



**Vermont Department of Environmental Conservation**

*Agency of Natural Resources*

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July 15, 2013

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

RE: COMMENTS ON UPDATED PROPOSED STUDY PLANS  
Wilder Hydroelectric Project – FERC No. 1892-026  
Bellows Falls Hydroelectric Project – FERC No. 1855-045  
Vernon Hydroelectric Project – FERC No. 1904-073  
Northfield Mountain Pump Storage Project – FERC No. 2485-063  
Turner Falls Project – FERC No. 1889-081

Dear Secretary Bose:

The Vermont Agency of Natural Resources (Agency) herein provides comments on the proposed study plan developed by TransCanada Hydro Northeast, Inc. (TransCanada) for the Wilder (FERC No. 1892), Bellows Falls (FERC No. 1855), and Vernon (FERC No. 1904) projects. TransCanada filed its proposed study plan on April 15, 2013 followed by six full-day meetings between May 13, 2013 and June 7, 2013 to received comments and recommendation from the resource agencies and other stakeholders. On June 20, 2013, TransCanada submitted a document to the resource agencies and stakeholders summarizing the comments and suggestions received during the meetings and stating whether or not they would be incorporated in the revised study plan. TransCanada filed a revised proposed study plan on July 8, 2013 with FERC. The Agency's comments are on the June 20, 2013 summary document and the July 8, 2013 updated proposed study plan.

The Agency also is providing comments on the proposed study plan developed by FirstLight Hydro Generating Co. (FirstLight) for the Northfield Mountain Pump Storage (FERC No. 2485) and Turners Falls (FERC No. 1889) projects. FirstLight filed its proposed study plan on April 15, 2013 followed by eight full-day meetings in which representatives from the Agency participated to give comments and recommendations on the study plans. FirstLight filed an updated study plan with FERC on June 28, 2013. Although the two projects are located on the Connecticut River in Massachusetts, project operations fluctuate flows and water levels in the Turners Falls impoundment, affecting about 5.7 miles of Vermont waters between Vernon dam and the Vermont/Massachusetts boundary. These operations may influence migratory fish species that must move upstream past these projects to reach habitat in Vermont, move from Vermont waters downstream past the projects, or both. Fish such as American shad and American eel use Vermont waters (Connecticut River and its tributaries) as part of their life cycle, and must be able to migrate to these waters from ocean habitats and then return. Other fish species such as walleye, brown trout and other species also move upstream and downstream to meet seasonal habitat needs, such as to find spawning habitat, over-wintering habitat, feeding areas or more favorable temperature conditions.

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These movements may be localized or may involve miles of travel, but they are very important to production and survival. The Agency's comments on the study plan reflect these concerns and we request that FERC recognize the Agency's interest in these projects and take into consideration our comments and suggestions.

**General Comments:**

FERC's Scoping Document 2 states that the Turners Falls impoundment extends to the base of the Vernon dam. During the study plan meetings held in May and June, FirstLight stated that its hydraulic model indicates that the impoundment does not extend to the base of Vernon dam, but ends at a point downstream. TransCanada has subsequently included the reach downstream of the Vernon dam in the study area in all relevant study plans. The Agency requests that FirstLight provide information on the operation of its projects so that the frequency, duration, and periodicity of conditions when the Vernon discharge has a significant influence on this reach of river can be fully understood. This information is necessary for the Agency to evaluate seasonal flow requirements to protect aquatic biota and habitat downstream of Vernon dam.

In general TransCanada and FirstLight have attempted to incorporate the Agency's comments and suggestion in their revised study plans, but issues remain. The Agency's comments for TransCanada (Attachment A) and FirstLight (Attachment B) are attached.

Thank you very much for considering our comments.

Very truly yours,



Brian T. Fitzgerald  
Streamflow Protection Coordinator

Attachments

c: Shannon Morrison, Department of Environmental Conservation  
Marie Caduto, Department of Environmental Conservation  
Lael Will, Department of Fish and Wildlife  
Rod Wentworth, Department of Fish and Wildlife  
Robert Popp, Department of Fish and Wildlife  
Eric Sorenson, Department of Fish and Wildlife  
Mark Ferguson, Department of Fish and Wildlife  
John Warner, U.S. Fish and Wildlife Service  
Melissa Grader, U.S. Fish and Wildlife Service  
Gregg Comstock, N.H. Department of Environmental Services  
Owen David, N.H. Department of Environmental Services  
Gabe Gries, N.H. Fish and Game Department  
Caleb Slater, MA Department of Fish and Game  
Kevin Mendik, National Park Service  
John Ragonese, TransCanada  
John Howard, FirstLight  
David Deen, Connecticut River Watershed Council  
Kim Greenwood, Vermont Natural Resources Council  
Chris Moore, Trout Unlimited – Vermont Council

## **Attachment A**

### **VANR Comments on TransCanada Proposed Study Plan**

#### **Study 1: Historic Riverbank Position and Erosion Study**

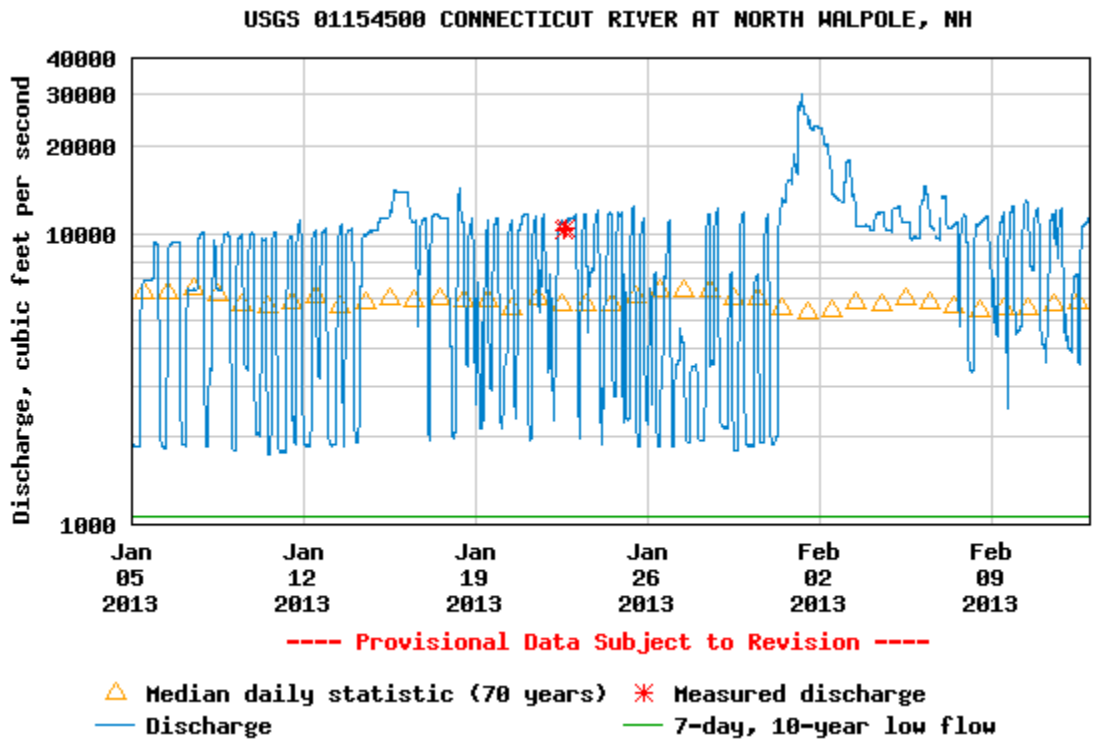
The Agency requested a study to determine the historical extent of erosion along the Connecticut River to determine if the rate or type of erosion has changed or increased with changes in operational procedure at Wilder, Bellows Falls, and Vernon hydroelectric projects. TransCanada proposed study plan in the Analysis section (pg. 17) indicates that the licensee will try to correlate historic bank loss to a specific period or time frame, historic hydrological events, or other causal agents. The Agency recommends that added to possible causal agents or specific periods when changes in operations occurred at the projects (i.e. increase operational capacity, change in impoundment elevation or management). Including this information in the correlation analysis will give the Agency a better idea of how project operations potentially are affecting the rate and type of riverbank erosion on the river.

#### **Study 2: Riverbank Transect Study**

The objective of the Agency's study request was to monitor riverbank erosion at selected sites in the impoundments and project-affected riverine sections below Wilder, Bellows Falls, and of Vernon dam. In the Agency's study request addressing riverbank erosion from water level fluctuation in the impoundment and downstream from peaking operations, the Agency requested that the study determine the process by which erosion is occurring at a site, determine the process causing erosion at a site, the extent erosion is negatively affecting other resources (i.e. riparian areas and shoreline wetlands, rare plant and animal populations, water quality, aquatic and terrestrial wildlife habitat, etc.), and determine how erosion could be stabilized or mitigated by changing project operations. In order to evaluate the relative influence of water level fluctuations on existing shoreline erosion, a minimum of six select sites (three in the impoundment and three downstream of the dam) for each project was requested. The Agency also requested that surveys be conducted biweekly for a period of one year, at each of the 18 sites. However, the licensee is proposing that surveys will occur at least four times per year for 2 years, including immediately after high spring flows, early and late summer, and then in late fall with additional surveys conducted within 15 days of any significant high water event (monitoring trigger flow to be determined after review of exceedance curves of natural inflows). In their study plan, the licensee states that the additional monitoring is not incorporated into this study as such information will only be valuable if active soil loss occurs nearly continuously throughout the year. Therefore, the licensee is assuming that erosion is not occurring continuously as a result of daily peaking operations and water level management in the impoundments.

Monitoring more frequently would provide a control (look at things in the absence of high flow events), and continuously because flow and water level fluctuations on a daily basis could slowly cause erosion to occur. The Agency also recommends that the study plan include monitoring in the winter season because of the relationship between ice scour and daily fluctuations in flow and water level. Additionally, the licensee states in the method section of the proposed study

plan under the sub-heading of Surface Water Level Monitoring (pg. 23) that “Flow variation is generally limited in the winter months, so the absence of data collection in the winter months should not alter study results.” The streamflow data from the USGS gauge located in North Walpole, NH below the Bellows Falls project for winter 2013 indicates that water level fluctuations associated with project operations happens on relatively the same periodicity as in other seasons (See hydrograph below). The Agency does not agree that absence of this data collection will not alter study results. The licensee study plan should indicate how they will address water level fluctuation in the winter and how it could potentially affect riverbank erosion.



In their “TC study Meeting comments and action items -2013 06 20.doc” the licensee did provide considerations in regards to changing the monitoring frequency. The Agency requests that the licensee increase their monitoring frequency to the biweekly schedule as proposed.

