Keeyask Generation Project

Aquatic Effects Monitoring Plan

Benthic Macroinvertebrate Monitoring Report

AEMP-2016-08

KEEYASK

Manitoba Conservation and Water Stewardship Client File 5550.00
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2015 - 2016

KEEYASK GENERATION PROJECT

AQUATIC EFFECTS MONITORING PLAN

REPORT #AEMP-2016-08

BENTHIC MACROINVERTEBRATE MONITORING IN THE NELSON RIVER, 2015: YEAR 2 CONSTRUCTION

Prepared for

Manitoba Hydro

By

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June 2016

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SUMMARY

Background

The Keeyask Hydropower Limited Partnership (KHLP) was required to prepare a plan to monitor the effects of construction and operation of the Keeyask Generating Station (GS) on the environment. Besides measuring the accuracy of the predictions made and actual effects of the GS on the environment, monitoring results will provide information on how construction and operation of the GS will affect the environment and if more needs to be done to reduce harmful effects.

Construction of the Keeyask GS began in mid-July 2014. During August and September, the flow in the north and central channels of Gull Rapids was blocked off and all the flow was diverted to the south channel. Cofferdams were constructed in the north and central channels and these channels were dewatered by fall (see construction site map below). The combination of high natural flows in the Nelson River and diversion of flow resulted in water levels on Gull Lake increasing about 1.3 m at the water level monitoring site at Caribou Island. The rise in water levels resulted in flooding along the shoreline and in low-lying areas. During the winter, a cofferdam was constructed extending into the south channel. During the spring of 2015, flows in the Nelson River decreased and water level on Gull Lake went down to pre-construction high water levels.

Benthic macroinvertebrates (BMIs) are tiny animals without backbones, such as insect larvae and clams, which live in, or on, the bottom sediments of lakes and rivers. The BMI community is an important part of the overall plan to monitor the effects of construction and operation of the Keeyask GS on the aquatic environment. BMIs are often used to determine the health of lakes and rivers, and are used in monitoring programs all over the world. For example, observing the changes in the numbers of mayflies, which is one of many different kinds of BMIs, is very helpful because these insects spend the early part of their lives in the bottom sediments and are sensitive to changes in the environment. BMIs are also a valuable food source for fish and important in describing the quality of habitat for fish.

This report describes the results of the BMI community monitoring conducted during fall 2015 (second year of construction at Gull Rapids). Samples were collected upstream of construction activities in Split Lake, immediately downstream of construction activities in the Nelson River, and further downstream in Stephens Lake.

DATA SOURCE:
Orthophoto: Manitoba Hydro - June 21, 2015

CREATED BY:
North/South Consultants

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	26-FEB-10	30-MAY-16
0 0.15 0.3 Kilometres / 0 0.15 0.3 Miles	VERSION NO: 2.0	QA/QC: PMC/FSV/MWZ

Construction Site

Map of instream structures at the Keeyask Generating Station site, June 2016.

Why is the study being done?

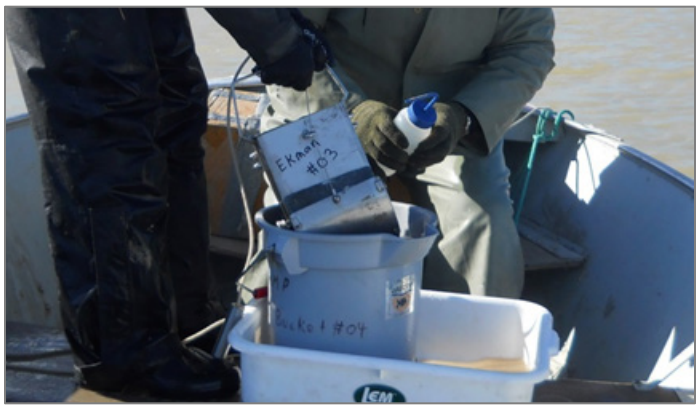
The study is being done to address a key question:

Are construction activities changing the numbers and/or kinds of benthic macroinvertebrates (BMIs) living in the bottom sediments of the Nelson River downstream of the Keeyask GS into Stephens Lake in comparison to either upstream and/or pre-construction conditions?

When construction work for a GS is done in a lake or river, sediments (the mud at the bottom of a lake or river) often get disturbed and mixed into the water; sediments mixed in the water will travel downstream with the current. To understand if the numbers and kinds of BMIs changed downstream of the GS due to increases in the amount of sediment in the water from construction work, BMIs were sampled at a few locations in the Nelson River and Stephens Lake. Negative effects of increased sediments in the water may include decreases in the numbers of fingernail clams and mayflies.

What was done?

BMIs were collected in late August to early September of 2015 (Year 2 of construction).



Collecting a BMI grab with an Ekman dredge.

BMIs were sampled in Split Lake as an example of conditions within an area unaffected by construction activities. BMIs were also sampled in three areas to monitor the potential effects of construction downstream of Gull Rapids and into Stephens Lake. These three areas were located approximately 3 km (area immediately downstream), 11 km (near-field area), and 25 km (far-field area) downstream of Gull Rapids (see regional study area map below). The near-field area was where some effects on the amount of sediment in the water were expected and the far-field area was used to determine if any effects observed at the near-field area extended further downstream. Within each sampling area, BMIs were sampled from both nearshore (close to the shoreline in shallow water) and offshore (far from the shoreline in deeper water) habitat types. Five stations were sampled with a dredge (see photo above) to collect bottom sediments and BMIs in each of these two habitat types.

N

WASKAMAW RIVER
CYGNET LAKE
LIMESTONE LAKE
WASKAIOWAKA LAKE
North Moswakot River
South Moswakot R.
STEPHENS LAKE
LIMESTONE RIVER
Limestone G.S.
Fox Lake Cree Nation
Fox Lake (Bird)
280
290
Nelson River
Long Spruce G.S.
Kettle G.S.
North Access Road
STL3KM-OS
STL11KM-PW
STL11KM-OS
STL25KM-PW
STL25KM-OS
STL3KM-PW
Keeyask G.S.
(Under Construction)
Fox Lake Cree Nation
A Kwis Ki Mahka Reserve
Gillam
Assean R.
Clark Lake
Nelson River
Birthday Rapids
GULL LAKE
Gull Rapids
Tataskweyak Cree Nation
Tataskweyak (Split Lake)
BURNT-OS
BURNT-PW
Assean Lake
SPLIT-PW
SPLIT-OS
LAKE
SPLIT
Burntwood River
ODEI RIVER
First Rapids
Grass River
Anipitapiskow Rapids
Sakitowak Rapids
Kelsey G.S.
York Factory First Nation
York Landing (Kawechiwasik)
Aiken River
Moose Nose Lake
War Lake First Nation
Ilford (Mooseocoot)
BUTNAU RIVER
BUTNAU LAKE
Kettle River
Kettle Lake
FOX (ATKINSON) LAKE
GRASS RIVER
Nelson River

KEEYASK

DATA SOURCE:
Government of Manitoba, Province of Manitoba, Manitoba Hydro

CREATED BY:
North/South Consultants

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	09-FEB-15	19-MAY-16
0 5.5 11 Kilometres / 0 4.5 9 Miles	VERSION NO: 1.0	QA/QC: CMP/YYY/ZZZ

Legend

Benthic Macroinvertebrate Sampling Locations

- 2013 (pre-construction)
- 2014 (Year 1 construction)
- 2015 (Year 2 construction)
- Generating Station (Existing)
- Generating Station (Under Construction)
- Generating Station (Potential)
- Highway
- Rail
- First Nation Reserve

Benthic Macroinvertebrate Sampling Locations in the Regional Study Area

Burntwood River to Limestone G.S.

Map of the study area. Locations of the reference and impact BMI sampling areas at Split Lake and the sites downstream of Gull Rapids in Stephens Lake: 2013 (pre-construction), 2014 (Year 1), and 2015 (Year 2).

What was found?

Nearshore Habitat

- In comparison to pre-construction and 2014, there was less variety of BMIs, and the number of mayflies and the percent of mayflies, stoneflies, and caddisflies that made up the BMI community were greatly reduced 3 km downstream of Gull Rapids in 2015.
- In comparison to pre-construction, the number of fingernail clams in the nearshore habitat 3 km downstream of Gull Rapids was lower in 2015.
- In comparison to pre-construction, the total number of BMIs and the number of mayflies found in nearshore habitat 11 km downstream of Gull Rapids was much lower in 2015.

Offshore Habitat

- In comparison to pre-construction, there were much fewer types of BMIs 3 km downstream of Gull Rapids in the offshore habitat in 2015.

What does it mean?

In 2015 there were negative changes to the BMIs in Stephens Lake at 3 km (nearshore and offshore habitats) and 11 km (less so and for nearshore only) downstream of Gull Rapids that may have been related to increases in the amount of sediment in the water, likely added to by erosion of nearby shorelines.

Construction-related changes were not detected at 25 km downstream in 2015, as BMIs either remained unchanged or increased in comparison to 2014, or followed a pattern similar to what was seen in Split Lake.

What will be done next?

BMI monitoring will be conducted in late August of 2016 (Year 3 of construction). Results of monitoring conducted in 2016 will be compared to pre-construction results and presented in the Year 3 construction report.

ACKNOWLEDGEMENTS

We would like to thank Manitoba Hydro for the opportunity and resources to conduct this study. Saul Mayham of Tataskweyak Cree Nation and Jimmy Lockhart Jr. of Fox Lake Cree Nation are thanked for their assistance in conducting the field work.

The collection of biological samples described in this report was authorized by Manitoba Conservation and Water Stewardship, Fisheries Branch, under terms of the Scientific Collection Permit #26-15.

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1.0 INTRODUCTION

The Keeyask Generation Project (the Project) is a 695-megawatt (MW) hydroelectric generating station at Gull (Keeyask) Rapids on the lower Nelson River in northern Manitoba. The Project is approximately 725 kilometres (km) northeast of Winnipeg, 35 km upstream of the existing Kettle Generating Station, where Gull Lake flows into Stephens Lake, 60 km east of the community of Split Lake, 180 km east-northeast of Thompson and 30 km west of Gillam (Map 1). Construction of the Project began in July 2014.

The *Keeyask Generation Project: Response to EIS Guidelines*, completed in June 2012, provides a summary of predicted effects and planned mitigation for the Project. Technical supporting information for the aquatic environment, including a description of the environmental setting, effects and mitigation, and a summary of proposed monitoring and follow-up programs is provided in the *Keeyask Generation Project Environmental Impact Statement: Aquatic Environment Supporting Volume* (AE SV). As part of the licencing process for the Project, an *Aquatic Effects Monitoring Plan* (AEMP) was developed detailing the monitoring activities of various components of the aquatic environment including the focus of this report, specifically monitoring the benthic macroinvertebrate community, for the construction and operation phases of the Project.

