Great River Hydro

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July 6, 2017

VIA ELECTRONIC FILING

Honorable Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, D.C. 20426

Re: Great River Hydro, LLC; FERC Project Nos. 1855, 1892, and 1904 – Response to US Fish and Wildlife Service Comments filed June 8, 2017

Dear Secretary Bose:

Great River Hydro, LLC (Great River Hydro) 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 (the previous licensee) 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.

On June 13, 2017 Great River Hydro submitted responses to various comments and specifically to Disagreements and Requests to Amend Study Plans regarding numerous Study Reports filed between November 30, 2016 and March 22, 2017 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 due from stakeholders by May 15, 2017 in accordance with FERC's Process Plan and Schedule issued February 22, 2017. US Fish and Wildlife Service (FWS) filed comments on June 9, 2017 (dated June 8, 2017) which did not allow Great River Hydro sufficient time to include those comments in our June 13, 2017 response filing. Therefore, with this filing Great River Hydro provides responses to FWS comments on applicable studies.

Two studies are ongoing at this time at the Vernon Project: Study 18 – American Eel Upstream Passage Assessment, and Study 21 – American Shad Telemetry Study (downstream passage route selection). Report supplements for these studies will be filed once all field work is complete and all data have been analyzed.

Additional consultation related to Study 9 – Instream Flow Study, and Study 24 – Dwarf Wedgemussel and Co-occurring Mussel Study, is ongoing at this time and additional analysis of Habitat Suitability Criteria (HSC) is anticipated to occur during the summer and fall of 2017. Report supplements will be filed as applicable once consultation is complete and data have been analyzed.

Based on FWS and other stakeholder comments received on Study 25 - Dragonfly and Damselfly Inventory and Assessment Final Report, we will file by July 31 or sooner, a study report supplement containing additional information and analysis.

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 jragonese@greatriverhydro.com.

Sincerely,

John L. Ragonese
FERC License Manager

Attachment: Response to FWS USR Comments

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

Study 9 – Instream Flow Study

Comment #	Source	Comment	Response
1	FWS	GRH calculated a combined suitability index (CSI) at each transect by using straight multiplication of the variables rather than the geometric mean. Using straight multiplication of the variables to calculate CSI can lead to undervaluing habitat suitability (versus using the geometric mean). It is our understanding that it is standard practice to calculate CSI using the geometric mean (Brown et al. 2000; Steffler and Blackburn 2002). In order to determine how these two methods affect model results, it would be helpful if GRH would recalculate a subset of the run scenarios using the geometric mean. We suggest using DWM for the Wilder riverine reach and American shad (spawning; *Alosa sapidissima)* for the Bellows Falls and Vernon riverine reaches. We recommend this issue be further discussed following review of the revised calculations.	FWS suggests that calculation of a combined suitability index (CSI) using geometric mean (GM) is “standard practice” and cites two publications (Brown et al. 2000 and Steffler and Blackburn 2002) to support the suggestion. We disagree that GM is considered standard practice, and it is in fact rarely used to calculate CSI. Multiplication is generally used and there are many examples from other instream flow studies that utilized CSI as part of their analysis. These include instream flow studies for FERC relicensing of numerous projects[1] including most recently, the Turners Falls Hydroelectric Project FERC No. 1889, VT (2016). Steffler and Blackburn (2002) do not make any recommendation for calculating CSI and ultimately WUA. GM is only mentioned as an option for calculating WUA under the habitat dialog box (page 107-108). Similarly the developers of IFIM/PHABSIM do not make any recommendation regarding calculation of CSI. Brown et al. (2000) is not an instream flow study but a habitat suitability index (HSI) model of an estuary based on the USFWS habitat evaluation procedures (HEP) which were developed for both terrestrial and aquatic systems. Unfortunately over the years the acronym HSI has been misused to refer to suitability index curves (SI). Both HSI models and PHABSIM habitat models can use SI curves but each model

[1] For instance Otter Creek Hydroelectric Project FERC No. 2558, VT (2010); Conowingo Hydroelectric Project FERC No. 504, PA (2012); Morrisville Hydroelectric Project FERC No. 2692, VT (2013); Hawks Nest Hydroelectric Project FERC No. 2512, WV (2015).

