EXHIBIT 12

Brassua Hydroelectric Project (FERC No. 2615)

Macroinvertebrate Survey

Initial Study Report

Prepared for
Owners of Brassua Dam

Prepared by
Normandeau Associates, Inc.

February 2008

EXHIBIT 12

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1 INTRODUCTION

The survey of benthic macroinvertebrates and freshwater mussels was conducted in support of the relicensing of the Brassua Hydroelectric Project (Project or Brassua Project), Federal Energy Regulatory Commission (FERC) No. 2615, as identified in the Revised Proposed Study Plan (Study Plan) submitted by the Owners of Brassua Dam (Licensees) on February 6, 2008 and approved by the FERC in its Study Plan Determination letter dated March 6, 2008. This is a report for the 2008 study efforts of the Survey of Benthic Macroinvertebrates and Freshwater Mussels in Brassua Reservoir and Attean Pond and the Brassua Dam Tailwater Benthic Macroinvertebrate Survey.

The bulk of work for this study, including macroinvertebrate sampling of Brassua Reservoir and Attean Pond was conducted by Normandeau Associates. The assessment of the tailwater macroinvertebrate community and comparison to Maine DEP standards was conducted by Lotic, Inc.

2 STUDY OBJECTIVES

During Scoping and Study Plan development, stakeholders identified certain issues associated with macroinvertebrates for which the existing, relevant and reasonably available information that was included in the Pre-application Document (PAD), was insufficient to address the issues including:

- Identification of macroinvertebrates (including EPT and other insects and mussels) species and habitats in the Project area; and
- Assess the effects of the existing flow regime and reservoir level fluctuations on macroinvertebrates by comparing to reference lakes.

Based on these identified information needs the specific goals and objectives for this study were to:

1. Survey macroinvertebrates (insects and freshwater mussels) that utilize Brassua Reservoir to describe the species composition, relative abundance and the quality of the habitat;
2. Assess the effects of continued operations on macroinvertebrates (insects and freshwater mussels) and their habitats within the reservoir; and
3. Assess the tailwater macroinvertebrate community compared to DEP standards.

3 STUDY AREA

The full pool elevation of Brassua Reservoir is 1,074 feet (USGS). The FERC Project boundary at the Brassua Project generally follows elevation 1,076 feet (USGS) around the reservoir, and the Licensees own the land surrounding the reservoir between the full pond elevation of 1,074 feet and Project boundary at elevation 1,076 feet. The Project boundary also encompasses the Project works and extends along the Moose River approximately 700 feet downstream of the dam.

The study area included the shoreline of Brassua Reservoir, the Moose River outlet to Brassua Reservoir, from Brassua Dam to the upstream influence of Moosehead Lake, and the shoreline of Attean Pond. Attean Pond is a 2,745 acre lake located in the Moose River drainage, upstream of Brassua Reservoir. It is a natural, unregulated lake with no shoreline development and excellent water quality.

4 METHODS

4.1. Reservoir Benthic Macroinvertebrate Survey

Benthic macroinvertebrates (aquatic insects and non-insects) were sampled at six locations in Brassua Reservoir (Figure 4.1-1) and at six locations in the reference lake, Attean Pond (Figure 4.1-2). Sampling targeted two general substrates, coarse substrates (cobble and gravel) and fine substrates (mud and sand). A Surber sampler was used to collect samples from cobble and gravel substrates with little or no aquatic vascular plants in areas generally exposed to wind, wave and ice action. Kick/jab samples were collected from soft silt/mud substrates in protected areas which may contain aquatic vascular plant growth. Sampling took place on June 4 and June 5, 2008 at near full pond and on August 24 and August 25, 2008 under typical reservoir level conditions. At each of these sampling stations emergence traps were also used to collect adult forms of the resident aquatic insect community.

Macroinvertebrate insect sampling in cobble and gravel substrates was conducted at three locations (BRA 3, BRA 4, BRA 6) in Brassua Reservoir (Figure 4.1-1) and at three locations (ATT 3, ATT 4, ATT 5) in Attean Pond (Figure 4.1-2). Three replicate quadrat samples were collected at each station using a square foot Surber sampler that was placed on the substrate in water depths between 0.5 and 2 feet. A grain scoop was used to excavate the substrate within the sampler to a depth of about 5 inches. The contents of the scoops were placed in the Surber collection bag. The remaining substrate was agitated and then the Surber was retrieved. The contents of each replicate Surber sample was washed in a 595 µm sieve bucket to remove fine grained material, placed in a labeled sample jar, and preserved with 10% formalin for laboratory processing.

Insect sampling in silt/ mud vegetated substrates was conducted at three locations (BRA 1, BRA 2, BRA 5) in Brassua Reservoir (Figure 4.1-1) and at three locations (ATT 1, ATT 2, ATT 6) in Attean Pond (Figure 4.1-2). Three replicate samples were collected at each station using an aquatic D-frame sweep net. Each replicate was collected by dragging the sweep net in a straight line for three feet with the handle held perpendicular to the bottom. The bottom of the net

penetrated the substrate by approximately one-half inch. The contents of each replicate sweep net sample was washed in a 595 µm sieve bucket to remove fine grained material, placed in a labeled sample jar, and preserved with 10% formalin for laboratory processing.

Emergent aquatic insects were collected using a single modified week model trap (LeSage and Hartison 1979, and Wrubleski and Ross 1989) at each sampling station (i.e., three cobble/gravel and three silt/mud stations from each lake). Traps were installed during the last week of May and emptied each week for eight weeks. The contents of each emergence trap sample was placed in a labeled sample jar and preserved with 10% formalin for laboratory processing.

All samples were analyzed using stereo-zoom and compound microscopes, where appropriate. Organisms were identified and enumerated to lowest practical taxon, generally genus and species, dependent on the age and integrity of the organism and detail in the taxonomic keys. Chironomidae (midges) larvae were slide mounted after being prepared in a clearing solution and identified using a compound microscope. Worms were also slide mounted and identified using a compound microscope. At each station, mean values of three replicate samples were used to calculate the following metrics:

Total Abundance – Total Abundance is the mean of the total number of specimens collected from a sampling station and gear type. Three replicate kick and Surber samples were collected from each sampling station during June and August; single replicate emergence trap samples were collected from each station during eight weeks in the spring and summer.