1.1 PROGRAM DESCRIPTION

Construction monitoring will specifically address the biological effects of predicted increases in total suspended solids (TSS) on the benthic community due to in-stream work on the Nelson River and will complement the water quality program. Monitoring of benthic macroinvertebrates occurred immediately downstream of instream construction activities related to the Keeyask GS where effects, should they be measureable, would be greatest. A series of potentially affected locations extending further downstream would be monitored depending on water quality results (*i.e.*, Long Spruce Reservoir, Limestone Reservoir and downstream of Limestone GS). Benthic macroinvertebrates were also assessed upstream of instream activities in the unaffected waterbody Split Lake (utilizing data collected as part of Manitoba and Manitoba Hydro's Coordinated Aquatic Monitoring Program [CAMP]).

The results of the benthic monitoring program will be used to assess the biological effects of predicted increase in TSS due to in-stream work on the Nelson River (intended to complement water quality monitoring). The key questions that monitoring during construction will address are:

- *To what degree will benthic invertebrate abundance and/or community composition change during construction activities in comparison to either upstream or pre-Project conditions?*

- *Are there any unexpected effects on benthic macroinvertebrates that may be related to GS construction activities?*

Unlike water or sediment, where protection of aquatic life guidelines may be used to develop triggers or thresholds for effects assessment, there are no universal benchmarks for biological variables such as abundance or diversity. Rather, the magnitude of change or difference relative to expected conditions is used to establish an appropriate benchmark for biological variables. Based on guidance provided in the Metal Mining EEM document (EC 2012) and the scientific literature, experience with other AEMPs (*e.g.*, Azimuth 2012), and power analysis utilizing CAMP data for a regional waterbody, an effect size of ±50% change in the mean of a metric (in comparison to reference areas and/or pre-construction data) was chosen as most appropriate to use (*i.e.*, realistically achievable with a well-designed program) for the AEMP.

The following report presents the results of benthic macroinvertebrate monitoring completed in the fall of 2015 during Year 2 of construction. Results are assessed using the AMF as summarized in Section 3.4.2 and detailed in the AEMP.

2.0 THE KEEYASK STUDY SETTING

The study area for the 2015 benthic macroinvertebrate construction monitoring program includes Split Lake, downstream of Gull Rapids on the Nelson River, and Stephens Lake.

Split Lake is immediately downstream of the Kelsey GS at the confluence of the Burntwood and Nelson rivers (Map 1). Due to large inflows from the Nelson and Burntwood rivers, the lake has a detectable current in several locations. Split Lake has maximum and mean depths of 28.0 m and 3.9 m respectively, at a water surface elevation of 167.0 m above sea level (ASL) (Lawrence *et al*. 1999). The surface area of Split Lake was determined to be 26,100 ha (excluding islands), with a total shoreline length, including islands, of 940.0 km (Lawrence *et al*. 1999). The numerous islands in Split Lake represent 411.6 km of the total shoreline.

Gull Rapids is located approximately 3 km downstream of Caribou Island on the Nelson River (Map 1). Two large islands and several small islands occur within the rapids, prior to the river narrowing. The rapids are approximately 2 km in length, and the river elevation drops approximately 11 m along its 2 km length. A summary of 2014/2015 construction activities at Gull Rapids is provided in Section 2.1.

Just below Gull Rapids, the Nelson River enters Stephens Lake. Stephens Lake was formed in 1971 by construction of the Kettle GS. Between Gull Rapids and Stephens Lake there is an approximately 6 km long reach of the Nelson River that, although affected by water regulation at the Kettle GS, remains riverine habitat with moderate velocity. Construction of the Kettle GS flooded Moose Nose Lake (which formed the north arm of Stephens Lake) and several other small lakes that previously drained into the Nelson River, as well as the old channels of the Nelson River that now lie within the southern portion of the lake. Major tributaries to Stephens Lake include the North and South Moswakot rivers, which enter the north arm of the lake. Looking Back Creek is a second order stream that also drains into the north arm of Stephens Lake (Map 1). Kettle GS is located approximately 40 km downstream of Gull Rapids.

2.1 2014/2015 CONSTRUCTION SUMMARY

Construction of the Keeyask GS began in mid-July 2014 with the construction of the Quarry Cofferdam in the north channel of Gull Rapids. In August, the North Channel Rock Groin and North Channel Cofferdam were constructed to diverted flow from the north and central channels of Gull Rapids to the south channel. The north and central channels were gradually dewatered by late fall 2014. The Stage 1 Powerhouse Cofferdam was constructed in the fall to permit excavation of the powerhouse. Construction of the Central Dam Cofferdam rock groins began the fall of 2014 and was completed the summer of 2015. During the winter of 2014/15 high flows in the Nelson River and partial failure of the ice boom resulted in high water levels in Gull Rapids which required some cofferdams to be raised. The North Channel Rock Groin was extended into the south channel of Gull Rapids during the winter 2014/15 to raise the water

level on Gull Lake to promote the formation of a stable ice cover. The groin extension was partially removed in 2015. Construction of the spillway cofferdam, which extends into the south channel of Gull Rapids, began in early winter 2015 and was completed by late summer. Dewatering of the spillway cofferdam occurred in summer/fall 2015. The configuration of cofferdams as of mid-summer 2015 is shown on Map 2.

During July and August 2015, additional ice booms were installed in Gull Lake so that a stable ice cover would develop upstream of the construction site (as noted above, the previous ice boom had partially failed during the winter of 2014/2015). Map 3 illustrates the location of the new ice booms, which are held in place by anchors drilled into the bedrock below the river bottom.

Due to high flows in the Nelson River (almost a 1:20 year flow event) and the construction of the North Channel Rock Groin, water levels in Gull Lake rose to between 155 m ASL and 156 m ASL during late summer 2014. This resulted in water levels above the existing environment 95th percentile water level for open-water (154.2 m ASL) until the following spring (Manitoba Hydro 2015). Open water levels on Gull Lake in the existing environment were as high as 155 m and surpassed 156 m during winter on occasion. The amount of land inundated during the 2014-2015 period is not known, but based on estimates of flooded areas expected in the later stages of construction (as presented in the Environmental Impact Statement), this area likely included the nearshore areas of much of Gull Lake and some localized areas in and around Gull Rapids, as well as low-lying areas that extended further inland. Water levels during the open-water season of 2015 declined due to lower discharge in the Nelson River. Water levels on Gull Lake ranged from 154 m ASL to 155 m ASL in 2015, and inundated areas were likely confined to localized sections of low-lying areas around Gull Lake.

3.0 METHODS

The following sections provide a description of the study design, sampling sites, field and laboratory methods, and data analysis methods for the benthic macroinvertebrate construction monitoring program.

3.1 STUDY DESIGN

The AEMP sampling design is comparable to the current CAMP design, such that data generated by the latter program will be used to augment AEMP reporting. Sampling areas (*i.e.*, polygons) were stratified by water depth and constrained by other aquatic habitat attributes (*e.g.*, substrate type, presence/absence of aquatic plants, water velocity, *etc.*) such that sampling areas represent the predominant habitat types(s) within each water body and/or those habitat type(s) with predicted effects as defined in the AE SV. Sampling conducted in 2013 (pre-construction/baseline) was based on the sampling design refined during AEMP development in an attempt to minimize the inherent variability within the benthic invertebrate data. As such, results are directly comparable to data collected in 2014 (Year 1 of construction) and 2015 (Year 2). The construction monitoring program is designed to facilitate comparisons of benthic macroinvertebrate metrics spatially (*i.e.*, upstream and downstream of construction activities) to delineate Project-related effects. Specifically, the program is designed to facilitate statistical comparisons of community metrics in reference areas to those monitored downstream of construction activities (*i.e.*, areas that are predicted to be most affected by the Project). The overall objective of monitoring during the construction period was to determine if in-stream activities resulted in or contributed to exceedances of the benchmark and to confirm predictions in the AE SV.

As TSS was not expected to increase by more than 5 mg/L above background for the majority of the period between mid-July and early October (during Year 2 of construction) and up to 8 mg/L in July, the downstream extent of benthic macroinvertebrate monitoring was restricted to Stephens Lake (25 km downstream).

3.2 SAMPLING LOCATIONS

Benthic macroinvertebrate sampling was conducted between 22 August and 26 September, 2013 (pre-construction), 19 August and 17 September, 2014 (Year 1 construction), and 20 August and 08 September, 2015 (Year 2 construction), for the AEMP and CAMP (Table 1). Benthos were assessed in Split Lake (used as reference location; Map 4) and in a gradient downstream of Gull Rapids and through Stephens Lake (potentially affected areas at approximately 3 km, 11 km, and 25 km downstream; Map 5).

Within each sampling polygon, samples were collected from the nearshore in predominantly wetted (PW) habitat and in the deeper offshore (OS) habitat. For PW habitat, water depths of >1 to 3 m, areas with consistent water movement (*i.e.*, standing water, low water velocity), and homogeneous substrate were targeted; areas with aquatic macrophyte beds were avoided. For the OS, sampling sites were constrained by the same habitat attributes, with the exception of water depth, which was >3 to 10 m. The spatial extent of a polygon was at least 100 m x 100 m, and large enough to adequately accommodate five replicate stations. For pre-construction and construction monitoring, the location of the five replicate stations were established by field crews and selected based on specific habitat attributes (*i.e.*, water depth, substrate type, absence of aquatic plants, water velocity) and the spatial separation criteria outlined in the Metal Mining Technical Guidance for Environmental Effects Monitoring (EEM; EC 2012). By EEM definition, a replicate station is a specific, fixed sampling location within an area that can be determined recognized, re-sampled and defined quantitatively (*e.g.*, UTM position and a written description). The geographic extent of each replicate station was minimally 10 m x 10 m and separated from other replicate stations by at least 20 m. Within the habitat type(s), a replicate station consisted of three (construction) to five (pre-construction) randomly collected benthic invertebrate sub-samples; the sub-samples were composited to provide an estimate of the benthic community at each station. Field sub-samples were collected using a random number table and from designated sampling locations around an anchored boat within the 10 m x 10 m replicate station area.

Note that Split Lake nearshore habitat was not sampled in 2013 (pre-construction) and Stephens Lake (nearshore and offshore habitats) were not sampled in 2013.

