APPLICATION FOR WATER QUALITY CERTIFICATION

Water Division
Water Quality Certification Program

RSA: 485-A:12

Date of Request 19 April 2024
Date Request Received by NHDES _____

I. Applicant Information

Principal Place of Business of the Applicant Great River Hydro, LLC	
Mailing Address [Street, PO Box, RR, etc.] 69 Milk Street, Suite 306	
City/Town and Zip Code Westborough, MA 01581	
Telephone No. 603-498-2851	Email Address jragonese@greatriverhydro.com
Name and Title of Signatory Official Responsible for the Activity for which Certification is Sought (e.g., President, Administrator) John L. Ragonese, FERC License Manager	

II. Project Information

Name of Project Bellows Falls Hydroelectric Project, FERC No. 1855
Name of Town and County that contains the Project Rockingham, Windham County, Vermont, and Walpole, Cheshire County, New Hampshire
Name of Receiving Waterbody and Drainage Basin Connecticut River, Connecticut River Drainage Basin
Summary of Activity (e.g., construction, operation, or other practice or action) The Applicant has filed with the Federal Energy Regulatory Commission Amended Applications for New License for Major Project - Existing Dam for the existing Bellows Falls Hydroelectric Project. Additional information is provided in the attached narrative.

III. Additional Submittal Information

PLEASE SUBMIT AS MUCH INFORMATION AS POSSIBLE IN ELECTRONIC FORMAT

phone (603) 271-2457
fax (603) 271-7894
PO Box 95, Concord, NH 03302-0095
www.des.nh.gov

Please provide an individual response to each bullet, below. If applicable information is contained in the application materials, please provide a reference to the specific section in the application materials that will represent the response to the individual bullets below.

- Type of activity (e.g., construction, operation, other action such as water withdrawal) and the start and end dates of the activity.
- The characteristics of the activity: Whether the activity is associated with a discharge and/or water withdrawal and whether the discharge and/or withdrawal is proposed or occurring.
- The characteristics of the discharge and/or withdrawal
    - Flow rate (cfs)
    - Potential chemical, physical, biological constituents
    - Frequency (e.g., daily, hourly,)
    - Duration
    - Temperature (Celsius)
    - Latitude and longitude (dd:mm:ss)

- The existing and designated use(s) that are potentially affected by the proposed activities. (Designated Uses are listed in the NHDES Consolidated Assessment and Listing Methodology).
- The provision(s) of surface water quality standards (Env-Wq 1700) that are applicable to the designated uses affected by the proposed activities.
- A pollutant loading analysis to show the difference between predevelopment and post-development pollutant loads for a typical year. The objective of the loading analysis is to show post-development pollutant loads do not exceed pre-development pollutant loads. Loading analysis guidance and a simple spreadsheet model will be provided by NHDES. The loading analysis will be used to determine appropriate stormwater management measures, which must be effectively designed, installed, and maintained to ensure compliance with surface water quality standards.
- A description of any other aspect of associated with construction and operation of the activity that would affect the chemical composition, temperature, flow, or physical aquatic habitat of the surface water.
- An original or color copy/reproduction of a United States Geological Survey Quadrangle Map that clearly shows the location of the activity and all potential discharge points.
- A copy of the final complete federal permit application or federal license application, including the federal permit, license, or project number.
- A copy of the NHDES wetlands permit (RSA 482-A:3), if necessary.
- A copy of the NHDES alteration of terrain permit (RSA 485-A:17), if necessary.
- The name(s) and address(es) of adjoining riparian or littoral abutters.
- A plan showing the proposed activities to scale including:
    - The location(s) and boundaries of the activities;
    - The location(s), dimension(s), and type(s) of any existing and/or proposed structures; and
    - The location(s), name(s), identification number(s), and extent of all potentially affected surface water bodies, including wetlands.
- For projects that involve a new surface water withdrawal, provide the following:

- a copy of the water conservation plan (WCP) submitted to the NHDES Water Conservation Program and the status of NHDES approval, or
- a copy of a waiver approved by the NHDES Water Conservation Program that waives the requirement to submit a WCP prior to or in conjunction with the application for water quality certification.

[Pursuant to Env-Wq 2101, and unless a waiver is applied for and granted by NHDES, all applicants for water quality certification are required to submit a water conservation plan (WCP) for projects that involve a new withdrawal from a surface water prior to or in conjunction with this application. Contact the NHDES Water Conservation Program for guidance related to drafting a WCP and the review and approval process. Information regarding the WCP, including contact information, may be found at NHDES' Water Conservation website.

- If the project is located within ¼ (one quarter) mile of a designated river, as defined under RSA 483 (the Rivers Management and Protection Act), provide documentation showing that the Local River Management Advisory Committee (LAC) has been provided with a copy of this complete application. A list and map of the designated rivers, as well as contact information, may be found at NHDES' Designated Rivers website.

Signature – MUST BE SIGNED AND DATED BY APPLICANT

To the best of my knowledge, the data and information described above, which I have submitted to the New Hampshire Department of Environmental Services, is true and correct. I understand that an approval of the requested water quality certification based upon incorrect data may be subject to revocation of the certification. I have complied with all local regulations or ordinances relative to the proposed activity and have obtained or will obtain, prior to the commencement of any work, all other approvals that may be required.

Signed: John Ragonese

Date: April 19, 2024

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III Additional Submittal Information

1.0 Type of activity (e.g., construction, operation, other action such as water withdrawal) and the start and end dates of the activity.

The proposed activity consists of continued operation of the existing Bellows Falls Hydroelectric Project (Project) in accordance with the revised, amended Final License Application (Bellows Falls FLA) Initial Statement and Exhibits A, B, C and D submitted to Federal Energy Regulatory Commission (FERC or the Commission) filed on June 7, 2023[1], along with the revised composite Exhibit E for Wilder, Bellows Falls and Vernon Projects (Exhibit E)[2]. Bellows Falls FLA Exhibits F, G and H were previously filed on December 7, 2020[3]. Great River Hydro's (GRH) proposal, as outlined in the Bellows Falls FLA Exhibit B (Exhibit B) reflects the proposed operation in accordance with a Memorandum of Understanding (MOU) executed on December 1, 2020[4] between Great River Hydro, the Project certifying authorities (including NHDES), and other participating stakeholders. The MOU includes an Exhibit A "Great River Hydro's Proposed Alternative Operation for the Projects" that is the basis of the proposed Project operation in the Bellows Falls FLA. The Bellows Falls FLA also included a proposed set of fish passage environmental measures that have since been incorporated into a Settlement Agreement on Fish Passage (SAFP) executed by New Hampshire Fish and Game Department among other state and federal agencies and filed with the Commission on August 2, 2022[5] . This Water Quality Certificate application presents information collected and presented in the Exhibit E and assumes future operations consistent with the Bellows Falls FLA, MOU and SAFP. Exhibit E provides a full description of the proposed Project activity and is summarized below. Additional supporting information is provided in the ILP Water Quality Study

[1] Accession No. 20230608-5102 Great River Hydro, LLC submits Revised Final License Application and Exhibits for the Bellows Falls Hydroelectric Project et. al. under P-1855 et. al. Includes Exhibit A, B, C and D for Bellows Falls Project revised 06-07-2023.

[2] Accession No. 20230608-5103 Great River Hydro, LLC submits Revised Final License Application and Exhibits for the Bellows Falls Hydroelectric Project et. al. under P-1855 et. al. Includes composite Exhibit E for Wilder, Bellows Falls and Vernon Projects revised 06-07-2023.

[3] Accession Nos. 20201207-5219 (Public), - 5220 (Privileged);-5221 (CEII); Amended Final License Applications of Great River Hydro, LLC for Bellows Falls Project, et. al. under P-1855 et. al. Includes Exhibit F, G, and H for Bellows Falls Project

[4] Memorandum of Understanding between Great River Hydro and the United States Fish and Wildlife Service, the New Hampshire Department of Environmental Services, the New Hampshire Fish and Game Department, the Vermont Department of Environmental Conservation, the Vermont Department of Fish and Wildlife, The Nature Conservancy, and the Connecticut River Conservancy; filed with Bellows Falls Project FLA Exhibit B of Amended Final License Applications of Great River Hydro, LLC for Bellows Falls Project, et. al. under P-1855 et. al. Accession Nos. 20201207-5219 (Public),

[5] Accession No. 20220803-5124 Great River Hydro, LLC submits Offer of Settlement between Great River Hydro, LLC and the U.S. Department of Interior et. al, and Revisions to Exhibit D Documents for the Bellows Falls Hydroelectric Project et, al. under P-1855, et. al.

6 Updated Study Report dated 12-15-2016[6] and ILP Fish Assemblage Study 10 Report dated 08-01-2016[7].

Project Description

The Bellows Falls Project dam and powerhouse are located on the Connecticut River at river mile (RM) 173.7, approximately 1 mile upstream of the Saxtons River confluence and 3 miles downstream of the Williams River at the upper end of a sharp bend of the Connecticut River at Bellows Falls, Vermont, in the town of Rockingham, Vermont, and in the town of Walpole, New Hampshire. The Project consists of a concrete gravity dam, spillway, and bypassed reach; an approximately 26-mile-long impoundment; a power canal and powerhouse; a substation, line garage, and storage buildings located near the powerhouse; fish passage facilities; and appurtenant facilities.

The dam is a concrete gravity structure extending across the Connecticut River from Rockingham, Vermont, to Walpole, New Hampshire. Virtually all of the dam structure is located in New Hampshire. It is 643 ft long with a maximum height of about 30 ft and is divided by concrete piers into 5 bays. Two bays contain steel roller-type flood gates, and the 3 other bays contain stanchion flashboards. A steel bridge runs the length of the dam for access and for operation of flashboards. A 25-ton gantry crane sits atop the bridge. A proposed new intake structure to house a 680 kW minimum flow unit would be added to the downstream face of stanchion flashboard bay 1, which is adjacent to the abutment at the Vermont end of the dam. The new concrete intake structure will also include three new spill conveyance structures, increasing the spill capacity of the existing dam by 465 cfs in addition to generation flow through the minimum flow unit itself.

The Project impoundment extends upstream about 26 miles to Chase Island at Windsor, Vermont, about 1 mile below the Windsor Bridge. The Project has limited storage capacity because of the relatively flat terrain from the upper extent of the Project impoundment to the dam. The impoundment has a surface area of 2,804 acres and about 74 miles of shoreline and a total volume of 26,900 acre-feet (acre-ft) at elevation (El.) 291.63 ft (NGVD29) at the top of the stanchion boards. The usable storage amounts to about 7,476 acre-ft in 3 ft of drawdown to El. 288.63 ft; however, the impoundment operating range depends on the proposed modes of operation: Inflow Equals Outflow (IEO); Flexible Operation, including Transitional Operation; Emergency and System Operation modes; and High Water Operations. The proposed operation is described below and detailed in the Bellows Falls FLA Exhibit B "Project Operations and Resource Utilization" and the MOU.