<b><i>E. Erosion Monitoring: Consider changes in proposed monitoring frequency due to observations of rapid erosion or based upon event triggers (high runoff events, ice scour, spring freshet). Identify and characterize events historically, frequency; if possible tie events to erosion observations or noted changes in morphology.</i></b>	
Describe plan for how to proceed with more details where rapid erosion is identified, need to identify added cost.	Will consider pending evaluation.

### **Study 3: Riverbank Erosion Study**

The proposed study plan largely meets the Agency's requirements and we do not have any additional comments. The Agency will work with the licensee and provide input and feedback as describe in the updated study plan.

### **Study 4: Hydraulic Modeling Study**

The proposed study plan largely meets the Agency's requirements and we do not have any additional comments. The Agency will work with the licensee and provide input and feedback as describe in the updated study plan.

### **Study 5: Operations Modeling Study**

The Agency's study request specifically requested that a model be developed to look at climate-altered flows on project operations over the course of the license. The licensee's proposed study plan currently does not address this objective. The proposed model will model project operations in five non-consecutive years selected from the past 30 years ranked from driest to wettest. This approach does not capture how project operations and river flows will be affected during consecutive wet or dry years. Additionally, the model does not capture any extreme climate and precipitation events that are predicted to increase in frequency with the onset of climate change, and how these will impact project operations or energy production. In other words, if extreme precipitation events increase in frequency resulting in more frequent tripping of the stanchion bays at the projects will be addressed. The Agency request that the licensee address the issue of climate-altered flows on project operations over the course of the license so that the Agency can better assess the potential impacts on the river ecosystem and water quality from project operations.

### **Study 6: Water Quality Monitoring and Continuous Temperature Monitoring**

The licensee has proposed in their study plan to continuously monitor temperature from June 1 through September 30. The Agency requested that continuous temperature monitoring be done from April 1 through November 15 or when conditions are safe for the field crew to deploy the temperature loggers. The original request was that the temperature loggers be deployed in the upper, middle, and lower part of the impoundment and an additional transect located in the free flowing section of the river above the each impoundment to serve as a reference. The continuous monitoring of temperature during this time it is an important factor in determining the effects the projects impounding water on a daily basis are potentially having on the timing of migratory fish runs and spawning. The rationale for the for extending the time period for continuous temperature monitoring is the spring and fall is typically when the fish ladders are open at each of the projects and riverine and diadromous fish are actively moving through project ladders and impoundments. Temperature is an important variable in determining the timing of fish migration and spawning. Therefore to understand how project operations affect river temperature and

whether they are being altered, possible causing delays during the spring and fall runs and out migration when fish are most actively moving through the project area is important.

Additionally, the Vermont Water Quality Standards state that the change in temperature either upward or downward shall be controlled to ensure full support of aquatic biota and habitat use, as well the Connecticut River managed as a cold water fish habitat and shall not exceed 1.0°F from the ambient temperature due to the activities from the project. The Agency needs to understand how temperature of the river is being potentially affected by project operations in the spring and fall to understand how it might impact the fisheries and aquatic habitat use and timing and possible delays in fish migrations. If potential delays in fish migrations are occurring from project operations effect on temperature, the Agency reserves the right to request a more detailed study in the second year of on the temperature within the impoundments at any of the projects.

### **Study 7: Aquatic Habitat Mapping**

The goal of this study is to survey, identify, and map aquatic habitat at the Wilder, Bellows Falls, and Vernon Project-affected areas and assess potential effects under current operations. TransCanada is proposing to collect supplemental temperature data during this study using Onset Hobo water level loggers and temperature loggers opposed to the Agency's request it the water quality study request that continuous temperature at transects located in each of the impoundments that would be collected from April 1 to November 15. In the revised study plan it is unclear if TransCanada is proposing to leave the water level and temperature loggers at the sites identified from April 1 to November 15. The licensee needs to clarify in its study plan how the duration the water level and temperature loggers will be deployed.

Additionally, the licensee is proposing to validate classifications of all habitat types from side scan imagery via visual assessment within shallow water habitats and/or clear water conditions as well as pole and ponar grab samples for deeper water areas. In order to quantify the composition of substrates collected from the ponar grab, the Agency recommends that samples be brought back to the lab for further analysis. Percent composition by weight using the modified Wentworth scale would provide additional information on the aquatic benthic habitat, and would not require much more effort.

Additionally the Agency agrees with the licensee's proposed revisions as described below.

<b><i>A. Note in the SP as to the ability or desire to perform the bathymetry mapping at the highest pond possible.</i></b>	
Consult with TC Operations and determine the extent possible for summer 2013.	SP Revised. We will attempt to do this based on flow/elevation changes and timing, and rain events.
<b><i>B. Provide clarity and criteria for adjusting and collecting 1-foot contour bathymetry when depths are 10 feet or less from top of reservoir max elevation, regardless of whether along edge or in center of river (i.e., islands).</i></b>	

	Revise SP	<p>SP revised and clarified, but not exactly as requested/commented upon.</p> <p>We propose 1-foot intervals in water depths of 10 feet or less (as measured from the full pond water surface elevation regardless of their spatial location (i.e. littoral edges of impoundment, mid-impoundment island areas, etc). All sections of the impoundments where pool depths are greater than 10 feet from the full pond water surface elevation will be collected at 2-foot intervals. These contour intervals will provide sufficient detail to assess the potential effects of reservoir fluctuations associated with project operations on aquatic habitat. The full operating range for each project is as follows; Wilder: 380.0' to 385.0' msl (5 feet), Bellows: 288.6' to 291.6' msl (3 feet), and Vernon: 212.0' to 220.0' msl (8 feet).</p>
<p><b><i>C. Provide greater clarity on substrate sampling methods, techniques; particularly in the deeper areas associated with downstream (riverine) reaches. (drag chain, copper pole methods suggested)</i></b></p>		
	Revise SP	SP Revised
<p><b><i>D. Note in the SP as to the ability or desire to perform the bathymetry below the dams (in riverine section) during low flow conditions, for the purpose of mapping the transition area from riverine to impoundment.</i></b></p>		
	Consult with TC Operations and determine the extent possible for summer 2013.	<p>SP Revised</p> <p>Statement added to address this in the first paragraph of the methods. Note that bathymetry is not the appropriate technique for riverine sections. See response to G below.</p>
<p><b><i>E. Provide more detail on accuracy of instruments, bathymetry sounding equipment. Provide more description on QA/QC methods and control.</i></b></p>		
	Revise SP	<p>SP Revised</p> <p>Added detail to QC habitat methods          Added bathymetry QC detail to methods section along with reference to NOAA survey guidelines being followed</p>

<b><i>F. Consider methods to assure coverage of so-called transitional zones (areas impacted by impoundments and discharge – sometimes exclusively and other time concurrently). Expressed desire to map under impoundment conditions (high pond) and map as riverine (low flows).</i></b>	
Consult with TC Operations and determine the extent possible for summer 2013.	SP Revised as noted above
<b><i>G. Deeper areas in the riverine habitats below the dams may require additional methods to acquire bathymetry. Please identify methods that will be considered as well as those that cannot be used and explain merits or issues associated with each. Identify criteria or decision making (when and why) that will drive the decision to use a particular method.</i></b>	
Identify options – both the positive and negative aspects of each.	<p>SP clarified</p> <p>Bathymetry was limited to the impoundment sections as the equipment to conduct that work needs to be mounted on an appropriate survey vessel and should not be bouncing around in riverine sections with limited access and/or shallow water obstacles.</p> <p>Mesohabitat mapping will be conducted as part of the instream flow study (#9) and this work will occur in the riverine sections.</p>

### **Study 8: Channel Morphology and Benthic Habitat Study:**

The Agency requested a study to determine the potential for projects to affected fluvial processes related to movement of coarse sediment and the potential effects on benthic habitat. In TransCanada's proposed study plan in the Study Area and Study Site Section (pg. 100) as proposed for study sites that are located below each of the projects to use a site at the head of the impoundment downstream as it will be a representative riverine reach of the upstream project and the impoundment. The Agency does not agree with this assumption because the sites will not representative of the affects from the dam. The riverine site should be located closer to dam and before any major tributaries enter the river to be representative of the dams' impact on benthic habitat conditions. The Agency recommends that the study plan be amended to include study site just downstream of the dam.

### **Study 9: Instream Flow Habitat Study:**

The study plan specifically mentions minimum flows in several locations. We want to be clear that the Agency is concerned about the entire flow regime (magnitude, frequency, duration, timing and rate of change). The objective of the instream flow study is to quantitatively assess the relationship between flow and aquatic habitat for selected target organisms so that the flows



needed to provide suitable habitat conditions can be determined. This will involve consideration not only of seasonal conservation flows (formerly known as minimum flows) but of maximum flows and when they occur, how often, and the transition rate. And, the ecological implications of locational shifts in suitable habitat with flow must also be assessed.

In its scoping of instream flow studies, the Agency typically focuses on riffle reaches. Riffle areas are the most sensitive to flow changes and are also critical to the stream's ecological functions. A flow regime that is adequate for riffle areas is likely to satisfy the needs for food production, fish passage, spawning and rearing. Other habitat types (runs, pools) will also be protected since they are less sensitive to flow changes. Fluvial-dependent species and life stages that utilize riffle habitats are then included among the target organisms.

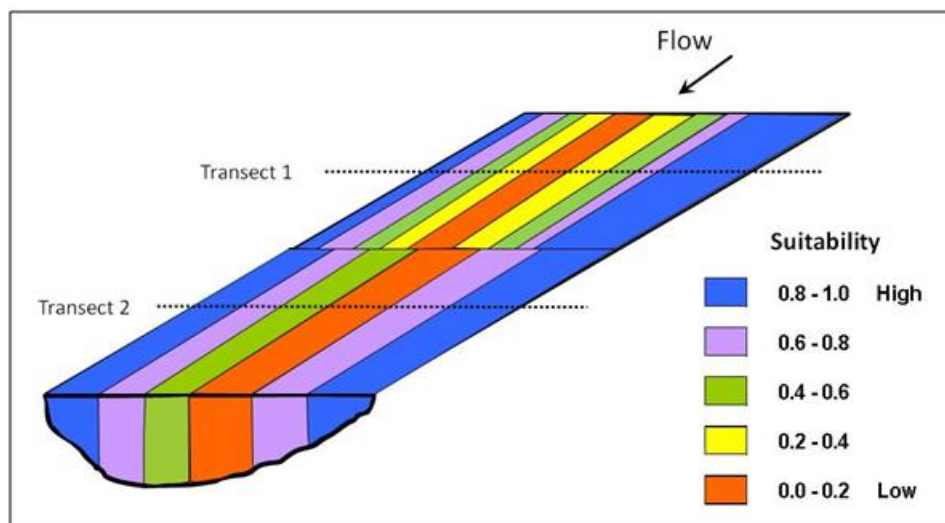
The Connecticut River includes a large quantity of impounded, relatively deep habitat with slow moving water. The instream flow studies should focus on organisms that require flowing water conditions and the corresponding habitats.