Community Density – Community Density (no./m^2) was only calculated from quantitative samples, therefore density estimates were only calculated from Surber samples in rocky substrates.

Taxa Richness – Taxa richness is the number of distinct taxa (types of organisms) in a sample and provides an estimate of the size of a macroinvertebrate community. For example, if two genera of mayfly, one genus of caddisfly, and five genera of midges were found in a sample, regardless of the number of individuals in each group, the taxa richness of the sample would be eight (8). A relatively large number of taxa would indicate less environmental stress.

Percent Dominant Taxon – This metric uses the abundance of the most commonly collected taxon as a measure of community balance. A community dominated by one or relatively few taxa suggests environmental stress. If the dominant taxon accounts for a large percentage of the individuals present, it is an indication of stress because the community is dominated by one taxon, whereas unstressed communities typically exhibit a more evenly balanced abundance among several taxa. Appendix Table 1 provides the dominant taxon and total (not mean) percent composition across three replicate samples.

EPT Richness – Three groups of benthic insects are considered particularly sensitive to pollution. EPT Richness is the number of distinct taxa (types of organisms) in a sample that represents the groups (taxonomic Orders) of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies), which are collectively referred to as the EPT taxa. Low values for

this metric indicate potentially stressful environmental conditions; values for this metric generally increase with increasing water quality.

Shannon Diversity Index – This metric compares the distribution of individuals among all taxa present in a sample. Shannon Diversity (H□') is calculated according to the formula: $H' = \Sigma\ p_i \log p_i$, where p_i is the proportion of the total number of individuals occurring in species *i* (Shannon 1948). Maximum diversity is obtained when the numbers of individuals are equally distributed among the taxa. A value near 0 would indicate a large number of individuals representing one or a few species. High values indicate that the numbers of individuals are evenly distributed among several species.

Community Loss Index – The community loss index measures the loss of benthic taxa in samples from an experimental station compared to those found at the reference station (Courtemanch and Davies 1987). It is calculated as the number of taxa found at the reference station minus the number of taxa common at both stations, divided by the number of taxa present at the experimental station. For example, if the reference station had three mayfly taxa, five midge taxa, and one stonefly taxon, while the test station had two of the same mayfly taxa, four of the same midge taxa, no stoneflies, and one caddisfly taxon, the community loss index for the test station would be (9-6)/7=0.43. The value of this index can range from 0 to infinity, and increases as the test station becomes increasingly dissimilar to the reference station; therefore lower values indicate less stressful conditions.

4.2. Freshwater Mussel Surveys

Qualitative mussel surveys were conducted in Brassua Reservoir, Attean Pond, and the Moose River during the week of September 8, 2008 using snorkel gear and viewtubes (Figure 4.1-1 and Figure 4.1-2). However, numerous searches for mussels were also conducted during spring through fall 2008 by field crews working on aquatic resources studies (shoreline of Brassua Reservoir), macroinvertebrate field work, fisheries sampling, and habitat mapping for the IFIM Study. During these other studies, mussel beds and the locations of relic shells were recorded with GPS in Attean Pond, the inlets to Brassua Reservoir, and in the Moose River downstream of the dam.

During the snorkel surveys, field biologists qualitatively surveyed the substrate using masks and snorkels. Surveys were conducted at each lake in suitable habitat areas, which would presumably not be affected by winter drawdowns (i.e., sections of the main channel that were deep enough to remain wet throughout the year and reaches that were upstream of any influence by water level fluctuations). In areas where mussels were found, length measurements were collected from a representative number of specimens. Density estimates were based solely on visual approximation; quantitative sampling was not conducted.

Surveys in Brassua Reservoir were conducted at Johnson Brook, the Moose River inlet, Brassua Brook, Misery Cove inlet, West Fletcher's Pond outlet, and East Fletcher's Pond outlet (Figure 4.1-1). In the Moose River below Brassua Dam, surveys were conducted at the island downstream of the dam, Scott Pool, and Gilbert Pool (Figure 4.1-1). In Attean Pond, surveys were conducted at the Attean Pond inlet, Attean Pond outlet, along the southern shore between

the Moose River inlet and the West inlet, and along the northern shoreline at approximately mid-pond (Figure Figure 4.1-2).

4.3. Tailwater Macroinvertebrate Survey

Lotic conducted macroinvertebrate surveys at three locations in the Moose River downstream of Brassua Dam (Figure 4.3-1) in late summer 2007. All work was done in accordance with standard MDEP protocols. Three replicate standard rock bags were placed at stations located approximately 700 feet, 1000 feet and 4,900 feet downstream of Brassua Dam. Rock bags were deployed on August 20, 2007 and were retrieved on September 13, 2007. Following MDEP protocols, rocks in each bag were cleaned and all macroinvertebrates were preserved, sorted and counted. The results of the counts were entered onto MDEP's Biological Monitoring Program, Aquatic Life Classification Attainment Report forms. Sampling was repeated during the summer of 2008; sample data are presently being processed.

5 PRELIMINARY RESULTS

5.1. Reservoir Benthic Macroinvertebrates

Physical habitat characteristics of each sampling station are provided in Table 5.1-1. Kick samples were collected from fine-grained substrates such as sand and mud, and Surber samples were collected from more coarse substrates such as cobble and gravel.

In Brassua Reservoir, kick samples were collected from Stations BRA 1, BRA 2, and BRA 5 (4.1-1). Overall, kick sample stations in Brassua Reservoir had a substrate that was predominately composed of mud with some cobble or boulders (Table 5.1-1). Some submerged aquatic vegetation (SAV) was present at Station BRA 2; however SAV was much more abundant at Stations BRA 1 and 5 and required emergence traps to be relocated to deeper water during incubation to avoid being fouled by the vegetation. The Attean Pond kick samples were collected at Stations ATT 1, ATT 2, and ATT 6 (Figure 4.1-2, Table 5.1-1). Substrate composition at all three Attean Pond kick sample stations was 80 to 100% mud (Table 5.1-1), and SAV was abundant at all three stations.

All Surber sample stations in both Brassua Reservoir and Attean Pond had substrates predominately composed of gravel and cobble (Table 5.1-1) with little or no SAV. These sampling stations were located in areas that received more wave action than the kick sample stations, which precluded the presence of silt, mud, and extensive beds of SAV.