A power canal connects the impoundment to the powerhouse. The canal is lined with stone stabilized by a grid of concrete grade beams and walls. The downstream end of the canal is a concrete wall forebay. The canal is 100 ft wide at the upstream end, about 36 ft wide at the downstream end, about 29 ft deep, and approximately 1,700 ft long, including the length of the powerhouse forebay. The canal creates a natural bypassed reach between the dam and the outlet of the powerhouse tailrace. The bypassed reach is about 3,500 ft (0.7 mile) long and currently receives between 125-300 cfs from leakage at the dam through the roller gates seals and stanchion flashboards and, when conditions dictate, much higher flows through intentional spill through roller gates and stanchion bays. As described in the Bellows Falls

[6] Accession No. 20161215-5280 ILP Study Reports 6, 25 and 30, final reports and supplements, TransCanada Hydro Northeast Inc. under P-1892, et al filed December 15, 2016
[7] Accession No. 20160801-5232 TransCanada Hydro Northeast Inc. August 1, 2016 Updated Study Report under P-1855, et. al.

FLA, a guaranteed year-round bypass flow of at least 300 cfs will be maintained primarily through discharge from a new 680 kW minimum flow unit at the dam.

The powerhouse contains three vertical Francis turbine generating units each with a maximum hydraulic capacity of 3,670 cfs and minimum hydraulic capacity of 700 cfs. Nameplate capacity for each unit is 17,000 kilovolt-amperes (kVA) at 0.8 power factor, or 13,600 kilowatts (kW).

Proposed new power generation facilities include a new 680kW minimum flow turbine generator, an affiliated control house and electrical interconnect equipment to local distribution utility in Vermont. The minimum flow unit will recover a portion of the lost energy resulting from the 300 cfs provided below the dam into the bypassed reach under the Proposed Project Operation described below.

The turbine generator will be housed in a concrete intake structure connected to the downstream face of the spillway Stanchion Bay #1. The concrete intake structure will be approximately 33 ft wide by 33 ft long and open to the headpond creating a small forebay for the minimum flow unit. The forebay floor that will be level with the concrete crest of the dam at elevation 278.6 msl; with one half concrete and the other half a floor screen serving as a horizontal trash rack above the vertically aligned turbine generator. The trash rack will measure approximately 14.4 ft wide by 30.9 ft long with 2-inch clear spacing between bars. The average velocity through the entire rack is calculated to be 0.97 feet per second (fps). The average velocity through the rack in an area measuring 11.3 ft wide by 20.4 ft long, concentrated around the unit itself is approximately 1.88 fps. The average velocity of the flow through the modified portion of the Stanchion Bay #1,which conveys water to the forebay is calculated to be less than 0.71 fps. The above calculations are based on a turbine flow of 300 cfs.

The design of the concrete intake structure will include three new spill conveyance structures, comprised of a 25 ft wide vertical crest gate, a 14 ft wide downward opening, bottom-hinge crest gate and 14 ft wide bay of removable stoplogs with a combined capacity of 5,476 cfs, increasing the existing spill capacity of the dam by 465 cfs in addition to generation flow through the minimum flow unit itself. See Bellows Falls FLA Exhibit A for views of the intake structure, new gates, control room and the unit location.

The new turbine will utilize adjustable-pitch wicket gates to allow ramping of output power for smooth grid interconnection. An existing auxiliary steel bulkhead used to repair and maintain stanchion sections of the dam will continue to function as a means of blocking flow to the intake structure and turbine for construction inspection, service, or repair.

The turbine will utilize an elbow draft tube (horizontal outlet) with steel liner supplied by Natel, rather than a straight (vertical) conical draft tube. The elbow draft tube better integrates to the existing conditions.

At full load, with inflow equaling a maximum station plus minimum flow turbine discharge of at least 11,740 cfs, the Project has the capability of producing 49.680 megawatts (MW) and an average annual generation of approximately 250,000 MWh.

The Project also includes an upstream fish passage ladder and downstream fish passage through a sluiceway located along the east side of the powerhouse, and recreation facilities including three boat launches, a portage, picnic areas, and a visitor center with a fish ladder viewing window. Plans and schedules for additional upstream and downstream passage enhancements are detailed in the SAFP.

Proposed Operations

Great River Hydro, with support from relevant state and federal resource agencies, and regional and national non-governmental organizations that have actively participated in scoping and study phases of relicensing, proposes a modified Project operation (proposed operation) that significantly reduces both the frequency, amplitude, and rate of change in Project-related discharge and impoundment water surface fluctuation in comparison to the current operation. The proposed operation is detailed in the Bellows Falls FLA Exhibit B "Project Operations and Resource Utilization" and the MOU.

The proposed operation focuses on creating more stable reservoir water surface elevations, reducing the magnitude of changes and the frequency of sub-daily changes in discharge from the Project, increasing the amount of time that the Project is operated as inflow equals outflow and at full reservoir. At the same time, the proposed operation maintains Great River Hydro's capability to be flexible and responsive to current wholesale energy, forward capacity, reserve, and other ancillary services markets managed by the New England Independent System Operator (ISO-NE). The proposed operation will also remain responsive to ISO-NE system emergencies when ISO-NE requires operation for reserves, security, system stability (e.g., VAR support), system over-supply conditions (ISO-NE minimum generation emergency or negative prices), and critical events or emergencies involving dam and public safety. The proposed operation ensures the Project's ability to address future regional energy demands and system needs as those evolve over time.

The proposed operation will predominantly maintain a specified water surface elevation (Target WSE) at the dam and, as a result, maintain flow below the Project equal to the approximate inflow as measured or calculated at the dam (inflow equals outflow or IEO). Specifically, a Target WSE of 291.1 ft (NVGD 29) will be maintained at the Bellows Falls dam by passing inflow within a Target WSE Bandwidth between 291.6 ft and 290.6 ft to account for potential differences between anticipated inflow and actual instantaneous inflow. In addition to IEO Operation, the Project will have restricted discretionary Flexible Operation capability to respond to elevated energy prices as well as unrestricted capability to respond to emergencies and ISO-NE transmission and power system requirements. The proposed operation is described in detail in Exhibit A of the MOU, and evidence of stakeholder support is provided through the signatures. Elements associated with the proposed operation including modes of operation, capabilities, restrictions, requirements, and allowances are defined and described below.

Great River Hydro proposes to construct and operate a new 680 kW turbine generator at the dam for the purpose of providing a continuous 300 cfs minimum flow into the bypassed reach below the dam through generation. During maintenance or emergencies, when the unit is out of service, spilling over the dam crest or through gates will provide the proposed minimum flow into the bypassed reach.

The Project will comply with an Inflow Equals Outflow (IEO) operating condition, as described in the Bellows Falls FLA and MOU, applying Target WSE and associated Target WSE Bandwidths as described below, unless:

- Flexible Operation along with Transition Operation are applied and implemented;
- IEO Operation is suspended due to either High Water Operation, or Emergency and System Operation Requirements; or

- IEO Operation is suspended due to non-emergency Maintenance Requirements that mandate deviating from IEO Operation, but only after consultation with relevant state and federal resource agencies prior to initiating a necessary deviation and developing a suitable refill plan and schedule.

Target WSE for the Project is 291.1 ft except during Dwarf Wedgemussel (DWM) Winter Habitat Protection Operation. The corresponding Target WSE bandwidth is between 290.6 and 291.6 ft, representing 0.5 ft above and below the Target WSE. Rates of change in station discharge to maintain a Target WSE (matching inflow with outflow) will be limited to reasonable changes necessary to continue or adjust the actual WSE to the Target WSE within the Target WSE Bandwidth.

Flexible Operations, when the Project is operated at the discretion of GRH and deviates from IEO Operation, are limited, in part, by maximum allowable Flexible Operation hours specified below, which are allocated on a monthly basis in order to reflect the seasonal criticality of instream aquatic resources as well as the criticality and fuel security concerns associated with winter peaking loads in New England.

- December, January, February, March: no more than 65 hours in each month.
- April, May, June: no more than 10 hours in each month.
- July: A total of 20 hours with no more than 10 hours from July 1 through July 15. Although a maximum of 10 hours is allowed from July 1 through July 15, in order to further enhance the potential for successful Sea Lamprey spawning, Great River Hydro will strive to minimize the hours of Flexible Operation during this period when conditions allow.
- August, September, October: a total of no more than 20 hours in each month.
- November: a total of 42 hours with no more than 10 hours from November 1 through 15.

Flexible Operations will comply with the Flexible Operations Impoundment Range, which is between 289.6 and 291.1 from October 1st to May 31st and 290.1 and 291.1 from June 1st to September 30th, excluding DWM Winter Habitat Protection Operation, and will be in accordance with Flexible Operations Operation Hours requirements.

Flexible Operations Maximum Discharge will be based upon the calculated inflow as follows:

- When calculated inflow is approximately 1,800 cfs or less, Flexible Operation Maximum Discharge is 4,500 cfs;
- When calculated inflow is greater than approximately 1,800 cfs, the Flexible Operation Maximum Discharge is limited to 2.5 times the calculated inflow and will not exceed the Bellows Falls Maximum Station Generating Capacity of 11,400 cfs.

For the purpose of protecting DWM from freezing in the winter, the Bellows Falls Project impoundment will be temporarily lowered in the fall of each year as described for Dwarf Wedgemussel Winter Habitat Protection Operation in the Bellows Falls FLA and MOU. Additionally, the Flexible Operating Impoundment Range is narrowed between June 1 and September 30 at the Bellows Falls Project to reduce the potential for dewatering at-risk DWM habitat and individuals within portions of the Project area.

There are no limitations on the number of Flexible Operation events per day or the duration of Flexible Operation events other than those indirect limitations due to Inflow and Transition Operation requirements as specified in the Bellows Falls FLA and MOU.

Scheduled Flexible Operation will require one hour of Transition Operation up-ramping (i.e., gradual flow increase from IEO Operation to Flexible Operation). Unscheduled (in response to Real-Time price signals) Flexible Operation, and Emergency and System Operation Requirements will not require up-ramping.

All Flexible Operation events will require Transition Operation down-ramping (i.e., gradual flow decrease from Flexible Operation to IEO Operation) and refill (i.e., to restore stable Target WSE) as defined in the Bellows Falls FLA and MOU. The Transition Operation modes will be applied as follows:

	Up-Ramping	Down-Ramping	Refill
IEO Operations	Not Applied	Not Applied	Not Applied
Flexible Operations, Scheduled	Applied during the hour prior	Applied as Defined	Applied as Defined
Flexible Operations, Un-scheduled	Not Applied	Applied as Defined	Applied as Defined
High Water Operations	Not Applied	Not Applied	Not Applied
Claimed Capacity Audits and Reactive Power Demonstrations	Not Applied	Applied as Defined	Applied as Defined
Emergencies and System Emergencies	Not Applied	Not Applied	Not Applied

Start and End Dates of the Activity

The Project is currently operating under the terms and conditions of the most recent FERC License originally issued on August 3, 1979, as amended, and expired on April 30, 2019. Since the expiration of the present license in 2019, FERC has issued from year-to-year an annual license under the terms and conditions of the present license until a new license is issued, or the Project is otherwise disposed of. Great River Hydro is seeking a new 40-year license as outlined in its Bellows Falls FLA, but the license term will be established by FERC in its Environmental Impact Statement to be issued at the completion of its review under the National Environmental Policy Act (NEPA). The start of the proposed activity will be the date of license Issuance and the term typically is based upon the last day of the month in which the license is issued by the FERC.