3.3 FIELD SAMPLING AND LABORATORY METHODS

3.3.1 SUPPORTING IN SITU AND SEDIMENT

Supporting environmental variables measured/recorded at each replicate station included:

- Water temperature (using a hand-held thermometer for water surface measurement);
- UTM position (using a hand-held GPS receiver);
- Water transparency (using a Secchi disk);
- Water velocity (using a Swoffer current velocity meter at approximately 20 cm below water surface or visually estimated);
- Riparian vegetation (photographic record and visual description);
- Aquatic macrophytes (description of relative abundance and dominant type); and,
- Dominant and secondary substrate types.

An additional benthic grab was taken at each replicate station and sub-sampled with a 5 cm diameter core tube (0.002 m^2 surface area) to provide a sample of approximately 100 mL of sediment to characterize the general type of sediments in terms of total organic carbon (TOC) content and particle size composition. Sediment samples were sent frozen in coolers to North/South Consultants Inc. (NSC) laboratory (Winnipeg, MB) and stored frozen/cold pending submission to the analytical laboratory. Sediment laboratory analyses were conducted by ALS Laboratory Group (ALS; Winnipeg, MB).

Supporting environmental variables measured/recorded at each sub-sample/grab site included:

- Water depth (using a hand-held depth sounder or metered benthic dredge rope);
- Presence/absence of aquatic macrophytes in sub-sample; and,
- Substrate composition (visual description *e.g.*, % cobble, gravel, silt, *etc.*).

3.3.2 BENTHIC MACROINVERTEBRATES

Benthic invertebrates were sampled at sites using either a petite Ponar dredge or an Ekman dredge (both with 0.023 m^2 opening). All sites were accessed by boat.

At each site within a replicate station, one benthic invertebrate sample was retrieved to the surface and carefully sieved through a 500 µm mesh rinsing bag. An acceptable sample required that the jaws be completely closed upon retrieval. If the jaws were not completely closed the sample was discarded into a bucket (and disposed of once sampling is completed) and the procedure was repeated. All sampling equipment was rinsed before sampling at the next site. All material, including invertebrates, retained by the screen was transferred to labelled plastic jars and fixed with 10% formaldehyde. Fixed samples were shipped to the NSC laboratory (Winnipeg, MB) for processing.

At the laboratory, samples from all locations were rinsed with water through a 500 µm sieve and sorted under a 3X magnifying lamp. The invertebrates were transferred to 70% ethanol prior to being identified to the appropriate taxonomic level. A Leica Mz125 microscope (maximum 100x magnification) and reference texts from Clifford (1991), Merritt and Cummins (1996), Peckarsky *et al*. (1990), Smith (2001), Stewart and Stark (2002), and Wiggins (2004) were used for taxonomic identification. Scientific names used followed the Integrated Taxonomic Information System (ITIS 2015) classification. Invertebrates were identified to major group (subclass, order, or family) and Ephemeroptera were identified to genus. All invertebrate identification and enumeration was performed by an invertebrate taxonomist at NSC.

All samples were processed following NSC's Quality Assurance/Quality Control (QA/QC) guidelines (Appendix 1). All sorted samples are checked by a second laboratory technician (QA/QC technician). Any additional invertebrates collected during the QA/QC process are combined with the original sample, but counted separately. Sorting efficiency must be ≥ 95%. The QA/QC technician checks on a tray-by-tray basis so that the sample is handled as few

times as possible; the QA/QC technician will sort any remaining invertebrates from the tray and record the number of missed invertebrates per tray. The QA/QC technician will also check the bench sheet data to ensure it matches the sample data. Ten percent (10%) of the in-house identifications were randomly selected and sent to an external taxonomy specialist for QA/QC. The accuracy of the sample subset is assessed for identification and enumeration. This specialist was also able to identify any uncertain or unknown organisms. The target overall accuracy level for in-house invertebrate identifications and enumeration is 95% at the Family level and 90% at the Genus level. Corrected identifications and enumeration values received from the external taxonomist are used in place of any in-house data discrepancies. For the 2015 benthic macroinvertebrate monitoring program, the overall percent identification error at the family-level was 3.9% (96.1% accurate), and ranged between 0.0% and 9.9% (100% to 90.1% accurate) for individual samples. The identification error is the result of one particular group at a taxonomic level that has no influence on conclusions for this program. Recalculation of the identification error including that particular taxa group at a higher taxonomic level resulted in an overall percent identification error of only 0.1% (99.9% accurate).

All sorted samples will be retained and archived for the duration of the construction phase should further identification be required. A reference collection of benthic invertebrates will be maintained to ensure taxonomic consistency throughout the monitoring program duration.

3.4 DATA ANALYSIS

3.4.1 SUPPORTING SEDIMENTS

Summary statistics (mean, standard deviation [± SD], standard error [± SE], median, minimum, and maximum, coefficient of variation [COV (%)], and mean ±50%) were calculated to characterize the general type of sediments observed in each aquatic habitat type sampled within a polygon. To facilitate such calculations, any parameters measured below the analytical detection limit were assigned a value of one-half the detection limit. All parameters were reviewed and comparisons to ±50% difference in the mean of a metric in comparison to reference locations, and/or pre-construction and Year 1 data were done to identify any potential physical habitat differences among sampling locations. For each parameter that was greater than 50% different, a statistical comparison was undertaken (as described in Section 3.4.2).

3.4.2 BENTHIC MACROINVERTEBRATES

To prepare data for analysis, abundance of invertebrates was converted to density (number of invertebrates per square metre [individuals/m^2]) by dividing the total number of invertebrates by the area of the sampling device (0.023 m^2). The mean, standard deviation (± SD), standard

error (± SE), median, minimum, maximum, COV (%), and mean ±50% were calculated to characterize each aquatic habitat type sampled within a polygon for each waterbody.

Benthic invertebrate community descriptors were calculated for each replicate station and habitat type. Composition metrics included:

- Total macroinvertebrate density;
- Densities and relative proportions of major groups. (non-Insecta: Oligochaeta, Amphipoda, Bivalvia, Gastropoda; Insecta: Chironomidae, Ephemeroptera, Plecoptera, Trichoptera);
- Percent Ephemeroptera;
- Percent Ephemeroptera, Plecoptera,and Trichoptera (EPT) (EPT index; Sullivan *et al*. 2004);
- Percent of total organisms made up of Oligochaeta and Chironomidae; and,
- Ratio of EPT to Chironomidae.

Richness measures included:

- Total taxonomic richness (family-level; total number of invertebrate families within a habitat polygon; Barbour *et al*. 1999; Klemm *et al*. 2002; Resh *et al*. 1997); and,
- EPT richness (family-level; total number of families of Ephemeroptera, Plecoptera, and Trichoptera within a habitat polygon).

Diversity indices included:

- Simpson's Diversity Index (EC 2012; Magurran 1988, 2004; Mandaville 2002).

The AEMP identified less variable (*i.e.*, more sensitive to change) benthic macroinvertebrate community metrics, and a benchmark to focus the monitoring program and provide a framework for adaptive management:

- Total macroinvertebrate abundance;
- Total taxonomic richness; and
- Simpson's Diversity Index.

Results of the benthic macroinvertebrate monitoring program are to be subject to the steps identified within the AMF. This framework prescribes data analysis methods and other tasks to be undertaken based on results of the monitoring program. Step 1 of the AMF entails comparison of the mean values of replicate samples for metrics to the benchmark identified in the AEMP. If the benchmark is not exceeded, the assessment would proceed to Response Level 1 – trend analysis. If the benchmark is exceeded, the assessment would proceed to Step 2 – determination of whether there is a statistical difference between upstream and downstream areas (*i.e.*, control-impact) and/or relative to pre-construction conditions (before-after). If a statistical difference is not observed, the assessment would proceed to Response Level 1.

Where statistical differences are identified, the assessment would proceed to Step 3, in which a determination of cause (*i.e.*, is the difference Project-related) would be undertaken.

All metrics were reviewed and comparisons to the benchmark (*i.e.*, ±50% change in the mean of a metric in comparison to reference locations, and/or pre-construction and Year 1 data) were done to identify the potential for adverse effects on the benthic macroinvertebrate community. For each metric that exceeded the benchmark, a statistical comparison between reference and exposure locations, and/or pre-construction and Year 1 data was undertaken. Prior to statistical analyses, macroinvertebrate metrics were tested for normality and homogeneity of variances and where the assumptions were met, were compared through a t-test or an Analysis of Variance (ANOVA) with Bonferroni pairwise comparison ($\alpha = 0.05$). Where these assumptions were not met, non-parametric analyses were applied such as the Mann-Whitney U-test or Kruskal-Wallis test followed by Dunn's multiple pairwise comparisons procedure ($\alpha = 0.05$). When data are non-normal, non-parametric tests are more powerful than parametric ones, *i.e.*, non-parametric analyses may be able to detect significant differences in the data when parametric analyses would not (Zar 1999). Non-parametric analyses are performed on ranks of the data and therefore do not require transformation of data; thus, all analyses are performed on the raw data. All analyses were performed using a current version of XLStat.

4.0 RESULTS

4.1 SUPPORTING SEDIMENTS

Sediment data for individual replicate stations sampled in 2013 (pre-construction), 2014 (Year 1 construction), and 2015 (Year 2) are presented in Appendix 2.

4.1.1 NEARSHORE HABITAT

4.1.1.1 TOC (%)

The benchmark (*i.e.*, a ±50% change in the mean of a metric in comparison to pre-construction data) was exceeded at Stephens Lake 3 km and the TOC of sediments was higher (not significantly) than +50% of that measured in 2013 (pre-construction); TOC of sediments was within ±50% of 2014 (Year 1) (Table 2). Mean TOC (%) content measured in nearshore habitat in 2015 was within ±50% of the pre-construction and Year 1 construction means at Stephens Lake 11 km downstream. TOC of sediments for nearshore habitat at Stephens Lake 25 km was within ±50% of the 2014 mean.

Mean TOC measured in nearshore habitat at Stephens Lake (3 km and 11 km) in 2015 was within ±50% of the Split Lake (reference) mean; TOC at 25 km was lower than -50% of the Split Lake mean.

4.1.1.2 SAND (%)

Mean sand (%) in 2015 was within ±50% of the pre-construction mean at Stephens Lake 3 km and 11 km (Table 3); sand content at 3 km in 2015 was higher than +50% of the 2014 mean, whereas sand content at 11 km remained unchanged from the Year 1 construction mean. Sand content of sediments in nearshore habitat at 25 km was within ±50% of the 2014 mean.

