

Maine Department of Environmental Protection  
Study Request  
Brunswick Hydropower Project (FERC No. 2284)

**Benthic Macroinvertebrate Study (Repeat)**

**Criteria for a New Study**

- 1. Explain any material changes in the law or regulations applicable to the information request.**

There have been no material changes in the law or regulations applicable to the information request.

- 2. Explain why the goals and objectives of any approved study could not be met with the approved study methodology.**

The goals and objectives of the approved Benthic Macroinvertebrate Study were not met with the approved study methodology due to the site location.

- 3. Explain why the request was not made earlier.**

The relevant information was not available at the time of the initial request. New information was available after the initial Benthic Macroinvertebrate Study.

- 4. Explain significant changes in the project proposal or that significant new information material to the study objectives has become available.**

The DEP Biological Monitoring Unit completed processing macroinvertebrate data from Station S-1298 below the Brunswick Falls dam, and an Aquatic Life Classification Attainment Report is now available. Data from this report and from the Applicant's study findings indicate aquatic life conditions consistent with Class C but not Class B standards in the vicinity of the Brunswick Project. Another BMI study in a different sampling location would provide additional details regarding Class B attainment.

**Content of Study Request**

- 1. Describe the goals and objectives of each study proposal and the information to be obtained.**

Assessment of the benthic macroinvertebrate community is critical to determine whether current in-stream flow releases affect attainment of Maine habitat and aquatic life criteria for Class B waters in the Androscoggin River below the Brunswick dam. The assessment provides biological data to evaluate potential impacts caused by Project operations.

**2. If applicable, explain the relevant resource management goals of the agencies or Indian tribes with jurisdiction over the resource to be studied.**

The resource management goal is to ensure attainment of Maine Water Quality Standards pursuant to the provisions of the *Water Classification Program*, 38 M.R.S. Sections 464-468 and certify attainment of such, with any necessary conditions, under Section 401 of the Federal Water Pollution Control Act (a.k.a. Clean Water Act)

**3. If the requestor is not a resource agency, explain any relevant public interest considerations in regard to the proposed study.**

Requestor is a resource agency.

**4. Describe existing information concerning the subject of the study proposal and the need for additional information.**

The Androscoggin River must meet Maine's habitat and aquatic life criteria in the vicinity of the Brunswick Project. The DEP Biological Monitoring Unit completed processing macroinvertebrate data from Station S-1298 below the Brunswick Falls dam, and an Aquatic Life Classification Attainment Report is now available. The macroinvertebrate community sampled at this station in 2025 attained aquatic life criteria for Class C ( $p = 1.00$ ) but did not attain criteria for Class B. The community was dominated by highly tolerant genera, including two midges (*Dicrotendipes* and *Ablabesmyia*), a flatworm (*Dugesiiidae*), two snail taxa (*Physella* and *Amnicola*), and a tolerant caddisfly (*Oecetis*), which together comprised approximately 73.5 percent of community abundance. Stonefly mean abundance was very low (1.33). EPT generic richness (mayflies, stoneflies and caddisflies) was 14, however many of the taxa present were either relatively tolerant or occurred in low numbers.

Substrate composition recorded by Normandeau Associates in the field was appropriate for macroinvertebrate rock basket sampling according to required DEP protocols and is not a likely factor in the class attainment result. The Initial Study Report states that the sampled area is tidally influenced, however specific conductance and total dissolved solids measurements recorded in the field at basket deployment (7/28/2025, 78.4 uS/cm, 51 PPM) and retrieval (8/26/2025, 93.2 uS/cm, 61 PPM) were not in the range to indicate brackish or saline conditions during the sampling period.

More information is needed regarding the range of any freshwater tidal fluctuations over the period when rock baskets were deployed to determine potential impacts on the macroinvertebrate community.

**5. Explain any nexus between project operations and effects (direct, indirect, and/or cumulative) on the resource to be studied, and how the study results would inform the development of license requirements.**

Data collected from the new sampling location will be used to evaluate the benthic macroinvertebrate community in the tailrace reach downstream of the Brunswick Project. Information will be used to evaluate whether the project meets Maine aquatic life criteria and will inform the water quality certification process.