2. The characteristics of the activity: Whether the activity is associated with a discharge and/or water withdrawal and whether the discharge and/or withdrawal is proposed or occurring

The activity is proposed modified continuation of hydroelectric power generation operations at the Bellows Falls Project under a new Federal License and consists of maintenance of a target water surface elevation in the Project impoundment except for limited flex hours, direction of flows through a power canal and the three generating units in the powerhouse, and regulation of flow into the bypassed reach through various flow gates and crest control structures at the dam including maintaining a continuous flow of at least 300 cfs, primarily through a proposed new minimum flow unit, as well as upstream and downstream fish passage structures in accordance with the proposed operations in the Bellows Falls FLA, MOU, and SAFP. The powerhouse is positioned at the end of the 1,700 ft long power canal with a

natural bypassed reach between the dam and the outlet of the powerhouse tailrace. Current and proposed water withdrawals and discharges are limited to non-consumptive flow through the powerhouse and passage of river flow. The proposed operation for the Project will predominately consist of run-of-river operations, where inflow equals outflow for the majority of time, and minimal water surface elevation fluctuations; both of which will reduce the degree of sub-daily discharge fluctuation that occurs under current operation. Under the relicensing proceeding or associated with this WQC application, there are no immediate proposed construction activities or activities that require water withdrawals or discharges outside of the proposed operations presented in the Bellows Falls FLA and MOU; except that flow into the bypassed reach will also include discharge through a 680 kW turbine generator and new spill gates associated with the proposed concrete intake structure modification to the dam.

3. The Characteristics of the Discharge and/or Withdrawal: a) Flow Rate; b) Potential Chemical, Physical, Biological Constituents; c) Frequency (e.g. daily, hourly); d) Duration; e) Temperature (Celsius); f) Latitude and Longitude

The withdrawals and discharges associated with the proposed operation consist of passage of flows in the Connecticut River at Bellows Falls Dam. Flow pathways listed in priority order include: 1.) Providing a continuous minimum flow of at least 300 cfs into the bypassed reach below the dam, and or including any potential downstream fish passage related flow to be provided at the dam; 2.) Diverting remaining flows, up to the maximum powerhouse hydraulic capacity, from the Connecticut River through a 1,700 ft long power canal that connects the impoundment to the Bellows Falls station and discharging into the tailrace at the base of the station through fish passage structures first, then through the powerhouse unit discharge; and 3.) River flow in excess of powerhouse capacity passed instantaneously through spillway structures and as needed through fish passage structures.

Flows in the Connecticut River equal to or less than station capacity (i.e. flows used for hydroelectric power production) are passed from the power canal concrete gravity intake structures directly into the scroll or wheel cases, through the turbine(s), and discharged through draft tubes cast in the concrete foundation into the tailrace area below the Bellows Falls powerhouse. The concrete gravity intake is integral with the powerhouse structure with two water passages for each of the three generating units. The water passages for the three generating units have trashracks (4-inch clear spacing) and two 18-foot wide by 24.4 tall broome gates (headgates) that can be moved and used to curtail flow to any one of the three units. The invert elevation for the intake gates is 243.38 ft (NGVD29), which is about 47.75 ft below the Target WSE for the proposed operation. The tailrace area is located immediately southeast of the Bellows Falls powerhouse which spans the width of the power canal and is adjacent to the Vermont shoreline (Figure 2.1-2 in Exhibit E).

3.a. Flow Rate (cfs)

Under the proposed operation, flow rates below the Project are determined by inflow (as measured at the dam) when operating in an inflow equals outflow operation (IEO Operation). In addition to IEO Operation, the Project will have restricted discretionary Flexible Operation capability to respond to elevated energy prices as well as unrestricted capability to respond to emergencies and ISO-NE

transmission and power system requirements. During these events, flow rates will exceed inflow for short periods and be lower than inflow during impoundment re-fill periods. While operating in Flexible Operation, preceding Up-ramping and subsequent Down-ramping, flows will be maintained above or equal to inflow. While operating in Transition Refill Operation (item 19.c in the MOU) discharge will be approximately 70% of estimated inflow and adjusted as necessary through hourly real-time monitoring and calculation of estimated inflow. Discharge during refill will not fall below the seasonal Minimum Base Flows, as specified in the MOU, of: Oct 1 through March 31 - 1,600 cfs; April 1 through May 31 - 3,000 cfs; June 1 through Sept 30 - 1,400 cfs. These are not minimum flows nor guaranteed minimum inflows. They represent levels which, for Flexible Operation planning and decisions, would need to be considered before initiating such operation. If inflows were low and the required discharge of 70% of inflow, to refill the impoundment, were below the minimum base flows the flexible operation should not be initiated. Inflow is not guaranteed to be above these levels but based upon upstream seasonal minimum flow requirements, it is anticipated that inflow would be above these flow levels. When inflow exceeds the station capacity of 11,400 cfs the excess flow is spilled through the Bellows Falls dam roller gates. In extreme flood events that exceed the flow capacity of the roller gates, stanchion flashboards would be removed or tripped to facilitate additional flows, such as was done during the Tropical Storm Irene flood (August 29, 2011). The proposed operation, including specific flow criteria, is described in Exhibit B of the Bellows Falls FLA and in Exhibit A of the MOU.

Minimum flow in the bypassed reach below the dam was the subject of numerous discussions held between the stakeholders and GRH in June 2020. Flow to the bypassed reach below the dam will be at least 300 cfs year-round. This flow rate, supported by state and federal fishery agencies, was determined based on IFIM modeling of various flow across a series of transects perpendicular to bypass channel habitat. Agencies chose to prioritize 1.) target fish species associated with flow sensitive riffle and run habitats, as opposed to species associated with less flow-sensitive pool habitat, and 2.) include non-spawning life stages because extreme flows scour the exposed bedrock that dominates the bypassed reach and remove finer spawning substrate on an annual or more frequent timeframe. The proposed continuous minimum flow of 300 cfs is supported by state and federal fishery agencies and both VT and NH water quality agencies. This will provide additional habitat to target fish species such as dace, suckers, darters, and Fallfish. See Appendix C Summary of Bellows Falls Bypass Instream Flow MOU Discussion and Flow Selection.

3.b. Potential Chemical, Physical, Biological Constituents

Project operations pass Connecticut River flow instantaneously through turbines (minimum flow unit or main powerhouse units), flow control structures, or fish passage structures and therefore have limited direct effects on the chemical, physical, or biological constituents in the discharge. The potential effects on water quality are primarily through the hydrologic modification (as proposed in the Bellows Falls FLA), associated with the dam structure/operations and the variable source of outflows – i.e. at depth in the power canal intake through the turbines or through the roller gates at the dam crest. The greatest concern for hydroelectric operations on water quality is thermal/chemical stratification in the impoundment which can then be preferentially conveyed downstream via submerged intake structures (Friedl and Wüest, 2002). Therefore, water quality studies for hydroelectric projects tend to be most focused on dissolved oxygen and temperature patterns in the project area. Nutrient cycling in an

impoundment is also a concern, particularly phosphorus which is the limiting nutrient in freshwater systems (NHDES, 2020) and therefore phosphorus data and chlorophyll-a data (another trophic state indicator) are typically collected and reviewed for hydroelectric water quality demonstrations (NHDES, 2020).

Water quality studies were completed for the FERC license application for Bellows Falls Project in 2012 and 2015, the scope of which included continuous monitoring of dissolved oxygen, temperature, specific conductance, and pH in the forebay, bypass reach, and tailrace, as well as additional discrete measurements at multiple stations, including as vertical profiles, and collection of samples for laboratory analysis of nutrients and other chemical parameters.

In the 2012 study, continuous measurements of dissolved oxygen (DO) in the forebay, bypassed reach, and tailrace indicated that waters were generally well oxygenated over the study season and generally met NH water quality standards for DO. Vertical profile data show DO levels in the forebay did fall below New Hampshire surface water quality standards with DO values as low as 3.3 mg/L in the lowest depths of the forebay on July 18, 2012. However, it should be noted that these observations coincided with periods of stratification during high water temperature and low flow and were brief in duration (1 day exceedance of NH surface water quality standard on July 18, 2012). Dissolved oxygen levels throughout the middle and upper impoundment remained above New Hampshire surface water quality standards throughout the 2012 study. In the 2015 study, no instances of stratification were observed in the forebay; however, weak and very brief stratification was observed in the middle impoundment station when a thermal discontinuity was observed at the surface resulting in a temperature difference between the surface and 1.0-meter depth of about 2.8 ^{o}C (July 29, 2015). Below the 1.0-meter-depth interval, temperatures were uniform and about 24 ^{o}C. No other instances of stratification occurred and dissolved oxygen levels never fell below state surface water quality standards (Tables 3.5-29, 3.5-30, 3.5-31, 3.5-32 in Exhibit E). The dissolved oxygen and temperature data collected in 2012 and 2015 indicate that thermal/chemical stratification in the Bellows Falls impoundment was uncommon, spatially limited, and exceedances of NH DO standards were rare (Exhibit E pages 3-181 through 3-183).

On average, during the 2012 and 2015 studies, measured pH levels were within the New Hampshire state surface water quality standards (between 6.5 and 8.0 standard units). However, there were documented exceedances of both high and low pH standards at various stations during both study periods. In 2012, pH values fell below the state standard on July 11 and September 5 with exceedances ranging from 6.1 to 6.3 on July 11 and only one exceedance of 6.4 measured on September 5. The exceedances of the lower pH standard in the Bellows Falls impoundment were attributed to atmospheric deposition, consistent with the impairment listing in that reach. Also in 2012, pH was observed to exceed the New Hampshire higher pH standard of 8.0 throughout the Bellows Falls Project area, primarily within the forebay, and ranged from 8.01 to 8.53. These exceedances were observed on July 11 and 12, August 21 through 25, and September 9 through 12. In the bypassed reach and tailrace, pH exceedances in 2012 were shorter in duration and lasted from August 23 to 24 and June 21 to 23, respectively. The high pH levels coincided with higher levels of chlorophyll-a and diel fluctuations of temperature and DO, suggesting that the pH exceedances are partly related to photosynthesis of algae and aquatic respiration (Exhibit E page 3-247).

In the 2015 study, pH levels were never observed to fall below the lower NH standard of 6.5, however the Bellows Falls upstream riverine, upper impoundment, and forebay stations did exceed the higher NH

standard of 8.0 multiple times, most frequently in August and September. Most of these observed exceedances in 2015 occurred during the 10-day, high-temperature, low-flow monitoring period at the upstream riverine and upper impoundment areas where pH exhibited large diel fluctuations relative to the lower impoundment and forebay areas. At the middle impoundment station, pH exceeded the surface water quality standard of 8.0 on September 7 and September 8, 2015. Specifically, on September 7, the highest pH value was 8.56 for a few hours in the late afternoon; on September 8, the highest pH value was 8.55 (Exhibit E page 3-247).

Water samples were collected from the Bellows Falls forebay and laboratory analyzed for nutrients and chlorophyll-a during the 2012 and 2015 water quality studies. Samples collected in 2012 and 2015 indicated total phosphorus samples were on average in the mesotrophic range of 0.008 mg/L <= TP <= 0.012 mg/L with a median value of 0.012 mg/L observed in both studies. Chlorophyll-a concentrations in samples collected from the Bellows Falls forebay in 2012 were on average in the mesotrophic range of 3.3 <= chlorophyll-a <= 5.0 with a median concentration of 3.8 ug/L, while in 2015 concentrations were in the oligotrophic range of chlorophyll-a <3.3 ug/L with a median concentration of 3.2 ug/L (Exhibit E Table 3.5-35 and Table 3.5-36). There were no visual observations of algal blooms during the Bellows Falls water quality studies and it was determined that Project-affected waters met state water quality standards for nutrients and designated uses were maintained and supported (Exhibit E Page 3-252).

