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May 31, 2016

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

Re: TransCanada Hydro Northeast Inc.'s March 1, 2016 Updated Study Report – Response to Comments
Project Nos. 1892-026, 1855-045, and 1904-073

Dear Secretary Bose:

TransCanada Hydro Northeast Inc. ("TransCanada") is the owner and licensee of the Wilder Hydroelectric Project (FERC No. 1892), the Bellows Falls Hydroelectric Project (FERC No. 1855), and the Vernon Hydroelectric Project (FERC No. 1904). The current licenses for these projects each expire on April 30, 2019. On October 31, 2012, TransCanada initiated the Integrated Licensing Process by filing with the Federal Energy Regulatory Commission ("FERC" or "Commission") its Notice of Intent to seek new licenses for each project, along with a separate Pre-Application Document for each project.

TransCanada submitted an Updated Study Report ("USR") for the three projects, as required by 18 C.F.R. §5.15(f) on March 1, 2016 and in accordance with the two-year anniversary of the Study Plan Determination ("SPD") for non-aquatics studies. The USR meeting was held on March 17 and March 18, 2016 in accordance with 18 C.F.R. §5.15(c)(2); and TransCanada submitted the USR meeting summary on March 31, 2016 in accordance with 18 C.F.R. §5.15(c)(3). With this filing, TransCanada submits responses to various comments and specifically to Disagreements and Requests to Amend Study Plans regarding the Study Reports filed on March 1, 2016 USR for the three projects, as required by 18 C.F.R. §5.15(c)(5). Comments, Disagreements and Requests to Amend Study Plans on the USR were filed by the following parties:

Name of Individual or Organization	Acronym Used in Comment/ Response Table
American Whitewater, Appalachian Mountain Club, and New England Flow	AW et. al.
Brattleboro, VT Historical Society	BHS
Connecticut River Joint Commissions and CJRC subcommittees (3)	CRJC
Connecticut River Watershed Council	CRWC
Mr. O. Ross McIntyre, MD, river abutter	McIntyre
Mr. John Mudge, river abutter	Mudge
New Hampshire Department of Environmental Services	NHDES
New Hampshire Fish & Game Department	NHFGD
The Nature Conservancy	TNC
Town of Lyme NH Selectboard	Lyme
US Fish & Wildlife Service	FWS
Vermont Agency of Natural Resources	VANR

Our responses are indicated in the attached table entitled, Response to March 1, 2016 USR Comments. Additional comments were provided on material and information presented at the most recent USR meeting regarding studies yet to be filed. While we have endeavored to provide responses regarding unfiled studies, we acknowledge there may be additional formal comments on the final reports to which we will respond. In addition, other comments and requests for studies previously not approved in FERC Study Plan Determinations were submitted. We have included those in a separate responsiveness table following the approved studies table.

Study reports that will be revised in response to comments received during the comment period for the March 1 USR, and the target date for filing of revisions are as follows:

1. Study 6 – Water Quality Monitoring Study, August 1, 2016
2. Study 10 – Fish Assemblage Study, June 17, 2016
3. Study 12 – Tessellated Darter Survey, June 17, 2016

In addition, final study reports for which interim reports were filed previously will include revisions in response to comments as described in the attached Comment Response Tables, are expected to be filed by June 17, 2016. These studies are:

1. Study 13 – Tributary and Backwater Fish Access and Habitats Study
2. Study 14/15 – Resident Fish Spawning
3. Study 16 – Sea Lamprey Spawning

If there are any questions regarding the information provided in this filing or the process, please contact John Ragonese at 603-498-2851 or by emailing john_ragonese@transcanada.com.

Sincerely,

John L. Ragonese
FERC License Manager

Attachment: Response to March 1, 2016 USR Comments

cc: Interested Parties List (distribution through email notification of availability and download from TransCanada's relicensing web site www.transcanada-relicensing.com).

TransCanada Response to March 1, 2016 USR Comments

Studies 1, 2 and 3: Erosion Studies (only Study 1 report has been filed to date)

Comment #	Study #	Source	Comment	Response
1	1	CRWC	In the summary, the study offers a preliminary finding that erosion has remained unchanged or decreased but the study does not offer the data/observations that allow for that or any other finding.	The data and level of analysis is a historical perspective not a full present day analysis. The data and analysis of 1958 and 1978 erosion records together with recent observations of the areas suggest erosion has remained unchanged or decreased over time. The comparison of 1958 and 1978 erosion maps shows only an overall increase of 1.4% in the areas mapped as eroding while preliminary analysis of historical aerial photographs shows that at a majority of sites inspected the rate of erosion decreased. Also, ground photographs show a number of erosion sites have stabilized. These data and level of analysis to date are suggestive that erosion has remained unchanged or decreased through time but Study 3 will more thoroughly examine this preliminary finding and compare with erosion throughout the entire study area mapped in 2014 that was not presented in Study 1.
2	1	CRWC	This is an incomplete study. There are studies that are not included in the bibliography of shoreland erosion studies conducted by the Conservation Districts in the valley in 1992 and presumably not used in the compilation of erosion over time since the bibliography does not list them.	Given the scope of Study 1, only erosion data sets covering the entire study area in the same timeframe were deemed sufficient for inclusion given the time and effort required to incorporate studies of limited spatial extent. As will be detailed in Study 3 report, comparing erosion mapping data from different years is wrought with complications including determining differences in what was actually considered to be an eroding bank, differences in the individuals doing the mapping, and differences in the time of year the mapping occurred. Despite these issues, the comparisons can be useful if these potential issues are minimized and recognized. Unfortunately, the CRJC-sponsored erosion mapping in the 1990's was completed at the County level utilizing the same method but completed by different individuals.

TransCanada Response to March 1, 2016 USR Comments

Comment #	Study #	Source	Comment	Response
				Furthermore, the mapping was completed over a several year period that adds yet another complication since the comparisons between different years completed in Study 1 is predicated on the assumption that the mapped erosion represents a single snapshot in time - indicating where the erosion was for a specific year (or more exactly the 1 or 2 month period in which the mapping was completed). A compilation of data over several years cannot represent such a snapshot as the location of areas mapped as eroding can potentially shift in that timeframe. The Study 3 report will review the results of the 1990's data and will potentially utilize that information in other aspects of the study but it was not utilized as part of Study 1.
3	1	CRWC	CRWC would add areas needing further analysis. Those related to climate change are: What effects have snow pack levels over the years 1958 and 2016 had on spring water flows? What are the changes if any in flows based on sever weather events year round? Have either of these situations increased or abetted shoreland erosion when added to the effects of project operations. If they would affect erosion, then would these conditions warrant a change in project operations?	These weather related analyses and questions are beyond the scope of Study 1 and the other erosion study plans approved by FERC.
4	1	VANR	Section specific comments: Appendix B – Appendix B presents comparisons of historical and 2015 ground photographs. The Appendix identifies the locations on a topographic map, but does not detail how the locations were documented in the historic record and how the 2015 work ensured the photos captured the same location. Please detail the procedures for matching previous photos to locations in the field. Please describe procedures used to ensure the 2015 photographs captured the historic site.	New England Power Company performed routine bank inspections for the three project areas. These reports are included in TransCanada's archives and consist of maps and ground photos. The maps have lines depicting areas of erosion and points and arrows showing the location and bearing of the accompanying ground photos. Once historic photos were selected to be re-taken they were scanned and printed and their location was recorded with a GIS point file. Photo location points were re-occupied in the field in a motorboat using ArcPad on a GPS-embedded Trimble tablet computer. The 2015

Comment #	Study #	Source	Comment	Response
			Appendix B – Many of the historic photos appear to be taken soon after ice out, while the 2015 photos appear to be taken further into the growing season. Photos taken later in the growing season have the potential to obscure the comparisons, as the amount of vegetation increases through the growing season. Where available, the dates of the photos should be included. Where not available, the lack of a known date should be included. Appendix D – Appendix D presents digitized river banks for four periods, 1939, 1955, 1970, and 2010. Are these four line files included with the geospatial data associated with the report? If not, could they be made available to stakeholders?	photo was carefully taken to match the orientation and scale of the historic photo to the extent possible. Where landmarks were clearly visible the match is more certain but in other cases a best effort was made to reoccupy the same position as the original photos. Dates of 2015 photographs and historic photos, if known, will be added to the Appendix B photo log and included in the revised study report. The line files were included with the supplemental geodata associated with the report.
5	1	CRJC Upper Valley Subcommittee	It is the opinion of this Subcommittee that Study #1 as presented is misleading and not unbiased. As reported by TransCanada's consultant for Study #1, John Field (March 17 Study Update Presentation): • Segments of the river that have been armored with rip rap or other means because erosion was threatening homes or public infrastructure are labeled as no longer eroding. This is true even in some segments where the armor has slumped down into the river. • Banks that are being undercut are not considered to be eroding if they still have some slumped vegetation. • Banks that erode and then green up with some kind of vegetation are not labeled as eroding. • Various studies of erosion over time being compared in Study #1 were not consistent as to what was considered to be erosion. Simply put, digitizing bad inconsistent data does not make it relevant or meaningful. The only river-wide erosion study done utilizing a consistent methodology	The comments made at the March 17 meeting appear, to some extent, to have been misunderstood and an attempt is made below to address the bulleted comments. • Study 1 compared erosion mapped in 1958 and 1978 and areas with riprap at those times were presumably mapped as "stable" then but no information is provided in those studies as to the condition of such bank armoring. Study 3 will compare these earlier erosion studies with mapping completed in 2014. Those areas where bank armor "has slumped down into the river" will be designated as "failed armor" in the 2014 mapping. • To clarify, banks that show evidence of undercutting are not mapped in these current studies as "eroding" only if the bank above is intact, stable, and shows no other signs of erosion. If the bank above has slumped vegetation then the bank is not mapped in the current studies as "stable" as suggested in the comment, but rather, mapped separately as "eroding - vegetated". "Banks that erode and green up with some kind of

Comment #	Study #	Source	Comment	Response
			was done in the 1990's for CRJC by the USDA NRCS. This Subcommittee believes this data set presents the only meaningful baseline data.	vegetation" may not have been mapped as eroding in previous erosion mapping efforts (unknown) but in the 2014 mapping effort would be mapped as "eroding" or "eroding – vegetated" if other evidence (such as failure surfaces) indicated the bank was continuing to erode despite the presence of vegetation. The mere presence of vegetation was not used in and of itself as an indication that the bank was stable. • The lack of detail in what was considered "erosion" in earlier erosion mapping efforts likely led to inconsistency between mapping efforts. This does not mean comparisons are completely without relevance or meaning but Study 3 will carefully detail, to the extent possible, what was considered "erosion" during various studies and to what extent comparisons are meaningful. Study 3 will carefully detail what is meant by each bank stability category to hopefully establish a more consistent method moving forward. As mentioned in an earlier comment, the 1990's erosion studies, while covering the entire study area in whole were done within individual districts, so the effort required to compile the studies was beyond the scope of Study 1. While the individual district studies in the 1990s work may have used a consistent methodology they were completed by different individuals and in different years which creates uncertainties and does not allow for any more meaningful comparisons with earlier erosion studies using different methods than will comparisons included in Study 3 with the 2014 mapping. The 1990's erosion studies also are not explicit as to what one means when saying a bank is "eroding" so these studies suffer from many of the same problems as the earlier mapping efforts. Again, this does not mean the 1990's or earlier mapping efforts are without meaning or relevance but one must be extremely careful in how the data are used to draw conclusions as to how the amount and location

Comment #	Study #	Source	Comment	Response
				of erosion is changing through time. While Study 3 will attempt to bring some clarity as to what is meant by calling something "eroding", the process is very complex and, therefore, difficult to easily place into distinct and obvious categories that can be reproduced reliably in different years by different mappers.
6	1 -3	Lyme	The Select board strongly requests that Trans Canada conduct the quantitative studies to demonstrate what the impact is of the rise and fall of the river on the river banks. If it is demonstrated that the operation of the dam is the cause of the erosion, Trans Canada should be held financially responsible for the damage and change the way the dam is operated to decrease further damage.	Comment acknowledged. FERC's issued its study determination on required erosion studies, including scope and methodology, and we are complying with such. The submittal date for Studies 2 and 3 is August 1 and therefore it is premature to request any sort of amendment to the study plan before the study report has been submitted completed.
7	1	McIntyre	The executive summary of the report is misleading. It fails to mention a number of caveats concerning the methodology of Study 1 that John Field offered while presenting the findings on March 17, 2016. When read by those who did not hear his presentation it could leave the impression that Study 1 provides reliable evidence that erosion "has remained steady or deceased over time at the majority of the sites studied." Although the subsequent sentence states that "further analysis as part of Study 3…..is needed to confirm this trend and to ascertain potential project-effects" the wording suggests that there is a trend to confirm when it is equally possible that there is no trend to confirm.	If Study 3 finds that no trend is confirmed, then such statements will be made within that study report that will make clear that such trends are no longer considered to exist.
8	1-3	McIntyre	To date, the studies have not been designed and carried out in a manner that could discover the extent of piping erosion, the most likely mechanism whereby dam operation could cause erosion. Even the language used by the staff to describe photos of river-bank erosion contains semantic bias. Erosion that has resulted in an overhanging bank is described as "undercut" a word that suggests removal of material	The processes of erosion are the focus of Study 3 and will include a discussion of "piping" erosion. The purpose of Study 1 was not to investigate processes of erosion and, therefore, did not include a discussion of piping erosion. To remove any semantic bias, Study 3 will utilize the term "overhanging" instead of "undercutting" to describe the physical features observed on the river banks.

Comment #	Study #	Source	Comment	Response
			by flowing river water. Overhanging material on a river-bank can be caused equally well by piping erosion or by stream action…I was encouraged when I suggested to John Field, who conducted the study, that he might use the term "overhanging" rather than "undercutting" that he agreed to change his description of such photos.	
9	1	McIntyre	Different observers were responsible for the data collected in each of the study periods. Methodologies were not standardized throughout the study period and in some cases they are not adequately documented. To this I would add that there is no evidence of statistician input into the design of any of the historical studies and no statistical evaluation of the summary data presented in this report.	The limitations of comparing data collected by different users utilizing different methodologies will be thoroughly discussed as part of Study 3. In addition, Study 1 as approved by FERC was not designed to include statistical analysis of historical data (largely map and photographic data).
10	1	McIntyre	The amount of effort spent in carrying out this study should not be minimized. The hand digitizing of erosion data from 1958 and comparison with similar data from the Corps of Engineers collected in 1978 clearly was a large task. This work is compromised by the omission of detailed information concerning the criteria used to allocate sections of river bank into the four categories used in the display. The presentation of this data on the topographical maps covering the three projects in Appendix A, uses colored lines that I estimate cover a breadth of 5-10 feet on the ground and for this reason are useful in this context only when changes exceed this amount. The changes seen in aerial photographs taken of the 11 sites chosen for detailed analysis of erosion are far more helpful in documenting the extent of erosive activity over time in these few and limited sites.	The limitations of making comparisons of the mapped data from different years will be thoroughly discussed in Study 3 including concerns regarding the accuracy of the position and measured lengths of changes in erosion given the scale at which the maps were made during the earlier mapping efforts. Uncertainties also exist in the overlays of aerial photographs and such uncertainties will also be further discussed in Study 3.
11	1	McIntyre	(Appendix B) The study selected sites that could be relocated for follow-up photos, but often conditions at the time of later photos has changed dramatically. This is particularly true for "naked" banks in the original	While the comments are valid, a consistent method of defining the "bank" in forested zones was used so as to limit potential error that will ultimately exist no matter what method is ultimately chosen.

Comment #	Study #	Source	Comment	Response
			photos (open fields or banks that had been clear cut) and later photos showing heavy forest replacement. On forested banks, the use of the center of trees to delineate the edge of the riverbank was used in compiling the digital map from aerial photos. Although this method has been used in other studies referenced in the report, I question whether a systematic error occurs in when tree-center is used to define the top of an eroding bank because trees in such locations often lean outwards toward the river. Other photos of banks covered with heavy brush or overhanging trees should not be considered a "match" as should underexposed photos in which detail is not seen. As might be expected, some pairs include a photo taken from a position on land and a photo taken from the water. These also can yield comparisons of doubtful value.	Every effort was made to match ground photographs as best as possible. The methods used to ensure such accuracy are described in a response above to a comment from VANR.
12	1	McIntyre	Causes of Erosion: On the base of the photographic record and other data from the study, erosion at various sites was allocated by cause. A small percentage of the total (data presented at the conference but not included in the report) was found to be piping erosion. The written report does not describe the criteria used for making this distinction and how these sites were selected [comment goes on to describe piping and discuss concerns in great detail and provides photos and discussion of River Road in Lyme NH]… Conclusions: Erosion due to piping may be difficult to detect in situations where there are other causes of erosion at work. It is more common than generally recognized and can result in bank collapse and sink hole appearance long after high water has receded. Such erosion may be recognized later when it occurs under paved roads than in farm fields where observations are easier. Piping may be anticipated when porous soils are exposed to fluctuating water levels as encountered in dam impoundments. Erosion	Study 3 will discuss in detail the various processes of erosion, drawing in part from the literature. What the commenter describes as "piping" erosion are more likely to be described as processes that create the "overhanging" banks – processes that will be described in Study 3 as distinct from (but not necessarily completely unrelated to) piping erosion. The limited amount of "piping" erosion mapped is likely more of a difference in semantics used rather than a difference in opinion of the processes occurring.

Comment #	Study #	Source	Comment	Response
			due to piping is clearly present in agricultural land surrounding the Wilder impoundment and this piping may also have been an important factor in damage to River Road in Lyme.	
13	1-3	McIntyre	Members of the public commenting at the Scoping meeting on Monday, January 28th, 2013 stated their belief that erosion had increased subsequent to the assumption of dam management by TransCanada. It should be determined whether this is true and if so, how important water level fluctuations in the Wilder Impoundment are to the piping erosion events mentioned above.	Study 3 will incorporate a discussion of likely causal mechanisms including the potential impacts of water level fluctuations. TransCanada has continued the same operation as previous project owners and operators, and has complied with license constraints, operating levels, minimum flows, drawdown rates etc. just as previous owners have. We cannot categorically state that inflows or patterns of inflow have remained similar as they change due to natural inflows and have changed due to increased upstream minimum flows.
14	1	Mudge	Previous erosion studies: Neither Study #1 nor the literature cited in that study, (page 10 of the study), makes any reference to different erosion studies that were done by the Grafton County (NH) Conservation District in 1992 and then in Cheshire and Sullivan counties (NH) in 1998.	Mention will be made in Study 3 but, as discussed above, only complete data sets covering the entire study area were utilized in Study 1.
15	1	Mudge	Historical Review of the Riparian Buffer on the Connecticut River: Study #1, the Historical Study, does not compare the riparian buffer of today with the riparian buffer before the construction of the Wilder Dam. That should have been done. Photographic evidence about the loss of the riparian buffer exists as is shown below [provides examples of historical and current photos]. There is no discussion of the lost riparian buffer in Study #1, the "Historical" riverbank study. Why not? Will that be in Studies 2 & 3?	Study 3 will include data on presence or absence of riparian buffer on most recent aerial photographs and relate it to erosion mapped in 2014; however, such an analysis was beyond the approved scope of Studies 1-3.
16	1	Mudge	Poor Comparable Pictures: Appendix B of Study #1does include a "comparison" of historical ground photographs. However, Study #1 includes no discussion of the photographs in the appendix. Perhaps that discussion will be a part of Studies 2 & 3? One problem	As discussed in response to other comments above, every effort was made to make as true and accurate a comparison as possible with the historical materials that were found and researched.