Mean sand content of sediments in 2015 appeared to increase in a downstream direction through Stephens Lake.

Mean sand content at Stephens Lake 11 km in 2015 was within ±50% of the Split Lake mean, however, the sand content at 3 km was lower than -50% of the Split Lake mean and the sand content at 25 km was higher than +50% of the mean.

4.1.1.3 SILT (%)

Mean silt (%) in 2015 was within ±50% of the pre-construction and 2014 means at Stephens Lake 3 km and 11 km (Table 4). Silt content of sediments in nearshore habitat at 25 km was within ±50% of the 2014 mean.

Silt content of sediments in 2015 appeared to decrease at the most downstream sampling location in Stephens Lake.

Mean silt content at Stephens Lake 3 km and 11 km in 2015 was within ±50% of the Split Lake mean, however, the silt content at 25 km was lower than -50% of the Split Lake mean.

4.1.1.4 CLAY (%)

Mean clay (%) in 2015 was within ±50% of the pre-construction and 2014 means at Stephens Lake 3 km and 11 km (Table 5). Clay content of sediments in nearshore habitat at 25 km was higher than +50% of the 2014 mean.

Mean clay content of sediments was higher at 3 km in comparison to further downstream in Stephens Lake (11 km and 25 km).

Mean clay content at Stephens Lake 11 km and 25 km in 2015 was within ±50% of the Split Lake mean, however, the clay content at 3 km was higher than +50% of the Split Lake mean.

Any variability noted for TOC content and particle size composition was likely related to physical habitat differences among sampling locations (spatially and temporally), rather than construction activities.

4.1.2 OFFSHORE HABITAT

4.1.2.1 TOC (%)

The benchmark was exceeded at Stephens Lake 3 km and the TOC content of offshore sediments was higher (not significantly) than +50% of that measured in 2013 and 2014 (Table 6). Mean TOC content measured in offshore habitat in 2015 was within ±50% of the pre-construction and Year 1 construction means at Stephens Lake 11 km. TOC content of sediments for offshore habitat at Stephens Lake 25 km was within ±50% of the 2014 mean.

Mean TOC content measured in nearshore habitat at Stephens Lake 11 km in 2015 was within ±50% of the Split Lake (reference) mean; TOC at 3 km and 25 km were higher than +50% of the Split Lake mean.

4.1.2.2 SAND (%)

Mean sand (%) in 2015 was higher than +50% of the pre-construction mean at Stephens Lake 3 km and 11 km (significantly so) (Table 7); sand content at 3 km in 2015 was lower than -50% of the 2014 mean, whereas sand content at 11 km was significantly higher than +50% of the Year 1 construction mean. Sand content of sediments in nearshore habitat at 25 km was significantly higher than +50% of the 2014 mean.

Mean sand content at Stephens Lake (3 km, 11 km, and 25 km) in 2015 was lower than -50% of the Split Lake mean.

4.1.2.3 SILT (%)

Mean silt (%) in 2015 was within ±50% of the pre-construction and 2014 means at Stephens Lake 3 km and 11 km (Table 8). Silt content of sediments in offshore habitat at 25 m was within ±50% of the 2014 mean.

Mean silt content at all Stephens Lake sampling locations in 2015 was within ±50% of the Split Lake mean.

4.1.2.4 CLAY (%)

Mean clay (%) in 2015 was within ±50% of the pre-construction and 2014 means at Stephens Lake 3 km (Table 9); clay content at 11 km was significantly lower than -50% of the 2013 and 2014 means. Clay content of sediments in offshore habitat at 25 km was significantly lower than -50% of the 2014 mean.

Mean clay content of sediments in 2015 was higher at 3 km in comparison to further downstream in Stephens Lake (11 km and 25 km).

Mean clay content at Stephens Lake 3 km in 2015 was higher than +50% of the Split Lake mean, however, the clay content at Stephens Lake 11 km and 25 km in 2015 was within ±50% of the Split Lake mean.

Any variability noted for TOC content and particle size composition was likely related to physical habitat differences among sampling locations (spatially and temporally), rather than construction activities.

4.2 BENTHIC MACROINVERTEBRATES

Benthic macroinvertebrate data for individual replicate stations sampled in 2013, 2014, and 2015 are presented in Appendix 2. Summary statistics by habitat type for metrics not presented in the following sections are provided in Appendix 3.

Obvious differences among the benthic macroinvertebrate communities in Split Lake (reference) and Stephens Lake (impact) were noted for the pre-construction program (2013) (Zrum and Gill 2015). For example, the mean total macroinvertebrate density measured in Stephens Lake in the offshore exceeded the benchmark (*i.e.*, was less than) when compared to the same habitat type in Split Lake. As such, the assessment of potential effects of construction-related activities on the downstream benthos also included:

- Investigating the changes over time in metrics used to describe the community at each impact polygon in comparison to any observed changes over time at reference polygons, for the same aquatic habitat types sampled; and
- Relating any observed changes over time in benthic community metrics in sampled aquatic habitat types at impact polygons to changes in the input of TSS.

4.2.1 KEY METRICS

4.2.1.1 TOTAL MACROINVERTEBRATE ABUNDANCE

NEARSHORE HABITAT

Mean total macroinvertebrate density measured in nearshore habitat in 2015 was within ±50% of the pre-construction and Year 1 construction means at Stephens Lake 3 km; density at 11 km was significantly lower than -50% of the 2013 mean, but within ±50% of 2014 (Table 10). Total macroinvertebrate density in nearshore habitat at 25 km was higher than +50% of the 2014 mean, but not significantly so.

In 2015, mean total density somewhat increased in a downstream direction through Stephens Lake (Figure 2).

Mean total macroinvertebrate density measured in nearshore habitat at Stephens Lake 3 km and 11 km was lower than -50% of the Split Lake (reference) mean; total density at 25 km was higher than upstream sampling locations and was within ±50% of the Split Lake mean.

OFFSHORE HABITAT

Mean total macroinvertebrate density measured in offshore habitat in 2015 was lower than -50% of the pre-construction and 2014 (significantly so) means at Stephens Lake 3 km; density at 11 km was within ±50% of the 2013 and 2014 means (Table 11). Total macroinvertebrate density in nearshore habitat at 25 km was within ±50% of the 2014 mean.

In 2015, mean total density increased in a downstream direction through Stephens Lake (Figure 3).

Mean total macroinvertebrate density measured in nearshore habitat at Stephens Lake 3 km and 11 km in 2015 was lower than -50% of the Split Lake mean; total density at 25 km was higher than upstream sampling locations and was within ±50% of the Split Lake mean.

4.2.1.2 TOTAL TAXONOMIC RICHNESS

NEARSHORE HABITAT

Mean total taxonomic richness (at the family level) measured in nearshore habitat in 2015 was within ±50% of the pre-construction and 2014 means at Stephens Lake 3 km and 11 km (Table 12). Similarly, total richness at 25 km was within ±50% of the 2014 mean.

In 2015, mean total richness somewhat increased in a downstream direction through Stephens Lake (Figure 4).

Mean total richness measured in nearshore habitat in Stephens Lake (3 km, 11 km, and 25 km) was within ±50% of the Split Lake mean for comparable habitat.

OFFSHORE HABITAT

Mean total richness measured in offshore habitat in 2015 at Stephens Lake 3 km was significantly lower than -50% of the pre-construction mean, but within ±50% of the 2014 mean (Table 13). At Stephens Lake 11 km, total richness was within ±50% of the 2013 and 2014 means; similarly, total richness at 25 km was within ±50% of the 2014 mean.

In 2015, mean total richness was somewhat higher at sampling locations further downstream in Stephens Lake in comparison to 3 km (Figure 5).

Mean total richness measured in nearshore habitat at Stephens Lake 3 km was lower than -50% of the Split Lake mean; in contrast, total richness at 11 km and 25 km was within ±50% of the Split Lake mean for comparable habitat.

4.2.1.3 SIMPSON'S DIVERSITY INDEX

NEARSHORE HABITAT

Mean Simpson's diversity measured in nearshore habitat in 2015 at Stephens Lake 3 km was lower than -50% of the pre-construction (significantly so) and 2014 means (Table 14). At Stephens Lake 11 km, diversity was within ±50% of the 2013 and 2014 means; similarly, diversity at 25 km was within ±50% of the 2014 mean.

In 2015, diversity was higher at sampling locations further downstream in Stephens Lake in comparison to 3 km (Figure 6).

Mean diversity measured in nearshore habitat at Stephens Lake 3 km in 2015 was lower than -50% of the Split Lake mean; total richness at 11 km and 25 km was within ±50% of the Split Lake mean for comparable habitat.

OFFSHORE HABITAT

Mean Simpson's diversity measured in offshore habitat in 2015 was within the benchmark value (±50%) of the pre-construction and 2014 means Stephens Lake 3 km (Table 15). At Stephens Lake 11 km in 2015, diversity was significantly higher than +50% of the pre-construction mean, but unchanged from 2014. Similarly, diversity at 25 km in 2015 was within ±50% of the 2014 mean.

In 2015, mean diversity was somewhat higher at Stephens Lake 11 km in comparison to 3 km and 25 km sampling locations (Figure 7).

Mean diversity measured in nearshore habitat in Stephens Lake (3 km, 11 km, and 25 km) in 2015 was within ±50% of the Split Lake mean for comparable habitat.

4.2.2 ADDITIONAL METRICS

Benthic macroinvertebrate metrics expected to be negatively affected by increases in TSS include a decrease in Ephemeroptera (mayfly) abundance, percent EPT (percent mayfly, stonefly, and caddisfly), and Pisidiidae (fingernail clam) abundance; as such, they are presented in the following sections.

4.2.2.1 NEARSHORE HABITAT

EPHEMEROPTERA ABUNDANCE

Mean mayfly density measured in nearshore habitat in 2015 at Stephens Lake 3 km was lower than -50% of the pre-construction and 2014 (significantly so) means (Table 16). Mayfly density at Stephens Lake 11 km was significantly less than -50% of the pre-construction mean, but within ±50% of the 2014 mean. In contrast, at Stephens Lake 25 km mayfly density was significantly higher than +50% of the 2014 mean.

In 2015, mean mayfly density appeared to increase downstream through Stephens Lake.

Mayfly density measured in nearshore habitat at Stephens Lake 3 km in 2015 was lower than -50% of the Split Lake mean. In contrast, density at 11 km was within ±50% of the Split Lake mean and density at 25 km was higher than +50% of the reference mean.

