-1: Binary HSI Scores for Three Massachusetts State-Listed Mussel Species

Parameter		Yellow Lampmussel		Eastern Pondmussel		Tidewater Mucket	
		Juvenile	Adult	Juvenile	Adult	Juvenile	Adult
Class	**Benthic Velocity Range (ft/s)**						
1	<0.16	1	1	1	1	1	1
2	0.16-0.34	1	1	1	1	1	1
3	0.35-0.67	1	1	1	1	1	1
4	0.68-0.99	1	1	1	1	1	1
5	1.00-1.32	1	1	1	1	1	1
6	1.33-1.65	1	1	1	1	1	1
7	1.66-2.47	0	1	0	0	0	1
8	2.48-3.29	0	0	0	0	0	0
9	3.30-4.93	0	0	0	0	0	0
10	4.94-6.56	0	0	0	0	0	0
11	>6.56	0	0	0	0	0	0
Class	**Water Depth Range (feet)**						
1	0	0	0	0	0	0	0
2	0.03-0.34	0	0	0	0	0	0
3	0.35-0.83	1	1	1	1	1	1
4	0.84-1.65	1	1	1	1	1	1
5	1.66-2.47	1	1	1	1	1	1
6	2.48-3.29	1	1	1	1	1	1
7	3.30-4.93	1	1	1	1	1	1
8	4.94-6.56	1	1	1	1	1	1
9	6.57-9.85	1	1	1	1	1	1
10	9.86-13.12	1	1	1	1	1	1
11	>13.12	1	1	1	1	1	1
Class	**Particle Size**						
1	Organic Material	0	0	0	0	0	0
2	Clay	0	0	0	0	0	0
3	<0.002 in [mud/silt]	1	1	1	1	1	1
4	0.002 – 0.08 in. [sand]	1	1	1	1	1	1
5	0.08- 1.26 in. [fine gravel]	1	1	1	1	1	1
6	1.26 – 2.52 in. [coarse gravel]	1	1	0	1	1	1
7	2.52 – 5.90 in. [small cobble]	1	1	0	0	0	0
8	5.90 – 9.84 in. [large cobble]	0	0	0	0	0	0
9	9.84 – 157.5 in. [boulder]	0	0	0	0	0	0
10	Bedrock	0	0	0	0	0	0



FIRSTLIGHT HYDRO GENERATING COMPANY
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Turners Falls Hydroelectric Project No. 1889

Study 3.3.1 - IFIM Reach 5

N

0 0.5 1 2 Miles

Figure 1.4-1: Mesohabitat in the Reach 5 river segment of the Connecticut River

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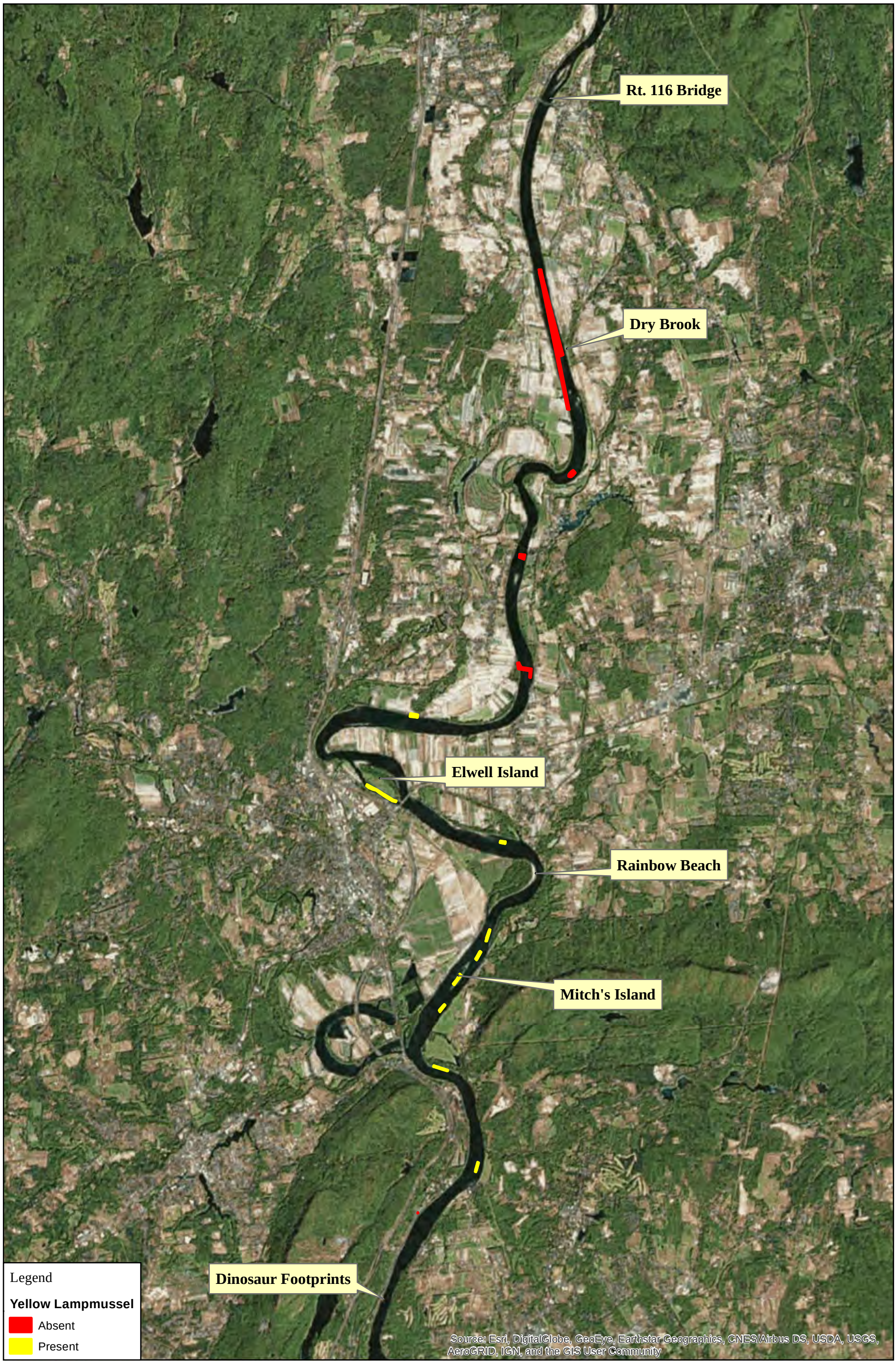

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N

0 0.5 1 2 Miles

Figure 1.4-2: Locations of HG&E mussel surveys in 2009 and 2013, showing presence/absence of Yellow Lampmussel

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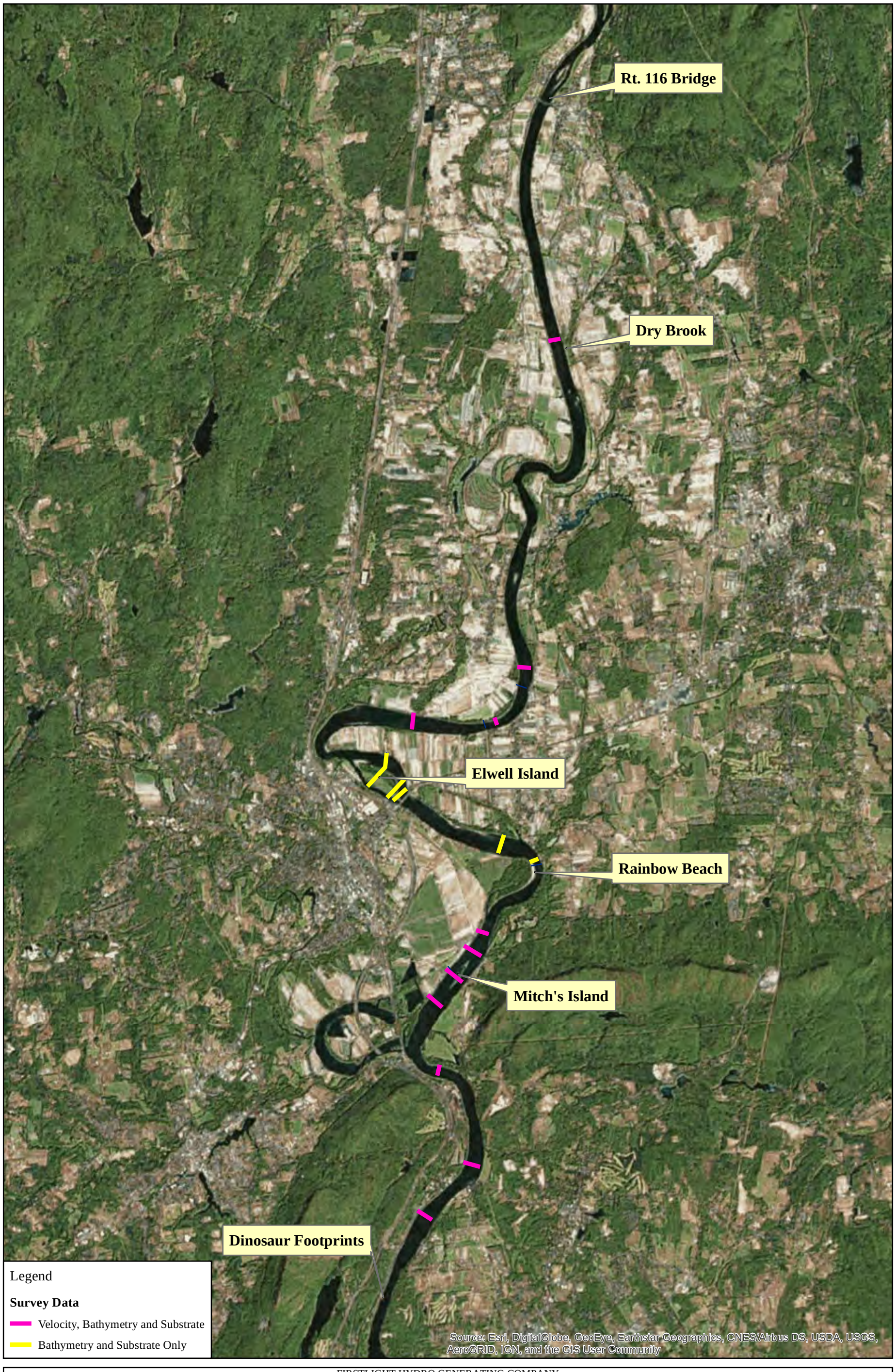

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Study 3.3.1 - IFIM Reach 5

FirstLight Power Resources

N

0 0.5 1 2 Miles

Figure 1.4-3: Locations of transects where data were collected by FirstLight in 2016

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1.5 Project Nexus

FirstLight operates Cabot Station as a peaking facility when flows are less than its hydraulic capacity (13,728 cfs). Project operations therefore have the potential to influence aquatic habitat in areas downstream of Cabot Station, including state-listed mussel species that have been documented within Reach 5.

1.6 Investigation Area

Reach 5 is approximately 22 miles long, extending from the Route 116 Bridge, approximately 9.75 miles downstream of the Project, to a natural hydraulic control located near Dinosaur Footprints Reservation. This section of the Connecticut River is a low gradient, alluvial reach with limited mesohabitat variability and in many cases, very gradual or subtle transitions from one mesohabitat type to the next contiguous type. Over 87% of this reach was classified as run mesohabitat; sand substrates are prevalent in most of the reach, with the exception of the furthest upstream areas where gravel is more prevalent. Hydraulics in this reach are also influenced by backwatering effects from the downstream Holyoke Project, located about 4 miles downstream of the natural hydraulic control located near Dinosaur Footprints Reservation. Those backwatering effects are more prominent in the lower reaches of Reach 5, but are prevalent throughout Reach 5. The current FERC license for the Holyoke Project permits the WSEL at the Holyoke Dam to vary between 99.47 and 100.67 ft NGVD 1929.

1.7 Methodology

An IFIM study is proposed to analyze key habitat suitability-flow relationships in the study area. A 1-D modeling approach is suitable for Reach 5 and will be completed using PHABSIM for Windows (V 1.5.1), which was developed by the USFWS and distributed by the USGS Fort Collins (CO) Science Center. The 1-D modeling approach will be based on hydraulic data developed from transect depth, velocity, and substrate measurements following Milhouse et al. (1989) for the target mussel species and host fish.

