

Monadnock Paper Mills, Inc.  
Attn: Michelle Hamm, Environmental Services Manager  
117 Antrim Road  
Bennington, NH 03442-4205

## **WATER QUALITY CERTIFICATION**

In Fulfillment of

### **Section 401 of the United States Clean Water Act (33 U.S.C 1341)**

WQC # 2013-FERC-001

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**Project Name:** Monadnock Hydroelectric Project  
**Project Location:** Bennington, Greenfield, Peterborough, and Hancock,  
New Hampshire  
**Affected Waterbody:** Contoocook River  
**Owner/Applicant:** Monadnock Paper Mills, Inc.  
117 Antrim Road  
Bennington, NH 03442-4205

**Appurtenant License:** Federal Energy Regulatory Commission No. P-6597

**Date of Approval:** January 31, 2014  
(subject to Conditions below)

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### **A. INTRODUCTION**

Monadnock Paper Mills, Inc. (the Applicant) owns and operates the Monadnock Hydroelectric Project (i.e., the Activity or Project) and proposes the continued operation of the Activity for hydropower generation.

The Activity consists of a series of four existing concrete gravity dams: Powder Mill Pond, Monadnock, Pierce, and Paper Mill, the latter three having existing power stations with a total installed capacity of 1,945 kW. The project works also include four impoundments and appurtenant facilities, including transmission lines. The Activity is located in Hillsborough County, New Hampshire, with impoundments of facilities sited in the towns of Bennington, Greenfield, Peterborough, and Hancock. According to the Applicant, the Activity boundary follows the normal full pond elevation around each of the project impoundments. The upstream extent of the Activity boundary extends approximately 3.6 miles upstream of the Powder Mill Pond headwaters on the Contoocook River. The downstream extent of the Activity boundary is the Antrim Road Bridge over the Contoocook River. The Federal Energy Regulatory Commission (FERC) issued a license for the Project on August 27, 1984; the license expires on August 1, 2014.

This 401 Water Quality Certification (Certification) documents laws, regulations, determinations and conditions related to the Activity for the attainment and maintenance of NH surface water quality standards, including the provisions of NH RSA

485-A:8 and NH Code of Administrative Rules Env-Wq 1700, for the support of designated uses identified in the standards.

## **B. WATER QUALITY CERTIFICATION APPROVAL**

Based on the facts, findings and conditions noted below, the New Hampshire Department of Environmental Services (DES) has determined that there is reasonable assurance that construction and operation of the Activity will not violate surface water quality standards. DES hereby issues this Water Quality Certification (Certification), subject to the conditions in Section E, in accordance with Section 401 of the United States Clean Water Act (33 U.S.C. 1341) and RSA 485-A:12,III.

## **C. STATEMENT OF FACTS AND LAW**

C-1. Section 23 of the United States Federal Power Act (Title 16 U.S. Code, Chapter 12, Subchapter I, Section 817(1)) states

“[i]t shall be unlawful for any person, State, or municipality, for the purpose of developing electric power, to construct, operate, or maintain any dam, water conduit, reservoir, power house, or other works incidental thereto across, along, or in any of the navigable waters of the United States, or upon any part of the public lands or reservations of the United States (including the Territories), or utilize the surplus water or water power from any Government dam, except under and in accordance with the terms of a permit or valid existing right-of-way granted prior to June 10, 1920, or a license granted pursuant to this chapter.”

C-2. Section 4 of the United States Federal Power Act (Title 16, U.S. Code, Chapter 12, Subchapter I, Section 797(e)) authorizes FERC

“[t]o issue licenses to citizens of the United States, or to any association of such citizens, or to any corporation organized under the laws of the United States or any State thereof, or to any State or municipality for the purpose of constructing, operating, and maintaining dams, water conduits, reservoirs, power houses, transmission lines, or other Project works necessary or convenient for the development and improvement of navigation and for the development, transmission, and utilization of power across, along, from, or in any of the streams or other bodies of water over which Congress has jurisdiction...”

C-3. Section 401 of the United States Clean Water Act (Title 33 U.S. Code, Chapter 26, Subchapter IV, Section 1341) states

“[a]ny applicant for a federal license or permit to conduct any activity including, but not limited to, the construction or

operation of facilities, which may result in any discharge into the navigable waters, shall provide the licensing or permitting agency a certification from the State in which the discharge originates or will originate...that any such discharge will comply with the applicable provisions of sections 301, 302, 303, 306, and 307 of this title.”

- C-4. Clean Water Act Section 401(a) states “[n]o license or permit shall be granted until the certification required by this section has been obtained or has been waived...No license or permit shall be granted if certification has been denied by the State...”
- C-5. Clean Water Act Section 401(a) and NH RSA 485-A:12,III authorizes DES to verify that the Project maintains compliance with NH surface water quality standards. RSA 485-A:12, III states:
- “No activity, including construction and operation of facilities, that requires certification under section 401 of the Clean Water Act and that may result in a discharge, as that term is applied under section 401 of the Clean Water Act, to surface waters of the state may commence unless the department certifies that any such discharge complies with the state surface water quality standards applicable to the classification for the receiving surface water body. The department shall provide its response to a request for certification to the federal agency or authority responsible for issuing the license, permit, or registration that requires the certification under section 401 of the Clean Water Act. Certification shall include any conditions on, modifications to, or monitoring of the proposed activity necessary to provide assurance that the proposed discharge complies with applicable surface water quality standards. The department may enforce compliance with any such conditions, modifications, or monitoring requirements as provided in RSA 485-A:22.”
- C-6. Env-Wq 1700, Surface Water Quality Regulations, effective May 21, 2008, fulfills the requirements of Section 303 that the State of New Hampshire adopt water quality standards consistent with the provisions of the Clean Water Act.
- C-7. Env-Wq 1701.02 provides that the surface water quality regulations shall apply to all surface waters and to any person who causes point or nonpoint source discharge(s) of pollutants to surface waters, or who undertakes hydrologic modifications, such as dam construction or water withdrawals, or who undertakes any other activity that affects the beneficial uses or the level of water quality of surface waters.
- C-8. Env-Wq 1702.46 defines surface waters as “perennial and seasonal streams, lakes, ponds and tidal waters within the jurisdiction of the state, including all streams, lakes, or ponds bordering on the state, marshes, water courses and other bodies of water, natural or artificial,” and waters of the United States as

defined in 40 CFR 122.2.

- C-9. Env-Wq 1703.01 (c) states that “[a]ll surface waters shall provide, wherever attainable, for the protection and propagation of fish, shellfish and wildlife, and for recreation in and on the surface waters.”
- C-10. Env-Wq 1703.01 (d) states that “[u]nless the flows are caused by naturally occurring conditions, surface water quantity shall be maintained at levels adequate to protect existing and designated uses.”
- C-11. Env-Wq 1703.19 states that:  
    “(a) The surface waters shall support and maintain a balanced, integrated and adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of similar natural habitats of a region; and  
    (b) Differences from naturally occurring conditions shall be limited to non-detrimental differences in community structure and function.”
- C-12. In 2010, DES published guidance (hereinafter called the 2010 instream flow guidance or 2010 ISF guidance) for estimating instream flow requirements for the protection of aquatic life for situations. The guidance is available at: <http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-11-3.pdf>.
- C-13. FERC issued a license for the Project on August 27, 1984; the license expires on August 1, 2014. The Applicant applied for a new FERC license on July 31, 2012 (i.e., the final license application). FERC completed an Environmental Assessment of the final license application on July 16, 2013.
- C-14. The US Fish and Wildlife Service (USFWS) has provided recommended conditions for the FERC license for the Monadnock Hydroelectric Project to protect, mitigate damages to, and enhance fish and wildlife resources pursuant to Section 10(j) of the Federal Power Act [16 U.S.C. 803(j)(1)]. The recommended conditions and supporting information were presented in letters from USFWS to FERC dated March 14, 2013, August 13, 2013, and September 18, 2013.
- C-15. In 2007, DES issued a 401 Certification for a National Pollutant Discharge Elimination System permit issued to the Applicant by the U.S. Environmental Protection Agency (Permit No. NH0000230). This permit and certification were relevant to a discharge of treated effluent from paper manufacturing processes, not operation of the Monadnock Hydroelectric Project.
- C-16. On February 1, 2013, the Applicant submitted an application and associated supplemental information for Water Quality Certification to DES. On July 19, 2013, DES requested additional information from the Applicant because the information submitted in the application was insufficient to determine whether water quality standards would be met in all areas affected by the Activity. On August 16, 2013, 28 days after the DES request, the Applicant provided the

information that was requested.

- C-17. DES issued a draft Certification for public comment from December 19, 2013 to January 20, 2014.

