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

RE: Wilder, Bellows Falls, and Vernon Hydroelectric Projects (FERC P-1892, P-1855, & P-1904)
Comments on Updated Study Reports and Request for Additional Study

Dear Secretary Bose,

The Vermont Agency of Natural Resources (Agency) herein provides comments on the updated study report filed by TransCanada Hydro Northeast, Inc. (TransCanada) for the Wilder (FERC No. 1892), Bellows Falls (FERC No. 1855), and Vernon (FERC No. 1904) hydroelectric projects.

TransCanada filed an updated study report with the Federal Energy Regulatory Commission (FERC) for the lower Connecticut River hydroelectric projects on March 1, 2016. This filing was followed by two meetings on March 17 and 18, 2016. A summary of the meetings was filed on March 31, 2016. After review of the filings and participation in the meetings, the Agency offers the following comments on the updated study report. Considering that many of the final study reports have not yet been filed, these comments focus on the reports that have been filed to date, incomplete study objectives that remain after completion of the 2015 study season, and additional information needed to certify that operation of the hydroelectric project will meet Vermont Water Quality Standards. In light of the need for critical information necessary to make future decisions on operations of the hydroelectric projects, the Agency encloses a request for amendments to the study plan as an attachment to this comment letter.

Comments on Final Study Reports

Study 1 – Historical Riverbank Position and Erosion

Section specific comments:

- Appendix B – Appendix B presents comparisons of historical and 2015 ground photographs. The Appendix identifies the locations on a topographic map, but does not detail how the locations were documented in the historic record and how the 2015 work ensured the photos captured the same location.
    - Please detail the procedures for matching previous photos to locations in the field. Please describe procedures used to ensure the 2015 photographs captured the historic site.
- Appendix B – Many of the historic photos appear to be taken soon after ice out, while the 2015 photos appear to be taken further into the growing season. Photos taken later in the growing season have the potential to obscure the comparisons, as the amount of vegetation increases through the growing season.
    - Where available, the dates of the photos should be included. Where not available, the lack of a known date should be included.
- Appendix D – Appendix D presents digitized river banks for four periods, 1939, 1955, 1970, and 2010.

- Are these four line files included with the geospatial data associated with the report? If not, could they be made available to stakeholders?

Study 4 – Hydraulic Modeling

The goal of this study was to develop a hydraulic model that would simulate routing of river flow on the mainstem of the Connecticut River for the three project impoundments (Wilder, Bellows Falls, and Vernon) and associated riverine sections downstream of each project dam. Specific Objectives include providing information about the relationships between hydraulic variables such as water levels and flows throughout the project impoundments and affected downstream reaches, as well as information regarding specific relationships at econodes of interest to the Operations Modeling Study.

Section specific comments

- 4.1.4 Expansion and Contraction Coefficients (p. 7) – The report states, "Coefficients of contraction and expansion of 0.1 and 0.3, respectively, were assigned to cross sections for this study. These values, the model defaults, are appropriate for the flow conditions observed in the Connecticut River".
  - Please provide additional detail that describes why these coefficients are appropriate for the Connecticut River.

- Table 4-6 Hydraulic Model Calibration Periods – The project reaches and hydrologic conditions (operations vs. spill) use different periods for calibration.
  - Please describe how the time periods for calibration were chosen.

- 5.1. Model Calibration and Validation – Model calibration was performed using data recorded at active USGS gages, level loggers deployed in 2014 for Study 2, and level logger data available from FirstLight. Gage and logger data for two observed flow events (operations and spill) were compared with results from the hydraulic model.
  - Please describe the calibration process in more detail. Was the HEC-RAS model simply compared to observed values or were modifications made to the model for the output to better fit the observed data? If modifications were made, please describe this process. What was considered an acceptable amount of error in the calibration process?

- Table 5-2. Velocity Comparison – The report states, "the simulated velocities compare very favorably with the observed data."
  - In general, the Agency agrees with this statement. However, the Agency notes that at location 'WR1-3' the modeled velocity exceeded the observed velocity by approximately 50%. What drove the discrepancy in modeled output from observed velocity in this reach?

- 6.0 Assessment of Project Effects (p.34) – The report states, "the rating curves allowed for an initial screening of project effects on resources by comparing the various resource-critical flows and water surface elevations noted in the field with modeled flows and water surface elevations. For cases where potential effects were unlikely, no further analysis of the resource would be warranted since project operations were identified as having little or no effect."
  - Please provide detail in each in each study report of how the initial screening of project effects occurs and provide a clear justification for determinations that "potential effects were unlikely" and not deserving of further analysis. The Agency does not necessarily disagree with the concept of an a priori exclusion of resources where it can be determined with certainty that a resource is not affected by project operations, but these determinations should be conservative. Conversely, determinations that "potential effects are unlikely" has the potential to exclude impacts on resources. Resource agencies will need to understand the degree to which impacts are "unlikely" to support the initial screening of project effects. Similarly, it may not be warranted to exclude resources where project operations have "little effect". Over the geographic scope of the project area "little effects" have the potential to represent a significant cumulative impact. Where further analysis did not occur due to determinations

of "little effect", resource agencies will need to understand the magnitude and frequency of these impacts.

Study 6 – Water Quality Monitoring

The primary goals of the study were to: characterize and describe the water quality throughout the study area; determine potential effects of the projects on the water quality parameters of water temperature, dissolved oxygen (DO), conductivity, turbidity, pH, nutrients, and chlorophyll-a; and determine whether the Connecticut River within the project-affected areas is in compliance with state surface water quality standards.

Section specific comments:

- Table 4.2-1. Correction Criteria – The table describes the criteria, which would result in the data needing to be corrected.
    - Please describe when the data meets the criteria for a correction, how the value of the correction is determined and how the correction is then applied to the data.

- Table 4.2.2 Calibration Methods, Solutions and Frequency
    - Were test solutions employed post calibration?
    - The conductivity standard in footnote 2 does not match the standard listed in the table.

- Table 5.1-3. Mean daily flow during the high temperature low flow monitoring period
    - Continuous data collection took place on a period longer than the 10 days listed in the table, please describe how the appropriate10 day high temperature, low flow window was selected.

- Figure 5.2.2-1. The figures present the continuous water temperature for each station across the period of study.
    - With the stations broken out on separate figures and spread along the whole season, it is hard to infer change from station to station and infer the magnitude of change. The Agency recommends overlaying each station on the same graph and separating the figures by month. For example, there would be one graph for May and all stations would be included on that graph. The Agency also recommends including project discharge on these graphs to provide some perspective on how project operations affect water quality parameters. This specific figure is for the Wilder project, but the comment applies to all three projects.

- 5.2.3 Bellow Fall Project (p. 53) – The report states, the greatest amount of warming through the impoundment occurred during the month of August.
    - However, Table 5.4-2 shows that largest increase in water temperature from the uppermost Bellows Falls impoundment station to the tailrace occurring in May, when water temperature increased by four degrees on a weekly mean basis. Please discuss.

- Table 5.4.2 Weekly Mean Temperature – One of the primary goals of the study is to, "determine potential effects of the projects on water quality parameters of water temperature, dissolved oxygen (DO), conductivity, turbidity, pH, nutrients, and chlorophyll-a". Due to the peaking nature of the projects when data is presented by either daily mean or weekly mean, the effect of project operations on water quality parameters is completely obscured. Any table that aggregates and averages data over a time period should also break out periods of peaking operations from minimum flow periods in order to meet the objectives of the study.