Instream Flow Study Background

FirstLight proposes to conduct the IFIM study using the representative reach approach which is consistent with IFIM protocols (Bovee et al. 1998) to evaluate fish habitat. As a first step in this approach, the mesohabitat in Reach 5 was documented. Mesohabitats are delineated by riffles, run and pools, and further divided based on substrate, hydraulics, and other habitat features such as instream cover, overhead cover, etc. The mesohabitat classification and length of mesohabitat features were documented in Reach 5 (and Reach 4) in 2012. From these mapped features, rather than evaluating the entire 22 miles of habitat, representative reaches are selected to represent the various habitat features. For illustration purposes assume a given reach is 10 miles long consisting of three mesohabitats such as a) runs with sand (4 miles), b) runs with gravel (4 miles) and c) riffles with gravel (2 miles). The representative reach approach consists of selecting a sub-section of each representative reach and placing transects (for illustration purposes assume three transects in each) in each of the three sub-sections. At each transect, depth, velocity, substrate, and the WSEL is collected under a given flow (a total flow measurement is also taken at each transect). Thus, a full data set of hydraulic data is collected under a single flow. Using the measured depth and velocity data, a hydraulic model is developed for each subset (in this example, three models would be developed for each subset). The hydraulic models are calibrated to the measured WSEL at each transect and velocities. Once calibrated, the hydraulic model can predict depths and velocities typically at 40-250% of the measured flow.

Relative to the number of hydraulic data sets needed (or the number of flows where hydraulic data is collected at each transect in the field), it is dependent on the Project operations. In this case, the Turners

Falls Project can operate up to a flow of 13,728 cfs. As described later in this document, two flow data sets are proposed that will allow FirstLight to evaluate the impact of Turners Falls Project operations on mussel and host fish habitat and shear stress for mussels.

From the hydraulic output data (depths, velocities), the habitat model is run to quantify the amount of habitat per unit length of river for each transect in a representative reach. In the end, a relationship between weighted usable area (WUA) per foot of river is developed for each representative reach. The WUA results for each representative reach are then extrapolated based on the miles of river that reach represents. Using the example above, the WUA/foot of river is multiplied by 2 miles to represents riffles with gravel to yield total WUA. The WUA for each of the three representative reaches are subsequently added together to yield the WUA for the entire 10 mile reach example.

Approach

The proposed study methodology is based on the mesohabitat distribution throughout the study area, as mapped in 2012. The mapping and characterization of aquatic mesohabitat provides essential information regarding the extent, location, and composition of aquatic habitats that may be affected by Turners Falls Project operation, and provides a framework for selecting strategic study sites and transects. Ten (10) transects are proposed to represent the primary mesohabitats in three representative reaches within Reach 5 (Figure 1.7-1). The representative reach names, representative habitat types, the number of miles represented by each reach, and existing hydraulic data sets are listed in Table 1.7-1. The reaches are listed in from upstream to downstream order.

Table 1.7-1: Representative Reaches and Proposed No. of Transects

Representative Reach Name	No. of Transects	Miles represented	Representative Habitat Type	Existing Data Sets
Dry Brook Reach	3	3.75 mi	Run with gravel substrates	None
Hatfield Reach	3	6.2 mi	Run with sand substrates	Depth, velocity and substrate data has already been collected at a flow of ~5,500 cfs. FL proposes to use these data.
Mitch's Island Reach	4	9.2 mi	Run with fine substrates. This reach is hydraulically distinct from the other two representative reaches- under low flows, there is a greater influence from the HG&E Project.	Depth, velocity and substrate data has already been collected at a flow of ~3,100 cfs. FL proposes to use these data.
Total	10	19.15 mi		

The Dry Brook, Hatfield, and Mitch's Island representative reaches collectively represent 19.15 miles of the ~22 miles of Reach 5. Pool habitat (1.9 miles of Reach 5) was eliminated from this analysis, given that there is limited pool habitat within Reach 5. No information from previous mussel bed surveys suggests

that the pool areas contain critical mussel habitat in Reach 5, and any mussel habitat that may exist there would be least-affected by Project operations due to the deeper, slower nature of pool habitat. Bedrock and glide mesohabitats (0.75 and 0.5 miles of Reach 5, respectively) were also eliminated from this analysis given the very small amount of those mesohabitats within Reach 5.

Calibration Flows

Model calibration will be completed at two flows of approximately 5,000 cfs and 9,000[1] cfs. As noted above, FirstLight will rely on existing hydraulic data sets for the Hatfield (~5,500 cfs) and Mitch's Island (~3,100 cfs) reaches, along with additional proposed hydraulic data sets. The proposed flows cover the range of Cabot operational flows. Based on common modeling procedure, calibrated hydraulic models may be extrapolated to as low as 40% to 250% of the measured. Shown in Table 1.7-2 are the flows ranges that could be evaluated with the model assuming flow targets are 4,000-6,000 cfs (low flow model) and 8,000-10,000 (high flow model):

Table 1.7-2 Proposed No. of Flows and Range of Flows that will be simulated

Flow (Dry Brook Reach)	**4,000-6,000 cfs (Low Flow Model)**	**8,000-10,000 cfs (High Flow Model)**
40%	1,600-2,400 cfs	3,600-4,000 cfs
250%	10,000-15,000 cfs	20,000-25,000 cfs
Flow (Hatfield Reach)	***5,500 cfs (Low Flow Model)**	**8,000-10,000 cfs (High Flow Model)**
40%	2,200 cfs	3,600-4,000 cfs
250%	13,750 cfs	20,000-25,000 cfs
Flow (Mitch's Island Reach)	***3,100 cfs (Low Flow Model)**	**8,000-10,000 cfs (High Flow Model)**
40%	1,240 cfs	3,600-4,000 cfs
250%	7,750 cfs	20,000-25,000 cfs

*Existing data sets.

Cabot has six turbines, each with a capacity of 2,288 cfs for a total station capacity of 13,728 cfs. Thus a two-flow calibration will cover Cabot's hydraulic capacity and there is overlap between the low and high flow models for all three representative reaches. Also recognize that the drainage area increases moving downstream, as the Deerfield River and other smaller tributaries drain into the Connecticut River.

Calibration flows will be provided by scheduled releases from the Project via a combination of unit operation, gate and/or fishway flow settings. The Montague USGS gage and field gaging will be collectively used to measure the calibration flow. Flow input from the tributaries downstream of the Project will be estimated by USGS gages (where available) or flow proration from available gage data[2]. These data will be added to the real-time discharge as measured at the Montague USGS gage to define the net calibration flow passing through the study sites.

[1] While these are the targeted flows, two stable calibration flows between 4,000 and 6,000 cfs and between 8,000 and 10,000 cfs are the goal but will be based on hydrological conditions of the watershed at the time of the survey.

[2] FirstLight used the same method for estimating tributary inflow in Reaches 4 and 5 as summarized in Study Report No. 3.2.2 *Hydraulic Study of Turners Falls Impoundment, Bypass Reach and below Cabot* (see Section 3.2.5 of that report, which was filed with FERC in March 2015).

Field Data Collection

The goal of field data collection is to collect depth, velocity, WSEL, and substrate data, along with a total flow measurement at each transect. All study transects will be field blazed with flagging or other appropriate means. Steel rebar will be driven into the ground at headpin and tailpin locations.

Streambank areas will be surveyed at each headpin and tailpin using standard optical surveying instrumentation and methods, or with Real-Time Kinematic Global Positioning System (RTK-GPS) if satellite coverage is sufficient. Within each of the three representative reaches described above, vertical survey control (NGVD29 datum) will be established such that all transects are tied to the same datum.

At the ten transects, Onset Hobo U20 pressure sensors will be installed to collect WSEL data prior to, and after, any depth and velocity data collection. The purpose of the pressure sensors is to determine if flows, and hence hydraulics, remain steady while the depth, velocity and substrate data are collected along the transects. The sensors will be programmed to collect data on 15-minute intervals. The HOBO loggers are non-vented and thus must be barometrically compensated using an atmospheric pressure logger- or a logger that records atmospheric pressure. Thus, an additional logger will be established in Reach 5 to record the atmospheric pressure. Elevations of all water level sensors will be surveyed using an RTK-GPS.

Depth and mean-column velocity measurements will be collected along each transect during both calibration flows, with an Acoustic Doppler Current Profiler (ADCP)[3]. The ADCP will be set to record measurements every second, and will be linked to an RTK-GPS for survey-grade precision. Depth and velocity at locations too shallow to effectively sample with the ADCP, if encountered, will be measured at regular intervals using a Marsh-McBirney Model 2000 Flowmate electronic current meter tethered to a top-setting wading rod. Mean column velocities will be measured at 0.6 times the depth. Ultimately, depths will be converted to riverbed bathymetric elevations by subtracting the depth from the recorded WSEL.

Substrate data will be collected at each transect visually where depth and water clarity allow, or by probing the riverbed when visual observation is not possible. Changes in the dominant substrate type along each transect will be recorded with a GPS and in a field notebook. Substrate will be delineated based on types and grain sizes pertaining directly to the mussel HSI criteria, as shown in Table 1.7-3.

Table 1.7-3: Substrate particle diameter for the IFIM study in Reach 5.

Substrate	Particle Diameter (inches)
Organic Material	-
Clay	-
Mud/Silt	< 0.002
Sand	0.002 - 0.08
Fine Gravel	0.08 - 1.26

[3] Though mussel habitat is based on benthic velocity, which the ADCP cannot measure directly due to side-lobe interference in close proximity to the bed, the relationship between bed roughness, depth, mean column velocity, and benthic velocity is well-defined in the literature. FirstLight examined the applicability of the theoretical function to ADCP data by fitting a logarithmic function for the velocity data collected in Reaches 4 and 5 previously. The resulting logarithmic function fit to the data were similar to curves from the theoretical functions based on larger substrates with greater bed roughness in Reach 4 relative to the finer substrates with lower bed roughness in Reach 5 (see figures in Appendix A).

Substrate	Particle Diameter (inches)
Coarse Gravel	1.26 - 2.52
Small Cobble	2.52 - 5.90
Large Cobble	5.90 - 9.84
Boulder	9.84 - 157.5
Bedrock	-

Analyses

Hydraulic Modeling

Reach 5 WSELs will be modeled by updating the existing HEC-RAS model with the ten new transects. The current model is based on cross sectional data from a combination of sources including:

- hydraulic cross sections from FEMA studies;
- bridge data from the Massachusetts Department of Transportation;
- the Nature Conservancy hydraulic model of Northampton, MA;
- FirstLight cross sections from the HEC-RAS hydraulic model developed for Study 3.2.2; and;
- FirstLight cross sections obtained for the screening level analysis conducted in 2016.

The HEC-RAS model will be updated to include the additional ten transects collected during the field survey. Two hydraulic models (low flow and high low) will be developed for each of the three representative reaches. In total, six independent hydraulic models will be developed and calibrated to the measured WSEL and flow as well as velocity. The downstream boundary of each model will be represented by lowermost transects measured WSEL at the given flow. Calibration will be achieved by matching the measured WSEL at each of the ten transects to +/- 0.1 feet for the low and high flow models. The low and high models will also be calibrated to the measured mean column velocity at each transect. Calibration will be achieved by matching the measured mean column velocities to within +/- 0.01 ft/sec at most cells to the modeled mean column velocities by using the velocity distribution model, VELSIM, within PHABSIM.

Once the hydraulic models are calibrated to WSEL and mean column velocity, the full HEC-RAS model will be used such that the hydraulics at the ten transects can be predicted under different downstream boundary conditions (the WSEL conditions at Holyoke Dam) and different flows (40-250% of the measured flow). Per its FERC license, the WSEL at the Holyoke Dam can operate between elevation 99.47 and 100.67 feet (NGVD 1929).

Once the models are calibrated a series of production runs will be made using the full hydraulic model from Holyoke Dam upstream to the Route 116 Bridge as shown in Table 1.7-4.

