FEDERAL ENERGY REGULATORY COMMISSION
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OFFICE OF ENERGY PROJECTS

Project No. 1892-026 – New Hampshire / Vermont
Project No. 1855-045 – New Hampshire / Vermont
Project No. 1904-073 – New Hampshire / Vermont
TransCanada Hydro Northeast Inc.

Mr. John Ragonese
Relicensing Project Manager
TransCanada Hydro Northeast Inc.
4 Park Street, Suite 402
Concord, NH 03301

Reference: Study Plan Determination for Aquatic Studies - Wilder, Bellows Falls and Vernon Hydroelectric Projects

Dear Mr. Ragonese:

Pursuant to 18 C.F.R. § 5.13(c) of the Commission's regulations, this letter contains the study plan determination for the aquatic resource studies associated with the Wilder Hydroelectric Project No. 1892 (Wilder Project), the Bellows Falls Hydroelectric Project No. 1855 (Bellows Falls Project), and the Vernon Hydroelectric Project No. 1904 (Vernon Project) located on the Connecticut River in the states of New Hampshire and Vermont. This determination is based on the study criteria set forth in section 5.9(b) of the Commission's regulations, applicable law, Commission policy and practice, and the record of information.

Background

On April 15, 2013, TransCanada Hydro Northeast Inc.'s (TransCanada) filed its proposed plan for 33 studies covering geologic and soil resources, water quality, geomorphology, hydrology, instream flow, fish and aquatic resources, wildlife resources, botanical resources, recreation and aesthetic resources, and cultural and paleontological resources in support of its intent to relicense the projects.

TransCanada held its initial Study Plan Meeting on May 13, 2013 and subsequently held resource-specific study plan meetings on May 16, 20, and 23, on June 6, 7, 18, 19, 20, and 21, and on August 6 and 9. On July 9, 2013, TransCanada filed an

updated Proposed Study Plan for additional stakeholder review and comment. Following the conclusion of the study plan meetings and after receiving comments on its updated Proposed Study Plan, TransCanada filed its Revised Study Plan on August 14, 2013.

Comments on the 33 studies were filed by: the U.S. Fish and Wildlife Service (FWS); the National Park Service (NPS); the New Hampshire Department of Environmental Services (NHDES); the New Hampshire Fish and Game Department (NHFGD); the Vermont Agency of Natural Resources (VANR); the Vermont Division of Historic Preservation; the City of Lebanon, New Hampshire; the Connecticut River Watershed Council (Watershed Council); the Connecticut River Joint Commission (Joint Commission); the American Whitewater Association; New England FLOW; The Nature Conservancy; the Appalachian Mountain Club; the Vermont River Conservancy; the Friends of the Connecticut River Paddlers' Trails; the Narragansett Indian Tribal Historic Preservation Office; the Nolumbeka Project; Two Rivers-Ottauquechee Regional Commission (Two Rivers); and F.William and Jennifer Lipfert.

On September 13, 2013, the study plan determination for the 13 proposed non-aquatic studies was issued. Of these studies, seven were approved as filed by TransCanada, and six were approved with staff-recommended modifications. However, as discussed below, decisions on the remaining 20 proposed aquatic resource studies and on the additional requested hydroacoustic study at the Vernon Project, that was not adopted by TransCanada, were deferred pursuant to section 5.29(f)(2) of the Commission's regulations.

Deferred Studies

On August 27, 2013, Entergy announced plans to decommission its Vermont Yankee Nuclear Power Plant (Vermont Yankee) during the fourth quarter of 2014. Vermont Yankee withdraws its cooling water from and discharges it back to TransCanada's reservoir for the Vernon Project. The Vernon reservoir is located immediately upstream of FirstLight Hydro Generating Company's reservoir for the Turners Falls Hydroelectric Project No. 1889. Operation of Vermont Yankee has influenced Connecticut River water temperatures within the Vernon reservoir and downstream through the Turners Falls Project since the plant went into operation in 1972. Because the baseline environmental condition will change after 2014, TransCanada's proposed aquatic studies may have produced invalid data if conducted while Vermont Yankee was still operating. Because of this unusual circumstance, staff hosted a technical meeting on November 26, 2013 to: (1) identify aquatic resource studies not affected by operation of Vermont Yankee that could be implemented in 2014; (2) identify aquatic resource studies likely affected by operation of Vermont Yankee; and (3) identify aquatic resource studies that may need modification due to the decommissioning of Vermont Yankee.

On December 31, 2013, TransCanada submitted revisions to five of its proposed study plans based on the November 26, 2013 technical meeting and follow-up discussions with agencies and stakeholders. Revisions were made to the following study plans: 6 – *Water Quality Monitoring*; 13 – *Tributary and Backwater Area Fish Access and Habitats*; 18 – *American Eel Upstream Passage*; 21 – *American Shad Telemetry – Vernon;* and 23 – *Fish Impingement, Entrainment, and Survival*. This determination addresses the proposed revisions submitted by TransCanada for these five study plans.

General Comments

A number of the comments received do not address study plan issues. This determination does not address these comments, but only addresses comments specific to the merits of the proposed studies submitted pursuant to section 5.13 of the Commission's regulations and comments received thereon.

Study Plan Determination

Of the 20 studies proposed by TransCanada and addressed in this study plan determination, 16 are approved as filed by TransCanada and four are approved with staff-recommended modifications (see Appendix A). The additional *Vernon Hydroacoustic Study* is also being required with modifications. Finally, we are amending the proposed schedules for 15 of these studies, as indicated in Appendix A, since they are potentially affected by the closure of Vermont Yankee.

The specific modifications to the study plan and the basis for modifying TransCanada's study plan, and the reasons for not adopting certain requested modifications to the study plan are discussed in Appendix B. Although Commission staff considered all study plan criteria in section 5.9 of the Commission's regulations, only the specific study criteria that are particularly relevant to the determination are referenced in Appendix B.

As discussed in Appendix B, Section II, TransCanada must file a study plan for Commission approval for the *Vernon Hydroacoustic Study* with its Initial Study Report in September 2014. The *Vernon Hydroacoustic Study* should be implemented during the 2015 and 2016 field seasons, after the closure of Vermont Yankee. In its plan for this study, TransCanada must include copies of comments received from the consulted entities, a discussion of how such comments are addressed, and its rationale for not adopting any recommendations.

Nothing in this study plan determination is intended, in any way, to limit any agency's proper exercise of its independent statutory authority to require additional

studies. In addition, TransCanada may choose to conduct any study not specifically required herein that it feels would add pertinent information to the record.

If you have any questions, please contact Ken Hogan at (202) 502-8434.

Sincerely,

Jeff C. Wright
Director
Office of Energy Projects

Enclosures: Appendix A -- Summary of determinations on proposed and requested study modifications and the additional study requested
Appendix B -- Staff's recommendations on proposed and requested study modifications and the additional study requested

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APPENDIX A

SUMMARY OF DETERMINATIONS ON PROPOSED AND REQUESTED STUDY MODIFICATIONS AND THE ADDITIONAL STUDY REQUESTED

Study	Recommending Entity	Approved	Approved with Modifications	Final Study Report Due
6 -- Water Quality Monitoring and Continuous Temperature Monitoring	TransCanada	X[1]		March 1, 2016
7 -- Aquatic Habitat Mapping	TransCanada	X		March 1, 2015
8 -- Channel Morphology and Benthic Habitat Study	TransCanada	X		March 1, 2015
9 -- Instream Flow Study	TransCanada	X		December 31, 2015
10 -- Fish Assemblage Study	TransCanada	X[1]		March 1, 2016
11 -- American Eel Survey	TransCanada	X[1]		March 1, 2016
12 -- Tessellated Darter Survey	TransCanada	X[1]		March 1, 2016
13 -- Tributary and Backwater Area Fish Access and Habitats Study	TransCanada	X		March 1, 2015
14 -- Resident Fish Spawning in Impoundments Study	TransCanada		X[1]	March 1, 2016
15 -- Resident Fish Spawning in Riverine Sections Study	TransCanada	X[1]		March 1, 2016
16 -- Sea Lamprey Spawning Assessment	TransCanada		X[1]	March 1, 2016
17 -- Upstream Passage of Riverine Fish Species Assessment	TransCanada	X[1]		March 1, 2016
18 -- American Eel Upstream Passage Assessment	TransCanada	X[1]		March 1, 2016

Study	Recommending Entity	Approved	Approved with Modifications	Final Study Report Due
19 -- American Eel Downstream Passage Assessment	TransCanada	X[1]		March 1, 2016
20 -- American Eel Downstream Migration Timing Assessment	TransCanada		X[1]	March 1, 2016
21 -- American Shad Telemetry Study – Vernon	TransCanada	X[1]		March 1, 2016
22 -- Downstream Migration of Juvenile American Shad - Vernon	TransCanada	X[1]		March 1, 2016
23 -- Fish Impingement, Entrainment, and Survival Study	TransCanada	X[1]		March 1, 2016
24 -- Dwarf Wedgemussel (Alasmidonta heterodon) and Co-Occurring Mussel Study	TransCanada	X		March 1, 2015
25 -- Dragonfly and Damselfly Inventory and Assessment	TransCanada		X[1]	March 1, 2016
Vernon Hydroacoustic Study	FWS, NHFGD, VANR, and Trout Unlimited		X	March 1, 2017

[1] Study schedule adjusted to initiate study in 2015 field season due to timing of the decommissioning of the Vermont Yankee Nuclear Power Plant.

APPENDIX B

STAFF'S RECOMMENDATIONS ON PROPOSED AND REQUESTED STUDY MODIFICATIONS AND THE ADDITIONAL STUDY REQUESTED

The following discusses staff's recommendations on studies proposed by TransCanada and requests for study modifications and an additional study. We base our recommendations on the study criteria outlined in the Commission's regulations [18 C.F.R. section 5.9(b)(1)-(7)].