- Table 5.5.2 Vermont Water Quality Standards – The report states, "The surface water quality standard for water temperature states the change or rate of change either upward or downward shall not exceed 1.0°F (0.56°C) from ambient temperatures." The report then describes changes in temperature on a weekly mean basis.
    - While the Agency appreciates the complexity of the temperature dynamics of water moving through the project impoundments. In issuing a water quality certification for the project, the Agency must

determine whether project operations comply with Vermont Water Quality Standards. Given weekly mean temperature obscures the effect of operations on water temperature, it is not clear that weekly mean temperature is a useful metric to assess compliance with Vermont Water Quality Standards. The Agency would strongly recommend comparing water quality parameters between operational scenarios (i.e. peaking vs. minimum flow operations).

Study 10 – Fish Assemblage

General Comment: It would be helpful to present the data in graphical form in addition to table form. For example, a pie graph of percent composition of total catch; relationships of diversity and habitat type; diversity and reach; diversity and season; CPUA and season; and CPUE and depth and velocity.

Section specific comments:

- Study Area (Page 3) - The report it states, "The upstream extent of sampling within a tributary was determined by the ability of available gear types to effectively sample the habitat as well as visual observations made by the field crew at the time of sampling to identify the apparent upper bound of the project-affected portion of the tributary".
    - Please describe in detail how the project affected portion of the tributary was determined in the field. For example, what characteristics were used to determine the project affected portion? Please clarify whether the upper bound of the project was mapped and whether that information was utilized field crews. If this data is available, please clarify where it can be accessed by stakeholders.

- Data Analysis (Page 22) - The report describes the calculation of Catch Per Unit Area as, "the estimated width of the effective electrical field."
    - Please define how the width of the effective electrical field was estimated and clarify if Catch Per Unit Area was calculated by sample or by gear type.

- Data Analysis (Table 4.2-2. Page 25) – There may be a typo in the table, where the heading of the third column from the left should be 'YOY'.

- Appendix E (Table E-1) – The table lists depth of sample. Please clarify whether this depth refers to the depth of the water quality sample or depth of the associated fish sample.

- Appendix E (Table E-2) – The table lists a column titled 'Vel. Depth'. Please clarify whether this column represents the depth at which a discrete velocity measurement was taken or whether this was the mean depth of a velocity profile.

Study 11 – American Eel Survey

The goal of the American Eel survey was to characterize the distribution of American eel in the project impoundments, riverine sections, and the project-influenced portions of tributaries upstream of Wilder, Bellows Falls, and Vernon dams; and characterize the relative abundance of American Eel in the project impoundments, riverine sections, and the project-influenced portions of tributaries upstream of the dams.

General Comment: Sampling consisted of a 500-m electrofish transect and a 24-hr baited eel trap set at 102 mainstem locations and the 24 major tributary locations. Although sampling effort was extensive and covered a wide geographic area, only three eels were captured. The Agency has concerns that these results are not truly representative of the distribution and abundance of eels in the project area. For example, boat mounted electrofishing was conducted along the shoreline (standard methods), which inevitably excludes the deeper habitats, and Appendix C indicated that the maximum depth of sampling efforts for both electrofishing and eel pots was 9 feet. Based on results of the Study 7, Aquatic Habitat Mapping, deep pools > 15 feet encompass 30% of aquatic habitat when averaged among all study reaches. It should also be noted that anglers have caught eels within the deeper habitats of the Connecticut River. In

addition, portable electrofishing was conducted during the day (variance from the study plan) which may have reduced catch rates.

Moreover, Study 17 Upstream Passage of Riverine Fish Species Assessment, also indicates that there are many more eel present in the system than was observed during the eel survey. As of November 23, 2015 a (net) total of 1551, 60, 52 eels passed upstream at Vernon, Bellows Falls and Wilder respectively. While it is assumed that some of these fish migrate into tributaries, the proportion of fish that rear outside of project affected areas is unknown.

Lastly, there are an estimated 6,398 miles of river and stream habitat in the Connecticut River watershed upstream of the Vernon Dam. Even at low densities, this quantity of habitat could produce a significant number of silver eels, all of which will have to move downstream through the project area to reach their spawning grounds.

Request: While in general, the Agency concurred with the sampling techniques, the report should acknowledge gear selectivity, limitations and biases when discussing the results. The Agency requests that the report acknowledge the limitations of sampling efforts and the likely bias towards shallow water habitats, which may result in an underestimate of the distribution and abundance of eels within the project area.

Study 18 – American Eel Upstream Passage Assessment

The goal of the American Eel Upstream Passage Assessment was 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. Specific objectives included systematic surveys to identify area of eel concentration and to deploy temporary eel trap passes from areas identified from the surveys at locations of eel concentrations to assess whether eels can be collected and passed in substantial numbers.

General Comment: The report incorporates data from Study 17 to document eel usage of the project fish ladders. The data is reported as a net number in which downstream usage is subtracted from upstream usage.

Request: The Agency recognizes the value of this approach in certain situations to avoid double counting fish and overinflating ladder usage, however this approach may not be appropriate in all circumstances. While the data from the fish ladder cannot be fully parsed until the final study report is filed, it appears from the materials presented to date, that there was distinct downstream usage by eel in the fall. Given the report is an assessment of upstream eel passage, the data from study 17 should be analyzed to determine if at some point during the year, eel began utilizing the fishway for downstream passage, that should mark the end of the upstream passage season and net upstream passage should be reported through that date. Subtracting distinct downstream usage from distinct upstream usage effectively under reports the degree to which eels used the fishway for upstream passage. The Agency also notes that inherent in fishway counts as done in study 17, the possibility exists for false negatives (fish using the ladder, but not observed through the observation window), which also serves to under report eel usage.

Section specific comments:

- Executive Summary – The report states, Of the eels observed, the greatest concentrations were observed in the fish ladders (Study 17) which operated continually throughout the study season as prescribed in the methods for that study.
    - The Agency concurs with this statement. Considering the number of eels documented using the fishway at each project to pass upstream was an order of magnitude greater than the number of eels observed in either the Eel Survey (Study 11) or in the systematic surveys employed in this study. The Agency recognizes the fishways at all three projects, while operating, represent aggregation points for American Eel.

- 5.0 Conclusions – The report states, "At Vernon, the attraction flows into the ladder appeared to greatly outweigh attraction flows at smaller leakages through or over the dam that would tend to produce more observations of eels attempting to cross a physical barrier by climbing across wet surfaces."

- The Agency notes the statement that "the attraction flows into the ladder appeared to greatly outweigh attraction flows at smaller leakages through or over the dam" is not applicable only to Vernon, but also to Bellow Falls and Wilder. Relative to the number of eels observed in the systematic surveys at Vernon (80), Bellows Falls (3), and Wilder (0), larger number of eels were documented utilizing the fishway for upstream passage at each project (net of1545, 60, 52 respectively). In addition, two of the eels observed during the systematic survey at Bellows Falls were observed by the fish ladder. These data indicate that the fishway at Vernon is not unique in its ability to attract eels attempting to pass the project. Rather eels are attracted to the fishway at each project when it is in operation, there are simply more eels below the Vernon project at this point in time.

- 5.0 Conclusions - The report states, "Had the ladder not been operating to pass resident fish (for Study 17) for the full duration of this study, it is possible that higher numbers of eels would have been detected and/or captured at other locations across Vernon dam."
  - While this comment was made in regards to the Vernon project, given that eels utilized the fishway at each project to pass when in operation, changes in ladder operation could result in larger numbers of eels congregating while attempting to pass each project. If the fishways were to not operate for resident species, where eels attempting to pass the project would congregate (objective 1) and whether they could be passed effectively (objective 2), remain open questions.

Need for Additional Information: Given that the final report for study 17 has not been filed, a determination cannot be made on year round operation of the fishway for resident and/or diadromous fish species under a new license at this time. To date, the upstream eel passage study has taken place under anomalous environmental conditions in which the hydraulics and flow dynamics below the projects have been altered by fishway operation. As such, resource agencies do not have the information needed to assess where eels congregate or determine if effective passage can be achieved in the absence of fishway operation.