The study plan calls for the inclusion of transects in all mesohabitat types. While we do not object to this, we do have concerns over how the information is used. For example, data from riffles, pools and runs should not be combined for analysis as this masks the effects on the most sensitive areas by pooling them with less affected habitats. We consider riffles to be critical habitat which should be studied using what is sometimes called a "critical reach" approach. Ultimately, a flow regime that provides suitable habitat conditions in riffles must be provided.

As was pointed out by TransCanada's consultants during the study plan review meetings, 2-D hydraulic modeling covers a specific reach of river since it uses a special grid network of data points instead of transects. Such a study reach could include more than one mesohabitat type. The Agency recommends that 2-D study reaches be selected based on the principles described above.

The species and life stages to be assessed (target organisms) should also focus on those that require or utilize flowing waters, as opposed to generalists such as yellow perch that also live in lake environments. The inclusion of early life stages is particularly important as flow-related habitat bottlenecks often occur at these stages. The details for the selection of target organisms and habitat suitability criteria should be resolved in consultation with the study working group members.

The Agency is pleased that TransCanada has included a dual flow analysis in its revised study plan, as part of the assessment of the effects of hydropeaking. The Agency recommends that the study also include graphics (sometimes referred to as habitat maps; not to be confused with the Aquatic Habitat Mapping Study 7) that show categorized PHABSIM cell suitabilities for selected flows. These graphics (see 1-D example below) clarify where in the river habitat exists, as well as its quality, and what shifts in location may be occurring. They are helpful in interpreting the dual flow results.



The Agency recommends that dual flow results be presented not only as a matrix of values, but also graphically, as shown in the following references.

Milhous, R.T. 1992. Determining the minimum flow below hydro peaking projects. *Hydro Review* 11(6):67-74.

Conners, M.E. and J. Homa Jr. 1992. Presenting dual flow modeling results for flow alternatives analysis. *Instream Flow Chronicle* II(3):1-3.

Additional details for these analyses should be resolved in consultation with the study working group members.

The study plan includes a section on “Time Series and Hydrology” that implies that this analysis will be done using habitat duration curves. A habitat time series combines a hydrograph and habitat-flow relationship to produce a graph showing habitat as a function of time. The Agency believes that this type of analysis is more useful than duration curves, especially in hydropeaking situations. However, it is necessary to carefully select the hydrologic data set (year), time step, time of year, target organisms and operating scenarios to be compared. These determinations should be made by the study working group and based on the steady state habitat results.

### **Study 10: Fish Assemblage Study:**

The goal of this study is to determine the occurrence, distribution, and relative abundance of fish species present in the project-affected areas. The proposed methods include electrofishing (boat, pram, and backpack) and gill netting with experimental nets. Fish assemblage studies typically employ a multi-gear approach as shown in the following reference.

Bonar, S. A., W. A. Hubert, and D. W. Willis, editors. 2009. *Standard methods for sampling North American freshwater fishes*. American Fisheries Society, Bethesda, Maryland. 335 pages.

The Agency recommends that sampling methodologies include a multi-gear approach and are consistent with the American Fisheries Society’s national standards as referenced above.

The licensee should also should consider employing a benthic trawl (as will be used in Study 12), in order to target deep water benthic habitat. The Agency recommends that the licensee employ a stratified random sample design to capture the spatio-temporal variability. The sampling sites should be stratified by habitat type, depth of water, day or night (or time of day), as well as distance from the dam, and season (spring, summer, fall).

The licensee proposes that for experimental gill nets; “Nets will be set and allowed to fish for a 24-hour period prior to pulling.” The Agency recommends that the nets soak for no more than two hours per set, as soaking for a 24-hr period will cause significant mortality. The licensee proposes to collect water quality data at the time of sampling. Parameters include temperature, DO, pH, and conductivity. The Agency recommends that turbidity also be included as a parameter because high turbidity will affect the visibility (and hence catch rate) during electrofishing. Studies have also shown that high turbidity reduces the ability of fishes to see the trawl net during benthic trawling. This may also affect catch rates.

The Agency agrees with the licensee’s proposed study plan revisions as described below.

<b><i>A. Suggest standard sampling methodology (VANR gave reference to refer to) for future comparison, randomized/replicate sampling at each location. Goal to improve ability to draw inference and reduce sampling error.</i></b>		
	Will review the reference. We use EPA standardized method. We will look for any updates in that protocol also.	SP Revised.  SP revised for methodology.
<b><i>B. Consider randomized/replicate sampling at each location. It is better to have data to draw inference on. Reduces sampling error. [K Kennedy]</i></b>		
	Will consider	SP Revised.  SP has been updated to reflect this approach – see response to comment A
<b><i>C. Beneficial to have analysis incorporate size category, and a measure of variance in that. Requests coefficient of variation to compare across different gear types. CV &lt; 20 are desirable.</i></b>		
	Revise Study Plan	SP Revised.
<b><i>D. Include turbidity in WQ data collection and specify time of day for electrofishing (or include time of day as a covariant)</i></b>		
	Revise Study Plan	SP Revised.
<b><i>E. Specify the time of day or night for each sample and be sure to include it as a co-variant in the analysis.</i></b>		
	Revise Study Plan	SP Revised. see response to D
<b><i>F. Include turbidity in the WQ sampling at each sample location</i></b>		

	Revise Study Plan	SP Revised. see response to D
<b><i>G. 2 hour gill sets at night are preferable to the proposed 24 sets – to reduce “fish gilling” mortality or injury. FL using trapnet for deeper water. Trawl for deeper waters similar to darter sampling we propose.</i></b>		
	Revise Study Plan	SP Revised.  SP revised to rely on 2 hour gill net sets. These will be done at night to increase likelihood of catch. 2 hour sets will reduce mortality and satisfy the VT fisheries request to do so.  Study 10 will rely primarily on boat electrofish with supplemental gill/trap netting. We are not proposing additional trawl sampling but will incorporate results from Study 12 (darter trawling)
<b><i>H. Review study requests for methods (gear), temporal variation (day or night) etc.</i></b>		
	Revise Study Plan	SP Revised. Clarified methods section to explain gear use including conditions that must be met to use a particular type of gear and what time of day that gear would be used.
<b><i>I. Specify electrofishing locations particularly with respect to setbacks and side</i></b>		
	Revise Study Plan; Clarify and provide detail as needed	SP Revised. Revised methods section to provide more detail on fish sampling in setbacks vs. mainstem areas
<b><i>J. Eagles –if using trapnets, consult w/ FWS on gear types and impacts on eagles. Get a permit for activities. Would gill netting also be a concern? Probably not if at night.</i></b>		
	If use of trap nets are specified, address this and revise Study Plan	SP Revised.
<b><i>K. Think through on study design to be sure it meets variety of goals, methodology, data collection, temporal etc., gear types to develop sampling design.</i></b>		
	Revise Study Plan	SP Revised. See comment A. Following discussion with Katie Kennedy and review of FL plan and associated references have modified our approach.
<b><i>L. Is there sampling in the setbacks or just mainstem? If so, specify method. Fyke nets may be appropriate method in those locations. Clarify in plan</i></b>		
	Clarify sampling in setbacks and shallows; specify method in plan. Consider sampling in locations even if not	SP Revised. Setbacks that occur within one of our randomly selected segments will be

	fluctuating enough to impact spawning (in that study).	sampled to the point that equipment can operate and area is still within the influence of project operations.
<b><i>M. Capture assemblage below Vernon Dam</i></b>		
	Revise plan to sample below Vernon to a location just below Stebbins Island. Utilize any VY data available	SP Revised. Added an additional stratum (Vernon to DS end of Stebbins Island (1.5 miles)). Will be sampled following same methodology used in other locations.  Will need to review publically available VY data as part of study (SP not yet revised).
<b><i>N. Commit to a repetitive study year or season if conditions are abnormal? [K Kennedy] – one way around those drawbacks (e.g. drought) is to sample outside of the project to reflect “natural” conditions and not on the project.</i></b>		
	We will rely on ILP regulations for anomaly conditions requiring additional year, as applicable to all studies.	No changes in SP, consultation will be ongoing for all studies. Progress reports and study reports will be prepared and shared for comment.
<b><i>O. Need scientific collecting permit from VT F&amp;W for fishing in VT water. Also in NH</i></b>		
	Specify in SP that we will secure all necessary permits for study	SP Revised. Sentence added to plan in Schedule section

### **Study 11: American Eel Survey:**

The goal of this study is to provide baseline data relative to the presence of American eel upstream in the project-affected areas. In the Agencies study request, the objective of the study was to determine the relative abundance and distribution of American eel upstream of the Vernon, Bellows Falls and Wilder dams in both riverine and lacustrine habitat. The Agency requested an eel survey be conducted in the mainstem river and tributaries upstream from the three projects. In general, a combination of electroshocking (backpack in wadeable rivers and boat-mounted in larger rivers and lakes) and eel pots should be used to collect eels and determine catch rates. Sampled habitat should include: the mainstem Connecticut River from upstream of Vernon Dam to below the Dodge Falls project located in Ryegate, VT; tributaries to the Connecticut within that stretch where eels have been collected previously; and lakes and ponds (such as, but not limited to, Spofford Lake and Lake Morey), where eels have been collected previously. Sampling should occur during the summer (July through September).

However, the licensee is only proposing to sample in the project waters upstream of each dam from the upper extent of Wilder impoundment downstream to Vernon dam stating the reasons for not conducting survey for eels in lakes and ponds because these areas are outside the FERC designated project areas and have no nexus with the project operations. FERC guidelines on

developing study criteria for the ILP process indicates that a FERC project boundary is not appropriate in limiting the geographic scope of studies and the geographic scope should be determined by the effects of the project on the resource in question. American eels migrate out of the Connecticut River watershed to the Sargasso Sea to spawn. Eels are known to occur within lakes, ponds and tributaries located above and outside the project-affected areas. In order for the Agency to assess the need to provide downstream fish passage for eels the relative abundance of the number of eels above each project is needed. As currently designed, the study will yield an underestimate of the eel population and will not be sufficient for assessing the need for downstream passage. Therefore, downstream passage prescriptions should not be based on these results.

The Agency recommends that a watershed survey should be done to provide data for passage prescriptions because all eels will have to pass through the projects in order to migrate to the ocean. The Agency does not agree with the licensee's response to limit the study scope to the mainstem.

The Agency would be willing to collaborate with the licensee to obtain more representative estimates. For example, if the licensee were to tag yellow eels and monitor within project affected areas, the Agency would be willing to take over and monitor/and or sample throughout the tributaries and ponds. These data would provide more robust results.

Setting up Hydroacoustics array at Vernon would support this study, and should be considered.