I. Requests for Study Modifications

Study 6 - Water Quality Monitoring and Continuous Temperature Monitoring Study

Operation of the Wilder, Bellows Falls, and Vernon Projects may affect water quality in the Connecticut River (e.g., increase water temperatures, and turbidity resulting from project induced shoreline erosion). TransCanada proposes to conduct a water quality study to determine potential project effects on water quality by monitoring dissolved oxygen (DO), water temperature, turbidity, conductivity, nutrients, and chlorophyll-a. The study area will include the Wilder, Bellows Falls, and Vernon impoundments, as well as riverine locations upstream of the impoundments, the project tailraces, the Bellows Falls bypassed reach, and the mouths of key tributaries. The study will include the same 13 stations sampled during a 2012 survey, 3 additional stations located upstream of the 3 project impoundments, and 10 tributary sites.

Location of Turbidity Dataloggers

Applicant's Proposal

TransCanada proposes to collect 15-minute turbidity data at 16 mainstem multi-parameter datasonde sampling locations.[1] This includes the same 13 stations sampled during its 2012 Baseline Water Quality Study and 3 additional stations upstream of the influence of the 3 project impoundments. Turbidity data will be collected at the forebay and tailrace sites as well as at a site in the Bellows Falls bypassed reach from June 1 to September 30. Turbidity data will also be collected at the upstream impoundment sites during an intensive 10-day, low-flow period between June and September. TransCanada

[1] Datasondes will monitor and record temperature, dissolved oxygen concentration, conductivity, pH, and turbidity every 15 minutes above and below each dam starting April 1 and continuing through November 15 and also at additional stations located in the main body of the project reservoirs during a 10-day, low-flow period.

will also collect weekly profile turbidity data at these sites in 1-meter increments from the water surface to the channel bottom from June 1 to September 30.

Comments

The New Hampshire Department of Environmental Services (NHDES) requests that TransCanada place turbidity dataloggers near shore and just below the lower operating elevation of the projects, both upstream and downstream of erosion monitoring reference sites (established by study 2 – *Riverbank Transect Study*). NHDES suggests this additional information will help identify the impact of project operation on sediment movement and erosion in the Connecticut River.

In response, TransCanada does not propose to add additional turbidity data loggers beyond those identified in the study plan and contends that methods for identifying project impacts on sediment movement and erosion are already included in the following studies: study 2 – *Riverbank Transect Study*, study 3 – *Riverbank Erosion Study*, and study 8 – *Channel Morphology and Benthic Habitats Study*.

Discussion and Staff Recommendation

TransCanada's Study 2 would monitor riverbank erosion at 20 transects with repeated cross-sections, ground photographs, and water-level monitoring. TransCanada's observations regarding changing water levels and the timing of bank erosion would provide information to establish whether water-level fluctuations and the potential increased shear stresses caused by project operation correlate with erosion in project-affected areas.

TransCanada's Study 3 would provide baseline data relative to erosion in project-affected areas by determining the locations of erosion, comparing these locations with previously compiled maps, characterizing erosion processes, ascertaining likely causes of erosion, and identifying the effects of erosion on other resources. The study would map riverbank erosion throughout the project impoundments by using existing maps and conducting field surveys. TransCanada proposes to ascertain causes of erosion by correlating the propensity of erosion to occur with certain conditions.

Study 8 would provide an understanding on how the projects affect bedload, particle size, and composition in relation to habitat availability for different life history stages of anadromous and riverine fish, as well as invertebrates.

Turbidity is an important component of water quality and can provide useful information on how much suspended material is in the water. TransCanada's proposal to monitor turbidity at 16 site locations is consistent with the goals and objectives of this study (section 5.9(b)(1)). These data coupled with the results of study 2 – *Riverbank*

Transect Study, study 3 – *Riverbank Erosion Study*, and study 8 – *Channel Morphology and Benthic Habitats Study* should provide sufficient information to ascertain the causes, including project operations, of rates and circumstances of stream bank erosion by periodically physically surveying the streambanks in question. The proposal by NHDES would increase the number of required dataloggers from 16 to 56 and could increase the costs of the $280,000 study by 15 to 25%. The level of effort and costs required to deploy the additional dataloggers would not necessarily result in additional useful information (section 5.9 (b)(7)), because the existing studies are already designed to detect and determine causes and rates of erosion at the stream bank erosion transects. Therefore, we do not recommend modifying the study as requested by NHDES.

Mercury and Dioxin Sampling

Applicant's Proposal

TransCanada does not propose to sample sediments or fish tissue for mercury or dioxin within the project area.

Comments

The Connecticut River Joint Commission (Joint Commission) recommends that this study be amended to sample sediments and fish tissue for mercury and dioxin within the project area. The Joint Commission also requests that the study determine mercury levels in the three reservoirs as well as possible mitigation measures. The Joint Commission believes that the fluctuating water levels in reservoirs exacerbate the accumulation of mercury in fish.

In its response, TransCanada disagrees that this additional sampling is needed because atmospheric deposition of mercury and subsequent bioaccumulation in fish tissue is a known problem in both Vermont and New Hampshire. Statewide advisories currently exist to warn the public to limit freshwater fish consumption because of elevated levels of mercury in fish tissue. TransCanada states that there is no evidence that the operation of the projects affects the bioaccumulation of mercury and dioxin in fish tissue.

Discussion and Staff Recommendation

Atmospheric deposition of mercury and other airborne contaminants is the primary contributing factor in the bioaccumulation of heavy metals in fish tissue.[2] Natural and

[2] Hammerschmidt, C.R. and W.F. Fitzgerald. 2006. Methlymercury in freshwater fish linked to atmospheric mercury deposition. Environmental Science & Technology. 40(24):7764-7770.

anthropogenic sources of mercury can be widely dispersed in the atmosphere and can accumulate in the soils.[3] During flooding, bacterial activity can increase and result in enhanced methylation of inorganic mercury.[4] As such, methylmercury can be transferred to the water column and made available to aquatic organisms.[5] Long-term seasonal water level fluctuations of water supply reservoirs can create this effect regularly, as the exposed sediment substrate is flooded. However, there is little evidence that routine short-term water level fluctuations, as practiced by TransCanada, have the ability to increase mercury bioavailability. A study by Tremblay[6] concluded that the gradual erosion of flooded soils by repeated water level fluctuations decreased the release of organic matter, suspended particles, and nutrients and ultimately decreased zooplankton production and methyl mercury concentration.

Similar to mercury, dioxins can be released into the environment in a number of ways and both man-made and natural sources exist. Regardless, sediment and fish tissue analysis of mercury or dioxins at the projects would be difficult to attribute to project operations and would not provide information needed to inform our environmental analysis or subsequent license requirements (section 5.9(b)(5)). Therefore, it is not appropriate to modify the study to sample river sediments or fish tissue for dioxin.

Because there is no clear connection between project-related reservoir fluctuations and the resource to be studied, we do not recommend modifying the study.

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[3] Tremblay, A., M. Lucotte, and R. Schetagne. 1998. Total mercury and methylmercury accumulation in zooplankton of hydroelectric reservoirs in northern Quebec (Canada). *The Science of the Total Environment*. 213:307-315.

[4] Tremblay, A., M. Lucotte, and R. Schetagne. 1998. Total mercury and methylmercury accumulation in zooplankton of hydroelectric reservoirs in northern Quebec (Canada). *The Science of the Total Environment*. 213:307-315.

[5] Bodaly, R.A., V. St. Louis, M.J. Patterson, R.J.P. Fudge, B.D. Hall, D.M. Rosenberg, and J.W. Rudd. 1997. Bioaccumulation of mercury in the aquatic food web in newly flooded areas. *In* Mercury and its effects on environment and biology. Vol. 34. H. Sigel and A. Sigel, editors. Marcel Dekker, New York. 259 - 287.

[6] Tremblay, A., M. Lucotte, and R. Schetagne. 1998. Total mercury and methylmercury accumulation in zooplankton of hydroelectric reservoirs in northern Quebec (Canada). *The Science of the Total Environment*. 213:307-315.

Permanent Wetland Reference Sites

Applicant's Proposal

TransCanada does not propose to establish permanent wetland reference sites within and outside the zone influenced by the projects.

Comments

The Joint Commission recommends that TransCanada collect data on species-richness at permanent wetland sites to determine if project operations affect wetland health.

Discussion and Staff Recommendation

It is unclear why the Joint Commission made this comment on study 6. We note that the Joint Commission made this same comment on study 27 - *Floodplain, Wetland, Riparian, and Littoral Habitats Study*, which we addressed in our study plan determination issued on September 13, 2013. Based on our discussion on study 27 in the September 2013 determination, we do not recommend that TransCanada's include permanent wetland reference sites in study 6.

Study 7 – Aquatic Habitat Mapping

The projects' peaking operations affect water levels in the impoundments and downstream riverine reaches potentially altering aquatic habitat quality in the project area. To describe baseline conditions, TransCanada proposes to map aquatic habitats from the head of the Wilder impoundment to Vernon dam. TransCanada would use this data, in conjunction with other studies, to examine the potential influences of project operation on aquatic habitats.

Substrate Analysis

Applicant's Proposal

TransCanada proposes to use side-scan sonar to survey and map aquatic habitat in the Wilder, Bellows Falls, and Vernon impoundments. The resolution of the sonar images would be approximately 5 cm; therefore, TransCanada would characterize the dominant substrate types as sand/silt/clay, gravel/cobble, boulder, riprap, ledge, or woody debris. TransCanada would validate sonar imagery and substrate in the field using a

variety of methods including visual assessments, view tubes, sediment probes, and ponar samples[7] in randomly-selected deep-water areas.