Comment #	Source	Comment	Response
			is intended for specific purposes (Armour et al. 1983). Though GM is used in the calculation of some HSI models as was done in Brown et al. (2000), others use a wide variety of methods including multiplication, division, weighting of variables and lowest component value (limiting habitat variable). In addition users of HSI models can pick and choose any number of variables (many consist of 10 or more) to include in their models and determine their own aggregation technique depending on site specific conditions.
2	FWS	We understand that GRH is in the process of updating the habitat suitability index (HSI) curves for sea lamprey *(Petromyzon marinus)* to incorporate empirical data collected during Study 16. Once those curves have been revised, GRH will re-run the Area Weighted Suitability (AWS) steady-state and dual flow models and provide the results to stakeholders. FirstLight (FL) is also in the process of revising its sea lamprey HSI curves. In order to have the most robust data set upon which to develop HSI curves for lamprey, we are soliciting the raw data from both companies to derive one single set of curves that will be representative of spawning habitat in the mainstem Connecticut River. We would appreciate it if GRH would wait to conduct more model runs with its new curves until we have finalized curves based on the combined data set.	Great River Hydro has reviewed the Lamprey curves distributed in an excel file dated May 24, 2017 from FWS. Revisions of velocity and depth SI curves are acceptable to us and will be used for any further analysis.
3	FWS	For freshwater mussels, shear-related variables were also used in calculating CSI. We would appreciate GRH providing us with some example output from this analysis.	We will provide an example in the course of the upcoming Study 9 meetings.

Comment #	Source	Comment	Response
4	FWS	For the time series analysis, GRH generated habitat duration curves. As noted at the April 6, 2017, USR meeting, this way of portraying how habitat varies over time masks sub-daily effects of peaking operations on habitat. The analysis most informative to project effects is the Daily Habitat versus AWS shown in Figure 4.9-1. We recommend that GRH provide those figures (which may already have been generated, as they are a component of developing the habitat duration curves provided) for the following species/life stages: sea lamprey (spawning); American shad (spawning); tessellated darter *(Etheostoma olmstedi;* broken down by season, i.e., each figure would be for a 3-month time period); co-occurring mussels (broken down by season); and DWM (for Wilder riverine, by season, for the five transects located in close proximity to historical DWM sites). For each species/life stage, the appropriate time step, as indicated in Table 4.3-1, should be used. For example, for sea lamprey spawning, the output would be for the time period May 1 through July 15.	These can be provided. However for Lamprey spawning (based on the new curves) in the Vernon reach, the time series would also need to be run through the Vista operational model which will require additional time.
5	FWS	In its analysis, GRH weighted all critical reaches (CRs) equally. Our expectation was that each component (riffles, diverse habitats, and sea lamprey spawning) would be analyzed separately and we recommend this analysis be provided. In addition, it would be helpful to analyze the five transects located in close proximity to historical DWM sites (i.e., WR2-14, WR3-1, WR3-9, WR3-11 and WR3-13) separately as another CR component.	We have provided an example of output by transect and calculations for some groups of CR transects for the Vernon reach. Adding the DWM transects to the CR analysis would be completed when we provide the time series example for DWM requested in Comment #3.
6	FWS	GRH analyzed the effects of project operations on immobile life stages such as spawning and fry for target	The purpose of dual-flow analysis is to evaluate the potential for modified flows to positively impact habitat