Table 1.7-4. Steady-State Production Runs to Simulate Habitat for Mussels and Host Fish

Scenario	Flow (cfs)	WSEL at Holyoke Dam
1A	2,000	99.47 ft
1B	2,000	100.67 ft
2A	3,000	99.47 ft
2B	3,000	100.67 ft
3A	4,000	99.47 ft
3B	4,000	100.67 ft
4A	5,000	99.47 ft

Scenario	Flow (cfs)	WSEL at Holyoke Dam
4B	5,000	100.67 ft
5A	6,000	99.47 ft
5B	6,000	100.67 ft
6A	8,000	99.47 ft
6B	8,000	100.67 ft
7A	10,000	99.47 ft
7B	10,000	100.67 ft
8A	12,000	99.47 ft
8B	12,000	100.67 ft
9A	14,000	99.47 ft
9B	14,000	100.67 ft
10A	18,000	99.47 ft
10B	18,000	100.67 ft
11A	22,500	99.47 ft
11B	22,500	100.67 ft

Habitat Modeling

The hydraulic model output (depth, velocity, along with the user-entered substrate) will be combined with HABTAE, the habitat model embedded within PHABSIM. The amount of aquatic habitat for a given species/life stage of mussel and host species will be calculated using PHABSIM or similar method. Each habitat area will be evaluated for its habitat suitability for a particular species/life stage based on the fixed characteristics (substrate) and the variable characteristics of the cell (depth and mean column velocity for host fish, or depth and benthic velocity for the mussels).

For assessing mussels only, mean column velocities will be converted to benthic velocities using a re-arrangement of the log-law velocity profile (ASCE Manual 110, Chapter 2), which calculates benthic velocity as a function of bed roughness (approximated by substrate), water depth, and mean column velocity[4]. The equation, after some re-arrangement, is:

$$u = U * \frac{\ln\left(30*\frac{z}{k_s}\right)}{\ln\left(11*\frac{H}{k_s}\right)}$$, where:

u = benthic velocity (ft/s);
U = mean column velocity (ft/s);
z = distance above the riverbed (ft);
k_s = bed roughness (ft);
H = water column depth (ft); and
Z = distance above the riverbed (ft) = 0.25 ft for all Reach 5 benthic velocity calculations.

[4] FirstLight examined the applicability of the theoretical function to ADCP data by fitting a logarithmic function for the data collected in Reaches 4 and 5. The resulting logarithmic function fit to the data were similar to curves from the theoretical functions based on larger substrates with greater bed roughness in Reach 4 relative to the finer substrates with lower bed roughness in Reach 5 (see figures in Appendix A).

Habitat suitability, as used in IFIM procedures, is an index quantified in terms of a variable known as Weighted Usable Area (WUA). A unit of WUA represents a unit of suitable habitat for the life stage evaluated. The following equations will be used to calculate the total WUA in Reach 5. The equations start at the cellular basis and end with computing WUA for the entire approximate 22 miles of Reach 5.

The Compound Function Index, CF(I), is calculated for each cell along a transect as follows:

$CF(I) = SI_V \times SI_D \times SI_S$, (unitless) where:

SI_V = Suitability Index for Velocity (or in the case of mussels, benthic velocity);

SI_D = Suitability Index for Depth; and

SI_S = Suitability Index for Substrate.

The individual cell WUA(I) (area per unit length of stream) is calculated for each transect as follows:

WUA(I) = CF(I) x Area(I), (typically the Area is defined as the length upstream and downstream of the transect represented by the habitat features in that transect) where:

Area(I) = Surface area of cell; and

CF(I) = Compound Function Index for cell(I)

The total WUA (area per unit length of stream)is computed for each representative reach by multiplying WUA/ft by the representative stream length. An example for the Dry Brook reach is below.

$$WUA_{\text{Dry Brook}} = \left(\sum_{i=1}^{n} WUA(I)_{T1} + \sum_{i=1}^{n} WUA(I)_{T2} + \sum_{i=1}^{n} WUA(I)_{T3} \right) \times L_{\text{Dry Brook}}$$

T1, T2 and T3 represent the WUA at Transects 1, 2, and 3 respectively.

L= the length or river representative of the Dry Brook reach

The total WUA for Reach 5 would be computed as follows:

$$\text{Total } WUA_{\text{Reach 5}} = WUA_{\text{DryBrook}} + WUA_{\text{Hatfield}} + WUA_{\text{Mitch's Island}}$$

Steady-state WUA figures depicting the relationship between the total amount of WUA in Reach 5 and flow will be developed for the three target mussels (juvenile and adult) and host fish (see Table 1.1-1). WUA will be calculated under a low and high backwater condition at the Holyoke Dam of 99.47 and 100.67 feet NGVD 1929, respectively.

Dual Flow Analysis

When streamflow varies, habitat quality may decrease in some habitat cells, while increasing in others. A dual flow analysis is commonly used to calculate the quantity of habitat that is present over a flow range, such as those that may be expected during a minimum flow/peaking flow hydroelectric operation. A dual flow analysis is particularly geared toward assessing peaking operations' impact on low-mobility species such as mussels, as it assesses the amount of habitat remaining over a given cell over a range of flows. For immobile aquatic biota, a dual flow analysis typically assumes that a transect's available habitat is equal to the sum of the individual cells' minimum habitat for a given flow pair. This analysis is somewhat simplified when using binary HSC, as habitat is either described as 'suitable' (meets all habitat criteria) or 'unsuitable' (does not meet one or more habitat criteria).

FL proposes to conduct dual-flow analyses for the three target mussel species (yellow lampmussel, eastern pondmussel, tidewater mucket) for juvenile and adult life stages. Dual flow analyses will not be conducted for the mussel host fish, as adult life stages are generally assumed to be mobile and able to travel between areas of suitable and unsuitable habitat throughout a peaking cycle.

Dual flow habitat will be defined as habitat that is suitable across a given flow pair (e.g., 4,000 cfs to 18,000 cfs) plus all modeled flows in-between the pair. For example, a cell would be considered dual-flow habitat for the 4,000-18,000 cfs flow pair if steady-state habitat was suitable at 4,000, 5,000, 6,000, 8,000, 10,000, 12,000, 14,000, 16,000 and 18,000 cfs. Dual flow habitat will be calculated independently for low and high Holyoke impoundment levels. The dual flow analysis will be run for all modeled steady-state flow combinations, but not 22,500 cfs which is substantially above the combined hydraulic generating capacity of Cabot Station and Station No. 1 (15,938 cfs) of the Turners Falls Project.

Results will be presented in tabular format comparing the amount of dual-flow habitat available at different flow combinations. Raw cellular analysis results will be made available to stakeholders in an appendix or upon request in an electronic format if the calculations are too cumbersome to fit in a paper format.

Shear Stress Analysis

Cellular shear stress will be evaluated at the ten transects for the same set of flows and boundary conditions at the Holyoke Dam as presented in Table 1.7-4. As requested by NHESP in its comments (email of June 9, attached as Appendix B)), the shear stress analysis will not be based on the entire water column but on the linear distance at the substrate surface. As discussed with the USFWS on July 21 (conference call with Brett Towler) FL will calculate cellular shear stress at the ten transects by manipulating the two equations below and solving for the shear stress as follows (ASCE Manual 110, Chapter 2):

$$\frac{u}{u_*} = \frac{1}{K} * \ln\left(30 * \frac{z}{k_s}\right), \qquad \text{(Eq. 1)}$$

$$u_* = \sqrt{\frac{\tau_b}{\rho}}, \text{ substituting for } u_* \qquad \text{(Eq. 2)}$$

$$\frac{u}{\sqrt{\frac{\tau_b}{\rho}}} = \frac{1}{K} * \ln\left(30 * \frac{z}{k_s}\right)$$

$$\rightarrow \tau_b = \rho * \left(\frac{u * K}{\ln\left(30 * \frac{z}{k_s}\right)}\right)^2, \text{ where}$$

τ_b = shear stress (lb/ft^2);
ρ = density of water (slugs/ft^3) = 1.94 slugs/ft^3 for all of Reach 5;
u_* = shear velocity (ft/s);
u = time-averaged flow velocity at a distance z above the bed (ft/s);
z = distance above the riverbed (ft) = 0.25 ft for all of Reach 5;
K = von Karman's constant = 0.41;
k_s = bed roughness (ft);

FL will produce figures at the ten habitat transects indicating whether a cell is, or is not, suitable for habitat based on the threshold recommended by the Massachusetts Division of Fisheries and Wildlife (MADFW) in its December 15, 2016 comment letter. MADFW recommended thresholds for juvenile and adult mussels are included in Table 1.7-5. An example cross section figure is presented in Figure 1.7-2. As requested by NHESP at the June 1 meeting, FL will also provide the data in tabular format.

Table 1.7-5: Shear Stress Thresholds for Juvenile and Adult State-Listed Mussels in Reach 5.

Mussel Species	Adult Shear Stress Threshold	Juvenile Shear Stress Threshold
Yellow Lampmussel	150 dynes/cm^2	10 dynes/cm^2
Eastern Pondmussel	150 dynes/cm^2	10 dynes/cm^2
Tidewater Mucket	150 dynes/cm^2	10 dynes/cm^2

Combined WUA and Shear Stress Analysis

In addition, as requested by NHESP at a June 1 meeting and in their June 9, 2017 email (Appendix B), shear stress will be included in the habitat analysis as a fourth suitability criteria for the mussel species. All four parameters will be run together to assess how shear stress affects habitat modeling and WUA. WUA that includes shear stress as a fourth parameter will be defined as Combined WUA and Shear Stress Analysis (WUA_C).

The same shear stress calculations and criteria as presented above will be used. Under this iteration, WUA will be calculated with the addition of a Suitability Index for Shear Stress as a fourth parameter to the Compound Function Index.

The Combined Compound Function Index for the combined WUA and shear stress analysis, $CF(I)_C$, will be calculated for each cell along a transect as follows:

$CF(I)_C = SI_V \times SI_D \times SI_S \times SI_{SS}$ (unitless) where:

SI_V = Suitability Index for Velocity (or in the case of mussels, benthic velocity);

SI_D = Suitability Index for Depth;

SI_S = Suitability Index for Substrate; and

SI_{SS} = Suitability Index for Shear Stress.

The individual cell WUA_C, total WUA_C for each representative reach (Dry Brook, Hatfield and Mitch's Island), and the total WUA_C for Reach 5 would be calculated in the same manner as described above in the Habitat Modeling section.

Steady-state combined WUA and shear stress analysis figures depicting the relationship between the total amount of WUA_C in Reach 5 and flow will be developed for the three target mussel species (yellow lampmussel, eastern pondmussel, tidewater mucket) for juvenile and adult life stages. WUA_C will be calculated under a low and high backwater condition at the Holyoke Dam of 99.47 and 100.67 feet NGVD 1929, respectively.

FL would also conduct dual-flow analyses based on the results of the combined WUA and shear stress analysis for the three target mussel species (yellow lampmussel, eastern pondmussel, tidewater mucket) for juvenile and adult life stages. Dual flow habitat will be calculated independently for low and high Holyoke impoundment levels. The dual flow analysis will be run for all modeled steady-state flow combinations, but not 22,500 cfs which is substantially above the combined hydraulic generating capacity of Cabot Station and Station No. 1 (15,938 cfs) of the Turners Falls Project.

Results will be presented in tabular format comparing the amount of dual-flow habitat available at different flow combinations. Raw cellular analysis results will be made available to stakeholders in an appendix or upon request in an electronic format if the calculations are too cumbersome to fit in a paper format.

Elwell Island Transects

As requested by NHESP at the June 1 meeting, FL will provide data previously collected at three transects in the vicinity of Elwell Island (see Figure 1.4-3). Rather than model the habitat at these transects, it was agreed that FL will provide the bathymetry and substrate data collected at these three transects, along with WSEL data under a subset of scenarios bounding the Turners Falls Project hydraulic range, including Scenarios 1A, 1B, 9A and 9B. (see Table 1.7-4).