#### **Study 12: Tessellated Darter Survey:**

The goal of this study is to characterize the distribution and relative abundance of tessellated darter within project-affected areas. The Agency recommends that trawling methods be consistent with section 5.3.3 from the following reference.

Bonar, S. A., W. A. Hubert, and D. W. Willis, editors. 2009. Standard methods for sampling North American freshwater fishes. American Fisheries Society, Bethesda, Maryland. 335 pages.

The Agency also recommends that turbidity measurements be taken at the time of sampling because studies have shown that as turbidity increases the ability for fishes to see the net decreases which could affect catch rates.

#### **Study 13: Tributary and Backwater Area Fish Access and Habitats Study:**

The goals of this study are to determine if water level fluctuations from project operations cause impediments to fish movement into and out of tributaries and backwater areas within the project-affected areas; and determine if water level fluctuations caused by project operations effect available fish habitat and water quality in the tributaries and backwater areas within the project-affected areas.

In the Agency's study request on the impacts of project operations on tributary and backwater area access and habitats, proposed methodology included collecting water quality information (dissolved oxygen, temperature, turbidity, and pH) within the tributaries and backwater areas because as water level changes is has the potential to alter water quality and quantity in these areas, which could decrease productivity or survival.

However, the licensee is proposing that during the first study year (2014), water level recorders (estimated 30 units total) will be placed in selected backwaters and tributary areas and will operate for an entire year to collect hourly depth changes and water temperature. Additional water quality data will only be collected in these areas (temperature, DO, pH, conductivity, and turbidity) if it is found that access to the main river is impeded. However, the Agency requests that water quality be monitored at a randomly selected subset of the 22 setback areas, because even if there is connectivity water quality may not be maintained.

The Agency requests that methods include a comparison of water quality between the mainstem and setbacks/tributary areas to establish relative differences between the two habitat types.

The Agency requests that a one-foot depth or less at the mouth of tributary or setback be the trigger for concerns relative to fish movement (i.e., depth barrier).

#### **Study 14: Resident Fish Spawning in Impoundments Study:**

The goal of this study is to assess whether project related water level fluctuation in the impoundments effect resident fish spawning. The proposed study plan will be conducted field surveys to assess potential effects of impoundment fluctuation on nest abandonment, spawning fish displacement, and egg dewatering. However, it is well known that the widened impoundments due to the dams replace riverine (lotic) habitats with a lake-like (lentic) environment. These impoundments serve as repositories for silt and sediments that cover natural gravel substrate that serve as spawning and habitats. Therefore, the Agency is requesting that the study investigate sedimentation, or the amount of fines within a nest (in addition to nest abandonment, spawning fish displacement, and egg dewatering) as a potential negative impact due to the project's impoundments and operations.

#### **Study15: Resident Fish Spawning in Riverine Sections Study:**

The goal of this study is to determine if project related water level fluctuations in the affected areas downstream of Wilder, Bellows Falls, and Vernon dams negatively affect resident fish spawning.

In addition to assessing potential effects of operational flows and water level fluctuations on nest abandonment, spawning fish displacement and egg dewatering, the Agency is requesting that the study assess nest scouring as a potential negative impact, as fluctuations in water levels and flow velocities from project operations could potentially cause scouring.

The Agency concurs with the licensee’s proposed study plan revisions as described below.

<i>A. Add detail on egg trap placement and sampling protocol; SP needs further definition. [is there a need for consultation with stakeholders?]</i>		
	Revise Study Plan	SP Revised. Methods section edited to add more detail on egg trap construction and the criteria we will initially use to identify potential sampling spots.
<i>B. Include (study) “riverine” reach below Vernon in the resident fish spawning in riverine study.</i>		
	Based on study meetings, all applicable studies will include approximately 1.5 miles downstream of Vernon dam to lower extent of Stebbins Island	SP Revised. Includes downstream of Vernon approximately 1.5 miles
<i>C. Longnose Dace should be added to the list of species, if identified in part through the fish assemblage study.</i>		
	Revise Study Plan	SP Revised. added
<i>D. Salmonids should also be included; noting if and where spawning occurs.</i>		
	Revise Study Plan	SP Revised. added

### Study 16: Sea Lamprey Spawning Assessment:

The goal of this study is to assess the level of spawning activity by sea lamprey (*Petromyzon marinus*) in the project-affected areas and to determine whether project operations are affecting the success (i.e., survival to emergence) of lamprey spawning. The Agency recommends that methods follow Chapter 8 in:

Bonar, S. A., W. A. Hubert, and D. W. Willis, editors. 2009. Standard methods for sampling North American freshwater fishes. American Fisheries Society, Bethesda, Maryland. 335 pages and Gallagher, S.P, P.K. Hahn, and D.H. Johnson. 2007. Redd Counts. Pages 197–234 in D.H. Johnson, B.M. Shrier, J.S. O’Neal, J.A. Knutzen, X.Augerot, T.A. O’Neil, and T.N. Pearsons. Salmonid field protocols handbook: techniques for assessing status and trends in salmon and trout populations. American Fisheries Society, Bethesda, Maryland.

The licensee is proposing to collect data on redd characteristics including location, size, substrate, depth and velocity. When analyzing substrate the Agency recommends that percent embeddedness be included in the characterization. As identified in Vermont’s Wildlife Action Plan (Kart et al. 2005), one of the threats identified is degraded spawning habitat due to sedimentation. Recording percent embeddedness would ascertain if sedimentation is having an



impact on survival to emergence. The Brusven Index describes sediment size and percent embeddedness using a three digit number. The number in the 10s place is the largest materials in the sample termed the dominant particle size. The figure in the ones place represents the material surrounding the dominant particles and the decimal place is used to describe the percent embeddedness (fines). These are standard methods for salmonid redd surveys (Gallagher 2007).

The Agency requests that the licensee collaborate with the Agency on the telemetry portion of the study so we can continue to monitor the lamprey once they leave the project affected areas.

The Agency agrees with the licensee’s proposed study plan revisions as described below.

<b><i>A. Rick’s comment in describing plan, that this is not in the plan</i></b>		
	Revise plan to state putting out pressure transducers if we find spawning areas	SP Revised.
<b><i>B. Clarify that non-telemetered areas (based on physical habitat) and we find redds will be monitored.</i></b>		
	Revise plan to include what we do when we go to these habitat sites and find redds. Do we then treat them the say way as others? <u>YES.</u> Also other spawning studies we will focus on shallow areas and will look at them.  Also clarify the number or “up to how many additional” physically identified redds we will also monitor. See D below	SP Revised.
<b><i>C. Use of habitat data – if half go to tributaries and/or scatter, that doesn’t lead you to more than that fish.</i></b>		
	May have to find some by plane if needed and they go up tributaries.	SP Revised.
<b><i>D. Need to identify how many redds you’d measure – specify level of effort to represent adequate sampling and habitat variability. Analysis is subjective so need a lot of redds to get adequate information</i></b>		
	Clarify in plan - we will count all redds and then subsample.	SP Revised.
<b><i>E. Tagging should be representative of migration timing – cover the entire season. USGS has been pit-tagging at Holyoke and receivers at TF and Vernon, may provide some info to help inform rates/timing.</i></b>		
	We won’t take the first 20. The goal is to try and select tagged fish throughout the migration period. Clarify and revise plan.	SP Revised.  Clarified to spread fish tagged out over different periods
<b><i>F. What is the scale of the effects analysis? Per redds? Per colony per habitat unit.</i></b>		
	Will be based on what we find – but will be broad representation of what we find. We	SP Revised.

	will try to do per colony/grouping within each habitat, will report everything found. Will locate and record depth of all. Could also randomly select which ones are capped. Specify scale of effects analysis in the plan.	Plan clarified.
<b><i>G. Let agencies know if fish move out of the area, so they can be tracked in the states.</i></b>		
	Will do, add this into plan – will provide/share codes of our tags with states.	SP Revised.
<b><i>H. [Lael] Refer to Gallagher – standard methods for changes in habitat over period they are actively spawning. Record % embeddedness when evaluating substrate etc. sedimentation within redds (impact on the resource).</i></b>		
	Specify in plan – once we find redds, additional field work every day in daylight with photos, also will have turbidity data. Also add embeddedness. (see 4 <sup>th</sup> paragraph on p.113 of PSP) in the event of no telemetered fish leading us to that spot, will still look in suitable habitats.	SP Revised. Clarified, but not sure of the Gallagher reference, need a citation in order to review that.
<b><i>I. Operations data collected at redds? Capture various operational conditions</i></b>		
	<p>Clarify and add detail on operations data collected and how at redds – may locate pressure transducers; measure velocity and depth at time of observation and link to discharge/elevation at station or other means of estimation of flow.</p> <p>Coordinate with TC Operations to understand what is going on operationally while in daily surveys of redds.</p> <p>Indicate how we will attempt to observe redds under varying flow conditions</p>	SP Revised with clarifications.

### **Study 17: Upstream Passage of Riverine Fish Species Assessment:**

The goals of this study are to determine the use and temporal distribution of riverine fish passing upstream in the existing Wilder, Bellows Falls, and Vernon fish ladders during year-round fishway operation and to determine the appropriate operation period for these fishways to pass riverine and diadromous fish. The Agency requested that monitoring in the fish ladders be conducted year round.

TransCanada is proposing to operate the upstream fish passage year round or until icing condition make or operations are infeasible because of icing conditions. The proposed schedule indicates that TransCanada will set up the video equipment in April 2014. The proposed study plan should be adjusted to state that TransCanada will operate the fish ladder and setup the video equipment and software as soon as conditions allow which could potentially occur in March.

Additionally, TransCanada is proposing to continuously monitor water temperature within each of the fish ladders during the study. Fish movement and migration is strongly associated with water temperature. Considering this, the Agency recommends that not only continuous temperature is monitor within the fish ladders, but also within the forebay area where fish exit the ladder and tailrace of each project to assess whether the projects operations are potentially impacting important migratory cues. If potential delays in fish migrations are occurring from project operations effect on temperature, the Agency reserves the right to request a more detailed study in the second year on the temperature within the impoundments at any of the projects.

The Agency will work with the licensee and the Salmonsoft company to define terms of use of the software and video monitoring equipment (with the exception of state owned computers).