Additional details of water quality in the vicinity of the Bellows Falls Project and potential Project impacts on water quality are provided in Exhibit E sections 3.5.1.2, 3.5.2.2, 3.5.3.2, and 3.5.4.2.

Water quality data were collected in 2004 by NHDES and EPA and most sites sampled for that study in the Bellows Falls Project area were found to fully support the designated uses of aquatic life and primary and secondary contact recreation (Exhibit E Page 3-143). Water quality data collected in 2008 and 2009 to evaluate the effectiveness of reduced combined sewer overflow discharges in the Connecticut River watershed indicated that on average bacteria concentrations were below the NH state standard, however, there were some instances of individual samples exceeding water quality standards, particularly under wet weather conditions (Exhibit E Page 3-146). Data collected at the USGS gages “Connecticut River at West Lebanon, New Hampshire” (USGS Gage No. 01144500) and “Connecticut River at North Walpole, New Hampshire” (USGS Gage No. 01154500) from 2005 through 2007 indicated no exceedances of dissolved oxygen or pH standards and phosphorus levels that on average ranged from mesotrophic to eutrophic with median total phosphorus of 0.0125 mg/L and 0.012 mg/L, respectively (Exhibit E Pages 3-146 through 3-151).

3.c. Frequency (e.g. daily, hourly)

Flow through the Project is continuous, based primarily on inflow at the dam. During IEO Operation, the rate of flow may fluctuate on an hourly basis based on dispatch schedules derived from predicted inflow or in real-time schedule adjustments made in an effort to match discharge with actual inflow. Adjustment to match inflow could potentially be made less frequently than hourly as long as the Bellows Falls impoundment WSE is within a Target WSE Bandwidth between 291.6 ft and 290.6 ft (NVGD 29). In addition to IEO Operation, the Project will have restricted discretionary Flexible Operation capability to respond to elevated energy prices as well as unrestricted capability to respond to emergencies and ISO-NE transmission and power system requirements. Flexible, transition, or emergency and system operation as described in the MOU is also scheduled or performed on an hourly basis.

3.d. Duration

Great River Hydro proposes a modified Project operation, as described in the Bellows Falls FLA and MOU, that will be in effect during all times under a new license. The flows through the powerhouse via the power canal or dam will be instantaneous and non-consumptive. Under the proposed operation, flow through the impoundment will largely mirror inflow (upstream inflow into the Project plus intermediate tributary inflow into the impoundment) except during periods of flexible operation or emergency and system operation. The requirements set forth in the proposed operation will be in effect at all times under a new license.

3.e. Temperature (°C)

Project water temperatures are primarily determined by ambient river and weather conditions with potential for modification by Project operations. Impoundments and hydroelectric operations have the potential to affect water temperature primarily through hydrologic modification of the natural river system, increasing storage volumes and residence times and decreasing turbulence which can lead to longitudinal temperature increases and development of thermal stratification (Friedl and Wüest, 2002).

Water temperatures were measured in the Bellows Falls Project area as part of two water quality studies in 2012 and 2015 and included both continuous measurements and discrete readings, including vertical profiles in the Bellows Falls forebay as described in Sections 3.5.1.2, 3.5.2.2, 3.5.3.2, and 3.5.4.2 of Exhibit E and ILP Study 6. Those studies demonstrated that, overall, current operations effects on water temperatures were indistinguishable from daily water temperature fluctuations (Exhibit E Pages 3-233 to 3-235, 3-244). Temperature increases of more than 1 degree Fahrenheit (°F, 0.56°C) can occur within the Project area, as was measured during ILP Study 6, however the cause of temperature rise was equivocal and could be attributed to natural variations. Thermal stratification can occur in the Bellows Falls forebay during an atypical warm year, such as 2012, but stratification documented during that study was intermittent, spatially limited, and short in duration. Downstream temperature effects are likely to be mitigated as tailrace temperatures were found to be slightly cooler than forebay surface temperatures due to entrainment and discharge of cooler hypolimnetic waters. Temperature effects from current operations were determined to support and maintain NH designated uses for Class B waters as any increase in temperature from upstream riverine areas to the Project dam will be gradual over the 26 river-mile Project area and variations caused by operations were indistinguishable from daily variations throughout the Project area.

The proposed operation under the new license, which largely mirrors a natural flow regime through and below the Project, will significantly reduce residency time in the impoundment and significantly increase instantaneous base flow in the riverine section below the Project when compared to the current license, typical operation. Both these attributes of the proposed operation will reduce the potential for water temperature increases caused by Project operation.

3.f. Latitude and Longitude

The Bellows Falls Powerhouse is located at approximately 43°8'0.1"N, 72°26'31"W. The intake structures are integral with the powerhouse located at the end of the power canal and the discharge is located southeast of the powerhouse. The powerhouse area occupies the entire power canal cross section. The Bellows Falls dam is located at approximately 43°8'16.46"N, 72°26'49.22"W; adjacent to (north of) the power canal diversion and spans the width of the natural channel above the bypassed reach.

4. The existing and designated use(s) that are potentially affected by the proposed activities. (Designated Uses are listed in the NHDES Consolidated Assessment and Listing Methodology).

Assessment Units are segments or portions of waterbodies used for reporting the results of all water quality assessments. Five New Hampshire assessment units along the mainstem Connecticut River encompass the Bellow Falls Hydroelectric Project:

- NHRIV801060305-12 (CT River from Sugar River, NH to Blow-Me-Down Brook, NH)
- NHRIV801060702-12 (CT River Black River VT to Sugar River, NH)
- NHIMP801060703-05 (CT River impoundment BF Station/Dam to Black River, VT)
- NHRIV801070501-10-01 (CT River BF bypass reach below the BF dam)
- NHRIV801070501-10-02 (CT River from BF bypass to Houghton Brook, NH)

Designated uses in these assessment units are described in the 2014 Section 305(b)/303(d) surface water quality list (NHDES, 2015). Drinking Water After Adequate Treatment is a listed use in all four assessment units, while Aquatic Life, Primary and Secondary Contact Recreation are listed uses in only some. In NHRIV801060702-12, use by Aquatic Life is impaired due to invasive aquatic algae and non-native aquatic plants, while in NHIMP801060703-05 and NHRIV801070501-10-01 Aquatic life is marginally impaired due to pH from atmospheric deposition and a TMDL is needed. Sufficient information is lacking to determine whether wildlife designated uses are supported in any of these assessment units. See Exhibit E Page 3-136 to 3-137 for detailed discussion of each assessment unit.

The entire portion of the Connecticut River encompassing the assessment units for the Bellows Falls Project is impaired for fish consumption because of mercury from atmospheric deposition. A Northeast-wide TMDL was completed for mercury and approved by EPA in 2007 for the entire Northeastern United States, which includes these New Hampshire assessment units (NEIWPCC, 2007).

Additionally, three tributary assessment units that flow into the Project waters and two assessment units of the Connecticut River within the Project waters were identified as impaired or threatened waters for which TMDL is needed per the NHDES 303(d) list:

- NHRIV801060407-16, “Sugar River” (Tributary entering NHRIV801060702-12)
- NHIMP801060703-05, “Connecticut River, Bellows Falls Impoundment”
- NHRIV801060703-06, “Clay Brook” (Tributary entering NHIMP801060703-05)
- NHRIV801070501-10-01, “Connecticut River, Bellows Falls Bypassed Reach” (Connects with NHIMP801060703-05 and NHRIV801070501-10-02)
- NHRIV801070203-12, “Cold River” (Tributary entering NHRIV801070501-10-02)

These tributaries and sections of the Connecticut River mainstem are listed as unable to support Aquatic Life due to impairments including pH, fishes bioassessments, and aluminum (Exhibit E Table 3.5-10).

Of the designated uses discussed above, Aquatic Life is an existing use within the Project waters that has the greatest potential to be impacted by Project operations. The reaches of the Connecticut River within the Bellows Falls Project area provide aquatic habitat for a variety of fish, freshwater mussels, and macroinvertebrates which depend on suitable habitat for migration, reproduction, and rearing. Numerous relicensing studies were conducted to evaluate fisheries resources and survey freshwater

mussel populations within the Project area and are discussed in detail in Exhibit E, Sections 3.6.1.3, 3.6.1.4, and 3.6.1.5. No fish species present in the Project area are listed as threatened or endangered under the federal ESA, though two species of concern (American Shad and Sea Lamprey) and one threatened species (Bridle Shiner) were found during field work for ILP Study 10 conducted in 2015 (Exhibit E Table 3.6-1). Collectively, these sensitive species constituted only 1.4 percent of the total catch in the Bellows Falls Project area in that study (Exhibit E Table 3.6-3). Mussel surveys in 2011 and 2013 found seven of the nine freshwater mussel species supported in the Connecticut River watershed in New Hampshire and Vermont within the mainstem and near the mouth of mainstem tributaries, including the federally endangered DWM. DWM were found in the Bellow Falls impoundment (Exhibit E Table 3.6-9).

In general, the proposed operational changes would provide environmental protection through an Inflow equals Outflow (IEO) operation most of the time and discretionary generation for a limited number of hours each month (1.4 to 9% of the total hours in a month), with fewer hours in the April-October period and more in the late fall to early spring months and even fewer instances where operations will address emergency and system needs. This operating protocol will protect critical aquatic resources during the most sensitive period between April and mid-November while allowing for more operational flexibility during less sensitive winter months when many aquatic resources are dormant (Exhibit E Section 3.3). Under the proposed operation, WSEs in the Project impoundment will exhibit much greater stability and remain at or near the impoundment's Target WSE for 60 percent to over 90 percent of the time in most months (Exhibit E Table 3.3-1, Figure 3.3-1). The proposed operation will also reduce the frequency of WSE fluctuations by 58 to 100 percent (average 79 percent) (Exhibit E Table 3.3-4), and the magnitude of WSE changes during Flexible Operations flows is expected to be less than 0.4 ft in most months (average 0.23 ft) (Exhibit E Table 3.3-2, Figure 3.3-2). Additionally, the proposed operation will result in flows close to or equal to naturally occurring flow through the Project (Exhibit E Figure 3.3-4 and Figure 3.3-3).

The proposed operations will reduce the frequency and magnitude of WSE fluctuations in the impoundment backwater habitats, which will significantly support spawning and rearing environments. An increase in the base flow levels and reduction in frequency, occurrence, and amount of change in flow, will support wetter habitat protection of gravel and cobble-bars in the riverine reaches of the Project areas and provide a more stable environment for riverine species. In particular, the proposed flow regime is expected to support spawning success and utilization of shallow shoal habitats. The higher base flow and Transitional Operation of up-ramping and down-ramping preceding and following Flexible Operation will provide consistent habitat for mussel recruitment and protect against stranding of mussels and other less mobile species, including small fish fry. Reduction in frequency, occurrence, and amount of change in flow, will also reduce the potential for nest scour or abandonment due to high velocities, reduce displacement of newly emerged fry of many species, and provide extended periods of more stable flow for nest construction (Exhibit E Section 3.6.2.1).