#### **D. FINDINGS**

- D-1. The Applicant owns and operates the Monadnock Hydroelectric Project, which requires a federal license under Section 23 of the Federal Power Act. The Applicant filed an application for a New Major Project Less than 5 MW to FERC on July 31, 2012.
- D-2. The project requires a Certification under RSA 485-A:12,III and Section 401 of the Clean Water Act.
- D-3. Monitoring requirements are appropriate for this Project during operational and non-operational periods to achieve the goals stated in Section E of this Certification, pursuant to Section 401 of the United States Clean Water Act (Title 33 U.S. Code, Chapter 26, Subchapter IV, Section 1341(d)), which provides that
- “[a]ny certification provided under this section shall set forth any effluent limitations and other limitations, and monitoring requirements necessary to assure that any applicant for a Federal license or permit will comply with any applicable effluent limitations and other limitations...and shall become a condition on any Federal license or permit subject to the provisions of this section.”
- D-4. The Monadnock Hydroelectric Project consists of a series of four existing concrete gravity dams: Powder Mill Pond, Monadnock, Pierce, and Paper Mill, the latter three having existing power stations with an approximate total installed capacity of 1,889 kW. The project works also include four impoundments and appurtenant facilities, including transmission lines.
- a. The Powder Mill Pond Dam is a concrete gravity structure consisting of earthen embankments, with concrete core walls. It is 366 feet long and 18.6 feet high, with a 228-foot-long spillway section provided with 2-foot-high flashboards. At the normal pond elevation (677.44 ft NGVD), the dam impoundment contains 1,940 acre-feet, covers approximately 435 acres, and extends upstream 3.6 miles. The total contributing drainage area at the Powder Mill Dam is 184 square miles.
  - b. The Monadnock Dam is located 4,200 feet downstream of the Powder Mill Dam. The Dam is a concrete gravity dam with a segmented spillway section and earthen embankments. It is a total of 500 feet long with a maximum height of 22 feet, with two spillway sections. The dam has a total impoundment area of approximately 5 acres at the normal pool level (665.8 ft NGVD when flashboards are installed), which extends upstream to the toe of the Powder Mill Dam. Water from the impoundment is diverted through a penstock to a powerhouse that contains two

generating units with a combined installed capacity of 423 kW and an operating range of 77 to 587 cfs. After passing through the turbines, the water is discharged back to the river approximately 100 feet downstream of the dam. The bypass channel at this facility is approximately 50 feet long.

- c. The Pierce Dam is located approximately 900 feet downstream from the Monadnock Dam. The Dam is approximately 28 feet high and 420 feet long with two spillway sections. At normal full pool (653.4 ft NGVD when flashboards are installed), the Pierce Dam impoundment covers 7 acres of surface area. Water from the impoundment is diverted through a penstock to a powerhouse that contains two turbines with combined installed capacity of 720 kW and an operating range of 53 to 493 cfs. After passing through the turbines, the water is discharged through a tailrace. The tailrace partially encircles an island and re-enters the main channel of the river approximately 600 feet downstream of the main dam. The bypass channel at this facility is approximately 750 feet long.
- d. The Paper Mill Dam is located 1,140 feet downstream of the Pierce Dam. Paper Mill Dam is a concrete gravity dam that is 280 feet long and 19 feet high. The Dam creates an impoundment that has a total surface area of approximately 5 acres and extends upstream approximately 1,140 feet at full pool elevation (627.6 ft NGVD). An intake structure and a steel penstock, 10 feet in diameter and approximately 200 feet long, diverts water from the impoundment to the powerhouse in the basement of the Monadnock Paper Mill building. The turbine-generator unit has an actual operating capacity of 746 kW and an operating range of 140 to 466 cfs. After passing through the turbine, the water is discharged through a tailrace and re-enters the river approximately 800 feet downstream of the dam. The bypass channel at this facility is approximately 1300 feet long.
- e. Minimum flows are required at the Project as per Article 26 of the 1984 FERC project license. The Project has a required continuous minimum flow through the Project of 70 cfs or inflow (whichever is less) as measured immediately downstream of the Powder Mill Development and at the confluence of the tailrace and bypass reach of the Paper Mill Development. At each of the three downstream developments (Monadnock, Pierce, and Paper Mill), the current license also requires the Applicant to release a year-round minimum flow of 13 cfs, or inflow (whichever is less), in the bypass reach.
- f. Overall, the Project is operated in a seasonal run-of- river mode. The Powder Mill Pond Dam is operated to regulate the flow of the river to the three lower dams for the maintenance of minimum flows and the generation of power at these sites. The downstream dams, Monadnock, Pierce, and Paper Mill, have generating facilities and are operated in a run-of-river mode, taking advantage of flows released by the Powder Mill Pond Dam. When inflow equals or exceeds required minimum flows plus minimum flows needed for generation, the optimum generating flow (300

cfs) for the three hydroelectric developments downstream is released from Powder Mill Pond Dam. When inflow is less than short-term downstream project generation demands, storage ponding and release can be implemented at the dam to allow for optimum power generating efficiency. According to the Applicant, storage ponding and releasing is typically implemented only occasionally at Powder Mill Pond for maintenance activities at the other downstream developments, to maintain minimum flows to downstream developments, to accommodate flood flows, and rarely for meeting short-term energy demands.

While the licensed operating regime allows for daily or weekly storage and release, the Applicant currently operates on a seasonal store and release mode for 6 months of the year. According to the Applicant this operational regime is more closely associated with maintenance, minimum flows, and flood storage, than with generation. During the summer season, the Applicant maintains Powder Mill Pond at normal full pond elevation in support of NH Fish and Game Department (NHFGD) fishery management objectives (i.e., to promote largemouth bass spawning). Likewise the Applicant does not typically manipulate pond levels for power generation in the winter months which allows for ice-over conditions to be maintained for public fishing.

The Applicant typically conducts a drawdown once per year for annual maintenance on the hydro facilities. This drawdown usually lasts approximately one to two weeks (and sometimes longer) depending on the issues that arise. The Applicant has historically refilled the impoundments for the Project by retaining the excess flow above the amount needed for maintenance of minimum outflow requirements. In a letter dated August 16, 2013 to FERC, the Applicant stated that according to the current license, the Applicant must provide state and federal agencies with notification at least 60 days prior to temporary maintenance drawdowns. The notification identifies the level of drawdown necessary, timing and duration, method for ensuring minimum flow requirements are met during drawdown, and the opportunity for agencies to respond to notification. The Applicant proposes to continue this notification procedure under the new license.

- D-5. The Contoocook River, Powder Mill Pond, other impoundments, and unnamed wetlands in the Project area are surface waters of the state under Env-Wq 1702.46. Surface waters that could be potentially affected by this Activity and their associated AU numbers (where available\*) include the following:

Assessment Unit (AU)	Water body Name
NHRIV700030104-23	Contoocook River – Boglie Brook Dam to Otter Brook
NHRIV700030106-08	Contoocook River – Otter Brook to Powder Mill Pond
NHLAK700030107-03	Powder Mill Pond

Assessment Unit (AU)	Water body Name
NHRIV700030108-03	Contoocook River – Powder Mill Dam to Monadnock Dam
NHIMP700030108-01	Monadnock Dam
NHIMP700030108-02	Pierce Dam
NHIMP700030108-03	Paper Mill Dam
NHRIV700030108-05	Contoocook River – Paper Mill Dam to upstream of Monadnock Paper Mill NPDES

\* DES has assigned Assessment Unit (AU) identification numbers to surface waters that appear on 1:24,000 scale hydrography. Consequently, not all surface waters currently have an AU number. Surface waters that do not have an AU number are still considered surface waters of the State in accordance with Env-Wq 1702.46.

D-6. The surface waters that may be potentially affected by the Activity are all Class B water bodies. Therefore, Class B New Hampshire surface water quality standards apply to the water bodies affected by the Activity. Class B water bodies are considered suitable for fishing, swimming, and, after adequate treatment, as a water supply.

D-7. According to the 2012 list of impaired waters, the following surface waters in the vicinity of the proposed Activity, which have assigned AU numbers, are listed as impaired. All impairments, with the exception of those highlighted in bold (which have approved Total Maximum Daily Load studies), are on the Section 303(d) List.

Assessment Unit (AU)	Water body Name	Cause of Impairment (Designated Use Impaired)
NHRIV700030104-23	Contoocook River – Bogle Brook Dam to Otter Brook	Dissolved Oxygen (AL) <b>Mercury (FC)</b>
NHRIV700030106-08	Contoocook River – Otter Brook to Powder Mill Pond	<b>E.coli (PCR)</b> Aluminum (AL) pH (AL) <b>Mercury (FC)</b>
NHLAK700030107-03	Powder Mill Pond	Chlorophyll-a (PCR) Aluminum (AL) Dissolved Oxygen (AL) Dissolved Oxygen Saturation (AL) <b>Non-Native Plants (AL)</b>
Notes: AL = Aquatic Life, PCR = Primary Recreation, SCR = Secondary Recreation, FC = Fish Consumption, SFC = Shellfish Consumption Impairments highlighted in bold have approved Total Maximum Daily Load studies. All other impairments are on the Section 303(d) List.		

D-8. The Contoocook River within the Activity boundary is impacted by the Activity’s four impoundments, three bypass reaches, and three tailraces. In addition, the

regulated river flows from the Project influence the river flows downstream. The impoundments, bypass reaches, and tailraces are created by the presence of the Powder Mill Dam, Monadnock Dam, Pierce Dam, and Paper Mill Dam. The diversion of water through powerhouses during hydroelectric power generation reduces the quantity of water available to bypass reaches. The presence of dams and the subsequent creation of impoundments at each development reduces water velocity and increases river residence time beyond that which occurs under unimpounded conditions. Store and release operations manipulate water levels in Powder Mill Pond. These conditions may promote variable water quality conditions, particularly water temperature and dissolved oxygen, and can foster the development of aquatic plant communities, including phytoplankton that can influence other water quality parameters such as pH and water clarity.