- 6. Explain how any proposed study methodology (including any preferred data collection and analysis techniques, or objectively quantified information, and a schedule including appropriate filed season(s) and duration) is consistent with generally accepted practice in the scientific community or, as appropriate, considers relevant tribal values and knowledge.**

The DEP *Methods for Biological Sampling and Analysis of Maine's Rivers and Streams* (April 2014) was established by Department staff and has been used successfully throughout the state by DEP and others since 1983.

- 7. Describe considerations of level of effort and cost, as applicable, and why proposed alternative studies would not be sufficient to meet the stated information needs.**

Replicate benthic macroinvertebrate sample collectors (rock baskets or cones) are deployed for a 28-day study period in the tailrace reach of the hydropower Project during low flow, high temperature conditions. Samples must be collected by a professional aquatic biologist and evaluated by a professional freshwater macroinvertebrate taxonomist. Methods are documented in the DEP manual *Methods for Biological Sampling and Analysis of Maine's River and Streams* (April 2014). Costs are considered reasonable given that this study is required for Maine water quality certification and is routinely completed at hydropower projects being relicensed in the State. No alternatives to this study are proposed.

## LAKES, PONDS, AND IMPOUNDMENTS

### *Applicability*

This impoundment sampling protocol shall apply to existing hydropower impoundments regardless of their waterbody classification, where existing data are insufficient (in terms of density or quality) to determine water quality.

### **Trophic State Study**

#### *Overview & Sampling Stations*

Each basin or station shall be sampled at the deepest location twice each month, at approximately 2-week intervals for at least five consecutive months during a minimum of one open-water season. Sampling will consist of obtaining physical measurements as well as water samples. Water samples will be obtained using an integrated core sampler that is 10-meters long, and, when water is of adequate depth, a grab sampling device. During August, additional water samples will be obtained. Sampling personnel must be certified for this sampling protocol annually prior to data collection, by DEP's Division of Environmental Assessment, Lake Assessment Section staff. If sampling is inadequate or certification is bypassed, a second open water season of data may be required. Additional sampling may be required due to the hydraulic or physical characteristics of a given waterbody or to the presence of significant water quality problems. Refer to Table 1 for an overview of parameters, frequency, sampling methods and detection/reporting limits.

Parameter	Frequency	Sampling Method	Detection/Reporting Limits
Secchi disk transparency	2x/month	disk and water scope	0.1 meter
Temperature	2x/month	electronic meter (profile)	0.1 °C
Dissolved oxygen	2x/month	electronic meter (profile)	0.2 mg/l
Total Phosphorus	2x/month	core tube, grab device	0.001 mg/L
Trichromatic Chlorophyll-a (uncorrected)	2x/month	core tube	0.001 mg/L
Water Chemistry	2x/month; additional samples in August	core tube or grab device	See Table 2 below

#### *Physical measurements*

Physical measurements will include the determination of water transparency using a Secchi disk and water scope following the Maine Lake Assessment SOP for *Secchi Disk Transparency* (DEPLW0947R3). In addition, profiles for temperature and dissolved oxygen will be taken from the water surface to the bottom of the impoundment. Readings will be obtained, recorded, and submitted on DEP lake monitoring forms. Readings will be obtained in 1-meter increments from the surface to 15 meters in depth, then in 2-meter increments from 15 meters to 25 meters, and every 5 meters in water deeper than 25 meters; if between 15 and 25 meters, a rapid change in temperature or oxygen is discovered, readings will be taken at 1-meter intervals until they stabilize. Refer to the Maine Lake Assessment SOP for obtaining Dissolved Oxygen/Temperature Profiles using electronic meters for additional details (DEPLW0941R3). If a multiparameter device is used that can also measure pH and specific conductance, these data

may be substituted for lab data, providing that calibration and quality control check records are maintained and submitted with the data.

### ***Epilimnetic core samples***

The depth to which an integrated epilimnetic sample will be obtained using a core tube will be determined according to the Maine Lake Assessment SOP for *Epilimnetic Core Sample Collection* (DEPLW0946R3). Water samples collected through the season will be analyzed for uncorrected chlorophyll-a by the trichromatic method, total phosphorus, color, pH and alkalinity. Water samples collected in August will be additionally analyzed for nitrate, TKN, DOC, iron, calcium, magnesium, total and dissolved aluminum, sodium, potassium, silica, specific conductance, chloride, and sulfate. Refer to Table 2 for specific requirements; obtain bottles and preservatives from the analytical lab. In impoundments that do not thermally stratify (no change in temperature greater than or equal to 1°C per meter below a depth of 2 meters from the water surface), the core sample will be collected to 1 meter above the bottom, unless dissolved oxygen is less than or equal to 2 ppm, in which case the sample should be collected to the meter above that depth.