A summary table of mean analytical metric values for each station is provided in Appendix 1 and a complete list of the taxa and the number of individuals per taxon collected from each sample is provided in Appendix 2. Summarized benthic data are provided in Table 5.1-2.

June kick sample data (Table 5.1-2) found Total Abundance, Taxa Richness, and Shannon Diversity to be somewhat higher in Attean Pond than in Brassua Reservoir; EPT Richness was higher in Brassua Reservoir kick samples than in Attean Pond kick samples (Table 5.1-2). The Percent Dominant Taxon was lower in Attean Pond than in Brassua Reservoir. Numerically

dominant taxa from both lakes were either Chironomidae (*Cryptotendipes* sp., *Tanytarsus* sp.) or Oligochaeta (*Stylodrilus heringianus*, *Nais alpina*, *Slavina appendiculata*). The Community Loss Index value for June kick sample data was 0.71 (Table 5.1-2, Appendix 1), a moderate value which indicates that there were differences in benthic community taxonomic composition between lakes.

Surber sample data also showed somewhat similar trends during June, although the differences were less. Chironomidae (*Tanytarsus* sp., *Cladotanytarsus* sp.) comprised the numerically dominant taxa in Attean Pond and Oligochaeta (*Stylodrilus heringianus*, *Nais alpina*) comprised the dominant taxa in Brassua Reservoir. The mean Percent Dominant Taxon across all stations from Attean Pond was also lower than stations from Brassua Reservoir (Table 5.1-2). Values for Total Abundance, Community Diversity, and Taxa Richness were slightly higher from Brassua Reservoir, while EPT Richness and Shannon Diversity scores were higher from Attean Pond during June. Community Loss Index values for June Surber samples was 0.76 (Table 5.1-2, Appendix 1), a moderate value which indicates that there were differences in benthic community taxonomic composition between lakes.

In August, Brassua Reservoir kick samples had a higher value for Total Abundance and a slightly lower value for Percent Dominant Taxon than at Attean Pond (Table 5.1-2). Values for Taxa Richness, EPT Richness, and Shannon Diversity were very similar between the two lakes. Kick samples from both lakes were numerically dominated by two oligochaete species (*Ripestes parasita* and *Stylaria fossularis*) and the gastropod *Amnicola* sp. (Table 5.1-2, Appendix 1), which are all typically found in mud substrates. The Community Loss Index value for August kick samples between Brassua Reservoir and Attean Pond was 0.37, a low value which indicates that there was natural variability in the benthic community taxonomic composition between lakes.

August Surber sample data had consistently higher values at Brassua Reservoir for Total Abundance and density, Community Diversity, Taxa Richness, and EPT Richness. Values for Percent Dominant Taxon and Shannon Diversity were generally similar between the two lakes, although the Percent Dominant Taxon value from one Brassua Reservoir Station, BRA 4, was 57.8%, the highest value recorded from any sample during the study. The numerically dominant taxa from Surber samples were the sideswimmer *Hyalella azteca*, the naid worm *Stylaria fossularis*, the earthworm *Stylodrilus heringianus*, the caddisfly *Polycentropus* sp., and the mayfly *Caenis* sp. (Table 5.1-2, Appendix 1). The Community Loss Index value for August Surber samples between Brassua Reservoir and Attean Pond was 0.29, a low value which indicates that there was natural variability in the benthic community taxonomic composition between lakes.

Emergence trap data are provided in Appendix 3 and are summarized in Table 5.1-3 and Table 5.1-4. A total of 6,164 adult aquatic insects were collected from all emergence traps combined during June 12 to July 30, 2008. Five taxonomic orders of insects were collected in emergence traps from Brassua Reservoir and Attean Pond, Ephemeroptera (mayflies), Plecoptera (stoneflies), Megaloptera (fishflies), Trichoptera (caddisflies), and Diptera (true flies).

In Brassua Reservoir, a total of 4,489 emergent insects from 50 taxa were collected (Table 5.1-3), which was over two times the number of emergent insects collected from Attean Pond. The numerically dominant insect order was Diptera (94.5%), followed by Trichoptera (3.4%), and Plecoptera (2.1%); Ephemeroptera and Megaloptera comprised less than 0.1% of the total abundance (Table 5.1-3). A total of 20 taxa were collected exclusively from Brassua Reservoir and 14 taxa were only collected from emergence traps (Table 5.1-4) and were not found during kick and Surber sampling. The greatest total number of organisms (2,303) and the highest taxa richness value (49) from Brassua Reservoir emergence traps were found at Station BRA 3 (Table 5.1-3), which had a predominately cobble substrate.

A total of 1,675 emergent insects representing 57 taxa were collected from Attean Pond (Table 5.1-3). In Attean Pond, as at Brassua Reservoir, the numerically dominant taxon in emergence traps was Diptera (96.0%) followed by Trichoptera (3.0%), all other orders comprised less than 1.0% of the total emergence trap catch (Table 5.1-3). A total of 13 taxa were collected exclusively from Attean Pond and 14 taxa were collected from emergence traps (Table 5.1-4), but were not collected during kick and Surber sampling. The greatest total number of organisms (585) was found at Station ATT 6, a predominately mud substrate station; however the highest value for taxa richness from Attean Pond emergence traps (33) was found at Stations ATT 2 (mud substrate) and ATT 3 (gravel/boulder substrate) (Table 5.1-3).

5.2. Freshwater Mussel Survey

A total of thirteen locations were searched for freshwater mussels throughout Brassua Reservoir, Moose River outlet, and Attean Pond (Figures 4.1-1, 4.1-2). In Brassua Reservoir, a total of nine locations were surveyed.

Johnson Brook (Station BL 1) is located at the northern end of Brassua Reservoir. Water depth was three to five feet and the substrate was composed of 60% cobble and 40% gravel (Table 5.2-1). This area was searched for a total of 105 minutes and no mussels or shells were seen (Table 5.2-2).

The Moose River (Station BL 2) inlet to Brassua Reservoir had a fast flow and a depth of one to three feet. Substrate composition was 10% boulder, 80% cobble, and 10% gravel (Table 5.2-1). This area was searched for over 120 minutes and a total of 38 eastern elliptio (*Elliptio complanata*) were found at this location (Table 5.2-2). The mean mussel length was 64.8 mm and the range of lengths was 43 to 79 mm (Table 5.2-3).