D-9. Water Quality Study. The Applicant studied the water quality of the Contoocook River from upstream of Powder Mill Pond to below the Paper Mill Dam tailrace during 2010 to address the water quality concerns raised by DES and other resource agencies during the pre-filing consultation period. The study consisted of continuous (every 30 minutes for approximately 2 to 3 weeks) measurements of dissolved oxygen and temperature using datasondes as well as monthly grab samples for nutrients, chlorophyll-a, bacteria, pH, alkalinity, and specific conductance. The study was conducted in June, July, August, and September 2010. During this time, the river flow ranged from approximately 30 to 50 cfs, which is approximately half the normal level for this period based on historical observations from 1945-2008. No hydropower was generated during the study because of the low flows.

- a. Dissolved oxygen was compliant with state water quality standards in all areas except Powder Mill Pond. In Powder Mill Pond, dissolved oxygen fell below state standards (no less than 5 mg/L or a daily average of 75% saturation) on one day (4.92 mg/L and 71% daily average percent saturation on July 26, 2013). This result is consistent with the fact that Powder Mill Pond is listed as impaired for dissolved oxygen in the 2012 NH 303(d) List. The minimum dissolved oxygen in the Monadnock impoundment was just above the dissolved oxygen standards (5.20 mg/L and daily average of 77.1% saturation). The minimum dissolved oxygen in the Pierce and Paper Mill impoundments were substantially above the dissolved oxygen standards (6.43 and daily average of 84.5% saturation in the Pierce impoundment and 6.56 mg/L and daily average of 85.1% saturation in the Paper Mill impoundment). Minimum impoundment temperature ranged from 72.2 °F (22.3 °C) to 75.3 °F (24.1 °C). Maximum impoundment water temperatures ranged from 81.8 °F (27.7 °C) to 84.2 °F (29.1 °C).
- b. Temperature measurements from deployed loggers showed a relatively small increase in average temperature from upstream of the project (71 °F) to below the project (73 °F)<sup>1</sup>.

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1. From Table 4-4, in the July 2012 Final Study Report (p.14 of the 2010 Water Quality Study Report (Revised)).

- c. Nutrient concentrations were highest at the station approximately 1 mile upstream of the Activity, indicating upstream sources of nutrients to Powder Mill Pond. Total phosphorus concentrations ranged from 46 to 106 ug/L upstream of the Activity and 30-48 ug/L downstream. Nitrate and total Kjeldahl nitrogen were only detected upstream of the Activity at 0.1 and 1.59 mg/L, respectively. Ammonia concentrations did not change appreciably from upstream (0.305 mg/L) to downstream of the Activity (0.227-0.26 mg/L).
- d. Chlorophyll-a concentrations were generally low during the study. The highest concentration of 4.76 ug/L was measured in Powder Mill Pond. The measured concentrations do not appear to be representative of conditions in Powder Mill Pond at all times because this water body is listed as impaired for chlorophyll-a on the 2012 NH 303(d) List based on measurements from other studies that exceeded the threshold of 15 ug/L.
- e. Instantaneous measurements of dissolved oxygen and water temperature were taken in the Powder Mill Pond reach and in the bypass channels for the Monadnock and Pierce developments in July, August and September of 2010. Estimated flows ranged from 31 to 56 cfs. The Paper Mill bypass reach was sampled in June and July of 2012. Estimated flows ranged from 31 to 47 cfs. All flow was spilling into the bypass reaches during the sampling events because river flows were too low to generate power. Dissolved oxygen ranged from 6.62 to 8.00 mg/L and temperature ranged from 66.6 °F (19.4 °C) to 75.2 °F (24.0 °C). Monitoring to determine compliance at flows equal to the current minimum allowable bypass flow of 13 cfs and with the 75 percent daily average percent saturation standard [Env-Wq 1703.07 (b)] was not conducted.
- f. Dissolved oxygen and temperature monitoring was not conducted downstream of the Paper Mill facility to determine if state dissolved oxygen standards were met at the minimum flow of 70 cfs.
- g. It is important to note that based on previous studies, Powder Mill Pond is categorized as eutrophic and listed as impaired for dissolved oxygen and chlorophyll-a on the New Hampshire 303(d) List of Impaired Waters. It is also noted that due to the chlorophyll-a and dissolved oxygen violations, a Total Maximum Daily Load study for phosphorus may be conducted for Powder Mill Pond and other reaches of the Contoocook River. Consequently, although samples collected by the Applicant in 2010 did not indicate high chlorophyll-a levels in 2010, historical sampling suggests that sampling conducted under different conditions could result in higher chlorophyll-a levels.
- h. Infrequent occurrences of non-attainment with established dissolved oxygen criteria were observed in Powder Mill Pond in 2010, which is consistent with the impairment for dissolved oxygen in Powder Mill Pond on the 2012 NH 303(d) List. Storing and releasing water from Powder Mill

Pond for hydropower generation has the potential to affect nutrient cycling and dissolved oxygen and chlorophyll-a concentrations. Pollutant loadings from upstream point and nonpoint sources can also impact the concentrations of these parameters. Since 2009, phosphorus loadings from two upstream wastewater treatment plants have been reduced (Jaffrey in 2009 and Peterborough in 2012). The effects of this change in pollutant loading on dissolved oxygen and chlorophyll-a in Powder Mill Pond is unknown.

- i. Based on the above, additional water quality monitoring is warranted to:
  - i. Determine compliance with dissolved oxygen standards (i.e., concentration and daily average percent saturation) in Powder Mill Pond and the Monadnock impoundment, in the river downstream of the Powder Mill Pond dam, in the Pierce and Paper Mill bypass reaches and downstream of the Paper Mill development (i.e., downstream of the confluence of the Paper Mill tailrace and bypass reach) when water levels in Powder Mill Pond are stable and when levels are fluctuated within the full allowable range to generate power and when minimum flows are passed downstream.
  - ii. Determine compliance with chlorophyll-a and nutrient thresholds in Powder Mill Pond under various conditions of operation.

Sampling should be conducted during periods of low flow and high temperature which is when dissolved oxygen is usually lowest and chlorophyll-a the highest. The sampling should include periods when power generation occurs and is absent, as well as when water level in Powder Mill Pond is fluctuated within the full allowable range. Finally, sufficient data should be collected to allow assessments of the surface waters in accordance with the DES Consolidated Assessment and Listing Methodology<sup>2</sup>.

D-10. Freshwater Mussel Study. The Applicant completed a study of freshwater mussels to address concerns raised by DES and other resource agencies during the pre-filing consultation period. The study was conducted in 2010 and consisted of field surveys of the perimeter of each impoundment to a depth of approximately 6 feet and the river reaches below each dam. Ten sites within Powder Mill Pond ranging in size from 0.2 acres up to 3.8 acres were surveyed. Eastern elliptio (*Elliptio complanata*) were found in all sites and were the most dominant species. The eastern floater (*Pyganodon cataracta*) was also found at 3 of the sites in Powder Mill Pond. A single remnant triangle floater shell (*Alasmidont a undulata*) was found in the Pierce reach. Eastern elliptio and eastern floaters are generalists that use pond, lakes and small rivers as preferred habitat. Brook floaters (a state-protected species) were not found during the survey.

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2. The 2012 Consolidated Assessment and Listing Methodology is available at <http://des.nh.gov/organization/divisions/water/wmb/swqa/2012/documents/2012-calm.pdf>

The Applicant concluded that, although somewhat lacking in species diversity, the survey results indicate that Activity waters contain healthy mussel populations and also provide a wide range of reproductive hosts for many of the freshwater mussel species found in New Hampshire.

In a letter dated August 13, 2013 to FERC, the USFWS stated that the mussel survey results showed lower densities in beds found at shallower elevations (i.e., in beds more frequently exposed to routine project operations). By limiting pond fluctuations, mussel distribution and/or abundance could increase in the 674.44 to 675.44 (feet NGVD) range.

In a letter dated May 22, 2011, DES commented that the mussel populations described by the Applicant (i.e., mainly one tolerant species with some indication of the presence of two other species) do not necessarily represent a healthy condition.