Comments

In order to quantify the composition of substrates collected from ponar grab samples, Vermont Agency of Natural Resources (VANR) recommends a laboratory analysis for grain size percent composition by weight using the modified Wentworth scale.[8] VANR asserts this would provide additional information on substrate composition but would not require much more additional effort than the proposed methodology.

In response, TransCanada states that ponar samples analyzed with the Wentworth scale are not appropriate to describe substrate in large segments of habitat as substrate composition could change every few feet. TransCanada contends the additional data collection and analysis requested would be costly and the data would not be useful to accomplish study objectives.

Discussion and Staff Recommendation

VANR does not explain how the fine-scale analysis of sediment size would improve the proposed benthic habitat characterization or assist with an evaluation of project effects (section 5.9(b)(5) and (7)). While detailed grain-size analysis of ponar samples would provide some additional quantitative information to describe existing substrate, including greater resolution of fine sediment (e.g., fine sand, very fine sand, silt), that level of detailed information is not needed to map aquatic habitat or inform our analysis of potential project effects (section 5.9(b)(5)). Typically, a detailed laboratory analysis of substrate size is used to describe sediment composition in small, well-defined areas and not to characterize habitat over large river segments such as TransCanada's study area (section 5.9(b)(6)). As such, the addition of a fine-scale sediment analysis is not needed because it would not provide much additional information but would add a substantial cost (section 5.9(b)(7)).

[7] A ponar sampler is a small clamshell dredge used to sample sediment in aquatic ecosystems.

[8] The Wentworth scale is a common sediment classification system based on particle diameter.

Existing vs. Historic Conditions

Applicant's Proposal

TransCanada proposes to map habitat conditions throughout all three project areas to provide baseline data and assist several studies with the evaluation of potential effects of water level fluctuations on various aquatic habitat types.

Comments

The Connecticut River Watershed Council (Watershed Council) recommends that TransCanada conduct a literature review to describe river habitat over time and compare existing habitat to pre-dam habitat conditions.

In its response, TransCanada states that current project operation and existing facilities are the baseline condition. TransCanada also notes that this request would not assist the development of license conditions or contribute to meeting the goals and objectives of this study (section 5.9(b)(5)).

Discussion and Staff Recommendation

The baseline condition for our environmental analysis of existing projects is the current environmental condition. This is a well-established policy defined in previous Commission orders and upheld by the courts.[9] The Watershed Council's request to compare existing habitat to pre-project habitat conditions seeks to evaluate pre-project conditions and not the effects of project operation under a new license. Therefore, the requested analysis is not needed (section 5.9(b)(5)).

[9] FERC Order 513, published in the Federal Register on June 2, 1989 (54 FR 23775-23776) and in a subsequent rehearing order published on January 2, 1990 (55 FR 16).

See *American Rivers v. FERC*, 187 F.3d 1007, *amended and rehearing denied*, 201 F.3d 1186 (9th Cir, 1999); Conservation *Law Foundation v. FERC*, 216 F.3d 41 (D. C. Cir. 2000).

Study 8 – Channel Morphology and Benthic Habitat

Hydropower facility's peaking operations can affect the movement of sediment in riverine systems, which can affect aquatic habitat distribution and quality. TransCanada proposes to assess the distribution and extent of the existing substrate types including gravel and cobble bars within the project-affected areas; and identify the current conditions of the channel and determine the stability of the present substrate/benthic habitat and potential project-related effects on these habitats in the project-affected areas.

Existing vs. Historic Conditions

Applicant's Proposal

This study would characterize the distribution and extent of existing substrate types, identify the current condition of the river channel, determine the stability of benthic habitat, and describe potential project effects on benthic habitat. TransCanada proposes to conduct a literature review to identify study sites and to conduct Field investigations at those sites that will include mapping, pebble counts using established methodologies (e.g., Wolman pebble counts); an evaluation of substrate embeddedness; and photo-documentation of each site.

Comments

Like its comment on study 7 above, the Watershed Council recommends that TransCanada conduct a literature review to describe historic river habitat over time and compare existing habitat to pre-dam habitat conditions.

In its response, TransCanada notes that study 1 – *Historical Riverbank Position and Erosion*, is designed to collect and evaluate information on historic river conditions to provide a context for erosion potential in the future. TransCanada considers the Watershed Council's request a new study request and feels it does not meet the ILP study criteria and notes that this request would not assist in the development of license conditions (section 5.9(b)(5)).

Discussion and Staff Recommendation

As discussed above in study 7, under *Existing vs. Historic Conditions*, the baseline condition for our environmental analysis of existing projects is the current environmental condition. This request seeks to evaluate pre-project conditions and not ongoing effects of project operation. Furthermore, TransCanada notes that study 1would provide some historical data to provide context for future evaluations of erosion. Therefore, the requested comparison of pre-dam and current conditions is not needed to evaluate project effects on environmental resources (section 5.9(b)(5)).

Study 9 – Instream Flow Study

Project operation, specifically peaking flows released from project powerhouses and dams, affect flows in the Connecticut River in bypassed reaches and downstream. TransCanada proposes to evaluate the effects of project operation on the relationship between flow and habitat in the riverine sections between Wilder dam and the Bellows Falls Project impoundment, between the Bellows Falls dam and the Vernon Project's impoundment (including the Bellows Falls bypassed reach), and downstream of the Vernon dam for 1.5 miles. TransCanada would use standard Instream Flow Incremental Methodology (IFIM), as well as 1-D and 2-D hydraulic modeling to evaluate project effects on aquatic habitat. The overall objective of this study is to assess the relationship between stream flow and resultant habitat of key aquatic species in riverine reaches downstream of project dams. The Specific objectives of this study are to:

- Compute a habitat index versus flow relationship for key aquatic species in each project reach.

- Use the habitat index versus flow relationship to develop a habitat duration time-series analysis over the range of current operational flows.

Extent of Study Reach

Applicant's Proposal

TransCanada proposes to study five project-affected Connecticut River reaches based on hydrology and river morphology. These reaches include:

- Wilder dam to the confluence of the White River (1.5 miles)
- Confluence of the White River to upper extent of the Bellows Falls impoundment (15.5 miles)
- Bellows Falls bypassed reach (3,500 feet)
- Bellows Falls dam to upper extent of the Vernon impoundment (6 miles)
- Downstream of Vernon dam, approximately 1.5 miles

Comments

NHDES requests that TransCanada provide justification for its decision to limit the downstream extent of the study to approximately 1.5 miles downstream of Vernon dam.

In response, TransCanada proposes to provide the aquatics working group with the final reach delineation and study sites for review and comment, and that final study sites would be selected with working group members in the field.

Despite TransCanada's response, NHDES maintains that it is still unclear how the downstream extent (1.5 miles) was determined.

Discussion and Staff Recommendation

Because of the complexity of the riverine/lacustrine habitat interface downstream of Vernon dam, it appears TransCanada's initial proposal to limit the downstream extent of study to 1.5 miles was arbitrary. However, because TransCanada proposes to make the final reach delineation and study site selections in the field with the aquatics working group, we find that the working group should be able to determine a reasonable study terminus; and therefore, we have no reason to modify the proposed study.

Model Calibration

Applicant's Proposal

TransCanada proposes a minimum of three sets of calibration flow measurements for each transect and one complete set of depth and velocity measurements at each transect at the target high flow or the flow level assuming the measurements can be effectively and safely taken.

Comments

NHDES requests that TransCanada take velocity and depth measurements at each 1-D transect location during the low-flow data collection. While TransCanada has revised its study plan to collect additional flow and stage data, it has not specifically adopted NHDES's request to take the additional velocity and depth measurements at each 1-D transect location during the low-flow data collection. TransCanada explains that the literature indicates that a single set of velocities at the highest possible flow is preferred (Bovee, 1997; Bovee et al., 1998).[10] Further, TransCanada reports that Payne and

[10] Bovee, K.D. 1997. Data Collection Procedures for the Physical Habitat Simulation System. USGS Biological Resources Division, Fort Collins, CO.

Bovee, K. D., B. L. Lamb, J. M. Bartholow, C. B. Stalnaker, J. G. Taylor, and J. Henriksen. 1998. Stream Habitat Analysis Using the Instream Flow Incremental Methodology: Biological Resources Discipline Information and Technology Report USGS/BRD-1998-0004, Viii +131 p.

Bremm (2003)[11] evaluated the effect of multiple-velocity calibration sets on the habitat index and concluded that generated habitat index results using a single-velocity set deviate only slightly from those incorporating three or more velocity sets.

Discussion and Staff Recommendation

NHDES does not provide any justification for its assertion that low-flow velocity data are necessary for proper model calibration (section 5.9(b)(6)). With regard to flow calibration in IFIM models, we note that the collection of a single set of velocities at the highest possible flows is a commonly accepted scientific practice (section 5.9(b)(6)). Payne and Bremm (2003)[12] found that the collection of low-flow calibration velocities provides no real benefit to the predictive power of the model and especially so in larger rivers, such as the Connecticut River. Larger rivers are less influenced by large bed elements and have fewer complex hydraulic controls; and therefore, feature less localized variability in depth and velocity. Therefore, TransCanada's proposed method for the calibration of water velocity within the IFIM model should be suitable. For these reasons we do not agree that additional flow calibration measurements are necessary (section 5.9(b)(4)).

Continuous Temperature and DO Monitoring

Applicant's Proposal

TransCanada is not proposing to collect water quality information, such as water temperature or dissolved oxygen, as a component of this study.