At the updated study report meetings in March, TransCanada stated that they do not propose to operate the fishways beyond the normal date of July 15. TransCanada has also expressed that operation for resident fish may not be necessary under a new license. The Agency will refrain from making a determination on fishway operation for resident species until the results from Study 17 can be evaluated. However, given the usage of the fishways by eels, any alternative that does not involve fishway operation will need to include a means to pass eels safely and effectively. The Agency recommends using the upcoming season in which TransCanada has proposed to not operate the ladder during the summer months to evaluate eel congregation and passage under these conditions. Prior to the installation of any temporary eel trap passes, TransCanada should consult with the aquatics working group to seek to reach agreement on appropriate locations, design, operation, and attraction flow for the eel trap passes.

In order to obtain the information needed to inform upstream eel passage alternatives, the Agency has included a request to amend the study plan in an attachment to this comment letter.

Study 31 – Whitewater Boating Flow Assessment

General Comment: The travel time of flow releases from Wilder Dam are estimated to be about two hours in the study report.

Request: Given the precision of the hydraulic modelling performed in study 4, please quantify the travel time of releases at Wilder Dam to Sumners Falls under several flow scenarios. This information has the potential to help inform recreational users of when flows may be available for boating.

Study 32 – Bellows Falls Aesthetic Flow

The goals of the study were to characterize the aesthetic conditions in the bypassed reach at various levels of flow and provide a range of aesthetic ratings to assist in assessing conditions relative to Vermont's water quality standards.

General Comment: The aesthetic flow evaluation deviated from the approved study plan. The Revised Study Plan states, "At a minimum, the controlled flow releases to be provided for the associated flow studies (Studies 9 and 31) would be videotaped and photographed for use in this study." The flows associated with study 31 (Whitewater Boating Flow Assessment) were evaluated, but flows associated with study 9 (Instream Flow) were not. As a result, the range of flows were rather high for evaluation of compliance with the aesthetics criteria of the Vermont Water Quality Standards. The lowest two flows were125 cfs (leakage) and 1,580 cfs. If the Agency needs to assess a flow between 125 and 1,580 cfs for compliance with aesthetics, the State may not have the necessary information to make a determination. Given the range of flows assessed, it is not clear that the study met its second goal to "provide a range of aesthetic ratings to assist in assessing conditions relative to Vermont Water Quality Standards". If the aesthetic flow evaluation included the flows from the instream flow study, as described in the revised study plan, it is likely that the range of flows evaluated would have been more appropriate.

Need for additional information: In order to issue a water quality certification for the Bellows Falls project, the State of Vermont will need to make a determination that Vermont Water Quality Standards will not be violated. In order to do so the State will need to make a positive finding that the aesthetics designated use will be fully supported. Given the information provided in the study report, the Agency may not have the requisite information to make such a determination, particularly for flows in between 125 and 1,580 cfs. In light of the deviation from the approved study plan, the Agency includes a request to amend the study plan in an attachment to this comment letter.

Comments on Interim Study Reports and Status Updates

Study 8 – Channel Morphology and Benthic Habitat

General Comment: The goal of this study was to understand how operations of the Wilder, Bellows Falls and Vernon hydroelectric projects affect bedload distribution, particle size, and composition in relation to habitat availability for different life-history stages of anadromous and riverine fish, and for aquatic invertebrates. Agency concerns in requesting the study were related to how project operations affect sediment supply, sediment composition and transport, and associated effects on fluvial processes including channel formation. Of specific interest is how project operations affect the availability of gravel-type substrate immediately downstream from the dam.

Request: In relation to sediment composition, please describe in the final report how percent embeddedness and substrate composition changes longitudinally downstream from the project dams.

General Comment: The analysis calls for evaluating the stability of coarse grained substrate at the mainstem sites in the context of stage-shear stress and stage-discharge curves obtained from the hydraulic modelling study. Resulting information on the stability of the evaluated sediment size classes will be referenced to the range of flows that result in mobilization of the sediment size classes; this comparison will provide insight regarding the effects of project operations on stability of sediments relative to higher flows.

Based on this analysis proposed it is not clear how the cumulative impacts of project operations and natural flow events (acting in concert) affect substrate composition, bedload distribution, and particle size will be evaluated. In other words, it is well known that particles move during high flow events (whether occurring naturally, via project operations or both). However, it is important to know how project operations and natural high flow events act in concert to mobilize sediment and how such events occur in frequency, duration and magnitude.

Request: In the final report, please describe how the cumulative effects of high flow events acting in concert with project operations are quantified and include analysis of these effects.

Study 9 – Instream Flow

Section Specific Comments

- 4.1 Habitat Mapping – The report notes that, "Based upon the river conditions described in the Study 7 report, pool (deep and shallow combined) was overall the most abundant habitat type in the Wilder and Bellows Falls riverine segments, accounting for over 50 percent of aquatic habitat. Riffle habitat was quite rare, making up 5 percent in the Wilder reach and less than 2 percent in the Bellows Falls reach. No riffles were identified in the Vernon reach, and comparatively equal proportions of pool, run and glide mesohabitats were present. There was a single rapid (Sumner Falls in Wilder reach 3) and a single cascade"
    - The Agency concurs that riffle habitat is quite rare. Due to the distribution of habitat types, particularly the abundance of deeper habitat types and the rarity of shallow habitat types, it may be appropriate to approach the instream flow analysis through a critical reach approach, rather than a representative reach approach.

- 5.3 Habitat Modelling –The report states, "At the request of the working group, AWS plots for 1D modeling were constructed by habitat type or groups of habitat types in a reach, in addition to standard weighting of all habitat types together.
    - The Agency requests that habitat types not be grouped together and each habitat type be broken out separately. The "standard" approach describes a representative reach approach, may not be the most appropriate way to evaluate this system.

- Figure 5.3.7 – The figure presents generalized habitat criteria for the Wilder reach and by habitat type.
    - Are the criteria (depth and velocity) thresholds defined in the report? If not, please define the velocity and depth thresholds that distinguish GHCs.

Study 13 – Tributary and Backwater Fish Access and Habitats Study

The goals of this study were to assess whether water-level fluctuations from project operations impede fish movement into and out of tributaries and backwater areas within the project-affected areas and investigate whether project operations impact available fish habitat and water quality in the tributaries and backwater areas in the project-affected area. Specific objectives for this study were to conduct a field study of a subset of tributaries and backwaters in the project-affected areas to assess potential effects of water-level fluctuations on fish access to these areas in the impoundments and riverine reaches below the projects and to examine potential effects of water level fluctuations on available habitat and water quality in a subset of project-affected tributaries and backwaters.

An updated analysis approach for this study was presented at a meeting on March 18, 2016, and more information was emailed to the Agencies on April 4, 2016, from TransCanada. The following comments are related to the new analysis approach.

General Comment: In general, we agree with the new approach. One aspect of the new approach is "For each study site, flag all spring dates (April 1 – June 30) in each of the 5 annual hydrology's run through the operations model, where < 0.5 ft. of water is present for 12+ hours of that date." As detailed in the email from April 4, 2016, 12 hours was selected simply to create a "breakpoint" and was also considered by TransCanada to be a time period that provided adequate fish access. We suggest that in addition to the 12+ hours, a complete separate analysis be conducted where all spring dates for each study site are "flagged" when < 0.5 ft. of water is present at any time.

Study 14 and 15 – Resident Fish Spawning

The overarching goal was to determine if project operations and water-level fluctuations affect resident fish spawning in terms of nest abandonment, spawning fish displacement and egg dewatering. The species of interest were smallmouth bass, largemouth bass, yellow perch, black crappie, pumpkinseed, bluegill, chain pickerel, northern pike, golden shiner, white sucker, spottail shiner, walleye, and fallfish.