Comment #	Study #	Source	Comment	Response
			anyone encounters when trying to assemble photographs of the riverbank is the summer foliage that can hide the erosion. In Study #1, Appendix B, Photo Match 59 appears to be of the Mudge land in Lyme. Photo 2015-88 (Match 59) [provided in comment letter along with other comparison photos], was obviously taken in the summer and shows the thick summer foliage.	
17	1	Mudge	Old Data on Maps: From Study #1 -Appendix A- Maps of the Connecticut River: Appendix A of Study #1 takes data from 1958 and 1978 and now, 58 and 38 years after that data was collected, it is presented in Study #1. At the meeting on March 17, 2016, great effort was made telling the attendees that this data would be more analyzed in Studies 2 & 3. A lot has happened since that data was collected. A lot needs to be analyzed. What new data will be added to this old data? [provides examples of photos/maps from Study 1 report and photos from other sources]… After reviewing the maps in Appendix A, reportedly based on data from 1958 and 1978, I have come to the conclusion that this material should not be too heavily relied upon today to characterize the riverbank Riverbank that was "Still stable" in 1958 in fact had extensive rip-rap dumped on it prior to 1962, most likely before 1958-probably as early as 1950, in order to stabilize the bank before the completion of the Wilder Dam. Riverbank that was "Still stable" in 1958 has seen extensive erosion and sometimes stabilization work since then. Those sections should be labeled as "Stabilized" rather than "Still stable." Great care must be made when characterizing different sections of the riverbank. A close look at it will probably show many more destabilized areas than are indicated in the study.	The erosion mapping data from 2014 will be added in Study 3 to 1958 and 1978 erosion mapping data presented in Study 1. The "still stable" label referred to by the commenter as characterizing conditions in 1958 is actually meant to indicate that in 1978 the bank was "still stable" as both in 1958 and 1978 the bank was not mapped as eroding so is presumed to have been stable both in 1958 and 1978 (only areas of erosion were mapped in 1958 and 1978 with no explicit indication given of conditions where no erosion was mapped such as locations of bank armor). No distinction is made on the 1958 or 1978 maps of areas that were armored with riprap or naturally stable. Presuming areas of riprap were not considered to be eroding in 1958 and 1978, they would have been considered stable. In Study 3, the 2014 erosion mapping will be presented and compared in a similar manner to 1958 and 1978 maps so changes since 1978 will be reflected and areas that were mapped as stable in 1978 and are now eroding will be indicated on the maps as "destabilized" indicating a stable bank in 1978 is now eroding in 2014.

Comment #	Study #	Source	Comment	Response
18	1	Mudge	• I am disappointed that the "Historical" study does not include references to other known studies of the riverbank erosion. • The "Historical" study makes no reference to the history of the riparian buffer and how it has been destroyed. • The use of data that is 58 and 38 years old, and making maps of the erosion with that information, is very misleading if the reader in fact knows the land or even if you just look at it today as you drive by. • The "Historical" study fails to address how and why federally funded erosion control projects have failed. Is that because of the operation of the Wilder dam? • Page 1 of the study states: "The goal of this study was to assess the historical erosion and riverbank movement." Then page 2 reads, "Study 1was largely conceived as a data collection exercise." • An assessment should be more than a data collection exercise.	Responses for the most part given elsewhere to these comments. Data for erosion mapping from 38 and 58 years ago is not intended to indicate how conditions are today but will be used in Study 3 to show how conditions compare with those mapped in 2014. Some discussion will be provided in Study 3 of where previous bank stabilization efforts have failed. Given the different timings of the studies, it became apparent that analysis of Study 1 historical material would best be completed as part of Study 3 once other data collection efforts (including erosion data from 2014) were available to compare with data collection efforts in Study 1.
19	1	CRJC	• Request and recommend study modifications, or additional studies, that are designed to determine the likely causes of erosion, particularly those that are designed to identify the portion of erosion that is directly attributable to project operations. • Suggest the effect of historic log drives and scour by ice be considered as erosive forces. • Recommend that the operational model be optimized to manage ramping rates and frequencies in a manner to minimize erosion. • Point out that erosion inventories conducted in 1992 by the Grafton County Conservation District, and in 1997 for Sullivan and Cheshire Counties in New Hampshire and Windham and Windsor	Study 3 is designed to determine, to the extent possible, the likely causes of erosion within the project-affected areas. The history of log drives and effects of ice will be discussed as part of Study 3 but it may be difficult to ascribe particular bank features to these events. As mentioned in earlier responses, 1990's erosion studies will be mentioned in Study 3 but will not be incorporated into study as these mapping efforts did not cover the complete study area in a single effort over a single field season. The operational model is expected to be used to evaluate operational alternatives to present operation, including ramping.

Comment #	Study #	Source	Comment	Response
			Counties in Vermont should be added to the inventory of prior studies.	

Study 4 – Hydraulic Modeling Study

Comment #	Study #	Source	Comment	Response
1	4	VANR	Section 4.1.4 Expansion and Contraction Coefficients (p. 7) – The report states, "Coefficients of contraction and expansion of 0.1 and 0.3, respectively, were assigned to cross sections for this study. These values, the model defaults, are appropriate for the flow conditions observed in the Connecticut River". Please provide additional detail that describes why these coefficients are appropriate for the Connecticut River.	Contraction and expansion zones occur in river flow at locations where there are abrupt changes in channel conveyance. These zones are characterized by rapidly varied flow in the vicinity of a flow constriction such as a narrow diameter culvert in a wide river channel or bridge abutments that extend into a river channel. The effect is the hydraulic constriction of flow, which forms a jet upstream of the structure in the contraction zone and turbulence downstream in the expansion zone. On river reaches like the study area of the Connecticut River where: 1) the changes in river cross sections are small due to the absence of significant channel encroachments; and 2) the flow is subcritical the coefficients are typically on the order of 0.1 and 0.3 for contraction and expansion, respectively (ACOE HEC-RAS Reference Manual, 2016). During model setup, calibration and verification, we reviewed available maps, aerial imagery, LiDAR and bathymetry survey data, and FEMA Flood Insurance studies for abrupt changes in the river channel (from both natural and man-made features) and evidence of potential contraction and expansion zones that would warrant entry of contraction and expansion coefficients outside of the typical values. Our review of the study area and published references, and the calibration results indicated that the typical values, also referred to as the model defaults, were acceptable.
2	4	VANR	Table 4-6 Hydraulic Model Calibration Periods – The project reaches and hydrologic conditions (operations vs. spill) use different periods for calibration. Please describe how the time periods for calibration were chosen.	The following steps were involved with the selection of time periods for calibration: 1) We reviewed the window of 2014 Study 2 logger deployment, which spanned from June 25, 2014 to October 31, 2014. 2) Within that window we identified time periods that

Comment #	Study #	Source	Comment	Response
				represented typical operations and spill events and verified these time periods with project operations data. 3) Within typical operations and spill event time periods, we reviewed the logger records for uninterrupted data spanning 5-7 days (e.g., time periods free of data interruptions such as loggers out of water, frozen loggers, vandalism, barometer changes, logger relocation, etc.). 4) We reviewed the time periods identified for the loggers with data for the USGS gages to check data availability at the gages. 5) We presented the selected time periods and locations (Study 2 loggers and USGS gages) during the Study 4 Consultation Call, (July 20, 2015) with the water resources working group. We found that it was necessary to vary some of the time periods across reaches based on the hydrology, data logger data, USGS gage data, and project operations along each reach. In other words the conditions (flows and data collection) on the reach from Wilder dam to Bellows Falls dam were not the same as the conditions along the reach from Bellows Falls dam to Vernon dam.
3	4	VANR	5.1. Model Calibration and Validation – Model calibration was performed using data recorded at active USGS gages, level loggers deployed in 2014 for Study 2, and level logger data available from FirstLight. Gage and logger data for two observed flow events (operations and spill) were compared with results from the hydraulic model. Please describe the calibration process in more detail. Was the HEC-RAS model simply compared to observed values or were modifications made to the model for the output to better fit the observed data? If modifications were made, please describe this	As indicated in Section 4.1.3 of the study report, Manning's n-values were initially entered during model setup based on published references and engineering judgement. The model was then run for a range of flows with the initial Manning's n-values. After the operation and spill time periods were selected for calibration, the actual project flows were entered into the hydraulic model for those time periods. The observed water surface elevations (from the USGS gage data and level loggers) were compared to the computed water surface elevations at the designated locations.

Comment #	Study #	Source	Comment	Response
			process. What was considered an acceptable amount of error in the calibration process?	If the observed and computed water surface elevations varied at a given logger (i.e., by more than 0.5 ft on average) and along a given reach (i.e., by more than 0.2 ft on average) then the Manning's n-values were adjusted (within reason) and the hydraulic model was re-run. This process was repeated until the observed and computed water surface elevations for the range of flows (operation and spill conditions) and the Manning's n-values were considered reasonable along sections of the reach. This process involved simultaneous review of all loggers during the calibration check/model run cycles since adjusting the model along one logger section could change the results along other sections of the model. The calibration results were compiled in Table 5-1 in the study report to check the calibration at individual logger locations and to evaluate the average for each reach. Our goal was to have a reach average that was ± 0.2 ft, which is well within the degree of accuracy of the project flows and impoundment water surface elevations and the vertical accuracy of the input data: • Based on information provided by U.S. Imaging, the LiDAR data has a vertical accuracy of about 0.4 ft. • The bathymetry provided by Normandeau Associates has a vertical accuracy of about 0.1 ft. • The USGS gages, listed as "good" condition, have a vertical accuracy on the order of 0.5 ft at a flow of about 10,000 cfs. • The margin of difference recorded for the Real Time Kinematic (RTK) survey for the reference points of the level loggers ranged from less than 0.01 ft to 0.6 ft. During the calibration process, we also performed a preliminary review of validation results and a preliminary velocity comparison to check whether refinements made to the model as part of calibration were adversely affecting the

Comment #	Study #	Source	Comment	Response
				relationship between observed and computed data. The validation process included a different set of loggers deployed as part of a separate study and data from a different time period than the data used in calibration. We did not adjust Manning's n-values during interim validation or velocity checks. The velocity comparison and calibration processes and preliminary results were presented at the study consultation call on July 20, 2015 and the USR meeting on October 1, 2015.
4	4	VANR	Table 5-2. Velocity Comparison – The report states, "the simulated velocities compare very favorably with the observed data." In general, the Agency agrees with this statement. However, the Agency notes that at location 'WR1-3' the modeled velocity exceeded the observed velocity by approximately 50%. What drove the discrepancy in modeled output from observed velocity in this reach?	The location of WR1-3 is about 1,500 ft downstream of Wilder dam and just upstream of an unnamed island in the main stem of the Connecticut River. The 0.6 ft/s difference between the observed and computed velocity at this location is likely due to the absence of detailed bathymetry as it may relate to the subtleties in the channel around the island just downstream of the velocity measurement. However, the use of surveyed transects along this section of the reach sufficiently represented the channel geometry for the model's intended purpose as shown in the model calibration results at this location for logger WR-01.
5	4	VANR	6.0 Assessment of Project Effects (p.34) – The report states, "the rating curves allowed for an initial screening of project effects on resources by comparing the various resource-critical flows and water surface elevations noted in the field with modeled flows and water surface elevations. For cases where potential effects were unlikely, no further analysis of the resource would be warranted since project operations were identified as having little or no effect." Please provide detail in each in each study report of how the initial screening of project effects occurs and provide a clear justification for determinations that "potential effects were unlikely" and not deserving of further analysis. The Agency does not necessarily	Other ILP Studies that relied on hydraulic and/or operations modeling provide study-specific discussions of the assessment of project effects in their study reports, including initial screening based on the hydraulic model.

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			disagree with the concept of an a priori exclusion of resources where it can be determined with certainty that a resource is not affected by project operations, but these determinations should be conservative. Conversely, determinations that "potential effects are unlikely" has the potential to exclude impacts on resources. Resource agencies will need to understand the degree to which impacts are "unlikely" to support the initial screening of project effects. Similarly, it may not be warranted to exclude resources where project operations have "little effect". Over the geographic scope of the project area "little effects" have the potential to represent a significant cumulative impact. Where further analysis did not occur due to determinations of "little effect", resource agencies will need to understand the magnitude and frequency of these impacts.	
6	4	NHDES	Section 4.1.7 Bridges, p. 15: It is stated that bridges were not explicitly modeled. This suggests that there is a flow limit, above which the model will not provide accurate results. The Department requests that this upper flow limit be specified in the report.	Model accuracy is linked to the calibration, which was performed using available logger data for flows up to about 13,000 to 24,000 cfs and USGS gage data for flows up to 25,000 to 50,000 cfs. We also believe the model produces reasonable results for flows up to 100,000 cfs based on a review of historic USGS gage data. Furthermore, bridges were likely designed to safely pass flows on these orders of magnitude, which are less than the 100-year recurrence interval for the study area. Our review of the LiDAR data during model setup indicated that the LiDAR represents in detail the earthen terrain and channel geometry in the vicinity of the bridges. Finally, consideration of the hydraulic impacts of bridges for extreme flows was beyond the study scope.
7	4	NHDES	Section 4.2 Hydraulic Model Calibration and Validation, p. 15: The Department requests that the range of flows used to calibrate and validate the model be specified.	The flow ranges used to calibrate and validate the model are based on the flows observed at the level loggers. We will update Table 4-6 with the requested information and add a table to describe the flow range for the USGS gage rating

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				curve comparison.
8	4	NHDES	Section 5.1 Model Calibration and Validation, p.28: Table 5-1 shows the Calibration Results. Modeled results were subtracted from observed results, totaled and then averaged. The Department requests that the range of the difference between observed and modeled results at each station be included in the table to provide a better understanding of how well the model is calibrated.	The graphs in Appendices B and C show the range of difference (in terms of both water surface elevation and the timing of the changes in water surface elevation) between observed and computed results for calibration and validation. We believe it is better to assess the calibration results graphically. Graphical representation shows the dynamic relationship between flow and water surface elevation across the calibration time period, which tabular data does not, and as with most temporal scientific data sets, quantifying the results based on one maximum and one minimum water surface elevation difference does not comprehensively portray the calibration in relation to observed data.
9	4	NHDES	Section 5.2 Velocity Comparison, p. 32: The HEC-RAS velocities represent the average velocity along the cross-section. It is not clear if the observed velocities also represent the average velocity (i.e., calculated by dividing the measured flow by the measured cross sectional area where flow and area are calculated from measurements of velocity and depth across the cross section). The Department requests that the report clarify what the observed velocities in Table 5-2 represent to facilitate interpretation of observed and simulated results.	Studies that collected field data such as velocity observations include a discussion of the methods of data collection and evaluation in those study reports. Velocity was measured as part of Study 9. The Study 4 report issued on March 1, 2015 incorrectly indicated that the work was performed in Study 7. Study 4 will be updated to correct this error. According to the Study 9 authors: “The observed velocities reported in Table 5-2 of the Study 4 report are from Acoustic Doppler Current Profiler (ADCP) output. They are the average velocity for the cross section. These values are very close (generally within 1%) of those calculated by dividing discharge by cross section area. However, they are more accurate because they take into account variation of velocity across the channel.”
10	4	NHDES	Appendix B-1 and B-2: Graphs of calibration results for each station are provided in these appendices. In some cases, the difference between observed and simulated elevations approximately 0.5 feet (e.g., W07, W09, WR01, WR05, WR08, B01, BR01, BR05, V02, Upstream Stebbins). Could a better match be	We believe that a better match would not be obtained with further adjustment of Manning’s n-value as discussed below. Manning’s n-values were repeatedly adjusted based on comparison of computed data with the observed data to balance the difference across the range of flows and water surface elevations at a given cross section, along each river

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			obtained with further adjustments of Manning's 'n'?	reach, and across the operations and spill events. The n-values (roughness) at a given river cross section is variable and depends on a number of factors including the depth of flow, the velocity, seasonal changes in vegetation, natural channel morphology, and the irregularity of the channel including sand bars and areas of scour as well as other factors. Modifying the n-values as part of the calibration process was an interactive and iterative process to obtain reasonable results for a range of flow conditions. Revising the n-values may help achieve better match results for a high flow but decrease the accuracy for a low flow. Modifying the n-values can also influence results at upstream and downstream calibration locations. The hydraulic calculations and calibration results are based on dynamic flow and water surface conditions which are subject to hydraulic hysteresis, (also known as a looped rating curve). In both the impoundments and riverine sections the same flow conditions can produce a range of results depending on whether the water surface is rising or falling. Six of the ten locations identified in the comment are in the impoundment areas. Four are located in the riverine sections. Modifying the n-values at the impoundment locations typically does not significantly influence the water surface elevation because the water levels are governed by a downstream dam versus channel resistance. There is more uncertainty of channel geometry versus the n-values in riverine areas where, due to shallow water access issues and boater safety concerns, estimated channel transects were used in place of detailed bathymetry. This applies to loggers WR01, WR05, WR08, and BR01. Accuracy of the observed and computed results are dependent on other variables such as the accuracy of the logger data, the flow data, as well as the channel/bathymetry.

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11	4 and 5	CRJC	Incorporate into the hydraulic and operations models scenarios of more intense storm events and prolonged periods of drought that are based on recent historical data and predicted by the preponderance of climate models. Not to do so is a glaring weakness in the studies that will undermine their credibility and defensibility. Furthermore, the resulting weaknesses in the models will hamper the projects owner's ability to meet desired stakeholder outcomes in future years.	Study 5 addresses historic hydrology which in itself has variability between the 5 yearly hydrologic inflow series. scenarios. FERC's study plan determination issued September 13, 2013 (Appendix B) did not require TransCanada to conduct climate-related studies or climate-related modeling.