- D-11. Baseline Fish Survey and Instream Flow Study. The Applicant completed a baseline fish survey and instream flow study to address fisheries concerns raised by DES and other resource agencies during the pre-filing consultation period. The baseline fish survey took place on October 2011 and consisted of electroshocking at four locations in the study area. Aquatic habitat suitability in relation to instream flow was evaluated using the Instream Flow Incremental Methodology (IFIM) modeling approach and a Physical Habitat Simulation Model (PHABSIM). Field data to calibrate the model was collected in July 2011 for the following river flows:

<b>Site/Reach</b>	<b>Low</b>	<b>Mid</b>	<b>High</b>
Powder Mill	23 cfs	63 cfs	117 cfs
Pierce	23 cfs	63 cfs	117 cfs
Paper Mill	15 cfs	63 cfs	109 cfs
Downstream Antrim	26 cfs	62 cfs	105 cfs

The calibration data were used to populate a PHABSIM model to predict habitat over a range of incremental flows from 10 to 120 cfs. In addition, a habitat duration and time-series analysis was completed so that the frequency and duration of various levels of suitable habitat could be evaluated. The results of the studies have been evaluated by fisheries experts at USFWS and the New Hampshire Fish and Game Department (NHFGD) to determine suitable instream flow levels to protect the fisheries resource. It should be noted that the NHFGD manages Powder Mill Pond as a warmwater fishery. Several bass fishing tournaments are held annually on the pond. NHFGD manages the bypass and riverine reaches of the Contoocook River near Bennington, including the project waters of the Monadnock, Pierce and Paper Mill developments as a put and take

trout fishery. Annual stocking of brown and rainbow trout is conducted below the Powder Mill and Monadnock dams.

- a. The range of flows modeled for the study was from 10 cfs to 120 cfs. The median monthly flows in the study area exceed 120 cfs (the upper end of the instream flow study) during all months other than July through October. Therefore, findings from the study are most applicable to the summer and early fall seasons.
- b. Calibration data was collected at 9 transects: two downstream of Antrim, 4 below the Paper Mill dam, 1 below the Pierce dam, and 2 below the Powder Mill dam.
- c. Weighted useable area (WUA) is a common measure used in instream flow studies to represent the aquatic habitats available to aquatic biota. WUA is calculated using the parameters (depth, velocity and substrate) forecast for each cell<sup>3</sup> as they relate to the Habitat Suitability Indices (HSI) criteria established for the target species and lifestage of interest. Selected target species for use as indicators of habitat suitability were brown trout (adult and juvenile), longnose dace (adult and juvenile) and benthic macroinvertebrates. For each cell the PHABSIM model rates each parameter based on the HSI criteria from 0.0 to 1.0. These values are then multiplied by the known area of the cell. All the areas are then summed to arrive at a total WUA for each transect. The WUA for each transect is then summed to arrive at the total available habitat for each study site, flow increment and target species. One unit of WUA represents 1 square foot of usable habitat.

Results are often expressed as a percent of maximum WUA which is the WUA at a certain flow divided by the highest WUA modeled for the range of flows studied. Since the range of flows studied only represents summer and early fall conditions, the maximum WUA metric represents the percent of WUA available under summer and early fall conditions, not during the entire year.

- d. Due to the short length of the Monadnock Dam bypass reach (50 feet), the Applicant and consulting agencies did not include this reach in the instream flow study. The Applicant has requested that the existing bypass reach minimum flow requirement (13 cfs) be used for the new FERC license. The USFWS agrees and has recommended that the bypass reach minimum flow for the Monadnock Dam continue to be 13 cfs.
- e. The Pierce bypass channel is the second longest bypass reach (750 feet) and is dominated by high gradient falls, fast flowing pool and riffle complexes strewn with large boulders, and large deep pools. The composite WUA / discharge relationship curve for the target fish species

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3. In PHABSIM, a "cell" is an increment of width of a stream channel multiplied by its length to give an area.

for the Pierce dam bypass reach is shown in Figure 9<sup>4</sup> below. Results of the study indicate that the existing Pierce Dam bypass reach minimum flow requirement (13 cfs) provides approximately 40% of maximum WUA for adult brown trout, 50% of maximum WUA for juvenile brown trout, 65% of maximum WUA for adult longnose dace, 95% of maximum WUA for juvenile longnose dace, and approximately 10% of maximum WUA for benthic macroinvertebrates. The Applicant has requested that the existing minimum flow requirement be used for the new FERC license. However, the USFWS has recommended that the bypass reach minimum flow requirement be increased to 40 cfs. Increasing the bypass reach minimum flow to 40 cfs would result in significant gains in WUA for the majority of species/life stages evaluated (see table below).

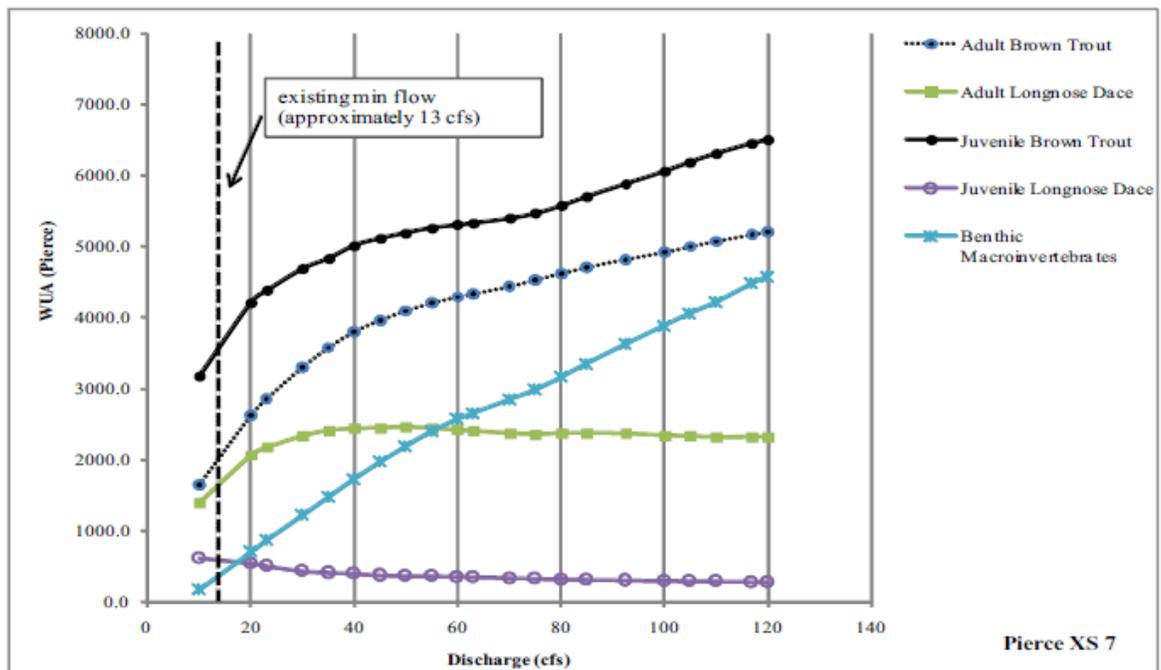


FIGURE 9. COMPOSITE WUA/DISCHARGE RELATIONSHIP FOR THE PIERCE BYPASSED REACH.

Percent of Maximum Weighted Usable Area for Target Fish Species in the Pierce Dam Bypass Reach at Different Flows		
Species	Flow=13 cfs	Flow=40 cfs
Adult Brown Trout	40%	73%
Juvenile Brown Trout	50%	77%
Adult Long Nose Dace	65%	99%
Juvenile Long Nose Dace	95%	65%
Benthic Macroinvertebrates	10%	38%

- f. The Paper Mill dam bypass reach is the longest bypass (1300 feet) and consists primarily of a high gradient bedrock dominated reach below the

4. Figure 9 is from the July 2012 Final License Application.

dam and a low gradient riffle-run-pool habitat complex located immediately upstream of the tailrace. The composite WUA / discharge relationship curve for the target fish species for the Paper Mill dam bypass reach is shown in Figure 8<sup>5</sup> below. Results of the study indicate that the existing Paper Mill bypass reach minimum flow requirement (13 cfs) provides approximately 50% of maximum WUA for adult brown trout, 64% of maximum WUA for juvenile brown trout, 48% of maximum WUA for adult longnose dace, 71% of maximum WUA for juvenile longnose dace, and approximately 25% of maximum WUA for benthic macroinvertebrates. The Applicant has requested that the existing minimum flow requirement be used for the new FERC license. However, the USFWS has recommended that the bypass reach minimum flow requirement be increased to 60 cfs. Increasing the bypass reach minimum flow to 60 cfs would result in significant gains in WUA for the majority of species/life stages evaluated (see table below).