Legend

- Glide, Sand
- Pool, Unknown
- Run, Bedrock
- Run, Gravel
- Run, Sand

Rt. 116 Bridge

Dry Brook

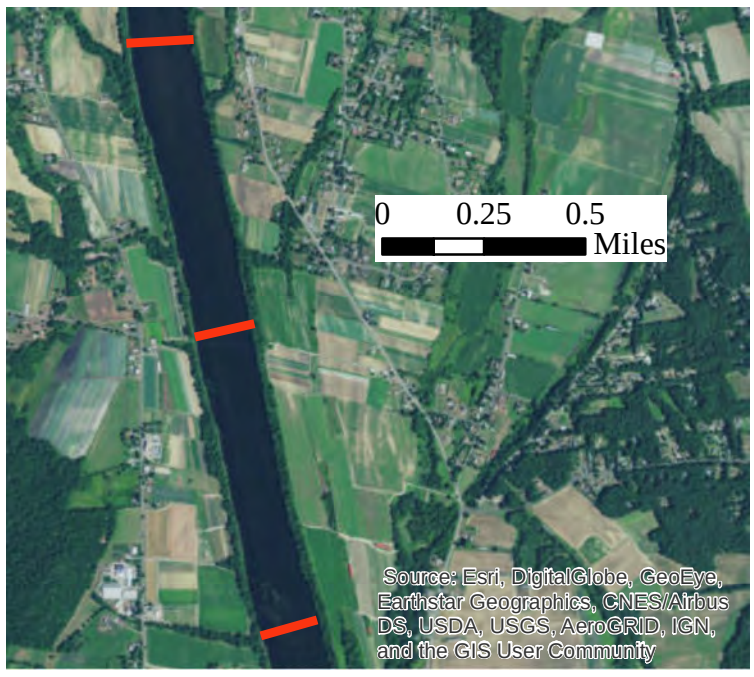
Elwell Island

Rainbow Beach

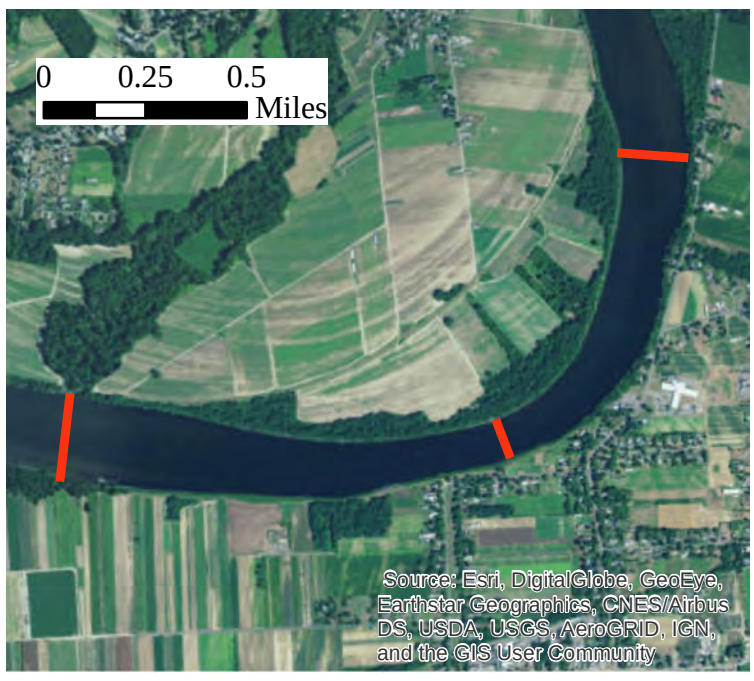
Mitch's Island

Dinosaur Footprints

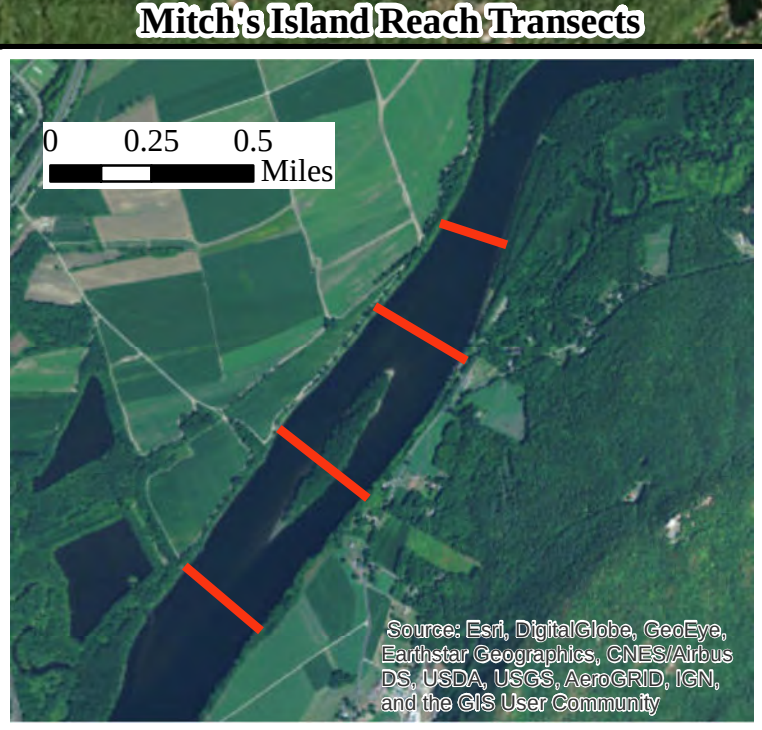
Dry Brook Reach Transects



Hatfield Reach Transects



Mitch's Island Reach Transects



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

FirstLight Power Resources

N

0 0.5 1 2
Miles

FIRSTLIGHT HYDRO GENERATING COMPANY
Northfield Mountain Pumped Storage Project No. 2485
Turners Falls Hydroelectric Project No. 1889

Study 3.3.1 - IFIM Reach 5

Figure 1.7-1: Proposed Transects for the IFIM Study in Reach 5 on the Connecticut River

Path: W:\gis\studies\3_3_1\maps\Reach 5 Mussels Proposed Transects2.mxd

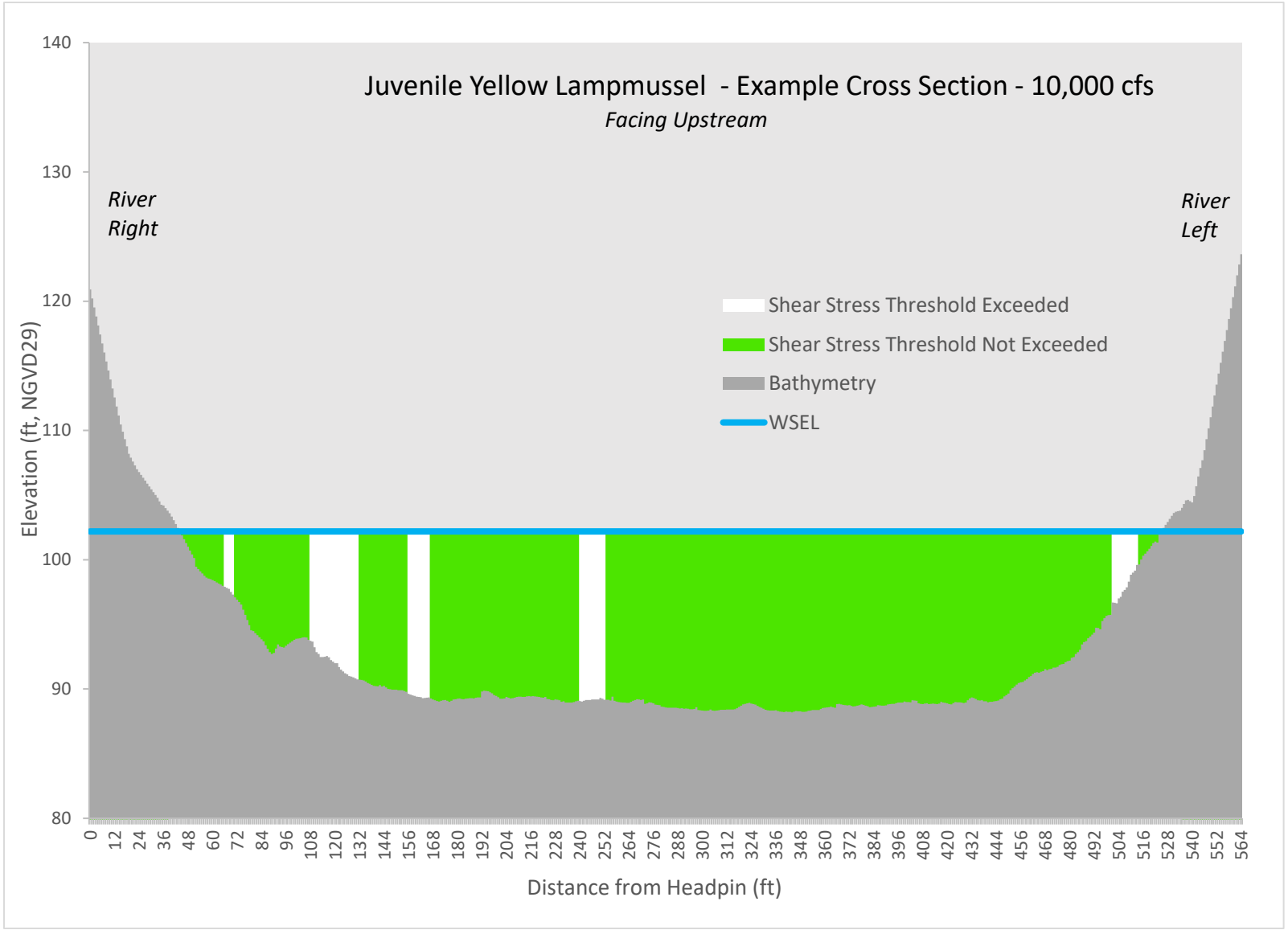


Figure 1.7-2: Shear Stress Suitability - Cross Section Example

1.8 Study Deliverables

A draft report will be prepared documenting methods and results. The report will quantify WUA versus flow relationships for applicable species and life stages of mussels and host fish. WUA and supporting hydraulic data will be presented in graphic and tabular form. Analyses of the trends in the data for the analyses conducted will also be provided. Appendices will include transect survey data, details of the calibration and validation of the hydraulic models, reference photographs of the transect sites, and other applicable data. The report will be finalized following receipt of input from the study team. Raw field data, model output, and similar datasets will be available in digital format upon request.

1.9 Study Schedule

Assuming that calibration flows can be provided between June and July, the report would be completed by the last quarter of 2017. FL will attempt to provide data results as soon as possible in advance of a full report, as requested by NHESP.

1.10 Stakeholder Consultation

In addition to the correspondence with Massachusetts NHESP and USFWS described in Section 1.1 of this study plan, a previous draft of this plan was send to relicensing participants via email on May 19, 2017. A meeting was subsequently held on June 1, 2017 to discuss this plan, with FERC in attendance via telephone. At the meeting, the NHESP and USFWS expressed verbal agreement with the plan, with some minor clarifications. Edits made to this version of the plan reflect the discussion and agreements made at the June 1, 2017 stakeholder meeting.

This revised plan was distributed to the NHESP, USFWS and TNC (and other stakeholders) on June 5, 2017. FL requested the three entities to provide sign-off on the plan. Included in Appendix B are emails from NHESP, USFWS and TNC supporting the plan. FirstLight addressed the comments and also had a conference call with the USFWS on July 21 (Brett Towler) to discuss the shear stress calculation method. Based on input received from USFWS, the shear stress calculation method was updated. A track change version of the updated study plans was again sent to NHESP, USFWS and TNC (and other stakeholders) on July 28 so the parties could see where FirstLight addressed comments and updated the shear stress calculation. NHESP, USFWS and TNC emailed indicating it supported the updated study plan on August 6, 17 and 17, respectively. Correspondence with NHESP, USFWS and TNC is included in Appendix B (earlier correspondence is followed by later correspondence).