During warmer times of the year, if the lake is deep enough to stratify, examine the dissolved oxygen / temperature profile to determine the depth of the true seasonal epilimnion using the 1°C change over 1 meter of depth rule below a depth of 2 meters. Be aware that within the true or seasonal epilimnion, a shallow, secondary ephemeral (temporary) epilimnion can form in the top few meters of water after a few calm, warm days. Take the core sample to 1-meter below the bottom of the true epilimnion to include neutrally buoyant algal growth at the epi/metalimnion interface. Elevated dissolved oxygen lower in the profile may indicate need to extend the core deeper to capture the algae responsible for the oxygen spike. Because Chlorophyll samples are generally obtained from the core sample, never incorporate any water having 2 ppm of oxygen or less into the sample.

### ***Grab samples***

During late summer (mid to late August depending on latitude and weather conditions), in stratified lakes, grab samples will be obtained using a Kemmerer, Van Dorn or similar device, according to the Maine Lake Assessment SOP for the *Collection of Grab (discrete) Samples* (DEPLW0949R3). The grab samples will be analyzed for total phosphorus, color, pH, alkalinity, TKN, DOC, iron, calcium, magnesium, total and dissolved aluminum, sodium, potassium, silica, specific conductance, chloride, and sulfate. Refer to Table 2 for additional details.

If the lake does not stratify, no grab samples are needed. Otherwise, the number of grab samples taken is determined by the depth and thermal stratification pattern in the lake. In lakes deep enough to thermally stratify into 3 layers, grabs will be obtained from the metalimnion and hypolimnion. The metalimnetic sample will be taken from the middle of the metalimnion at the thermocline (depth of maximum change in temperature), and the hypolimnetic sample will be taken a meter above the bottom of the impoundment. In lakes that only stratify thermally into 2 layers, only one grab depth is necessary; in this case the grab sample will be obtained a meter above the bottom of the impoundment.

Parameter	Reporting Level	2x per month	August	Sample types
Trichromatic Chlorophyll a (uncorrected)	0.001 mg/L	X	X	core
Total phosphorus	0.001 mg/L	X	X	core & grab(s)
Nitrate	0.01 mg/L	X	X	core & grab(s)
TKN	0.01 mg/L	X	X	core & grab(s)
Color	5.0 SPU	X	X	core & grab(s)
DOC	1.0 mg/L	X	X	core & grab(s)
pH	0.1 pH units	X	X	core & grab(s)
Total alkalinity	1.0 mg/L	X	X	core & grab(s)
Total iron	0.05 mg/L		X	core & grab(s)
Total & dissolved aluminum	0.002 mg/L		X	core & grab(s)
Total calcium	0.05 mg/L		X	core & grab(s)
Total magnesium	0.05 mg/L		X	core & grab(s)
Total sodium	0.05 mg/L		X	core & grab(s)
Total potassium	0.05 mg/L		X	core & grab(s)
Total silica	0.05 mg/L		X	core & grab(s)
Specific conductance	2 $\mu$ S/cm		X	core & grab(s)
Chloride	0.5 mg/L		X	core & grab(s)
Sulfate	1 mg/L		X	core & grab(s)

### **Habitat Study**

For lakes, ponds, and riverine impoundments, determination of attainment of the designated use ‘habitat for fish and other aquatic life’ will be determined as follows. Using a depth of twice the mean summer Secchi disk transparency, determined from the Trophic State Study or historic DEP data, as the bottom of the littoral zone, the volume and surface area dewatered by the drawdown will be calculated to determine if at least 75% of the littoral zone remains watered at all times. Alternatively, studies of fish and other aquatic life communities, including freshwater mussels, may be conducted to demonstrate that the project maintains ‘structure and function of the resident biological community’ despite a drawdown that results in less than 75% of the littoral zone remaining watered at all times.

### **Fishing (Mercury Contamination) Study**

To ensure that the project does not contribute to the Statewide Fish Consumption Advisory due to mercury, projects with excessive drawdowns (generally >10 feet) may be required to analyze sport fish from the project waterbody and one or more reference waters for mercury. Contact DEP for specific requirements for each project.