Study 6 – Water Quality Monitoring

Comment No.	Study #	Source	Comment	Response
1	6	VANR	Table 4.2-1. The table describes the criteria, which would result in the data needing to be corrected. Please describe when the data meets the criteria for a correction, how the value of the correction is determined and how the correction is then applied to the data.	Section 4.2.6 on page 13 of the report briefly describes data censorship and correction. For a more thorough description we asked the reader to refer to the Agency approved Site Selection and Sampling and Analysis Plan (SSR). See Section 5.2, Data QA/QC in the SSR specifically.
2	6	VANR	Table 4.2.2. Were test solutions employed post calibration? The conductivity standard in footnote 2 does not match the standard listed in the table.	Yes, after calibration readings were verified to be within acceptable calibration criteria (Table 4.2-1) using calibration solutions listed in Table 4.2-2. Footnote 2 refers to all environments as single environment that spans freshwater to saltwater environments. YSI recommends for freshwater deployment of the YSI 6920 v2 sonde that 1mS/cm (1000 µS/cm) solutions be used. We will clarify footnote 2 of Table 4.2-2 in the report. See YSI's Calibration, Maintenance & Troubleshooting Tips for YSI 6-Series Sondes and Sensors, which is available online.
3	6	VANR	Table 5.1-3. Continuous data collection took place on a period longer than the 10 days listed in the table, please describe how the appropriate10 day high temperature, low flow window was selected.	We selected the appropriate ten-day low-flow monitoring based on the low-flow sampling criteria specified in the SSR and described in Section 4.1.1 of the report. These criteria specify the low-flow monitoring period would commence when mean daily water temperatures generally equaled or exceeded 23°C and average daily flows at USGS streamflow gages at West Lebanon, NH (01144500) and North Walpole, NH (01154500) were near or below 3 x 7Q10 flows. This time period satisfied those two criteria.
4	6	VANR	Figure 5.2.2-1. The figures present the continuous water temperature for each station across the period of study. With the stations broken out on separate figures and spread along the whole season, it is hard to infer change from station to station and infer the magnitude of change. The Agency recommends overlaying each station on the same graph and separating the figures by month. For example, there would be	We will plot all mainstem stations for each project on monthly graphs for temperature along with inflow, project discharge. We will use a large scale format to allow for detailed review and will incorporate the plots into the revised report as an appendix. We will also point out general patterns that can be explained. However, we note that the data are affected by a range of variables beyond project operations (local weather patterns, tributary

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			one graph for May and all stations would be included on that graph. The Agency also recommends including project discharge on these graphs to provide some perspective on how project operations affect water quality parameters. This specific figure is for the Wilder project, but the comment applies to all three projects.	inflows, etc.) which we will also include to the extent that information is available.
5	6	VANR	5.2.3 Bellow Fall Project (p. 53) – The report states, the greatest amount of warming through the impoundment occurred during the month of August. However, Table 5.4-2 shows that largest increase in water temperature from the uppermost Bellows Falls impoundment station to the tailrace occurring in May, when water temperature increased by four degrees on a weekly mean basis. Please discuss.	On page 53 of the report we state the greatest amount of warming through the impoundment occurred during the month of August when mean monthly water temperatures ranged from 23.5°C (06-BF-04) to 24.4°C (06-BF-01). Table 5.4-2 shows weekly and monthly mean water temperatures. The difference of 4°C in Table 5.4-2 shows the monthly mean difference between station 06-BF-04 and 06-BF-TR. Station 06-BF-04 is an upstream riverine station and upstream of influence of the Bellows Falls impoundment and is not an impoundment station. The uppermost Bellows Falls impoundment station is 06-BF-03. The 4°C difference between the upstream riverine station (06-BF-04) and the Bellows Falls tailrace station (06-BF-TR) compares mean monthly temperature and the large difference is because station 06-BF-TR was deployed in the latter half of May due to unsafe conditions in the tailrace, whereas station 06-BF-04 was deployed in April. This is a comparison of two different time periods and is noted by an "*" next to the value referring the reader to a table note that states, "indicates incomplete data available due to late deployment." Therefore, we will remove the values "4.0*" and "1.9*" from Table 5.4-2 as we agree that they can be misleading.
6	6	VANR	Table 5.4-2 Weekly Mean Temperature – One of the primary goals of the study is to, "determine potential effects of the projects on water quality parameters of water temperature, dissolved oxygen (DO), conductivity, turbidity, pH, nutrients, and chlorophyll-a". Due to the peaking nature of the projects when data is presented by either daily mean or weekly mean, the effect of project operations on water quality parameters is	Table 5.4-2 and similar tables were designed to characterize the spatial pattern of water temperature over the study area, and in section 5.5.2 we assess compliance with Vermont's temperature standard for Class B waters. Considering that there are multiple variables associated with the various water quality parameters, summarizing periods of peak flow and minimum could be misleading.

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			completely obscured. Any table that aggregates and averages data over a time period should also break out periods of peaking operations from minimum flow periods in order to meet the objectives of the study.	Therefore, we will provide similar monthly figures for DO, specific conductivity, pH, and turbidity as we will for temperature (see response to comment #4 above) for all stations when these parameters were measured by project along with flow.. .
7	6	VANR	Section 5.5.2 Vermont Water Quality Standards – The report states, "The surface water quality standard for water temperature states the change or rate of change either upward or downward shall not exceed 1.0°F (0.56°C) from ambient temperatures." The report then describes changes in temperature on a weekly mean basis. While the Agency appreciates the complexity of the temperature dynamics of water moving through the project impoundments. In issuing a water quality certification for the project, the Agency must determine whether project operations comply with Vermont Water Quality Standards. Given weekly mean temperature obscures the effect of operations on water temperature, it is not clear that weekly mean temperature is a useful metric to assess compliance with Vermont Water Quality Standards. The Agency would strongly recommend comparing water quality parameters between operational scenarios (i.e. peaking vs. minimum flow operations).	Please see responses to comment #4 and #6.
8	6	NHDES	Executive Summary: The Department requests that the Executive Summary be revised to be consistent with the comments below.	The Executive Summary will be revised as needed to be consistent with the revised study report.
9	6	NHDES	Section 3 Study Area, p.3-5, Tables 3.0-1, 3.0-2, and 3.0-3: The tables include mean depths for each station. It is not clear how the mean depths were determined and, therefore, what they represent. The Department requests that an explanation be added. Also, it is unclear if the tributary stations are influenced by water quality in the Connecticut River (i.e., due to backwater effects). The Department requests that an explanation be added as this is needed to interpret the water quality data.	The mean depths presented in Tables 3.0-1, 3.0-2 and 3.0-3 were determined by taking the depth of each station during each station visit using a HONDEX® SM-5 portable depth sounder, and then the mean of the individual depths measured during the course of the study was calculated for each station. For the tributary stations the portable depth sounder was used as well as visual estimates if the depth was too shallow for the depth sounder to obtain a reading. We will add notes below each table for clarification as well as in the main body text.

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				We installed the tributary stations upstream of water level influence of the mainstem Connecticut River based on mapping and field observations. At no time throughout the duration of the study did we visually observe the Connecticut River to backwater (e.g., pooling of water) up to the tributary monitoring stations. Backwatering would most likely occur during high flow events, and when stations were visited around the time of a high flow event no backwatering was observed. We will add text to section 4.1.1 in the revised report to clarify.
10	6	NHDES	Section 4.1.2 Continuous Monitoring with Multiparameter Datasondes, p. 10: It is stated that the multiparameter sondes during the 10-day high temperature, low flow monitoring were deployed from one of three moorings (river left, mid-channel, river right) at whichever location was most representative of the river cross section. The Department requests that selected location be specified for each station.	Station locations for the ten-day low flow monitoring period are presented in Table 3.0-3 of the report. We will note in this table in the revised report, the location of the multiparameter sondes during the 10-day low flow period.
11	6	NHDES	Section 4.1.4 Impoundment Water Column Sample and Laboratory Analyses, p. 11: This section discusses the sampling protocols for nutrient and chl-a but does not include the frequency of sampling. The Department requests that the frequency of sampling be added.	On average, impoundment water column sampling for nutrients and chlorophyll-*a* occurred every 8 days (range: 4 to 13 days). We will add text to section 4.1.4 clarifying the sampling frequency.
12	6	NHDES	Section 4.2.5 Data Synthesis, p. 13: This section states that flow in the Bellows Falls bypassed reach during spill was provided by TransCanada and during periods without spill, leakage flows in the bypass Reach were determined by TransCanada to be approximately 125 cfs. How these flows were determined is not provided. The Department requests that further details be provided regarding how these flows were calculated.	Leakage flows in the Bellows Falls bypassed were estimated by TransCanada to be approximately 125 cfs based on a measurement made at the fish bypass dam. This flow may be considered a minimum leakage flow however actual leakage flows can change at times based on impoundment elevation above the dam or when a gate is opened and closed as in high water or in 2015 for whitewater or instream flow study demonstration flows. . A footnote will be added to section 4.2.5 in the revised report to clarify this.
13	6	NHDES	Section 4.2.6 Data Censorship and Correction, p. 14: It is stated that some datasonde deployment intervals required correction to adjust for calibration drift and biofouling effects on sensor readings and that the decision to apply a correction	We appreciate NHDES identifying our error in referencing the incorrect table and we will make the appropriate revisions to the revised report.

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			was based on criteria described in a USGS document, as summarized in Table 4.2-2. It appears the wrong table was inadvertently referenced as correction criteria is included in Table 4.2-1 (not 4.2-2); this should be revised. Further, to facilitate interpretation of the data, a summary of the corrected parameters, corrected time periods and the values used to determine that correction was necessary should be provided. In addition, for each corrected parameter, graphs showing the uncorrected and corrected continuous data for each corrected time interval, should be provided for comparison. The Department requests that this information be provided.	We will also provide as an appendix to the report a table of the corrected parameters, corrected time periods and the correction factors applied to the correction time period. We will also provide as an appendix to the report univariate regressions of uncorrected and corrected data for each parameter for comparison.
14	6	NHDES	Section 4.3 Data Analysis, Table 4.3.1, p. 20. Applicable Vermont and New Hampshire surface water quality standards for the mainstem Connecticut River, p. 20: Designated Uses for New Hampshire surface waters are provided in the New Hampshire Consolidated Assessment and Listing Methodology1 (CALM). These include Aquatic Life, Fish and Shellfish Consumption, Drinking Water Supply after Adequate Treatment, Primary and Secondary Contact Recreation, and Wildlife. The Department requests that the Designated Uses for New Hampshire in Table 4.3-1 be revised to reflect the CALM. In addition, the Department requests that the following be added to the turbidity standard in the table "Env-Wq 1703.11 (d)." For purposes of state enforcement actions, if a discharge causes or contributes to an increase in turbidity of 10 NTUs or more above the turbidity of the receiving water upstream of the discharge or otherwise outside of the visible discharge, a violation of the turbidity standard shall be deemed to have occurred."	In the revised report we will modify Table 4.3-1 to more adequately reflect CALM and the designated uses for Class B waters; and will add and will add relevant text from NH Code of Administrative Rules Chapter Env-Wq 1700. We note however that the term "discharge" is defined in Env-Wq 1702.18(a) and (b) as "The addition, introduction, leaking, spilling, or emitting of a pollutant to surface waters, either directly or indirectly through the groundwater, whether done intentionally, unintentionally, negligently or otherwise;" or "The placing of a pollutant in a location where the pollutant is likely to enter surface waters." In this context, the TransCanada projects do not "discharge" water that can cause or contribute to an increase in turbidity, but rather simply pass inflows (including tributary inflows) that may be turbid on their own.
15	6	NHDES	Section 5.2.1 Tributaries, p.30: As previously stated above, it is unclear if the tributary stations are influenced by water quality in the Connecticut River. The Department requests that an	Please see response to comment #9 above.

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			explanation be added as this information is needed to interpret the water quality data.	
16	6	NHDES	Sections 5.2.2, 5.2.3, 5.2.4 (Stratification): In the discussions for temperature and dissolved oxygen for the Wilder, Bellows Falls and Vernon projects, terms such as "mild surface warming" and "thermal discontinuity" are used which are not defined. It is not clear if, and when, stratification, as defined in section 4.1.3 (... "the temperature difference in the stratum of greatest thermal discontinuity exceeded 1oC per meter), occurred. The Department requests clarification and consistency in the document as to where and when (dates) stratification (as defined in section 4.1.3) occurred.	We will add a footnote to section 4.1.2 defining greatest thermal discontinuity and will add text to section 4.1.3 clarifying our meaning of mild surface warming. We will revise the text throughout the report to be consistent with our definitions.
17	6	NHDES	Sections 5.2.2, 5.2.3, 5.2.4 (Turbidity): Turbidity was measured in the forebays and tailraces of each Project from June through September. In the discussions for turbidity it is stated that "Turbidity did not exceed the NH surface water quality standard of 10 NTU beyond natural conditions at the forebay, bypassed reach, or tailrace stations." It is not clear how this conclusion was reached. According to Env-Wq 1702.29 "Naturally occurring conditions" means conditions which exist in the absence of human influences." Clearly, none of the stations sampled for this study are without human influence; consequently, "natural conditions", as defined in the State surface water quality regulations, have not been determined. To avoid confusion the Department requests that the term "natural" not be used…. For the purposes of this report, the Department recommends using the stations above each impoundment (06-W-04, 06-BF-04 and 06-V-04) as estimates of background beyond the influence of each project recognizing that this is an approximation as background for the downstream projects may still have some influence from the upstream projects. Further, some stations within the influence of each project may also be influenced by other sources such as tributaries. The background stations should then be compared to the	To avoid confusion we will remove the word "natural" from the text and replace it with "receiving waters" in the revised report o be more consistent with the NH standard. In the analyses for the report, we examined the continuous and vertical profile data collectively by comparing tailrace, forebay, and upstream station turbidity for all stations to make our determination that turbidity did not exceed the 10 NTU standard. We will revise the report to clarify our analysis.

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			turbidity in the impoundments and tailraces to determine if the stations in the impoundments and tailraces exceed the background by 10 NTU or more.	
18	6	NHDES	Comparison of the graphs in Appendix E suggests that during the low flow sampling period (8/30/15 to 9/9/15), turbidity criteria in Env-Wq 1703.11(d) were met. Though based on grab samples, the graphs showing mean turbidity in the water column (+ one standard deviation) in Appendix B, can also be used to estimate compliance with turbidity criteria. Comparison of these plots suggests that on the sampled dates, there may have been an exceedance on 6/4/15 in the Wilder impoundment. Figure B-1 (p. B-1) shows a background of <1 NTU at 06-W-04. Turbidity remains low through the upper and mid impoundment exceedances but then spikes in the forebay to a mean of 25 NTU (Figure B-4, p. B-4). It's not clear if this is primarily due to operation or other sources of turbidity. The report states that June 4, 2015 was a high flow event and that the addition of runoff resulted in turbidity levels through the profile that ranged from approximately 10 to 60 NTU (p. 37). It's curious, however, why the mid and upper impoundment stations did not reflect a similar increase during the storm. An explanation should be provided?	The June 2015 hydrologic record indicates that we sampled at the tail end of a high flow event on June 4. The peak flow at the USGS West Lebanon gage occurred on June 2 with approximately 27,000 cfs which decreased to approximately 20,000 cfs on June 3. On the day of sampling (June 4), the remaining flow had decreased to approximately 12,000 cfs. During this sampling event, the field crew noted the vertical profile was collected through and within a large debris field (which accumulated as a result of the high flows). The vertical profile indicates particles settling in the water column, with a turbidity level of approximately 12 NTU at the surface, a peak of 60 NTU at a depth of 2.5 m, and 8 NTU near the river bottom (depth of 10 m). On June 4 (about an hour later), the continuous sonde was also installed at the forebay station. Readings on June 4 at the continuous sonde ranged from 1.2 to 3.3 NTU. These different measurements indicate that turbidity in the water column was patchy, and the elevated concentrations in the vertical profile were a result of settling particles associated with the debris field that accumulated due to the storm. We will add text to the revised study report to explain this event.
19	6	NHDES	The graphs in Appendix B and sections 5.2.2 through 5.2.3, show other times when turbidity increases which are attributed in the report to high flow events. This may be the case, however, since flow was not included on the graphs, one cannot confirm or readily see the relationship between turbidity and flow. The Department requests that flow be included on the turbidity graphs in Appendix B, E and Figures 5.2.2-3, 5.2.2-4, 5.2.3-3, 5.2.3-4, 5.2.3-5, 5.2.4-3 and 5.2.4-4.	Please see response to comment #4 and #6.
20	6	NHDES	Section 5.5.1 New Hampshire Water Quality Standards, p102: This section summarizes compliance with New Hampshire water quality standards based on data collected in 2015. The	Section 5.5.1 was designed to analyze the 2015 data. Data from 2012 are discussed in Section 5.6. In order to maintain consistency, we will change the title of Section

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			Department requests that this section mention that there were occasions of noncompliance with dissolved oxygen and pH in 2012 as discussed in section 5.6.	5.5 to "Compliance of the 2015 data with State Water Quality Standards". Data from 2012 exceeding standards are covered in Section 5.6, as pointed out in the comment.
21	6	NHDES	It is stated that "This suggests that elevated levels of pH are due to natural causes related to photosynthesis of algae and aquatic vegetation." The sentence should be revised as not all sources of nutrients stimulating growth of algae and other aquatic vegetation (such as nutrients from wastewater treatment facilities) are natural. Further, impoundments formed by dams are not natural and can facilitate algal growth by increasing residence times and water temperature. Although diel patterns were more prevalent in the upstream stations, pH did occasionally increase in the forebays by approximately 0.5 pH units (see Appendix E) which could be due to increased algal growth. The Department recommends the sentence above be revised to the following: "This suggests that elevated levels of pH are due to photosynthesis of algae and aquatic vegetation." We also request that the report acknowledge that the Project's impoundments may contribute to the pH exceedances by increasing residence times and water temperatures which can facilitate growth of algae and other aquatic vegetation. Similar revisions should be made throughout the document wherever pH is discussed.	We will remove the word "natural" and "naturally" from the text where we mention pH and photosynthesis. We will also add the suggested text in the document stating that the project impoundments may contribute to trends in pH; however, we note that since the projects have little storage capability, inflows are typically passed within the same day so travel time is typically short (~ 8-9 hours at Wilder and less at Bellows Falls and Vernon).
22	6	NHDES	Section 5.6 Comparison of Results to 2012 Water Quality Study, p. 105: This section includes a general description of exceedances of water quality standards in 2012. However, it is unclear how many exceedances of each state's water quality standards occurred in 2012, and where they occurred. The Department requests the number and range of 2012 dissolved oxygen and pH values at each station, that were in noncompliance with each state's water quality standards, be added to this section.	We will provide plots of the original data from 2012 (temperature, DO, pH, specific conductivity) on a monthly basis and incorporate those data into the revised report as an appendix.
23	6	NHDES	The Department also requests that the average and range of flows during the low flow sampling periods in 2012 and 2015 be added to facilitate comparison of conditions during these	In 2012, there was no 10-day low-flow sampling. For 2015, Figure 5.6-1 presents mean daily flow for both

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			two years.	2012 and 2015 studies at the USGS West Lebanon and North Walpole gages, Table 5.1-3 presents the mean daily flows for the three impoundments, as well as the range for the study period.
24	6	NHDES	Section 6.0 Assessment of Project Effects, p. 112: It is stated that "Overall, mean water temperatures were generally very similar among forebay and tailrace stations..." This sentence references tables which show mean monthly temperatures. The Department requests that the sentence be revised to indicate these are mean monthly temperatures. Similarly throughout the report, wherever the term "mean" is used the Department requests that it be qualified with the appropriate time reference (i.e., daily mean, monthly mean, annual mean, etc.) so that the reader can properly interpret the statements being made.	We will make the suggested revision throughout the report text. There were two other locations in the text where clarification is also appropriate.
25	6	NHDES	The discussion in this section [Section 6] appears to focus mainly on mean monthly results. It is not readily apparent how water quality is impacted by project operation on a shorter time scale. Using the near-continuous data from the datasondes, it is recommended that information be provided that clearly shows the effects of operation throughout the study period (June through September). This would capture the effects of operation during a wider range of temperatures, flows and generation. The graphs shown in Figures 6.0-1 through 6.0-5 for the low flow sampling period in the tailrace stations are good templates with the exception that continuous data from the forebay should be added to each graph to clearly show the effects of operation. Similar graphs should be provided for the rest of the sampling period (June through September) and at a scale no smaller than those shown on Figures 6.0-1 through 6.0-5. Similar graphs should also be provided using the data from the 2012 data report. The Department requests this information to facilitate assessment of project operation on water quality.	In response to comments above requesting a more detailed analysis of project effects, we will be providing time series plots showing all mainstem continuous water quality parameters along with flow on a monthly time frame and incorporate these plots into a report as an appendix. We will further discuss these data in the report. We will analyze the 2012 data further and prepare graphics that will be similar to the monthly graphics prepared for 2015.
26	6	NHDES	The last paragraph in this section [Section 6] states the	We will refine our conclusion, integrating also the findings

Comment No.	Study #	Source	Comment	Response
			following: "Although the presence and operation of the projects appeared to have some minor effects on temperature and DO, and negligible to no effect on pH, specific conductivity, or turbidity, all water quality parameters were generally within VT and NH state water quality standards. Therefore, there is no indication that operation of the Wilder, Bellows Falls, and Vernon projects would affect adherence to VT or NH state surface water quality standards." The Department disagrees with this conclusion. Based on the information presented in the report, it is the Department's understanding that under the conditions sampled in 2012 and 2015, the presence and operation of the projects can increase water temperature, significantly decrease DO (by approximately 1 mg/L), and that the longer residence times and higher temperatures in the impoundments may contribute to increased growth of algae and other aquatic vegetation which can impact pH.	of the month-by-month data graphics (as described above in related comments), and include additional text with times and likely causes of exceedances of standards, as appropriate. We note that while the data collected in 2012 and 2015 showed that the water temperatures increased from upstream to downstream, part of the warming is expected to be caused by latitudinal warming. A similar north-to-south warming trend was observed in the various monitored tributaries, which were sampled outside the influence of backwatering effects of the river. We note that the data collected in 2015 indicate that most occurrences of pH exceedances (see Table 5.5.1-1) occurred within the Bellows Falls impoundment (06-BF-02 specifically), which suggest factors other than residence time could be affecting algal growth and aquatic vegetation.
27	6	NHDES	Since there were occasional exceedances of New Hampshire water quality standards for pH (in 2012 and 2015) and dissolved oxygen (one in 2012) the presence and/or operation of the projects can cause or contribute to occasional exceedances of state surface water quality standards. The impact of the projects on turbidity is not readily apparent from the way the data is presented but a visual comparison of the forebay and tailrace graphs in Appendix E and Figure 6.0-5 respectively, suggests that operation can cause increased levels of turbidity during operation (see the previous comment for information needed to help determine compliance with turbidity water quality standards and the impact of operation on turbidity). With regards to compliance with turbidity standards, it can be said that during the low flow sampling period and on the dates profiles were taken in 2015, it appears compliance with turbidity criteria in Env-Wq 1703.11(d) were met (with the possible exception the Wilder forebay on June 4,	As we noted above, we will provide time series plots showing all mainstem continuous water quality parameters on along with flow on a monthly time frame and incorporate these plots into the report as an appendix. We will further discuss these data in the report, and make appropriate revisions if needed, in our interpretation of the data based on that analysis.