<p><b>A. Fish Ladder Operational monitoring:</b></p> <p><i>a. Will you record the number of times etc. that the fishways get blocked? Check often enough to ensure that ladders operate correctly for the study.</i></p> <p><i>b. [J Warner] – maybe get FWS engineers, station staff, study staff together to identify the visual effects of things blocking the fishways.</i></p> <p><i>c. Or periodically shut down to check ladders.</i></p>	
<p>We don't want to shut the fishways unless they really get blocked.          Work with station staff to set up an inspection schedule/protocol. Perhaps seasonal shutdown – after spring run and after fall run.          Revise plan as needed</p>	<p>SP Revised.</p> <p>Sampling will occur during the open water period (ice-out until freezing temperatures make it infeasible).</p> <p>TC will develop an in-house protocol for station personnel to assess ladders for blockages on a weekly basis. If a significant blockage is suspected, TC can shut down and address either after the spring or summer periods.</p>
<p><b>B. Use of VT's Salmonsoft licenses; Receive training and orientation from VT; set-up at Wilder</b></p>	
<p>Clarify and confirm in Study Plan:</p> <ul style="list-style-type: none"> <li>• Confirm use of Salmonsoft licenses held by VT.</li> <li>• Determine hardware or additional software needs. High processing speeds for software.</li> </ul>	<p>SP Revised.</p> <p>Added use of VT licenses to SP, added cost to purchase of 3 laptops that can handle the salmon soft software transferred from VT</p>

	<ul style="list-style-type: none"> <li>Develop set-up system for Wilder</li> </ul>	<p>(minimum of a dual core computer running at 2.0 GHz with a suitable video capture device, a minimum of 2 GB of RAM, running Windows XP (preferred) or Windows Vista. The recommended video board is the Plextor PX-AV200U)</p>
<p><b><i>C. High turbidity events that preclude seeing fish via Salmon Soft - and record those events. Turbidity doesn't allow Salmon soft to capture the frame if there is movement in the ladder. Sun can trigger Salmonsoft and small light directly into window for nighttime is useful too.</i></b></p>		
	<p>Specify in plan – 24 hour Salmonsoft usage. Consider the experience from Vernon to ensure the best data collection.</p> <p>Could use the 2<sup>nd</sup> camera side-by-side. FL will share their experience downstream to help study design. VANR can provide protocol.</p>	<p>SP Revised.</p> <p>Added text to specify 24 hour coverage. Added text saying we would operate 2<sup>nd</sup> non salmonsoft camera during turbid periods after rain events. Added text saying TC can confer with VT and FL to install proven design improvements for limiting sun and night time interference.</p>
<p><b><i>D. Salmonsoft was designed for upstream. If one fish goes upstream and on that goes downstream at the same time, Salmonsoft can cancel out each other.</i></b></p>		
	<p>There are work-arounds in the software. Identify methods to address this and enable both up and down counts.</p> <p>Clarify and specify procedure in revise SP accordingly</p>	<p>SP Revised.</p> <p>Added text saying TC would confer with FL and VT to learn about getting net counts from Salmonsoft</p>
<p><b><i>E. 1-year study may limit identification of early and late season species use (walleyes for example). How early will you open the ladders? If see fish moving early and late, it might be important to define those time frames. [K Kennedy] – can record temp, flow, elevation etc at the time of first and last seeing fish. Then license conditions could be based on date and/or those conditions</i></b></p>		
	<p>We expect to be able to get ladders open as soon as reasonably possible and run as late as reasonably possible or when it appears as if no use is observed.</p> <p>Will need to develop a monitoring protocol in real time rather than wait until season is over to observe and process salmon soft information.</p> <p>Clarify this and revise the SP</p>	<p>SP Revised.</p> <p>Clarified in SP: Ladders will open as soon as logistically possible (i.e.no ice).</p> <p>We will record operational parameters.</p> <p>Monitoring of video files/analysis of data etc. will occur throughout the study, not at the end of the study.</p>

<b><i>F. Page 122, schedule says April date.</i></b>		
	<p>Correct this in the SP.          NOTE – will need to coordinate with CRASC and FWS on fishway inspections early at all projects, not just Vernon.</p> <p>Will periodically check in with agencies on status, especially. if there are issues that arise.</p> <p>Revise Study Plan</p>	<p>SP Revised.</p> <p>SP revised to reflect the open water period (ice-out until freezing temperatures make it infeasible)</p> <p>Sentence added to indicate TC will coordinate fishway inspections with agencies to ensure timely start to monitoring.</p>
<b><i>G. Will Salmon Soft software run 24 hours continuously?</i></b>		
	<p>Clarify if this is what we are aiming for in SP.</p> <p>If there is some unforeseen reason why this becomes a problem, we will immediately notify agencies and stakeholders.</p>	<p>SP Revised.</p> <p>Clarified 24-hour monitoring. Added a few sentences at end of methods saying TC will be in contact with agencies and if our proposed methodology is not working well, will seek alternate approaches in consultation.</p>
<b><i>H. Consider setting up trial at Wilder in 2013</i></b>		
	<p>We will consider this as an option based on VT work in 2013, but no revision expected in Study Plan</p>	<p>No change in plan.</p>
<b><i>I. Consider using 2013 recording data for training on species Identification.</i></b>		
	<p>We will consider this and indicate in Study Plan if needed.</p>	<p>SP Revised.          added</p>

### **Study 18: American Eel Upstream Passage Assessment:**

The goal of this study is to provide baseline data on the presence of American eels attempting to move upstream of the projects and the locations where they congregate while attempting upstream passage.

During the study plan meetings, it was suggested by FERC that the licensee mark all captured eels to avoid double counting. The licensee has since proposed to pass all captured eels upstream, thereby alleviating agency concerns over recaptures impacting estimates of eel congregations below projects. However, the Agency feels that there is value to marking eels (e.g. elastomer tags) with the goal of obtaining information on movement (e.g. duration between dams, percent passed by dam, number recaptured). The Agency requests that the licensee consider marking eels with elastomer tags to obtain this information.

The Agency agrees with the licensee's proposed study plan revisions as described below, with the addition of marking the eels.

<b><i>A. Revise Study Plan schedule: monitor with night surveys and eel traps in the first year to identify potential locations for temporary upstream passage devices, install and test those sites in the second year. Include an element of stakeholder consultation prior to passage device deployment.</i></b>		
	Revise Study Plan	SP Revised. SP edited to reflect a two year approach Year 1 – systematic surveys – visual searches and eel pots Year 2 – following consultation with agencies after year 1, temporary eel passes will be installed at appropriate locations where suitable eel concentrations were detected.
<b><i>B. Comment that the minimum number of pots should be 10.</i></b>		
	<ol style="list-style-type: none"> <li>1. Unclear as to how many we are proposing. Is this per project? Up and downstream? Is this a critical item? Discuss with TC prior to revising SP</li> <li>2. Clarify number to potentially address this concern.</li> <li>3. Revise Study plan as necessary</li> </ol>	SP Revised. We are proposing to fish at least 10 pots per project. Clarified SP to indicate that this is 10 pots at each Project and they are placed in areas DS of the dam
<b><i>C. Study design should account for and document re-captures though some sort of marking of eels prior to releasing them.</i></b>		
	Revise Study plan as necessary	SP Revised. Rather than marking yellow eels (some of which have the potential to be very small and difficult to mark), SP has been edited to have eels captured in eel pots during year 1 passed over dam – similar to approach for temporary eel traps during year 2. This will alleviate agency concerns over recaptures impacting estimates of eel congregations below projects
<b><i>D. Study Plan should include consideration for a smaller mesh size associated with traps and specify such.</i></b>		
	Revise Study plan as necessary	SP Revised. Reviewed available literature pertinent to mesh retention of eels and agree with agencies. Have modified SP to propose the use of 1/8 “ mesh which will greatly increase retention of smaller eels

### **Study 19: American Eel Downstream Passage Assessment:**

The goals of this study are to identify project-related effects on downstream passage timing, injury, stress, and survival in order to maximize the number of American eels migrating to their spawning grounds.

In the licensee's proposed study plan the objectives of this study are to 1) quantify the movement rates (including timing) and relative proportion of eels passing via various routes at the projects including through the turbines, the Bellows Falls bypassed reach, the current downstream passage facilities, and spillways; and 2) assess instantaneous and latent mortality and injury of eels passed via each route.

These objectives are misleading because they are not assessing mortality through spillway and downstream passage facilities because it is assumed survival is high. Therefore objective 2 should state assess instantaneous and latent mortality and injury of eels passed through each turbine type.

<b><i>A. In SP, discuss pros and cons of PIT and radio telemetry for this site and this study, provide rationale for choosing not to include PIT.</i></b>		
	Revise Study Plan to explain the rationale and experience for choosing radio telemetry and not PIT technology.	SP Revised Rationale described.
<b><i>B. Consider survival studies through spill gates in the scope of the study.</i></b>		
	<ol style="list-style-type: none"> <li>1. What are the gate passage options for eels specific to projects including gate operation priority and flow in terms of how they operate – bottom or surface; minimum flow or gate opening etc.</li> <li>2. Is there literature on adult eel gate passage survival?</li> <li>3. Consider an assessment methodology that would reach a consensus as to whether or not additional survival studies would be necessary in a second study season.</li> </ol>	<p>SP clarified as follows:</p> <p>TC expects gate passage survival to be high in general.</p> <p>As part of the route selection study, we will consult with TC Operations on gate structures operations to evaluate potential gate-specific issues. We are not aware of literature on gate passage, but can review as part of the study.</p> <p>We could consider gate survival evaluation if the route selection portion of the study indicates that a significant proportion of fish use the spillways and if sufficient numbers of fish are available (see C below). We will consult with the aquatics working group on the need for potential changes to the scope of the survival portion of the study and/or an alternate desktop methodology to assess this.</p>

<b><i>C. Sample size per turbine types appears low – consider boosting sample size per unit type</i></b>		
	<ol style="list-style-type: none"> <li>1. Evaluate the additional scope and cost.</li> <li>2. Revise Study Plan as necessary and provide rationale.</li> </ol>	<p>SP clarified as follows:</p> <p>The survival sample size in the study plan is the same as requested by the resource agencies (including survival through all passage routes). It appears that agencies realize that a large number of eels would likely not be available, so they specified 50 for each project. By limiting survival to just turbines and not gates, the number of fish per turbine type is increased. We also believe that the number of tags and effort required to capture higher numbers of fish (if available) for survival studies would be cost-prohibitive.</p> <p>We propose to use the preliminary route selection data to focus allocations of fish for turbine survival (and gate survival if appropriate - see B above). For example if 60% of the fish in the route selection study use turbines 1-4 (a single turbine type) at Vernon then 60% of the allocated 50 eels for that site would be tested through one of those turbines</p>
<b><i>D. To what extent will the study incorporate the results of the radio-tag (RT) monitoring results (route selection, movement activity, preferences, or lack thereof) and the survival analysis portion of this study? Will or should the RT results determine the scope or distribution of survival study distribution?</i></b>		
	Revise Study Plan as necessary and provide clarity on the process or linkage.	SP Revised. Plan clarified – see also B and C above.
<b><i>E. Study plan should reflect radio tagging releases to coincide with the mid-September thru early October period.</i></b>		
	Revise Study plan as necessary.	SP Revised. Field study will be conducted late August through mid-October.
<b><i>G. [from Study 11 discussion] Comment on tagging, loosely associated with Study 19 (Downstream eel passage). Is TC tagging yellow eels, or willing to? TC monitor in impoundments and VT would take over when eels entered VT tributaries.</i></b>		
	<p>Will we be monitoring movement in project waters using fixed and mobile tracking?</p> <p>Revise plan to clarify above and that we can provide tag information to agencies.</p>	<p>SP revised for clarity.</p> <p>This study and requests were for silver eels only. We are not proposing to tag yellow eels. Manual monitoring is already</p>



		<p>included in the plan along with fixed stations.</p> <p>SP revised to share tag information with agencies in addition to sharing with FL.</p>
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### **Study 20: American Eel Downstream Migration Timing Assessment:**

As stated in the licensee’s study plan, the goal of the requested study was to assess the timing of American eels migrating from the Connecticut River to their spawning grounds. The specific objective is to characterize the general migratory timing and presence of silver phase American eels in the Connecticut River compared to environmental factors including air and water temperature, turbidity, rainfall, river flow, lunar phase and flow-related operations of mainstem river hydroelectric projects. The licensee states in its study plan (pg. 189), “However, it finds that a field study is premature at this time. There are few American eel upstream of the TransCanada projects, as indicated by annual electrofishing conducted in the lower portion of Vernon impoundment as summarized in the Vernon PAD, and collections made by Yoder et al. (2009) above the Bellows Falls and Wilder dams.”