In the Bellows Falls impoundment, specifically, pre-winter habitat operations will be implemented to reduce the likelihood of dewatering or freezing of DWM during their winter hibernation. This will be accomplished by maintaining WSEs near the lower limit of the proposed operational range for a period of time when water temperatures are dropping from 15 ^{o}C to 10 ^{o}C, a period when DWM are expected to be seeking overwintering habitat. Once water temperatures are consistently below 10 ^{o}C, the Project will return to normal operations and will not drop WSEs below the pre-winter elevation during the

remainder of the winter period (unless required to by flood profile operation) to ensure hibernating DWM remain submerged (Exhibit E Section 2.2.1).

The proposed operations will not affect the capability to operate structures for fish passage (Exhibit E Sections 3.6.2.6 through 3.6.2.8). Additionally, Great River Hydro proposes to improve and enhance fish passage through the Project. Under the terms of the SAFP, the ladder shall be opened on April 1 (if conditions allow), providing opportunities for spring spawners such as Walleye and White Sucker to utilize the fish ladder. Monitoring of fish ladder use by eels, an eel PIT study of in-ladder movement, fish ladder engineering assessment, and an eel survey below the powerhouse and spillway will lead to the design, installation, and operation of permanent upstream eel passage at the Project. Studies will be conducted upstream of the dam to support development of downstream eel passage. Design, construction, operation, and evaluation of downstream eel passage will be undertaken under the new License as stipulated in the SAFP. The proposed operation will provide a higher base flow, far fewer instances of high-peak flow, and a significantly reduced range and pace of flow fluctuation, all of which should generally improve conditions for migratory species including American Eel and Sea Lamprey. Water residency time will be reduced, allowing for improved downstream migration in terms of reduced transit times through the reservoir and subsequent improved fitness.

Despite the absence of data supporting Primary and Secondary Contact Recreation, existing in-stream recreational use, particularly power boating, paddle boating (both local and through-paddlers), and fishing is prevalent throughout the Connecticut River within or affected by the Bellows Fall Project. The only exception to existing recreation is in the 0.7-mile bypassed reach below the dam due to extremely high and variable flow conditions, lack of public access, and lack of GRH property ownership. Under the GRH proposal, current access to the river within the Project Boundary (excluding the bypassed reach) will be maintained or enhanced through the capital improvements to the boat launches, improved portage/boat transport support, and general recreation area access and parking. The proposed operation will result in higher base flow conditions in the river that will more closely resemble natural flows enhancing river paddling conditions while at the same time providing for stable impoundment water surface elevations that support the continuation of power boating, flat water canoeing and rowing. Fishing conditions and opportunities are anticipated to continue or improve under the proposed operation.

Anticipated and actual flow and discharge information below Bellows Falls Project will continue to be made available to the general public to inform recreation use.

With respect to the bypassed reach, under the proposed operation, a continuous minimum flow of 300 cfs is supported by state and federal fishery agencies and both VT and NH water quality agencies. This will provide additional habitat to target fish species such as dace, suckers, darters, and Fallfish. While the whitewater boating community requested GRH study and consider providing scheduled whitewater recreation releases under a new license, the proposed operation does not support or include such. Periodic releases that would support whitewater boating would significantly affect and disrupt the aquatic habitat intended to be enhanced below the dam and were not supported by fishery agencies that supported the proposed minimum flow in the bypassed reach. Furthermore, the reach currently does not support public recreation use due to inherent dangers associated with naturally, highly variable, and often extremely turbulent flow that can spill over the dam once station flow capacity is exceeded. Such flows can rise rapidly and far exceed boating capabilities of average recreational

boaters. The lack of safe and available access to the reach for ingress or egress (i.e., for put-in, take-out or emergency rescue purposes) further discourages recreational use of the bypass. During high water conditions, the reach is posted to discourage in-stream use of any kind due to rapidly changing conditions and extreme velocity and strength of the current passing through the bypass.

5. The provision(s) of surface water quality standards (Env-Wq 1700) that are applicable to the designated uses affected by the proposed activities.

It is anticipated that the provisions of the surface water quality standards that are applicable to the designated uses that could potentially be affected (Aquatic Life) are Env-Wq 1703.13 Temperature, Env-Wq 1703.07 Dissolved oxygen (DO), 1703.18 pH, 1703.11 Turbidity, and 1703.14 Nutrients. Given that the Project is an existing project and there is no proposed new or increased discharge, or other change in operations that would reasonably be expected to result in increased loading of any pollutant, the NH antidegradation rules (Env-Wq 1708) do not apply to this activity.

ILP Study 6, *Water Quality Study*, was conducted to assess water quality within the Project waters under current operational conditions (Exhibit E Section 3.5.1.2,) and the potential water quality effects due to the Project are discussed in Exhibit E Sections 3.5.2.1, 3.5.2.2, 3.5.3.2, and 3.5.4.2. In general, it was found that any adverse effects caused by current normal operational flows and impoundment fluctuations on water quality appear to be minimal to no effects in most cases.

WSE fluctuations were found to have negligible effect on water temperatures, with water temperature patterns driven by factors other than Project operations such as weather and longitudinal effects. Therefore, any effects of Project generation on water temperatures would be indistinguishable from daily water temperature fluctuations (Exhibit E Pages 3-233 to 3-235, 3-244).

The water quality data collected in 2012 suggest that low-flow, warm-weather conditions, as observed in 2012, can lead to thermal stratification resulting in potential low-DO levels in the hypolimnetic waters of the forebay. However, this condition was not persistent in either the 2012 or 2015 water quality studies and was spatially limited to the forebay area with no documented exceedances of dissolved oxygen standards in the Bellows Falls tailrace area in either study. As water is passed through the Project powerhouse it enters the shallower and more turbulent tailrace area below the dam, which supports re-oxygenation, and state water quality standards are expected to be maintained in downstream reaches of the Connecticut River under a variety of flow and temperature conditions (Exhibit E Pages 3-244 to 3-245). Operations under the inflow equals outflow conditions proposed maintains a continuous passing of water through the powerhouse, thus reducing the potential for low-DO conditions downstream.

Data from ILP Study 6 showed 2012 pH exceedances of state water quality standards in the impoundments was related to atmospheric deposition and increased rates of photosynthesis of algae and aquatic vegetation, not to Project operations effects (Exhibit E Pages 3-247 to 3-248). ILP Study 6 also demonstrated that turbidity levels within the mainstem Project waters were very low (less than 5 NTU) for the majority of the time, though did increase in response to precipitation events that often

result in high flows and spill conditions (Exhibit E Page 3-250). Nutrients and chlorophyll-a analysis in 2012 and 2015 indicate that Project-affected waters meet state water quality standards and that designated uses were maintained and supported and continued Project operations will not alter these conditions (Exhibit E Page 3-252).

6. Pollutant loading analysis

NHDES requires as part of the 401 WQC application a pollutant loading analysis to show the difference between pre-development and post-development pollutant loads for a typical year. The objective of the loading analysis is to show post-development pollutant loads do not exceed pre-development pollutant loads. Loading analysis guidance and a simple spreadsheet model will be provided by NHDES. The loading analysis will be used to determine appropriate stormwater management measures, which must be effectively designed, installed, and maintained to ensure compliance with surface water quality standards.

A pollutant loading analysis was not considered necessary for the Bellows Falls FERC relicensing as the Project is an existing project and no new development or construction is proposed. Water quality considerations are discussed in Sections 3 and 5 of this additional information summary and are detailed in Sections 3.5.1.2, 3.5.2.2, 3.5.3.2, and 3.5.4.2 of the Exhibit E and ILP Study 6.

7. A description of any other aspect associated with construction and operation of the activity that would affect the chemical composition, temperature, flow, or physical aquatic habitat of the surface water.

Bellows Falls Project is an existing project that has been in continuous operation for decades. No new development or construction associated with the Project is proposed other than what has been described above; a new intake structure including several new spill conveyance structures and a 680-kW fish-friendly minimum flow turbine generator, none of which are anticipated to affect chemical composition, temperature, flow or physical aquatic habitat. These features are only intended to support the delivery of the proposed required minimum flow or natural high flows that exceed powerhouse capacity. Similarly, anticipated, yet to be designed, fish passage enhancement construction and operation will not affect chemical composition, temperature, flow, or aquatic habitat. The licensee proposes a modified Project operation that significantly reduces both the frequency, amplitude, and rate of change in Project-related discharge and impoundment water surface fluctuation in comparison to current operation. The proposed operations are expected to result in a more stable aquatic environment that will support existing and designated uses in the Project-affected areas while remaining flexible and responsive to energy demand and system needs. Operation of the Project and associated effects on the chemical composition, temperature, flow, and physical aquatic habitat have been addressed in Sections 3.5.1.2, 3.5.2.2, 3.5.3.2, and 3.5.4.2 of Exhibit E.

8. An original or color copy/reproduction of a United States Geological Survey Quadrangle Map that clearly shows the location of the activity and all potential discharge points.

A USGS-based topographic map showing the location of the activity and all potential discharge points is included as Appendix A.

9. A copy of the final complete federal permit application or federal license application, including the federal permit, license, or project number.

The Bellows Falls FLA, Exhibit E, MOU, SAFP, ILP Study 6 Report and ILP Study 10 Report and SAFP are referenced by endnotes. A list of these Supporting Documents, providing hyperlinks to the documents in both the FERC's eLibrary and the GRH Public Information Document Library is included as Appendix B.

10. A copy of the NHDES wetlands permit (RSA 482-A:3), if necessary.

No NHDES wetlands permit is required for this Project.

11. A copy of the NHDES alteration of terrain permit (RSA 485-A:17), if necessary.

No NHDES alteration of terrain permit is required for this Project.

12. The name(s) and address(es) of adjoining riparian or littoral abutters.

This list is not included with the application package due to the large area abutting the Project impoundment. NHDES was consulted and concurred the abutter list is not necessary.

13. A plan showing the proposed activities to scale

NHDES requires a plan be included with the WQC application showing the proposed activities to scale including:

> The location(s) and boundaries of the activities;
>
> The location(s), dimension(s), and type(s) of any existing and/or proposed structures; and
>
> The location(s), name(s), identification number(s), and extent of all potentially affected surface water bodies, including wetlands.

A comprehensive Project plan is provided in Exhibit G of the Bellows Falls FLA.

14. For projects that involve a new surface water withdrawal provide additional information

There is no new surface water withdrawal associated with this Project and therefore no WCP or waiver is required.

15. Rivers Management and Protection Act

The Connecticut River is a Designated River under the NH Rivers Management and Protection Program. The LAC under RSA 483 is represented by the Mount Ascutney Local River Subcommittee to the Connecticut River Joint Commission. The LAC has been provided access to a complete digital copy of this application.

References

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New Hampshire Department of Environmental Services (NHDES). 2010. Final Report New Hampshire Statewide Total Maximum Daily Load (TMDL) for Bacteria Impaired Waters. New Hampshire Department of Environmental Services. Available at: https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/final-bacteria-tmdl-report-statewide-379.pdf.

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NHDES. 2020. 2020 Draft Section 305(b) and 303(d) Consolidated Assessment and Listing Methodology. October 16, 2020.

