Great River Hydro

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July 12, 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 – Study 25 – Dragonfly and Damselfly Inventory and Assessment, Supplement to Final Study Report

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). On July 6, 2017 Great River Hydro submitted additional responses to comments on those study report filed by US Fish and Wildlife Service (FWS) on June 9, 2017 (dated June 8, 2017).

With this filing, Great River Hydro is submitting a Study Report Supplement for Study 25 - Dragonfly and Damselfly Inventory and Assessment based on stakeholder comments received on that study's Final Report.

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: Study 25 – Dragonfly and Damselfly Inventory and Assessment Supplement to Final Study Report

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

GREAT RIVER HYDRO, LLC

ILP Study 25
Dragonfly and Damselfly Inventory and Assessment

Supplement to Final Study Report

In support of Federal Energy Regulatory Commission Relicensing of:

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

Prepared for

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July 12, 2017

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This supplement to the Study 25 – Dragonfly and Damselfly Inventory and Assessment Final Study Report that was filed December 1, 2016 provides additional information as requested in comments on the Final Study Report received from Vermont Agency of Natural Resources (VANR) and the Connecticut River Conservancy (CRC). Great River Hydro's responses to those comments were filed on June 13, 2017. On June 8, 2017, FWS filed comments on study reports and responses were filed on July 6, 2017.

Note:

A recent study (Ware et al., 2016) examined phylogenetic relationships among the odonate family Gomphidae and proposed nomenclatural changes for several species that were discussed in the Final Study Report. These taxonomic changes have since been incorporated into the The Odonata of North America (Paulson, 2017). For consistency with the Final Study Report, this document will retain the prior names, but changes are noted in Table 1.

Table 1. Taxonomic changes since the publication of the Final Study Report (Prior Scientific Name) to those proposed in Ware et al (2016) and adopted by Paulson (2017).

Common Name	Prior Scientific Name	Scientific Name
Spine-crowned Clubtail	*Gomphus abbreviatus*	*Hylogomphus abbreviatus*
Lancet Clubtail	*Gomphus exilis*	*Phanogomphus exilis*
Rapids Clubtail	*Gomphus quadricolor*	*Phanogomphus quadricolor*
Cobra Clubtail	*Gomphus vastus*	*Gomphurus vastus*
Skillet Clubtail	*Gomphus ventricosus*	*Gomphurus ventricosus*

Comment #56 (VANR):

The report appears to not differentiate between odonate species and their habitat preference. That is neither the report nor the analysis distinguish between species that prefer lotic habitat of the riverine section versus those species that are generalist or select the semi-lotic habitat of the impounded reaches. The importance of making this distinction is that project operations affect the impoundment sections of the river differently than the riverine sections. In general, riverine sites had lower abundance of odonates than the impounded sites. The completion of this type of analysis would allow the resource agencies to determine whether project operations are having a disproportional effect on odonate using riverine sections versus the impounded reaches. The Agency acknowledges that given the limited observations of eclosion of different species that this is difficult. However, without this distinction and analysis we cannot conclude that project operations are not having a significant effect on odonates species, especially in the riverine reaches of the project-affected area.

It should be noted that *Gomphus quadricolor* and *Stylurus amnicola* larvae have also been reported to be associated with gravel substrate which may be more abundant in the riverine sections of the river (Dunkle, 2000). Additionally, it should be noted that some species of odonates prefer the lotic habitat of the riverine section, such as *Ophiogomphus rupinsulensis* while other species will be more apt to use the semi-lentic habitat of the impounded reaches.

In Section 4.2 Site Selection of the report, *Gomphus abbreviatus* is identified with being associated with gravel substrate which is more abundant downstream of the projects in the riverine sections of the Connecticut River. While the survey only found this species in the impounded reaches of river were the substrate is likely to be more silt is different from what is reported as larvae habitat. Although the report suggest that *G. abbreviatus* may be more likely to occur in the impoundment areas then the riverine, this could also suggest that the species is using suboptimal habitat and that populations of this species are being effected in the riverine sections.

A similar comment (Comment #15) was made by FWS in their June 8, 2017 comment letter.