Brassua Stream (Station BL 3) is located at the northern end of Brassua Reservoir (Figure 4.1-1). At the survey location, water depth was estimated to be over five feet and substrate composition was 80% boulder and 20% cobble (Table 5.2-1). Since the water depth was too deep to search effectively and substrate composition was not conducive to supporting mussels, no search was conducted at this area.

Misery Cove (Station BL 7) is located at the southern end of the reservoir (Figure 4.1-1). Substrate composition was bedrock, cobble, and gravel (Table 5.2-1), and no mussels were found during a 90 minute search.

East and West Fletcher's Pond outlets (Stations BL 8 and BL 9) are located in the western arm of Brassua Reservoir (Figure 4.1-1). Substrate composition was predominately mud with some gravel at both locations (Table 5.2-1). At East Fletcher's Pond outlet only eastern elliptio was found with an estimated density of 0.1 mussel/m². At West Fletcher's Pond eastern elliptio and eastern floater (*Pyganodon cataracta*) were found with an estimated density of 0.5 mussels/m² (Table 5.2-2).

The Moose River outlet between Brassua Dam and Moosehead Lake was searched at three locations, at the island downstream of the dam (Station BL 6), Scott Pool (Station BL 4), and Gilbert Pool (Station BL 5) (Figure 4.1-1). The island downstream of the dam had a substrate composed of cobble and gravel (Table 5.2-1). A total of three eastern elliptio were found near this island with a mean length of 79.3 mm and a range of 61 to 95 mm (Table 5.2-3).

Scott Pool (Station BL 4) is located downstream of the island (Figure 4.1-1). The substrate at this station was 80% cobble and 20% gravel (Table 5.2-1). Water depth was one to two feet and flow was slow outside of the main channel. This area was searched for 90 minutes and an estimated 400 to 500 eastern elliptio were found at this location with an estimated density of 5 to 10 mussel/m² (Table 5.2-2). Mean elliptio length was 72.7 mm with a range of 52 to 101 mm (Table 5.2-3).

Gilbert Pool (Station BL 5) is located downstream of Scott Pool (Figure 4.1-1). At this location, the substrate was composed of 65% cobble, 25% gravel, and 10% sand (Table 5.2-1). Eastern elliptio were also abundant at this location, although fewer mussels were found here than at Scott Pool. An estimated 100 to 150 mussels were found in Gilbert Pool with an estimated density of 5 mussels/m². Two species were found at Gilbert Pool, eastern elliptio and triangle floater (*Alasmidonta undulata*). Only one specimen of triangle floater was found at this location, its length was 42.8 mm (Table 5.2-3).

Attean Pond was searched at four locations, the Moose River inlet, the outlet, at an inlet along the southern shore, and along the northern shore (Figure 4.1-2).

The Attean Pond outlet (Station AP 1) had a substrate composed of boulders, cobble, and sand (Table 5.2-1). A 90 minute search found that virtually the entire substrate at the outlet was covered with eastern elliptio with an estimated density of 50 to 70 mussels/m² (Table 5.2-2). This location had the highest density of mussels throughout both lakes.

The Moose River inlet (Station AP 2) to Attean Pond also had a high density of eastern elliptio, estimated at 10 to 20 mussels/m² (Table 5.2-2). Mussels collected during the survey had a size range of 46 to 91 mm and the mean value was 68.9 mm (Table 5.2-3). The substrate was composed of finer grained material than at the other Attean Pond locations and was evenly composed of mud, silt, and clay (Table 5.2-1).

The south shore inlet (Station AP 3) had a substrate composed of cobble, gravel, and sand and had a depth of 1.5 ft (Figure 4.1-2). The substrate was searched for 90 minutes with a viewtube and no mussels were found.

The north shore inlet (Station AP 4) had a substrate composed of sand and clay (Table 5.2-1). The mussel bed at this location was composed of estern elliptio and eastern floater at a density estimated at 5 to 10/m² (Table 5.2-2). Eastern elliptio length ranged from 51.0 to 81.0 mm and mean length was 67.0mm; eastern floater mean length was 87.3mm with a range of 63.0 to 108.0 mm (Table 5.2-3).

5.3. Tailwater Macroinvertebrate Surveys

The results of the tailwater macroinvertebrate surveys are provided in Appendix 4.

6 SUMMARY

6.1. Benthic Macroinvertebrates

Data collected during 2008 demonstrated that the benthic community in Brassua Reservoir is similar in most respects to the benthic community found in Attean Pond. Although there are some apparent variations throughout the season, taken as a whole, kick, Surber, and emergent insect sample data showed that benthic communities in the two lakes had generally similar analytical metric values.

Kick and Surber metric values for Brassua Reservoir during the summer sampling (August) and the total abundance of aquatic insects collected from emergence traps in May and June were better or similar to Attean Pond, indicating the presence of a robust benthic community such as would be expected on a natural lake. During the spring sampling (June), some metrics derived from kick and Surber samples were higher or similar at Attean Pond compared to Brassua Reservoir. More specifically, somewhat reduced values for Total Abundance, Taxa Richness, and Shannon Diversity, and a higher value for Percent Dominant Taxon were found at Brassua in June, as compared to Attean Pond. However, benthic communities inhabiting shoreline areas of Brassua Reservoir that are drawn down during winter months appear to have recovered by mid-summer. Moreover, Community Loss Index values indicated that differences in taxonomic composition of the benthic communities at both lakes were not indicative of stressed conditions, even during the spring sample. Community Loss Index values in this study ranged from 0.29 to 0.76, which are within the range of 0.15 to 0.83 that Courtemanch and Davies (1987) found indicated water segments essentially unaffected by human use.

6.2. Freshwater Mussels

The mussel survey results also suggest similar communities at both Brassua Reservoir and Attean Pond. Eastern elliptio and eastern floater were the only two species found in both lakes, and eastern elliptio was, by far, the most abundant species throughout each lake. Eastern elliptio is a common species and will often travel along the substrate, especially as water levels drop. In the Moose River outlet, eastern elliptio was abundant and the numerically dominant species; a single triangle floater was also collected from the Moose River outlet to Brassua Reservoir. The freshwater mussel data do not indicate that inlets and outlets of Brassua Reservoir are severely depleted compared to Attean Pond. However, shoreline areas of Brassua Reservoir had substantially fewer mussels than Attean Pond.