Appendices

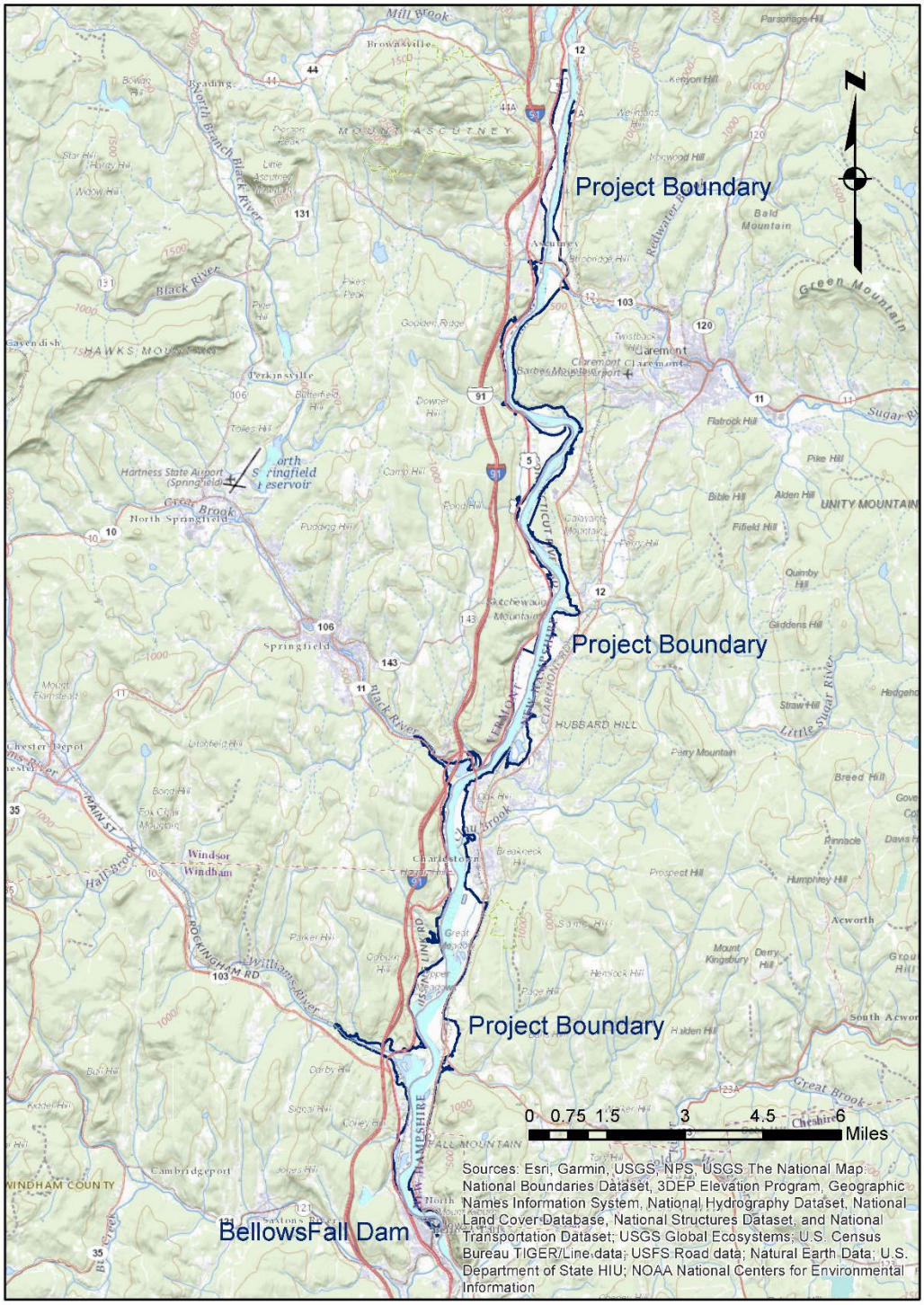
Appendix A – USGS Map of Project Area

Appendix B – List of Supporting Documents to this Application

Appendix C - Summary of Bellows Falls Bypass Instream Flow MOU Discussion and Flow Selection

Appendix A – USGS Map of Project Area

Bellows Falls Hydroelectric Project No. 1855



Appendix B – List of Supporting Documents to this Application NH 401 Water Quality Certification
Bellows Falls Hydroelectric Project

Revised Amended Bellows Falls FLA 06-07-23 (Includes Initial Statement and Exhibits A, B, C, and D):

Accession Nos. 20230608-5102; Revised Amended Final License Applications of Great River Hydro, LLC for Project, et. al. under P-1855 et. al.

GRH Website:
https://relicensing.greatriverhydro.com/overview/documents/?eeFront=1&ee=1&eeFolder=Documents%2F85-Revised-Final-License-Application-BF-Min-Flow-Unit&eeListID=1

Revised Amended Exhibit E for Wilder, Bellows Falls and Vernon Projects; Revised 06-07-2023:

Accession No. 20230608-5103 Great River Hydro, LLC submits Revised Final License Application and Exhibits for the Bellows Falls Hydroelectric Project et. al. under P-1855 et. al

GRH Website: http://relicensing.greatriverhydro.com/wp-content/uploads/simple-file-list/Documents/85-Revised-Final-License-Application-BF-Min-Flow-Unit/2023-06-07-WLDR-BF-VERN-RFLA-Exhibit-E.pdf

Amended Bellows Falls FLA 12-7-2020 (Includes Exhibits F, G, and H):

Accession Nos. 20201207-5219 (Public), - 5220 (Privileged);-5221 (CEII); Amended Final License Applications of Great River Hydro, LLC for Project, et. al. under P-1855 et. al.

GRH Website:
https://relicensing.greatriverhydro.com/overview/documents/?eeFront=1&ee=1&eeFolder=Documents%2F80-Amended-Final-License-Applications-AFLA%2F30-Bellows-Falls&eeListID=1

Memorandum of Understanding executed December 1, 2020:

Included in 12-7-2020 FLA Exbibit B, Accession Nos. 20201207-5219 (Public) (see above). MOU between Great River Hydro and the United States Fish and Wildlife Service, the New Hampshire Department of Environmental Services, the New Hampshire Fish and Game Department, the Vermont Department of Environmental Conservation, the Vermont Department of Fish and Wildlife, The Nature Conservancy, and the Connecticut River Conservancy.

GRH Website: http://relicensing.greatriverhydro.com/wp-content/uploads/simple-file-list/Documents/80-Amended-Final-License-Applications-AFLA/10-Wilder/2020-12-07_WLDR_Amend_FLA_ExABCDFGH.pdf

Settlement Agreement on Fish Passage (SAFP) 08-02-2022:

Accession No. 20220803-5124. Settlement Agreement on Fish Passage (SAFP) executed by New Hampshire Fish and Game Department among other state and federal agencies and filed with the Commission on August 2, 2022.

GRH Website: http://relicensing.greatriverhydro.com/wp-content/uploads/simple-file-list/Documents/80-Amended-Final-License-Applications-AFLA/70-AFLA-Settlement-Agreement-Fish-Passage/2022-08-02-GRH-AFLA-Fish-Passage-Settlement-Agreement.pdf

ILP Study 6 Water Quality Updated Study Report:

Accession No. 20161215-5280 ILP Study Reports 6, 25 and 30, final reports and supplements, TransCanada Hydro Northeast Inc. under P-1892, et al filed December 15, 2016

GRH Website:
https://relicensing.greatriverhydro.com/overview/documents/?eeFront=1&ee=1&eeFolder=Documents%2F50-Study-Reports%2F130-Study-Reports-1-33%2FStudy-06-Water-Quality-Monitoring&eeListID=1

ILP Study 10 Fish Assemblage Study Report:

Accession No. 20160801-5232 TransCanada Hydro Northeast Inc. August 1, 2016 Updated Study Report under P-1855, et. al.

GRH Website:
https://relicensing.greatriverhydro.com/overview/documents/?eeFront=1&ee=1&eeFolder=Documents%2F50-Study-Reports%2F130-Study-Reports-1-33%2FStudy-10-Fish-Assemblage&eeListID=1

Summary of Bellows Falls Bypass Instream Flow MOU Discussion and Flow Selection

The mitigation concerns related to the relicensing efforts for the Bellows Falls Hydroelectric Project (Project), FERC No. 1855, included selection of instream flow releases through the bypass reach (Bypass). The issues related to Bypass flow releases were treated in multiple confidential discussions between the stakeholders and Great River Hydro (GRH) in June 2020. Confidential meeting minutes, presentations and documents were produced during the process of identifying proposals for operating the projects under new licenses. This memo is intended to place into the public record the essence of those discussions including pertinent presentation material.

The summary below relates to five primary issues regarding Bypass flows:

1. Selection of appropriate species for instream flow modeling;
2. Selection of appropriate life stages for instream flow modeling;
3. Treatment of the existing fish dam in the middle of the Bypass;
4. Selection of appropriate transects used for modeling instream flows; and
5. The magnitude and periodicity of downstream flow releases in the Bypass.

Target Species

Approximately 73% of the Bypass is composed of pool habitat (Figure 1), primarily large, deep bedrock-controlled pools that are relatively insensitive to Bypass discharge (e.g., depth and velocity changes little except at very high flows). Due in part to the insensitivity of such habitats, fish species that are typically associated with deep, slow pool characteristics, such as juvenile and adult walleye and smallmouth bass, were judged to be inappropriate species for assessing flow needs in the Bypass. Consequently, those pool-dwelling species life stages were dropped from the analysis and species more closely associated with flow-sensitive riffle and run habitats, such as dace, suckers, darters, and fallfish, were retained for instream flow modeling.

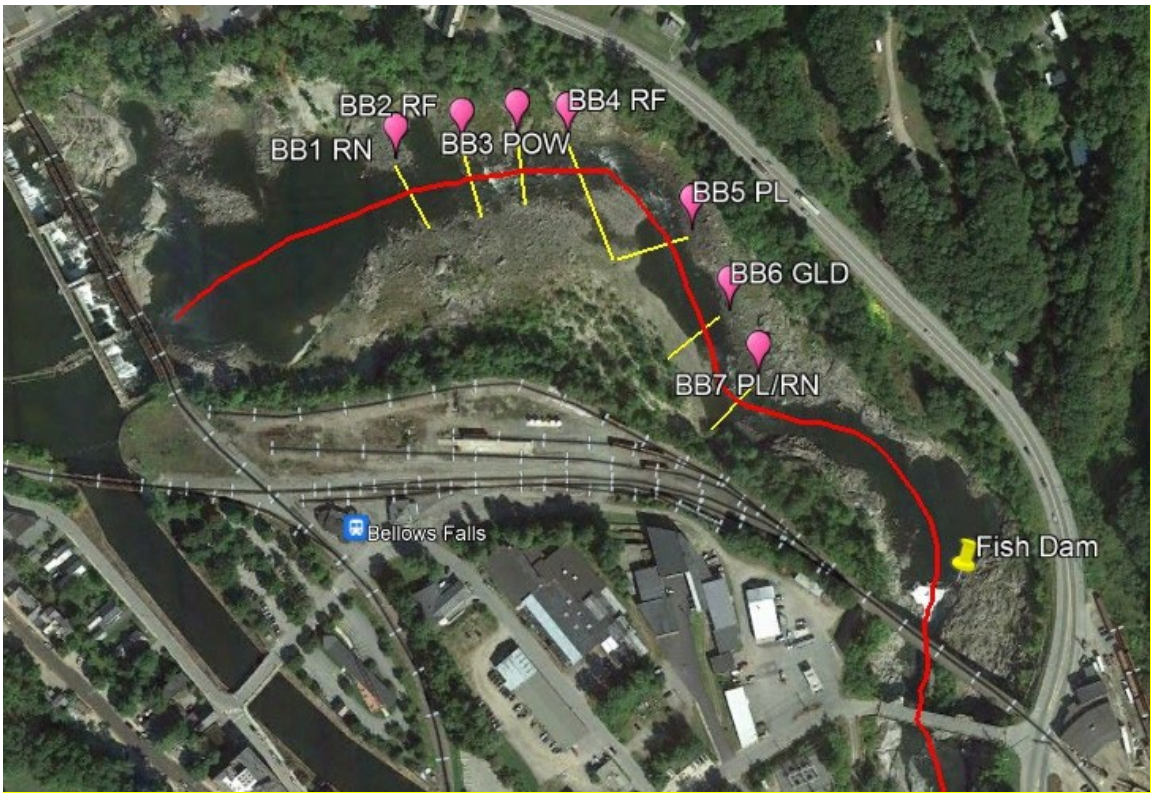


Figure 1. Bellows Falls Bypass reach showing channel (red line), fish dam, and instream flow transects (yellow lines). PL=pool, RN=run, POW=pocketwater, GLD=glide, RF=riffle.