## RIVERS AND STREAMS

### **Temperature and Dissolved Oxygen Study**

#### ***Applicability***

This rivers and streams sampling protocol shall apply to tailwater areas that are not impoundments where existing data are insufficient to determine existing and future water quality.

#### ***Sampling Stations***

Sampling shall occur in the tailwater downstream from the turbine/gate outlet or dam at a location representative of downstream flow as agreed by DEP on a case by case basis. Initially, measurements of temperature and dissolved oxygen should be made along a transect across the stream at the first, second and third quarter points across the width. If there is no violation of dissolved oxygen criteria and no significant (<0.4 mg/l) difference in concentrations among the quarter points, subsequent measurements may be made at the location shown to be representative of the main flow. Otherwise, measurements should be made at the location of the lowest concentration and the location of the main flow. Sampling should also occur in any bypassed segment of the river created by the project. Additional sampling stations may be required in the upstream or downstream areas where significant point or nonpoint sources exist or where slow moving or deep water occurs. The number and spacing of any additional stations will be determined by DEP on a case-by-case basis.

#### ***Parameters***

Temperature and dissolved oxygen shall be sampled at mid-depth in rivers less than 2 m deep or in a profile of 1-meter increments of depth in rivers greater than 2 m deep. In rivers where it is already known that attainment of required statutory dissolved oxygen criteria is questionable, sampling for additional parameters (e.g. BOD, nitrogen, phosphorus) may be necessary.

#### ***Frequency and Timing***

Sampling should be conducted during the summer low flow high temperature period, with the ideal conditions being the 7Q10 flow (the 7-day average low flow with a 10-year recurrence interval) combined with daily average water temperatures exceeding 24 °C. Measurements of temperature and dissolved oxygen shall be made every hour with a data sonde in remote unattended mode continuously during July and August, unless high flows well above seasonal median flows occur.

Alternatively, with concurrence by DEP, sampling could be undertaken one day per week for a minimum of ten weeks throughout the summer low flow, high temperature period. Each discrete grab sampling event for temperature and dissolved oxygen would consist of a minimum of two daily runs, the first of which should occur before 7 AM and the second of which should occur after 2 PM. Sampling results will not be considered complete unless a minimum of 5 sampling days meets the following conditions: The product of the water temperature (°C) and the flow duration (the percentage of the time a given flow is statistically exceeded) at the time of sampling exceeds 1500. For cycling hydropower projects, in addition to twice daily monitoring, continuous monitoring may be required at some locations for a duration equivalent to the period of one cycle of the storage and the release of flow.

For either method, a summer in which low flows and high temperatures are not experienced may result in additional sampling requirements for the next summer. Low flow conditions may occur naturally, as an unregulated river or may be artificially induced, as in the case of upstream flow regulation or flows downstream from a cycling or peaking power project or in the case of a bypassed segment which receives flow only by spillage, leakage or specific releases.

### ***Available Data***

The use of data already available is encouraged provided that adequate QA/QC procedures have been followed. Old data may not be acceptable for considerations of meeting minimum sampling requirements but could still provide useful information. Acceptance/rejection of data will be determined on a case by case basis, but generally data more than 10 years old may be rejected.

### **Habitat and Aquatic Life Studies**

For rivers and streams, determination of attainment of the designated use ‘habitat for fish and other aquatic life’ and “structure and function of the resident biological community” will be determined as follows. A Cross-Section Flow Study is required that measures width and depth at various flows to determine the flow at which at least 75% of the bank full cross-sectional area of the river or stream is continuously watered. At least three cross-sections representative of the river or stream must be measured. Alternately, a combination of ambient measurements in one cross-section, flow data from existing flow gages, and/or modelling may be approved by DEP.

In addition, to determine if the project ‘attains the aquatic life criteria, i.e. ‘maintains the structure and function of the resident biological community’, biological monitoring of the benthic macroinvertebrate community must be conducted following DEP’s standard protocol in Methods for Biological Sampling and Analysis of Maine’s Rivers and Streams, DEP LW0387-B2002.

A copy can be found at [www.maine.gov/dep/water/monitoring/biomonitoring/material.html](http://www.maine.gov/dep/water/monitoring/biomonitoring/material.html)