PERCENT EPT

In nearshore habitat in 2015, percent (%) EPT was lower than -50% of the pre-construction and 2014 (significantly so) means at Stephens Lake 3 km (Table 17). At Stephens Lake 11 km, %

EPT in 2015 was within ±50% of the pre-construction and 2014 means. Similarly, % EPT at 25 km was within ±50% of the 2014 mean.

In 2015, mean % EPT was higher at sampling locations further downstream in Stephens Lake in comparison to 3 km.

Mean % EPT measured in the nearshore habitat at Stephens Lake 3 km in 2015 was lower than -50% of the Split Lake mean. In contrast, % EPT at 11 km and 25 km was higher than +50% of the reference mean.

PISIDIIDAE ABUNDANCE

In nearshore habitat at Stephens Lake 3 km in 2015, fingernail clam density was lower than -50% of the pre-construction mean, but within ±50% of the 2014 mean (Table 18). At Stephens Lake 11 km, fingernail clam density in 2015 was within ±50% of the pre-construction and 2014 means. Similarly, at Stephens Lake 25 km density was within ±50% of the 2014 mean.

In 2015, fingernail clam density appeared to increase downstream through Stephens Lake.

Mean fingernail clam density measured in the nearshore habitat at Stephens Lake 3 km and 11 km was lower than -50% of the Split Lake mean. In contrast, density at 25 km was higher than +50% of the reference mean.

4.2.2.2 OFFSHORE HABITAT

EPHEMEROPTERA ABUNDANCE

Mean mayfly density measured in offshore habitat in 2015 at Stephens Lake 3 km was lower than -50% of the pre-construction (significantly so) and 2014 means; mayflies were absent at 3 km in 2015 (Table 19). Mayfly density at Stephens Lake 11 km was significantly less than -50% of the pre-construction mean, but within ±50% of the 2014 mean. Similarly, at Stephens Lake 25 km mayfly density was significantly lower than -50% of the 2014 mean.

In 2015, mean density was higher at Stephens Lake 11 km in comparison to 3 km and 25 km sampling locations.

Mayfly density in offshore habitat at Stephens Lake 3 km in 2015 was lower than -50% of the Split Lake mean. In contrast, density at 11 km was higher than +50% of the reference mean and density at 25 km was within ±50% of the Split Lake mean.

PERCENT EPT

In offshore habitat in 2015, % EPT was higher than +50% of 2013 and 2014 means at Stephens Lake 3 km (Table 20). At Stephens Lake 11 km, % EPT was within ±50% of the pre-construction and 2014 means. In contrast, at Stephens Lake 25 km density was significantly lower than -50% of the 2014 mean.

In 2015, % EPT was higher at Stephens Lake 11 km in comparison to 3 km and 25 km sampling locations.

Percent EPT in Stephens Lake (3 km, 11 km, 25 km) was higher than +50% of the Split Lake mean.

PISIDIIDAE ABUNDANCE

In offshore habitat in 2015, fingernail clam density was lower than -50% of the pre-construction and 2014 means at Stephens Lake 3 km; fingernail clams were absent at 3 km in 2015 (Table 21). Fingernail clams were also absent from 11 km in 2013, 2014, and 2015, and from 25 km in 2015 (significantly lower than -50% of the 2014 mean), and appear to be rare in the offshore habitat of Stephens Lake.

Fingernail clam density in Stephens Lake (3 km, 11 km, 25 km) in 2015 was lower than -50% of the Split Lake mean.

5.0 DISCUSSION

Results from 2015 indicated there were negative changes in the benthos at 3 km (nearshore and offshore habitats) and 11 km (nearshore only) downstream of Gull Rapids that may have been related to TSS inputs, likely contributed to by local shoreline erosion rather than instream construction activities; this was supported by the following observations for metrics expected to be negatively affected by increases in TSS (Table 22):

Nearshore Habitat

- Diversity at nearshore habitat 3 km downstream was lower than -50% of the pre-construction (significantly so) and 2014 means.
- Mayfly density and percent EPT at nearshore habitat 3 km downstream were both lower than -50% of the pre-construction and 2014 (significantly so) means.
- Fingernail clam density at nearshore habitat 3 km downstream was lower (not significantly so) than -50% of the pre-construction mean.
- Total abundance at nearshore habitat 11 km downstream was significantly lower than -50% of the pre-construction mean.
- Mayfly density at nearshore habitat 11 km downstream was significantly lower than -50% of the pre-construction mean.

Offshore Habitat

- Total richness at offshore habitat 3 km downstream was significantly lower than -50% of the pre-construction mean.

Construction-related changes were not detected at 25 km downstream in 2015, as BMIs either remained unchanged or increased in comparison to 2014, or followed a pattern similar to what was seen in Split Lake (Table 22).

Turbidity monitoring conducted under the Keeyask Generation Project Physical Environment Monitoring Program (PEMP) along the mainstem of the Nelson River showed that turbidity in 2015 was generally similar at the outlet of Clark Lake, the inlet of Gull Lake, upstream of Gull Rapids, and Stephens Lake immediately upstream of the Kettle GS, and that the range was comparable to what was recorded in the pre-construction period (2008) (Manitoba Hydro 2016). Turbidity monitoring conducted under the Sediment Management Plan (SMP) in the open water season of 2015 indicated no substantive change in turbidity between a site immediately upstream of the construction area and sites in Stephens Lake 1.5 and 9 km downstream of the construction site, indicating that sediment inputs at the construction site were not causing detectable increases in turbidity (and by inference, TSS) in the mainstem of the Nelson River (Manitoba Hydro 2016).

During winter 2015 (March to April), TSS in the nearfield polygon (near 11km downstream BMI sampling locations in Stephens Lake) exceeded the 30-day (chronic) PAL objective (Wyn and

Cooley 2016). TSS exceeded the PAL at two sites; one was a marginal exceedance but the other TSS result (from site NF-6) was very high. The latter site also had high results for many other parameters (though they were all within PALs and benchmarks). This site was relatively close to shore, compared to the other nearfield sampling locations, and localized shoreline erosion may have contributed to the elevated results for the site. The water quality monitoring data collected during major in-stream construction activities in the open-water season of 2015 showed that there was no evidence that activities affected long-term TSS concentrations in the local study area.

Benthic macroinvertebrate metrics expected to be negatively affected by increases in TSS included a decrease in Ephemeroptera (mayfly) abundance and Pisidiidae (fingernail clam) abundance (Section 4.2.2). There was notable among-year variability in mayfly abundance at Stephens Lake sampling locations that may be in part attributable to the Ephemeridae (*Hexagenia* sp.; burrowing mayfly) life cycle; this genus of mayfly has a two-year life cycle with a larger cohort emerging on alternate years. The natural variability in mayfly abundance, particularly in nearshore habitat, will affect the sensitivity of this metric for detecting construction-related effects on the BMI community and will need to be considered as subsequent years of data are collected for the AEMP. Similarly, detecting construction-related effects in offshore habitat of Stephens Lake using the metric fingernail clam abundance is problematic due to the absence of this family periodically at 3 km, 11 km, and 25 km downstream of Gull Rapids. As such, this metric will not be sensitive to changes over time, either natural or related to construction activities

5.1 KEY QUESTIONS

The results of the benthic monitoring program are used to assess the biological effects of the predicted increases in TSS due to instream construction activities. As TSS was not expected to increase by more than 5 mg/L above background for the majority of the period between mid-July and early October (during Year 2 of construction) and up to 8 mg/L in July, the downstream extent of benthic macroinvertebrate monitoring was restricted to Stephens Lake (25 km downstream).

The key questions that monitoring during construction will address are:

- ***To what degree will benthic invertebrate abundance and/or community composition change during construction activities in comparison to either upstream or pre-Project conditions?***

The AE SV (KHLP 2012) considered the following pathways of effect during construction of the Project:

- Changes to water quality, such as increases in concentration of TSS and related variables (*e.g.*, turbidity). However, it was expected that measures to protect water quality would

reduce the likelihood of any measurable effects on the benthic macroinvertebrate community;

- Deposition of sediments in Stephens Lake. This was not expected to affect benthic macroinvertebrates as the total amount of sediments deposited was predicted to be very small (less than 0.6 cm thickness over the period of construction) and the composition of bottom substrate would not be changed.

Results from 2015 are discussed in detail above and indicate there were negative changes that may have been related to TSS inputs on the following BMI metrics: diversity, mayfly density, percent EPT, and fingernail clam density for nearshore habitat at 3 km downstream of Gull Rapids; total richness for offshore habitat at 3 km downstream; and total abundance and mayfly density for nearshore habitat at 11 km downstream. However, monitoring did not detect a change in turbidity and TSS during instream construction, which indicates that these changes in the BMI community were likely caused by local shoreline erosion.

- ***Are there any unexpected effects on benthic macroinvertebrates that may be related to GS construction activities?***

To date, benthic macroinvertebrate monitoring during construction has not detected any unexpected effects that may be related to instream construction activities.

6.0 SUMMARY AND CONCLUSIONS

BMIs were sampled in late August to early September of 2015 (Year 2 of construction) at Split Lake as an example of conditions within an area unaffected by construction activities and in three areas to monitor the potential effects of construction downstream of Gull Rapids and into Stephens Lake. These three areas were located approximately 3 km (area immediately downstream), 11 km (near-field area), and 25 km (far-field area) downstream of Gull Rapids. Within each sampling area, BMIs were sampled from both nearshore (close to the shoreline in shallow water) and offshore (further from the shoreline in deeper water) habitat types. Five stations were sampled with a bottom dredge to collect bottom sediments and BMIs in each of these two habitat types.

Results from 2015 indicated there were negative changes in the benthos at 3 km (nearshore and offshore habitats) and 11 km (nearshore only) downstream of Gull Rapids that may have been related to TSS inputs; this was supported by the following 2015 observations for metrics expected to be negatively affected by increases in TSS:

Nearshore Habitat

- In comparison to pre-construction and 2014, there was less variety of BMIs, and the number of mayflies and the percent of mayflies, stoneflies, and caddisflies that made up the BMI community were greatly reduced 3 km downstream of Gull Rapids.
- In comparison to pre-construction, the number of fingernail clams in the nearshore habitat 3 km downstream of Gull Rapids was lower.
- In comparison to pre-construction, the total number of BMIs and the number of mayflies found in nearshore habitat 11 km downstream of Gull Rapids was much lower.

Offshore Habitat

- In comparison to pre-construction, there were much fewer types of BMIs 3 km downstream of Gull Rapids in offshore habitat.