Considering there have been no targeted eel surveys in riverine and lacustrine habitat on the Lower Connecticut River as well as in the ponds and tributaries of the Connecticut River basin, it is unknown how many eels are residing within and/or outside of project bounds. As such the Agency requests that this statement be revised as follows,

“There have been few documented American eel upstream of the TransCanada projects in the mainstem Connecticut River, as indicated by annual electrofishing conducted in the lower portion of Vernon impoundment and as summarized in the Vernon PAD, and collections made by Yoder et al. (2009) above the Bellows Falls and Wilder dams”.

Similarly, the project nexus states (pg. 192), “Currently the TransCanada projects have little, if any, direct effect on the overall outmigration of Connecticut River American eel because so few eels exist upstream of the TransCanada projects”

The Agency requests that this statement be removed because it is unknown how many eels exist upstream of the TransCanada projects. This statement also suggests that if eel numbers are already low, then TransCanada could have more of an impact on their population.

As stated above, sampling efforts will likely underestimate the distribution and abundance of the eels because the scope is limited to the mainstem of the Connecticut River. This should be accounted for in the analysis.

The Agency does not agree with section B as described below.

<b><i>A. Include potential American eel observations noted during Study 17 in the information and assessments presented within Study 20</i></b>		
	Revise Study Plan to reflect that observations	SP Revised.

	and timing from Study # 17 will be documented in Study 20	Included study 18 – upstream eel passage, study 17 – resident species upstream passage (may have incidental eels) and study 11 – eel survey.
<b><i>B. Consider extending scope of the study into the tributaries of the CT River.</i></b>		
	TC does not intend to expand the geographic scope of this study to include an assessment of American eel in tributary waters. TC considers this expansion to be a request to perform species management analyses rather than a study to determine the effect of project operations on American eel migration timing.	No change in the plan.
<b><i>C. Revise the study plan objectives and goals when stating that because so few eels were captured above the dam state “in the mainstem” because there may be many eels in tributaries and lakes.</i></b>		
	Clarify this in the study plan	SP Revised.

### **Study 21: American Shad Telemetry Study – Vernon:**

The goals of this study are to 1) characterize the potential effects from project operations on behavior, approach routes, passage success, survival, and residency time by adult American shad as they encounter the Vernon Project during both upstream and downstream migrations; and 2) characterize whether if project operations affect American shad spawning site use and availability, spawning habitat quantity and quality, and spawning activity in the river reaches downstream and upstream of Vernon dam and in the area downstream of the Bellows Falls Project.

In the licensee’s revised study plan in the Method Section (pg. 201) states, “Tagged shad will be manually tracked and spawning areas located.” It does not state as to what frequency tracking in the area between Vernon and Bellows Falls will occur. The Agency recommends that the methods and frequency of tracking be consistent with previous study approaches used by Conte Laboratory which will be beneficial in the additional review of study data from 2011 and 2012, as noted.

The Agency requests that tagged individuals be selected from the early, middle and late part of the run to fully represent the breadth of the run. Incorporating mortality add-ons would provide more conclusive results related to the project’s impacts on survival.

As noted, it is expected that FirstLight and TransCanada will coordinate so radio tag study fish, will share radio tag frequencies, code sets, and codes. The Agency requests that fish be tagged below Turners Falls and be allowed to proceed upstream as they would naturally. This will give the Agency a better idea of the condition that these fish are in and experience as they migrate upstream through the projects.

In order to determine if Bellows Falls operations are affecting American shad spawning site use and availability, spawning habitat quantity and quality, and spawning activity downstream of the Bellows Falls Project the Agency requests that stationary receivers be deployed between the lower Vernon impoundment and Bellows Falls Project.

The Agency is in agreement with the changes to the revised study plan as described below.

<b><i>A. In SP identify what the goal and differences this study contains versus the Study in 2012 conducted by USGS with TC support. Identify why we believe the 2012 data that has not yet been processed, used with the results of this study may provide a good picture of Shad movement up to Vernon and through Vernon and in particular the near-field behavior monitored in this study.</i></b>		
	Revise Study Plan	SP Revised.
<b><i>B. What is the number of tagged shad necessary to reduce signal collisions? Is there a maximum? By releases groups or by total? Consider with respect to early, mid, and late season spawners.</i></b>		
	Examine options for accommodating this. Revise Study Plan if necessary	SP revised as proposed here:  We feel that 60 tags may provide a better balance between numbers and signal collisions. The draft SP was for 40 tags, agencies had suggested 100.  SP revised for timing (see E below).
<b><i>C. Conservatively, TC should not count on radio tagged shad from Vernon (from Bob Stira of FL).</i></b>		
	Not a critical element in TC's study, but duly noted.	No change in plan.
<b><i>D. Better describe and illustrate the telemetry layout;, receivers locations, tracking coverage areas, fish ladder wiring and monitoring locations – both up and downstream. Identify all fixed receiver sights below Vernon, at Vernon and upstream of Vernon.</i></b>		
	Revise Study Plan	SP Revised.  Figures added to plan and clarified in the SP.
<b><i>E. Study should be designed to reflect the entire shad run. Collecting and releasing shad from the early, middle and late run. Timing and breadth of the run should be captured.</i></b>  <b><i>Potential data points to assess these periods include: historical returns - data and trends; real-time monitoring or actual counts at Holyoke; real-time temperature monitoring (First Light? and TC or Holyoke); good and active communication between TC and fishery agencies.</i></b>		
	Will consider and revise Study Plan as needed.	SP revised as proposed here:  Unless 2012 data (when analyzed)

		<p>indicates otherwise, we expect to tag 1/3, 1/3 and 1/3 in early, mid and late season, respectively.</p> <p>Consultation/communication with agencies is already part of the SP.</p>
<b><i>F. Consider Mortality Tags vs. what we are proposing.</i></b>		
	Will consider and revise Study Plan as needed.	If in agreement SP will be revised..
<b><i>G. Provide better clarity, process, consultation and decision making associated with reviewing 2012 and possibly 2011 USGS study data to determine ultimately the final # of tags, monitoring locations, source of fish and release points.</i></b>		
	<ol style="list-style-type: none"> <li>1. Better delineate the steps and time table</li> <li>2. Propose criteria for decision making – this might be modified in the final SP following additional consultation (could add a comment in the revision to that effect)</li> <li>3. Revise Study Plan</li> </ol>	<p>SP Revised.</p> <p>Expanded section on 2012 data review, including consultation after 2012 data is analyzed.</p>
<b><i>H. Include elements to better assess the impact on shad migration potentially caused by the Bellows Falls operation – both movement and spawning. Consider multiple fixed receiver locations below Bellows Falls.</i></b>		
	Will consider and revise Study Plan as needed.	<p>SP Revised.</p> <p>Added one monitor in Bellows Falls bypassed reach and one monitor in the Bellows Falls tailwaters - see Figure 21-2.</p>
<b><i>I. Numbers of radio tagged fish released as “late season” representatives may need to be greater than numbers of the previous early and middle representative fish due to inherent late season mortality or fatigue in order to capture a reasonable sample population size to observe.</i></b>		
	Will consider and revise Study Plan as needed.	<p>SP revised as proposed here (same as E above):</p> <p>Unless 2012 data (when analyzed) indicates otherwise, we expect to tag 1/3, 1/3 and 1/3 in early, mid and late season, respectively.</p> <p>The increased number of fish proposed (in B above) should alleviate this concern.</p>
<b><i>J.</i></b>		
<b><i>a. If we use Holyoke fish and release them or some of them above TF would we be able to detect their potential downstream movement at TF?</i></b>		
<b><i>b. Describe in the SP how we could coordinate and share tag specifications: tag codes, pulse</i></b>		

<b><i>rates, frequencies, receivers with FL to reduce signal collision and expand tracking network and numbers of overall tagged fish for both studies.</i></b>		
<b><i>c. Is there any value in releasing a portion of the fish into the canal or below TF as well as above TF?</i></b>		
	Will consider and revise Study Plan as needed.	<p>No changes in SP at this time.</p> <p>a. TC and FirstLight would each be able to detect those fish within their respective studies.</p> <p>b. Sharing of info/tracking is included in the SP. However, it is too early for detailed discussions with FL on how that will happen, but both companies have agreed in principle to share information.</p> <p>c. For purposes of TC’s study there is no value in this request, this should be requested of FL for their studies.</p>
<b><i>K. Consider adding language in the SP with respect to criteria or reasons that would warrant repeating all or portions of Study #21 in a second season.</i></b>		
	Will consider and revise Study Plan as needed.	<p>No changes in SP at this time.</p> <p>We feel that a single study year is sufficient. An additional study year would be subject to FERC’s review of the year 1 study results.</p>

### **Study 22: Downstream Migration of Juvenile American Shad – Vernon:**

The study goal is to determine whether project operations affect juvenile American shad outmigration, survival, production, and recruitment. The specific objectives of this study are to 1) assess project operation effects on the timing, route selection, migration rates, and survival of juvenile shad migrating past the project; 2) characterize the proportion of juvenile shad using all possible passage routes at Vernon over the period of downstream migration under normal operational conditions; and 3) conduct controlled turbine passage survival tests for juvenile shad passed through one of the older Francis units (Unit Nos. 1 - 4) and one of the new Kaplan units (Unit Nos. 5 - 8) to estimate the relative survival specific to those unit types.