Response:

The Final Study Report distinguished between lotic and semi-lotic species in both the literature and in the study area. Based on additional comments, the study report supplement will include more description of the locations where lotic and semi-lotic species were found, and summarize our findings relative to these species to make the information more clear.

Supplementary Discussion:

All potential effects occur in the riverine sections of the project area. Odonate species were found in the impounded sections in addition to riverine sections. The only species which were found exclusively in the riverine sections were *Ophiogomphus rupinsulensis* and *Stylogomphus albistylus*. As noted in the VANR comment, the literature supports the strong association of *Ophiogomphus rupinsulensis* with lotic habitats. *Stylogomphus albistylus* is reported in the literature as being associated with smaller water bodies (Paulson, 2011; Nikula et al., 2007), which typically exhibit higher flow velocities. Although no comparison to other species was made in the Final Study Report, exuviae of *Ophiogomphus rupinsulensis* were found at similar heights to *Gomphus vastus* where exuviae co-occurred, strongly suggesting these species eclose at similar heights.

Although Dunkle (2000) suggests gravel substrate associations for *Stylurus amnicola*, subsequent works have not identified these associations. McLain et al. (2004) states that in lab experiments, *Stylurus amnicola* avoided gravel substrates. Nikula et al. (2007) described the species' preferred habitat as having a "sand, gravel, or mud bottom" and Paulson (2011) reports a preference for "medium to large slow-flowing to rapid rivers with varied bottom types."

The hypothesis that *Gomphus abbreviatus* may be negatively affected in the riverine sections and is using suboptimal habitat as a result is not supported by the collected data. Study 25 found this species to be more common at the lower impoundment sites than the upper impoundment sites. The upper impoundments have more lotic characteristics and WSE fluctuations are less affected by project operations than in the lower portions of the impoundments. Additionally, the majority (8 of 10 observations) of exuviae were located high on the bank (20 or more inches from the water surface), suggesting that the species ecloses at heights that would not be affected by water level rises in riverine sections of the project area. Because of this observation, there is no reason to suspect that the species would be affected by water level rises in riverine reaches associated with normal project operations.

Although *Gomphus quadricolor* is often identified as occurring in rapidly flowing rivers (Dunkle, 2000; Nikula et al., 2007; Paulson, 2011), the species is generally uncommon and poorly studied, and a review of known sites suggests that this species may show some preference for semi-lotic habitat. Hunt et al. (2010) identified the species only upstream of Vernon dam. In Study 25, only one individual of this species was found at one site in the upper half of the Wilder impoundment (Site 25-02). The species has also been documented immediately upstream of the Amoskeag dam on the Merrimack River during the New Hampshire Dragonfly Survey (Pam Hunt, personal communication, dated June 13, 2017). Additionally, the nymph stage of this species was initially described from a semi-lotic habitat in Ontario (Walker, 1932). Although the species may be more likely to occur in lotic habitat, these observations shed doubt on that assertion.

Comment #57 (VANR):

The assumptions used as part of the usable habitat elevations and the approach to the analysis evaluating water level rise potentially results in an underestimate of projects effects. While the report identifies two potential effects of project operations, the first being inundation of usable habitat, define[d] as steep bank, the report also indicates that no consistent trend was found in substrate or habitat preference based on observed odonates or abundance. Acknowledging that there may be differences in species habitat / substrate preference for emergence it would be more informative to provide information on the proportion of habitat types available below the low habitat elevation being used identified in the report, especially for the riverine habitat where there is between 1.5 – 4 feet of substrate that was documented being used by odonates.

Response:

We observed few eclosing odonates in the areas below the toe of slope, and sediments were uniformly fine. We will revisit the data and if possible, describe the

conditions and frequency of use, and assess the potential habitat impacts of project operations, if relevant in those areas, in the report supplement.

Supplementary Discussion:

Data on the below-bank habitat are presented in Appendix E of the Final Study Report. At most sites, available habitat in this area was fine sediment; however, two sites, each in the lower impoundment of their respective project (Wilder [Site 25-03] and Bellows Falls [Site 25-07]) contained significant amounts of coarse woody debris. The remaining two sites in the Bellows Falls Project (Site 25-06 in the impoundment and Site 25-08 in the riverine reach) each contained two transects with significant cobble in the below-bank habitat.