6.3. Tailwater Macroinvertebrate Sampling

Results of the 2007 sampling found the macroinvertebrate community at the two stations closest to Brassua Dam to be consistent with Class C standards. The downstream most station located approximately one mile downstream of the dam was found to have a macroinvertebrate community consistent with Class B standards. Tailwater macroinvertebrate sampling was repeated in 2008. The samples are being processed and will be reported on in the final study report.

7 VARIANCES FROM FERC-APPROVED STUDY PLAN AND PROPOSED MODIFICATIONS

There was no variance from the study plan and schedule as described in the FERC-approved study plan.

8 REFERENCES

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Table 5.1-1. Habitat and collection data for benthic samples collected from Brassua Reservoir and Attean Pond during 2008.

Station	Date	Collection Time	Sample Type	Substrate % Composition					Water Quality		
				Boulder	Cobble	Gravel	Sand	Mud	Temperature (˚C)	Dissolved Oxygen (mg/l)	pH
BRA 1	4-Jun-08	1604	Kick	10				90	18.8	10.4	6.2
BRA 2	4-Jun-08	1628	Kick	10	10			80	20.1	10.2	6.4
BRA 3	4-Jun-08	1651	Surber		80		20		18.1	10.0	6.0
BRA 4	4-Jun-08	1751	Surber			100			16.7	10.2	5.9
BRA 5	5-Jun-08	1915	Kick					100	18.5	10.3	6.3
BRA 6	5-Jun-08	1920	Surber			70	30		18.0	9.8	5.9
ATT 1	5-Jun-08	1150	Kick					100	19.0	9.7	6.3
ATT 2	5-Jun-08	1145	Kick	10				90	17.0	10.0	6.6
ATT 3	5-Jun-08	1220	Surber	20		80			17.7	9.5	6.3
ATT 4	5-Jun-08	1345	Surber			85	15		17.0	10.2	6.4
ATT 5	5-Jun-08	1415	Surber			70	30		17.2	10.0	6.3
ATT 6	5-Jun-08	2130	Kick	10				90	17.8	9.8	6.2

Station		Date	Collection Time	Sample Type	Substrate % Composition					Water Quality		
					Boulder	Cobble	Gravel	Sand	Mud	Temperature (˚C)	Dissolved Oxygen (mg/l)	Sp. Cond. (µS/cm)
BRA 1		24-Aug-08	1630	Kick					100	21.1	8.2	71.1
BRA 2		24-Aug-08	1520	Kick	10		10		80	23.8	8.8	44.0
BRA 3		24-Aug-08	1545	Surber	5	30	65			23.9	10.7	44.4
BRA 4		24-Aug-08	1440	Surber	5	80	15			21.1	9.6	61.0
BRA 5		25-Aug-08	910	Kick					100	22.4	7.3	51.4
BRA 6		25-Aug-08	930	Surber		85	10	5		22.4	7.5	47.3
ATT 1		25-Aug-08	1320	Kick					100	21.4	8.9	53.3
ATT 2		25-Aug-08	1300	Kick	20				80	21.8	9.5	51.9
ATT 3		25-Aug-08	1245	Surber	90	10				20.9	9.4	50.3
ATT 4		25-Aug-08	1155	Surber			85	15		21.8	8.8	50.5
ATT 5		25-Aug-08	1220	Surber		90		10		21.8	8.5	48.2
ATT 6		25-Aug-08	1345	Kick	10				90	23.6	8.6	50.6

Table 5.1-2. Summary of metric values from Brassua Reservoir and Attean Pond benthic macroinvertebrate samples during 2008.

	June Kick Samples		
	Attean Pond	**Brassua Reservoir**	**Comments**
Total Abundance	167.6	106.4	Brassua slightly different
Taxa Richness	26.1	18.7	Brassua slightly different
Percent Dominant Taxon	17.2%	30.5%	Brassua slightly different
EPT Richness	2.9	3.7	Attean slightly/moderately different
Shannon Diversity	2.67	2.15	Brassua slightly different
Community Loss Index	0.71		no adverse effects indicated
	June Surber Samples		
	Attean Pond	**Brassua Reservoir**	**Comments**
Total Abundance	48.0	48.4	no adverse effects indicated
Density (No./m²)	521.7	526.6	no adverse effects indicated
Taxa Richness	16.1	13.1	no adverse effects indicated
Percent Dominant Taxon	26.9%	36.5%	Brassua slightly different
EPT Richness	3.1	2.9	no adverse effects indicated
Shannon Diversity	2.25	1.85	Brassua slightly different
Community Loss Index	0.76		no adverse effects indicated
	August Kick Samples		
	Attean Pond	**Brassua Reservoir**	**Comments**
Total Abundance	290.6	558.8	Attean moderately different
Taxa Richness	24.4	25.1	no adverse effects indicated
Percent Dominant Taxon	26.9%	25.8%	no adverse effects indicated
EPT Richness	3.7	4.0	no adverse effects indicated
Shannon Diversity	2.00	2.15	no adverse effects indicated
Community Loss Index	0.37		no adverse effects indicated
	August Surber Samples		
	Attean Pond	**Brassua Reservoir**	**Comments**
Total Abundance	26.8	55.4	Attean moderately different
Density (No./m²)	291.1	602.7	Attean moderately different
Taxa Richness	13.0	16.3	no adverse effects indicated
Percent Dominant Taxon	23.1%	28.4%	no adverse effects indicated
EPT Richness	2.40	4.40	Attean moderately different
Shannon Diversity	2.20	2.31	no adverse effects indicated
Community Loss Index	0.29		no adverse effects indicated

Table 5.1-3. Summary of emergent trap data from Brassua Reservoir and Attean Pond in 2008.