Comments

NHDES requests continuous water temperature and DO data monitoring at each of the instream flow study data collection locations (1-D transects and 2-D study sites). In response, TransCanada asserts that continuous DO and temperature recording at the instream flow data collection locations is not appropriate or necessary, as it currently proposes to collect instantaneous measurements of DO and temperature at each IFIM study transect at the time of flow data collection, as well as continuous water quality parameters, including DO and temperature, in study *6 – Water Quality Monitoring and*

[11] Payne, T.R. and D.J. Bremm. 2003. The influence of multiple velocity calibration sets on the PHABSIM habitat index. Paper presented to International IFIM User's Workshop, June 1-5, 2003, Ft. Collins, CO.

[12] Payne, T.R. and D.J. Bremm. 2003. The influence of multiple velocity calibration sets on the PHABSIM habitat index. Paper presented to International IFIM User's Workshop, June 1-5, 2003, Ft. Collins, CO.

Continuous Temperature Monitoring. TransCanada also indicates it will collect supplemental water quality data as part of several other proposed studies.

Discussion and Staff Recommendation

NHDES did not explain the need for additional continuous water quality monitoring as an element of the instream flow study (section 5.9(b)(4)). TransCanada will collect continuous water quality data at 13 sites, inclusive of the proposed IFIM transects, from above the Wilder impoundment downstream to the Vernon tailrace in study 6 – *Water Quality Monitoring and Continuous Temperature Monitoring*. The data gathered by TransCanada's proposed study should be suitable to provide the information necessary for evaluation of potential project effects on DO and temperature. Therefore, additional continuous water temperature and DO data monitoring at the instream flow data collection locations is not necessary.

Scope of Resources Evaluated

Applicant's Proposal

As noted above, TransCanada's overall objective of this proposed study is to assess the relationship between stream flow and the habitat of key aquatic species in riverine reaches downstream of the project dams.

Comments

The Joint Commission recommends that TransCanada modify this study to include a determination of the flow requirements of all significant uses for which the river was designated into the New Hampshire Rivers Management and Protection Program (NH River's Program), rather than just aquatic life. Specifically, the Joint Commission recommends that TransCanada consult with stakeholders and the Joint Commission's local river subcommittees to consider all of the Instream Protected Uses, Outstanding Characteristics and Resources (IPUOCRs) listed in New Hampshire RSA 483 for which the Connecticut River was designated, in order to determine which are significant and flow dependent.

In response, TransCanada states that all of its study plans are designed to assess the projects' operational effects on natural resources within the project affected areas. It explains that its' studies will provide a broader basis for assessment than the instream flow element of the NH River's Program.

Discussion and Staff Recommendation

After extensive scoping of potential project-related issues and in collaboration with stakeholders, TransCanada has proposed over 30 studies, each seeking to determine potential project effects on differing resource areas, including, but not limited to aquatic organisms, water quality, recreation, cultural resources, and aesthetics. Furthermore, the Joint Commission has not specified the need for additional information regarding any designated IPUOCRs (section 5.9(b)(4)). As such, we find no reason to recommend modifying TransCanada's proposed *Instream Flow Study* to specifically address all of the IPUOCRs listed in New Hampshire RSA 483.

Study 10 - Fish Assemblage

Hydropower projects can affect multiple aspects of riverine and lacustrine aquatic habitat, which in turn could potentially affect the fish assemblage in project-affected areas. The occurrence, distribution, and relative abundance of fish species could also be influenced by project operations. Therefore, to evaluate the effects of the projects' operations on species occurrence, distribution, and relative abundance TransCanada proposes to sample the fish assemblage of within project impoundments, tailwaters, and downstream riverine sections with multiple methods, including electrofishing, gill netting with experimental mesh nets, trap netting, and beach seining.

Sampling Design

Applicant's Proposal

TransCanada proposes to conduct sampling to characterize the baseline fish assemblage within project-affected areas from the upper extent of the Wilder impoundment downstream to Vernon dam, as well as in the Bellows Falls bypassed reach. TransCanada proposes replicate sampling at a reach-level scale. Specifically, TransCanada proposes to divide this approximately 120-mile reach of the Connecticut River into seven geographic reaches delineated based on a combination of general river morphology and project structures. Following review of the aquatic habitat mapping (study 7), each geographic reach would be stratified based on habitat characteristics. The total number of sampling locations within each geographic reach would be randomly placed proportional to habitat type frequency. Effort would be made to ensure that a minimum of three sampling locations are placed within each strata (i.e., habitat type) within a particular geographic reach. A total of 12 to 15 randomly selected 500-meter segments would be selected (proportional to habitat availability) in each of the geographic reaches with the exception of the Bellows Falls bypassed reach and area downstream of Vernon dam where, as physically permitted, a total of 3 randomly selected 500-meter segments would be placed due to the short nature of those geographic reaches.

Comments

The U.S. Fish and Wildlife Service (FWS) and The Nature Conservancy requested that TransCanada conduct replicate sampling to improve the statistical integrity of the study data. In response, TransCanada noted that this added effort would unreasonably increase the cost of the study. However, The Nature Conservancy contends that the intent of including site-level replicates is to "…improve the scientific rigor of the study while maintaining its current scope, objectives, and cost." The Nature Conservancy suggests smaller 50- to 100-meter replicates within each selected 500-meter reach and that sampling in such a manner would allow for greater statistical rigor at the site level as well as at the reach level, which would improve the quality of the study and keep study costs the same.

Discussion and Staff Recommendation

While we agree that electrofishing costs would not substantially increase based on increasing the number of replicates at the site level, we do not agree that the cost would be the same with the other proposed gear methods, as suggested by The Nature Conservancy. For example, the cost of electrofishing five 100-meter sites vs. one 500-meter site would essentially be the same. However, gill netting for one 2-hour time period does not result in the same cost as gill netting for three 2-hour periods if workers are required to maintain a presence at the nets. Therefore, The Nature Conservancy's requested sample replicates would require added effort and therefore, would increase the study's cost. Further, The Nature Conservancy did not provide detailed methodology or consider the level of cost and effort associated with replicating gill netting, trap netting, and seining], nor has it described why TransCanada's proposed methodology is not sufficient to meet the stated information needs (section 5.9(b)(7)).

The Nature Conservancy's request may increase the statistical rigor of the proposed study somewhat. However, we note that the study, as proposed, will satisfy the study objective and produce results with an associated level of statistical integrity that would allow for the critical evaluation of the study, consistent with generally accepted scientific practice (section 5.9(b)(6)). Therefore, the increase in costs associated with The Nature Conservancy's requested methodology does not justify the slight statistical benefits to the study (section 5.9(b)(7)). As such, we do not recommend any modification to the proposed study.

Study 11 – American Eel Survey

Project facilities and operations have the potential to affect the distribution and relative abundance of American eel within the mainstem Connecticut River and its tributaries upstream of the project dams by impeding upstream and downstream migration. TransCanada proposes to characterize the distribution and relative abundance

of American eels in the projects' impoundments; the intermediate riverine sections between Wilder dam and the Bellows Falls impoundment; between Bellows Falls dam and the Vernon impoundment (including the Bellows Falls bypassed reach) ; and within the project-influenced portions of 24 randomly selected tributaries within the Wilder, Bellows Falls, and Vernon projects.

Study Goals and Objectives and Geographic Scope

Applicant's Proposal

To characterize the distribution and relative abundance of American eel within project-affected reaches of the Connecticut River, TransCanada proposes to conduct the study, within the FERC project boundary of the three projects, within the intermediate riverine reaches between the Wilder Project and the Bellows Falls project, and between the Bellows Falls Project and the Vernon Project. TransCanada also proposes to characterize the distribution and relative abundance of American eel within the project-influenced portions of 24 randomly selected tributaries.

Comments

VANR, the Watershed Council and the New Hampshire Fish and Game Department (NHFGD) find the stated goals and objectives of the study to be overly restrictive, and do not provide information on project effects on the distribution and relative abundance of American eel within the Connecticut River watershed upstream of the projects' facilities. As a result, VANR and NHFGD suggest the geographic scope of the study be expanded to include tributaries throughout the Connecticut River watershed. The Watershed Council suggests that surveys for juvenile upstream migrating eels be implemented at known barriers to tributaries to the Connecticut River to yield information on the presence of eels throughout the entire reach of the Connecticut River affected by the three projects.

The agencies state that information on the distribution and relative abundance of American eels within the Connecticut River watershed upstream of the projects' facilities is needed to evaluate the need for downstream fishways for out-migrating eels. VANR suggests that the installation of a hydroacoustic array at Vernon dam would help support this study.[13]

[13] Requests for the installation of a hydroacoustic array at Vernon dam were made in studies 11, 20, 21, and 22. Because we treat the requests for the Vernon hydroacoustic array as a new study request, and TransCanada largely did not adopt the request, we address the need for a hydroacoustic array at Vernon dam below, in Section II. *Study Requested but not Adopted by TransCanada*.

Discussion and Staff Recommendation

The presence of the three projects and their operation can influence the population and distribution of the American eel throughout its range in the Connecticut River watershed upstream of Vernon dam (section 5.9(b)(5)). TransCanada's proposed study limits the geographic scope of the study to an evaluation of the eel population and distribution within project-affected reaches of the Connecticut River and within the projects' hydraulic influence of select tributaries. TransCanada's proposed study would not evaluate the population of eels that pass through the projects' area and reside outside of the influence of the projects within the Connecticut River watershed.

Limiting the geographic scope of this study as TransCanada has to only project-affected reaches of the Connecticut River would likely misinform an analysis of potential project effects because as noted above, the population of eels affected by the projects would likely be substantially underestimated (Section 5.9(b)(7)). However, conducting a watershed-wide survey for American eel as requested by VANR and suggested by NHFGD, would be extremely costly (section 5.9(b)(7)). While the Watershed Council's approach (evaluate upstream eel migrations within tributaries) would provide information on relative eel abundance above each project, it would not provide information on the population of adult eel attempting to migrate downstream past the projects (section 5.9(b)(6)).