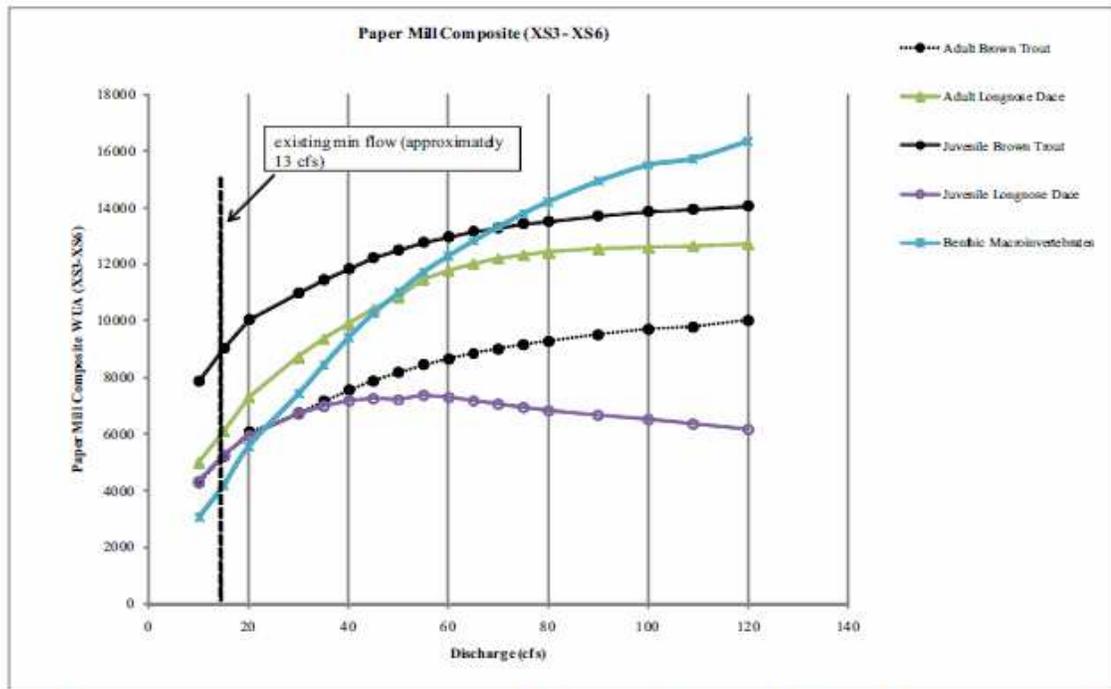


FIGURE 8. COMPOSITE WUA/DISCHARGE RELATIONSHIP FOR THE PAPER MILL BYPASSED REACH.

5. Figure 8 is from the July 2012 Final License Application.

Percent of Maximum Weighted Usable Area for Target Fish Species in the Paper Mill Dam Bypass Reach at Different Flows		
Species	Flow=13 cfs	Flow=60 cfs
Adult Brown Trout	50%	86%
Juvenile Brown Trout	64%	92%
Adult Long Nose Dace	48%	93%
Juvenile Long Nose Dace	71%	99%
Benthic Macroinvertebrates	25%	75%

- g. The results of this study also indicate that the existing instream minimum flow requirement (70 cfs or inflow if less) downstream of the Activity provides approximately 84% of maximum WUA for adult brown trout, 92% of maximum WUA for juvenile brown trout, 99% of maximum WUA for adult longnose dace, 74% of maximum WUA for juvenile longnose dace, and approximately 86% of maximum WUA for benthic macroinvertebrates. The Applicant has requested that the existing minimum flow requirement be used for the new FERC license. The USFWS agrees and has recommended that the minimum flow through the project continue to be 70 cfs (or inflow if less).
- h. The applicant discharges treated effluent to the Contoocook River below the project. Dilution calculations for the discharge permit are based on a 7Q10 low flow in the river of 16.5 cfs. The minimum flow through the project recommended by the applicant and USFWS (70 cfs or inflow) is higher than the 7Q10 and, therefore, should not affect dilution of the treated effluent.
- i. The NHFGD has advised DES (personal communication with Carol Henderson and Executive Director Glenn Normandeau in December 2013), that although the NHFGD recognizes the potential benefit of increasing bypass flows on aquatic habitat and the fish and benthic community in the bypass reaches, their primary concern is the fishery within Powder Mill Pond. Increasing bypass flows could result in more frequent water level fluctuations in Powder Mill Pond to meet the short-term energy demand, which could, in turn, negatively impact the fishery in Powder Mill Pond. With this in mind, the existing minimum bypass flow of 13 cfs at the 3 developments is considered not ideal but acceptable, in this case, by the NHFGD.
- j. Maintaining sufficient instream flows for fisheries is necessary for DES to certify that the water quality standard for biological and aquatic community integrity (Env-Wq 1703.19, see C-11) will be met by the Activity. Based on information above, DES concurs with the USFWS recommendations for minimum flow through the project of 70 cfs and with the NHFGD recommendation to keep existing minimum flow of 13 cfs in the bypass reaches for the Monadnock, Pierce and Paper Mill developments provided that monitoring indicates there is sufficient dissolved oxygen to meet state dissolved oxygen standards at these

minimum flows (see Finding D-9).

D-12. Run of River Operations. Overall, the Activity is operated in a seasonal run-of-river mode with Powder Mill Pond storing and releasing water during certain seasons for maintenance activities at the other downstream developments, to maintain minimum flows to downstream developments (Monadnock, Pierce, and Paper Mill dams), to accommodate flood flows, and rarely for meeting short-term energy demands for generation. The three downstream dams are operated in instantaneous run-of-river mode. During the summer season (May 1 to August 31), the Applicant maintains Powder Mill Pond at normal full pond in support of fishery management objectives (i.e. to promote largemouth bass spawning). Likewise, the Applicant does not typically manipulate pond levels in the winter months (January 1 to February 28), so that ice-over conditions are maintained for public fishing.

- a. The Applicant proposes to continue the current practice of operating Powder Mill Pond in an instantaneous run-of-river mode by maintaining Powder Mill Pond at normal full pool between January 1 and February 28 and between May 1 and August 31 of each year. During the remaining six months in the spring and fall seasons, the Applicant proposes to continue to operate the Powder Mill Pond dam in modified run-of-river mode.
- b. The USFWS has recommended that Powder Mill Pond be maintained at normal full pool from January 1 through February 28 and from May 1 through August 31. The USFWS recommendation is consistent with the Applicant's proposal.
- c. Based on the above information, DES concurs with the Applicant and the USFWS recommendation that Powder Mill Pond be maintained at normal full pool and operated in an instantaneous run-of-river mode from January 1 through February 28 and from May 1 through August 31.

D-13. Powder Mill Pond Water Level Study. The Applicant completed a Drawdown Modeling and Shoreline Habitat Assessment in Powder Mill Pond in 2010. For this study, the Applicant created a bathymetric map of the Powder Mill Pond and maps of abutting wetland communities. The Applicant also reviewed historical records of water surface elevation in the pond between October 1, 2006 and April 30, 2012. This information was used to assess the potential effects of Powder Mill Pond water level management on existing wetland and littoral habitat.

- a. The frequency analysis of average daily Powder Mill Pond water surface elevation showed that the water level was drawn down by 2 feet or less approximately 97.8% of the time. Drawdowns greater than 2 feet occurred 2.2% of the time (approximately 8 days / year on average) and drawdowns greater than 3 feet occurred only 0.2% of the time (approximately 1 day per year on average) over an approximate 5.5 year period. In the last 14 years, the water surface elevation has not been drawn down the full 4-feet authorized in the existing FERC license for the

Activity.

The information from the study is summarized in the table below. The percents of time shown in the table are based on the period October 1, 2006 to April 30, 2012 and include drawdowns for purposes other than power generation, such as flood storage, maintenance, and satisfying minimum flow requirements. According to the Applicant it is impossible to discern from the reservoir elevation data the frequency of drawdown for generation purposes only, however, as indicated in Finding D-4.f, drawdowns to meet short-term power demands are rarely conducted. The maximum number of days per year that the water surface elevation was drawn down more than 2 feet was approximately 18 days in 2011 (from July to November)<sup>6</sup>. According to the Applicant, maintenance drawdowns are conducted once per year and usually last one to two weeks depending on the issues that arise. This suggests that drawdowns greater than 2 feet for power generation and minimum flow have historically occurred no more than approximately 4 to 11 days per year (average of 7 days/year) and much less frequently in most years.

Drawdown Depth from Full Pool in feet	Water Surface Elevation (WSEL) in feet NGVD29	Percent of time* WSEL is at or above this level
0	677.44	58.5%
1	676.44	82.4%
2	675.44	97.8%
3	674.44	99.8%
4	673.44	100%

\* Based on records from October 1, 2006 through April 30, 2012. Values include drawdowns for power generation, maintenance, flood storage and minimum flow.

- b. The bathymetric map and digital terrain model showed how different drawdown levels would affect the surface area, volume, and littoral area of Powder Mill Pond. The data from the study are shown in the following table. A drawdown of 2 feet would reduce the lake area by 24%, lake volume by 46%, and littoral area by 28%. A drawdown of 3 feet would reduce the lake area by 34%, lake volume by 64%, and littoral area by 38%.

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6. From Table 3-1 in the July 2012 Final License Application.

Draw-down Depth from Full Pool in feet	Lake Surface Area		Lake Volume		Lake Littoral Area*	
	Acres	% of full pool	Acre-feet	% of full pool	Acres	% of littoral area
0	508	100%	1932	100%	449	100%
1	438	86%	1460	76%	378	84%
2	384	76%	1051	54%	325	72%
3	337	66%	691	36%	278	62%
4	291	57%	377	19%	232	52%
5	139	27%	157	8%	79	18%
6	60	12%	66	3%	0	0%
7	35	7%	19	1%		
8	6	1%	1	0%		
9	0	0%	0	0%		

\* Littoral area is defined as the lake surface area between 0 and 6 feet in depth (449 acres, which is 508 acres at 0 feet minus 60 acres at 6 feet). Changes in littoral area were estimated from changes in lake surface area.