BRASSUA RESERVOIR	**BRA 1**	**BRA 2**	**BRA 3**	**BRA 4**	**BRA 5**	**BRA 6**	**TOTAL**
TOTAL SPECIMENS	302	544	2,303	329	732	279	4489
TAXA RICHNESS	26	31	49	29	30	25	50[a]
UNIQUE TAXA[b]							20
NEW TAXA[c]	1	2	10	3	2	4	14
							MEAN
% EPHEMEROPTERA	0	0.2	0	0.3	0	0	0.0%
% PLECOPTERA	0	0	4.0	0	0	0	2.1%
% MEGALOPTERA	0	0	0	0.3	0	0	0.0%
% TRICHOPTERA	3.3	9.6	2.7	3.0	2.0	0.7	3.4%
% DIPTERA	96.7	90.3	93.2	96.4	98.0	99.3	94.5%

ATTEAN POND	**ATT 1**	**ATT 2**	**ATT 3**	**ATT 4**	**ATT 5**	**ATT 6**	**TOTAL**
TOTAL SPECIMENS	75	132	419	76	388	585	1675
TAXA RICHNESS	24	33	33	19	29	29	57[a]
UNIQUE TAXA[b]							13
NEW TAXA[c]	2	6	5	1	4	5	14
							MEAN
% EPHEMEROPTERA	1.3	0	1.9	1.3	0.3	0	0.7%
% PLECOPTERA	0	0	0	3.9	0.3	0	0.2%
% MEGALOPTERA	0	0	0	0	0.3	0	0.1%
% TRICHOPTERA	13.3	3.8	2.4	5.3	3.1	1.7	3.0%
% DIPTERA	85.3	96.2	95.7	89.5	96.1	98.3	96.0%

[a] = calculated across all stations
[b]= taxa found only in one lake
[c]= taxa not found during kick net and Surber sampling

Table 5.1-4. Taxa collected exclusively in emergence traps from Brassua Reservoir and Attean Pond in 2008.

BRASSUA RESERVOIR	**ATTEAN POND**
Ephemeroptera	
Centroptilum sp.	
Plecoptera	Plecoptera
Alloperla sp.	*Alloperla sp.*
Clioperla sp.	
Trichoptera	Trichoptera
Nectopsyche sp.	*Nectopsyche sp.*
Ceraclea sp.	*Ironoquia sp.*
Platycentropus sp.	*Micrasema sp.*
Megaloptera	Megaloptera
Sialis sp.	*Sialis sp.*
Diptera	Diptera
Cardiocladius sp.	*Conchapelopia sp.*
Alluaudomyia sp.	*Alluaudomyia sp.*
Enfeldia sp.	*Enfeldia sp.*
Harnischia complex	*Harnischia* complex
Anopheles sp.	*Anopheles sp.*
Psectrotanypus sp.	*Atrichopogon sp.*
Zavrelimyia sp.	*Micropsectra sp.*
	Eukiefferiella sp.
	Thienemannimyia sp.

Table 5.2-1. Substrate composition for the Brassua Project mussel survey in September 2008.

Station	Location	Latitude	Longitude	Percent Composition							
				Bedrock	Boulder	Cobble	Gravel	Sand	Mud	Silt	Clay
	Brassua Reservoir										
BL1	Johnson Brook	45.7289° N	69.9058° W			60	40				
BL2	Moose River inlet to Brassua	45.6347° N	69.9360° W		10	80	10				
BL3	Brassua Stream	45.7220° N	69.9069° W		80	20					
BL7	Misery Cove inlet	45.6254° N	69.8429° W	45		35	10	10			
BL8	West Fletchers Pond outlet	45.6771° N	69.9379° W				20		80		
BL9	East Fletchers Pond outlet	45.6767° N	69.9346° W				20		80		
	Moose River outlet										
BL6	Island Downstream of dam	45.6614° N	69.8117° W			75	25				
BL4	Scott Pool	45.6680° N	69.8062° W			80	20				
BL5	Gilbert Pool	45.6699° N	69.8004° W			65	25	10			
	Attean Pond										
AP1	Attean Pond Outlet	45.5891° N	70.2609° W		25	45		30			
AP2	Moose River Inlet to Attean	45.5456° N	70.2483° W						33	33	34
AP3	South Shore Inlet	45.5651° N	70.3078° W			30	30	40			
AP4	Norh Shore Inlet	45.5743° N	70.2998° W					50			50

Table 5.2-2. Brassua Project mussel survey search locations and survey results during September 2008.

Location	Search Date	Search Time (man hour)	Results
Brassua Reservoir			
Johnson Brook	9-Sep-08	105 min	no mussels found
Moose River inlet to Brassua	9-Sep-08	135 min	38 live *Elliptio complanata* found, estimated density < 0.1/m²
Brassua Stream	9-Sep-08	0 min	too deep to survey
Misery Cove inlet	11-Sep-08	90 min	no mussels found
West Fletchers Pond outlet	19-Oct-08	60 min	*Elliptio complanata*, *Pyganodon cataracta*, estimated density 0.5/m²
East Fletchers Pond outlet	19-Oct-08	60 min	*Elliptio complanata*, estimated density 0.1/m²
Moose River outlet			
Island Downstream of dam	10-Sep-08	70 min	3 *Elliptio complanata* found, estimated density < 0.1/m²
Scott Pool	10-Sep-08	90 min	estimated 400-500 *Elliptio complanata*, estimated density 5-10 mussels/m²
Gilbert Pool	10-Sep-08	90 min	estimated 100-150 *Elliptio complanata*, 1 *Alasmidonta undulata*, estimated density 5 mussels/m²
Attean Pond			
Attean Pond Outlet	11-Sep-08	90 min	*Elliptio complanata*, estimated density 50-70 mussels/m²
Moose River Inlet to Attean	11-Sep-08	135 min	*Elliptio complanata*, estimated density 10-20 mussels/m²
South Shore Inlet	11-Sep-08	90 min	no mussels found
Norh Shore Inlet	11-Sep-08	105 min	*Elliptio complanata*, *Pyganodon cataracta*, estimated density 5-10 mussels/m²

Table 5.2-3. Live mussel lengths collected during the Brassua Reservoir mussel survey in September 2008.