Alternatively, the installation of the hydroacoustic array at Vernon dam, as suggested by VANR and recommended below in *Section II. Study Requested but not Adopted by TransCanada*, *Vernon Hydroacoustic Study*, would provide data on the out-migrating population of adult American eel from above Vernon dam in an efficient and cost-effective manner because the study would be conducted at one key project location (Vernon dam) rather than the entire watershed area upstream. Data provided by TransCanada's proposed study 18 – *American Eel Upstream Passage Assessment* along with data from study could be used to make some assumptions on the distribution and relative abundance of eels above each project. This information, when coupled with hydroacoustic data from Vernon dam, could be used to estimate the number of adult eel out-migrating past each project; thereby, supporting an analysis of the need for downstream fishways at each project (sections 5.9(b)(5), (6) and (7)).

For these reasons, we do not find it necessary to expand the geographic scope of study 11 – *American Eel Survey* to include tributaries to Connecticut River watershed or surveys for juvenile upstream migrating eels therein.

Study 14 – Resident Fish Spawning in Impoundments

Project operations, specifically fluctuating water levels in the three impoundments, could affect fish spawning success and spawning habitat quality and quantity.

TransCanada proposes to assess the timing and location of fish spawning under existing conditions and evaluate the effects of reservoir fluctuations on various attributes of spawning habitat and spawning success.

Eastern Silvery Minnow

Applicant's Proposal

TransCanada proposes to conduct field studies to identify the timing and location of spawning for several target fish species. Target species include nest builders such as bluegill but also include golden and spottail shiner, which scatter eggs. TransCanada would assess potential effects of impoundment fluctuation on nest abandonment, spawning fish displacement, and egg dewatering, as applicable, for each target species.

Comments

FWS and NHFGD request that TransCanada add eastern silvery minnow (*Hybognathus regius*) to the list of target species and note that it uses backwater coves for spawning.

In its reply, TransCanada states that this fish would be difficult to locate and directly observe during spawning. TransCanada indicates that surveyors could find this fish during sampling for other target species in backwater coves and suggests that water level loggers in the sampling area could identify potential effects on eastern silvery minnow spawning. TransCanada also suggests the request to add this species does not meet the Commission's study criteria (section 5.9(b)(6) and (7)).

Discussion and Staff Recommendation

The distribution of eastern silvery minnow in the Connecticut River is likely poorly understood or poorly documented, as the only occurrence record we've found is downstream of the projects in central Massachusetts.[14] We also note that eastern silvery minnow was not found by Yoder et al. (2009) during a boat electrofishing survey in the project area.[15] Further, this species is not listed under any New Hampshire, Vermont, or

[14] Massachusetts Division of Fish and Wildlife. 2008. Eastern Silvery Minnow Fact Sheet. http://www.mass.gov/eea/docs/dfg/nhesp/species-and-conservation/nhfacts/hybognathus-regius.pdf

[15] Yoder, C.O., L.E. Hersha, and B. Appel. 2009. Fish Assemblage and Habitat Assessment of the Upper Connecticut River: A Preliminary Result and Data Presentation. Final Project Report. Submitted to U.S. Environmental Protection Agency, Region 1,

federal law; although, eastern silvery minnow is listed as a species of special concern under the State of Massachusetts Endangered Species Act.

In addition, FWS and NHFGD did not provide any information as to why this species is expected to occur within the project area, nor did they recommend a methodology or provide justification for the additional sampling costs (section 5.9(b)(6) and (7)) that would be incurred. Since there is no designated habitat, applicable conservation status, or occurrence record for this species in the project area, adding it to the list of target species for this study is not warranted at this time (section 5.9(b)(5) and (7)). However, if this species is present, project operations could impact its spawning habitat and/or spawning success as backwater coves are potentially influenced by changes in water levels (section 5.9(b)(5)). Therefore, if this species is found during other target species surveys, we recommend TransCanada record any applicable target species data (spawning habitat presence, depth of spawning habitat, etc.) and evaluate project effects on eastern silvery minnow.

Including eastern silvery minnow in the analysis based on confirmed presence is consistent with TransCanada's response to the FWS and NHFGD; thus, we do not anticipate any significant additional costs as a result of this modification (section 5.9(b)(7)).

Cumulative Impacts on Fish Habitat

Applicant's Proposal

TransCanada would map and qualitatively describe aquatic habitat types in the littoral zone of each impoundment and conduct surveys to document the timing and location of spawning fish, nest abandonment, spawning fish displacement, and egg dewatering.

Comments

NHFGD states that the impacts of water level fluctuations go beyond direct impacts to fish under current conditions. It states that water level fluctuations have a cumulative impact on fish habitat by preventing the establishment of aquatic plant communities and altering sediment deposition. NHFGD suggests that TransCanada map potential aquatic vegetation and substrate under a more natural flow regime to assess long-term effects of water level fluctuation on fish spawning habitat.

Boston, MA. Center for Applied Bioassessment & Biocriteria, Midwest Biodiversity Institute, Columbus, OH.

TransCanada agrees that the presence or absence of aquatic plant communities and sediment can influence fish spawning, but notes that the goal of this study is to assess spawning under the current project operating regime. TransCanada states it would not be able to predict future distributions of plant communities or sediment, nor map potential habitat under a natural flow regime within the scope of this study.

Discussion and Staff Recommendation

TransCanada's proposed study would provide sufficient information to evaluate the effects of current project operation on resident fish spawning and respective habitat (section 5.9(b)(5)). Additional mapping of vegetation and substrate under a more natural flow regime is not needed to evaluate current project operational effects on fish spawning and respective habitat (section 5.9(b)(7)). NHFGD does not indicate that the current proposal is inadequate to meet the goals and objectives of this study, nor does it provide any framework to produce a map or model potential vegetation communities or substrate conditions under alternative flow regimes (section 5.9(b)(6)). In addition, ILP studies typically identify and describe direct and/or indirect effects of project operations to provide information for our environmental review including an analysis of cumulative effects. For example, if project operations affect spawning substrate, then we would use information from this study and other related studies from all nearby hydropower projects to assess cumulative effects on spawning substrate in the affected area.

Sedimentation and Spawning Habitat

Applicant's Proposal

In this study, TransCanada proposes to evaluate the effects of project-related water level fluctuations on nest abandonment, spawning fish displacement, and egg dewatering. To support this analysis, TransCanada would quantify silt, sediment, and scour in subsets of fish nests throughout the projects' reservoirs. Sampling would occur in successful nests after eggs hatch and larvae disperse as well as in abandoned nests identified during the study, which would help describe any relationship between spawning habitat and sedimentation.

Comments

The Watershed Council expresses concern about the lack of a provision to assess potential effects of sediment deposition on redds and other aquatic species. To address this concern, The Watershed Council requests that TransCanada record where newly deposited sediment covers suitable spawning habitat and assess whether sediment deposition is related to project-induced water level changes or other factors.

TransCanada states that an attempt to assess the causes of deposition is beyond the scope of the proposed study but notes that the habitat, bathymetry, and erosion studies (studies 2, 3, and 7) would provide data on the location of sediment deposition in the study area.

Discussion and Staff Recommendation

In this study, TransCanada would collect sediment data in both successful and abandoned nests, which will provide some data to assess sediment impacts on nests, and would identify some areas where newly deposited sediment covers spawning habitat as the Watershed Council requests. However, TransCanada would not be able to determine the cause of sediment deposition without significantly more data collection regarding the locations of erosion and deposition in relation to project facilities and operations. Peaking operations may affect erosion and sedimentation due to changes in water level and/or flow in the reservoirs, but a causal assessment of sediment deposition is outside the scope of this study and is not needed to accomplish the goal of evaluating potential effects of water level fluctuations on spawning fish and their habitat (section 5.9(b)(7)).

As noted by TransCanada, other studies would determine where erosion and sediment deposition occur in the project-affected area, which would help evaluate the relationship between project operation and sediment deposition.[16] If project effects on sedimentation and aquatic habitat are occurring, we expect TransCanada to include an analysis of the effects in the preliminary licensing proposal or draft license application. As such, there is no need to include a causal analysis of sedimentation in this study.

Study 15 – Resident Fish Spawning in Riverine Sections

Project operations, specifically fluctuating water levels in riverine reaches downstream of the projects, may affect fish spawning success. Therefore, TransCanada proposes to assess the timing and location of fish spawning under existing conditions and assess the effects of water level fluctuations on target fish species and spawning habitat.

Sedimentation and Spawning Habitat

Applicant's Proposal

TransCanada proposes to evaluate the effects of project-related water level fluctuations on nest abandonment, spawning fish displacement, and egg dewatering. To support this analysis, TransCanada would also quantify silt, sediment, and scour in

[16] Based on our review, studies 1 through 5 and study 7 should provide adequate data on erosion, operations and sediment distribution throughout the project-affected area to describe the relationship between water level fluctuations and sediment.

subsets of fish nests in the project-affected riverine reaches. Sampling would occur in successful nests after eggs hatch and larvae disperse as well as in abandoned nests identified during the study, which would help describe any relationship between spawning habitat and sedimentation. Nest building species in this study include smallmouth bass and fallfish.

Comments

Like its comments on study 14 above, the Watershed Council expresses concern about the lack of a provision to assess potential effects of sediment deposition on redds and other aquatic species. To address this concern, The Watershed Council requests that TransCanada record where newly deposited sediment covers suitable spawning habitat and assess whether sediment deposition is related to project-induced water level changes or other factors.

TransCanada states that an attempt to assess the causes of deposition is beyond the scope of the proposed study but notes that the habitat, bathymetry, and erosion studies (studies 2, 3, and 7) would provide data on the location of sediment deposition in the study area.