In order to gain a better understanding of fish movement patterns with respect to seasonality, flow conditions, and temperature conditions, the Agency requests that hydroacoustic assessment technology be employed. The use of hydroacoustics in the forebay will provide a more accurate picture of the timing, duration, and magnitude of juvenile shad migration through the Vernon project as well as assess the timing and duration of other migrator species such as American eels.

### **Study 23: Fish Impingement, Entrainment, and Survival Study:**

The goal of this study is to assess the adequacy of the intakes at the projects to minimize fish mortality resulting from impingement and entrainment of fishes residing in the Connecticut River. The objectives of the study will be accomplished through desktop analysis, not through field study as requested by other entities. As stated in the project nexus, this study will provide data to establish a baseline condition to assist in evaluating entrainment and impingement potential and the expected survival of those fish at each of the projects. However, the Agency feels that a desktop analysis alone would not provide the information needed to calculate the above. The Agency requests that in addition to the desktop analysis, estimates be ground-truthed by obtaining a sub-set of the actual numbers impinged or entrained. This would insure the study results would be more conclusive.

### **Study 24: Dwarf Wedgemussel and Co-occurring Mussel Study**

The proposed study plan largely meets the Agency's requirements and we have no further comments. The Agency will work with the licensee as proposed in the revised study plan after the Phase 1 portion of the study is completed to further develop the study design.

### **Study 25: Dragonfly and Damselfly Inventory and Assessment**

The Agency requested a study on the effects of water level fluctuations from project operations on odonate species of greatest conservation need. The licensee's proposed study plan does not indicate at what water level the field surveys will be conducted. The Agency request that field surveys be standardized to the extent possible as the level of the impoundment or generation flows could greatly affect the survey. The Agency recommends that the impoundment elevation or project flows be recorded at the beginning and end of the each survey. Additionally the study plan should be clarified to indicate that height or elevation of each alarvae, tenerals, and exuviae found will correspond to the impoundment operation elevations.

### **Study 26: Cobblestone and Puritan Tiger Beetle Survey**

The licensee has incorporated many of the Agency's comments into the proposed study plan and it largely meets the Agency's requirements and we have no further comments.

### **Study 27: Floodplain, Wetland, Riparian, and Littoral Habitats Study**

The proposed study plan largely meets the Agency's requirements and we have no further comments.

### **Study 28: Fowler's Toad Study**

The Agency study request for the Fowler's toad survey recommended that the study include wet road searches and wildlife acoustic recorder to increase the likelihood of detecting toads. TransCanada study proposal does not include the use of wet road searches and only will use wildlife acoustic recorders depending on the habitat available. The Agency request that TransCanada use wet road surveys because it allows you to find Fowler's Toads outside of their brief breeding period and away from the breeding pools. This will greatly expand your time-search window and allows you to find toads in their terrestrial habitat away from breeding pools and may provide useful information that would lead to the discovery of alternative or unexpected breeding and foraging habitat within the project boundary. Small roads within the floodplain and within a mile of the river could be targeted.

Additionally, the Agency continues to recommend that TransCanada use wildlife acoustic recorders. Using acoustic wildlife recorders would allow for continual gathering of call data from a handful of the most promising locales without requiring the presence of observers, increasing the likelihood of detection of breeding sites during the brief breeding period. Furthermore, predicting when weather conditions will be right for breeding is difficult, therefore relying on the three call surveys conducted in late May through July will not be adequate and using the acoustic wildlife recorders would increase the likelihood of detection.

### **Study 29: Northeastern Bulrush Survey**

The licensee has incorporated many of the Agency's comments into the proposed study plan largely meets the Agency's requirements and we have no further comments.

### **Study 30: Recreation Facility Inventory, Use and Needs Assessment**

The goal of the Agency's study request for recreational survey and enhancement is to identify opportunities for improving recreational opportunities at project facilities and on project lands, including new or improved recreational facilities and changes in project operations. TransCanada's proposed study plan includes an inventory at recreational facilities currently available to users to evaluate the site conditions and ability to meet the recreational demand, and to identify any impediments to recreational users. Additionally, TransCanada is purposing to conduct recreational user surveys and site inventory evaluations between May 1 and September 30 with survey of users ending around October 15. The Agency concern is that by ending the study at the end of September the study will not include any comments from the winter recreationalist that ice fish, cross country skiing, snowshoe, or snowmobile. Furthermore, the site evaluation form should indicate if the recreational facility is maintained on a regular basis in the winter months, as a major impediment to winter recreationalist could be lack of access to unplowed facilities.

The Agency has the following comments on the attached forms that were submitted with the proposed study plan.

- Attachment 30-D: On-Site Intercept Survey - Question 17: The Agency request that TransCanada include winter activities such as ice fishing, snowmobiling, cross country skiing, and snowshoeing in the list of activities.
- Attachment 30-D: On-Site Intercept Survey – Question 24: The Agency request that TransCanada modify or include an additional question that ask the recreationalist if their recreational experience had ever been effected by fluctuation in water levels at either the Wilder, Bellows Falls, or Vernon reservoirs or downstream of the projects.
- Attachment 30-E: Potential Visitor Questionnaire: Section 1 Mail/Internet Survey – Question 6: This question request that a recreationalist select only the primary season (Winter, Spring, Summer, and Fall) which the person recreates on the Wilder, Bellows Falls, or Vernon reservoir or downstream of the projects. This question should be reworded so that a recreationalist can select any season that they recreate in the vicinity of the projects. The Agency’s concern is that multi-seasonal recreationalist will not be captured in the survey.
- Attachment 30-E: Potential Visitor Questionnaire: Section 2 Mail/Internet Survey – Question 24: The Agency request that TransCanada include winter activities such as ice fishing, snowmobiling, cross country skiing, and snowshoeing in the list of activities.

### **Study 31: Whitewater Boating Flow Assessment – Bellows and Sumner Falls**

No comments.

### **Study 32: Bellows Falls Aesthetics Flow Study**

The licensee has incorporated many of the Agency’s comments into the revised study plan, and it largely meets the Agency’s requirements and we have no further comments. The licensee should incorporate the Agency’s input as it refines and selects the observation point for the study.

### **Comments on Study Request Not Accepted:**

#### **Climate Change Study**

The Agency requested a study on climate change. TransCanada did not develop a study plan for this request. It is already clear that climate change is affecting weather patterns in Vermont and elsewhere as identified by Betts (2011). One of the effects is an increased frequency and magnitude of extreme weather, such as dry spells or heavy rain events. This is resulting in a change in the hydrology of our rivers and streams. We should expect to see more severe low flow events, possibly with increased frequency and duration. The same thing should be expected concerning high flows. Overall, conditions will also be more erratic.



Since the Vernon, Bellows Falls and Wilder hydropower projects regulate the flow of the Connecticut River, their future operation will not be the same as it has been in the past. Even if precipitation increases, their ability to generate may decrease, both as a result of more low flow conditions and as a result of more high flow conditions when the projects must drop the headpond elevations to manage flood conditions.

Both situations also affect the ability of the projects to provide environmental flows and to meet objectives for relatively stable impoundment levels. Furthermore, the US Department of Energy report on *Effects of Climate Change on Energy Production and Use in the United States* (2008) identified these as potential impacts from hydroelectric projects as well as issues with temperature-related stresses, operational modification from extreme weather (floods/droughts), and the alteration of habitat for threatened and endangered species.

Operational modeling (Study 5) will be used to assess operating alternatives. However, this modeling is built on historic river gage records and historic operation of the projects, neither of which reflects future conditions. Modeling should include scenarios that are likely to be experienced during the upcoming license period.

A climate change prediction model should be used in conjunction with other information about Connecticut River hydrology to predict the future river flow regime. This regime can then be used in conjunction with the operations model to assess new operating regimes that include environmental measures.

#### **References:**

Betts, A.K. 2011. Vermont Climate Change Indicators. *Weather, Climate, and Society* 3: 106-115.

CCSP, 2007: *Effects of Climate Change on Energy Production and Use in the United States*. A Report by the U.S. Climate Change Science Program and the subcommittee on Global Change Research. [Thomas J. Wilbanks, Vatsal Bhatt, Daniel E. Bilello, Stanley R. Bull, James Ekmann, William C. Horak, Y. Joe Huang, Mark D. Levine, Michael J. Sale, David K. Schmalzer, and Michael J. Scott (eds.)]. Department of Energy, Office of Biological & Environmental Research, Washington, DC., USA, 160 pp.

## **Attachment B**

### **VANR Comments on FirstLight Proposed Study Plan**

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

The goal of this study is to identify and assess potential locations for upstream American eel passage at the Turners Falls Project.

According to the Updated Proposed Study Plan dated June 28, 2013 systematic surveys of eel presence and relative abundance will be conducted 10-12 times during the 2014 eel upstream migratory season. The first survey will be initiated within one week of eels being observed downstream of the project area at the Holyoke eel pass, with subsequent surveys occurring at night after precipitation events throughout the 2014 migration season. The study plan should clarify an end date for the surveys.

According to Murphy and Willis (1996) systematic surveys are conducted by selecting sampling units and or events at regular intervals. For example, TransCanada is proposing to conduct visual surveys at night, once per week, downstream of each dam on foot (wading) or from a boat from May 1 through October 15 (or when water temperature exceeds 50°F). This sampling regime more closely reflects the definition of systematic and should be considered. Please clarify how this study meets the definition of systematic, as surveying after precipitation events is more impromptu rather than systematic.

Recorded data will include location, observation of eels (presence, absence) and relative numbers, relative sizes, behaviors, and time/date of observation, recent weather, and current discharge. Please clarify what it is meant by relative, as the term estimated might be more appropriate.

In addition to visual surveys the Agency requests that eel pot trapping be conducted to gain a better understanding of eel numbers and sizes. Data collected should include location, number captured (or recorded as none captured), estimated sizes, and time and date of observation. Each eel should be assigned a length class (0 to 6 inches, 6 to 12 inches, 12 to 18 inches, and >18 inches). The first 10 individuals within each length class should be individually measured for total length (nearest mm) and wet weight (nearest gram). The first 10 individual eels in the >18-inch length class should also have eye diameter measurements recorded. To facilitate collection of length and weight data as well as prevent unnecessary injuries to the eels, it may be necessary to anesthetize individuals using an appropriate anesthetic for the species (i.e., ice, clove oil, or MS-222).

Murphy, B. R., and D. W. Willis, editors. 1996. Fisheries techniques, second edition. American Fisheries Society, Bethesda, Maryland. 732 pages.