At low water levels, odonates were more likely to be found at transects with fine substrates at Sites 25-06 and 25-08 (82% of observations) than those with cobble substrates at the same sites (18% of observations). Interestingly, *Stylurus amnicola* was not found at any transects with cobble habitat, despite more than half of the observations of this species occurring at Site 25-06. This is consistent with the note in VANR Comment #56 that the species showed a preference for finer substrates.

The habitat below the toe of the bank slope averages approximately 50% shallower compared to the lower river bank (30% grade below the bank versus 62% grade on the bank). Although odonates may travel a greater horizontal distance at low water levels, Study 25 found horizontal distance to be a poor predictor of vertical distance (see section 6.3 of the Final Study Report).

Comment #58 (VANR):

Additionally, as discussed in the Agency's comments below, the analysis of water level rise of 8-inches over a 30 minute period as a result of project operations is an underestimation of the project effects. During the surveys the full eclosion process was observed a limited amount of time and for those observed it ranged from 20 – 45 minutes with a mean of 31 minutes. This time step does not include the time for the teneral to harden and take flight. The Agency believes that this analysis should at least evaluate water level rise from project operations over a 45-minute period. However, the Agency recommends that a conservative approach be taken for this analysis and evaluate the water level rise over the course of one-hour.

A similar comment (Comment #13) was made by FWS in their June 8, 2017 comment letter.

Response:

Because many tenerals were observed climbing almost immediately after eclosing, we believe 30 minutes is a reasonable timeframe to analyze, but will perform the 1 hour analysis as requested.

Supplementary Discussion:

Water surface elevation data were reviewed to determine the frequency at which water levels rise by 8 inches over a 1-hour period during the critical eclosion period (04:00 to 21:00). All water level rises were assumed to be project related although some are likely to be the result of other events (e.g., precipitation). Although the 1-hour analysis results in an increase in frequency of potential mortality events, the threat to eclosing odonate larvae is still very low, and mortality is unlikely to have a significant effect on odonate populations. The sites with the greatest water level fluctuations (riverine Sites 25-04 and 25-08) experienced water level rises of 8 inches within one hour approximately 7% of the time versus less than 2% in the 30-minute analysis. Making the extremely conservative assumption that all larvae eclose at the lowest observed height, this would result in 7% mortality at these sites due to rising water levels. More than 50% of the sites had no water level rises of 8 inches within one hour, and the remaining three sites ranged from 0.27% to 4.57% frequency.

Critical Time Period	Frequency of 8-inch rise over 1 hour (% of time during critical eclosion period)										
	25-01	25-02	25-03	25-04	25-05	25-06	25-07	25-08	25-09	25-10	25-11
1 hour	0	0	0.27	7.28	4.57	0	0	6.83	0	0	2.84
30 minutes	0	0	0.03	1.38	0.17	0	0	1.94	0	0	0.37

Related FWS comment (Comment #14):

Given that only 8 *Stylurus spiniceps* were tracked, the data set that project effects analysis was based on appears limited. Our concern is that 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 that the data set is representative.

Response and Supplementary Discussion:

Project effects analysis was not limited to *Stylurus spiniceps* 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*, which was found 3 inches lower in average vertical distance from the water surface compared with *Stylurus spiniceps* (although *Stylurus amnicola* accounted for only 5% of all species, and 12.5% of focal species observations). Data on *Gomphus quadricolor* (one observation) and *Ophiogomphus rupinsulens* (10 observations) were insufficient to draw conclusions about the relative likelihood of project effects

from rapidly rising water on direct mortality to those 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). This is consistent with other studies and with the literature (i.e., Corbet, 1999). Water level loggers recorded data over fifteen minute intervals. For each fifteen minute reading, the maximum positive change in water level was calculated for the prior critical time period (30 minutes in the report, 1 hour in the subsequent analysis herein). Inundation frequencies were calculated by dividing the total number of changes that exceeded the critical elevation determined during the study (8 inches) by the total number of time periods.