Discussion and Staff Recommendation

As discussed above in study 14 – *Resident Fish Spawning in Impoundments*, TransCanada would collect some information to assess the effects of sedimentation on fish nests and identify areas of newly deposited sediment as requested by the Watershed Council. However, it is beyond the scope of this study to determine the cause of sedimentation, which would require much more data collection and analysis but is not necessary to achieve the goals of this study (section 5.9(b)(7)). TransCanada should collect information from several other studies to describe the relationship between project operations, water level changes, erosion, and sedimentation. As such, there is no need for a causal analysis of sedimentation in this study.

Longnose Dace

Applicant's Proposal

TransCanada proposes to evaluate potential effects of project-induced water level fluctuations on smallmouth bass, fallfish, walleye, and white sucker spawning. TransCanada would conduct field surveys to identify spawning areas and monitor water level fluctuations at spawning locations during the egg development period.

Comments

NHFGD requests the study consider longnose dace, a fluvial specialist, as a target species.

In its response, TransCanada states that it is difficult to observe spawning activity of longnose dace because this species spawns in swift flowing riffles and the eggs are hard to find in fast water. TransCanada also points out that this species may spawn over several months, which would increase the cost of field efforts to locate actively spawning fish. For the reasons above, TransCanada believes the request fails to meet the Commission's study criteria for acceptable methodology and level of effort/cost (section 5.9(b)(6) and (7)).

Discussion and Staff Recommendation

According to a previous survey by Yoder et al. (2009)[17], longnose dace occur in the Connecticut River but no individuals of this species were observed downstream of Wilder dam. In addition, longnose dace made up less than 1% of the entire fish assemblage in Yoder et al. (2009).

In addition, NHFGD did not provide any occurrence information nor did it recommend any sampling methodology or justification for the additional sampling costs that would be incurred (section 5.9(b)(6) and (7)). However, if this species is present, project operations could impact this species spawning habitat and/or spawning success as riffle habitats downstream of the projects are potentially influenced by changes in water levels (section 5.9(b)(5)). Although we are not aware of any occurrence records for longnose dace in the project-affected area, this species is likely present as TransCanada includes longnose dace in study 9 – *Instream Flow*. TransCanada would examine the relationship between project flows and habitat suitability in study 9 – *Instream Flow Study*, which is sufficient for our environmental review (section 5.9(b)(5)). Considering the analysis that would occur in study 9, difficulties in identifying precise spawning locations, and lack of a rationale for directly evaluating impacts on this species, we do not recommend TransCanada include longnose dace as a target species in this study.

[17] Yoder, C.O., L.E. Hersha, and B. Appel. 2009. Fish Assemblage and Habitat Assessment of the Upper Connecticut River: A Preliminary Result and Data Presentation. Final Project Report. Submitted to U.S. Environmental Protection Agency, Region 1, Boston, MA. Center for Applied Bioassessment & Biocriteria, Midwest Biodiversity Institute, Columbus, OH.

Study 16 – Sea Lamprey Spawning Assessment

Changes in water level and flows due to project peaking operations may affect sea lamprey spawning habitat throughout project-affected areas. TransCanada proposes to identify sea lamprey spawning habitat and assess whether or not project operations cause dewatering or scouring of lamprey redds.

Habitat-Based Assessment

Applicant's Proposal

TransCanada proposes to radio tag up to 40 sea lamprey, 20 released upstream of Vernon dam and 20 upstream of Bellows Falls dam, and track them to spawning sites where other non-tagged lamprey would likely spawn. TransCanada would then characterize the spawning habitat and monitor redds throughout the egg incubation period. TransCanada would monitor depth, velocity, embeddedness, relative condition of redds, and other variables across a range of project operational flows to evaluate effects on sea lamprey redds. TransCanada would also note any sea lamprey redds encountered during other studies including the *Habitat Mapping*, *Instream Flow*, and the *Tributary/Backwater Habitat* studies (i.e., studies 7, 9, and 13, respectively) and monitor these redds if feasible. TransCanada indicates that studies 7, 9, and 13 along with study 4 – *Hydraulic Modeling* and study 5 – *Operations Modeling* would supplement the analysis of project effects in this study.

Comments

The FWS does not believe the proposed study is adequate to meet the goal of determining whether project operations affect sea lamprey spawning success. FWS expresses concern regarding the possibility for few or no tagged lamprey to spawn in project-affected areas, and that studies 7, 9, and 13 would not necessarily overlap with the spawning period. Therefore, the FWS requests additional habitat-based monitoring to identify sea lamprey spawning areas.

Discussion and Staff Recommendation

TransCanada proposes to use observations during studies 7, 9, and 13 to identify additional lamprey spawning sites, but it is not clear how useful this strategy would be as study 7 is already completed and studies 9 and 13 would not necessarily overlap with the sea lamprey spawning migration period. In addition, TransCanada's proposed upper limit of tagged lamprey is 40 individuals, or up to 20 at each study site; thus, if the lamprey run is limited, TransCanada may not achieve its tagging goal. Further, even if TransCanada tags 40 lamprey, there is no guarantee these fish will spawn within the

project-affected areas, as lamprey could ascend several tributaries and leave the study area.

Considering the limitations above, TransCanada may not identify an adequate number of spawning sites throughout the large project-affected area to assess the effects of operational water level and flow changes on spawning habitat; thus, additional survey effort would be needed to inform our environmental analysis (section 5.9(b)(5) and (7)). A habitat-based survey, as recommended by FWS, is an accepted scientific approach that would assist with the identification of suitable spawning habitat and active spawning sites (section 5.9(b)(6)).

As such, we recommend TransCanada conduct habitat-based surveys to identify suitable spawning habitat and redds within the project-affected areas described in the proposal. TransCanada should use existing information in the Revised Study Plan and data from study 7 – *Aquatic Habitat Mapping* to focus field survey efforts on potential spawning habitat including shallow fast-moving water with gravel/cobble substrate typically found in riverine sections, tributary mouths, and near islands within the project-affected areas. Habitat surveys should coincide with the tracking efforts and use the methodology described in the Revised Study Plan to characterize suitable habitat and monitor redds.[18] We estimate the cost of additional habitat-based surveys would be approximately $45,000 (section 5.9)(b)(7)).

Ammocoete Sampling

Applicant's Proposal

To evaluate the effects of project-related water level fluctuations on sea lamprey spawning success, TransCanada would monitor sea lamprey redds for potential impacts related to dewatering, sedimentation, and scouring while directly evaluating spawning success by capping redds and enumerating emergent larvae.

Comments

NHFGD requests an electrofishing survey for ammocoetes[19] to assess sea lamprey spawning success. NHFGD suggests surveying downstream from identified spawning areas from late August to September and collecting length, weight, and maturity data.

[18] Specific methods are described in last paragraph on page 169 and first full paragraph on page 170 of the Revised Study Plan.

[19] An ammocoete is the larval form of lamprey species and live in burrows along the river bottom.

In its reply, TransCanada states that ammocoete sampling would not provide an indicator of spawning success because it is impossible to relate any observed ammocoetes to specific redds. TransCanada notes that study 10 - *Fish Assemblage* would record observations of ammocoetes collected through electrofishing.

Discussion and Staff Recommendation

NHFGD does not indicate why TransCanada needs ammocoete surveys to meet the goals and objectives of this study (section 5.9(b)(7)). Although ammocoete surveys would likely identify the location of ammocoete habitat, it is unclear how data from ammocoete surveys would help evaluate spawning success because surveyors would not be able to relate ammocoetes to specific redds. TransCanada's proposal to monitor and cap redds should provide enough information to evaluate spawning success (section 5.9(b)(5)). In addition, TransCanada would likely capture ammocoetes during electrofishing surveys for study 10 which would identify ammocoete habitat and provide the length, weight, and condition data sought by NHFGD at no additional cost (section 5.9(b)(7)). As such, we do not believe ammocoete surveys are necessary.

Study 18 – American Eel Upstream Passage Assessment

Project dams and fishways may affect the ability of eels to pass upstream thereby limiting their distribution and access to suitable habitat. TransCanada proposes to identify locations where eels concentrate near the base of project facilities and evaluate upstream passage options.

Condensed Study Schedule and Contingency Data Collection

Applicant's Proposal

TransCanada proposes to conduct visual surveys downstream of each dam to identify areas where eels concentrate in an attempt to migrate upstream. Shortly after TransCanada identifies these areas, it will deploy eel trap passes to determine if eels could be passed upstream in substantial numbers. TransCanada proposes to conduct these surveys in study year 2015.[20]

[20] In the Revised Study Plan, TransCanada proposed to conduct the study over a two-study season period (2014 and 2015) with eels surveys conducted in 2014 to identity locations for eel traps in 2015. However, as result of the technical meeting held on November 26, 2013, TransCanada amended its revised study plan, on December 31, 2013, to incorporate both aspects of the study (surveys and trapping) during the 2015 study season.

Comments

FWS, VANR, and NHFGD express concern regarding the amended and condensed study and indicated the data collection may be insufficient to meet the study goals and objectives. Specifically, FWS suggests that the location and number of eels may be highly variable within a single season and there is an increased risk that eel traps may not be placed in the proper locations to inform the environmental analysis and develop recommendations. However, the commenters generally supported TransCanada's amendment but desired specific language be added to the study plan to acknowledge their reservations with the amended approach. Specifically, to address concerns of insufficient data collection, all commenters request TransCanada include contingency language, which would require a second year of study if the initial study results are insufficient to meet the goals of this study.

In response, TransCanada notes that the methodology of study18 as amended on December 31, 2013, reduces potential effects of annual variability on eel trapping efforts and states that it is unclear what constitutes insufficient data. TransCanada acknowledges that that anomalous conditions or confounding data may warrant another year of study, depending on the outcome of the initial study review process currently in place, but it does not specifically include the contingency language requested by the agencies.