General Comment: While the Agency understands the nuances in life history characteristics among species (nest guarding, incubation time etc.) it would be preferred if a consistent approach was applied to all species when evaluating potential project effects during the egg incubation period.

Request: When comparing nest elevation to WSE's a preferred approach would be to take the nest observation date and evaluate forwards and backwards (if WSE data are available) in time for the entire incubation period (based on water temperatures). While this may be a conservative approach, it insures that the egg incubation period is covered in the absence of knowing the exact spawning date. In most cases, the diurnal fluctuations in WSE render a nest dewatering event, so extending the time period would not necessarily overestimate such events but rather would assure that the analysis covers the entire incubation and or nest guarding period prior to and after the initial observation.

General Comment: While it is informative to present proportion of nest abandonment and dewatering by site, range, mean etc., resource agencies need to understand the proportion of nests that are subject to negative impacts as a proportion of the total number of nests.

Request: The report should present data on nest abandonment and dewatering for each species as a proportion of the total number nests. For example, of the 123 sunfish nests how many were dewatered or abandoned?

General Comment: It is stated throughout the report that the 2015 dataset constitutes a year with high flows at the start of the perch and pike/pickerel spawning season, and high flows during the bulk of the smallmouth bass spawning season, with mostly project-controlled flows during the interim fallfish spawning and much of the later spawning by sunfish and (presumably) shiners.

Request: While high flows are expected during the spring months, the hydrologic record should be analyzed by spawning season and if 2015 represents such an anomalous year in terms of flows for target species, the need for repeating elements should be evaluated.

General Comment: In Section 6.1 Egg and Nest Dewatering or Adult Abandonment, specifically 6.1.1 Yellow Perch, there is a discussion about what spring WSE levels would be most beneficial to spawning yellow perch.

Request: The Agency requests that similar discussions be added for other species where appropriate.

General Comment: In a response to comments on a prior updated study report regarding the lack of data for certain target species, TC stated, "For those species where few or no spawning observations were made (northern pike, chain pickerel, white sucker, walleye, black crappie, and golden or spottail shiners), the lack of such observations, despite the intense survey effort, suggests that these species are not likely to be utilizing shallow, project-influenced habitats for spawning, their abundance is too low, or their spawning activities are too limited in scope to be detectable by the survey methods approved for these studies." While the factors enumerated may be influencing observations of spawning activity, it is also possible that spawning activity was missed or is adversely affected by project operations. The Agency does not believe there is ample information to make a determination as to why spawning was not observed in certain target species.

General Comment: Spawning locations were not identified for northern pike, chain pickerel, black crappie, or either species of shiner. Very limited spawning data was collected for white sucker, walleye, and largemouth bass. While we acknowledge the extensive effort to document spawning activity for these species, the low or no sample size for walleye, northern pike, chain pickerel, golden shiner, spottail shiner, black crappie, white sucker and largemouth bass, does not provide the data needed to assess project-related effects for these species.

Request: Given the lack of data for several target species, the goals and objectives of the study have not been fully met. In order for the Agency to make a determination regarding the potential impacts of project effects on these species, the goals and objectives of the study must be fulfilled. The Agency recommends that TransCanada allocate additional field efforts in order to meet the goals and objectives of the revised study plan consistent with the study plan determination issued by FERC. The Agency recommends that TransCanada develop a sampling plan that would involve sampling earlier in the season and target species where no or limited spawning data was collected in consultation with the aquatics working group.

Section specific Comments:

- Study Goals and Objectives (p. 2)- The report is missing the original first objective for Study 15- "locate and map nesting locations and spawning sites in riverine sections."

- 3.2.1 Impoundment sites: The report states that "Prior to the selection of potential study sites, areas were excluded that were not expected to provide significant spawning habitat, e.g. steep banks; silty mid-channel habitat; depths >5 feet deep (normal impoundment fluctuations are approximately 1-2 feet)". As such, shallow-water habitats (< 5 feet deep) were the main focus of this study. This is consistent with the stated goals of determining if water level fluctuations affect successful reproduction as many of these species prefer to spawn in shallow-water habitats. However, on page 23, the report states that "the estimated proportion of spawning sites impacted by project operations is likely to be over-estimated in this report" (due to limited water visibility and biases towards shallow waters).
    - Since the goal of the study was to understand the proportion of shallow water (<5 feet) nests that are affected by project influenced water-level fluctuations, the spawning preference of the target species for shallow water, and since the report acknowledges that deep (>5 feet) habitats were "not expected to provide significant spawning habitat", the Agency recommends the statement from page 23 quoted above be removed.

Methodology (p. 23) – The report states, "suspended egg masses, elevations measured at the highest elevation (e.g., at the suspending branch) and in some cases also at the lowest elevation (e.g., typically the substrate). Such egg masses frequently exhibited a 1-2 feet range in elevation (range 0.6-2.1 feet, mean 1.3 feet). Where both upper and lower elevations were measured, the mean elevation was calculated for comparison with WSE data".

- The Agency disagrees with this approach. A consistent approach should be applied across the project affected area. If the mean elevation can only be derived for a subset of egg masses, but the upper elevation was recorded for all egg masses, the upper elevation should be used to ensure a consistent approach.

Methodology (p. 27, 72, & 111) – The report states, "Fallfish nest elevations were measured at two locations: at the base of the nest and at the top of the nest mound. Note that Fallfish eggs are deposited at the original bed elevation prior to being covered by the mound (Reed, 1971; Magee, 1989; Maurakis & Woolcott, 1992), therefore comparison of Fallfish nest elevations with WSE data utilized the RTK elevation measured at the base of the nest mound."

- Maurakis and Woolcott (1992) also suggested that changes in interstitial aeration may stimulate larvae to move into interstices within the nest. This suggests that the nest must be inundated enough to provide adequate aeration to developing larvae, and if oxygen levels are not sufficient larvae will move around within the nest. Ross and Reed (1978) observed that fallfish nests were almost always constructed on gravel substrate in water at least 0.5 m (1.5 feet) deep. Similarly, on page 111, the report states that it is unknown to what degree hatched fry will migrate within the nest mound and if fry occupy higher regions of the nest mound the impacts could be greater than predicted. Based on this information, the Agency recommends that the WSE be compared to the top of the nest mound rather than the base.

4.2 Data Analysis (p. 29) – The report states, "Because Yellow Perch eggs are encapsulated within a moist, gelatinous mass, brief periods of exposure did not appear to affect viability. Differences in the appearance between egg masses suspended well above the WSE and those suspended just above the WSE were evident, with the higher egg masses clearly desiccated and limp, whereas lower hanging egg masses typically appeared firm and moist. Consequently, perch egg masses were not classified as "dewatered" unless they were exposed to air for an extended period of time (e.g., several hours)". Additionally, on page 56 of the report it is stated, "As noted earlier, the gelatinous mass that surrounded the Yellow Perch egg masses undoubtedly afforded some protection against short-term dewatering events, but the relationship between exposure duration and egg viability is unknown."

- Request: If the statements regarding the potential protection afforded by the gelatinous mass are not supported by the literature, it would seem more appropriate to simply state that it is unknown how egg viability is affected by these "short term events". As such, the Agency recommends that egg perch masses that are dewatered for any amount of time be classified as dewatered.

4.1.4 Backwater Sampling – In regards to pike and pickerel spawning, backwater surveys were conducted in 12 study sites from April 28 to July 2, generally two days/week (Tuesdays and Thursdays). Angling during this period showed that only one of the 33 captured individuals (9 pike and 24 pickerel) expressed eggs, milt, or showed evidence of recent or imminent spawning. No spawning activity was observed.