1.11 References

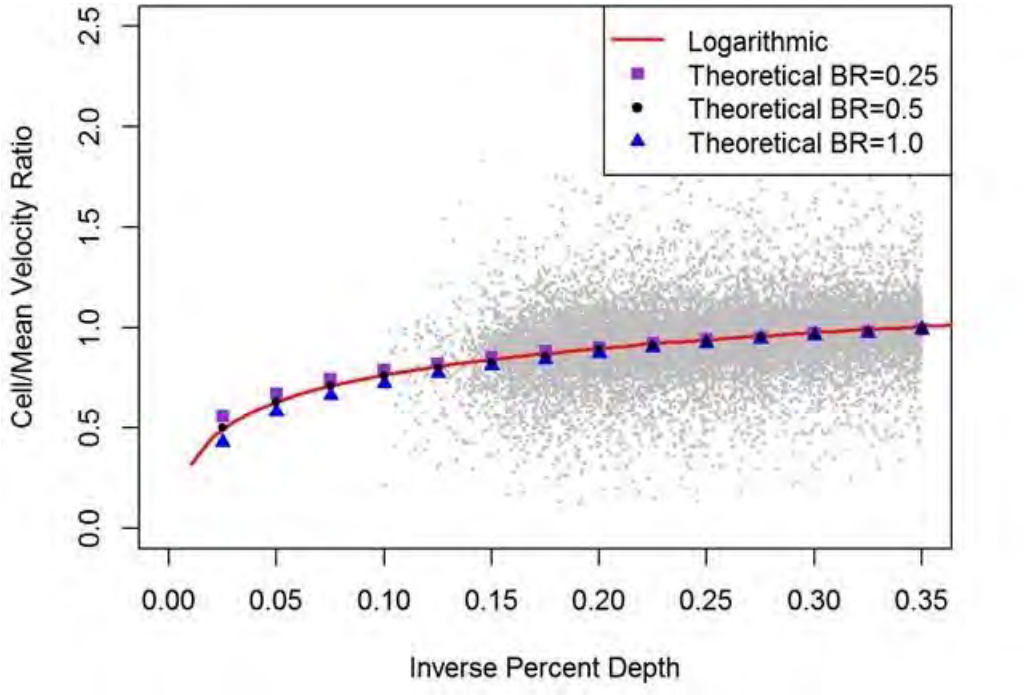
García, M. (2006) ASCE Manual of Practice 110 — Sedimentation Engineering: Processes, Measurements, Modeling and Practice. World Environmental and Water Resource Congress 2006. doi: 10.1061/40856(200)94

Bovee, K, Lamb. J, Bartholow, J, Stalnaker, C, Taylor, J and Henriksen, J (1998) Stream Habitat Analysis Using the Instream Flow Incremental Methodology. US Department of Interior, US Geological Survey. Report No. USGS/BRD/ITR-1998-0004

Milhouse, R. T., Updike, M. A, & Schneider, D. M.. (1989). *Physical habitat simulation system reference manual: version 2, Instream flow information paper 26* (Biological Report 89(16)). Washington, D.C.: U.S. Fish and Wildlife Service.

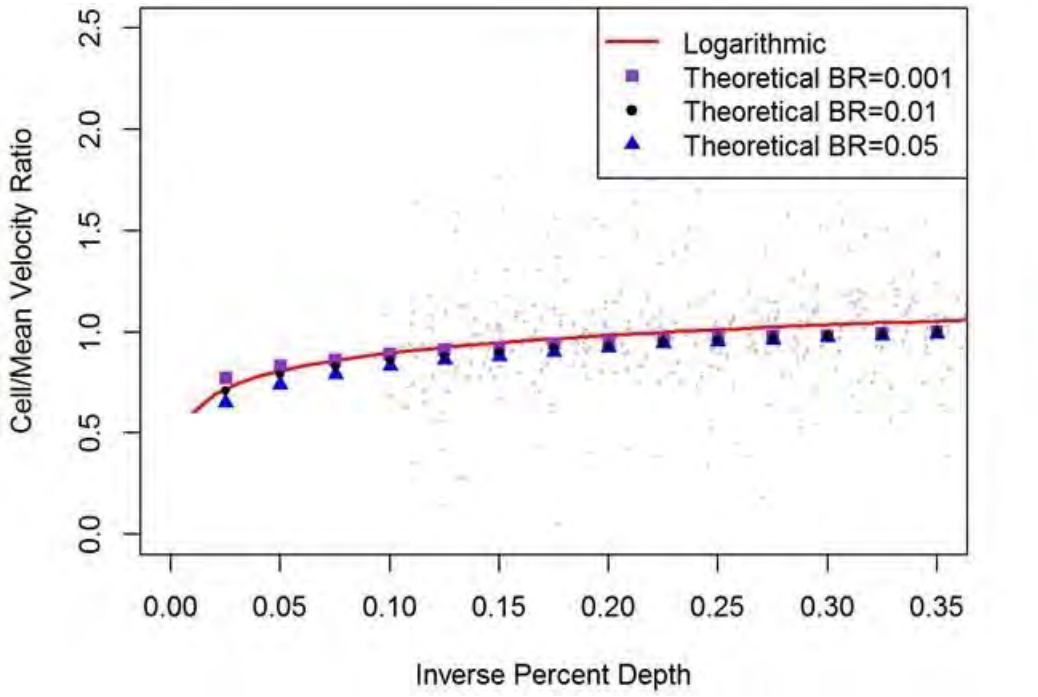
APPENDIX A: COMPARISONS OF THEORETICAL LOG-LAW EQUATION WITH ADCP FIELD DATA

Figure A1: Comparison of field-collected velocities in the lower 35% of the water column versus the log-law equation for Reach 4.[5]



[5] The x-axis is the % depth in the water column (e.g., 0.15 in a 10-ft deep area equals 1.5-ft above the bottom. The y-axis is the ratio of the cellular velocity to the mean column velocity (e.g., a value of 0.5 means the velocity at that depth is 50% of the mean column velocity). Each grey dot represents a field-measured ADCP cellular velocity. The red line represents the best-fit logarithmic line. The purple squares, black circles, and blue triangles represent log-law predicted cellular velocities at different bottom roughness (ks) values.

Figure A2: Comparison of field-collected velocities in the lower 35% of the water column versus the log-law equation for Reach 5.[6]



[6] The x-axis is the % depth in the water column (e.g., 0.15 in a 10-ft deep area equals 1.5-ft above the bottom. The y-axis is the ratio of the cellular velocity to the mean column velocity (e.g., a value of 0.5 means the velocity at that depth is 50% of the mean column velocity). Each grey dot represents a field-measured ADCP cellular velocity. The red line represents the best-fit logarithmic line. The purple squares, black circles, and blue triangles represent log-law predicted cellular velocities at different bottom roughness (ks) values.

APPENDIX B: CONSULTATION RECORD ON DRAFT/FINAL REACH 5 IFIM STUDY PLAN FOR MUSSELS

From:	Leddick, Jesse (FWE)
To:	Mark Wamser; Warner, John; Ken Sprankle (ken_sprankle@fws.gov); Melissa Grader (melissa_grader@fws.gov); julianne_rosset@fws.gov; brett_towler@fws.gov; Slater, Caleb (FWE); Hazelton, Peter (FWE); Kubit, Robert (DEP); Foulis, David (DEP); Harrington, Brian (DEP); Cameron, David (DEP); Julie Crocker (julie.crocker@noaa.gov); William McDavitt - NOAA Affiliate; jeff.murphy@noaa.gov; Bjorn Lake - NOAA Federal; susan.tuxbury@noaa.gov; Mendik, Kevin; "Don Pugh"; kkennedy@tnc.org; "Karl Meyer"; Andrea Donlon (adonlon@ctriver.org); johnbenn@sover.net; Tom Miner (wtminer@crocker.com); Kimberly Noake MacPhee (kmacphee@frcog.org); mjbathory@comcast.net; Brandon Cherry (brandon.cherry@ferc.gov); stephen.kartalia@ferc.gov; william.connelly@ferc.gov; patrick.crile@ferc.gov; john.baummer@ferc.gov; nicholas.ettema@ferc.gov; aharo@usgs.gov; TCastro_Santos@usgs.gov; Norm Sims (normsims@me.com); Bob Nasdor (bob@americanwhitewater.org); Tom Christopher (tom.christopher@comcast.net); John Ragonese - Great River Hydro (jragonese@greatriverhydro.com); Jennifer Griffin (jennifer_griffin@transcanada.com); Paul Ducheney (ducheney@hged.com); Kristen Sykes; A. Fisk; Peggy Sloan; Frost, Karro (FWE); Marold, Misty-Anne (FWE); Nelson, Mike (FWE); robert.wernerhl@state.ma.us; Christopher Boelke - NOAA Federal; John Ward (selectman.ward@gmail.com)
Cc:	Jason George; Tom Sullivan; Gary Lemay; John Hart; Aaron Rubin; Ian Kiraly; Doug Bennett (Douglas.bennett@firstlightpower.com); Don Traester (donald.traester@firstlightpower.com); Stira, Robert; Swiger, Mike; Wood, Julia; Verville, Sarah
Subject:	RE: Reach 5 Mussels
Date:	Friday, June 09, 2017 1:49:48 PM
Attachments:	2017_Study_Plan_3_3_1_IFIM_Reach_REV1.pdf

Mark,

Overall, we (NHESP) concur with the updated IFIM Study Plan for Reach 5 (Revision 1: June 2017). However, please note the following:

Shear Stress Analysis

1. As discussed during our June 1 meeting, we highlighted that the shear stress analysis should not be based on the entire water column but on the linear distance at the substrate surface. We didn't see this articulated in the updated Study Plan.
2. We also highlighted the need to define the flows for which the shear stress analysis will be completed. We didn't see this articulated in the updated Study Plan; will FL be running this analysis for all flows shown in Table 1.7-4, or a subset of flows?
3. Finally, we highlighted - based on the results of the separate analyses (one for depth/velocity/substrate and the other for shear stress) – the need to run all 4 parameters together in PHABSIM to assess how shear stress affects habitat modeling and WUA. We didn't see this articulated in the updated Study Plan.

General Comment

4. As discussed during our June 1 meeting ,we highlighted the need to update the mussel habitat suitability analysis for Reach 3 to include shear stress as a 4th parameter. FL should submit an updated study plan to the working group for review and comment. This needn't hold up data collection and analysis efforts related to Reach 5, but it remains an important, outstanding element of the mussel analysis.

Many thanks to you and your team for your work on this.

Jesse Leddick
Endangered Species Review Biologist
Massachusetts Division of Fisheries & Wildlife
1 Rabbit Hill Road, Westborough, MA 01581
p: (508) 389-6386 | e: Jesse.Leddick@state.ma.us

From: Mark Wamser [mailto:mwamser@gomezandsullivan.com]
Sent: Monday, June 05, 2017 9:16 AM
To: Warner, John; Ken Sprankle (ken_sprankle@fws.gov); Melissa Grader (melissa_grader@fws.gov); julianne_rosset@fws.gov; brett_towler@fws.gov; Slater, Caleb (FWE); Leddick, Jesse (FWE); Hazelton, Peter (FWE); Kubit, Robert (DEP); Foulis, David (DEP); Harrington, Brian (DEP); Cameron, David (DEP); Julie Crocker (julie.crocker@noaa.gov); William McDavitt - NOAA Affiliate; jeff.murphy@noaa.gov; Bjorn Lake - NOAA Federal; susan.tuxbury@noaa.gov; Mendik, Kevin; 'Don Pugh'; kkennedy@tnc.org; 'Karl Meyer'; Andrea Donlon (adonlon@ctriver.org); johnbenn@sover.net; Tom Miner (wtminer@crocker.com); Kimberly Noake MacPhee (kmacphee@frcog.org); mjbathory@comcast.net; Brandon Cherry (brandon.cherry@ferc.gov); stephen.kartalia@ferc.gov; william.connelly@ferc.gov; patrick.crile@ferc.gov; john.baummer@ferc.gov; nicholas.ettema@ferc.gov; aharo@usgs.gov; TCastro_Santos@usgs.gov; Norm Sims (normsims@me.com); Bob Nasdor (bob@americanwhitewater.org); Tom Christopher (tom.christopher@comcast.net); John Ragonese - Great River Hydro (jragonese@greatriverhydro.com); Jennifer Griffin (jennifer_griffin@transcanada.com); Paul Ducheney (ducheney@hged.com); Kristen Sykes; A. Fisk; Peggy Sloan; Frost, Karro (FWE); Marold, Misty-Anne (FWE); Nelson, Mike (FWE); robert.wernerhl@state.ma.us; Christopher Boelke - NOAA Federal; John Ward (selectman.ward@gmail.com)
Cc: Jason George; Tom Sullivan; Gary Lemay; John Hart; Aaron Rubin; Ian Kiraly; Doug Bennett (Douglas.bennett@firstlightpower.com); Don Traester (donald.traester@firstlightpower.com); Stira, Robert; Swiger, Mike; Wood, Julia; Verville, Sarah
Subject: RE: Reach 5 Mussels

Dear Relicensing Participant-

On May 19, 2017, FL sent you a draft study plan for conducting a Reach 5 IFIM study for mussels and notified parties that a meeting to discuss the plan would occur on June 1, 2017. On June 1, 2017, FL held an afternoon meeting to discuss the plan. Present at the meeting was FL, Gomez and Sullivan, Jesse Leddick, Misty-Anne Marold and Pete Hazelton (NHESP), Katie Kennedy (TNC), Melissa Grader, Julianne Rosset (USFWS), Andrea Donlon (CRC), and Steve Kartalia (FERC). At the meeting, comments were provided on the Draft IFIM Study plan. Please find attached a Final IFIM Study plan based on the comments received at the meeting. As noted at the meeting, we will not have time to go through the full FERC process of obtaining FERC's Study Plan Determination because field data needs to be collected under higher flows. Given this, we respectfully request an email from those who attended the meeting- NHESP TNC, USFWS, and CRC -- supporting the plan. We would like to file with FERC the Final IFIM Study plan along with emails supporting the plan (to be included in Appendix B). If you could provide these emails by Friday of this week it would be greatly appreciated. Please feel free to call me if you have any questions.