Location	Common Name	Species Name	Mean Length (mm)	Shortest (mm)	Longest (mm)
Brassua Reservoir					
Moose River inlet to Brassua	eastern elliptio	*Elliptio complanata*	64.8	43.0	79.0
Moose River outlet					
Island Downstream of dam	eastern elliptio	*Elliptio complanata*	79.3	61.0	95.0
Scott Pool	eastern elliptio	*Elliptio complanata*	72.7	52.0	101.0
Gilbert Pool	eastern elliptio	*Elliptio complanata*	72.4	44.0	99.0
	triangle floater	*Alasmidonta undulata*	42.8		
Attean Pond					
Attean Pond Outlet	eastern elliptio	*Elliptio complanata*	90.4	56.0	113.0
Moose River Inlet to Attean	eastern elliptio	*Elliptio complanata*	68.9	46.0	91.0
North Shore Inlet	eastern elliptio	*Elliptio complanata*	67.0	51.0	81.0
	eastern floater	*Pyganodon cataracta*	87.3	63.0	108.0

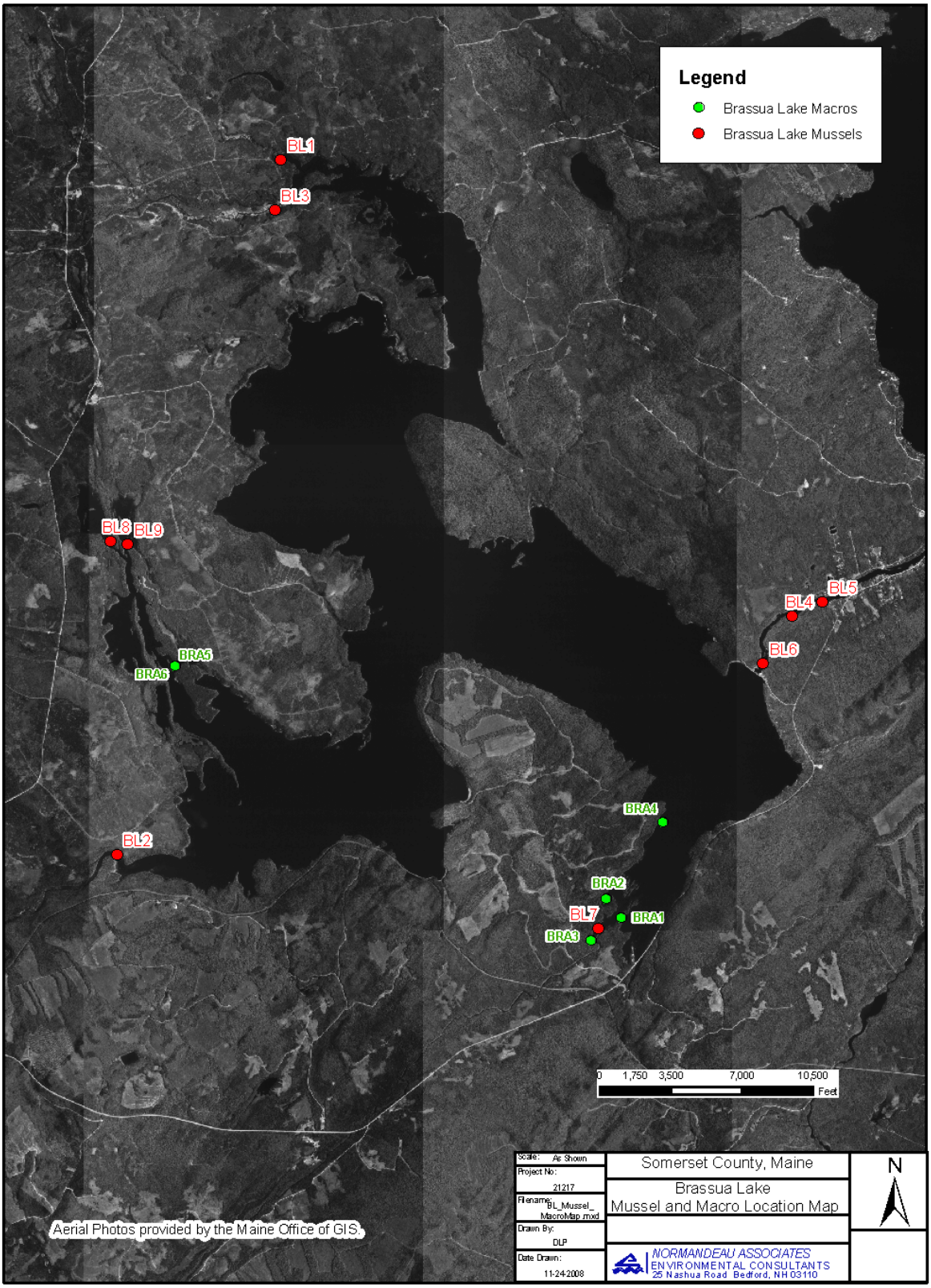

Figure 4.1-1. Brassua Reservoir and Moose River outlet macroinvertebrate and mussel sampling stations in 2008.