Turbidity and TSS monitoring in 2015 indicated that these changes in the BMI community at 3 km and 11 km downstream were likely contributed to by local shoreline erosion rather than instream construction activities.

Construction-related changes were not detected at 25 km downstream in 2015, as BMIs either remained unchanged or increased in comparison to 2014, or followed a pattern similar to what was seen in Split Lake.

The key questions related to BMI monitoring during construction are addressed below:

- ***To what degree will benthic invertebrate abundance and/or community composition change during construction activities in comparison to either upstream or pre-Project conditions?***

Results from 2015 indicated there were negative changes that may have been related to TSS inputs on the following BMI metrics: diversity, mayfly density, percent EPT, and fingernail clam density for nearshore habitat at 3 km downstream of Gull Rapids; total richness for offshore habitat at 3 km downstream; and total abundance and mayfly density for nearshore habitat at 11 km downstream. However, turbidity and TSS monitoring indicated that these changes in the BMI community were likely contributed to by local shoreline erosion rather than instream construction activities.

- ***Are there any unexpected effects on benthic macroinvertebrates that may be related to GS construction activities?***

BMI monitoring during construction has not detected any unexpected effects that may be related to instream construction.

Based on the analyses completed to date, no change to monitoring activity is anticipated. BMI monitoring will be conducted in late August of 2016 (Year 3 of construction) as set out in the AEMP. Results of monitoring conducted in 2016 will be compared to pre-construction results and presented in the Year 3 construction report.

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TABLES

Table 1: Coordinates and supporting habitat variables measured at benthic macroinvertebrate monitoring sites sampled in 2013 (pre-construction), 2014 (Year 1 construction), and 2015 (Year 2 construction).

Waterbody	Site ID	Habitat Type	Sample Date	Study Year	UTM (NAD 83)			Water Temp. (ºC)	Water Velocity (m/sec.)	Mean Water Depth (m)	Mean Secchi Depth (m)	Substrate Description
					Zone	Easting	Northing					
Stephens Lake	STL3KM-PW	NRSH-PW	25-Sep-13	2013	15	365672	6248917	14	0	2.8	0.33	clay
Stephens Lake	STL11KM-PW	NRSH-PW	26-Sep-13	2013	15	376454	6248753	11	0	2.4	0.58	clay
Split Lake	SPLIT-OS	OFFSH	22-Aug-13	2013	14	678461	6233976	17	0	7.4	0.46	clay
Stephens Lake	STL3KM-OS	OFFSH	25-Sep-13	2013	15	366128	6248908	14	0.02	6.1	0.30	clay
Stephens Lake	STL11KM-OS	OFFSH	26-Sep-13	2013	15	376340	6248573	11	0	6.9	0.70	clay
Burntwood River	BURNT-PW	NRSH-PW	19-Aug-14	2014	14	645413	6224249	18	0.17	2.5	0.45	clay
Split Lake	SPLIT-PW	NRSH-PW	23-Aug-14	2014	14	673602	6232992	17	0	2.6	0.30	clay
Stephens Lake	STL3KM-PW	NRSH-PW	16-Sep-14	2014	15	365666	6248912	10	0	2.8	0.30	silt/OM
Stephens Lake	STL11KM-PW	NRSH-PW	16-Sep-14	2014	15	376451	6248753	10	0	2.2	0.30	silt/clay/OM
Stephens Lake	STL25KM-PW	NRSH-PW	17-Sep-14	2014	15	386545	6247951	10	0	2.5	0.35	silt/clay
Burntwood River	BURNT-OS	OFFSH	19-Aug-14	2014	14	646090	6224449	18	0.32	8.3	0.35	clay/OM
Split Lake	SPLIT-OS	OFFSH	23-Aug-14	2014	14	678466	6233977	18	0	7.8	0.52	clay
Stephens Lake	STL3KM-OS	OFFSH	16-Sep-14	2014	15	366127	6248901	10	0	6.0	0.30	silt/clay
Stephens Lake	STL11KM-OS	OFFSH	16-Sep-14	2014	15	376354	6248567	10	0	6.8	0.30	clay
Stephens Lake	STL25KM-OS	OFFSH	17-Sep-14	2014	15	385548	6248048	10	0	9.1	0.35	clay
Split Lake	SPLIT-PW	NRSH-PW	23-Aug-15	2015	14	673607	6232997	16	-	0.9	0.6	clay/OM
Stephens Lake	STL3KM-PW	NRSH-PW	20-Aug-15	2015	15	365666	6248914	16	-	2.4	-	clay/OM/gravel
Stephens Lake	STL11KM-PW	NRSH-PW	21-Aug-15	2015	15	376445	6248747	16	-	3.5	-	clay/OM/gravel
Stephens Lake	STL25KM-PW	NRSH-PW	08-Sep-15	2015	15	386545	6247952	15.5	-	2.0	0.5	sand/clay/OM
Split Lake	SPLIT-OS	OFFSH	23-Aug-15	2015	14	678468	6233975	16	-	6.1	0.6	clay
Stephens Lake	STL3KM-OS	OFFSH	20-Aug-15	2015	15	366125	6248901	16	-	5.7	-	clay
Stephens Lake	STL11KM-OS	OFFSH	20-Aug-15	2015	15	376351	6248567	16	-	5.9	-	clay
Stephens Lake	STL25KM-OS	OFFSH	21-Aug-15	2015	15	385549	6248050	16	-	9.0	-	clay

- not measured.

Table 2: Summary statistics for total organic carbon (TOC, %) content measured in nearshore habitat in 2013 (pre-construction), 2014 (Year 1 construction), and 2015 (Year 2 construction).

Site	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**Total Organic Carbon (TOC, %)**									
n	5	5	5	5	5	5	5	5	5	5
Mean	2.17	2.51	1.28	2.38	3.03	1.86	2.51	2.64	1.16	0.84
Minimum	1.51	1.67	1.13	1.67	0.89	0.49	1.26	1.04	0.35	0.24
Maximum	3.97	3.26	1.48	3.13	6.83	3.61	5.60	3.78	2.52	1.80
Median	1.65	2.67	1.25	2.28	1.36	1.68	1.64	2.87	0.40	0.74
Standard deviation (n-1)	1.05	0.61	0.16	0.61	2.68	1.13	1.78	1.03	1.08	0.59
Standard error of the mean	0.47	0.27	0.07	0.27	1.20	0.50	0.80	0.46	0.48	0.26
COV (%)	48.24	24.25	12.33	25.47	88.62	60.39	70.98	39.12	93.80	70.04
+50% Mean	3.26	3.77	1.92	3.56	4.54	2.80	3.77	3.96	1.73	1.26
-50% Mean	1.09	1.26	0.64	1.19	1.51	0.93	1.26	1.32	0.58	0.42
Benchmark Exceedance (temporal comparison)	-	No	-	Yes	Yes (2013)	-	No	No (both)	-	No
Significant Inter-annual Difference	N/A	N/A	N/A	No	No	N/A	N/A	N/A	N/A	N/A

Table 3: Summary statistics for sand (%) measured in nearshore habitat in 2013 (pre-construction), 2014 (Year 1 construction), and 2015 (Year 2 construction).

Site	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric						**Sand (%)**				
n	5	5	5	5	5	5	5	5	5	5
Mean	39.30	36.68	11.22	10.18	16.10	38.84	41.86	25.93	74.86	68.44
Minimum	25.90	24.50	9.38	3.46	7.40	4.01	10.60	1.22	54.00	16.00
Maximum	55.00	58.20	12.60	18.20	30.60	75.70	55.50	65.00	90.40	88.60
Median	40.60	29.60	11.40	9.60	12.20	49.60	52.90	18.80	74.10	78.20
Standard deviation (n-1)	10.78	13.62	1.41	5.43	9.82	30.62	19.27	26.92	15.76	30.10
Standard error of the mean	4.82	6.09	0.63	2.43	4.39	13.69	8.62	12.04	7.05	13.46
COV (%)	27.42	37.14	12.61	53.33	61.01	78.83	46.04	103.81	21.05	43.98
+50% Mean	58.95	55.02	16.82	15.27	24.15	58.26	62.79	38.89	112.29	102.66
-50% Mean	19.65	18.34	5.61	5.09	8.05	19.42	20.93	12.96	37.43	34.22
Benchmark Exceedance (temporal comparison)	-	No	-	No	Yes (2014)	-	No	No (both)	-	No
Significant Inter-annual Difference	N/A	N/A	N/A	N/A	No	N/A	N/A	N/A	N/A	N/A

Table 4: Summary statistics for silt (%) measured in nearshore habitat in 2013 (pre-construction), 2014 (Year 1 construction), and 2015 (Year 2 construction).

Site	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric						**Silt (%)**				
n	5	5	5	5	5	5	5	5	5	5
Mean	41.32	45.76	41.46	49.96	38.70	46.58	41.72	62.06	14.80	15.48
Minimum	30.00	29.80	38.20	42.10	20.30	16.50	34.90	26.50	4.72	7.68
Maximum	49.10	57.60	42.80	61.20	51.10	71.60	51.40	87.70	27.40	25.10
Median	40.20	46.60	42.80	50.80	40.40	40.30	36.10	70.30	17.70	15.40
Standard deviation (n-1)	7.54	10.77	2.04	7.67	12.53	24.17	8.67	26.49	9.66	7.12
Standard error of the mean	3.37	4.82	0.91	3.43	5.60	10.81	3.88	11.85	4.32	3.19
COV (%)	18.25	23.53	4.91	15.36	32.37	51.90	20.77	42.69	65.29	46.03
+50% Mean	61.98	68.64	62.19	74.94	58.05	69.87	62.58	93.09	22.20	23.21
-50% Mean	20.66	22.88	20.73	24.98	19.35	23.29	20.86	31.03	7.40	7.74
Benchmark Exceedance (temporal comparison)	-	No	-	No	No (both)	-	No	No (both)	-	No
Significant Inter-annual Difference	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 5: Summary statistics for clay (%) measured in nearshore habitat in 2013 (pre-construction), 2014 (Year 1 construction), and 2015 (Year 2 construction).