Comment #59 (VANR):

The analysis of vertical distance from the water surface at which an exuvia was found was assumed to be the vertical distance from the water surface at which the individual eclosed, likely results in an overestimate of the distance traveled by an individual. The Agency suggests a method to potential way to limit the overestimation of the distance travel is for each sampling period at each site the mean, maximum, and minimum water level be presented for a one week period prior to the survey.

Response:

The relationship between elevations estimated from exuvia and those measured from eclosing animals is discussed in Section 5.3 (page 20) of the Final Study Report. We consider this approach and resulting data to be more accurate than the weekly water level data requested in the comment.

Supplemental Discussion:

Although weekly statistics are calculable based on collected data, they do not provide a reliable correction of the effects of water level fluctuations on observed exuviae heights. Use of these statistics requires the assumption that odonates eclose uniformly and that water levels vary uniformly during the week prior to the survey. Since water levels are affected by project operations as well as by inflows and precipitation, neither of these assumptions is reasonable, and violation of these assumptions could result in a greater overestimation of eclosion heights.

Stylurus spiniceps was used as an analog for other species (Section 5.3 in the Final Study Report). Although other species almost certainly eclose at different heights compared with *Stylurus spiniceps*, field observations and literature suggest that this approach is conservative, as members of the genus *Stylurus* typically eclose at

lower heights than other species. Based on observed exuvia heights the other members of the genus *Stylurus* (*Stylurus scudderi* and *Stylurus amnicola*) may eclose at slightly lower heights (exuviae were found at a range of 0-40 inches) and that most other species observed eclosed higher on the banks (exuviae were found at a range of 0-200 inches, see Figure 5.1 in the Final Study Report).

Comment #60 (CRC):

The study uses 30 minutes for assessing project impacts on dragonfly eclosure, based on a literature review. Using an eclosure period of 30 minutes seems to be too short a time span. The FirstLight dragonfly study used a critical duration of 2 hours in their risk assessment. CRC recommends Great River Hydro consider using a longer eclosure period to be consistent with the FirstLight report.

The study used logger data to assess impacts from water elevation increases during the 30-minute eclosure period. The logger data were collected every 15 minutes and the hydraulic model data is hourly. Showing an accurate river elevation rate of change for 30 minutes would be difficult with the available data. Again, CRC recommends that Great River Hydro use a longer eclosure period, such as 1-2 hours.

Response:

See response to VANR Comment #58.

Comment #61 (CRC):

It seems that to assess project effects, the study should look at the height of water surface elevation (WSE) change over the critical time period (30 minutes in this study, but CRC would prefer 1-2 hours, as FirstLight did) and compare that with the typical distance above water that eclosure takes place. Despite the habitat elevations and hourly WSE's in figures in the report, we could not find information that would help us understand the amount of change in a 30-min, 1-hour, or 2-hour period. For example, on page 20 it states that, "The mean vertical distance from the water surface at which eclosing *Stylurus spiniceps* were observed was 12 inches (range of 8-16 inches)." What is the likelihood in the study areas that the water level would rise by 12 inches in the span of 30 minutes, 1 hour, or 2 hours?

Response:

See response to VANR Comment #58. Evaluating an 8-inch water level rise as was done in the Final Study Report is a more conservative approach than evaluating a 12-inch rise. The 30-minute time period is reasonable and based on study observations, but as noted in response to Comment #58 (related VANR comment),

the supplemental analysis also used a 1-hour time period. As explained above, there is no basis for looking at water level rise over longer timeframes such as 2 hours.

Supplemental Discussion:

Additional analysis was conducted with a critical time period of one hour. Although FirstLight used a critical duration of two hours, this included the time between eclosion and first flight which was based on a different study plan and methodology than Study 25. During Study 25, eclosing odonates left their eclosion site prior to their first flight, generally travelling upward along the bank. Additionally, individuals may not fly at the first possible moment, thus the transition from flightless teneral to flying adult is not determinable (Corbet, 1999). Although the FirstLight study considered a time period of two hours, the 95th percentile during the study for start-flight was only one hour and sixteen minutes. As such, the two-hour time period is not representative even under the broader critical time period suggested.

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