- Comment: Data collected from VTFWD biologists indicate that pike spawning commences at ice out. For example, 2013 trapnetting in Keeler Bay, Lake Champlain, nets were set immediately following ice-out. From the period of April 8-April 23, captured females were either green (n=6), running ripe (n=42), or spent (n=16). At the start of sampling most of the females were either green or running ripe and the number of spent females increased through the sample period. Based on these observations it was suggested that that the timing of sampling was a close match to the spawning season. Water temperatures ranged from 40°F to a high of 52°F. (4.4-12 °C). While Figure 5.2-4 (Page 53) indicates that sampling occurred within the reported range of spawning temperatures, captured fish should have shown signs of being in spawning condition. As noted by VTFWD biologists, hook and line sampling is typically ineffective for spawning pike because they do not bite during the spawn and for several weeks after while these fish recover (Shawn Good, VTDFW Fisheries Biologist, Personal communication). As indicated herein, investigations conducted in Vermont demonstrate that spawning commences immediately following ice out at the lower range of reported spawning temperatures. As such, the Agency believes that pike spawning commenced prior to the surveys.

5.2.4 Yellow Perch (p. 55) - The report describes the duration of time that an egg mass elevation would be compared to WSEs to determine dewatering events. For yellow perch egg masses, the egg incubation time was dependent on water temperature. For comparisons to WSE data, the egg incubation time was centered around the observation date, such that evaluations of potential dewatering occurred 50 % backwards and 50% forwards in time.

- However, as noted on in the report, "the backwater WSE data is not available for the periods prior to the initial sampling (or initial logger deployment date), whereas projected incubation times extend backward in time; consequently the potential for egg mass dewatering over this period cannot be fully assessed". Moreover, the timing of spawning is not known from the spawning survey. The analysis presented in the report results in shortening the duration of evaluations and likely underestimates dewatering events. Considering it is not possible to evaluate potential dewatering prior to the observation, and it is unknown when that fish spawned, we recommend that for yellow perch, the period of evaluation occur immediately following the observation forward in time for the entire incubation period. If WSE data is available for a particular site prior to an egg mass observation, then it would be appropriate to evaluate backwards in time. However, evaluations should also occur forwards in time for the entire incubation period, for the reasons stated above.

5.3.2 Bluegill and Pumpkinseed (p. 64) – The report states that sunfish "nest elevation plots assume a conservative incubation time of five days from the date when eggs were first observed (although hatching likely occurred sooner)", It is also assumed that a nest with a guarding adult will remain active for a period of 10 days following the initial nest observation. For those active nests where no adult was observed, it was assumed the nest was active for the preceding 10 days. However, Figure 5.3.4 Sunfish Nests at VB-050 Unnamed Backwater, the analysis occurs 10 days prior to and 10 days after nest observation.

- Please explain why the approach is different for VB-050. Of note is that for the majority of sunfish sites, analyzing WSE 10 days prior to and 10 days after nest observation does not affect the outcome in terms of nest dewatering (as illustrated in VB-050).

5.3.6 Fallfish – The report uses a period 10 days prior to nest observation and 5 days following to evaluate potential dewatering.

- Similar to other species, please describe the fallfish egg incubation period and the rationale for selecting this window of analysis.

5.3.6 Fallfish – It would be helpful if Figure 5.3-8 was labeled similar to others presented in the report (red dashed line and black solid line, and percent of nests subject to dewatering).

5.3.7 Smallmouth Bass (p. 89) – The report states, "nest vs. WSE plots assume potential continued residence of adult bass observed at empty nests for up to 30 additional days following the last adult observation, thus allowing time for egg deposition, incubation, and fry rearing. For nests containing eggs, nests were assumed to be potentially active for an additional 25 days after eggs were first observed, allowing for continued egg incubation and fry rearing. Nests containing fry were assumed to remain active for an additional 20 days following the first observation of fry. The period of potential nest activity was terminated at all nests on any date when a subsequent observation failed to identify the presence of an adult, eggs, or fry"

- Since observations could occur at any one of these stages, please explain why evaluations did not occur backwards in time. Please label Figure 5.3-12. similar to others with red dashed line and black solid line and percent subject to dewatering.

6.1.1 Yellow Perch – The report states "that up to 25% of perch eggs may have been dewatered due to project operations".

- This characterization does not account for the range of impacts across sites and may imply the effects were homogeneous across study sites. The report should note the range of impacts across study sites. For example, the estimated percentage mortality of yellow perch egg masses was as high as 83% in some of the backwaters (WB-051; Zebedee Brook).

6.1.1. Yellow Perch Egg Dewatering - On Page 110, the report states, "Although the 2015 data suggested that up to 25% of perch eggs may have been dewatered due to project operations, large numbers of perch eggs remained wetted throughout the incubation period and this estimate of mortality would likely change significantly under different flow conditions (e.g., higher mortality with more frequent uncontrolled high flow events, lower mortality under more stable and controlled conditions)."

- The Agency recommends this statement be removed. A similar statement could be made for any of the species for which data were collected and while likely true, unless future studies are to be conducted under different flow regimes in future years, it is of limited value.

6.1.2 Bluegill and Pumpkinseed – The report estimates that 23% of sunfish nests were potentially impacted by fluctuations in WSEs in 2015.

- Similar to the previous comment, this characterization of impacts does not account for the range of impacts across sites and may imply the effects were homogeneous across study sites. The report should note the range of impacts across study sites. For example, up to 50% of observed sunfish nests were subject to loss due to dewatering or abandonment of the adult guardian.

6.4 Project Effects Modeling (p. 113) – The report states that "In general, project operations did not appear to exert significant negative impacts to spawning within project impoundments for the observed species and identified spawning locations."

- Request: The Agency recommends the word "significant" be struck. It is not appropriate in this context as no statistical analyses were conducted. Regardless of terminology, the Agency notes that the results do show a cause for concern in regards to project impacts (yellow perch: mean of 25% of eggs may have been dewatered due to project operations; sunfish: mean of 23% of observed sunfish nests could be subject to loss due to dewatering or abandonment of the adult guardian; fallfish: 36% of nests in riverine reaches dewatered or impacted; smallmouth bass: 13% of nests in tributaries had minimum depths <1 foot and 34% of nests in riverine sections were potentially vulnerable to dewatering or nest abandonment by adult guardian)

Study 16 – Sea Lamprey Spawning Assessment

The goal of this study was to assess the level of spawning activity by Sea Lamprey (Petromyzon marinus) in the Wilder, Bellows Falls, and Vernon project-affected areas and to determine whether project operations are affecting the success (i.e., survival to emergence) of lamprey spawning.

The second goal of this study related to whether project operations affected success (i.e., survival to emergence) was not met. Therefore, it must be assumed that any dewatering of a nest results in the failure of that nest.

General Comment: One of the objectives of the study was to assess if flow alterations cause dewatering and/or scouring of Sea Lamprey nests. While it is informative to present proportion of nest dewatering by site, range, mean etc., resource agencies need to understand the proportion of nests that are subject to negative impacts as a proportion of the whole.

Request: The report should present data on nest dewatering for sea lamprey as a proportion of the total number nests.

General Comment: The study report states 26% (6 of 23) of sites experienced dewatering due to project impacts (including 6 sites at which no nests were identified). Also stated is that 44% (7 of 16) of sites at which nests were found were shown to be potentially exposed to dewatering.

Request: The value that should be reported is the percentage of dewatered sites where lamprey actually nested (i.e. 44%).