Discussion and Staff Recommendation

The commenters express a legitimate concern regarding the amended study approach. Specifically, the location of eel concentrations may vary throughout the study season. As such, TransCanada may not place eel trap passes in adequate locations to study eel passage because a full study season of visual survey data would not be available to identify appropriate sites first.

If upon review of the initial study report, it appears that conditions occurred that support the need for additional data collection, the commenters could request that the study plan be modified to require the additional data collection and we would make this determination as required in section 5.15(c) of our regulations. Therefore, there is no need to include contingency language requiring additional data collection at this time.

Study 20 – American Eel Downstream Migration Timing Assessment

Project operations have the potential to affect the timing of American eels migrating downstream through the Connecticut River. TransCanada proposes 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 the projects.

Field Data Collection

Applicant's Proposal

TransCanada proposes to conduct this study through a review of available literature for the Connecticut River Basin and other rivers in the Northeast to characterize the general timing of the Connecticut River American eel downstream migration. TransCanada states that both peer-reviewed and other literature related to American eel downstream migration on the Connecticut River and other river systems in the Northeast and general eel migration biology will be reviewed to quantify and characterize the expected outmigration of American eels. TransCanada states that the review will focus on environmental cues that stimulate migration.

Comments

NHFGD and VTANR expressed concerns regarding TransCanada's proposal stating that the study plan lacks a field component for determining the migration timing of silver phase American eels. NHFGD specifically requests that fyke nets or other sampling methods be used at the mouth of upstream tributaries to obtain data on the migration timing of American eels.

Discussion and Staff Recommendation

Providing a field component to the study to sample out-migrating silver eels would provide empirical data for use in TransCanada's proposed analysis in study 20 (section 5.9(b)(6)). However, TransCanada states that there are few eel upstream of its projects "in the mainstem Connecticut River," and as such, the effort necessary to capture a "reasonable proportion" of the eels that migrate downstream through the projects would be cost prohibitive. We note, however, that American eels may reside in rivers, streams, lakes, and ponds throughout a watershed; therefore, drawing conclusions regarding the upstream population of eels based on limited data collected in the "mainstem" Connecticut River is not possible.

In Section II, *Study Requested but not Adopted by TransCanada, Vernon Hydroacoustic Study*, we recommend TransCanada develop and implement a hydroacoustic study at Vernon dam. The resulting hydroacoustic data should be used to quantify and characterize the outmigration of silver phase American eels within the Connecticut River basin upstream of Vernon dam and would provide the information on the timing and magnitude of downstream American eel migration necessary to evaluate potential project effects on American eel and the need for protective license conditions (section 5.9(b)(5) without the need for the requested and potentially costly fyke netting.

Therefore, we recommend that the analysis of study 20 – *American Eel Downstream Migration Timing Assessment* incorporate the results of the *Vernon Hydroacoustic Study.* Because TransCanada proposes to utilize data from other on-going relicensing studies, it is unlikely this recommendation would result in any significant increase in cost to study 20 (section 5.9(b)(7)). We further discuss the *Vernon Hydroacoustic Study* in Section II below.

Study 22 – Downstream Migration of Juvenile American Shad - Vernon

Project operations may affect the downstream passage of juvenile American shad (e.g., timing, passage route selection, and mortality). TransCanada proposes to conduct a study to evaluate whether turbine passage adversely affects juvenile American shad survival and provide information to evaluate migration timing and forebay residency time. Monitoring methods to be used by TransCanada for this study include radio telemetry, balloon mortality tags, and hydroacoustic monitoring in the downstream fish bypass at Vernon dam.

Hydroacoustic Monitoring

Applicant's Proposal

TransCanada proposes to utilize a single-beam hydroacoustic transducer to monitor the Vernon Project forebay in the immediate vicinity of the downstream fish bypass pipe.

Comments

FWS, NHFGD, and VANR have requested the use of hydroacoustics for monitoring the downstream passage timing, duration, and population of juvenile American shad at the Vernon project and note that this monitoring would benefit the migration studies focused on American eels. Specifically, the commenters request a comprehensive hydroacoustic system that would provide complete project coverage within the Vernon Project forebay.

Discussion and Recommendation

The request for the installation of a comprehensive hydroacoustic system at Vernon dam is also related to studies 11- *American Eel Survey*, 19 – *American Eel Downstream Passage Assessment*, and 20 – *American Eel Downstream Migration Timing Assessment*; as a result, we consider the requested study modification to be tantamount to a study request that was not adopted by TransCanada. Therefore, we address this comment and the need for a hydroacoustic study below in Section II, *Vernon Hydroacoustic Study.*

Study 23 - Fish Impingement, Entrainment, and Survival Study

Project operations can affect fish populations due through impingement, entrainment, and turbine mortality. TransCanada proposes 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 potential for impingement or entrainment will be characterized based on the relationships between site-specific intake characteristics, swim speed and the life history characteristics of target fish species and guilds.

Study Timing

Applicant's Proposal

TransCanada proposes to conduct a qualitative study to model impingement and entrainment risk for resident fish species at the Vernon, Bellows Falls, and Wilder projects, while also estimating turbine survival for American shad (*Alosa sapidissima*) and American eel (*Anguilla rostrata*). The results of these survival estimates will be compared to empirical American eel and American shad entrainment and turbine survival estimates from the following studies:

- American Eel Downstream Passage Assessment (study 19),
- American Eel Downstream Migration Timing Assessment (study 20),
- American Shad Telemetry Study – Vernon (study 21), and
- Downstream Migration of Juvenile American Shad – Vernon (study 22).

TransCanada proposes to complete the study report in 2015 after the results of the studies above are available.

Comments

The Watershed Council requests that TransCanada file a draft report for stakeholder review in 2014 of the desktop model prior to incorporating the results from the empirical studies.

Discussion and Staff Recommendation

TransCanada is required to follow the established ILP study reporting regulations, which requires that progress reports for all ILP studies be filed with the Commission each study year (section 5.1.5). Additionally, we note that relicensing participants may comment on both the initial study report meeting as well as the initial study report document. As such, we see no need to recommend an additional requirement to report and review interim results of the proposed study.

Study 25 – Dragonfly and Damselfly Inventory and Assessment

Operational water level fluctuations may influence odonate assemblages in both reservoir and riverine habitats throughout the Wilder, Bellows Falls, and Vernon projects. Specifically, frequent changes in water level may decrease odonate habitat suitability or directly affect odonate survival as rising water level drown emerging odonate larvae. Therefore, TransCanada proposes to conduct a baseline inventory of odonate populations, collect field data on emergence and eclosure[21] behavior, and combine this information with data from other studies, including *Operations* and *Hydraulic Modeling* (4 and 5), to evaluate project effects.

Sampling Frequency

Applicant's Proposal

TransCanada proposes to conduct three odonate sampling events (mid-June, mid-July, and early August), with a focus on Vermont's special status odonate species, at 11 locations distributed throughout the three projects.

Comments

NHFGD expresses concern that three sampling events would not be sufficient to describe the distribution and behavior of the focal odonate species. NHFGD suggests the rarity and variability of these species through time and space could result in completely missing the peak emergence of some species, thus limiting the data available to evaluate project effects.

In response, TransCanada claims the proposed three sampling events are based in part on existing odonate studies[22] and should provide a representative estimate of species, diversity, and distribution of all riverine odonates.

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[21] Emergence is defined here as the event in which a mature larval insect leaves the water, travels up the river bank, and initiates eclosure. Eclosure is the process in which a larva sheds its exoskeleton and transforms into an adult.

[22] Hunt, P.D., M. Blust, and F. Morrison. 2010. Lotic Odonata of the Connecticut River in New Hampshire and Vermont. Northeastern Naturalist 17(2):175–188.

Morrison, F., D. McLain, and L. Sanders. 2006. A Survey of Dragonfly Emergence Patterns Based on Exuvia Counts and the Results of River Bottom Transects at Selected Sites in the Turners Falls Pool of the Connecticut River. Submitted to New England

Discussion and Staff Recommendation

TransCanada states that the proposed sampling effort is based on Hunt et al. 2010 and Morrison et al. 2006, but does not discuss the goals of these studies. Based on our review of the literature, the objective of Hunt et al. (2010) was to establish a general baseline inventory of species occurrence. As such, the methods and frequency of sampling from one to four times during the emergence season were successful at describing species occurrence. In Morrison et al. 2006, surveys were conducted more frequently (twice per week throughout the summer) to evaluate the effect of bank stabilization on odonate habitat use and emergence.

In other studies similar to Morrison et al. (2006), odonate sampling occurred relatively frequently, often twice per week, and typically reported very high variability in species emergence times and relative abundance.[23] The results of these studies support NHFGD's assertion that sampling only three times during the odonate emergence season is likely to miss the peak emergence of some rare species, thus compromising the data set needed to meet study objectives and evaluate project effects (section 5.9(b)(4) and (5)).

Environmental, Inc., Energy Capital Partners, The Massachusetts Environmental Trust, and Franklin Land Trust.

[23] Martin, K. 2006. Impact of bank stabilization technique, boat wake, water level rise, and predation on the mortality rate, and eclosure success of odonate nymphs in Gill, MA: Results of the 2006 field season. Unpublished report (MA Natural Heritage and Endangered Species Program, New England Environmental, Inc.)

Martin, K. 2008. Impact of bank stabilization technique, boat wake, water level rise, and predation on the mortality rate, and eclosure success of odonate nymphs in Gill, MA: Results of the 2008 field season. Unpublished report (New England Environmental, Inc.)

Martin, K. 2010. The transition zone: impact of riverbanks on emergent dragonfly nymphs. Implications for riverbank restoration and management. Ph.D. Dissertation, Antioch College.