- c. Studies of the riparian wetlands around the edge of Powder Mill Pond found that existing and historic operations have resulted in a productive system with a diverse array of wetland and aquatic habitats. Given that the conditions in this Certification do not significantly modify existing operations, the effects of operating the Activity in accordance with this Certification on existing wetland and plant communities is expected to be minimal.
- d. The existing FERC license permits a maximum drawdown depth of 4 feet. The Applicant is proposing to change the maximum drawdown at the Powder Mill Pond Development to 3 feet below the permanent crest elevation of the dam (maximum drawdown elevation of 672.44 ft NGVD) except in cases of maintenance or emergency preparedness.
- e. The USFWS has recommended that the maximum drawdown depth for power generation be 2 feet (maximum draw down elevation of 675.44 feet NGVD). To justify this recommendation, USFWS cited the following information:
  - i. Mussel survey results indicate that mussel densities were lower in beds that were more frequently exposed during drawdowns. By limiting the drawdown range, the mussel distribution and/or abundance in Powder Mill Pond could increase. (See Finding D-10 for more information on the mussel study)
  - ii. Limiting drawdowns to 2 feet would protect a significant amount of littoral area from exposure. A 3-foot drawdown would expose 26% of the littoral area. A 2-foot drawdown would expose 19% of the littoral zone. Therefore, a 2-foot drawdown limit would prevent 30 of the 449 acres (or 7%) of the littoral area from being exposed.

- iii. Maintaining Powder Mill Pond at a higher elevation would help to limit the occurrence of variable leaf milfoil. (See Finding D-15 for more information on milfoil infestation in Powder Mill Pond)
  - iv. The Applicant has stated that drawdowns in excess of 2 feet occur infrequently. However, there is no guarantee that the Applicant will continue to operate the Activity in the same manner in the future without enforceable limits.
  - v. The Baseline Fish Survey found that the majority of the most abundant species in Powder Mill Pond were in the young of year age class. The lack of older, spawning age fish is of concern. Therefore, USFWS disputes the claim that the Powder Mill Pond fishery is well supported despite infrequent drawdowns below 2 feet in the past.
- f. The Applicant currently fluctuates Powder Mill Pond for power generation for 6 months of the year ( March and April and September through December).
- g. The NHFGD (personal communication with Carol Henderson in December 2013) recommends that fall drawdowns for lakes be made no later than November 1 (and preferably before October 15) in order to protect hibernating wildlife from exposure. To ensure that drawdowns below 2 feet are not conducted during critical periods (such as fish spawning), the NHFGD has also requested that the Applicant be required to contact them at least 14 days in advance, and receive their approval, prior to drawing Powder Mill Pond down lower than 2 feet. This will help ensure protection of the fishery.
- h. During the spring season (March 1 through April 30), river flows are typically higher than the hydraulic capacity of the turbines in the development. The mean of the daily average flows at the project in March and April are 616 and 948 cfs, respectively. The maximum hydraulic capacity for power generation by the project is 587 cfs (at the Monadnock development). Therefore, it is unlikely that modified run-of-river operations (i.e., storage and release at Powder Mill Pond) will be necessary during most of the spring season.
- i. During the fall season (September 1 through December 31), river flows are lower. The mean of the daily average flows at the project in September, October, November, and December are 130, 204, 313, and 377 cfs, respectively. These flows fall within the operating range of 53 to 587 cfs for the turbines in the downstream developments. Therefore, it is likely that the storage and release of water in Powder Mill Pond during this four-month period would occur more frequently as compared to the months of March and April.
- j. USFWS recommends that Powder Mill Pond be drawn down and refilled gradually during the spring and fall on a weekly or seasonal basis.

- k. As discussed in Finding D-9, water quality impairments (dissolved oxygen and chlorophyll-a) have been documented in Powder Mill Pond. Drawing the pond down excessively and frequently may exacerbate these violations. As a minimum, to prevent conditions from becoming worse, restrictions should be in place to prevent the magnitude and frequency of drawdowns (especially those below 2 feet) from exceeding historical levels.
- l. Based on the above, DES has determined that the following fluctuation requirements in Powder Mill Pond are necessary to support and maintain a balanced, integrated, and adaptive community of organisms per Env-Wq 1703.19.
  - i. Limit the maximum drawdown to 3 feet (except for maintenance and emergency drawdowns) as proposed by the Applicant.
  - ii. To ensure the frequency of drawdowns below 2 feet continue to occur very infrequently and closely match historical practices, require that drawdowns below 2 feet (for any reason) occur no more than approximately 2% of the time over any 5 year period and that drawdowns below 2 feet for power generation occur no more frequently than 7 days in any given year.
  - iii. To protect hibernating wildlife from exposure, require that drawdowns in November and December be limited to no more than 6 inches below the top of the Powder Mill Pond flashboards (i.e., no less than 676.94 feet NGVD). According to the table presented in Finding D-13b, a 6-inch drawdown would expose about 7% of the lake area (35 acres), which is much less than the area that can be currently exposed at a 2 foot drawdown (24% or 124 acres). This should improve survival of hibernating wildlife along the shores of Powder Mill Pond while still providing the Applicant with the some flexibility to operate the pond in a storage and release mode to supplement power generation (which, according to the Applicant, is rarely done for meeting short-term energy demand).
  - iv. To ensure that drawdowns below 2 feet are not conducted during critical fishery periods (such as fish spawning), and except in the case of emergencies, require the Applicant to notify the NHFGD at least 14 days in advance and receive NHFGD approval prior to drawing Powder Mill pond down below 2 feet for any reason. As noted in Finding D-4.f, the Applicant is currently required to provide a 60 day notification for maintenance and proposes to continue this procedure under the new FERC license.

D-14. Ramping Rate Study (Drawdown and Refill). The Applicant completed a Drawdown Modeling and Shoreline Habitat Assessment to address concerns raised by DES and other resource agencies during the pre-filing consultation period. The drawdown modeling consisted of predicting the rate of change for

water levels and shoreline exposure during typical drawdowns.

- a. The drawdown study assumed that 300 cfs would be released from Powder Mill Pond during a typical drawdown. According to the Applicant, this release rate is equivalent to the minimum hydraulic capacity of the three downstream developments (i.e., 300 cfs at Paper Mill), which is likely representative of an optimal release for generation that could occur. This is not the minimum flow needed to generate power. The minimum flows needed to generate power and maintain minimum bypass flows at each facility are 90 cfs at the Monadnock, 70 cfs at the Pierce, and 153 cfs at the Paper Mill facility. The model showed that, for inflows of 100 and 200 cfs, the drawdown would expose littoral area in Powder Mill Pond at rates between 3.5 and 2 acres per hour, respectively. These rates would amount to exposing 19% and 11% of the littoral area in the first 24 hours of the drawdown, respectively.
- b. For a drawdown that lowers the water level by 2 feet while releasing 300 cfs, the maximum rate that the water level would change would be approximately 0.7 inches per hour (or approximately 16 inches per day) over 1.5 days. This calculation assumes no inflow so it is an over-estimate of the typical rate of water level drawdown. For a drawdown that lowers the water level by 2 feet while releasing 300 cfs, and assuming an inflow of 100 cfs, the maximum rate that the water level would change would be approximately 0.5 inches per hour (or approximately 11 inches per day) over 2.2 days.
- c. The drawdown study also modeled how long it would typically take to refill Powder Mill Pond after a drawdown. For the range of daily average flows in September and October, the pond would refill within 1.3 to 6.4 days from a 2-foot drawdown, assuming the minimum flow of 70 cfs continued to be released. The rate of water level change during the refill for this scenario would be between 0.1 and 0.7 inches per hour.
- d. The NHFGD (personal communication with Carol Henderson in December 2013) recommends a maximum drawdown rate of 6 inches per day to allow adequate time for aquatic organisms, such as mussels, to move and stay sufficiently submerged as the water level gradually recedes. This could improve the health and density of the mussel population, especially in the top 2 feet of Powder Mill Pond (elevation 675.44 to 677.44 NGVD) that is most prone to fluctuations. According to the 2010 mussel survey (see Finding D-10), mussel densities were lower in the top 2 feet as compared to deeper waters.

For a drawdown that lowers the water level by 2 feet at a rate of 6 inches per day, and assuming no inflow (which is conservative) the maximum release is estimated to be approximately 110 cfs which still exceeds the minimum flow needed to generate power and maintain minimum bypass flows at the Monadnock (90 cfs) and Pierce (70 cfs) facilities. With increasing inflow, the ability to generate power will also increase. Since

the Applicant has stated that drawdowns for short-term power generation rarely occur, a maximum ramping rate of 6 inches per day during drawdown is not expected to have a significant impact on project operation.

- e. USFWS recommends that Powder Mill Pond be drawn down and refilled gradually during the spring and fall on a weekly or seasonal basis. Further, after flashboard replacement, dam maintenance or emergency drawdown, USFWS recommends the project be operated such that 50 percent of the inflow is passed downstream and refilling of the impoundments with the remaining 50 percent of inflow. USFWS notes that this deviates from the standard agency ratio of 90/10 (pass 90 percent of inflow and refill on the remaining 10 percent) but is warranted in this case due to the wetland resources in Powder Mill Pond. They further recommend that if more than one headpond is drawn down at the same time, the 50/50 protocol should be adjusted on prior consultation with the resource agencies. As stated in Finding D-4.f, this differs from current practice wherein the Applicant has historically refilled the impoundments for the Project by maintaining minimum flow requirements and retaining the remainder of inflow.
- f. Based on information presented above, and to support and maintain a balanced, integrated, and adaptive community of organisms per Env-Wq 1703.19 a maximum ramping rate during drawdowns (except in the case of emergencies) of 6 inches per day should be required. Further to balance the refilling of the impoundments as quickly as possible with downstream flow, refilling of the impoundments after flashboard replacement, dam maintenance or emergency drawdown, should be conducted such that when inflow equals or exceeds 93 cfs, the minimum downstream flow of 70 cfs shall be released and the remainder shall be used for refill. When inflow is less than 93 cfs, 75% of the inflow shall be passed downstream and 25% shall be used for refill.