General Comment: Sample sites were distributed evenly throughout the project area, but potential project effects vary widely depending on the location of the site. Eleven of the 23 sites were located in impounded habitat (6 sites in the Bellows Falls Dam impoundment and 5 sites in the Vernon Dam impoundment) and 12 sites were located in riverine habitat. All sites where nests were documented in impounded areas were associated with tributaries, with one exception at the very upper end of the Bellows Falls Dam impoundment. The focus of this report was on nest exposure due to project related water level fluctuations, yet nest exposure is not the only a suitable metric for assessing project impacts in impounded areas. The primary project impacts in impounded areas include inundation of spawning habitat, fine sediment deposition in lower tributary mouths, and tributary accessibility. These effects were not evaluated in this report.

General Comment: There are 52 miles of impounded habitat and approximately 25 miles of riverine habitat in the project area studied. Of the 12 sites located within riverine sections, 7 were located in the 18-mile riverine reach below the Wilder Dam, 3 were in the 6-mile reach below the Bellows Falls Dam, and 2 were located less than 1 mile below the Vernon Dam. Of the sites located in the Wilder riverine reach, 2 did not contain nests, leaving a total of 10 sites within riverine reaches where sea lamprey nests were documented. Six out of these 10 sites (60%) contained nests that showed signs of dewatering.

Request: A clear distinction should be made in the report between riverine sites, where the majority of spawning in the mainstem river occurs, and impounded sites, where the majority of habitat has been flooded and suitable habitat is dependent on tributaries. These two habitat types should not be grouped in the Study Conclusion section and the percent of nests and sites (containing nests) dewatered should also be examined by habitat type.

General Comment: The percentage of time that sea lamprey nests were exposed (Table 5.2-3) over the entire length of the study period (May 15 to July 15) does not capture the true nature of exposure in some nests, which were rapidly dewatered and inundated multiple times during periods of project influenced flow.

Request: The total number of exposures, average length of exposure, and the min/max length of exposure should be presented for each nest. In addition, percent exposure should be calculated based on periods when flows are within project generating capacity. The length of time that flows exceed project generating capacity will vary each spring. Focusing only on percent exposure during periods of project influenced flow will aid in comparisons of nest exposure.

Section Specific Comments:

- Table 3.1-1 – Please add stream order to the table.

- 4.2 Supplementary Habitat Assessment – The report states, “sites could not be surveyed for evidence of spawning due to unsafe or limited visibility conditions…As a result, sites that could not be adequately surveyed during the spawning season (and that had not been characterized as having little suitable habitat

during habitat assessment efforts), were revisited in August or September 2015 during low flow conditions when the maximum amount of habitat was exposed or accessible to survey."

- What was the proportion of sites that were included in the supplemental habitat assessment? The report should also acknowledge that nests have to propensity to change over time in response to flow events, fines settling out etc.

- 4.4 Data from Other Studies – The report states, "Water surface elevation data from loggers (see Section 4.3 and Study 14/15 report for detail) were used where nest capping was not done, and therefore lamprey nest specific loggers were not deployed. For most sites, elevation data were selected for stations that coincided with Sea Lamprey spawning habitat assessment sites. For some sites where study sites did not overlap, data from the nearest available logger was substituted (proxy logger). Water surface elevation data were plotted relative to nest elevations."
  - It is important that logger elevations represent data for the specific site where nests were observed. Please describe proximity to these loggers especially considering these loggers were deployed for sites associated with Studies 14/15. For example, were loggers deployed in Partridge Brook? Mill Brook? There are concerns (as indicated in Appendix C) that many of these WSE loggers are miles away from the nesting sites. This may result in WSEs that are not representative of WSEs at a nesting site. For example, at Site 16-WL-007, four nests were identified and one was observed to be dewatered. However, logger data indicated 0.0% exposure. The report notes that "that the level logger was located 0.68 miles upstream so water surface elevations could be biased to indicate less exposure." Similarly, there were several sites where nests were observed to be dewatered but WSE indicated 0.0% exposure. This represents a major flaw in the analysis.

- 6.1 Water Level Fluctuation and Nest Exposure – The period of record for level loggers varied among sites and generally occurred within the window of May 15 – July 15, 2015.
  - The Agency recommends that when comparing nest elevation to WSE's the approach utilize the nest observation date and evaluate WSE's forwards and backwards (if WSE data are available) in time for the entire incubation period (based on water temperatures). While this may be a conservative approach, it insures that the egg incubation period is covered in the absence of knowing the exact spawning date. In most cases, the diurnal fluctuations in WSE render a nest dewatering event so extending the time period would not necessary overestimate such events but rather would assure that the analysis covers the entire incubation period prior to and after the initial observation.

- 6.1 Water Level Fluctuation and Nest Exposure (p. 76) – The study report states "Exposure was not necessarily relative to mortality, however, because the assignation of risk assumes that exposed nests were occupied during periods of project-controlled discharge" and "Finally, dewatered nests do not necessarily represent negative effects since the nests may not be occupied during exposed periods, or the duration of exposure may not be detrimental to early life stages."
  - Regardless of the validity of these statements, they are not relevant because nest occupation during periods of project-controlled discharge and/or during exposed periods, and whether the duration of exposure was detrimental to early life stages, were not quantified. These statements should be removed from the report. In general, any nest exposure time represents negative impacts and any conclusions should be classified as such.

- 6.1 Water Level Fluctuation and Nest Exposure (p. 76) – The report states that ammocoetes are adapted to survive some dewatering. Based on lab testing, "mortality was less than 7 percent for exposure periods of less than 24 hours. For nests that experienced exposure, the average period of exposure was always less than 10 hours".
  - It should be noted that this represents an average period of exposure. Table 6.1-2 indicates exposure times can be as high as 81,53, 17, and 58 hours depending on the site. Moreover, Strief (2009) documented that a single stream dewatering event, even of short duration, can inhibit up to seven years of lamprey production by eliminating all age classes of ammocoetes. Therefore, we disagree with the above statement and recommend it be removed from the report.

- 6.1 Water Level Fluctuation and Nest Exposure (ps. 76-77) - Several mitigating factors are detailed in the report. One mitigating factor given was: "It is not clear that spawning occurs in all nests. As noted in Section 5.1, radio telemetry tracking suggested the potential for serial spawning or, alternatively, exploratory nest construction. Nests that may be abandoned or unoccupied due to non-operational flows are inconsequential in terms of project affects."
    - Regardless of the validity of this statement, it is not relevant to this study because nests that were abandoned or unoccupied due to non-operational flows were not quantified. This statement should be removed from the report. In addition, the effect of project influenced flows on nest placement, nest construction, spawning behavior, and nest abandonment was not evaluated in this report. Without a better understanding of the influence of flow on spawning behavior, it is difficult to assess the relative importance of each nest.
- Another mitigating factor given was: "The spawning season included periods when high river discharges exceeded project generating capacity, conditions that typically occur during the spring spawning season. Vulnerable nest elevations were therefore most accessible to spawning lamprey in flow periods beyond project operations. Spawning and gestation could occur entirely or mostly during extended periods of continuous submergence."
    - The statement assumes that periods of nonoperational flows will reliably occur each spring and that these flows are beneficial to sea lamprey spawning. The timing and duration of non-operational flows vary each year. Spawning success during periods of non-operational flow vs. project influenced flow was not evaluated in this study. Any reference to the occurrence of non-operational flows during the spawning season as a mitigating factor to potential project impacts should be deleted.
- Another mitigating factor given was: "At all sites except one (16-BT-004) where identified nests were exposed in low or minimum flow periods, there were other nests identified that were always submerged. Additionally, suitable habitat was often available in channel areas adjacent to island / bar assessment sites. It is possible that spawning occurred in those deeper habitats as well. Radio telemetry tracking indicated that adult lamprey were frequently located in areas of suitable substrate, but that were >10 ft. deep. Those areas were generally out of the scope of this study because they were not vulnerable."
    - While this observation is likely true, it was not quantified (either actual spawning or spawning success) and therefore should not be used as a mitigating factor as spawning success of these deeper nests was also unknown.