McLain, D. 2008. Dragonfly population dynamics and bank stabilization in the Turners Falls Pool of the Connecticut River: Results of the 2008 field season. Unpublished report to New England Environmental, Inc., and Energy Capital Partners.

McLain, D., Morrison, F., and Sanders, L. 2004. Dragonfly population dynamics, effects of bank stabilization, and ecology of nymphs in the Turners Falls Pool of the Connecticut River, 2004 field season. Unpublished report to The Massachusetts Environmental Trust, Franklin Land Trust, and Northeast Generation Services.

While it is not practical to survey twice-per week at all 11 sites, increasing the field survey effort to once every two weeks from June through August would improve the chances of capturing target species. A bi-monthly survey would increase the quality of data needed to evaluate project effects and is a reasonable approach considering the goals of this study (section 5.9(b)(5) and (7)).

We recommend that TransCanada increase the odonate survey frequency to twice per month from June through August resulting in a minimum of six sampling events at each site. We estimate the cost of this additional field survey effort and assessment will increase study costs from the estimated $101,000 to approximately $200,000 (section 5.9(b)(7)).

Water Surface Elevation Data

Applicant's Proposal

TransCanada proposes to collect emergence and eclosure data including distance of larvae from the edge of water, emergence speed, various physical habitat parameters, time of observation, and water level at every sampling station. To the extent possible, TransCanada would coordinate field work with operations to sample during low water levels in an attempt to standardize survey conditions.

Comments

VANR expresses concern that the proposed surveys would not account for water level at the time of data collection and requests that TransCanada standardize field surveys to water level at the time of the survey. Specifically, the height or elevation of exuviae[24] and tenerals[25] should correspond to water levels at the sample site. VANR recommends that TransCanada record elevation or project flows at the beginning and end of each survey to adequately standardize field data.

In its reply, TransCanada indicates that surveyors would note water level data during the surveys, but does not provide any details regarding how surveyors would collect this data.

[24] An exuvia is the shed exoskeleton of an insect.

[25] A teneral is a soft-bodied adult dragonfly (or other insect). The teneral life stage is very short and occurs immediately after eclosure.

Discussion and Staff Recommendation

In order to evaluate project effects on odonates, TransCanada must be able to accurately identify the position of odonate larvae relative to water level at a particular survey site (section 5.9(b)(5)). Without accurate position data, it may be impossible to describe how water level fluctuations affect odonate survival. TransCanada would attempt to conduct surveys during low-flow or low-pool conditions in an attempt to standardize water levels, but some degree of water level fluctuation between sampling dates or during the survey would occur. Although TransCanada indicates that surveyors would collect water level data, the study plan provides no methodology. To accurately describe odonate position, TransCanada should standardize measurements by site-specific water surface elevation at the time of the survey.

Deploying water level loggers at each survey site would be an acceptable and cost-effective method to determine water levels at each site throughout the sampling season (section 5.9(6) and (7)). Water level data would provide a means to standardize field measurements and describe water level conditions prior to the survey. This information, in combination with data from study 4 – *Hydraulic Modeling* and study 5 – O*perations Modeling*, would provide adequate detail to describe effects of water level fluctuations on odonate habitat and survival (section 5.9(b)(5)).

Therefore, we recommend TransCanada deploy a water level logger at each survey site throughout the entire study period. All loggers should record on 15-minute intervals and reference a common vertical datum such as NGVD[26] to ensure accuracy and utility of the data. If water level loggers for other studies are within or immediately adjacent to the odonate survey sites, TransCanada could use existing loggers as long as accurate data for this study is collected. We estimate the cost of this additional effort and assessment to be $10,500.

[26] NGVD (National Geodetic Vertical Datum) is a vertical control datum used to measure the elevation above or below mean sea level.

II. Study Requested but not Adopted by TransCanada

In this section, we discuss our findings on the study requested by stakeholders that was not adopted by TransCanada. We base our findings on the study criteria outlined in the Commission's regulations [18 C.F.R. section 5.9(b)(1)-(7)].

Vernon Hydroacoustic Study

Study Request

Project operations and facilities may affect downstream migrating silver phase American eel and adult and juvenile American shad populations in the Connecticut River. These potential effects include entrainment and turbine mortality, migratory delay, and passage route selection (section 5.9(b)(5)). FWS, NHFGD, VANR, and Trout Unlimited filed the same study request (*Impact of Vernon Project Operations on Downstream Migration of Juvenile American Shad*) to utilize hydroacoustic monitoring of the juvenile shad outmigration, at the Vernon dam. As discussed above in section I, VANR also notes that the implementation of hydroacoustic monitoring could inform study 11- *American Eel Survey*, and VANR and NHFGD recommended a field component to support study 20 – *American Eel Downstream Migration Timing Assessment.*

Applicant's Proposal

In response to the requested studies and comments on the proposed study plan, TransCanada proposes to evaluate (using radio telemetry), run timing and route selection of juvenile shad and out-migrating American eels at the Vernon Project in studies 22 and 19, respectively. TransCanada also proposes to evaluate the duration, timing, and the relative number (its interpretation of magnitude or frequency) of juvenile shad migrating past the dam with a single-beam hydroacoustic transducer near the downstream fish bypass in study 22.

FWS Response to TransCanada's Proposed Study 22

Throughout the study plan development process, FWS has consistently requested a comprehensive hydroacoustic array at Vernon dam to evaluate juvenile shad downstream migrations. With regard to study 22, FWS raises concerns with relying solely on radio-tagged juvenile shad to represent their wild out-migrating counterparts. In response to TransCanada's proposal to include a single-beam hydroacoustic transducer near the downstream fish bypass, FWS notes this approach may provide information on the timing, duration, and relative abundance but the proposed approach would not allow for an assessment of delays to downstream migration at the project. As such, FWS requests the installation of a hydroacoustic transducer array at all possible passage routes (e.g.,

turbine intakes, fish bypass, spillway gates) to assess migratory delays cause by the Vernon Project.

TransCanada's Response

TransCanada acknowledges that installing a hydroacoustic array as requested by FWS would be the most comprehensive approach to evaluating the downstream migration of, and project effects on, juvenile out-migrating shad. However, TransCanada asserted that a costly comprehensive hydroacoustic array is not needed to accomplish the goals and objectives of the study.[27] In response to FWS' specific concern with assessing migratory delays at the project, TransCanada notes that it has conducted passage delay assessments utilizing radio-telemetry methods at Vernon dam for more than 20 years (We note, however, that TransCanada did not indicate for which species these assessments were conducted - Atlantic salmon or American shad or other).

Discussion and Staff Recommendation

TransCanada's proposed study 22 to monitor juvenile shad out-migration would provide nearly all the information FWS requested with one exception: the project's effect on downstream migratory delay. Because the source of the radio-tagged shad is unknown and stresses associated with tagging, holding, and transport will occur, the radio-tagged shad may not be representative of their wild, untagged counterparts, and, therefore, may not be suitable to evaluate migratory delay as TransCanada asserts (section 5.9(b)(7)).

Hydroacoustic data could also quantify and characterize the outmigration of silver phase American eels residing within the Connecticut River watershed upstream of the Vernon Project (sections 5.9(b)(6) and (7)).

To provide a more comprehensive approach to evaluating the downstream migration of, and related project effects on, juvenile out-migrating shad including migratory delays at the Vernon Project, and for reasons discussed above in Section I, study 11 – *American Eel Survey,* and study 20 – *American Eel Downstream Migration Timing Assessment,* we recommend that TransCanada develop a comprehensive hydroacoustic study for the Vernon Hydroelectric Project.

Additionally, because downstream migrations of adult American eel are strongly influenced by environmental conditions which can vary significantly from year to year, implementation of the hydroacoustic study for a single study season would not be

[27] TransCanada estimates the cost of FWS' request would add between $530,000 and $600,000 to the cost of study 22.

sufficient to address the magnitude of the out-migrating adult American eel population (section 5.9(b)(6)).[28]

Therefore, TransCanada should develop a two-year hydroacoustic study through consultation with FWS, VANR, NHFGD, and Commission staff to determine the timing, duration, and magnitude of the downstream migration of juvenile American shad and adult silver American eels at the Vernon Project for implementation during the 2015 and 2016 field seasons. Following consultation, TransCanada should file with the Commission for approval, the *Vernon Hydroacoustic Study* when it files its initial study report in September 2014. The study plan should document TransCanada's consultation efforts, consider comments received, and if recommendations are not adopted, provide TransCanada's reasons based on project-specific information.

We also recommend that the data generated from the *Vernon Hydroacoustic Study* be utilized in the analysis of the following four studies:

- Study 11 - *American Eel Survey*
  - Provide American eel passage data in the Connecticut River through observation of downstream migrating silver eels.

- Study 19 - *American Eel Downstream Passage Assessment*
  - Provide information on the timing, duration, magnitude, and passage route selection of downstream migrating American eels.

- Study 20 - *American Eel Downstream Migration Timing Assessment*
  - Provide information on the timing, duration, and magnitude of downstream migrating American eels.

- Study 22- *Downstream Migration of Juvenile American Shad Study – Vernon*
  - Provide information on the timing, duration, and magnitude and passage route selection of downstream migrating juvenile American shad.

Based on TransCanada's estimate, the development and implementation of this study would increase the cost of TransCanada's study plan by $530,000 to $600,000 but would provide significantly greater information on American eel population and their downstream migrations in the Connecticut River and on potential juvenile shad migration delays in the Vernon Project forebay (section 5.9(b)(7)).

[28] Haro, A. 2003. Downstream migration of silver-phase anguillid eels. Pages 215-222 in: Aida, K., K. Tsukamoto, and K. Yamauchi, eds. Eel Biology. Springer, Tokyo.

Document Content(s)