Comment No.	Study #	Source	Comment	Response
			2015, for which the Department requires further information as previously requested in above). The Department requests that that this paragraph be revised to be more in-line with the Department's interpretation and that conclusions regarding turbidity be revised based on the results of the analyses requested above.	
28	6	NHDES	Appendix B and E: The Department requests that flow be added to the turbidity graphs in each of these appendices so that one can readily see the relationship between flow and water quality.	As we noted above, in response to VANR comment requesting a more detailed analysis of project effects, we will provide time series plots showing all mainstem continuous water quality parameters on along with flow on a monthly time frame and incorporate these plots into the report as an appendix. We will further discuss these data in the report.
29	6	NHDES	Appendix C – Profiles: The Department requests that the depth of the turbine intakes be shown on the forebay profiles to assist with interpreting the results.	We will add a page at the beginning of the Appendix describing the location of all intakes for the three projects to allow for comparison with the forebay stations.

Study 8 – Channel Morphology and Benthic Habitat Study

Comment #	Study #	Source	Comment	Response
1	8	VANR	Request: In relation to sediment composition, please describe in the final report how percent embeddedness and substrate composition changes longitudinally downstream from the project dams.	This request is addressed in the updated report (filed May 16, 2016). Specifically, see Section 5.2 (including Figure 5.1) regarding substrate composition, and see Section 5.4 (including Figure 5.2) regarding embeddedness.
2	8	VANR	Request: In the final report, please describe how the cumulative effects of high flow events acting in concert with project operations are quantified and include analysis of these effects.	As discussed in Section 5.5 (new section) of the updated report (filed May 16, 2016), review of data from the Study 4 HEC-RAS model suggests that, relative to stability of coarse-grained material, the effects of project ops are generally dwarfed by high-flow events and high flows exceeding the MGF have a dominant influence on mobility of coarse-grained material.

Study 10 – Fish Assemblage Study

Comment #	Study #	Source	Comment	Response
1	10	CRWC	The spatial scope of the Vernon Riverine reach (1.5 miles) is significantly smaller than that of Wilder (17.7 miles) or Bellows Falls (6 miles) therefore abundance and distribution rates may not be comparable.	Comparability among riverine reaches will vary dependent upon which metric are being evaluated. For example, taxa richness will be impacted by the number of samples and amount of effort within each reach. A reach with more effort will likely produce a higher number of species observed. Comparison of relative abundance (CPUA) for species among river reaches will not be influenced by reach length as they are scaled to a common unit of effort.
2	10	CRWC	CRWC requests that the study report clarify any criteria used to determine the upper extent of project influence upon tributaries. With respect to electrofishing techniques of boat, pram, & backpack, CRWC requests that the study report provide clarity regarding the methods by which the study team estimated the width of the effective electrical field of the shocking area Within the study report, “habitat type” is actually referring to substrate type. CRWC feels that the term habitat type is more indicative of riffle, run, glide, pool, etc. rather than substrate type. CRWC requests a terminology change from habitat type to substrate type. CRWC requests that the report offer assemblage data in graphical form rather than, or in addition to the previously offered tables in the interest of ease of data analysis and interpretation. CRWC requests that the study report provide criteria with respect to how age designation (>500g = adult, 499-11g = juvenile, <10g = YOY) was determined. Is this a standard rule of thumb?	The upper extent of project tributaries was determined using the best professional judgment of the field crews and relied on visual determination based on indicators such as presence/absence of terrestrial and aquatic vegetation, sedimentation, and dominant water lines on permanent objects (e.g., boulder or abutment). This will be clarified in the final report. The effective width of the electrofish field was determined by experienced crew leaders and was based on visual observation of stunned individuals as well as the effective reach distance of netters. This information will be added to the final report. The final report will present “substrate type” in lieu of “habitat type”. Assemblage data will be provided in graphical format in the final report in addition to the tabular format currently presented. As stated in section 4.2 of the report, length/weight at age data was obtained from available literature on each species (primarily Yoder et al. 2009).

Comment #	Study #	Source	Comment	Response
3	10	NHGFD	Please describe what characteristics were used to determine where the project-affected portion of tributaries ended. The heading to the far right on Table 4.2-2 (Page 25) should be "YOY" and not "Adult."	As stated previously, the upper extent of project tributaries was determined using the best professional judgment of the field crews and relied on visual determination based on indicators such as presence/absence of terrestrial and aquatic vegetation, sedimentation and dominant water lines on permanent objects (e.g., boulder or abutment). This will be clarified in the final report. Table 4.2-2 will be corrected in the final report.
4	10	NHGFD	It should be noted that although the study plan said "scap netters" (plural) would be used while sampling fish via boat electrofishing, the Final Report detailed that only a single scap netter was used. The efficiency of netting fish in a riverine environment can be compromised if flows are high and/or water clarity is poor, and use of a single netter can exacerbate this situation. Lower catches and/or netting efficiency should be addressed in the study report as a result of using a single netter. We would have strongly suggested two netters be utilized if we knew of this study plan deviation.	The final report will be clarified to indicate that a single netter was used for boat electrofish sampling. This approach was used at all study locations so results within the evaluation and across all study reaches was consistent.
5	10	FWS	Appendices do not provide location information for each sample station.	Coordinate information for sampling units is provided in Table 3.1-1 and in the study's supporting geodata filed with the study report.
6	10	VANR	General Comment: It would be helpful to present the data in graphical form in addition to table form. For example, a pie graph of percent composition of total catch; relationships of diversity and habitat type; diversity and reach; diversity and season; CPUA and season; and CPUE and depth and velocity.	Assemblage data will be provided in graphical format in the final report in addition to the tabular format currently presented.
7	10	VANR	Study Area (Page 3) - The report it states, "The upstream extent of sampling within a tributary was determined by the ability of available gear types to effectively sample the habitat as well as visual observations made by the field crew at the time of sampling to identify the apparent upper bound of the project-affected portion of the tributary". Please describe in detail how the project affected portion of	The upper extent of project tributaries was determined using the best professional judgment of the field crews and relied on visual determination based on indicators such as presence/absence of terrestrial and aquatic vegetation, sedimentation, and dominant water lines on permanent objects (e.g., boulder or abutment). The "upper bound" of these tributaries was not mapped by field crews but

Comment #	Study #	Source	Comment	Response
			the tributary was determined in the field. For example, what characteristics were used to determine the project affected portion? Please clarify whether the upper bound of the project was mapped and whether that information was utilized field crews. If this data is available, please clarify where it can be accessed by stakeholders.	was instead used as a visual boundary to ensure that fish samples were collected within a project-affected portion of that water body.
8	10	VANR	Data Analysis (Page 22) - The report describes the calculation of Catch Per Unit Area as, "the estimated width of the effective electrical field." Please define how the width of the effective electrical field was estimated and clarify if Catch Per Unit Area was calculated by sample or by gear type.	The effective width of the electrofish field was determined by experienced crew leaders and was based on visual observation of stunned individuals as well as the effective reach distance of netters. This information will be added to the final report. CPUA values were calculated on a gear and sample specific basis. Values presented in the study report are mean values of the sample-gear values recorded within habitat types for a particular riverine or impoundment section.
9	10	VANR	Data Analysis (Table 4.2-2. Page 25) – There may be a typo in the table, where the heading of the third column from the left should be 'YOY'.	Table 4.2-2 will be corrected in the final report.
10	10	VANR	Appendix E (Table E-1) – The table lists depth of sample. Please clarify whether this depth refers to the depth of the water quality sample or depth of the associated fish sample.	The value for depth in Appendix E (Table E-1) is the depth at which water quality parameters were recorded (generally at 1 m or 3.3 ft).
11	10	VANR	Appendix E (Table E-2) – The table lists a column titled 'Vel. Depth'. Please clarify whether this column represents the depth at which a discrete velocity measurement was taken or whether this was the mean depth of a velocity profile.	The value for depth presented in Appendix E (Table E-2) is the depth of the water at the location where velocity was recorded. Velocity measurements were recorded following standard techniques (see Section 4.1.4 of the study report).

Study 11 – American Eel Survey

Comment #	Study #	Source	Comment	Response
1	11	CRWC	The catch rates for this study were *very* low, as the study shows only three eels captured. This presents potential questions regarding the effectiveness of the methodology used for this study, as other studies have produced much greater numbers of eels…[describes studies 17, 18, HG&E, and FL studies]… The overarching theme of this study is that American Eels are present in the Connecticut River system, but distributed in *very* low abundance throughout the project affected reach. CRWC feels that may not be the case given potential problems with sampling and differing results in various survey and passage studies.	The approach used for the survey of American eels within the TransCanada impoundments relied on techniques used at other projects with capture success. This study was not intended to quantify eels congregating at known barriers to movement but was intended to quantify the distribution and abundance of eels at randomly selected sampling locations within the project-affected reaches. To that effect, the sampling was useful in showing that although eels are present, they are at a low abundance within the project-affected reaches.
2	11	CRWC	Request that FERC require another field season of American Eel survey over the widest areas of known concentration of eels using the widest array of survey techniques.	We respectfully disagree, given the methods and effort expended on this study, and the results are valid. There were no unusual circumstances or conditions (flows, weather, equipment failure) that affected the ability to conduct the study as prescribed in the approved study plan, or which would suggest a need for additional field study.
3	11	NHFGD	Because sampling efforts were limited to shallow water, it is possible that eel abundance in the project-affected areas is higher than suggested due to the following: 1) Personal angling experience and direct communication with anglers shows eels are present in deep pools above and below the Vernon Dam (in several instances, the number of eels caught by angling in a single day equaled the entire number captured during Study 11); and 2) Pools > 15 feet deep make up 30% of aquatic habitat when averaged among all study reaches (Study 7). Portable electrofishing sampling (62.5% of all tributary samples and 20.6% of all mainstem samples) were performed during day, as opposed to night, due to safety concerns (this was not discussed with group or included in USR). This deviance could have impacted catch rates, especially if	We acknowledge that electrofish sampling is indeed a shallower water, littoral based sampling approach. We have observed numerous American eels conducting boat electrofishing during day time sampling at other locations (e.g., Merrimack River which also has deeper areas that where efish is ineffective as well as a number of good sized tributaries). The inclusion of baited eel pots was done in an effort to extend the range of water depths sampled into deeper areas. That technique proved ineffective during Study 11 and may be attributable to low overall densities of eels. The study plan variance related to day versus night sampling is acknowledged in Section 4.1.1 of the study report which could have resulted in some

Comment #	Study #	Source	Comment	Response
			densities are low in shallow water habitats, and should be discussed in the study report. Accordingly, we request the report acknowledges the limitations of sampling efforts and that results are biased towards shallow water habitats which may result in an underestimate of the abundance of eels within the project-affected areas.	under collection but unlikely to affect results since if eels were present in significant numbers they would likely be caught day or night. It is apparent that there is very low abundance of eels within the study area.
4	11	FWS	Boat shocking occurred at night but portable electrofishing was conducted during daytime hours due to safety concerns. Twenty-one of the 102 mainstem reaches and 15 of the 24 tributary reaches were sampled with portable equipment (i.e., during daytime). This shift in methodology represents a significant variance to the approved study plan…. Service is concerned that the variance to the approved study plan affected eel catch rates (i.e., conducting many sampling events during the day rather than at night, as stipulated). We do not, however, dispute the general conclusion that it is likely that upriver reaches have lower eel abundance and density, given the lack of eel-specific passage measures at TC's projects and at the downstream Turners Falls Project, as well as the relatively large amount of available habitat between the dams.	See response to comment #3 above.
5	11	VANR	While in general, the Agency concurred with the sampling techniques, the report should acknowledge gear selectivity, limitations and biases when discussing the results. The Agency requests that the report acknowledge the limitations of sampling efforts and the likely bias towards shallow water habitats, which may result in an underestimate of the distribution and abundance of eels within the project area [additional introductory general comments provided].	See response to comment #3 above.

Study 12 – Tessellated Darter Survey

Comment #	Study #	Source	Comment	Response
1	12	FWS	FWS notes that the number of darters from Study 10 reported in Study 12 Table 6.0-1 differ from those reported in Study 10 appendix A. TC states that individuals were regularly observed in areas of appropriate habitat (shallow, relatively slow moving, sand-mud substrates) apparently referring to results from Study 10 (Fish Assemblage) as well as Study 12. However, results of Study 10 show that darters were collected from a variety of habitats. In Table 1 below [provided in comment letter], we consolidated study results, which show that 47 percent of the darters collected in Study 10 were from gravel/cobble substrate, with only 31 percent being taken from sand/silt/clay habitat. While soft sediment may be suitable darter habitat, it clearly is one of several types where darters were documented within the study area.	We note that Appendix A of the Study 10 report (length-weight data) and the Section 4.1(discussion) included in some cases a representative subset of length/weight data (N=981), not necessarily length/weight data on all collected individuals (N= 1091). Given the clarifications above, the proportion of substrate in which darter were collected in Study 10 was 30% in sand/silt/clay, 39% in cobble/gravel, and 19% in boulder. Study 12 acknowledges (in Section 1) that darter can be found in a variety of habitat types. However, the report appendices and geodata do not include all the information stated in the study plan, so the report will be revised to include additional data from Study 10.
2	12	FWS	Further, in Table 2 [provided in comment letter], we present the contrasts [in] the numbers of darters collected within different river reaches between the two studies. Although nearly 80 percent of darters sampled from all river reaches were collected within the Wilder Impoundment during Study 12, less than 20 percent of the darters were found in this reach during Study 10, with nearly 70 percent being collected from the Wilder and Bellows Falls riverine reaches (32 and 35 percent, respectively). There could be a number of reasons for the observed differences between the two studies. For example, it may be easier for divers to see tessellated darters against a sand/silt/clay substrate versus a cobble/gravel substrate, given their cryptic coloration. Regardless, we recommend that the study report acknowledge and attempt to explain these differences rather than ignore them.	As above, we note that the goals, methods, locations, and timing/duration of the two studies differed, per the approved study plans. This is likely to be the primary reason observations differed. There was no intent to ignore differences in results; however, while results from each study relative to tessellated darter may be informative to each other, they are not necessarily comparable. The Study 12 report acknowledges that darter were distributed throughout the three project impoundments and their respective downstream riverine reaches.

Study 13 – Tributary and Backwater Fish Access and Habitats Study

The Interim study report had been filed September 14, 2015 and a proposed springtime analysis approach was discussed at the March 17-18 Study Meeting and provided to the aquatics working group on April 4, 2016.

Comment #	Study #	Source	Comment	Response
1	13	CRWC	The study report relied heavily on the claim that the period of fieldwork was somewhat drier than what is typical for that time of year during portions of the study season. This statement provided the study a platform to state that any instances of inadequate fish passage presented a worst-case scenario, likely implying that these conditions are not typical even during low-flow conditions, despite the fact that these instances occurred during the study season. They employed a ten-year average in making the claim of unusually dry conditions.	We respectfully disagree that the report “relied heavily” on this point, but rather attempted to put several factors that could have influenced study results into a broader context. The report states “The observation period was limited for some sites due to missing or invalid level logger data; did not encompass the earlier spring season when most fish species would be likely to seek access to tributaries and backwaters for spawning and residency; and included the typically drier late summer/early fall months which in 2014 were drier than normal.”
2	13	NHFGD	An updated analysis approach for this study was presented at a meeting on March 18, 2016, and more information was emailed to the Agencies on April 4, 2016, from TransCanada. We suggest that in addition to the 12+ hours, a complete separate analysis be conducted where all spring dates for each study site are “flagged” when < 0.5 ft. of water is present at any time.	The final study report will include the requested analysis based on the operations model which uses a one-hour time step so that sites will be flagged when < 0.5 ft. of water is present on an hourly basis.
3	13	VANR	An updated analysis approach for this study was presented at a meeting on March 18, 2016, and more information was emailed to the Agencies on April 4, 2016, from TransCanada. The following comments are related to the new analysis approach. General Comment: In general, we agree with the new approach. One aspect of the new approach is “For each study site, flag all spring dates (April 1 – June 30) in each of the 5 annual hydrology’s run through the operations model, where < 0.5 ft. of water is present for 12+ hours of that date.” As	See response to comment #2 above.

Comment #	Study #	Source	Comment	Response
			detailed in the email from April 4, 2016, 12 hours was selected simply to create a “breakpoint” and was also considered by TransCanada to be a time period that provided adequate fish access. We suggest that in addition to the 12+ hours, a complete separate analysis be conducted where all spring dates for each study site are “flagged” when < 0.5 ft. of water is present at any time.	