Thanks Mark

Mark Wamser, PE
Senior Water Resource Engineer
Gomez and Sullivan Engineers, DPC
41 Liberty Hill Road
PO Box 2179
Henniker, NH 03242

P 603-428-4960
C 603-568-6088
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From: Mark Wamser
Sent: Friday, May 19, 2017 12:38 PM
To: John Warner - US Fish and Wildlife Service (john_warner@fws.gov) <john_warner@fws.gov>; Ken Sprankle (ken_sprankle@fws.gov) <ken_sprankle@fws.gov>; Melissa Grader (melissa_grader@fws.gov) <melissa_grader@fws.gov>; 'julianne_rosset@fws.gov' <julianne_rosset@fws.gov>; brett_towler@fws.gov; Caleb Slater (caleb.slater@state.ma.us) <caleb.slater@state.ma.us>; Jesse Leddick (jesse.leddick@state.ma.us) <jesse.leddick@state.ma.us>; peter.hazelton@state.ma.us; Bob Kubit (robert.kubit@state.ma.us) <robert.kubit@state.ma.us>; Foulis, David (DEP) (david.foulis@state.ma.us) <david.foulis@state.ma.us>; Harrington, Brian D (DEP) (brian.d.harrington@state.ma.us) <brian.d.harrington@state.ma.us>; 'david.cameron@state.ma.us' <david.cameron@state.ma.us>; Julie Crocker (julie.crocker@noaa.gov) <julie.crocker@noaa.gov>; 'William McDavitt - NOAA Affiliate' <william.mcdavitt@noaa.gov>; 'jeff.murphy@noaa.gov' <jeff.murphy@noaa.gov>; 'Bjorn Lake - NOAA Federal' <bjorn.lake@noaa.gov>; susan.tuxbury@noaa.gov; Kevin R. Mendik - National Park Service North Atlantic Region (kevin_mendik@nps.gov) <kevin_mendik@nps.gov>; 'Don Pugh' <don.pugh@yahoo.com>; kkennedy@tnc.org; 'Karl Meyer' <karlmeyer1809@verizon.net>; Andrea Donlon (adonlon@ctriver.org) <adonlon@ctriver.org>; johnbenn@sover.net; Tom Miner (wtminer@crocker.com) <wtminer@crocker.com>; Kimberly Noake MacPhee (kmacphee@frcog.org) <kmacphee@frcog.org>; mjbathory@comcast.net; Brandon Cherry (brandon.cherry@ferc.gov) <brandon.cherry@ferc.gov>; 'stephen.kartalia@ferc.gov' <stephen.kartalia@ferc.gov>; 'william.connelly@ferc.gov' <william.connelly@ferc.gov>; 'patrick.crile@ferc.gov' <patrick.crile@ferc.gov>; 'john.baummer@ferc.gov' <john.baummer@ferc.gov>; 'nicholas.ettema@ferc.gov' <nicholas.ettema@ferc.gov>; aharo@usgs.gov; 'TCastro_Santos@usgs.gov' <TCastro_Santos@usgs.gov>; Norm Sims (normsims@me.com) <normsims@me.com>; Bob Nasdor (bob@americanwhitewater.org) <bob@americanwhitewater.org>; Tom Christopher (tom.christopher@comcast.net) <tom.christopher@comcast.net>; John Ragonese - Great River Hydro (jragonese@greatriverhydro.com) <jragonese@greatriverhydro.com>; Jennifer Griffin (jennifer_griffin@transcanada.com) <jennifer_griffin@transcanada.com>; Paul Ducheney (ducheney@hged.com) <ducheney@hged.com>; Kristen Sykes <KSykes@outdoors.org>; 'A. Fisk' <afisk@ctriver.org>; Peggy Sloan <PSloan@frcog.org>; Frost, Karro (FWE) <karro.frost@state.ma.us>; Marold, Misty-Anne (FWE) <misty-anne.marold@state.ma.us>; 'mike.nelson@state.ma.us' <mike.nelson@state.ma.us>; 'robert.wernerhl@state.ma.us' <robert.wernerhl@state.ma.us>; 'Christopher Boelke - NOAA Federal' <christopher.boelke@noaa.gov>; John Ward (selectman.ward@gmail.com) <selectman.ward@gmail.com>
Cc: Jason George <jgeorge@gomezandsullivan.com>; Tom Sullivan <tsullivan@gomezandsullivan.com>; Gary Lemay <glemay@gomezandsullivan.com>; John Hart <jhart@gomezandsullivan.com>; Aaron Rubin <arubin@gomezandsullivan.com>; Ian Kiraly

<ikiraly@gomezandsullivan.com>; Doug Bennett (Douglas.bennett@firstlightpower.com) <Douglas.bennett@firstlightpower.com>; Don Traester (donald.traester@firstlightpower.com) <donald.traester@firstlightpower.com>; Stira, Robert <Robert.Stira@firstlightpower.com>; 'mas@vnf.com' <mas@vnf.com>; 'Julia Wood (jsw@vnf.com)' <jsw@vnf.com>; Sarah Verville (sverville@trcsolutions.com) <sverville@trcsolutions.com>
Subject: Reach 5 Mussels

Dear Relicensing Participant-

Based on discussions with the USFWS and NHESP, additional work is being requested in Reach 5 (below Cabot from Route 116 to Dinosaur Footprint) relative to state-listed mussels. Please find attached a study plan to conduct an instream flow study in Reach 5 for state-listed mussels and host fish. FirstLight will have a meeting on June 1, 2017, starting at 9:00 am at the Northfield Visitors Center to discuss the plan. FirstLight is proposing to collect velocity, depth and substrate data in Reach 5 under two flows. Because time is critical (some of the field data will be collected under a higher flow and that window will be closing as we approach summer low flows), we would like to reach agreement on the study plan as soon as possible. Given that, if NHESP, USFWS, or other stakeholders have comments on the plan prior to the meeting, it would be greatly appreciated.

If you have any questions, please fee free to contact me. Much appreciated, Mark

Mark Wamser, PE
Senior Water Resource Engineer
Gomez and Sullivan Engineers, DPC
41 Liberty Hill Road
PO Box 2179
Henniker, NH 03242
P 603-428-4960
C 603-568-6088
F 603-428-3973

From:	Leddick, Jesse (FWE)
To:	Mark Wamser; Warner, John; Ken Sprankle (ken_sprankle@fws.gov); Melissa Grader (melissa_grader@fws.gov); julianne_rosset@fws.gov; brett_towler@fws.gov; Slater, Caleb (FWE); Hazelton, Peter (FWE); Kubit, Robert (DEP); Foulis, David (DEP); Harrington, Brian (DEP); Cameron, David (DEP); Julie Crocker (julie.crocker@noaa.gov); William McDavitt - NOAA Affiliate; jeff.murphy@noaa.gov; Bjorn Lake - NOAA Federal; susan.tuxbury@noaa.gov; Mendik, Kevin; "Don Pugh"; kkennedy@tnc.org; "Karl Meyer"; Andrea Donlon (adonlon@ctriver.org); johnbenn@sover.net; Tom Miner (wtminer@crocker.com); Kimberly Noake MacPhee (kmacphee@frcog.org); mjbathory@comcast.net; Brandon Cherry (brandon.cherry@ferc.gov); stephen.kartalia@ferc.gov; william.connelly@ferc.gov; patrick.crile@ferc.gov; john.baummer@ferc.gov; nicholas.ettema@ferc.gov; aharo@usgs.gov; TCastro_Santos@usgs.gov; Norm Sims (normsims@me.com); Bob Nasdor (bob@americanwhitewater.org); Tom Christopher (tom.christopher@comcast.net); John Ragonese - Great River Hydro (jragonese@greatriverhydro.com); Jennifer Griffin (jennifer_griffin@transcanada.com); Paul Ducheney (ducheney@hged.com); Kristen Sykes; A. Fisk; Peggy Sloan; Frost, Karro (FWE); Marold, Misty-Anne (FWE); Nelson, Mike (FWE); robert.wernerhl@state.ma.us; Christopher Boelke - NOAA Federal; John Ward (selectman.ward@gmail.com)
Cc:	Jason George; Tom Sullivan; Gary Lemay; John Hart; Aaron Rubin; Ian Kiraly; Doug Bennett (Douglas.bennett@firstlightpower.com); Don Traester (donald.traester@firstlightpower.com); Stira, Robert; Swiger, Mike; Wood, Julia; Verville, Sarah
Subject:	RE: Reach 5 Mussels
Date:	Monday, August 07, 2017 2:56:21 PM

Hi Mark,

This is to confirm that the Division approves the final Reach 5 Mussel Study Plan, as revised. Thanks for everyone's ongoing work on this.

As an aside, we look forward to receiving an updated Reach 3 Mussel Study Plan (including shear stress as a 4th parameter) as soon as possible.

Best regards,

Jesse Leddick
Endangered Species Review Biologist
Massachusetts Division of Fisheries & Wildlife
1 Rabbit Hill Road, Westborough, MA 01581
p: (508) 389-6386 | e: Jesse.Leddick@state.ma.us
mass.gov/masswildlife | facebook.com/masswildlife

From: Mark Wamser [mailto:mwamser@gomezandsullivan.com]
Sent: Monday, August 07, 2017 12:52 PM
To: Leddick, Jesse (FWE); Warner, John; Ken Sprankle (ken_sprankle@fws.gov); Melissa Grader (melissa_grader@fws.gov); julianne_rosset@fws.gov; brett_towler@fws.gov; Slater, Caleb (FWE); Hazelton, Peter (FWE); Kubit, Robert (DEP); Foulis, David (DEP); Harrington, Brian (DEP); Cameron, David (DEP); Julie Crocker (julie.crocker@noaa.gov); William McDavitt - NOAA Affiliate; jeff.murphy@noaa.gov; Bjorn Lake - NOAA Federal; susan.tuxbury@noaa.gov; Mendik, Kevin; 'Don Pugh'; kkennedy@tnc.org; 'Karl Meyer'; Andrea Donlon (adonlon@ctriver.org); johnbenn@sover.net; Tom Miner (wtminer@crocker.com); Kimberly Noake MacPhee (kmacphee@frcog.org); mjbathory@comcast.net; Brandon Cherry (brandon.cherry@ferc.gov); stephen.kartalia@ferc.gov; william.connelly@ferc.gov; patrick.crile@ferc.gov; john.baummer@ferc.gov; nicholas.ettema@ferc.gov; aharo@usgs.gov; TCastro_Santos@usgs.gov; Norm Sims (normsims@me.com); Bob Nasdor (bob@americanwhitewater.org); Tom Christopher (tom.christopher@comcast.net); John Ragonese - Great River Hydro (jragonese@greatriverhydro.com); Jennifer Griffin (jennifer_griffin@transcanada.com); Paul Ducheney (ducheney@hged.com); Kristen Sykes; A. Fisk; Peggy Sloan; Frost, Karro (FWE); Marold, Misty-Anne (FWE); Nelson, Mike (FWE); robert.wernerhl@state.ma.us; Christopher Boelke - NOAA Federal; John Ward (selectman.ward@gmail.com)
Cc: Jason George; Tom Sullivan; Gary Lemay; John Hart; Aaron Rubin; Ian Kiraly; Doug Bennett (Douglas.bennett@firstlightpower.com); Don Traester (donald.traester@firstlightpower.com); Stira, Robert; Swiger, Mike; Wood, Julia; Verville, Sarah

From:	Grader, Melissa
To:	Mark Wamser
Cc:	Leddick, Jesse (FWE); Hazelton, Peter (FWE); Marold, Misty-Anne (FWE); Andrea Donlon; Katie Kennedy; Warner, John; Rosset, Julianne
Subject:	Re: Reach 5 Mussels
Date:	Friday, June 09, 2017 2:22:36 PM

Mark,

The Service concurs with and supports the comments made by NHESP.