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

In order to determine the impacts that project operations have on shad spawning the Agency requests that shad eggs be sampled in randomly selected areas after observed spawning events. As stated in the updated study plan ichthyoplankton nets will be deployed downstream of suspected spawning areas that may potentially become dewatered. However, dewatering is only one factor that could potentially affect spawning success (e.g. sedimentation could also impact spawning success). Therefore, the Agency requests that eggs also be randomly collected to quantify viability, and to represent a range of conditions that could potentially hinder success. Density of eggs collected per sample should be determined by enumerating a sub-sample and relating that to volume of water filtered. Spawning activity and fervor should be described subjectively and relatively to other spawning activities observed. Factors affecting egg collection, i.e. water turbulence, high velocities, shallow depth, should be noted. In order to gauge the effects of project operations on shad spawning, collected data should be analyzed and compared to project operational data. The times and dates of all observed spawning activities, substrate description, water measurements (i.e., velocity, temperature, dissolved oxygen, pH, conductivity, and turbidity), and observational characteristics or anomalies (e.g., extensive water roiling or turbulence) should be recorded and related to the operational data.

Observed effects of the projects should be classified per operational regime observations: 1. no effect –no observable effect on spawning, viable eggs were collected; 2. moderate effect – observable possible effect on normal spawning activity; spawning may have been hindered but viable eggs were collected; and 3. adverse effect – project operations likely to have prevented successful spawning of shad; no viable eggs collected.

### *3.3.7 Fish Entrainment and Turbine Passage Mortality Study*

The goal of this study is to assess fish impingement, turbine entrainment, and turbine passage survival at the two Projects. The requestors proposed that a field study be conducted to assess fish entrainment from the Connecticut River at the Northfield Mountain Project. In addition to the desktop analysis as described in the proposed study plan, the Agency requests that estimates be ground-truthed by obtaining a sub-set of the actual numbers impinged or entrained. Results would then be more conclusive.

### *3.3.11 Fish Assemblage Assessment*

The goal of this study is to provide baseline information pertaining to the fish assemblage structure within the study area. Specific objectives include to:

- Document species occurrence, distribution, and relative abundance of resident and diadromous fish within the project area along spatial and temporal gradients.

- Describe the distribution of resident and diadromous fish species within reaches of the river and in relationship to habitat.
- Compare historical records of fish species occurrence in the project area to results of this study.

*Methodology:*

The study area will be divided into stations based on habitat type; multiple methods of fish capture will be used in each station. Please describe the habitat types, the spatial extent of each station, whether or not stations will be continuous or non-continuous within the study area, how many samples will be collected with each gear type, how the sample locations will be selected in each station, and whether or not all gear types will be used in each station.

*Task 1: Sampling Location Selection*

The licensee states that prior to field sampling, stations to be sampled will be selected to ensure all habitat types are adequately represented. Alternative sampling locations will also be identified by habitat in case a selected sampling station is inaccessible.

However, on page 3-178 the licensee states that the proposed study will include a statistically rigorous and comprehensive stratified-random design similar to what has been used successfully on large rivers a high degree of spatial heterogeneity. Please clarify how the study design will accomplish this. Employing a stratified-random sample design ultimately removes bias from the collected data, allows for clear interpretation of results, and provides the best information for making decisions. To capture the spatio-temporal variability, sites/samples should be stratified by habitat type, depth of water, day or night (or time of day), as well as distance from the dam, and season (spring, summer fall).

The study area will be divided into stations based on habitat type; multiple methods of fish capture will be used in each station. Selected locations within each station will be sampled during the early summer and again in the fall. At least 18 stations will be sampled during each sampling event. Early summer sampling will be performed when spawning anadromous species are present; fall sampling will be performed when most juvenile fish are large enough to sample. The Agency requests that sampling be conducted spring (April-June), summer (July-August), and fall (September-October), in order to capture the temporal variability (i.e. fishes occupy different habitats during different seasons).

Proposed methods include boat electrofishing (shoreline and littoral habitat), gill nets (deeper, benthic areas), and seine net (wadeable shoreline and littoral habitat). The licensee should also consider employing a benthic trawl in order to actively (vs. passively) target deep water benthic habitat.

Fish assemblage studies typically employ a multi-gear approach as referenced in Bonar, S. A., W. A. Hubert, and D. W. Willis, editors. 2009. Standard methods for sampling North American freshwater fishes. American Fisheries Society, Bethesda, Maryland. 335 pages.

The Agency recommends that sampling methodologies are consistent with the American Fisheries Society national standards as referenced above.

### *Task 2: Fish Capture*

Please specify if electrofishing will occur during the day or night. The Agency recommends a combination of both in order to capture fishes that move inshore during the night (e.g. bass).

The licensee is proposing that gill nets will be set in selected locations and allowed to fish for 24 hours prior to retrieval. Due to high mortality associated with a 24-hour soak time, the Agency recommends that sets be limited to two hour duration.

### *3.3.13 Impacts of the Turners Falls Project and Northfield Mountain Project on Littoral Zone Fish Habitat and Spawning Habitat*

The goal of this study is to collect information in order to determine if project operations negatively impact fish species so that appropriate mitigation measures may be developed, if warranted, to protect and conserve the species utilizing project waters. Specific objective of this study are to 1) assess timing and location of fish spawning in the littoral zone, 2) delineate, qualitatively describe (e.g. substrate composition, vegetation type and relative abundance), and map shallow water habitat types subject to inundation and exposure due to project operations, evaluate potential impacts of impoundment fluctuation on nest abandonment, spawning fish displacement and egg dewatering. However, it is well known that the widened impoundments due to the dams replace riverine (lotic) habitats with a lake-like (lentic) environment. These impoundments serve as repositories for silt and sediments that cover natural gravel substrate that serve as spawning and habitats. Therefore, the Agency is requesting that the study investigate sedimentation, or the amount of fines within a nest (in addition to nest abandonment, spawning fish displacement, and egg dewatering) as a potential negative impact due to the project's impoundments.

In addition to visual surveys, the Agency requests that the licensee deploy egg traps in order to assist in the identification of spawning sites for species such as walleye and white sucker; two riverine fish species which broadcast spawn their eggs. Egg traps should be constructed of standard 8x16 inch concrete blocks wrapped in hog's hair synthetic filter media that forms an ideal surface to collect the broadcasted white sucker and walleye eggs. Egg traps should also be set in some of the lower tributaries with the proper habitat that are influenced by project operations to attempt to locate their spawning sites.

The Agency requests that data on the depth of the nesting site, fish species, water quality data (temperature, DO, pH, conductivity, and turbidity) and habitat type (i.e., aquatic weed bed, gravel bar) be recorded. Water level recorders should also be employed to facilitate determining the effects of project operations on spawning of target resident fish species.

### *3.3.14 Aquatic Habitat Mapping of Turners Falls Impoundment*

Due to the higher turbidity in the lower river, the Agency requests that habitat data be collected using a side scan sonar system, and then validated via ponar dredge or through use of a sediment probe to generally classify substrates.

In order to quantify the composition of substrates collected from the ponar grab, the Agency recommends that samples be brought back to the lab for further analysis. Percent composition by weight using the modified Wentworth scale would provide additional information on the aquatic benthic habitat, and would not require much more effort.

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

The goal of this study is to determine the impacts that operations of the Turners Falls Project and Northfield Mountain Project may have on sea lamprey spawning activity. One of the objectives of the study is to collect the information to assess whether operations of the Turners Falls Project and Northfield Mountain Project are adversely affecting spawning areas (*i.e.*, if flow alterations are causing dewatering and scouring of lamprey spawning area).

As identified in Vermont's Wildlife Action Plan (Kart et al. 2005), one of the threats identified is degraded spawning habitat due to sedimentation. Recording percent embeddedness would ascertain if sedimentation is having an impact on survival to emergence and should be included in the analysis. The Brusven Index describes sediment size and percent embeddedness using a three digit number. The number in the 10s place is the largest materials in the sample termed the dominant particle size. The figure in the ones place represents the material surrounding the dominant particles and the decimal place is used to describe the percent embeddedness (fines). These are standard methods for salmonid redd surveys (Gallagher 2007).

See Gallagher, S.P, P.K. Hahn, and D.H. Johnson. 2007. Redd Counts. Pages 197–234 in D.H. Johnson, B.M. Shrier, J.S. O'Neal, J.A. Knutzen, X.Augerot, T.A. O'Neil, and T.N. Pearsons. Salmonid field protocols handbook: techniques for assessing status and trends in salmon and trout populations. American Fisheries Society, Bethesda, Maryland.

In order to identify specific lamprey spawning sites within the study area, and observe spawning activity of lamprey, the Agency requests that a minimum of 30 lamprey be radio tagged and tracked to spawning locations. All redds should be enumerated and a sub-sample of redds (to include as much habitat variability as possible) should be chosen to monitor daily. Environmental variables including water velocity, depth, temperature, exposure, and relative condition of redds/area will be measured; and the grounds photographed if possible, over the range of normal project discharges in order to characterize operational effects.

The Agency requests that success of spawning by sea lamprey within the project-affected areas be characterized by emergence of larvae from capped redds, if larvae emerge, spawning was successful. If eggs do not hatch, and no larvae emerge, spawning was not successful. Emerging

larvae should be enumerated and timing of emergence relative to redd construction will be documented. Redds should be characterized as to location, range and average depth, general surrounding substrate, and range and average water velocity.

Effects of the projects will be classified per operational regime observed as:

- 1) No effect - no observable difference to habitat/redd structure or lamprey activity – successful spawning documented.
- 2) Moderate effect – observable difference to habitat/redd structure and/or behavior noticeable but not enough
- 3) Large effect – observable structural differences to habitat/redds and observable decreased spawning activity – minimal to no successful spawning documented.
- 4) Severe effect – noticeable habitat/redd degradation, i.e. de-watered, scoured out, and conditions, depth, water velocity, preclude normal spawning activity – no successful spawning documented.

### *3.3.17 Assess the Impacts of Project Operations of the Turners Falls Project and Northfield Mountain Project on Tributary and Backwater Area Access and Habitat*

The goals of this study are to determine if water level fluctuations from the Turners Falls and Northfield Mountain Projects result in reductions of available aquatic habitat due to movement barriers and/or habitat alterations.

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

The licensee states that common tools to evaluate water level impacts may be used including: bathymetric mapping; habitat measurements (*e.g.*, substrate, depth and velocity), and water quality information (*e.g.*, dissolved oxygen, temperature, turbidity, and pH). Other methods (river bed surveys, visual inspections, GIS/GPS mapping, and hydraulic/habitat modeling) will also be utilized.

The Agency requests that water level recorders (pressure transducers) be employed to determine if water level fluctuations from project operations cause impediments to fish movement into and out of tributaries within the project-affected areas. If the water level drops to 1 foot or less water depth during low impoundment water levels, it should be assumed that movement is impeded. Water level recorders should be placed in tributary areas and operate for an entire year to collect hourly depth changes and water temperature. Additional water quality data should be collected in these areas (temperature, DO, pH, conductivity, and turbidity) if it is found that access to the main river is impeded.

Utilizing pressure transducers in addition to the methods described would provide more conclusive results.

Document Content(s)

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