Spawning Life Stages

Most of the target species rely on smaller substrate materials, such as sand, gravel, or small cobbles for successful spawning. However, the bedrock nature of the Bypass combined with the extreme flows that regularly occur during times of spill have removed finer substrate types from the Bypass. Any remaining gravel substrate components are likely restricted to the bottom of the deep pool habitats that are not suitable for spawning. Among the shallower habitats, gravel substrate was only observed in any notable quantity on the lowest transect (#7), which occurred in a pocket just downstream of a glide habitat (Figure 2). Due to the paucity of suitable spawning habitat in the Bypass, the spawning life stages of target species were dropped from the instream flow modeling. suitable spawning habitat in the Bypass, the

spawning life stages of target species Bypass, the spawning life stages of target species were dropped from the instream flow modeling.

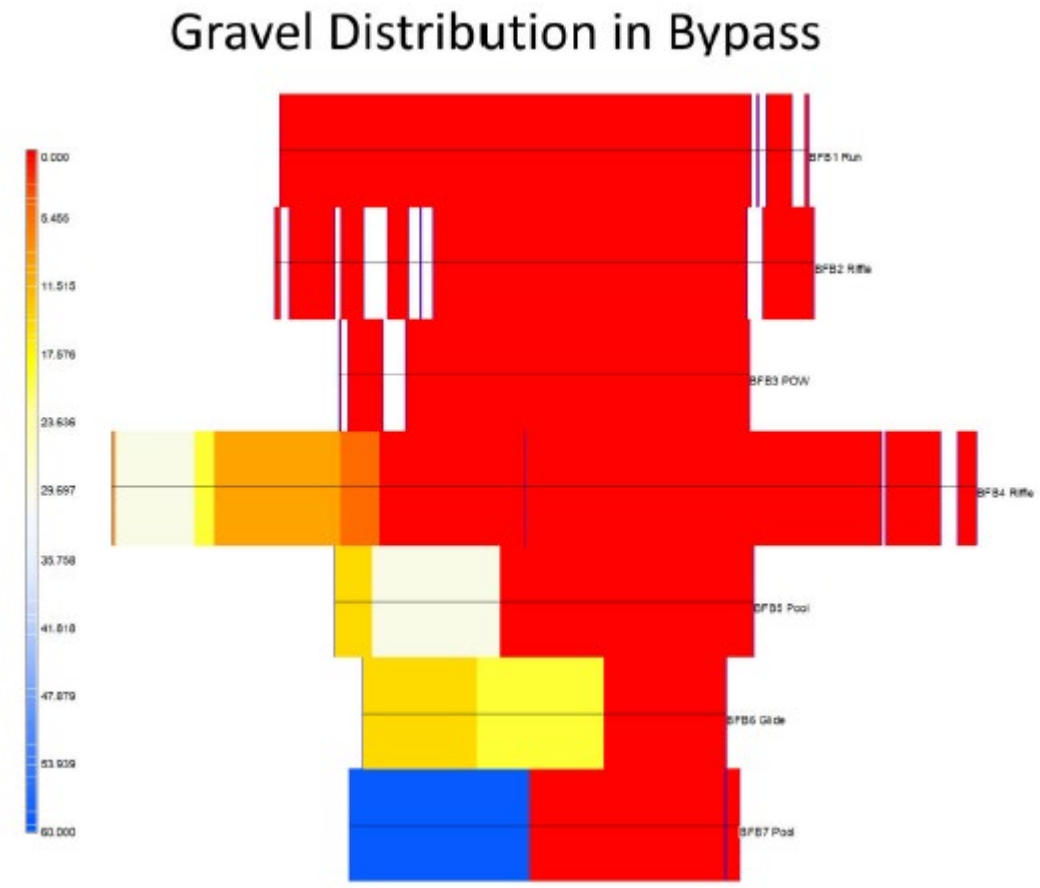


Figure 2. Distribution and percent of gravel substrate along transects in the Bypass reach.

Existing Fish Dam

An 11-foot tall concrete fish barrier dam sits atop an exposed natural ledge drop that exists near the lower extent of the Bypass reach, in the region of deep bedrock pools downstream of the instream flow transects (Figure 1). This dam was installed to prevent upstream migrant Atlantic salmon from being attracted into the Bypass under high spill conditions, and essentially encouraged fish to utilize the fish ladder installed at the base of the powerhouse. The barrier dam and the fish ladder were designed and constructed in consultation with state and federal agencies, specifically to address Atlantic salmon reintroduction program requirements. Due to the abandonment of that program, the dam is no longer a desired feature for these agencies, which will now look to other initiatives (besides GRH and relicensing recommendations) to potentially remove this man-made structure. However, given the lack of spawning habitat for target species in the Bypass and the presence of a natural bedrock drop underlying the existing dam, removal of the dam would not result in improved immigration of or utilization of available habitat by target species in the Bypass.

Selection of Transects for Instream Flow Modeling

Seven transects were placed in the Bypass reach to develop the hydraulic habitat model (Figure 1). Transects were distributed among the shallow water habitats to represent riffle (2), run (1), pocketwater (1), glide (1), and shallow (non-bedrock) pool (2) habitats. Transect #4 was placed where the Bypass channel took a 90-degree bend, however the transect was not wholly perpendicular to flow, but instead the lower (right bank) half of the transect was oriented parallel to flow. Due to this placement, the lower half of the transect ran along the margin of the channel rather than up the bank, and consequently this transect erroneously suggested the channel had a wide band of shallow margin habitat. Initial modeling further suggested that this shallow margin habitat provided an increasing abundance of suitable habitat for target species as flows increased (Figures 3 and 4). However, this result was contrary to all other transects that appropriately extended perpendicular up onto each bank rather than parallel downstream along the channel margin. Because of the misleading results associated with transect #4, the initial assessment of instream flow needs, based on application of the Vermont 401 WQS policy, was biased towards flows of almost 1,000 cfs. To address this source of bias, transect #4 was removed from the hydraulic model and the flow-habitat relationship was reassessed.

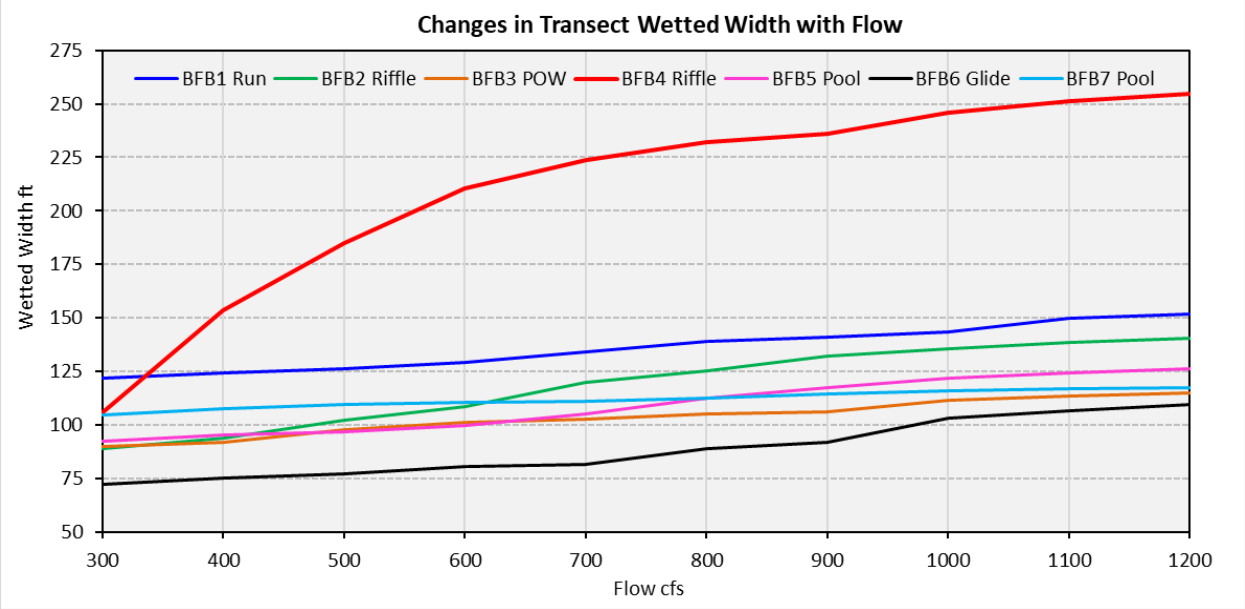


Figure 3. Changes in wetted width with increasing flow, showing rapid change for transect 4 but little change for remaining transects.