D-15. Wetlands, Noxious Weeds, and Rare, Threatened and Endangered (RTE) Species. The Applicant completed a study of wetlands, noxious weeds, and RTE species to address concerns raised by DES and other resource agencies during the pre-filing consultation period. The study was completed in 2010 and consisted of field surveys and delineation of jurisdictional wetlands.

- a. Wetlands and submerged aquatic vegetation beds are prevalent throughout the Project, especially within Powder Mill Pond. Powder Mill Pond can be characterized as a typical freshwater pond that provides suitable habitat for a variety of common wildlife species and aquatic wetland plants. Specifically, the most significant wetlands in terms of their habitat value occurred in the sheltered backwater coves along the pond especially those associated with Moose Brook. The surrounding uplands and wetlands in the study area are forested and largely undisturbed, thus invasive plant species were not prevalent.

- b. Variable leaf milfoil was the dominant invasive submerged aquatic vegetation in the study area. Milfoil was concentrated and prevalent in Powder Mill Pond, occurring in dense mats almost uninterrupted along the shoreline. Public boating access to Powder Mill Pond has likely contributed to the introduction and spread of variable leaf milfoil throughout the pond.
  - c. There were no direct observations of RTE plants or wildlife in the study area during the 2010 surveys. However, suitable habitat for some RTE wildlife species such as bald eagle and Blanding's turtle was documented in the study area. Some RTE species are known to occur in the study area.
  - d. Based on the diversity of aquatic habitats and prevalence of wetlands found at Powder Mill Pond, seasonal drawdowns (less than 2 feet 98% of the time) do not appear to have a significant adverse affect on existing wetlands and aquatic habitats.
  - e. In a letter to FERC dated March 14, 2013, the USFWS recommended that the Applicant be required to develop and implement a plan for monitoring and controlling invasive species. Absent sufficient monitoring and control, it is likely that noxious weeds (such as Variable Leaf Milfoil) will become more abundant in Powder Mill Pond. Given the abundance and diversity of native wetlands within the project area, long-term monitoring and control of invasive species should be a high priority.
  - f. Based on information presented above, DES believes that invasive species such as variable leaf milfoil present a significant threat to native habitats and wildlife in Powder Mill Pond and that monitoring should be conducted to track the spread of invasive species and that the Activity should be operated in a manner consistent with control efforts.
- D-16. Anadromous Fish. The four dams in the Project do not have fishways for upstream fish passage currently. USFWS and NHFGD manage Atlantic salmon and other anadromous fish in rivers of New Hampshire. There are currently no anadromous fish within the project area, nor are there currently any plans to restore anadromous fish to portions of the Contoocook River upstream of Paper Mill Dam. In a letter on March 14, 2013, the USFWS made the following fishways recommendation under Section 18 of the Federal Power Act: "Authority is hereby reserved to the Federal Energy Regulatory Commission to require the licensee to construct, operate, and maintain such fishways as may be prescribed during the term of this license by the Secretary of the Interior pursuant to Section 18 of the Federal Power Act."

## **E. WATER QUALITY CERTIFICATION CONDITIONS**

Unless otherwise authorized by DES, the following conditions shall apply:

- E-1. **Compliance with Certification Conditions.** The Applicant shall operate and maintain the Activity to comply with the conditions of this certification.
- E-2. **Compliance with Water Quality Standards.** The Activity shall not cause or contribute to a violation of New Hampshire surface water quality standards. Should DES determine that the Activity is causing or contributing to violations of surface water quality standards, DES may modify this Certification in accordance with condition E-4 of this Certification.
- E-3. **Approval of Project Changes.** The Applicant shall consult with and receive prior written approval from DES regarding any proposed modifications to the Activity that could have a significant or material effect on the facts, findings or conditions of this Certification, including any changes to project operation or approved plans required by this Certification.
- E-4. **Modification of Certification.** The conditions of this Certification may be amended and additional terms and conditions added as necessary to ensure compliance with New Hampshire surface water quality standards, when authorized by law, and after notice and opportunity for hearing.
- E-5. **Reopening FERC License.** DES may, at any time, request that FERC reopen the license for the Activity to consider modifications to the license if necessary to ensure compliance with New Hampshire surface water quality standards.
- E-6. **Compliance Inspections.** The Applicant shall allow DES to inspect the Activity and its impacts on affected surface waters at any time to monitor compliance with the conditions of this Certification.
- E-7. **Posting of Certification and Operation and Maintenance Plan.** A copy of this Certification and the approved Operation and Maintenance Plan (condition E-10) shall be posted within each of the Project powerhouses within seven days of receiving written approval of the Operations and Maintenance Plan from DES.
- E-8. **Transfer of Certification.** Within 15 days after filing an application with FERC for transfer of ownership of the FERC license, the Applicant shall provide a copy of the application to DES. Within 15 days following a transfer of ownership for the FERC license and/or this Certification, the Applicant shall notify DES in writing of the date of the transfer and provide contact information (legal name, mailing address, email (if available) and phone number) for the new owner.
- E-9. **Project Operation:**
  - a. The Applicant shall operate the project in a seasonal run-of-river mode. During the periods January 1 to February 28 and May 1 through August 31, inflow to the Powder Mill Pond shall equal outflow immediately downstream from the confluence of the Paper Mill bypass reach and tailrace on an instantaneous basis. At all times, fluctuations of the Monadnock, Pierce and Paper Mill impoundment water surface elevations shall be minimized. This operating regime may be temporarily modified for short periods due to operating emergencies beyond the control of the Applicant or other reasons after consulting with DES, the NHFGD and USFWS (see Condition E-9.e below for notification requirements).
  - b. Unless due to operating emergencies beyond the control of the Applicant (such as flashboard failure due to high flows), pre-approved maintenance, or

other reasons specified in the DES approved Operations and Maintenance Plan (see Condition E-10), the Applicant shall maintain the Powder Mill Pond water surface elevation at or above 677.44 feet NGVD (top of flashboards) from January 1 to February 28 and from May 1 through August 31 and at or above 676.94 NGVD (6 inches below the top of flashboards) from November 1 through December 31. At all other times (except for emergencies, pre-approved maintenance or other reasons specified in the DES approved Operations and Maintenance Plan) the elevation shall be kept between 674.44 feet and 677.44 feet NGVD. Drawdowns (for any reason) below 675.44 feet NGVD shall be minimized and shall not occur more frequently than the historical average of approximately 2% of the time over any five year period and no more than 7 days in any given year for meeting short-term power demand. In addition, at all times, the Applicant shall maintain:

- i. The Monadnock impoundment water surface elevation at least one inch above the top of the flashboards (665.88 feet NGVD) when flashboards are in place or at least 1 inch above the dam crest (663.88 feet NGVD) when the flashboards have been temporarily removed due to failure or other reasons;
  - ii. The Pierce impoundment water surface elevation at or above the top of the flashboards (653.4 feet NGVD) or at or above the dam crest (651.4 NGVD) when the flashboards have been temporarily removed due to failure or other reasons; and
  - iii. The Paper Mill impoundment water surface elevation at or above the crest of the dam (627.6 feet NGVD; there are no flashboards at this facility).
- c. Except in the case of emergencies or for other reasons specified in the DES approved Operations and Maintenance Plan (see Condition E-10), the maximum drawdown rate shall be no more than 6 inches per day.
  - d. Flashboards shall be reinstalled as soon as reasonably practicable after failure or temporary removal for other reasons.
  - e. Except as noted below, the Applicant shall notify and receive NHFGD approval prior to drawing Powder Mill Pond down for maintenance or below 2 feet (elevation 675.44) for any reason. Notification shall identify the level of drawdown necessary, timing and duration, and method for ensuring minimum flow and refill requirements are met. Notification shall be provided at least 60 days in advance unless due to operating emergencies beyond the control of the Applicant [such as flashboard failure due to high flows or other situations described in the DES approved Operations and Maintenance Plan (Condition E-10)] in which case notification shall be provided as soon as reasonably practicable but no longer than 24 hours after the emergency event has occurred. DES and NHFGD approval is not required prior to drawing the pond down for emergency situations such as when extreme levels of precipitation are forecasted and it is necessary to draw the pond down to reduce the potential for flooding, or other emergency situations as described in the DES approved Operations and Maintenance Plan.