Studies 14 and 15 – Resident Fish Spawning Studies (only the interim report has been filed to date)

Comment #	Study #	Source	Comment	Response
1	14 15	CRWC	It is very clear, especially given the lack of Chain Pickerel & Northern Pike spawn observed, that this sampling effort was carried out too late in the season. This should have taken place mid-late March/early April. Fallfish nest elevations were measured from the base on the premise that "Fallfish lay their eggs at the level of the streambed prior to covering them with the mound of rocks." CRWC feels that the nests likely need some water above the base of the nest in order for the eggs to remain viable, even if it is just a fraction of an inch.	We respectfully disagree. We acknowledge that backwater sampling did not commence until late April. However, in terms of spawning season, water temperatures were well within the middle of the range of reported spawning temperatures. As is common each year during spring runoff, flows and turbidities were high when spring sampling (egg blocks) began on April 16th. The low species density/large survey area relationship also made it unlikely to observe spawning. We believe these factors resulted in lack of observation of adult pike or pickerel exhibiting spawning behavior, not that sampling was carried out too late in the season. With regard to fallfish, we agree with the comment. Fallfish nest mounds ranged in height from 0.5-1.3 ft, with an average height of 0.9 ft. Application of a 0.5 ft minimum depth criterion results in an average of nearly 60% of the mound height remaining wetted, although the actual volume of the wetted mound would be much greater than 60% because the mounds are much broader at their base than at their summit. Therefore, we believe that a 0.5 ft criteria is sufficient. The final study report will be revised with this modification.
2	14 15	CRWC	CRWC requests that the study report include an explanation as to how it was determined that dewatering had no adverse effects upon Yellow Perch egg viability when dewatered for only a "brief period of time." CRWC also requests that the study report define a "brief period of time" and include a citation to any scientific literature that supports this claim. If there is no scientific literature available to support this claim, the study report should classify Yellow Perch eggs as dewatered if they exceed the WSE at any time regardless of exposure duration.	The yellow perch egg mass analysis will be revised in the final study report to assume that any dewatering resulted in mortality

Comment #	Study #	Source	Comment	Response
3	14 15	NHFGD	Despite the directed approach of focusing on shallow water spawning areas, the report consistently refers to biases associated with this approach and that the proportion of spawning sites found to be impacted by project operations is likely over-estimated [provides examples from the interim report]. References to bias and over-estimation should be removed from the report and clarifying language added. For example, rather than stating that "an average of 23% of sunfish nests may have been subject to depths less than 0.5 ft.", report that "an average of 23% of surveyed sunfish nests that were located in shallow habitats most vulnerable to project effects may have been subject to depths less than 0.5 ft. There were likely sunfish nests in deeper water that were not surveyed and/or not vulnerable to project effects."	The known bias of the visually-based spawning surveys is critical to understanding the limitations of the results and thus required emphasis in the report. Descriptions of potential dewatering events will be reviewed and clarified in the final report where appropriate. In addition, the interim report did not include analysis of operations model data which, in the final report, will assist in evaluation of project effects.
4	14 15	NHFGD	In addition to data presented (proportion by site, range, mean etc.), data on nest abandonment and/or dewatering due to project impacts should be explicitly presented for yellow perch and sunfish as a proportion of the total number of nests/egg masses examined (similar to how data were presented for smallmouth bass and fallfish). For example, in addition to stating "an average of 20-25% of yellow perch egg masses may have been dewatered at some point in their development", also report the proportion of the 838 yellow perch egg masses examined that may have been dewatered at some point in their development. Our interest here is to be able to examine total project impacts for all nests/egg masses examined of a particular species, in addition to the data already presented in the report.	The figures showing potential dewatering for each species will be revised in the final study report to indicate the number of potential eggs/nests dewatered compared to the total number observed. Text associated with these descriptions will be reviewed and clarified where appropriate. The interim report did not include analysis of operations model data which will assist in evaluation of project effects.
5	14 15	NHFGD	Page 2, 2.0- The report is missing the original first objective for Study 15- "locate and map nesting locations and spawning sites in riverine sections."	Text will be added in the final report.
6	14 15	NHFGD	The study report states on Page 113 that "In general,	The term "significant" will be removed from the final

Comment #	Study #	Source	Comment	Response
			project operations did not appear to exert significant negative impacts to spawning within project impoundments for the observed species and identified spawning locations." We believe the word "significant" is not appropriate in this context as no statistical analyses were conducted. Regardless of terminology, we feel that results presented do show a cause for concern in regards to project impacts [provides examples including yellow perch: up to 25% of eggs may have been dewatered due to project operations]	study report. With regard to yellow perch eggs potentially dewatered in 2015, see response to comment #4.
7	14 15	NHFGD	There is limited data (walleye- 1 egg, white sucker- 62 eggs from two sites, and largemouth bass- 5 nests) or no data (black crappie, northern pike, chain pickerel, spottail shiner, golden shiner) for 62% (8/13) of species that were investigated. We request that these studies be repeated in 2017 for walleye, white sucker, largemouth bass, black crappie, northern pike, chain pickerel, spottail shiner and golden shiner. Without additional studies, we cannot assess potential project-related effects on these species	The interim report discusses walleye and white sucker spawning likely occurring within tributaries upstream of project influence or in mainstem reaches deeper than sampled by egg blocks (>10-12 ft). We note that one study site in each riverine section was selected specifically for walleye based on NHFGD information about previous spawning at those locations. Sucker adults were observed staging and walleye adults were also captured. Largemouth bass adults were also captured, as were larvae in several backwaters. The interim report notes repeatedly that the study was purposely biased toward shallower habitats because: a) shallower areas are more likely to have project-related flow fluctuations that could impact spawning; and b) visual observation was reduced in deeper and/or more turbid water at high river flows. We believe that additional unobserved spawning for these species took place and spawning was documented for species in the same "species groups" having similar habitat preferences and spawning periodicity. The final report will include analysis of operations model data to assist in evaluating project effects and Study 9 – Instream Flow Study will evaluate project effects on suitable habitats.

Comment #	Study #	Source	Comment	Response
				While 2015 had periodic high flows in June, overall springtime conditions (flows and temperatures) were not sufficiently anomalous to materially affect 2015 results (FERC criteria for modification of studies at 18 C.F.R. § 5.15(d)). For all of these reasons, we do not feel that additional field surveys are warranted or would necessarily produce different or additional useful information.
8	14 15	NHFGD	Black Crappie: This species is not rare [as implied in the report] in these sections of the Connecticut River. In fact, angling catches during winter and spring at Study Site 14-VB-039 and 14-VB-050 are quite high, based on personal and professional observations. In the winter of 2014/2015, schools of hundreds of black crappie were present at Study Site 14-VB-050. It is not surprising that angling efforts during Study 14 caught a number of largemouth bass and chain pickerel, but only two black crappie, as lures that consistently capture bass and pickerel are typically not suitable for catching crappie. It is also not surprising that more black crappie were not collected during Study 10 boat electrofishing surveys as in the experience of the NHFGD, boat electrofishing is not an efficient or effective method to capture black crappie. Finally, in a number of NH water bodies black crappie have been observed to spawn on open flats and not in aquatic vegetation.	The comment on abundance of Black Crappie is noted, although it was clear to the spawning crews that if crappie were spawning in shallow water (as were sunfish) they would have been observed during spawning surveys. The fact that crappie nests were not observed strongly suggests that they either spawn in deeper water, in areas of denser cover, or else in highly limited locations not encompassed by the random site selection procedure. The NHFGD comment on angling success suggests that crappie are abundant and successful in the study area.
9	14 15	NHFGD	Yellow Perch: [In the report] perch egg masses were not classified as “dewatered” unless they were exposed to air for an extended period of time (e.g., several hours). Due to this [the lack of studies supporting this], we strongly suggest the above language is removed from the report and that yellow perch eggs are considered dewatered as soon as they are exposed to air.	The yellow perch egg mass analysis will be revised in the final study report to assume that any dewatering resulted in mortality and to utilize only the highest elevation of suspended egg masses.

Comment #	Study #	Source	Comment	Response
			We disagree with the mean elevation calculation [used at yellow perch sites where 2 readings were taken] and suggest that the highest egg mass elevation be used for comparison with the WSE as it is unknown if eggs will be viable, and for how long, if only a portion of an egg mass is in water. Additionally, the highest egg mass elevation should also be used so methods are consistent and results comparable among sites.	
10	14 15	NHFGD	Yellow Perch: On Page 110 it is reported that up to 25% of perch eggs may have been dewatered due to project operations. It should be noted that estimated percent mortality of yellow perch egg masses was as high as 83% in some backwaters (WB-051; Zebedee Brook). On Page 110 it is stated, "Although the 2015 data suggested that up to 25% of perch eggs may have been dewatered due to project operations, large numbers of perch eggs remained wetted throughout the incubation period and this estimate of mortality would likely change significantly under different flow conditions (e.g., higher mortality with more frequent uncontrolled high flow events, lower mortality under more stable and controlled conditions)." A similar statement could be made for any of the species for which data were collected and while likely true, it is somewhat irrelevant unless future studies are to be conducted under different flow regimes in future years. Also on Page 110, there is a discussion about what spring WSE levels would be most beneficial to spawning yellow perch. We request that similar discussions be added for other species where appropriate.	Spawning figures will be revised in the final study report to include estimated proportions of potentially dewatered egg masses or nests at each site. Textual descriptions will be reviewed and clarified where appropriate. The most beneficial elevations for spawning, assessment of project effects and recommended WSE's for each species spawning will be added to the final report. We note that the interim report did not include analysis of operations model data which will assist in evaluation of project effects.
11	14 15	NHFGD	Pike and Pickerel: No northern pike or chain pickerel spawning activity was observed. Although extensive effort was made to survey the literature to document spawning temperature ranges, the resulting combination of these studies makes for a very wide	See response to comment #1

Comment #	Study #	Source	Comment	Response
			spawning temperature range which may not be applicable to the Connecticut River. For example, northern pike are known to spawn under the ice at times and large pike are caught at both Study Site 14-VB-039 and 14-VB-050 soon after ice out each spring. Given correspondence filed with FERC by the Vermont Fish and Wildlife Department concerning this study, we agree it is likely pike spawning occurred prior to the start of the Study 14 surveys.	
12	14 15	NHFGD	Sunfish: Page 111 of the report states an estimated 23% of sunfish nests were potentially impacted by fluctuations in WSE. It should be noted that this represents a mean of 23% as up to 50% of observed sunfish nests were subject to loss due to dewatering or abandonment of the adult guardian. As noted earlier, data on impacts to nest due to project operations should also be presented as a proportion of the total number of nests examined.	Spawning figures will be revised in the final study report to include estimated proportions of potentially dewatered egg masses or nests at each site. Textual descriptions will be reviewed and clarified where appropriate. Again, the interim report did not include analysis of operations model data which will assist in evaluation of project effects.
13	14 15	NHFGD	Smallmouth Bass: Please show estimates of percent of nests vulnerable to dewatering similar to Figure 5.3-4.	Spawning figures will be revised in the final study report to include estimated proportions of potentially dewatered egg masses or nests at each site. Textual descriptions will be reviewed and clarified where appropriate.
14	14 15	NHFGD	Fallfish: Please describe the rationale, as was done for other species, for selecting 10 days prior to nest observations and 5 days following an observation for the fallfish egg incubation period. Please show estimates of percent of nests vulnerable to dewatering similar to Figure 5.3-4. We concur and support the Vermont Fish and Wildlife Department's comments related to measuring fallfish nest elevation at the top of the nest mound instead of at the base.	The rationale for the 10-day assessment period for Fallfish egg incubation was due to the fact that it was evident the nests were already completed at the time of observation, but we also included enough future time to allow for recent eggs to hatch. This will be clarified in the final study report. Spawning figures will be revised in the final study report to include estimated proportions of potentially dewatered egg masses or nests at each site. Textual descriptions will be reviewed and clarified where appropriate.

Comment #	Study #	Source	Comment	Response
				With regard to fallfish see response to comment #1 above and comment #23 below.
15	14 15	VANR	General Comment: While the Agency understands the nuances in life history characteristics among species (nest guarding, incubation time etc.) it would be preferred if a consistent approach was applied to all species when evaluating potential project effects during the egg incubation period. Request: When comparing nest elevation to WSE's a preferred approach would be to take the nest observation date and evaluate forwards and backwards (if WSE data are available) in time for the entire incubation period (based on water temperatures). While this may be a conservative approach, it insures that the egg incubation period is covered in the absence of knowing the exact spawning date. In most cases, the diurnal fluctuations in WSE render a nest dewatering event, so extending the time period would not necessarily overestimate such events but rather would assure that the analysis covers the entire incubation and or nest guarding period prior to and after the initial observation.	We respectfully disagree. While it may be convenient to use a common method, it ignores the highly significant differences in species spawning behaviors. Backward projection can only be justified where a new nest was already completed and could be identified to species (e.g., fallfish, sunfish, or suckers) where we can only look back to the previous block inspection; and possibly for yellow perch as noted below, but not for active nests with an attending adult fish (Smallmouth bass, most sunfish). We will clarify the rationale used for each species in the final study report (see also response to comment # 14 for fallfish). For Smallmouth Bass, the presence of a guarding adult, viable eggs, or resident fry proves that the nest was still currently active, thus it would be irrelevant to extend the assessment period backwards in time (see also response to comment # 30 below). For yellow perch, the final study report evaluates forward only as per VANR requests during the March 17-18, 2016 meeting and a following comment (#26 below).
16	14 15	VANR	General Comment: While it is informative to present proportion of nest abandonment and dewatering by site, range, mean etc., resource agencies need to understand the proportion of nests that are subject to negative impacts as a proportion of the total number of nests. Request: The report should present data on nest abandonment and dewatering for each species as a proportion of the total number nests. For example, of the 123 sunfish nests how many were dewatered or abandoned?	Spawning figures will be revised in the final study report to include estimated proportions of potentially dewatered egg masses or nests at each site. Textual descriptions will be reviewed and clarified where appropriate.

Comment #	Study #	Source	Comment	Response
17	14 15	VANR	General Comment: It is stated throughout the report that the 2015 dataset constitutes a year with high flows at the start of the perch and pike/pickerel spawning season, and high flows during the bulk of the smallmouth bass spawning season, with mostly project-controlled flows during the interim fallfish spawning and much of the later spawning by sunfish and (presumably) shiners. Request: While high flows are expected during the spring months, the hydrologic record should be analyzed by spawning season and if 2015 represents such an anomalous year in terms of flows for target species, the need for repeating elements should be evaluated.	The final report will include analysis of operations model data which will assist in evaluation of project effects across a broad range of hydrologies. This analysis should be sufficient to place 2015 conditions into a broader context relative to other years. Please also see response to comment # 7 above.
18	14 15	VANR	General Comment: In Section 6.1 Egg and Nest Dewatering or Adult Abandonment, specifically 6.1.1 Yellow Perch, there is a discussion about what spring WSE levels would be most beneficial to spawning yellow perch. Request: The Agency requests that similar discussions be added for other species where appropriate.	The most beneficial elevations for spawning, assessment of project effects and recommended WSE's for each species spawning will be added to the final report.
19	14 15	VANR	General Comment: Spawning locations were not identified for northern pike, chain pickerel, black crappie, or either species of shiner. Very limited spawning data was collected for white sucker, walleye, and largemouth bass. While we acknowledge the extensive effort to document spawning activity for these species, the low or no sample size for walleye, northern pike, chain pickerel, golden shiner, spottail shiner, black crappie, white sucker and largemouth bass, does not provide the data needed to assess project-related effects for these species. Given the lack of data for several target species, the goals and objectives of the study have not been fully	See response to comment #7 request for additional field study.

Comment #	Study #	Source	Comment	Response
			met...The Agency recommends that TransCanada allocate additional field efforts...The Agency recommends that TransCanada develop a sampling plan that would involve sampling earlier in the season and target species where no or limited spawning data was collected in consultation with the aquatics working group.	
20	14 15	VANR	Study Goals and Objectives (p. 2)- The report is missing the original first objective for Study 15- "locate and map nesting locations and spawning sites in riverine sections."	TC acknowledges this omission as a result of combining goals and objectives for both studies 14 and 15; however, the study did include field methods intended to meet this objective. That objective will be added into the final report.
21	14 15	VANR	3.2.1 Impoundment sites: The report states that "Prior to the selection of potential study sites, areas were excluded that were not expected to provide significant spawning habitat, e.g. steep banks; silty mid-channel habitat; depths >5 feet deep (normal impoundment fluctuations are approximately 1-2 feet)". As such, shallow-water habitats (< 5 feet deep) were the main focus of this study...However, on page 23, the report states that "the estimated proportion of spawning sites impacted by project operations is likely to be over-estimated in this report" (due to limited water visibility and biases towards shallow waters). Since the goal of the study was to understand the proportion of shallow water (<5 feet) nests that are affected by project influenced water-level fluctuations, the spawning preference of the target species for shallow water, and since the report acknowledges that deep (>5 feet) habitats were "not expected to provide significant spawning habitat", the Agency recommends the statement from page 23 quoted above be removed.	This text will be revised in the final study report to indicate that spawning over 5 ft may in fact occur but would not likely be detectable by visual methods due to limitations in water clarity. It is critical to understanding and interpreting the results of the visual surveys that deep-water spawning may have in fact occurred for many species but it could not be addressed by visual means, therefore inherent biases did exist and should be recognized.
22	14 15	VANR	Methodology (p. 23) – The report states, "suspended egg masses, elevations measured at the highest elevation (e.g., at the suspending branch) and in some cases also at the lowest elevation (e.g., typically the	The yellow perch egg mass analysis will be revised in the final study report to assume that any dewatering resulted in mortality and to utilize only the highest elevation of suspended egg masses.

Comment #	Study #	Source	Comment	Response
			substrate). Such egg masses frequently exhibited a 1-2 feet range in elevation (range 0.6-2.1 feet, mean 1.3 feet). Where both upper and lower elevations were measured, the mean elevation was calculated for comparison with WSE data". The Agency disagrees with this approach. A consistent approach should be applied across the project affected area. If the mean elevation can only be derived for a subset of egg masses, but the upper elevation was recorded for all egg masses, the upper elevation should be used to ensure a consistent approach.	
23	14 15	VANR	Methodology (p. 27, 72, & 111) – The report states, "Fallfish nest elevations were measured at two locations: at the base of the nest and at the top of the nest mound. Note that Fallfish eggs are deposited at the original bed elevation prior to being covered by the mound (Reed, 1971; Magee, 1989; Maurakis & Woolcott, 1992), therefore comparison of Fallfish nest elevations with WSE data utilized the RTK elevation measured at the base of the nest mound." Maurakis and Woolcott (1992) also suggested that changes in interstitial aeration may stimulate larvae to move into interstices within the nest. This suggests that the nest must be inundated enough to provide adequate aeration to developing larvae, and if oxygen levels are not sufficient larvae will move around within the nest. Ross and Reed (1978) observed that fallfish nests were almost always constructed on gravel substrate in water at least 0.5 m (1.5 feet) deep. Similarly, on page 111, the report states that it is unknown to what degree hatched fry will migrate within the nest mound and if fry occupy higher regions of the nest mound the impacts could be greater than predicted. Based on this information, the Agency recommends that the WSE be compared to the top of the nest mound rather than the base.	As indicated in response to comment #1, fallfish nest mounds ranged in height from 0.5-1.3 ft, with an average height of 0.9 ft. Application of a 0.5 ft minimum depth criterion results in an average of nearly 60% of the mound height remaining wetted, although the actual volume of the wetted mound would be much greater than 60% because the mounds are much broader at their base than at their summit. Therefore we believe that 0.5 ft is a sufficient depth criterion to provide protection for larvae. In the absence of other evidence that fallfish use the top of the nest mound, we do not believe that evaluating from the elevation at top of the mound is warranted.