Comment #	Source	Comment	Response
		fish species as well as macroinvertebrates (including freshwater mussels) via dual flow and persistent habitat methodologies. In the flow pairs analyzed by GRH, the highest base flow was substantially less than the peak flow out of that station. For example, the highest base flow assessed for the Wilder Project was 5,000 cfs, which is roughly half that station's hydraulic capacity. The problem with limiting the base flows in this manner is that for some species/life stages, AWS values continue to increase, as with American shad spawning below Vernon (AWS of 216 at 6,000 cfs, but increases to 264 at peak flow). This represents a roughly 20 percent increase in AWS over the highest base flows assessed. We recommend that GRH provide the output from supplemental analyses for base flows of 8,000 cfs, 10,000 cfs, and 12,000 cfs for the following species/life stages: co-occurring mussels (Wilder Reach 1); American shad (spawning; Vernon riverine reach) and sea lamprey (spawning; Wilder, Bellows Falls, and Vernon riverine reaches). Likewise, the dual flow tables in Appendices K, M, and N show the percent loss of persistent AWS, rather than the percent of maximum AWS that a given flow combination provides (which is how FL presented its dual flow results). The way GRH portrayed the dual flow results does not provide information on the relative habitat value of that flow combination, only the comparative loss in AWS within that particular flow pair. For example, for American shad spawning in the Bellows Falls riverine reach, there is a 0 percent loss of persistent AWS under a 1,300 cfs/2,500 cfs flow	availability for the species of interest, particularly at base flow levels, which would reflect a conservation or minimum flow level, and higher flows representing peaking or temporary flow levels. While AWS may increase beyond the evaluated flows for some species/life stages (primarily American Shad spawning), the baseline for project effects analysis is the current minimum flow, not maximum hydraulic capacity which in the case of these projects could not be sustained in the absence of matching, continuous inflow. A dual flow analysis is not meant to address maximum AWS but rather the change in persistent habitat between flow pairs. We already know that for American Shad spawning in the Bellows Falls reach, the AWS at 1,300 cfs is approximately 57% of the maximum AWS but that is not what we are comparing. The analysis is comparing what habitat persists between say 1,300 cfs and 6,350 cfs. There is no relationship between AWS at 6,350 cfs to maximum AWS because the starting point was AWS for 1,300 cfs.

Comment #	Source	Comment	Response
		combination, but that AWS actually only provides 56 percent of maximum AWS. This leads to a conclusion that there is relatively little loss in AWS for a base flow of 1,300 cfs paired with peaking flows from 2,500 cfs up to 6,350 cfs. However, none of those flow combinations provide more than 56 percent of maximum AWS; to maximize AWS, you would need a base/peak combination of 6,000 cfs/6,350 cfs. We recommend GRH provide revised dual flow tables showing the results in terms of percent of maximum AWS.	

Literature Cited in Study 9 Responses:

Armour, C.L., R.J. Fisher, and J.W. Terrell. 1984. Comparison of the use of the habitat evaluation procedures (HEP) and the instream flow incremental methodology (IFIM) in aquatic analyses. United States Fish and Wildlife Service FWS/OBS-84/11. 30pp.

Brown, S.K., K.R. Buja, S.H. Jury, M.E. Monaco, and A. Banner. 2000. Habitat suitability index models for eight fish and invertebrate species in Caso and Sheepscot Bays, Maine. North American Journal of Fisheries Management (20)2: 408-435.

Steffler, P., and J. Blackburn. 2002. River 2D, two-dimensional depth averaged model of river hydrodynamics and fish habitat, introduction to depth averaged modeling and user's manual. University of Alberta, September 30, 2002. 120pp.

Study 18 – American Eel Upstream Passage Assessment Report Supplement

Comment #	Source	Comment	Response
7	FWS	[The comment summarizes the results of the 2016 supplemental eel surveys and temporary ramp installation at Vernon]…GRH is proposing to repeat the upstream eel survey for a third year using the same eel ramp and operational settings as last year. We support this proposal, as it will allow for collecting additional data for nearly the entire upstream eel migration period (May through October), during periods when the anadromous fish ladder is operating, as well as after it has shut down.	The 2017 study is underway at this time and results will be reported after the surveys have concluded and all data has been analyzed.
8	FWS	As noted by GRH, as well as a number of stakeholders, there will likely need to be additional surveys conducted to definitively determine the best location(s) to site permanent upstream eel passage facilities at the Vernon Project (as well as the Bellows Falls and Wilder projects). For example, the best location for an eelway in the powerhouse area may depend on whether the fish ladder will operate from spring through fall or continue to close on July 15 as it does now.	Great River Hydro concedes that depending on the results of the 2017 Vernon evaluation, additional surveys at that project could be needed in the future. We disagree however, that additional surveys are necessary at Bellows Falls or Wilder at this time, given the lack of eels documented at those projects in 2015.