Study 17 – Upstream Passage of Riverine species

A final report has not yet been provided, so the Agency is not in a position to comment on the need for additional information regarding passage of riverine species, nor make any recommendations, at this time.

Study 21 - American Shad Telemetry Study

General Comment: We support and concur with comments filed by the USFWS on May 2, 2016, regarding this report.

Very truly yours,

Eric Davis
River Ecologist

c: Jeff Crocker, VTDEC
Lael Will, VTDFW
Owen Davis, NHDES
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John Ragonese, TransCanada
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Enc: Request to Amend Study Plan

ATTACHMENT
REQUEST TO AMEND STUDY PLAN

Wilder Hydroelectric Project – FERC No. 1892-026
Bellows Falls Hydroelectric Project – FERC No. 1855-045
Vernon Hydroelectric Project – FERC No. 1904-073

Study Plan Amendment Request 1: Upstream American eel passage assessment

Goals and Objectives

This study has two objectives:

1. Conduct systematic surveys of eel presence/abundance at tailrace and spillway locations at the Vernon, Bellows Falls, and Wilder projects to identify areas of concentration of eels staging in pools or attempting to ascend wetted structures that would potentially establish the most effective locations to place upstream eel passage facilities.
2. Collect eels with temporary trap/pass devices from areas identified from surveys as potential locations of eel concentration to assess whether eels can be collected/passed in substantial numbers, and whether locations are viable sites for permanent eel trap/pass structures.

Resource Management Goals

The American eel (*Anguilla rostrata*), is also one of New Hampshire and Vermont's Species of Greatest Conservation Need (SGCN). The status for conservation need in Vermont is listed as high priority (Kart et al. 2005), and the species is listed as "vulnerable" in New Hampshire. As identified in Vermont's Wildlife Action Plan (Kart et al. 2005), threats to the species include the construction of large dams on rivers which obstruct juvenile fish access to critical rearing habitats, as well as mortality associated with passing through hydroelectric facilities' turbines during their outmigration to sea.

As outlined in Vermont's Wildlife Action Plan (Kart et al. 2005), research and monitoring needs for this SGCN include determining their distribution and abundance, as the contribution of eels in northern regions to overall stock is unknown. One of the conservation strategies for this species is to support efforts to enhance access of American eels to Vermont waters by eliminating or minimizing impacts of dams and other obstructions along the Richelieu, St. Lawrence, and Connecticut Rivers.

The Atlantic States Marine Fisheries Commission has developed two documents related to the management of American eel:

1. Interstate Fishery Management Plan for American Eel. April 2000. Atlantic States Marine Fisheries Commission.
2. Addendum II to the Fishery Management Plan for American Eel. Atlantic States Marine Fisheries Commission. Approved October 23, 2008. 8 pp.

In addition, the Connecticut River Atlantic Salmon Commission (CRASC) developed the draft document: A Management Plan for American Eel (*Anguilla rostrata*) in the Connecticut River Basin in 2005. The goal of the plan is "to protect and enhance the abundance of the American eel resource to ensure its continued role in the Connecticut River Basin ecosystem…" Management objectives in the plan include the following:

1. Protect and enhance eel populations where they currently exist;
2. Where practical, restore populations to waters where they had historical abundance;
3. Provide effective upstream and downstream fish passage around dams and other barriers within the species' range in the basin; and
4. Comply with all requirements of the Fishery Management Plan of the ASMFC.

Based on these plans, the Agency seeks the accomplishment of a number of resource goals and objectives through the relicensing process for the three projects. General goals include the following:

1. Ensure that protection, mitigation and enhancement measures are commensurate with Project effects and help meet regional fish and wildlife objectives for the basin.
2. Conserve, protect, and enhance the habitats for fish, wildlife, and plants that continue to be affected by the Project.

Specific to upstream passage of American eel, the Agency's goals are:

1. Minimize current and potential negative project operation effects that could hinder management goals and objectives.
2. Minimize project-related sources of upstream passage delay, injury, and stress in order to facilitate access to historical rearing habitat.

Our study requests are intended to facilitate the collection of information necessary to conduct effects analyses and to develop reasonable and prudent conservation measures, and protection, mitigation, and enhancement measures pursuant to the Endangered Species Act of 1973, as amended (16 U.S.C. §1531 *et seq*.), the Fish and Wildlife Coordination Act, as amended (16 U.S.C. §661 *et seq*.), and the Federal Power Act (16 U.S.C. §791a, *et seq*.).

Public Interest Consideration

The requester is a resource agency.

Existing Information

The PAD contains no information relative to areas where eels seeking to move upstream concentrate downstream of the three dams, or annual numbers of eels attempting to ascend past the dams. While eels have been known to ascend the Vernon and Bellows Falls fish ladders, their efficiency for passing eels is unknown, and they are only operated during the American shad passage season (from April 15 through July 15). Eels are currently able to pass Vernon, Bellows Falls, and Wilder dams (as evidenced by documented presence of eels upstream), but the total number of eels attempting to pass all three dams and the proportion successfully passing each project is unknown (but suspected to be low). The downstream Holyoke Project has operated upstream eel passage facilities since 2004. Last year these facilities passed over 40,000 juvenile eels. While the next dam upstream (the Turners Falls Project; FERC No. 1889) has no dedicated upstream eel passage facilities, eels have been known to ascend the Cabot Station fish ladder (A. Haro, U.S. Geological Survey, pers. comm.). Although there is rearing habitat in between the Turners Falls and Vernon dams, some eels will attempt to continue upstream, and passage needs to be provided so these fish can access historical habitat.

TransCanada filed a final study report for Study 18 – Upstream Eel Passage Assessment as part of the March 1, updated study report. During the study period, the fishways were operating year round for resident fish as a component of Study 17. The attraction flows into the ladder appeared to greatly outweigh attraction flows at smaller leakages through or over the dam at each project. Relative to the number of eels observed in the systematic surveys at Vernon (80), Bellows Falls (3), and Wilder (0), larger number of eels were documented utilizing the fishway for upstream passage at each project (1545, 60, 52 respectively). Given the attraction and effectiveness of the fishways in passing eel, congregations were generally not observed and temporary means of passage could not be deployed.

Given that the final report for study 17 has not been filed, a determination cannot be made on year round operation of the fishway for resident and/or diadromous fish species under a new license at this time. To date, the upstream eel passage study has taken place under anomalous environmental conditions in which the hydraulics and flow dynamics below the projects have been altered by fishway operation. As such, resource agencies do not have the information needed to assess where eels congregate or determine if effective passage can be achieved in the absence of fishway operation.

These information gaps need to be filled so resource agencies can determine the best locations to site upstream eel passage facilities and assess whether operating the existing anadromous ladders would be an effective mechanism to move juvenile eels upstream past the projects.

We also note that within the past seven years, the USFWS has received two petitions to list the American eel under the Endangered Species Act. The first petition was received on November 18, 2004. On July 6, 2005 the USFWS issued a substantial 90-day finding on the petition and initiated a 12-month status review that concluded on February 2, 2007 with a finding that listing was not warranted. The second petition was filed on April 30, 2010 by the Council for Endangered Species Act Reliability (CEASAR). On September 29, 2011 the USFWS issued a substantial 90-day finding and initiated a 12-month status review. The USFWS is still accepting new American eel information for the ongoing status review. The USFWS also is currently in settlement negotiations with CESAR on their legal complaint that the USFWS failed to complete the 12-month finding within the statutory timeframe. Although the date for completion of the USFWS's 12-month finding on the latest petition is uncertain, it is likely that it will be made before any new licenses are issued for the projects.