Comment #	Study #	Source	Comment	Response
24	14 15	VANR	Data Analysis (p. 29) – The report states, "Because Yellow Perch eggs are encapsulated within a moist, gelatinous mass, brief periods of exposure did not appear to affect viability. Differences in the appearance between egg masses suspended well above the WSE and those suspended just above the WSE were evident, with the higher egg masses clearly desiccated and limp, whereas lower hanging egg masses typically appeared firm and moist. Consequently, perch egg masses were not classified as "dewatered" unless they were exposed to air for an extended period of time (e.g., several hours)". Additionally, on page 56 of the report it is stated, "As noted earlier, the gelatinous mass that surrounded the Yellow Perch egg masses undoubtedly afforded some protection against short-term dewatering events, but the relationship between exposure duration and egg viability is unknown." Request: If the statements regarding the potential protection afforded by the gelatinous mass are not supported by the literature, it would seem more appropriate to simply state that it is unknown how egg viability is affected by these "short term events". As such, the Agency recommends that egg perch masses that are dewatered for any amount of time be classified as dewatered.	See response to comment #1
25	14 15	VANR	4.1.4 Backwater Sampling – In regards to pike and pickerel spawning, backwater surveys were conducted in 12 study sites from April 28 to July 2, generally two days/week (Tuesdays and Thursdays). Angling during this period showed that only one of the 33 captured individuals (9 pike and 24 pickerel) expressed eggs, milt, or showed evidence of recent or imminent spawning. No spawning activity was observed. Comment: Data collected from VTFWD biologists	See response to comment # 1

Comment #	Study #	Source	Comment	Response
			indicate that pike spawning commences at ice out [and provide examples]… While Figure 5.2-4 (Page 53) indicates that sampling occurred within the reported range of spawning temperatures, captured fish should have shown signs of being in spawning condition. As noted by VTFWD biologists, hook and line sampling is typically ineffective for spawning pike because they do not bite during the spawn and for several weeks after while these fish recover. As such, the Agency believes that pike spawning commenced prior to the surveys.	
26	14 15	VANR	5.2.4 Yellow Perch (p. 55) - The report describes the duration of time that an egg mass elevation would be compared to WSEs to determine dewatering events. For yellow perch egg masses, the egg incubation time was dependent on water temperature. For comparisons to WSE data, the egg incubation time was centered around the observation date, such that evaluations of potential dewatering occurred 50 % backwards and 50% forwards in time…The analysis presented in the report results in shortening the duration of evaluations and likely underestimates dewatering events. Considering it is not possible to evaluate potential dewatering prior to the observation, and it is unknown when that fish spawned, we recommend that for yellow perch, the period of evaluation occur immediately following the observation forward in time for the entire incubation period. If WSE data is available for a particular site prior to an egg mass observation, then it would be appropriate to evaluate backwards in time.	As we understand the request, Yellow Perch incubation assessments will be revised in the final study report to extend only forward in time for the full potential time period (based on water temperatures).
27	14 15	VANR	5.3.2 Bluegill and Pumpkinseed (p. 64) – The report states that sunfish "nest elevation plots assume a conservative incubation time of five days from the date when eggs were first observed (although hatching likely occurred sooner)", It is also assumed that a nest with a guarding adult will remain active for a period of 10 days	Sunfish were evaluated: • forward only over 10 days for active nests and adult present • backward only over 10 days for active nests but no fish present no adult or eggs present • assumes 5 days for nest building by adult plus 5

Comment #	Study #	Source	Comment	Response
			following the initial nest observation. For those active nests where no adult was observed, it was assumed the nest was active for the preceding 10 days. However, Figure 5.3.4 Sunfish Nests at VB-050 Unnamed Backwater, the analysis occurs 10 days prior to and 10 days after nest observation. Please explain why the approach is different for VB-050. Of note is that for the majority of sunfish sites, analyzing WSE 10 days prior to and 10 days after nest observation does not affect the outcome in terms of nest dewatering (as illustrated in VB-050).	days for incubation = 10 days following observation of nest with an adult but no eggs present; only 5 days following observation for nests with eggs; and 10 days preceding observation for a cleaned nest without adult or eggs (assumed already spawned) In some cases such as at site VB-050 the nest elevations as shown in the elevation figures represent multiple nests that occurred at the same elevation (yellow circles in the graphs). If all of the nests at a single elevation were occupied by an attending adult, the incubation plot extended forward in time only. If all of the nests at a single elevation were vacant of an adult, the incubation plot extended backwards in time only (assuming eggs had already hatched and fry dispersed). If the nests at a single elevation represented both types of active nests (with and without adults), the incubation plot extended both forwards and backwards.
28	14 15	VANR	5.3.6 Fallfish – The report uses a period 10 days prior to nest observation and 5 days following to evaluate potential dewatering. Similar to other species, please describe the fallfish egg incubation period and the rationale for selecting this window of analysis.	See response to comment #14
29	14 15	VANR	5.3.6 Fallfish – It would be helpful if Figure 5.3-8 was labeled similar to others presented in the report (red dashed line and black solid line, and percent of nests subject to dewatering).	Fallfish figures will be revised in the final study report
30	14 15	VANR	5.3.7 Smallmouth Bass (p. 89) – The report states, "nest vs. WSE plots assume potential continued residence of adult bass observed at empty nests for up to 30 additional days following the last adult observation, thus allowing time for egg deposition, incubation, and fry rearing. For nests containing eggs, nests were assumed to be potentially active for an additional 25 days after eggs were first observed, allowing for continued egg incubation and fry rearing. Nests containing fry were	See response to comment # 15 above. More specifically, the rationale was to look: • 30 days forward for an empty nest with adult (new nests without an adult were not assessed due to potential confusion w rock bass (except a limited separate analysis in Fig 5.3-15) • 25 days forward for eggs present • 20 days forward for fry present.

Comment #	Study #	Source	Comment	Response
			assumed to remain active for an additional 20 days following the first observation of fry. The period of potential nest activity was terminated at all nests on any date when a subsequent observation failed to identify the presence of an adult, eggs, or fry" Since observations could occur at any one of these stages, please explain why evaluations did not occur backwards in time. Please label Figure 5.3-12 similar to others with red dashed line and black solid line and percent subject to dewatering.	• No backward evaluation. Adult bass are not known to remain on a nest after completion, so it is logical and defensible to assume an adult on a cleaned nest is still active with future potential for egg deposition Figure 5.3-12 will be revised as requested, in the final study report.
31	14 15	VANR	6.1.1 Yellow Perch – The report states "that up to 25% of perch eggs may have been dewatered due to project operations". This characterization does not account for the range of impacts across sites and may imply the effects were homogeneous across study sites. The report should note the range of impacts across study sites. For example, the estimated percentage mortality of yellow perch egg masses was as high as 83% in some of the backwaters (WB-051; Zebedee Brook).	See response to comment #4.
32	14 15	VANR	6.1.1. Yellow Perch Egg Dewatering - On Page 110, the report states, "Although the 2015 data suggested that up to 25% of perch eggs may have been dewatered due to project operations, large numbers of perch eggs remained wetted throughout the incubation period and this estimate of mortality would likely change significantly under different flow conditions (e.g., higher mortality with more frequent uncontrolled high flow events, lower mortality under more stable and controlled conditions)." The Agency recommends this statement be removed. A similar statement could be made for any of the species for which data were collected and while likely true, unless future studies are to be conducted under different flow regimes in future years, it is of limited value.	This statement will be removed from the final report.
33	14 15	VANR	6.1.2 Bluegill and Pumpkinseed – The report estimates	The final report will include WSE fluctuations and

Comment #	Study #	Source	Comment	Response
			that 23% of sunfish nests were potentially impacted by fluctuations in WSEs in 2015. Similar to the previous comment, this characterization of impacts does not account for the range of impacts across sites and may imply the effects were homogeneous across study sites. The report should note the range of impacts across study sites. For example, up to 50% of observed sunfish nests were subject to loss due to dewatering or abandonment of the adult guardian.	impacts at each study site separately, based on the operations model analysis.
34	14 15	VANR	6.4 Project Effects Modeling (p. 113) – The report states that "In general, project operations did not appear to exert significant negative impacts to spawning within project impoundments for the observed species and identified spawning locations." Request: The Agency recommends the word "significant" be struck. It is not appropriate in this context as no statistical analyses were conducted. Regardless of terminology, the Agency notes that the results do show a cause for concern in regards to project impacts (yellow perch: mean of 25% of eggs may have been dewatered due to project operations; sunfish: mean of 23% of observed sunfish nests could be subject to loss due to dewatering or abandonment of the adult guardian; fallfish: 36% of nests in riverine reaches dewatered or impacted; smallmouth bass: 13% of nests in tributaries had minimum depths <1 foot and 34% of nests in riverine sections were potentially vulnerable to dewatering or nest abandonment by adult guardian).	The term "significant" will be removed from the final study report. We also note that the interim report did not include analysis of operations model data which will assist in evaluation of project effects and will be included in the final study report.

Study 16 – Sea Lamprey Assessment (only the interim report has been filed to date)

Comment #	Study #	Source	Comment	Response
1	16	NHFGD	The second goal of this study related to whether project operations affected success (i.e., survival to emergence) was not met. Therefore, it must be assumed that any dewatering of a nest results in the failure of that nest.	We respectfully disagree that it must be assumed that any dewatering necessarily results in failure. That assumption requires all nests to have been occupied at the time of dewatering by a vulnerable life stage.
2	16	NHFGD	The study report states 26% (6 of 23) of sites experienced dewatering due to project impacts (including 6 sites at which no nests were identified). Also stated is that 44% (7 of 16) of sites at which nests were found were shown to be potentially exposed to dewatering. The value that should be reported is the percentage of dewatered sites where lamprey actually nested (i.e. 44%).	The final report will clarify the calculation as the proportion of sites where nests were found.
3	16	NHFGD	The focus of this report was on nest exposure due to project related water level fluctuations, yet nest exposure is not the only a suitable metric for assessing project impacts in impounded areas. The primary project impacts in impounded areas include inundation of spawning habitat, fine sediment deposition in lower tributary mouths, and tributary accessibility. These effects were not evaluated in this report.	The goals and objectives of this study specified that the study would assess project effects (flow alterations) that could cause dewatering and/or scouring of redds. Sedimentation of tributary mouths and tributary accessibility were also beyond the scope of this study. However, Study 9 – Instream Flow Study will provide more information on operations in relation to suitable habitats within the project-affected area.
4	16	NHFGD	A clear distinction should be made in the report between riverine sites, where the majority of spawning in the mainstem river occurs, and impounded sites, where the majority of habitat has been flooded and suitable habitat is dependent on tributaries. These two habitat types should not be grouped in the Study Conclusion section and the percent of nests and sites (containing nests) dewatered should also be examined by habitat type.	The final report will more clearly discriminate riverine sites from impoundment sites and will group and examine dewatering proportions by those categories.
5	16	NHFGD	The sampling design in this report does not provide information on the relative importance of spawning	It was beyond the scope of this study to investigate relative importance of spawning habitat across reaches or in relation

Comment #	Study #	Source	Comment	Response
			habitat in different riverine reaches or on the relative importance of tributary vs. riverine spawning sites. Without the ability to compare the importance of spawning habitat at the reach, site, or nest level, all nests must be considered equally important.	to tributaries. However, Study 9 – Instream Flow Study, report will provide more information on suitable habitats within the study area.
6	16	NHFGD	The water surface elevations depicted at sites in Figure C-14 and C-15 in Appendix C. are very different from that depicted in Figure C-13, which represents a site just upstream. These three sites were all in the Bellows Falls riverine reach. The report mentions the Wilder and Vernon riverine reaches have a higher risk of nest exposure because flows there are the most dynamic, but does not explain why flows in the Bellows Falls riverine reach are less dynamic. The captions below each figure should explain why some of the graphs do not represent the same pattern of flow fluctuations that is shown for the other riverine sites.	The apparent difference in water surface elevations depicted in Figure C-15 and C-15 as compared to C-13 are an artifact of scaling of the primary Y axis in the plots. Appendix C will be revised in the final report to correct axis scaling issues. The statement in the interim report did not intend to characterize the reaches in their entirety as more or less dynamic (the operations model can do that in general), but rather characterized specific study sites (WL-001, WL-002 located within 1 mile of Wilder dam, WL-005 at Hart Island, and VL-001, VL-002 located just downstream of Vernon dam) based on water level logger data. The Bellows Falls riverine sites were located farther downstream of the project (~ 2.5 miles or more) where flow is attenuated and the fluctuations are less. In addition, localized patterns will vary based on site-specific characteristics, including topography, tributary inflows, etc..
7	16	NHFGD	Site WL-005 is listed as no project impact in Table 6.1-2, but is reported as having one nest exposed for 16.3% of logger records in Table 5.2-3. Please correct or clarify.	The final report will correct and clarify regarding site WL-005 exposure.
8	16	NHFGD	The percentage of time that sea lamprey nests were exposed (Table 5.2-3) over the entire length of the study period (May 15 to July 15) does not capture the true nature of exposure in some nests, which were rapidly dewatered and inundated multiple times during periods of project influenced flow. The total number of exposures, average length of exposure, and the min/max length of exposure should be presented for each nest.	The final report will tabulate the number of exposures, and mean and range of duration of exposures for each nest elevation. The final report will include an analysis of operations model output at nest sites and will evaluate project –controlled flows.

Comment #	Study #	Source	Comment	Response
			In addition, percent exposure should be calculated based on periods when flows are within project generating capacity. The length of time that flows exceed project generating capacity will vary each spring. Focusing only on percent exposure during periods of project influenced flow will aid in comparisons of nest exposure.	
9	16	NHFGD	The extent of flow fluctuation at each site was not well documented in the report. From the graph in Figure C-1 (Appendix C.), water level appears to have fluctuated by up to 6 feet in a 24-hour period. This rapid fluctuation in water level may influence spawning behavior and impact the total number of nests available for study. The difference between maximum and minimum water level elevation, average daily (24-hr) water level fluctuation, and the average rate of change in water level elevation (ft. /hr.) should be reported for each site during periods of project influenced flow.	To the extent feasible, the final report will include analysis of water surface elevation ranges, and rate of change calculations for operations model output at nest sites in relation to project –controlled flows/elevations. We note that project-controlled elevations can increase and decrease several times over the course of a day in response to inflows as well as generation levels, potentially confounding this analysis.
10	16	NHFGD	In addition to reporting the percentage of sites (with nests) that were dewatered, the percentage of nests that were dewatered should be reported (nests at all sites combined).	The proportion of nests that were dewatered will be included in the final report. Note, however, we do not assume that any dewatering at any time during a two-month period when a nest may or may not be occupied necessarily indicates failure.
11	16	NHFGD	The comment discusses [on pp. 11-13 of the comment letter] specific statements in the report characterized as mitigating factors, and requests they be deleted in whole or part because those factors were not specifically evaluated as part of the study.	Although the mitigating factors discussed in Section 6.1 of the interim report were not specifically evaluated or quantified as part of the study, they help to characterize the 2015 field observations, as well as contribute to the current understanding of lamprey behavior. The final report will be revised to indicate that these factors were not specifically evaluated and will include additional text to clarify the intent of each factor.
12	16	NHFGD	Please provide a table showing the distance between each study site and the logger used to determine WSE. We are concerned that some loggers were located far	Those relative locations are listed in Table 5.2-3 of the interim report. Some loggers were relatively far away from study sites, but were included as best available data at the

Comment #	Study #	Source	Comment	Response
			away from study sites and might not be representative of actual water level conditions experienced at the study site.	time (BT-004, 2.5 mi downstream, BL-001, 1.2 mi downstream, BL-003, 1.1 mi upstream). The final report will include a similar assessment of project operations model output that should provide a better representation for those sites.
13	16	NHFGD	Pending future revisions of the Study 16 report and additional analyses requested in our comments, an additional year of study may be required in order to be able to assess potential project impacts on sea lamprey spawning.	We respectfully disagree that additional field study would be warranted or would necessarily provide different or additional useful information. While 2015 had periodic high flows in June, overall springtime conditions (flows and temperatures) were not sufficiently anomalous to materially affect 2015 results (FERC criteria for modification of studies at 18 C.F.R. § 5.15(d)). The final report will include analysis of operations model output to inform project effects at the study sites, and Study 9 – Instream Flow will provide information on project effects on habitat.
14	16	FWS	The way the results are reported is confusing. For example, the narrative summary of Assessment Station BT31 indicates that one potential lamprey nest was documented during the supplementary low-water survey, while Table 5.2-1 has a "Y" under the Nests column and Table 5.2-2 shows no nests at this site. Table 3 below [provided in comment letter] is our attempt to try to consolidate all related data.	The results will be clarified in the final report. The specific example given, BT-031, had one possible nest, but without confidence in the identification. Results for that site will be revised to indicate no nests were found, but the description in Section 5.2.1 will be retained to indicate that a potential nest was present.
15	16	FWS	The report should provide an explanation as to why four sites identified as having suitable habitat based on habitat mapping were subsequently determined to have unsuitable habitat based on field observations.	Descriptions of the habitat observed were presented in Section 5.2.1 of the interim report. The final report will more clearly describe habitat observations characterized as unsuitable. It is not unusual to pre-select potentially suitable habitat based on mapping (done in 2013) and once in the field (in 2015) observe conditions or site characteristics that differ from those expected. In some cases, there were limited areas of suitable habitat at the general study site but with no evidence of spawning.
16	16	FWS	According to the Site Selection Report for Study 16, redds would be monitored at 20 sites. Those 20 sites	Radio tagged lamprey were distributed throughout the study area. Frequently lamprey were tracked to areas that

Comment #	Study #	Source	Comment	Response
			were to be determined based on radio-tracking tagged fish, supplemented as needed by some or all of 20 selected habitat survey sites; however, it appears that the way the study was carried out, the habitat survey sites were the primary means of selecting where to monitor for spawning activity. The result was that only 16 of the 23 sites surveyed included redds (four short of the stipulated 20). It is unclear from the report if redds were documented at non-assessment site locations to which tagged lampreys were tracked. If tagged lampreys were tracked to locations within project- affected areas and redds were found, TC should explain why those locations were not included in the study.	were too deep to confirm or monitor spawning behavior. Sites where tagged fish were tracked and spawning activity was confirmed, either by observation of nest construction or observation of nests were included in the study. There were no sites where lamprey were tracked and nests identified that were omitted from the study. We included those stations where no nests were identified so that habitat assessment would remain distributed throughout the study reach as intended. The final report will clarify that there were no sites where lamprey were tracked and redds identified that were not included in the habitat assessment.
17	16	FWS	In the Assessment Station summaries, TC states that for a number of sites where lamprey nests were dewatered, suitable substrate was available in deeper water. However, substrate alone does not determine suitability, as depths and velocities also need to be within a certain range. The fact that nests were found in sites that became dewatered could reasonably be assumed to indicate that site had more suitable habitat than the deeper site.	The purpose in mentioning the deeper sites in the report was that lamprey were frequently tracked in deeper water, but we could not observe spawning behavior, particularly during high water periods. Nests may well have been constructed in the deeper water, but they were unobservable in the study and were considered not to be vulnerable to project effects related to dewatering.
18	16	FWS	For the project effects analysis, a determination of "no project effects" was assigned to sites where no nests were identified; however, just because nests were not built in 2015 does not mean they will not be built there in future years. The Service recommends that the project operations effects analysis include all areas with suitable habitat regardless of whether nests were documented in 2015 or not.	The final report will be revised to state “no spawning was evident in 2015” rather than “no project effects” in Section 6.1 and additional project effects analysis will be included based on the operations model data which was not available at the time of the interim report. The analysis was based on observed nests as indicative of spawning activity, the assessment of all suitable habitat was beyond the scope of Study 16, however Study 9 – Instream Flow Study will provide more information on habitat suitability.
19	16	FWS	Of the sites with suitable habitat and lamprey nests, project effects analysis showed that nests were	The interim report indicated that the analysis therein was based on the available short term water level logger data

Comment #	Study #	Source	Comment	Response
			exposed up to 38.4 percent of the time, with the number of exposure events ranging from 4 to 53 at a given site. The duration of exposure ranged from 1 hour to 276 hours. When looking at the number of nests dewatered (15) relative to the total number of documented nests (42), it appears that 36 percent of the nests were dewatered. Again, this analysis was based on 2015 operations and water level logger data…Therefore, the Service recommends that the analysis of operations impacts be expanded using the hydraulic model to represent the range and frequency of operations based on long term hydrography, and not based solely on a single-study year.	and results were characterized as "preliminary". It was acknowledged in the interim report that additional analysis would be conducted on nest sites with the hydraulic and operations models. That analysis is forthcoming in the final study report.
20	16	FWS	There appear to be discrepancies between on-site observations and operations analysis results. For example, Figure C-8 of Appendix C indicates that water surface elevation fluctuations at Site BT3 would not dewater the nest observed there; however, during the supplementary low-water survey, the nest was noted to be dewatered. TC provides no explanation for this discrepancy, which calls into question the accuracy of the water level logger data and/or the method of analysis. It should be noted that the logger for Site BT3 actually was located in the vicinity of the lamprey habitat, whereas seven other loggers were anywhere from 0.2 mile to nearly 2.5 miles away from the associated lamprey habitat assessment site. Given the importance of determining water levels at the actual spawning site, TC should have installed water level loggers at habitat assessment stations that did not already have them.	The supplementary survey was intentionally conducted in minimum flow periods in order to maximize the amount of habitat that could be visually surveyed. Those conditions were not common during the lamprey spawning season, thus a site may not have been dewatered during the spawning season but was dewatered during the late summer and after water level loggers were removed. The final report will include an assessment of project effects at nest sites using the hydraulic and operations models that will help to characterize water levels at the nest sites during the spawning season. The approved study plan did not include a provision to deploy water level loggers; however, where logger data from other concurrent studies were available, that information was considered to contribute substantially to the study and so was used to conduct initial analysis. The interim report acknowledged the limitations of these data in some cases due to their distance from the lamprey site.
21	16	FWS	According to TC, due to access and safety issues, only three redds were capped. No ammocoetes were collected from the nest capping effort. However, even	We concur that redd capping did not produce ammocoetes as expected; however, Section 5.3.2 of the interim report discusses the fact that ammocoetes and juveniles were

Comment #	Study #	Source	Comment	Response
			if ammocoetes were collected, TC would not be able to determine if project operations affected spawning success, because all the capped redds were from sites shown not to be affected by project operations, based on the water level logger data.	collected in other simultaneous studies which demonstrates spawning success within the study area. As a note, four redds (not three) were capped at three sites, two were located within tributaries at the apparent upstream extent of project influence. One was located in the mainstem river at a tributary delta within the Vernon impoundment. Other mainstem nest sites were in water that was too deep for redd capping during the majority of the spawning season.
22	16	VANR	The second goal of this study related to whether project operations affected success (i.e., survival to emergence) was not met. Therefore, it must be assumed that any dewatering of a nest results in the failure of that nest.	We concur that redd capping did not produce ammocoetes as expected; however, Section 5.3.2 of the interim report discusses the fact that ammocoetes and juveniles were collected in other simultaneous studies which demonstrates spawning success within the study area. We respectfully disagree that it must be assumed that any dewatering necessarily results in failure. That assumption requires all nests to have been occupied at the time of dewatering by a vulnerable life stage.
23	16	VANR	General Comment: One of the objectives of the study was to assess if flow alterations cause dewatering and/or scouring of Sea Lamprey nests. While it is informative to present proportion of nest dewatering by site, range, mean etc., resource agencies need to understand the proportion of nests that are subject to negative impacts as a proportion of the whole. Request: The report should present data on nest dewatering for sea lamprey as a proportion of the total number nests.	The final report will tabulate the number of exposures, and mean and range of duration of exposures for each nest elevation, and as a proportion of the total number of nests observed. We note that we can only report on observed nests but that Study 10 (Fish Assemblage) collected sea lamprey throughout the study area (except for the Bellows Falls bypassed reach) and in all sampling seasons. Suitable habitat is present throughout the study area so it is likely that sea lamprey spawning is successful throughout the study area. Study 9 – Instream Flow Study will provide more information on operations in relation to suitable habitats in the project-affected area.
24	16	VANR	General Comment: The study report states 26% (6 of 23) of sites experienced dewatering due to project impacts (including 6 sites at which no nests were identified). Also stated is that 44% (7 of 16) of sites at which nests were found were shown to be potentially	The final report will clarify the calculation as the proportion of sites where nests were found.