Regards,

Melissa Grader
Fish and Wildlife Biologist
U.S. Fish and Wildlife Service - New England Field Office
103 East Plumtree Road
Sunderland, MA 01375
413-548-8002 x8124
melissa_grader@fws.gov

On Fri, Jun 9, 2017 at 1:47 PM, Leddick, Jesse (FWE) <Jesse.Leddick@massmail.state.ma.us> wrote:

> Mark,
>
> Overall, we (NHESP) concur with the updated IFIM Study Plan for Reach 5 (Revision 1: June 2017). However, please note the following:
>
> Shear Stress Analysis
>
> 1. As discussed during our June 1 meeting, we highlighted that the shear stress analysis should not be based on the entire water column but on the linear distance at the substrate surface. We didn't see this articulated in the updated Study Plan.
>
> 2. We also highlighted the need to define the flows for which the shear stress analysis will be completed. We didn't see this articulated in the updated Study Plan; will FL be running this analysis for all flows shown in Table 1.7-4, or a subset of flows?
>
> 3. Finally, we highlighted - based on the results of the separate analyses (one for depth/velocity/substrate and the other for shear stress) – the need to run all 4 parameters together in PHABSIM to assess how shear stress affects habitat modeling and WUA. We didn't see this articulated in the updated Study Plan.

General Comment

4. As discussed during our June 1 meeting ,we highlighted the need to update the mussel habitat suitability analysis for Reach 3 to include shear stress as a 4th parameter. FL should submit an updated study plan to the working group for review and comment. This needn't hold up data collection and analysis efforts related to Reach 5, but it remains an important, outstanding element of the mussel analysis.

Many thanks to you and your team for your work on this.

Jesse Leddick
Endangered Species Review Biologist
Massachusetts Division of Fisheries & Wildlife
1 Rabbit Hill Road, Westborough, MA 01581
p: (508) 389-6386 | e: Jesse.Leddick@state.ma.us
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From: Mark Wamser [mailto:mwamser@gomezandsullivan.com]
Sent: Monday, June 05, 2017 9:16 AM
To: Warner, John; Ken Sprankle (ken_sprankle@fws.gov); Melissa Grader (melissa_grader@fws.gov); julianne_rosset@fws.gov; brett_towler@fws.gov; Slater, Caleb (FWE); Leddick, Jesse (FWE); Hazelton, Peter (FWE); Kubit, Robert (DEP); Foulis, David (DEP); Harrington, Brian (DEP); Cameron, David (DEP); Julie Crocker (julie.crocker@noaa.gov); William McDavitt - NOAA Affiliate; jeff.murphy@noaa.gov; Bjorn Lake - NOAA Federal; susan.tuxbury@noaa.gov; Mendik, Kevin; 'Don Pugh'; kkennedy@tnc.org; 'Karl Meyer'; Andrea Donlon (adonlon@ctriver.org); johnbenn@sover.net; Tom Miner (wtminer@crocker.com); Kimberly Noake MacPhee (kmacphee@frcog.org); mjbathory@comcast.net; Brandon Cherry (brandon.cherry@ferc.gov); stephen.kartalia@ferc.gov; william.connelly@ferc.gov; patrick.crile@ferc.gov; john.baummer@ferc.gov; nicholas.ettema@ferc.gov; aharo@usgs.gov; TCastro_Santos@usgs.gov; Norm Sims (normsims@me.com); Bob Nasdor (bob@americanwhitewater.org); Tom Christopher (tom.christopher@comcast.net); John Ragonese - Great River Hydro (jragonese@greatriverhydro.com); Jennifer Griffin (jennifer_griffin@transcanada.com); Paul Ducheney (ducheney@hged.com); Kristen Sykes; A. Fisk; Peggy Sloan; Frost, Karro (FWE); Marold, Misty-Anne (FWE); Nelson, Mike (FWE); robert.wernerhl@state.ma.us; Christopher Boelke - NOAA Federal; John Ward (selectman.ward@gmail.com)
Cc: Jason George; Tom Sullivan; Gary Lemay; John Hart; Aaron Rubin; Ian Kiraly; Doug Bennett (Douglas.bennett@firstlightpower.com); Don Traester (donald.traester@firstlightpower.com); Stira, Robert; Swiger, Mike; Wood, Julia; Verville, Sarah
Subject: RE: Reach 5 Mussels

Dear Relicensing Participant-

On May 19, 2017, FL sent you a draft study plan for conducting a Reach 5 IFIM study for mussels and notified parties that a meeting to discuss the plan would occur on June 1, 2017. On June 1, 2017, FL held an afternoon meeting to discuss the plan. Present at the meeting was FL, Gomez and Sullivan, Jesse Leddick, Misty-Anne Marold and Pete Hazelton (NHESP), Katie Kennedy (TNC), Melissa Grader, Julianne Rosset (USFWS), Andrea Donlon (CRC), and Steve Kartalia (FERC). At the meeting, comments were provided on the Draft IFIM Study plan. Please find attached a Final IFIM Study plan based on the comments received at the meeting. As noted at the meeting, we will not have time to go through the full FERC process of obtaining FERC's Study Plan Determination because field data needs to be collected under higher flows. Given this, we respectfully request an email from those who attended the meeting- NHESP TNC, USFWS, and CRC -- supporting the plan. We would like to file with FERC the Final IFIM Study plan along with emails supporting the plan (to be included in Appendix B). If you could provide these emails by Friday of this week it would be greatly appreciated. Please feel free to call me if you have any questions.

Thanks Mark

Mark Wamser, PE

Senior Water Resource Engineer

Gomez and Sullivan Engineers, DPC

41 Liberty Hill Road

PO Box 2179

Henniker, NH 03242

P 603-428-4960

C 603-568-6088

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From: Mark Wamser
Sent: Friday, May 19, 2017 12:38 PM
To: John Warner - US Fish and Wildlife Service (john_warner@fws.gov) <john_warner@fws.gov>; Ken Sprankle (ken_sprankle@fws.gov) <ken_sprankle@fws.gov>; Melissa Grader (melissa_grader@fws.gov) <melissa_grader@fws.gov>; 'julianne_rosset@fws.gov' <julianne_rosset@fws.gov>;

brett_towler@fws.gov; Caleb Slater (caleb.slater@state.ma.us) <caleb.slater@state.ma.us>; Jesse Leddick (jesse.leddick@state.ma.us) <jesse.leddick@state.ma.us>; peter.hazelton@state.ma.us; Bob Kubit (robert.kubit@state.ma.us) <robert.kubit@state.ma.us>; Foulis, David (DEP) (david.foulis@state.ma.us) <david.foulis@state.ma.us>; Harrington, Brian D (DEP) (brian.d.harrington@state.ma.us) <brian.d.harrington@state.ma.us>; 'david.cameron@state.ma.us' <david.cameron@state.ma.us>; Julie Crocker (julie.crocker@noaa.gov) <julie.crocker@noaa.gov>; 'William McDavitt - NOAA Affiliate' <william.mcdavitt@noaa.gov>; 'jeff.murphy@noaa.gov' <jeff.murphy@noaa.gov>; 'Bjorn Lake - NOAA Federal' <bjorn.lake@noaa.gov>; susan.tuxbury@noaa.gov; Kevin R. Mendik - National Park Service North Atlantic Region (kevin_mendik@nps.gov) <kevin_mendik@nps.gov>; 'Don Pugh' <don.pugh@yahoo.com>; kkennedy@tnc.org; 'Karl Meyer' <karlmeyer1809@verizon.net>; Andrea Donlon (adonlon@ctriver.org) <adonlon@ctriver.org>; johnbenn@sover.net; Tom Miner (wtminer@crocker.com) <wtminer@crocker.com>; Kimberly Noake MacPhee (kmacphee@frcog.org) <kmacphee@frcog.org>; mjbathory@comcast.net; Brandon Cherry (brandon.cherry@ferc.gov) <brandon.cherry@ferc.gov>; 'stephen.kartalia@ferc.gov' <stephen.kartalia@ferc.gov>; 'william.connelly@ferc.gov' <william.connelly@ferc.gov>; 'patrick.crile@ferc.gov' <patrick.crile@ferc.gov>; 'john.baummer@ferc.gov' <john.baummer@ferc.gov>; 'nicholas.ettema@ferc.gov' <nicholas.ettema@ferc.gov>; aharo@usgs.gov; 'TCastro_Santos@usgs.gov' <TCastro_Santos@usgs.gov>; Norm Sims (normsims@me.com) <normsims@me.com>; Bob Nasdor (bob@americanwhitewater.org) <bob@americanwhitewater.org>; Tom Christopher (tom.christopher@comcast.net) <tom.christopher@comcast.net>; John Ragonese - Great River Hydro (jragonese@greatriverhydro.com) <jragonese@greatriverhydro.com>; Jennifer Griffin (jennifer_griffin@transcanada.com) <jennifer_griffin@transcanada.com>; Paul Ducheney (ducheney@hged.com) <ducheney@hged.com>; Kristen Sykes <KSykes@outdoors.org>; 'A. Fisk' <afisk@ctriver.org>; Peggy Sloan <PSloan@frcog.org>; Frost, Karro (FWE) <karro.frost@state.ma.us>; Marold, Misty-Anne (FWE) <misty-anne.marold@state.ma.us>; 'mike.nelson@state.ma.us' <mike.nelson@state.ma.us>; 'robert.wernerhl@state.ma.us' <robert.wernerhl@state.ma.us>; 'Christopher Boelke - NOAA Federal' <christopher.boelke@noaa.gov>; John Ward (selectman.ward@gmail.com) <selectman.ward@gmail.com>
Cc: Jason George <jgeorge@gomezandsullivan.com>; Tom Sullivan <tsullivan@gomezandsullivan.com>; Gary Lemay <glemay@gomezandsullivan.com>; John Hart <jhart@gomezandsullivan.com>; Aaron Rubin <arubin@gomezandsullivan.com>; Ian Kiraly <ikiraly@gomezandsullivan.com>; Doug Bennett (Douglas.bennett@firstlightpower.com) <Douglas.bennett@firstlightpower.com>; Don Traester (donald.traester@firstlightpower.com) <donald.traester@firstlightpower.com>; Stira, Robert <Robert.Stira@firstlightpower.com>; 'mas@vnf.com' <mas@vnf.com>; 'Julia Wood (jsw@vnf.com)' <jsw@vnf.com>; Sarah Verville (sverville@trcsolutions.com) <sverville@trcsolutions.com>
Subject: Reach 5 Mussels

Dear Relicensing Participant-

Based on discussions with the USFWS and NHESP, additional work is being requested in

Reach 5 (below Cabot from Route 116 to Dinosaur Footprint) relative to state-listed mussels. Please find attached a study plan to conduct an instream flow study in Reach 5 for state-listed mussels and host fish. FirstLight will have a meeting on June 1, 2017, starting at 9:00 am at the Northfield Visitors Center to discuss the plan. FirstLight is proposing to collect velocity, depth and substrate data in Reach 5 under two flows. Because time is critical (some of the field data will be collected under a higher flow and that window will be closing as we approach summer low flows), we would like to reach agreement on the study plan as soon as possible. Given that, if NHESP, USFWS, or other stakeholders have comments on the plan prior to the meeting, it would be greatly appreciated.