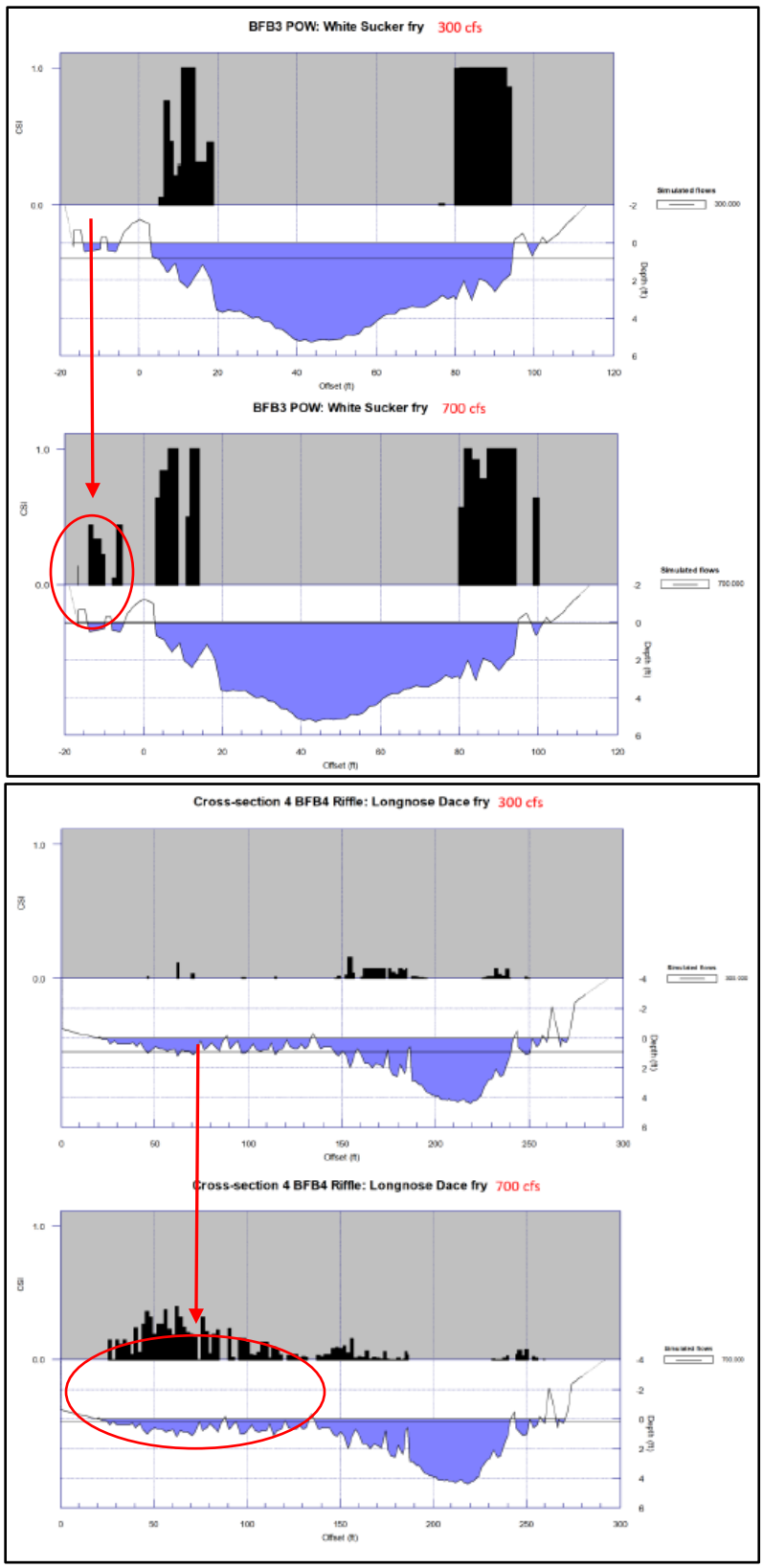


Figure 4. Differences in magnitude and suitability of margin habitat (red circles) at higher flows between transect 3 (upper graphs) and transect 4 (lower graphs).

Magnitude and Periodicity of Bypass Flows

Figures 5, 6, and 7 show the results of the reassessment without transect #4, pool-dwelling species/life stages, or spawning life stages, which resulted in WQS flows ranging from 150 cfs to 330 cfs, depending upon season. Further discussions concluded that providing different seasonal flows was not feasible given the structure of the dam facilities at the head of the Bypass. Consequently, a single year-round flow of 300 cfs was determined to be appropriate for release into the Bypass reach.

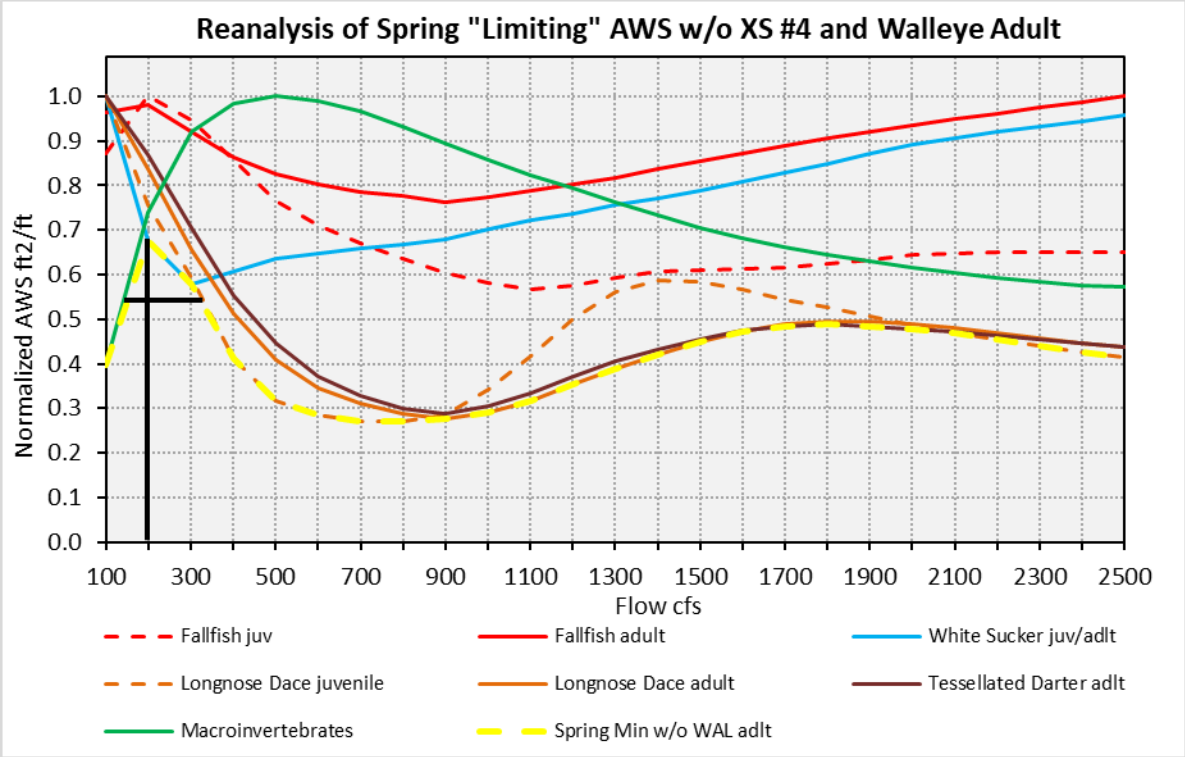


Figure 5. AWS for spring species and life stages, showing limiting AWS (yellow line), maximum value of limiting AWS (thick black vertical line), and range in flows meeting 80% of maximum (thick black horizontal line).

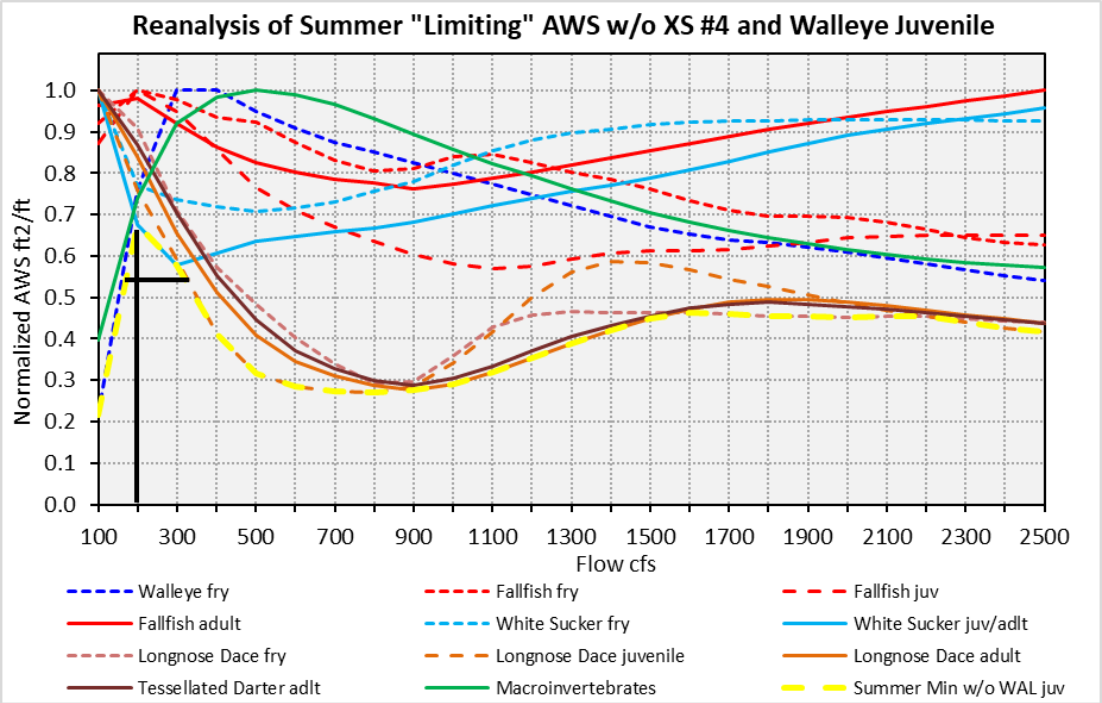


Figure 6. AWS for summer species and life stages, showing limiting AWS (yellow line), maximum value of limiting AWS (thick black vertical line), and range in flows meeting 80% of maximum (thick black horizontal line).

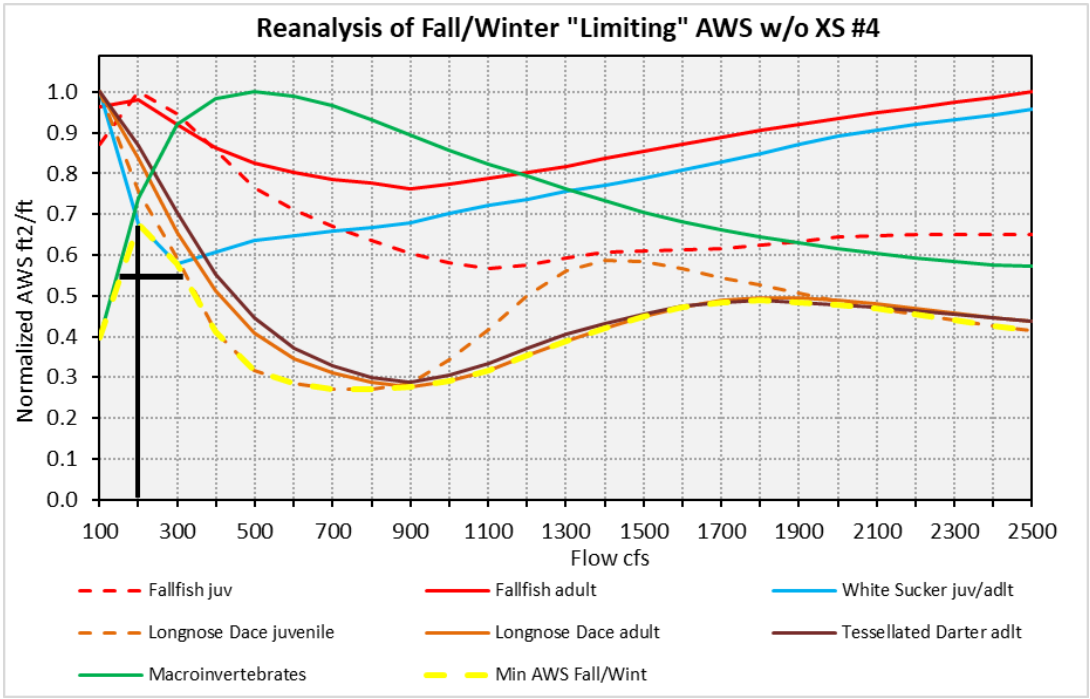


Figure 7. AWS for fall/winter species and life stages, showing limiting AWS (yellow line), maximum value of limiting AWS (thick black vertical line), and range in flows meeting 80% of maximum (thick black horizontal line).