Comment #	Study #	Source	Comment	Response
			exposed to dewatering. Request: The value that should be reported is the percentage of dewatered sites where lamprey actually nested (i.e. 44%).	
25	16	VANR	General comment… the focus of this report was on nest exposure due to project related water level fluctuations, yet nest exposure is not the only a suitable metric for assessing project impacts in impounded areas. The primary project impacts in impounded areas include inundation of spawning habitat, fine sediment deposition in lower tributary mouths, and tributary accessibility. These effects were not evaluated in this report.	The goals and objectives of this study specified that the study would assess project effects (flow alterations) that could cause dewatering and/or scouring of redds. Sedimentation of tributary mouths and tributary accessibility were also beyond the scope of this study. However, Study 9 – Instream Flow Study will provide more information on operations in relation to suitable habitats in the project-affected area.
26	16	VANR	General comment…Request: A clear distinction should be made in the report between riverine sites, where the majority of spawning in the mainstem river occurs, and impounded sites, where the majority of habitat has been flooded and suitable habitat is dependent on tributaries. These two habitat types should not be grouped in the Study Conclusion section and the percent of nests and sites (containing nests) dewatered should also be examined by habitat type.	The final report will more clearly discriminate riverine sites from impoundment sites and will group and examine dewatering proportions by those categories.
27	16	VANR	General Comment: The percentage of time that sea lamprey nests were exposed (Table 5.2-3) over the entire length of the study period (May 15 to July 15) does not capture the true nature of exposure in some nests, which were rapidly dewatered and inundated multiple times during periods of project influenced flow. Request: The total number of exposures, average length of exposure, and the min/max length of exposure should be presented for each nest. In addition, percent exposure should be calculated based on periods when flows are within project generating	The final report will include water surface elevation ranges, and rate of change calculations for operations model output at the nest sites and will evaluate project –controlled flows.

Comment #	Study #	Source	Comment	Response
			capacity. The length of time that flows exceed project generating capacity will vary each spring. Focusing only on percent exposure during periods of project influenced flow will aid in comparisons of nest exposure.	
28	16	VANR	Table 3.1-1 – Please add stream order to the table.	The final report will include stream order in Table 3.1-1.
29	16	VANR	4.2 Supplementary Habitat Assessment – What was the proportion of sites that were included in the supplemental habitat assessment? The report should also acknowledge that nests have a propensity to change over time in response to flow events, fines settling out, etc.	Seventeen of 23 sites (73.9%) were included in the supplemental low water assessment (Table 5.2-1 of the interim report for sites with survey dates in August or September). The remaining sites had already been adequately characterized during spawning season surveys. We acknowledge the comment about nest changes and note that Table 6.3-1 in the interim report includes information for 13 sites having enough repeat observations to characterize nest site substrate, embeddedness, nest condition, and interpretation of nest changes during the spawning season.
30	16	VANR	4.4 Data from Other Studies – The report states, “Water surface elevation data from loggers (see Section 4.3 and Study 14 15 report for detail) were used where nest capping was not done, and therefore lamprey nest specific loggers were not deployed. For most sites, elevation data were selected for stations that coincided with Sea Lamprey spawning habitat assessment sites. For some sites where study sites did not overlap, data from the nearest available logger was substituted (proxy logger). Water surface elevation data were plotted relative to nest elevations.” There are concerns (as indicated in Appendix C) that many of these WSE loggers are miles away from the nesting sites. This may result in WSEs that are not representative of WSEs at a nesting site [provides	The approved study plan did not include a provision to deploy water level loggers; however, where logger data from other concurrent studies were available, that information was considered to contribute substantially to the study and so was used to conduct initial analysis. The interim report acknowledged the limitations of these data in some cases due to their distance from the lamprey site. The interim report indicated that the analysis therein was based on the available short term water level logger data and results were characterized as “preliminary”. It was acknowledged in the interim report that additional analysis at the nest sites would be conducted with the hydraulic and operations models. That analysis is forthcoming in the final study report.

Comment #	Study #	Source	Comment	Response
			examples]…Similarly, there were several sites where nests were observed to be dewatered but WSE indicated 0.0% exposure. This represents a major flaw in the analysis.	
31	16	VANR	6.1 Water Level Fluctuation and Nest Exposure…The Agency recommends that when comparing nest elevation to WSE's, the approach utilize the nest observation date and evaluate WSE's forwards and backwards (if WSE data are available) in time for the entire incubation period (based on water temperatures). While this may be a conservative approach, it insures that the egg incubation period is covered in the absence of knowing the exact spawning date. In most cases, the diurnal fluctuations in WSE render a nest dewatering event so extending the time period would not necessary overestimate such events but rather would assure that the analysis covers the entire incubation period prior to and after the initial observation.	We characterized the approach taken, comparing WSEs from water level loggers for a two-month period that encompassed the time that lamprey were available in the study reach through the approximate latest period of gestation, as highly conservative since it encompassed virtually the entire period that spawning, eggs, or larvae were predicted to occur / be present on the nests. The VANR recommended approach would not be applicable to sites where nests were identified after the spawning season.
32	16	VANR	6.1 Water Level Fluctuation and Nest Exposure (p. 76) – The study report states "Exposure was not necessarily relative to mortality, however, because the assignation of risk assumes that exposed nests were occupied during periods of project-controlled discharge" and "Finally, dewatered nests do not necessarily represent negative effects since the nests may not be occupied during exposed periods, or the duration of exposure may not be detrimental to early life stages." Regardless of the validity of these statements, they are not relevant because nest occupation during periods of project-controlled discharge and/or during exposed periods, and whether the duration of exposure was detrimental to early life stages, were not quantified. These statements should be removed	We feel that the statements are relative because the period assessed was two months. The spawning and gestation period could be completed and larvae migrated to pool habitat entirely during higher water periods. With regard to the conclusion that any nest exposure represents a negative impact may not apply universally. If the exposure occurred after the nest was vacated then there would be no impact. The frequency and duration of exposure and the rate of water surface elevation changes will be further assessed at nest sites in the final study report using the hydraulic and operations models.

Comment #	Study #	Source	Comment	Response
			from the report. In general, any nest exposure time represents negative impacts and any conclusions should be classified as such.	
33	16	VANR	6.1 Water Level Fluctuation and Nest Exposure (p. 76) – The report states that ammocoetes are adapted to survive some dewatering. Based on lab testing, “mortality was less than 7 percent for exposure periods of less than 24 hours. For nests that experienced exposure, the average period of exposure was always less than 10 hours”. It should be noted that this represents an average period of exposure. Table 6.1-2 indicates exposure times can be as high as 81,53, 17, and 58 hours depending on the site. Moreover, Strief (2009) documented that a single stream dewatering event, even of short duration, can inhibit up to seven years of lamprey production by eliminating all age classes of ammocoetes. Therefore, we disagree with the above statement and recommend it be removed from the report.	This comment reflects a stream dewatering, it is not clear that dewatering of some elevations of bar habitat are equivalent to total stream dewatering. Based on literature reports, most ammocoetes are expected to vacate those spawning habitats in favor of pool habitats with fine sediments. We note that dewatering of the top of a gravel bar within a stream is not nearly the same as bank-to-bank dewatering of a stream as Streif (1990) was referring to: *“An instream action that may <u>dewater a stream</u> includes culvert replacements, some instream habitat projects, and irrigation withdrawals and diversions. Substrate disturbance projects can include dredging, road-crossing modifications (such as culvert replacements), and instream structures for grade. Since ammocoetes are found in the stream substrate year-round, taking into account the potential for them to utilize an area is essential to their conservation. A single dewatering event, physical disturbance, or contamination event may have a significant effect on multiple year-classes of a local lamprey population due to the inability of ammocoetes to move quickly from a disturbed area…”*
34	16	VANR	The comment discusses [on pp. 15 of the comment letter] specific statements in the report characterized as mitigating factors, and requests they be deleted in whole or part because those factors were not specifically evaluated as part of the study.	Although the mitigating factors discussed in Section 6.1 of the interim report were not specifically evaluated or quantified as part of the study, they help to characterize the 2015 field observations and place study results and conclusions into context, as well as contribute to the current understanding of lamprey behavior. The final report will be revised to indicate that these factors were not specifically evaluated and will include additional text to clarify the intent of each.

Study 18 – American Eel Upstream Passage Assessment

Comment #	Study #	Source	Comment	Response
1	18	NHFGD	TC did not draw the same inferences at Wilder and Bellows Falls with respect to attraction to the ladders as it did for Vernon, apparently based on the relatively lower ladder passage numbers	This comment is correct, as we feel the low numbers of eels at Wilder and Bellows Falls obviates any inferences at those projects.
2	18	NHFGD	We recommend that TC repeat Study 18 in 2016 [at Vernon only], using visual observations at wetted locations along the dam and an eel trap pass within a lower portion of the Vernon fish ladder. TC should determine the location, design, and operation and attraction flows of the fish ladder eel trap pass in consultation with the agencies and Dr. Alex Haro of the USGS Conte Anadromous Fish Research Center…Additionally, similar to methods in Study 18, temporary eel trap passes should be installed, with consultation with the aquatic working group, if adequate concentrations of eels are found during visual observation surveys.	We concur that 2015 study results may have been affected by continued operation of the fish ladders for Study 17 and agree that additional analysis may be warranted (at Vernon only). We will consult with stakeholders on an approach with the intent of doing some additional study in 2016.
3	18	FWS	The Service recommends that TC repeat Study 18 in 2016 [only at Vernon], using visual observations at wetted locations along the dam and near and along the fishway entrance area, and placement of an eel trap within a lower portion of the Vernon fish ladder. In accordance with the approved 2015 study plan, TC should again plan to install temporary eel trap passes at any locations where adequate concentrations of eels are found through visual surveys. TC should determine the location, design, and operation and attraction flows of the eel trap pass within the fish ladder and at any other sites found to have eel concentrations, in consultation with the agencies and Dr. Alex Haro of the USGS Conte Anadromous Fish Research Center.	Please see response to NHGFD comment #2 above.
4	18	VANR	Given the report is an assessment of upstream eel passage, the data from study 17 [up and downstream ladder usage] should be analyzed to determine if at some point during the	Up and downstream eel movement counts reported in study 17 will be reviewed to see whether a cut-off date for upstream movements can be determined. If

Comment #	Study #	Source	Comment	Response
			year, eel began utilizing the fishway for downstream passage, that should mark the end of the upstream passage season and net upstream passage should be reported through that date.	the beginning of downstream passage can be discerned that information will be reported in the Study 20 – American Eel Downstream Migration Timing Assessment report.
5	18	VANR	Executive Summary – The report states, Of the eels observed, the greatest concentrations were observed in the fish ladders (Study 17) which operated continually throughout the study season as prescribed in the methods for that study. The Agency concurs with this statement. Considering the number of eels documented using the fishway at each project to pass upstream was an order of magnitude greater than the number of eels observed in either the Eel Survey (Study 11) or in the systematic surveys employed in this study. The Agency recognizes the fishways at all three projects, while operating, represent aggregation points for American Eel.	The study report also acknowledges this point, no additional response required.
6	18	VANR	5.0 Conclusions: The Agency notes the statement that “the attraction flows into the ladder appeared to greatly outweigh attraction flows at smaller leakages through or over the dam” is not applicable only to Vernon, but also to Bellow Falls and Wilder. Relative to the number of eels observed in the systematic surveys at Vernon (80), Bellows Falls (3), and Wilder (0), larger number of eels were documented utilizing the fishway for upstream passage at each project (net of 1545, 60, 52 respectively). In addition, two of the eels observed during the systematic survey at Bellows Falls were observed by the fish ladder. These data indicate that the fishway at Vernon is not unique in its ability to attract eels attempting to pass the project. Rather eels are attracted to the fishway at each project when it is in operation, there are simply more eels below the Vernon project at this point in time.	Given the very low numbers of eels observed at Bellows Falls and none at Wilder in this study, the study report conclusions focused on Vernon, but did not intend to suggest that Vernon’s fish ladder was unique in that regard.
7	18	VANR	Additional Study Request: 5.0 Conclusions - The report states, “Had the ladder not been operating to pass resident fish (for Study 17) for the full duration of this study, it is possible that higher numbers of eels would have been detected and/or captured at other	Please see response to NHDES comment #2 above. We note that the NHDES and FWS requests are limited to additional study at Vernon only. Given the low numbers of eels detected in the Bellows Falls and Wilder fish ladders in Study 17, along with lack of eels detected at Wilder and the extremely

Comment #	Study #	Source	Comment	Response
			locations across Vernon dam." While this comment was made in regards to the Vernon project, given that eels utilized the fishway at each project to pass when in operation, changes in ladder operation could result in larger numbers of eels congregating while attempting to pass each project. If the fishways were to not operate for resident species, where eels attempting to pass the project would congregate (objective 1) and whether they could be passed effectively (objective 2), remain open questions… The Agency recommends using the upcoming season in which TransCanada has proposed to not operate the ladder during the summer months to evaluate eel congregation and passage under these conditions. Prior to the installation of any temporary eel trap passes, TransCanada should consult with the aquatics working group to seek to reach agreement on appropriate locations, design, operation, and attraction flow for the eel trap passes [study request attached].	low numbers detected at Bellows Falls in this study, there is no reason to conduct additional field work at those projects at this time.

TransCanada Response to March 1, 2016 USR Comments

Study 21 – American Shad Telemetry Study (report has not been filed to date)

Comment #	Study #	Source	Comment	Response
1	21	FWS	According to information provided by TC at the March 17-18, 2016 meeting, it intends to analyze the upstream passage telemetry data to determine fishway attraction effectiveness, upstream fish passage efficiency, and upstream fish passage effectiveness. All of these analyses involve calculations using direct proportions of the number of tagged shad at a certain location relative to all tagged fish available. The Service believes that, while the analyses proposed by TC will provide useful information, they are insufficient to achieve the stated study goals of assessing project operations effects on shad behavior, approach routes, and passage success. Data analysis requires consideration and accounting for time-varying covariates (e.g., turbine discharge, river discharge) that must be examined at an appropriate time scale and rate to examine and understand any potential effects and how those effects may vary under different conditions…The Service needs to understand not only proportions of shad passed but the rates of passage, which require use of more recently developed and established analytical approaches of telemetry data at fishways, such as the time-to-event analysis described in Castro-Santos and Perry (2012). In their paper, the researchers state "Because passage at obstacles is a time-based process, almost any study of fish passage is likely to encounter time varying covariates, and analytical methods that do not explicitly include these processes will always contain systematic errors" (Castro- Santos and Perry 2012). The Service recommends that TC include a time-to-event analysis [per Castro-Santos and Perry (2012)]; this analytical approach will help achieve the stated study goal, is consistent with using the best available scientific approaches, and is consistent with FL's proposed method of analyzing similar project operations effects.	The study report has not yet been filed; however, we acknowledge the request and will consider it as we attempt to complete the study report. We note that this methodology was not part of the approved study plan, nor was it discussed in study plan meetings or study report meetings.

Study 24 – Dwarf Wedgemussel and Co-Occurring Mussel Survey – Delphi Panel Report

The Delphi Panel Report had not been filed at the time of receipt of comments; however, the report as filed on May 16, 2016 is responsive to the comments received as noted in the table below.