If you have any questions, please fee free to contact me. Much appreciated, Mark

Mark Wamser, PE

Senior Water Resource Engineer

Gomez and Sullivan Engineers, DPC

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P 603-428-4960

C 603-568-6088

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From:	Grader, Melissa
To:	Mark Wamser
Cc:	Warner, John; Leddick, Jesse (FWE); Ken Sprankle (ken_sprankle@fws.gov); julianne_rosset@fws.gov; brett_towler@fws.gov; Slater, Caleb (FWE); Hazelton, Peter (FWE); Kubit, Robert (DEP); Foulis, David (DEP); Harrington, Brian (DEP); Cameron, David (DEP); Julie Crocker (julie.crocker@noaa.gov); William McDavitt - NOAA Affiliate; jeff.murphy@noaa.gov; Bjorn Lake - NOAA Federal; susan.tuxbury@noaa.gov; Mendik, Kevin; Don Pugh; kkennedy@tnc.org; Karl Meyer; Andrea Donlon (adonlon@ctriver.org); johnbenn@sover.net; Tom Miner (wtminer@crocker.com); Kimberly Noake MacPhee (kmacphee@frcog.org); mjbathory@comcast.net; Brandon Cherry (brandon.cherry@ferc.gov); stephen.kartalia@ferc.gov; william.connelly@ferc.gov; patrick.crile@ferc.gov; john.baummer@ferc.gov; nicholas.ettema@ferc.gov; aharo@usgs.gov; TCastro_Santos@usgs.gov; Norm Sims (normsims@me.com); Bob Nasdor (bob@americanwhitewater.org); Tom Christopher (tom.christopher@comcast.net); John Ragonese - Great River Hydro (jragonese@greatriverhydro.com); Jennifer Griffin (jennifer_griffin@transcanada.com); Paul Ducheney (ducheney@hged.com); Kristen Sykes; A. Fisk; Peggy Sloan; Frost, Karro (FWE); Marold, Misty-Anne (FWE); Nelson, Mike (FWE); robert.wernerhl@state.ma.us; Christopher Boelke - NOAA Federal; John Ward (selectman.ward@gmail.com); Jason George; Tom Sullivan; Gary Lemay; John Hart; Aaron Rubin; Ian Kiraly; Doug Bennett (Douglas.bennett@firstlightpower.com); Don Traester (donald.traester@firstlightpower.com); Stira, Robert; Swiger, Mike; Wood, Julia; Verville, Sarah
Subject:	Re: Reach 5 Mussels
Date:	Thursday, August 17, 2017 4:28:33 PM

The FWS has no objections to the final Reach 5 Mussel Study Plan, as revised.

Regards,

Melissa Grader
Fish and Wildlife Biologist
U.S. Fish and Wildlife Service - New England Field Office
103 East Plumtree Road
Sunderland, MA 01375
413-548-8002 x8124
melissa_grader@fws.gov

On Mon, Aug 7, 2017 at 2:54 PM, Leddick, Jesse (FWE) <Jesse.Leddick@massmail.state.ma.us> wrote:

> Hi Mark,
>
> This is to confirm that the Division approves the final Reach 5 Mussel Study Plan, as revised. Thanks for everyone's ongoing work on this.
>
> As an aside, we look forward to receiving an updated Reach 3 Mussel Study Plan (including shear stress as a 4th parameter) as soon as possible.
>
> Best regards,
>
> **Jesse Leddick**
> Endangered Species Review Biologist

From:	Katie Kennedy
To:	Mark Wamser
Cc:	Leddick, Jesse (FWE); Grader, Melissa; Hazelton, Peter (FWE); Marold, Misty-Anne (FWE); Andrea Donlon; Warner, John; Rosset, Julianne
Subject:	RE: Reach 5 Mussels
Date:	Friday, June 09, 2017 2:29:44 PM

Mark, TNC also concurs with and supports NHESP's comments.

Katie.

Katie Kennedy, PhD
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

From: Grader, Melissa [mailto:melissa_grader@fws.gov]
Sent: Friday, June 09, 2017 2:22 PM
To: Mark Wamser <mwamser@gomezandsullivan.com>
Cc: Leddick, Jesse (FWE) <Jesse.Leddick@massmail.state.ma.us>; Hazelton, Peter (FWE) <peter.hazelton@massmail.state.ma.us>; Marold, Misty-Anne (FWE) <misty-anne.marold@massmail.state.ma.us>; Andrea Donlon <adonlon@ctriver.org>; Katie Kennedy <kkennedy@TNC.ORG>; John Warner <John_Warner@fws.gov>; Rosset, Julianne <julianne_rosset@fws.gov>
Subject: Re: Reach 5 Mussels

Mark,

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Regards,

Melissa Grader
Fish and Wildlife Biologist
U.S. Fish and Wildlife Service - New England Field Office
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Sunderland, MA 01375
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> 2. We also highlighted the need to define the flows for which the shear stress analysis will be completed. We didn't see this articulated in the updated Study Plan; will FL be running this analysis for all flows shown in Table 1.7-4, or a subset of flows?
>
> 3. Finally, we highlighted - based on the results of the separate analyses (one for depth/velocity/substrate and the other for shear stress) – the need to run all 4 parameters together in PHABSIM to assess how shear stress affects habitat modeling and WUA. We didn't see this articulated in the updated Study Plan.
>
> General Comment
>
> 4. As discussed during our June 1 meeting ,we highlighted the need to update the mussel habitat suitability analysis for Reach 3 to include shear stress as a 4th parameter. FL should submit an updated study plan to the working group for review and comment. This needn't hold up data collection and analysis efforts related to Reach 5, but it remains an important, outstanding element of the mussel analysis.
>
> Many thanks to you and your team for your work on this.
> **Jesse Leddick**
> Endangered Species Review Biologist
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>
> ---
>
> **From:** Mark Wamser [mailto:mwamser@gomezandsullivan.com]
> **Sent:** Monday, June 05, 2017 9:16 AM
> **To:** Warner, John; Ken Sprankle (ken_sprankle@fws.gov); Melissa Grader (melissa_grader@fws.gov); julianne_rosset@fws.gov; brett_towler@fws.gov; Slater, Caleb (FWE); Leddick, Jesse (FWE); Hazelton, Peter (FWE); Kubit, Robert (DEP); Foulis, David (DEP); Harrington, Brian (DEP); Cameron, David (DEP); Julie Crocker (julie.crocker@noaa.gov); William McDavitt - NOAA Affiliate; jeff.murphy@noaa.gov; Bjorn Lake - NOAA Federal; susan.tuxbury@noaa.gov; Mendik, Kevin; 'Don Pugh'; kkennedy@tnc.org; 'Karl Meyer'; Andrea Donlon (adonlon@ctriver.org); johnbenn@sover.net;

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Cc: Jason George; Tom Sullivan; Gary Lemay; John Hart; Aaron Rubin; Ian Kiraly; Doug Bennett (Douglas.bennett@firstlightpower.com); Don Traester (donald.traester@firstlightpower.com); Stira, Robert; Swiger, Mike; Wood, Julia; Verville, Sarah
Subject: RE: Reach 5 Mussels

Dear Relicensing Participant-

On May 19, 2017, FL sent you a draft study plan for conducting a Reach 5 IFIM study for mussels and notified parties that a meeting to discuss the plan would occur on June 1, 2017. On June 1, 2017, FL held an afternoon meeting to discuss the plan. Present at the meeting was FL, Gomez and Sullivan, Jesse Leddick, Misty-Anne Marold and Pete Hazelton (NHESP), Katie Kennedy (TNC), Melissa Grader, Julianne Rosset (USFWS), Andrea Donlon (CRC), and Steve Kartalia (FERC). At the meeting, comments were provided on the Draft IFIM Study plan. Please find attached a Final IFIM Study plan based on the comments received at the meeting. As noted at the meeting, we will not have time to go through the full FERC process of obtaining FERC's Study Plan Determination because field data needs to be collected under higher flows. Given this, we respectfully request an email from those who attended the meeting- NHESP TNC, USFWS, and CRC -- supporting the plan. We would like to file with FERC the Final IFIM Study plan along with emails supporting the plan (to be included in Appendix B). If you could provide these emails by Friday of this week it would be greatly appreciated. Please feel free to call me if you have any questions.

Thanks Mark

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From: Mark Wamser
Sent: Friday, May 19, 2017 12:38 PM
To: John Warner - US Fish and Wildlife Service (john_warner@fws.gov) <john_warner@fws.gov>; Ken Sprankle (ken_sprankle@fws.gov) <ken_sprankle@fws.gov>; Melissa Grader (melissa_grader@fws.gov)

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Cc: Jason George <jgeorge@gomezandsullivan.com>; Tom Sullivan <tsullivan@gomezandsullivan.com>; Gary Lemay <glemay@gomezandsullivan.com>; John Hart <jhart@gomezandsullivan.com>; Aaron Rubin <arubin@gomezandsullivan.com>; Ian Kiraly <ikiraly@gomezandsullivan.com>; Doug Bennett (Douglas.bennett@firstlightpower.com) <Douglas.bennett@firstlightpower.com>; Don Traester (donald.traester@firstlightpower.com) <donald.traester@firstlightpower.com>; Stira, Robert <Robert.Stira@firstlightpower.com>; 'mas@vnf.com' <mas@vnf.com>; 'Julia Wood (jsw@vnf.com)' <jsw@vnf.com>; Sarah Verville (sverville@trcsolutions.com) <sverville@trcsolutions.com>
Subject: Reach 5 Mussels

Dear Relicensing Participant-

Based on discussions with the USFWS and NHESP, additional work is being requested in Reach 5 (below Cabot from Route 116 to Dinosaur Footprint) relative to state-listed mussels. Please find attached a study plan to conduct an instream flow study in Reach 5 for

state-listed mussels and host fish. FirstLight will have a meeting on June 1, 2017, starting at 9:00 am at the Northfield Visitors Center to discuss the plan. FirstLight is proposing to collect velocity, depth and substrate data in Reach 5 under two flows. Because time is critical (some of the field data will be collected under a higher flow and that window will be closing as we approach summer low flows), we would like to reach agreement on the study plan as soon as possible. Given that, if NHESP, USFWS, or other stakeholders have comments on the plan prior to the meeting, it would be greatly appreciated.

If you have any questions, please fee free to contact me. Much appreciated, Mark

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From:	Katie Kennedy
To:	Grader, Melissa; Mark Wamser
Cc:	Warner, John; Leddick, Jesse (FWE); Ken Sprankle (ken_sprankle@fws.gov); julianne_rosset@fws.gov; brett_towler@fws.gov; Slater, Caleb (FWE); Hazelton, Peter (FWE); Kubit, Robert (DEP); Foulis, David (DEP); Harrington, Brian (DEP); Cameron, David (DEP); Julie Crocker (julie.crocker@noaa.gov); William McDavitt - NOAA Affiliate; jeff.murphy@noaa.gov; Bjorn Lake - NOAA Federal; susan.tuxbury@noaa.gov; Mendik, Kevin; Don Pugh; Karl Meyer; Andrea Donlon (adonlon@ctriver.org); johnbenn@sover.net; Tom Miner (wtminer@crocker.com); Kimberly Noake MacPhee (kmacphee@frcog.org); mjbathory@comcast.net; Brandon Cherry (brandon.cherry@ferc.gov); stephen.kartalia@ferc.gov; william.connelly@ferc.gov; patrick.crile@ferc.gov; john.baummer@ferc.gov; nicholas.ettema@ferc.gov; aharo@usgs.gov; TCastro_Santos@usgs.gov; Norm Sims (normsims@me.com); Bob Nasdor (bob@americanwhitewater.org); Tom Christopher (tom.christopher@comcast.net); John Ragonese - Great River Hydro (jragonese@greatriverhydro.com); Jennifer Griffin (jennifer_griffin@transcanada.com); Paul Ducheney (ducheney@hged.com); Kristen Sykes; A. Fisk; Peggy Sloan; Frost, Karro (FWE); Marold, Misty-Anne (FWE); Nelson, Mike (FWE); robert.wernerhl@state.ma.us; Christopher Boelke - NOAA Federal; John Ward (selectman.ward@gmail.com); Jason George; Tom Sullivan; Gary Lemay; John Hart; Aaron Rubin; Ian Kiraly; Doug Bennett (Douglas.bennett@firstlightpower.com); Don Traester (donald.traester@firstlightpower.com); Stira, Robert; Swiger, Mike; Wood, Julia; Verville, Sarah
Subject:	RE: Reach 5 Mussels
Date:	Thursday, August 17, 2017 4:31:43 PM

Hi Mark – TNC is also in concurrence that the final Reach 5 Mussel Study Plan is acceptable as revised.

Katie.

Katie Kennedy, PhD
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From: Grader, Melissa [mailto:melissa_grader@fws.gov]
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