Study 19 – American Eel Downstream Passage Assessment

Comment #	Source	Comment	Response
9	FWS	We intend to provide comments on this report at a later date.	We refer FWS to our June 13, 2017 responses to other stakeholder comments on the Study 19 Final Report. Great River Hydro would appreciate FWS providing any and all comments on this study as soon as possible so that we can consider and evaluate those comments within the total context of all relicensing recommendations or proposed PM&E measures (some yet to be determined or proposed) in an alternative to the currently proposed and no-action alternatives in an amended FLA or during the course of FERC's post-filing environmental analysis, as appropriate.

Study 23 – Fish Impingement, Entrainment, and Survival Report Supplement

Comment #	Source	Comment	Response
10	FWS	The comment notes the limitations of using radio telemetry (and motion sensing tags for adult shad in Study 21) to assess downstream passage survival that were described in the Study 23 Report Supplement relative to Studies 19 (American Eel), 21 (adult shad), and 22 (juvenile shad). The comment further notes that that motion sensing tags are not being used for the 2017 Study 21 supplemental assessment of downstream passage although they had been used in the 2015 study; and as a result, downstream passage survival estimates for adult shad will need to rely on the Franke et al. (1997) equation.	We note that the Franke equation is applicable to turbine passage routes only. The 2017 Study 21 downstream passage assessment is intended to provide additional data to supplement that collected in 2015 on route selection and post-passage tag detections via radio telemetry (see Section 5.4.3 of the Study 21 final report). Motion-sensing tags were not specified for 2017 precisely because of their inherent limitations and the potential for misinterpretation of results as estimates of "survival", particularly project-related "survival".
11	FWS	With regard to American Eel downstream passage (Study 19), FWS calculated survival at Vernon based on the number of eels detected at FirstLight's receivers, data which was unavailable at the time of filing of the	We note that the Study 23 Report Supplement provides a wide range of eel survival estimates using Study 19 turbine survival and radio telemetry results, along with Franke equation estimate ranges, which resulted in a calculated

Comment #	Source	Comment	Response
		Study 19 Final Report and Study 23 Report Supplement. Based on that data, FWS calculates a "through-project survival estimate" at Vernon of 48 percent and that the "actual" estimate likely lies somewhere between 48 percent and 86 percent.	range of 39.9 percent to 88.7 percent for the Vernon project as a whole, a similar but slightly broader range than that calculated by FWS using FirstLight detections. Again, it is important to avoid making the assumptions that non-detections indicate mortality, and that all non-detections are project related.

Study 24 – Co-Occurring Mussel Habitat Suitability Criteria

Comment #	Source	Comment	Response
12	FWS	Although we have no objection conceptually to the methods and analysis used by GRH to develop HSC for Eastern elliptio, its use as a surrogate for DWM is not supported by habitat data used by the two species. Eastern elliptios are quite common in lakes and rivers throughout New England and are found in a variety of habitats. DWMs are not known to inhabit lakes and ponds; therefore, at least one of the core habitat parameters (water velocity) differs between the two species. Also, developing HSC for a species such as Eastern elliptio that is known to inhabit lacustrine areas by using only data collected at a lotic site suggests that the HSC may not portray habitat suitability for the species throughout all environments where it is known to occur. Therefore, while the HSC might be a robust representation of habitat suitability at the Chase Island site, its transferability/applicability to other areas of the Connecticut River (e.g., impoundments, backwater sites, lakes, ponds, pools or deep runs) is likely limited.	The intent of using Eastern elliptio was not to serve as a surrogate to DWM, but rather to represent the habitat requirements of co-occurring mussels in general. The goal of Study 24 related to co-occurring species was to "assess the influence of flow regime (which includes water-level fluctuations) on DWM, co-occurring mussel species, and mussel habitat." HSC for DWM were developed independently using the Delphi process, as described in that report (filed May 16, 2016). The co-occurring HSC were intended to represent a different (and locally common) mussel species, other than DWM. The Co-occurring HSC report makes clear that Eastern elliptio was selected based on its abundance within the project area as documented in Study 24 Phase 1 surveys. It was not the intent of the instream flow study and associated development of HSC to either represent or assess habitat suitability for mussels in the impoundments, thus the emphasis on the riverine reaches. The Chase Island 2D site was selected based on the availability of a large dataset of mussel counts and due to the ability to simulate habitat parameters at various flows in Study 9 –