Comment #	Study #	Source	Comment	Response
1	24	TNC	At the Study Report meeting, we (TNC) asked TransCanada to describe the criteria that were used to determine who would qualify as an expert on the panel, but it was not clear from their response what criteria were used. If the criteria include peer-reviewed publications about the habitat requirements of dwarf wedgemussel or similar taxa, this should be specified and followed. If the criteria include field work experience with dwarf wedgemussel or similar taxa, the pool of available experts should be much larger than four individuals. In light of this, we ask that TransCanada please provide justified criteria for expert selection and justification for including only four individuals on the expert panel. Avoiding bias in results is a key characteristic of the Delphi approach, and without adequate documentation of the methods used for development of the Study 24 Delphi panel, it will not be clear how such bias was avoided.	The Delphi Panel Report (filed May 16, 2016) describes the panelist criteria which included research (field) experience and the collective works (peer-reviewed publications, books, and reports) of prospective candidates, particularly with dwarf wedgemussels. TransCanada felt it necessary to identify and produce a panel of experts with DWM field experience and that field is limited. We reached out to two experts from the USGS Northern Appalachian Research Laboratory, where some key dwarf wedgemussel research has been ongoing for years, and targeted the two lead researchers there. This would have given us 5 participants, but one declined at the outset and the other never participated despite assurances to do so. The five experts that were approached for this project undeniably have the most research and field experience with dwarf wedgemussels.
2	24	TNC	It was brought to our attention that one of the panelists was also a contractor hired by TransCanada who was involved in developing the expert questionnaire. Although TransCanada wisely brought in another individual to facilitate the latter portion of the Delphi process, we assume that the contractor will also be intimately involved with the analysis and preparation of the report. As a result, we are concerned that this close involvement could bring unintentional bias into the study results. In our understanding of the Delphi process, there are three separate groups: 1) the decision makers; 2: the facilitator(s) who design the initial questionnaire; and 3) the respondent panel. Although we have not seen full documentation of the process, we are concerned that TransCanada has not clearly differentiated among these	The panelist in question was not involved in development of the Delphi questionnaire, but only involved in development of the initial approach to HSC development (including the HSC proposal presented to the working group and consultation March 5, 2015). As part of preparation for the Delphi process, that panelist: • provided publically-available background literature to the facilitator (moderator) for use in developing the questionnaire; and • developed the initial list of potential panelists and made initial contact with them to solicit their interest in participating. We note that the "decision makers" in this case includes the

Comment #	Study #	Source	Comment	Response
			groups. We ask that TransCanada therefore please provide documentation from the literature that supports the overlapping role of the contractor in the Delphi process.	working group via consultation on the final HSC.
3	24	VANR	In the Updated Study Report submitted by TC on September 14, 2015, TC stated that five panelists had agreed to participate in the Delphi process. However, at the March 17-18, 2016 study report meeting, TC's consultant informed the stakeholders that only three panelists were actively participating in developing the HSI curves. One of the panelists was the person who had developed the background information and questionnaire that was sent out to prospective panelists and who initially had been identified as the Delphi facilitator (but who has since been replaced by another person). Delphi group guidance (Habibi et al. 2014) recommends: • That there are three "separate" groups: (1) the decision makers, (2) a person or group designing the initial questionnaire, and (3) the respondent group or panel. Given what has transpired, there has been no clear separation between the latter two groups; • Number of panelists: literature suggests a minimum of 5, with between 6 and 10 being ideal (Habibi et al. 2014). There are only three active panelists in the DWM Delphi process; and • Avoiding "overrepresentation" by stakeholders or individuals from a single agency, interest group or geographical area. Presently, both the moderator and one of the panelists (i.e., one third of the expert panel) are associated with TC.	As stated above, the panelist in question did not develop background information (other than previously published or FERC-filed reports of field studies) nor did that panelist develop the Delphi panel questionnaire. As indicated above and in the study report, an attempt was made to identify and solicit participation by a larger panel (5), but the group ultimately included three active experts. While true that the moderator and one panelist are each associated with TC, the two individuals are not associated with each other, and the moderator had not previously been involved with DWM research or studies. The moderator was chosen to separate the roles, and based on his unique expertise in developing HSC for other species. The Delphi process was conducted in accordance with the guidance of Crance (1987) and was based on TC's proposal and consultation with the working group (March 5, 2015), and we believe it produced unbiased, meaningful results.
4	24	VANR	The new Delphi moderator (a representative from NAI) informed stakeholders during the March 17-18, 2016 study report meeting that, after two rounds of input, the panel was having difficulty reaching consensus on three of the five parameters. The moderator suggested that if	At the time of the March 17-18, 2016 meeting, the second round was still in progress with ongoing interaction between the moderator and each panelist. Full consensus was reached in the third Delphi round. Since

Comment #	Study #	Source	Comment	Response
			consensus could not be reached after a third round, the remaining curves would be developed based on feedback from the panelists who could reach agreement. The purpose of the Delphi technique is to gain consensus from panelists who have expertise in a particular area. The number of review rounds should not be the basis for reaching agreement; rather, reaching a consensus is a basis for ending the review rounds (Habibi et al. 2014). If a composite value is in favor of the two agreeing panelists and the final panelist is in dissent, then adding additional panelists (ideally two or more) for subsequent rounds may help reduce the uncertainty in the suitability scores. Further, the number of panelists on a team could affect composite scores, depending on the method used to calculate them, therefore this is a concern with only three panelists now on the DWM team.	consensus was reached, the third round was ultimately the final round. Full "consensus" is never a guarantee, no matter how many panelists or how many rounds are conducted, but full consensus is always the desired outcome. The dissenting expert was misinterpreting how HSC are applied in hydraulic modeling and, after the moderator clarified this issue with the individual, the expert agreed to the final HSC.
5	24	VANR	Given the concerns detailed above, the Service recommends that TC provide all of the materials related to the Delphi process…	These materials are included in the Delphi panel final report filed May 16, 2016.

Study 30 – Recreation Facility Inventory and Use & Needs Assessment

Comment #	Study #	Source	Comment	Response
1	30	CRWC	Sumner Falls (a notoriously dangerous site – a number of deaths have occurred at that site) was given a 9 out of 10 for safety by survey respondents. This site is subject to heavy dam operational influence. Table 4.1-2, depicting estimated use (in recreation days) at study area recreation sites from March 2014 through February 2015 does not appear to take into consideration the fact that the Charlestown Boat Launch & Picnic Area (among the more heavily utilized recreational facilities in the project affected reach) has since closed. No analysis appears discussing potential project operational affects upon the closure of this facility due to poor boat launch condition. The traffic counter (counts traffic at facility access points) at Hoyt's Landing went missing upon the site visit in March 2015, having disappeared at some point following the November 2014 site visit. CRWC has concerns regarding the lack of available data with respect to recreational use of Hoyt's Landing, which even given the large data gap at this site still appears to be by far the most heavily utilized recreational facility within the project affected reach (it also happens to be the best designed and most effectively maintained facility in the reach). Lack of data at this site could vastly skew overall recreational use data within the context of the entire project affected reach.	Study 30 presented the results from survey respondents collected during the 2014-2015 field season. No deaths have occurred at this site during TransCanada's ownership and operation of hydro projects on the Connecticut River. TransCanada recognizes this site in its Public Safety Plan and has installed a number of safety warnings and measure to alert the public to the dangers of rapids, provides a portage, and provides an up-to-the minute flow information service for the public. The study does not make any suggestion that the site is free of all risks as boating, and especially whitewater boating, is widely recognized as a dangerous sport with inherent risks. The Charlestown Boat Launch and Picnic Area receives regular use as described in the study report; however it also received comments from the public related to its maintenance and the condition of the amenities at the site. TransCanada had to close the boat launch to trailer launching due to safety concerns that progressed rapidly within last couple of years as a result of wash-outs. Plans are in place to repair this functionality .and the picnic area has remained open, the road and parking areas have been re-graded, and the safety hazards removed. The site is open to car-top boating while a redesign of the launch is engineered and permitted. The temporary closure to trailered boats required to re-design and permitting to reconstruct the ramp is required to achieve the goal of providing safe, adequate public access to the Project waters. Hoyt's Landing is recognized in the study report as a popular recreation destination year-round given its combination of proximity to major roads, ease of access, and onsite amenities. Review of other sites that did have traffic

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				counter data for the period in question suggests winter use levels in general are much lower than the remainder of the year. This was also recognized by the study plan in only scheduling two spot counts per month during the winter months. Although, total use estimates may be lower due to the loss of the counter, the types of uses occurring during this period (e.g., ice fishing, snowmobiling) is not dependent on parking as most users drive onto the ice. As such, physical capacity during this time of year is not a notable issue, nor does it significantly alter the understanding of recreation use and activities in the reach as noted in the comment.
2	30	CRWC	Did the study carry out more detailed sampling with respect to places of origin of users? CRWC feels that while it is important to understand which state respondents hail from, understanding the relative abundance of abutters (residents who live in close proximity to the river) to respondents who traveled long distances to reach the river can vastly influence responses received. CRWC has some concerns that the 6% of respondents who traveled from states which do not meet the Connecticut River at any point, as well as the unknown number of respondents who had to travel several hours to get to the river, may influence the overall survey responses to an unprecedented degree.	As stated in section 4.3, *Places of Origin*, zip codes of respondents to onsite interviews were used as an additional method of identifying towns of origin of visitors. Figures 4.3-1 through 4.3-3 show the distribution of places of origin for visitors recreating at the projects as collected in onsite interviews and show the majority of visitors to the sites reside in the communities closest to the river. Out-of-state visitors also used the public access points included in the study and were the minority of responses received. The mail-out survey targeted local communities and was designed to learn more from the population of potential users that would not be captured by the on-site interviews. All survey methods and tools (e.g., interview questions, spot count forms) were developed in accordance with the FERC-approved study plan. Study methods incorporated sample sizes needed to meet statistical significance goals. Based on the number of potential returned surveys (sample population) and the actual number of returned surveys (sample size), the 95 percent confidence level resulted in a confidence interval, or margin of error, of ±5.65, slightly higher than the goal (of 5 percent). This means that from a statistical perspective, TransCanada can be 95% certain that the survey results are within 5.65% of the result that could be expected if TransCanada had asked the question of the

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				entire relevant population. As such, the suggestion that out of state respondents somehow influence the survey results in an unprecedented manner is unsupported by the study results.
3	30	CRWC	That FERC require TransCanada to do a season long count of usage at Hoyts Landing and that the information become part of the final Recreation Study. In the meantime, FERC should extend the study comment period until TransCanada adds the data generated to the study report.	We respectfully disagree that additional study of this site is necessary. TransCanada recognizes Hoyt's Landing is a popular site and although it is unfortunate the traffic counter was not retrievable once the site was accessible in the spring, we observed and recorded through systematic spot counts regular winter use (also supported by evidence of tracks in the snow). Use during the winter generally consisted of visitors driving out onto the ice for access to the river for ice fishing . Given the nature of the activities and the lack of crowding or impact to physical capacity (parking) it is not clear what additional counts would achieve beyond what we know about this site already. As described in the study report, it is a popular site with regular use with the majority of visitors recreating between Memorial Day and Labor Day.
4	30	NHFGD	Please detail the next steps in regards to how decisions will be made concerning what TransCanada boat ramps will undergo improvements or repairs. In the report it is detailed that 42.8 percent of those surveyed desired lower water level fluctuations and 42.9 percent stated current water level fluctuations are fine. How does this information get incorporated into the relicensing of these dams and future project operations? The "Hinsdale access" referenced on Page 100 is owned by NH DRED, not NHFGD.	TransCanada is in the process of developing their Draft and Final License Applications. Within this process, TransCanada will evaluate which environmental measures it proposes for inclusion as conditions of the new licenses. The results of all studies will be used to inform those measures. We acknowledge the Hinsdale Access site ownership is DRED, and have noted that for purposes of license application.

Study 31 – Whitewater Boating Flow Assessment – Bellows Falls and Sumner Falls

Comment #	Study #	Source	Comment	Response
1	31	VANR	General Comment: The travel time of flow releases from Wilder Dam are estimated to be about two hours in the study report. Request: Given the precision of the hydraulic modelling performed in study 4, please quantify the travel time of releases at Wilder Dam to Sumners Falls under several flow scenarios. This information has the potential to help inform recreational users of when flows may be available for boating.	Estimated lag times of flows from Wilder to Sumner Falls based on different combinations of generating unit operations will be derived from the hydraulic model and that information will be included and discussed in the revised study report.
2	31	AW et al	2.0 Whitewater Recreation Opportunities in the Region: TransCanada provides a map which identifies other whitewater opportunities available in New England that are within a 2-hour drive to Sumner Falls and Bellows Falls. The report, however, fails to recognize that, with the exception of the Deerfield River in Massachusetts and several projects located in the mountains of western Maine that have dam releases as a result of FERC license articles, all identified resources are only seasonal in nature. The map provided in the comment letter identifies locations where there are scheduled whitewater boating releases. With the exception of the Deerfield, the rivers shown have no scheduled releases during the summer months and have releases on as few as one day annually, which makes the comparison to the Connecticut River largely irrelevant.	Figure 2-1 *Sample whitewater boating opportunities in the region,* provides context to the proximity of whitewater boating opportunities relative to Sumner Falls. What makes Sumner Falls interesting to boaters is its flow during the summer months which was reinforced in the findings in the study report; however this was not the only criterion used in developing the figure. The figure helps provide the context that there are multiple boating opportunities (with or without scheduled releases) throughout the region.
3	31	AW et al	3.0 Study Area: Along with removal of the barrier dam, AW, AMC, and FLOW seek a post-license evaluation of flows in the lower portion of the natural river channel [in the Bellows Falls bypassed reach] from the barrier dam pool to the tailrace. When combined with the results from the Whitewater Boating Flow Evaluation, we will be able to identify minimum acceptable and	Comment acknowledged. There are currently no plans to or requirement to remove the barrier dam.

Comment #	Study #	Source	Comment	Response
			optimal flows that should be provided in order to mitigate the Licensee's impact on recreational resources.	
4	31	AW et al	4.0 Controlled Flow Study: At Sumner Falls, the Licensee selected target flows, after consultation with stakeholders, that were within the capacity of its generating units and operating procedures at Wilder Dam…It is within the Licensee's operational ability to provide all flows evaluated during the boating study through either generational flows or spillage, limited by seasonal inflows and other operational constraints. Additionally, measuring flows at Sumner Falls, and to a lesser extent at Bellows Falls, was challenging due to the lack of a USGS gage in the study area.	The whitewater study at Sumner Falls inherently involved water discharged at the Wilder Dam and additional inflow from tributaries below Wilder dam. We respectfully disagree that flows at Sumner Falls either during the study or throughout any period are difficult to estimate. TransCanada provides flow information regarding the discharge at Wilder Dam. The USGS gages on the White River, the Connecticut River below Wilder Dam and the White River confluence and the Ottaquechee River above Sumner Falls are also available publicly. The NHDES Water Resource Bureau website also provides flow information on the other significant tributary, the Mascoma River. Collectively, the flows at Sumner Falls can be reasonable estimated and were during this study. Additionally, many users surveyed during the recreation study and participants in the white water boating study at Sumner Falls indicated familiarity of how to locate and estimate flows and anticipated flows based upon the aforementioned public flow information sources.
5	31	AW et al	5.0 Results [Sumner Falls]: We agree with the study results showing that "the Sumner Falls complex has broad appeal across a wide range of flows and boater types." We believe that, as a condition of any project license, the Licensee should provide a range of flows that allow an optimal boating experience over the range of flows evaluated, perhaps varying over the course of a single day to provide something for everyone. We are also seeking flows with sufficient frequency to enable the recreation use of Sumner Falls throughout the boating season, particularly during the summer months when other regional boating opportunities are unavailable. These boating opportunities should be made available earlier in the	Comment noted; we have not proposed license conditions, mitigation, or enhancements in this report.

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			day than would otherwise be available under the Licensee's typical generating regime, as well as later on work days…. We are seeking guaranteed boating flows under any new project license.	
6	31	AW et al	5.0 Results [Bellows Falls]: At Bellows Falls, recreational use of the natural river channel is completely eliminated by the lack of flows, the lack of access, and the presence of the fish barrier dam… In its present state there is currently no formal public put-in access or parking for whitewater boaters or canoeists. While TransCanada contends they own no real estate along the river, their office and parking area [are] located at the site of the whitewater boating study and could provide an adequate put-in location… the Licensee should construct stairs to facilitate access to the natural river channel near the top of the whitewater run below the primary dam. With the removal of the fish barrier dam, the run could end at the boating access location below the bypass reach where flows from the powerhouse rejoin the mainstem of the Connecticut River along the east side of the river on NH-RT 12… In addition, the possibility of developing a whitewater park in the natural river channel will also need to be considered when designing features for particular flow levels….	Comment noted; we have not proposed license conditions, mitigation, or enhancements in this report.
7	31	AW et al	USGS gage information for the Connecticut River at North Walpole (USGS-01154500) for the period from 1946 to 2014 shows that the Licensee has the ability to release flows into the natural river channel that are within the range of flows evaluated in the boating study throughout the year except during the spring freshet when spillage exceeds the Licensee's hydraulic capacity by more than 10,000 cfs, or the highest flow evaluated during the study. It is unknown at what level the natural reach can be boated once the fish barrier dam is removed. Other than during the spring freshet,	Flows evaluated during the study are generally within the operating range of the station; with the maximum demonstration flow equating generally to the maximum station flow. If flows were released into the bypassed reach, they would likely reduce the amount of flow passing through the generating station on a periodic and annual basis and therefore would be likely to affect energy production. The ability to release flows as suggested in this comment is one of many aspects related to the suitability, or lack thereof, of the bypassed reach for whitewater boating. Public access and safety are other key factors that must be considered.

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			mean daily flows in the range of those evaluated during the boating study occur daily at Bellows Falls, including the driest month from mid-August to mid-September when inflows are still sufficient to provide an optimal boating opportunity if flows were restored to the natural river channel.	

Study 32 – Bellows Falls Aesthetic Flow Study

Comment #	Study #	Source	Comment	Response
1	32	VANR	Additional Study Request: The aesthetic flow evaluation deviated from the approved study plan. The Revised Study Plan states, "At a minimum, the controlled flow releases to be provided for the associated flow studies (Studies 9 and 31) would be videotaped and photographed for use in this study." The flows associated with study 31 (Whitewater Boating Flow Assessment) were evaluated, but flows associated with study 9 (Instream Flow) were not. As a result, the range of flows were rather high for evaluation of compliance with the aesthetics criteria of the Vermont Water Quality Standards…. Given the information provided in the study report, the Agency may not have the requisite information to make such a determination, particularly for flows in between 125 and 1,580 cfs. In light of the deviation from the approved study plan, the Agency includes a request to amend the study plan in an attachment to this comment letter. [study request attached].	We acknowledge that the lack of Study 9 video constitutes a study plan variance that was not called out in the study report. We were unable to coordinate Study 9 controlled flows with videotaping for this study, and photographs taken in Study 9 were taken at transect locations within the bypassed reach rather than from the Key Observation Points (KOPs), so were deemed not useful to this study and were not included in the Study 32 report. As recommended in the study request's first alternative, we will videotape flows from the KOPs between leakage and approximately 1,580 cfs (the lowest flow assessed previously), qualitatively analyze each flow, summarize the assessment, and provide the additional video and photographs in the revised study report. We note that video from Study 31 used in Study 32 was filed with FERC on April 8, 2016.

Non-Study Report Comments

Several commenters provided comments not associated with specific filed study reports.

Study #	Source	Comment	Response
n/a	CRJC	Address the potential for the accumulation of increased levels of toxins (e.g., mercury in fish) within the reservoirs as a result of fluctuating water levels. As mercury adversely affects human health, data on it should be gathered through these studies. This is an appropriate subject that must be carefully reviewed during water quality certifications by New Hampshire and Vermont, under Section 401 of the Clean Water Act.	In its July 13, 2015 comments on TC proposed study plans, CRJC recommended modifying Studies 5 and/or 6 to include an assessment of mercury and dioxins. In its February 21, 2015 Study Plan Determination, FERC concluded that because there is no clear connection between project-related reservoir fluctuations and methyl mercury or dioxin concentrations, they did not modifying either study to include such an assessment.
n/a	CRJC	Assess the cumulative economic impact of the hydroelectric projects.	In its September 13, 2013 Study Plan Determination, FERC determined that this type of study was not required.
n/a	CRJC	The CRJC recommends that TransCanada establish, by December 2016, a mitigation and enhancement fund (similar to the fund established under the 1997 settlement agreement for Connecticut River dams at Fifteen Mile Falls) for the lower Connecticut River as part of the draft license agreement.	Comment Noted – not related to specific Study Report results
n/a	CRJC Upper Valley, Ascutney and Wantastiquet Subcommittees	Require the owner to establish a mitigation fund for riverbank restoration and stabilization projects to protect public and private property.	Comment Noted – not related to specific Study Report results
n/a	CRJC Upper Valley, Ascutney and Wantastiquet Subcommittees	Require that the operational model be optimized to manage ramping in a manner that will minimize riverbank erosion.	Comment Noted . This comment relates to potential alternatives analyses using the Operations Model developed under Study 5.
n/a	CRJC Ascutney Subcommittee	Requiring a revenue sharing arrangement in return for the use of these public waters for private profit.	Comment Noted – not related to specific Study Report results
n/a	CRJC Upper Valley Subcommittee	Require increased cooperation with the valley's agricultural industry regarding access to plant fields in the spring in a timely manner.	Comment Noted – not related to specific Study Report results

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n/a	Town of Lyme	If it is demonstrated that the operation of the dam is the cause of the erosion, TransCanada should be held financially responsible for the damage and change the way the dam is operated to decrease further damage.	Comment Noted.