Project Nexus

The three projects generate hydropower on the head created by the Vernon, Bellows Falls, and Wilder dams. These dams create barriers to upstream migrating eels. While some eels are able to pass dams, some are not, and the passability of a given dam depends on factors such as its height, hydraulics, presence of climbable surfaces, presence of predators, risk of exposure to heat or drying while climbing a dam, etc. All three dams are high (Vernon: 58 ft. high; Bellows Falls: 30 ft. high; and Wilder: 60 ft. high), and the majority of the dam faces are dry during most of the upstream eel passage season. Design of the dams is not currently amenable to passage of eels by climbing. As mentioned earlier, the existing anadromous passage facilities are not designed to pass eels, and even if some eels are able to ascend the ladders, they may incur delays (in attraction or passage rates), be size-selective (e.g. velocity barrier for small eels presented by ~8 ft/sec flow through weirs and orifices), present a potential predation risk (predators in or near the fishways), and are not operated throughout the upstream eel passage season.

At the updated study report meetings in March, TransCanada stated that they do not propose to operate the fishways beyond the normal date of July 15. TransCanada has also expressed that operation for resident fish may not be necessary under a new license. The Agency will refrain from making a determination on fishway operation for resident species until the results from Study 17 can be evaluated. However, given the usage of the fishway by eels, any alternative that does not involve fishway operation will need to include a means to pass eels safely and effectively. The Agency recommends using the upcoming season in which TransCanada has proposed to not operate the ladder during the summer months to evaluate eel congregation and passage under these conditions.

Proposed Methodology

Objective 1: Systematic Surveys

Surveys of eel presence and relative abundance should be conducted at regular intervals throughout the eel upstream migratory season (~1 May to ~15 October, or when river temperatures exceed 10 C). Surveys should consist of visual inspection and trapping in likely areas where eels may concentrate as they attempt to climb structures wetted by significant spill or leakage flow below the dams and associated structures. These locations include: the upstream fish ladders at all three projects (dewatered state) and leakage or overflow points along the downstream faces of all three dams, including spillways. Methods should include visual surveys (on foot, from a boat, or snorkeling) and trapping using small mesh (< 1/8" clear opening) baited eel pots. Visual surveys should be performed once per week, at night, preferentially during precipitation events. Trap sets should be performed once per week, with an overnight soak time. Recorded data should include location, observation of eels (presence, absence, relative numbers, relative sizes, behaviors, time/date of observation), and survey method.

Objective 2: Trap/Pass Collections

Areas identified from Systematic Surveys as having significant number of eels present should be targeted as potential areas for permanent eel trap/passes, and should be initially assessed using temporary/portable trap passes. At a minimum (regardless of survey results), temporary trap passes should be installed at stilling basins and/or lower sections of fishways supplied with

minimal attraction flow (0.5-1.0 cfs) during dewatered conditions at all three projects , as these locations may be supplemented with additional attraction flow and have high potential for being concentration points for upstream migrant eels. Similarly, traps should also be placed at spillway or bypass channel locations where eels have a potential to climb wetted (e.g., via leakage) flow zones, at the highest points where eels are able to climb to, or where otherwise feasible. Temporary trap/passes should be purpose-designed and built for each location, and operated throughout the eel upstream migratory season (~1May to 15 October, or when river temperatures exceed 10° C). Ramp-type traps with supplementary attraction flow are preferred temporary trap/pass designs. Traps should operate daily, with catches quantified every 2-3 days. Recorded data should include location, trapping interval, absolute numbers of eels trapped, relative eel sizes, and hydraulic and environmental conditions during the trapping period. Prior to the installation of any temporary eel trap passes, TransCanada should consult with the aquatics working group to seek to reach agreement on appropriate locations, design, operation, and attraction flow for the eel trap passes.

All collected eels from surveys should be released at their point of capture; those eels collected from trap/pass collections should be transported to and released into the headponds upstream of where they were collected.

These methodologies are consistent with accepted practice.

Level of Effort and Cost

The level of cost and effort for the survey component of the study would be low for each individual project (moderate for all three projects combined); a minimal number of personnel may be able to conduct the weekly surveys. The trap/pass component would require low to moderate cost and effort. We estimate $40,000 per project to conduct this study.

Literature Cited

Kart, J., R. Regan, S.R. Darling, C. Alexander, K. Cox, M. Ferguson, S. Parren, K. Royar, B. Popp, editors. 2005. Vermont's Wildlife Action Plan. Vermont Fish & Wildlife Department. Waterbury, Vermont. http://www.vtfishandwildlife.com/swg_cwcs_report.cfm. (Accessed September 10, 2012).

Vermont Fish and Wildlife Department . 2006. Vermont Fish and Wildlife Strategic Plan. http://www.vtfishandwildlife.com/library/reports_and_documents/Fish_and_wildlife/Strategic_Plan.pdf

Bellows Falls Hydroelectric Project – FERC No. 1855-045

Study Plan Amendment Request 2: Bellows Falls aesthetic flow study

Goal and Objective
The goal of this study is to determine the flow required at Bellows Falls dam and bypass reach to support aesthetics under the Vermont Water Quality Standards.

Resource Management Goals
The Connecticut River is considered Class B waters. Pursuant to the Vermont Water Quality Standards, Class B waters shall be managed to achieve and maintain a level of quality that fully supports designated uses including aesthetics. The management objective for aesthetics in Class B waters is water character, flows, water level, bed and channel characteristics exhibiting good aesthetic value. Good aesthetic value is also a water quality criterion for Class B waters in Vermont.

Public Interest Consideration
The requestor is a state resource agency.

Existing Information
The PAD indicates when flows exceed project capacity, excess flow is spilled over the dam into the bypass reach. During most of the year, no minimum flow is required in the bypass reach, and the amount of flow is limited to leakage.

The Licensee conducted an aesthetic flow assessment and filed a final study report on March 1, 2016. The study report provides information on several flows ranging from 125 cfs (leakage) to 5,560 cfs. The flows assessed correspond to the flows released for the whitewater boating flow assessment. Flows associated with the instream flow study (Study 9) were not assessed. This represents a deviation from the approved study plan that stated, "At a minimum, the controlled flow releases to be provided for the associated flow studies (Studies 9 and 31) would be videotaped and photographed for use in this study."

As a result of this deviation, the majority of the flows assessed in the study report exceed what can likely be sustained as conservation flows in the bypass reach. For example, three flows (50%) exceed the highest flow considered in the instream flow study (3,000 cfs). Given that the first flow assessed above leakage was 1,580 cfs, the data collected as part of this study may not allow the Agency determine whether flows between leakage and 1,580 cfs fully support aesthetics. Given that the deviation from the study plan has resulted in a range of flows that may pose challenges in determining compliance with the aesthetics criteria of the Vermont Water Quality Standards, the Agency does not consider the second goal of the proposed study, "to provide a range of aesthetic ratings that can be used to assess conditions relative to Vermont's water quality standards" to have been adequately met.

Project Nexus
Flow over the dam and in the bypass reach directly impacts aesthetics, which must be supported to conform to Vermont Water Quality Standards. The Agency requests a study of alternate spillage flows at the facility within the range of reasonable bypass flows. This information will be needed before the Agency can certify that the project meets Vermont Water Quality Standards.

Proposed Methodology
A range of alternate spillages can be videotaped and qualitatively analyzed, or a demonstration study can be arranged for direct observation of flows by a team for subjective grading. If the latter approach is used, the flows should be documented using both still photographs and videotaping. Typically, a range of flows are observed from several vantage points. If direct observation is used, a rating form is employed to provide a structure for the individual observations.

Level of Effort and Cost
The effort and cost would be determined by the approach used, but the cost should be rather modest. Under appropriate conditions, one day of field work should be required.