Comment #	Source	Comment	Response
			Instream Flow (which is limited to riverine reaches and does not include impoundments or backwaters). The Chase Island 2D site was the only location that had both quantitative counts of mussels as well as a detailed flow:habitat model that could be used to estimate historical habitat parameters at specific quadrat locations. Although the Chase Island study site was riverine, it did possess a wide diversity of habitats including deep, slow pool habitat (up to 20 ft at 5,000 cfs) around the bridge abutments and also at the bottom of the island.

Study 25 – Dragonfly and Damselfly Inventory and Assessment

Comment #	Source	Comment	Response
13	FWS	A 30-minute time interval represents the shortest time recommended by Wagner et al. (1995) and the average eclosure time based on the observation of the eclosion process for eight individual *Stylurus spiniceps.* Because S. *spiniceps* is a listed species, and only one of eight focal species in this study, we recommend basing the analysis on a more conservative time period (in this case, the longest time it took to finish the eclosure process [45 minutes]). We note that in FL's odonate study, the project effects analysis was based on the time it took a larva to depart from the water to flight (rather than just to completion of eclosion). We support using this wider time interval as it would be more protective of those adults that, although deemed to be mobile by GRH's consultant, may not be able to respond to rising water levels fast enough to avoid inundation.	As noted in our response to VANR and CRC comments filed June 13, 2017, because many tenerals were observed climbing almost immediately after eclosing, we believe 30 minutes is a reasonable timeframe to analyze, but we performed the 1-hour analysis as requested [by VANR] and will present those results in the forthcoming report supplement.
14	FWS	Given that only eight S. *spiniceps* individuals were	Project effects analysis was not limited to *Stylurus spiniceps*

Comment #	Source	Comment	Response
		tracked during the investigation, the data set that the project effects analysis was based upon appears limited. Our concern is that the water level logger data collected during those eclosure periods may not be representative of typical conditions. We would appreciate GRH providing any information that verifies the data set is representative.	as the comment suggests, but we used that species as a proxy for project effects since other species are not as susceptible to water level rises (with the exception of *Stylurus amnicola*, as that species was found 3 inches lower in average vertical distance from the water surface compared with *Stylurus spiniceps*. Data on *Gomphus quadricolor* and *Ophiogomphus rupinsulens* are insufficient to draw conclusions about the relative likelihood of project effects from rapidly rising water on direct mortality to these species (p. 33 of the final study report). Analysis of the water level logger data during the critical period of eclosion was not limited to the observed eclosion periods of *Stylurus spiniceps*, but included all daylight hours during the study period and is therefore, necessarily representative of the 2015 study period (see Figure 5.1 in the final study report).
15	FWS	The study does not currently report differences between odonate species and their preferred habitat. For example, the study does not provide details regarding those species that prefer the lotic habitat of the riverine section of the River versus those species that are generalist or prefer the semi-lotic habitat of impounded reaches. Project operations affect the impoundment sections of the River differently than the riverine sections. Differentiating between odonate species and their preferred habitat would allow the resource agencies to determine whether project operations have a disproportional effect on odonates using riverine sections versus the impounded reaches.	As noted in our response to VANR comments filed June 13, 2017 the final study report (filed December 15, 2016) distinguishes between lotic and semi-lotic species in both the literature and in the study area. The forthcoming study report supplement will include more description of the locations where lotic and semi-lotic species were found, and will summarize our findings relative to these species to make the information more clear.