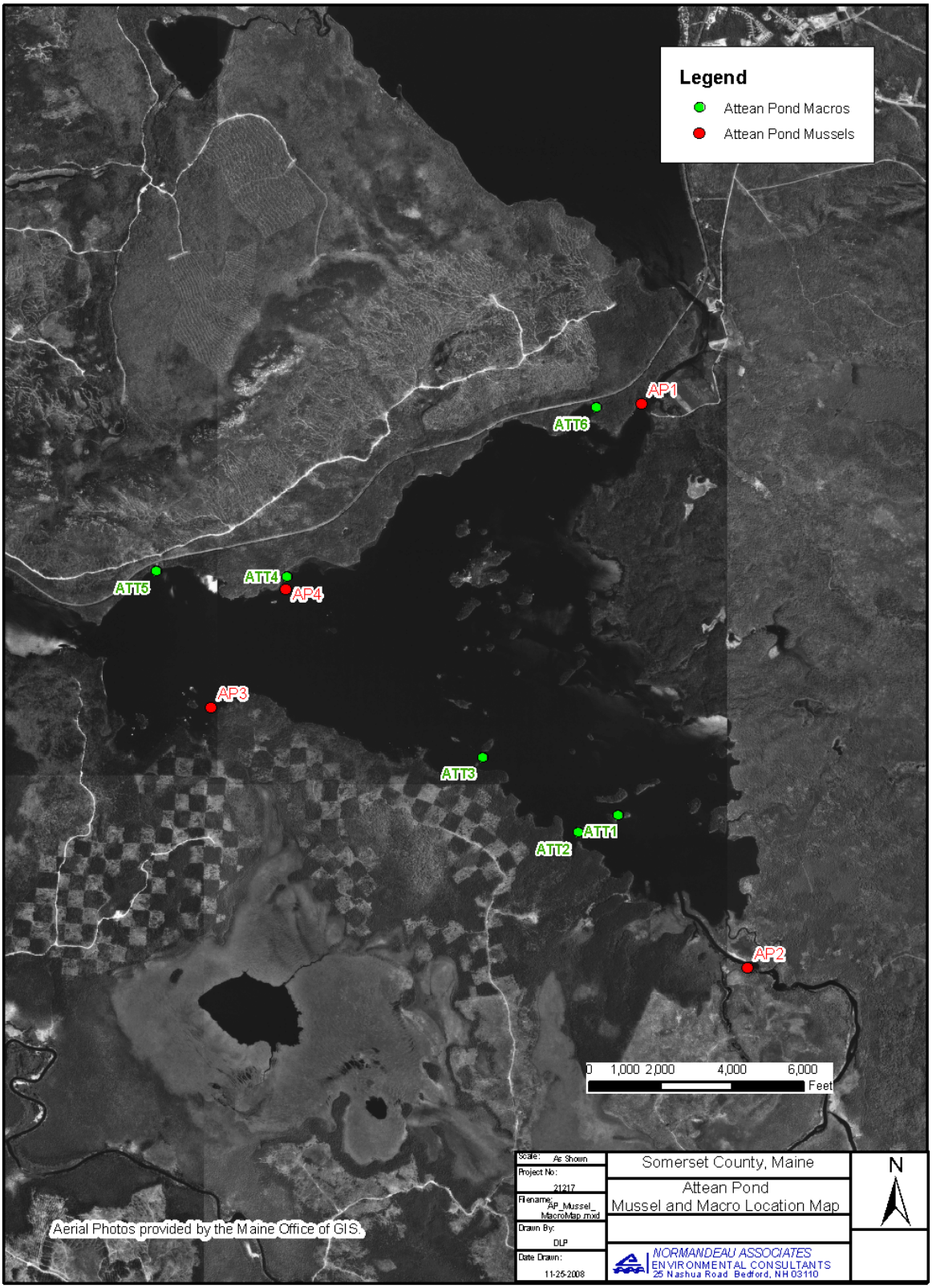

Figure 4.1-2. Attean Pond macroinvertebrate and mussel sampling stations in 2008.

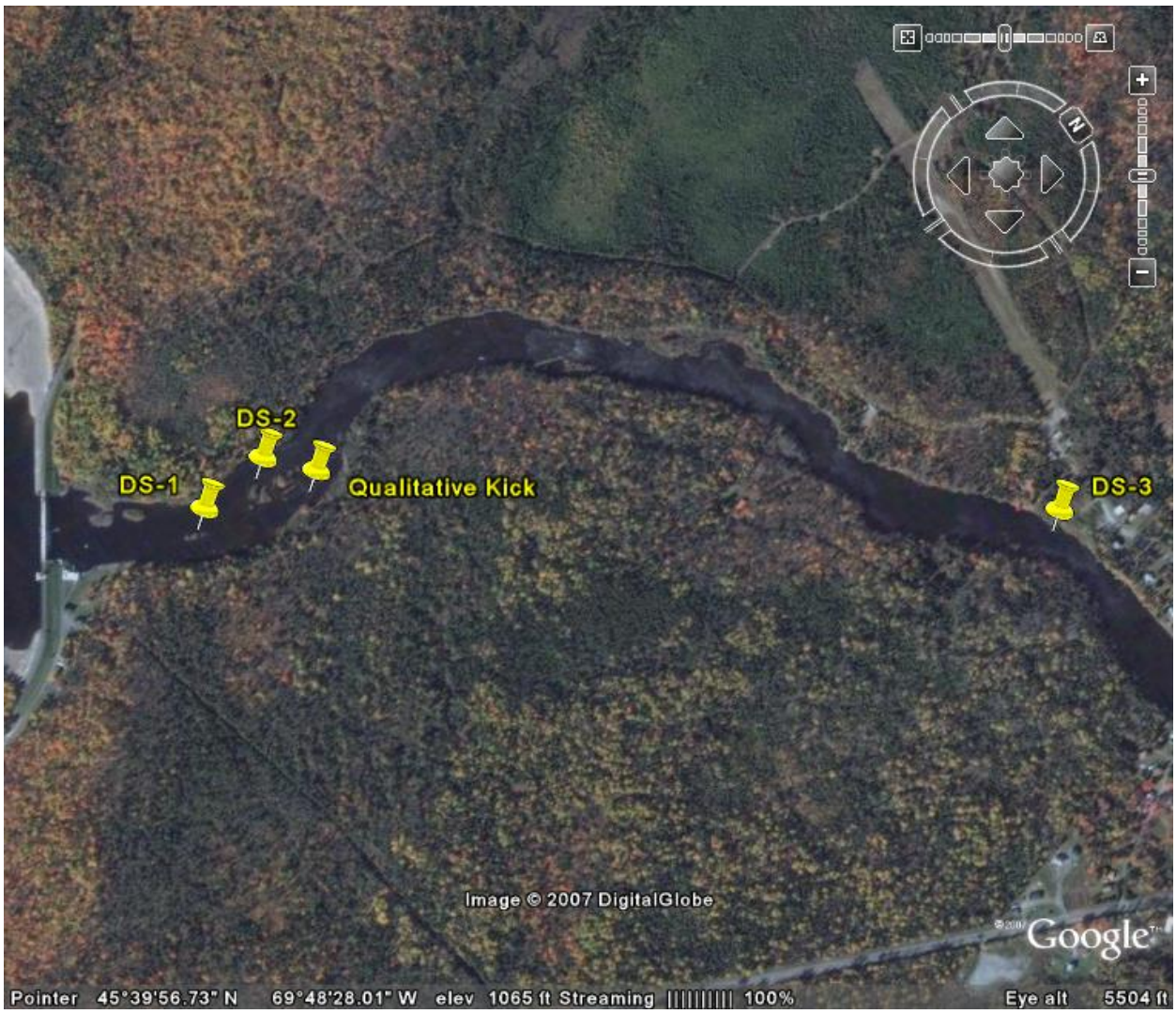

Figure 4.3-1. Tailwater macroinvertebrate sampling stations