Site	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric						**Clay (%)**				
n	5	5	5	5	5	5	5	5	5	5
Mean	19.38	17.54	47.32	39.82	45.22	14.58	16.39	12.01	10.34	16.09
Minimum	15.00	12.00	44.60	35.30	36.80	7.82	8.36	8.46	4.18	2.94
Maximum	25.00	24.00	52.40	48.60	58.30	25.00	37.90	16.50	27.20	58.90
Median	19.10	16.40	45.80	38.20	43.90	11.90	12.20	10.90	6.88	6.43
Standard deviation (n-1)	3.60	5.50	3.37	5.16	8.82	6.96	12.17	3.88	9.55	24.04
Standard error of the mean	1.61	2.46	1.51	2.31	3.94	3.11	5.44	1.73	4.27	10.75
COV (%)	18.57	31.33	7.13	12.96	19.50	47.74	74.25	32.27	92.42	149.42
+50% Mean	29.07	26.31	70.98	59.73	67.83	21.88	24.59	18.01	15.51	24.13
-50% Mean	9.69	8.77	23.66	19.91	22.61	7.29	8.20	6.00	5.17	8.04
Benchmark Exceedance (temporal comparison)	-	No	-	No	No (both)	-	No	No (both)	-	Yes (2014)
Significant Inter-annual Difference	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No

Table 6: Summary statistics for total organic carbon (TOC, %) measured in offshore habitat in 2013, 2014 (Year 1 construction), and 2015 (Year 2 construction).

Site	SPLIT-2013	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**Total Organic Carbon (TOC, %)**										
n	5	5	5	5	5	5	5	5	5	5	5
Mean	1.07	1.28	1.28	1.12	1.47	2.36	1.24	2.21	1.28	2.03	2.09
Minimum	1.01	1.10	1.08	0.75	0.77	0.27	1.11	1.27	1.19	1.88	2.00
Maximum	1.15	1.34	1.53	1.59	2.43	4.98	1.36	5.71	1.40	2.23	2.22
Median	1.05	1.32	1.24	1.16	1.51	2.23	1.23	1.30	1.22	2.01	2.09
Standard deviation (n-1)	0.05	0.10	0.16	0.32	0.65	2.02	0.10	1.96	0.11	0.14	0.08
Standard error of the mean	0.02	0.05	0.07	0.14	0.29	0.90	0.04	0.88	0.05	0.06	0.04
COV (%)	4.99	7.91	12.75	28.18	44.58	85.43	7.71	88.75	8.23	6.82	3.99
+50% Mean	1.60	1.92	1.92	1.68	2.20	3.55	1.86	3.31	1.91	3.04	3.14
-50% Mean	0.53	0.64	0.64	0.56	0.73	1.18	0.62	1.10	0.64	1.01	1.05
Benchmark Exceedance (temporal comparison)	-	No	No (both)	-	No	Yes (both)	-	Yes	No (both)	-	No
Significant Inter-annual Difference	N/A	N/A	N/A	N/A	N/A	No (both)	N/A	No	N/A	N/A	N/A

Table 7: Summary statistics for sand (%) measured in offshore habitat in 2013, 2014 (Year 1 construction), and 2015 (Year 2 construction).

Site	SPLIT-2013	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**Sand (%)**										
n	5	5	5	5	5	5	5	5	5	5	5
Mean	18.58	18.52	16.18	2.05	15.17	3.57	0.47	0.29	0.90	0.18	0.30
Minimum	17.60	14.80	11.90	1.08	2.18	0.51	0.27	0.11	0.61	0.11	0.20
Maximum	19.50	24.20	22.10	3.51	45.20	8.79	0.57	0.48	1.43	0.31	0.38
Median	19.00	17.70	15.20	1.90	9.63	3.54	0.50	0.29	0.88	0.14	0.28
Standard deviation (n-1)	0.83	3.61	4.24	0.90	17.50	3.35	0.12	0.15	0.33	0.08	0.07
Standard error of the mean	0.37	1.62	1.90	0.40	7.83	1.50	0.05	0.07	0.15	0.04	0.03
COV (%)	4.48	19.51	26.21	43.99	115.35	93.85	24.94	52.13	36.88	46.98	24.48
+50% Mean	27.87	27.78	24.27	3.08	22.76	5.36	0.70	0.44	1.35	0.27	0.45
-50% Mean	9.29	9.26	8.09	1.03	7.59	1.79	0.23	0.15	0.45	0.09	0.15
Benchmark Exceedance (temporal comparison)	-	No	No (both)	-	Yes	Yes (both)	-	No	Yes (both)	-	Yes
Significant Inter-annual Difference	N/A	N/A	N/A	N/A	No	No (both)	N/A	N/A	Yes (both)	N/A	Yes

Table 8: Summary statistics for silt (%) measured in offshore habitat in 2013 (pre-construction), 2014 (Year 1 construction), and 2015 (Year 2 construction).

Site	SPLIT-2013	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**Silt (%)**										
n	5	5	5	5	5	5	5	5	5	5	5
Mean	61.40	53.42	65.82	37.20	50.08	51.14	72.48	66.28	89.48	72.66	87.36
Minimum	50.50	50.00	58.70	21.50	30.60	27.20	68.10	59.90	77.10	66.20	82.30
Maximum	79.70	56.60	77.70	52.30	61.30	65.60	75.70	68.60	98.50	76.70	94.30
Median	55.60	53.50	62.40	40.20	51.80	49.50	73.70	67.40	89.50	72.30	85.90
Standard deviation (n-1)	11.69	2.51	8.37	12.84	12.40	15.58	3.36	3.61	8.96	4.33	4.57
Standard error of the mean	5.23	1.12	3.74	5.74	5.55	6.97	1.50	1.61	4.01	1.94	2.04
COV (%)	19.04	4.70	12.71	34.51	24.77	30.47	4.63	5.44	10.01	5.96	5.23
+50% Mean	92.10	80.13	98.73	55.80	75.12	76.71	108.72	99.42	134.22	108.99	131.04
-50% Mean	30.70	26.71	32.91	18.60	25.04	25.57	36.24	33.14	44.74	36.33	43.68
Benchmark Exceedance (temporal comparison)	-	No	No (both)	-	No	No (both)	-	No	No (both)	-	No
Significant Inter-annual Difference	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 9: Summary statistics for clay (%) measured in offshore habitat in 2013 (pre-construction), 2014 (Year 1 construction), and 2015 (Year 2 construction).

Site	SPLIT-2013	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**Clay (%)**										
n	5	5	5	5	5	5	5	5	5	5	5
Mean	20.00	28.04	17.96	60.76	34.76	45.28	27.04	33.44	9.62	27.14	12.35
Minimum	2.72	20.90	10.30	46.10	24.20	30.80	23.70	31.20	0.53	23.10	5.36
Maximum	30.40	31.40	24.70	75.00	38.60	68.60	31.70	40.00	22.20	33.60	17.30
Median	25.30	28.80	18.80	57.60	36.50	42.40	25.80	32.10	9.66	27.60	13.90
Standard deviation (n-1)	10.94	4.16	6.03	12.15	6.02	14.91	3.50	3.69	9.19	4.33	4.58
Standard error of the mean	4.89	1.86	2.70	5.43	2.69	6.67	1.57	1.65	4.11	1.94	2.05
COV (%)	54.67	14.83	33.56	20.00	17.31	32.93	12.94	11.04	95.57	15.95	37.08
+50% Mean	30.01	42.06	26.94	91.14	52.14	67.92	40.56	50.16	14.43	40.71	18.53
-50% Mean	10.00	14.02	8.98	30.38	17.38	22.64	13.52	16.72	4.81	13.57	6.18
Benchmark Exceedance (temporal comparison)	-	No	No (both)	-	No	No (both)	-	No	Yes (both)	-	Yes
Significant Inter-annual Difference	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes (both)	N/A	Yes

Table 10: Summary statistics for total macroinvertebrate abundance (density, no. per m^2) nearshore habitat in 2013 (pre-construction), 2014 (Year 1 construction), and 2015 (Year 2 construction).

Site	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**Total Invertebrate Density (no. per m^2)**									
n	5	5	5	5	5	5	5	5	5	5
Mean	689.64	3119.23	1204.99	1480.26	1136.89	3034.97	1751.50	1321.56	2461.33	4175.32
Minimum	403.97	1110.92	727.15	476.11	216.41	1566.83	1428.32	1009.93	1168.63	1457.18
Maximum	865.65	8281.39	1523.55	2351.69	3015.35	4241.69	2495.96	1803.44	4429.25	8685.36
Median	721.38	2221.84	1263.85	1514.89	807.94	3298.13	1529.32	1284.05	2669.09	3202.91
Standard deviation (n-1)	179.74	2926.29	301.52	851.38	1159.93	1081.24	445.22	320.12	1320.63	2725.34
Standard error of the mean	80.38	1308.68	134.84	380.75	518.74	483.55	199.11	143.16	590.61	1218.81
COV (%)	26.06	93.81	25.02	57.52	102.03	35.63	25.42	24.22	53.66	65.27
+50% Mean	1034.45	4678.84	1807.48	2220.39	1705.33	4552.46	2627.25	1982.34	3692.00	6262.98
-50% Mean	344.82	1559.61	602.49	740.13	568.44	1517.49	875.75	660.78	1230.67	2087.66
Benchmark Exceedance (temporal comparison)	-	Yes	-	No	No (both)	-	No	Yes (2013)	-	Yes
Significant Inter-annual Difference	N/A	Yes	N/A	N/A	N/A	N/A	N/A	Yes	N/A	No

Table 11: Summary statistics for total macroinvertebrate abundance (density, no. per m^2) in offshore habitat in 2013 (pre-construction), 2014 (Year 1 construction), and 2015 (Year 2 construction).

Site	SPLIT-2013	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**Total Invertebrate Density (no. per m^2)**										
n	5	5	5	5	5	5	5	5	5	5	5
Mean	7978.42	8973.92	3433.75	1101.11	1465.84	184.67	1878.46	1488.92	1249.42	2767.20	2594.07
Minimum	4039.70	6174.98	3000.92	709.83	403.97	43.28	0.00	1139.77	894.51	2135.27	1255.19
Maximum	10806.21	11311.17	3938.71	1679.36	2683.52	346.26	2778.74	1890.00	1702.45	3231.76	3433.75
Median	8281.39	9060.48	3477.03	900.28	1428.32	158.70	2198.75	1312.90	1125.35	2856.65	2452.68
Standard deviation (n-1)	2521.25	2377.87	348.06	415.67	841.05	135.50	1079.20	340.56	313.38	447.53	899.00
Standard error of the mean	1127.54	1063.42	155.66	185.89	376.13	60.60	482.63	152.30	140.15	200.14	402.04
COV (%)	31.60	26.50	10.14	37.75	57.38	73.37	57.45	22.87	25.08	16.17	34.66
+50% Mean	11967.62	13460.87	5150.62	1651.66	2198.75	277.01	2817.69	2233.38	1874.13	4150.80	3891.10
-50% Mean	3989.21	4486.96	1716.87	550.55	732.92	92.34	939.23	744.46	624.71	1383.60	1297.03
Benchmark Exceedance (temporal comparison)	-	No	Yes (both)	-	No	Yes (both)	-	No	No (both)	-	No
Significant Inter-annual Difference	N/A	N/A	Yes (both)	N/A	N/A	Yes (2014)	N/A	N/A	N/A	N/A	N/A

Table 12: Summary statistics for total richness (Family-level) in nearshore habitat in 2013 (pre-construction), 2014 (Year 1 construction), and 2015 (Year 2 construction).