- f. During periods when the Powder Mill impoundment water surface elevation may fluctuate, the Applicant shall provide a minimum flow of 70 cfs, or inflow (whichever is less), immediately downstream of the Powder Mill Development and at the confluence of the tailrace and bypass reach of the Paper Mill Development. This flow is contingent upon monitoring data which confirms that state water quality standards for dissolved oxygen are attained at this flow downstream of the Paper Mill development. If monitoring indicates that this minimum flow is not sufficient to meet state dissolved oxygen standards, the applicant shall conduct a study to determine the minimum flow that is sufficient to meet state dissolved oxygen standards. The new approved minimum flow shall then become the required minimum flow and the Operations and Maintenance Plan (see Condition E-10) shall be revised accordingly to reflect this change.
- g. The Applicant shall provide the following year-round, continuous minimum flows to the project bypass reaches provided these flows are confirmed to meet state water quality standards for dissolved oxygen (Env-Wq 1702.19):
  - i. 13 cfs, or inflow (whichever is less), at the Monadnock facility;
  - ii. 13 cfs, or inflow (whichever is less), at the Pierce facility; and
  - iii. 13 cfs, or inflow (whichever is less), at the Paper Mill facility.

If monitoring indicates that any of these bypass flows are not sufficient to meet state dissolved oxygen standards, the applicant shall conduct a study to determine the bypass flow that is sufficient to meet state dissolved oxygen standards. The new approved bypass flow shall then become the required minimum flow for that bypass reach and the operations and maintenance plan (see Condition E-10) shall be revised accordingly to reflect this change.

- h. During refilling of the impoundments after flashboard replacement, dam maintenance or emergency drawdown, the Applicant shall operate the project such that when inflow equals or exceeds 93 cfs, the minimum downstream flow of 70 cfs shall be released and the remainder shall be used for refill. When inflow is less than 93 cfs, 75% of the inflow shall be passed downstream and 25% shall be used for refill. If the Applicant anticipates refilling more than one impoundment at once, prior consultation with the DES, NHFGD, and USFWS shall be required so that an appropriate refill regime may be developed. This refill protocol may be modified on a case-by-case basis after consulting with DES, NHFGD, and USFWS and after receiving written approval from DES.

**E-10. Operation and Maintenance Plan:**

- a. Within two (2) months (or a later date acceptable to DES) from the effective date of the license, the Applicant shall submit to, and obtain DES approval of an Operation and Maintenance Plan for the Activity that describes in detail how the Activity will be operated and maintained to comply with run-of-river, minimum flow and impoundment fluctuation requirements included in this Certification (Condition E-9). The plan shall also include procedures that will be implemented should the Activity not be in compliance with the conditions of this Certification, including notification of appropriate regulatory authorities

and a schedule for implementation of the plan. The Applicant shall then implement the approved plan.

- b. Any proposed modifications to the approved Operation and Maintenance Plan shall be submitted to DES for review and approval. Proposed modifications shall not be implemented until approved by DES. Exceptions to the approved Operation and Maintenance Plan may be granted by DES on a case-by-case basis, as necessary, in consultation with the Applicant, USFWS, and NHFGD.
  - c. The Applicant shall notify DES not more than 24 hours after any significant deviations from the approved Operation and Maintenance Plan. The notification shall include an explanation as to why the deviations occurred, a description of corrective actions taken, and how long it will take until the operations will comply with the approved Operation and Maintenance Plan. The Applicant shall maintain a log of deviations. A summary of the deviations shall be submitted annually to DES not later than December 31 of each year. The submittal shall also include the number of days drawdowns below 2 feet (elevation 675.44) occurred in Powder Mill Pond during the year as well as the reason and duration for each drawdown below 2 feet (i.e., power generation, maintenance, flood storage, minimum flow, etc.).
- E-11. **Monitoring and Reporting Plan for Impoundment Level and Flow:** Within three (3) months (or a later date acceptable to DES) from the effective date of the FERC license, the Applicant shall prepare and submit to DES for approval, a plan for monitoring, recording and reporting impoundment water surface elevations, inflows, turbine flows, bypass flows and power generation. To the maximum extent feasible, monitoring and recording of data shall be automated and collected continuously (i.e., at least every hour). The plan shall include a description and design of the mechanisms and structures that will be used, including equipment accuracy, frequency of measurement, the level of automation and any periodic maintenance and/or calibration necessary to ensure the devices work properly. The plan shall also address how data will be recorded to verify proper operations and how these data will be maintained for inspection by DES and other resource agencies. The plan shall also include a schedule for when the plan will be implemented. The Applicant shall consult with DES, NHFGD, and USFWS in developing these plans and shall respond to agency comments. The Applicant shall then implement the DES approved plan.
- E-12. **Water Quality Sampling and Analysis Plan:** The Applicant shall conduct water quality monitoring surveys after the FERC license is reissued. Prior to conducting the surveys a Sampling and Analysis Plan (SAP) shall be developed in consultation with DES, NHFGD, and USFWS, and shall be submitted to DES for approval within two (2) months (or a later date acceptable to DES) from the effective date of the license. The Applicant shall then implement the approved SAP. Unless otherwise authorized or directed by DES, the SAP shall, as a minimum, include the following.
- a. Continuous (at least every 30 minutes) monitoring for dissolved oxygen (concentration and daily average percent saturation) and temperature in Powder Mill Pond and the Monadnock impoundment, in the river downstream of the Powder Mill Pond dam, in the Pierce and Paper Mill bypass channels, and in the river downstream of the Paper Mill

development during periods of low flow and high temperature. Measurements shall include times when the minimum flows are being passed as well as when water levels in Powder Mill Pond are stable and being fluctuated for power generation. If requested by DES, dissolved oxygen and temperature profiles shall also be taken in the impoundments mentioned above.

b. Monitoring for chlorophyll-a (algae) and nutrients in Powder Mill Pond.

c. Sampling and laboratory protocols, including quality assurance/ quality control provisions.

d. Sufficient monitoring to allow the surface waters to be assessed for compliance with these parameters in accordance with the DES Consolidated Assessment and Listing Methodology<sup>7</sup>.

e. Initiation of data collection during the first low-flow season (i.e., stream flows less than three times 7Q10) after FERC license issuance. Depending on the results of the first year, DES may require additional years of monitoring.

f. A schedule for filing summary reports, a description of what will be provided in the reports and a schedule for uploading monitoring results into the DES Environmental Monitoring Database (EMD).

**E-13. Invasive Species:**

- a. The Applicant shall, within six (6) months (or a later date if acceptable to DES) from the effective date of the license, prepare and submit to DES for approval, a plan to monitor invasive plant species, such as variable leaf milfoil (*Myriophyllum heterophyllum*), yellow iris (*Iris pseudacorus*), and purple loosestrife (*Lythrum salicaria*), at the project. The plan shall include, but not be limited to, the following: (1) a description of the monitoring method; (2) frequency of monitoring; (3) a schedule for filing monitoring reports with DES, NHFGD, USFWS, and FERC; and (4) a description of and implementation schedule for providing public information about species. The Applicant shall consult with the DES, NHFGD and USFWS in developing the Invasive Species Monitoring Plan and shall then implement the DES approved plan.
- b. The Applicant shall participate with DES and others in the development of a Long Term Management Plan (LTMP) to control invasive species in Powder Mill Pond and shall comply with any Project operational requirements specified in the DES approved LTMP provided they do not conflict with this Certification.

**E-14. Fish Passage.** Should the Secretary of the Interior pursuant to Section 18 of the Federal Power Act require the Applicant to construct, operate and maintain any fish passage facilities for the Project, those requirements shall become a condition of this Certification.

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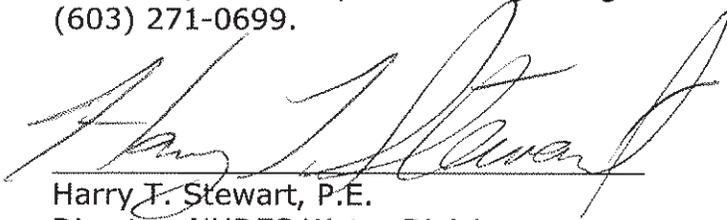
<sup>7</sup> The 2012 Consolidated Assessment and Listing Methodology is available at <http://des.nh.gov/organization/divisions/water/wmb/swqa/2012/documents/2012-calm.pdf>

## F. APPEAL

Any person aggrieved by this decision may appeal to the N.H. Water Council ("Council") by filing an appeal that meets the requirements specified in RSA 21-O:14 and the rules adopted by the Council, Env-WC 100-200. The appeal must be filed directly with the Council within 30 days of the date of this decision and must set forth fully every ground upon which it is claimed that the decision complained of is unlawful or unreasonable. Only those grounds set forth in the notice of appeal can be considered by the Council.

Information about the Council, including a link to the Council's rules, is available at <http://nhec.nh.gov/> (or more directly at <http://nhec.nh.gov/water/index.htm>). Copies of the rules also are available from the DES Public Information Center at (603) 271-2975.

If you have questions regarding this Certification, please contact Owen David at (603) 271-0699.



Harry T. Stewart, P.E.  
Director, NHDES Water Division

cc: Samantha Davidson, FERC  
Denise P. French, Administrator, Town of Bennington  
Pamela L. Brenner, Administrator, Town of Peterborough  
Aaron Patt, Administrator, Town of Greenfield  
Barbara Caverly, Administrator, Town of Hancock  
John Warner, US Fish and Wildlife Service  
Carol Henderson, NH Fish and Game Department