Site	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**Total Richness (Family level)**									
n	5	5	5	5	5	5	5	5	5	5
Mean	7.60	10.60	9.40	7.80	5.80	9.40	7.20	7.60	8.20	9.40
Minimum	6.00	8.00	8.00	6.00	2.00	8.00	6.00	6.00	5.00	7.00
Maximum	10.00	12.00	11.00	10.00	11.00	12.00	9.00	10.00	11.00	13.00
Median	7.00	11.00	9.00	8.00	5.00	9.00	7.00	7.00	8.00	8.00
Standard deviation (n-1)	1.52	1.52	1.14	1.79	3.70	1.67	1.30	1.52	2.39	2.88
Standard error of the mean	0.68	0.68	0.51	0.80	1.66	0.75	0.58	0.68	1.07	1.29
COV (%)	19.95	14.31	12.13	22.93	63.82	17.80	18.11	19.95	29.12	30.65
+50% Mean	11.40	15.90	14.10	11.70	8.70	14.10	10.80	11.40	12.30	14.10
-50% Mean	3.80	5.30	4.70	3.90	2.90	4.70	3.60	3.80	4.10	4.70
Benchmark Exceedance (temporal comparison)	-	No	-	No	No (both)	-	No	No (both)	-	No
Significant Inter-annual Difference	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 13: Summary statistics for total richness (Family-level) in offshore habitat in 2013 (pre-construction), 2014 (Year 1 construction), and 2015 (Year 2 construction).

Site	SPLIT-2013	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**Total Richness (Family level)**										
n	5	5	5	5	5	5	5	5	5	5	5
Mean	8.60	8.80	9.60	7.40	5.40	2.80	4.80	5.00	4.20	4.20	4.00
Minimum	7.00	7.00	8.00	5.00	3.00	2.00	0.00	3.00	3.00	3.00	3.00
Maximum	10.00	10.00	11.00	10.00	7.00	5.00	6.00	6.00	6.00	5.00	5.00
Median	9.00	9.00	9.00	8.00	6.00	2.00	6.00	5.00	4.00	5.00	4.00
Standard deviation (n-1)	1.52	1.30	1.34	2.30	1.52	1.30	2.68	1.22	1.10	1.10	0.71
Standard error of the mean	0.68	0.58	0.60	1.03	0.68	0.58	1.20	0.55	0.49	0.49	0.32
COV (%)	17.63	14.82	13.98	31.11	28.08	46.57	55.90	24.49	26.08	26.08	17.68
+50% Mean	12.90	13.20	14.40	11.10	8.10	4.20	7.20	7.50	6.30	6.30	6.00
-50% Mean	4.30	4.40	4.80	3.70	2.70	1.40	2.40	2.50	2.10	2.10	2.00
Benchmark Exceedance (temporal comparison)	-	No	No (both)	-	No	Yes (2013)	-	No	No (both)	-	No
Significant Inter-annual Difference	N/A	N/A	N/A	N/A	N/A	Yes	N/A	N/A	N/A	N/A	N/A

Table 14: Summary statistics for Simpson's diversity index in nearshore habitat in 2013 (pre-construction), 2014 (Year 1 construction), and 2015 (Year 2 construction).

Site	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**Simpson's Diversity Index**									
n	5	5	5	5	5	5	5	5	5	5
Mean	0.73	0.65	0.69	0.65	0.31	0.57	0.68	0.69	0.71	0.74
Minimum	0.64	0.51	0.57	0.53	0.04	0.48	0.62	0.64	0.60	0.70
Maximum	0.81	0.77	0.79	0.71	0.67	0.69	0.73	0.76	0.76	0.79
Median	0.77	0.67	0.69	0.68	0.24	0.56	0.68	0.67	0.73	0.74
Standard deviation (n-1)	0.08	0.09	0.10	0.07	0.28	0.09	0.04	0.05	0.07	0.04
Standard error of the mean	0.04	0.04	0.04	0.03	0.12	0.04	0.02	0.02	0.03	0.02
COV (%)	10.74	14.42	14.40	10.95	88.93	16.29	6.23	6.89	9.45	5.17
+50% Mean	1.10	0.98	1.03	0.98	0.46	0.85	1.02	1.03	1.06	1.12
-50% Mean	0.37	0.33	0.34	0.33	0.15	0.28	0.34	0.34	0.35	0.37
Benchmark Exceedance (temporal comparison)	-	No	-	No	Yes (both)	-	No	No (both)	-	No
Significant Inter-annual Difference	N/A	N/A	N/A	N/A	Yes (2013)	N/A	N/A	N/A	N/A	N/A

Table 15: Summary statistics for Simpson's diversity index in offshore habitat in 2013 (pre-construction), 2014 (Year 1 construction), and 2015 (Year 2 construction).

Site	SPLIT-2013	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**Simpson's Diversity Index**										
n	5	5	5	5	5	5	5	5	5	5	5
Mean	0.64	0.57	0.55	0.50	0.53	0.35	0.30	0.40	0.59	0.53	0.40
Minimum	0.48	0.48	0.36	0.37	0.51	0.09	0.24	0.16	0.48	0.50	0.29
Maximum	0.76	0.61	0.71	0.59	0.57	0.60	0.32	0.52	0.64	0.56	0.59
Median	0.69	0.59	0.64	0.54	0.52	0.32	0.31	0.44	0.60	0.53	0.31
Standard deviation (n-1)	0.12	0.05	0.16	0.11	0.02	0.19	0.04	0.14	0.07	0.02	0.13
Standard error of the mean	0.05	0.02	0.07	0.05	0.01	0.08	0.02	0.06	0.03	0.01	0.06
COV (%)	18.67	9.05	29.89	21.36	4.61	53.47	11.92	35.73	11.46	4.12	33.16
+50% Mean	0.96	0.85	0.82	0.75	0.79	0.53	0.44	0.60	0.88	0.80	0.59
-50% Mean	0.32	0.28	0.27	0.25	0.26	0.18	0.15	0.20	0.29	0.27	0.20
Benchmark Exceedance (temporal comparison)	-	No	No (both)	-	No	No (both)	-	No	Yes (2013)	-	No
Significant Inter-annual Difference	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes (2013)	N/A	N/A

Table 16: Summary statistics for Ephemeroptera abundance (density, no. per m^2) in nearshore habitat in 2013 (pre-construction), 2014 (Year 1 construction), and 2015 (Year 2 construction).

Site	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**Ephemeroptera Density (no. per m^2)**									
n	5	5	5	5	5	5	5	5	5	5
Mean	193.33	432.83	64.06	496.31	11.54	1944.25	718.49	432.83	346.26	1197.48
Minimum	158.70	201.99	34.63	57.71	0.00	787.74	216.41	259.70	201.99	432.83
Maximum	245.27	923.36	103.88	923.36	43.28	3003.81	1226.34	591.53	649.24	1587.03
Median	187.56	360.69	69.25	634.81	0.00	2328.60	822.37	461.68	245.27	1486.03
Standard deviation (n-1)	37.62	289.09	27.10	356.57	18.81	908.57	416.33	127.01	186.72	497.49
Standard error of the mean	16.83	129.29	12.12	159.46	8.41	406.33	186.19	56.80	83.51	222.48
COV (%)	19.46	66.79	42.30	71.84	162.98	46.73	57.94	29.34	53.93	41.54
+50% Mean	289.99	649.24	96.09	744.46	17.31	2916.38	1077.74	649.24	519.39	1796.23
-50% Mean	96.66	216.41	32.03	248.15	5.77	972.13	359.25	216.41	173.13	598.74
Benchmark Exceedance (temporal comparison)	-	Yes	-	Yes	Yes (both)	-	Yes	Yes (2013)	-	Yes
Significant Inter-annual Difference	N/A	No	N/A	No	Yes (2014)	N/A	No	Yes	N/A	Yes

Table 17: Summary statistics for percent EPT (EPT index) in nearshore habitat in 2013 (pre-construction), 2014 (Year 1 construction), and 2015 (Year 2 construction).

Site	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**Percent EPT (EPT Index)**									
n	5	5	5	5	5	5	5	5	5	5
Mean	31.11	18.41	7.43	31.11	0.80	62.14	39.77	35.70	19.58	32.28
Minimum	22.00	10.56	3.80	12.12	0.00	51.38	15.69	14.40	5.54	17.61
Maximum	50.00	27.27	13.10	42.86	3.06	71.63	53.77	47.30	49.45	47.27
Median	28.33	20.13	6.82	32.91	0.00	63.66	49.13	45.71	15.34	29.73
Standard deviation (n-1)	10.88	7.22	3.75	12.14	1.33	9.55	16.92	15.09	17.32	10.91
Standard error of the mean	4.87	3.23	1.68	5.43	0.59	4.27	7.56	6.75	7.74	4.88
COV (%)	34.98	39.21	50.42	39.03	165.29	15.37	42.53	42.26	88.45	33.80
+50% Mean	46.67	27.62	11.15	46.66	1.21	93.21	59.65	53.54	29.37	48.42
-50% Mean	15.56	9.21	3.72	15.55	0.40	31.07	19.88	17.85	9.79	16.14
Benchmark Exceedance (temporal comparison)	-	No	-	Yes	Yes (both)	-	No	No (both)	-	Yes
Significant Inter-annual Difference	N/A	N/A	N/A	No	Yes (2014)	N/A	N/A	N/A	N/A	No

Table 18: Summary statistics for Pisidiidae abundance (density, no. per m^2) in nearshore habitat in 2013 (pre-construction), 2014 (Year 1 construction), and 2015 (Year 2 construction).

Site	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**Pisidiidae Density (no. per m^2)**									
n	5	5	5	5	5	5	5	5	5	5
Mean	23.08	256.81	27.70	8.66	8.66	119.46	129.85	121.19	409.74	458.80
Minimum	0.00	0.00	8.66	0.00	0.00	25.97	28.86	28.86	187.56	72.14
Maximum	57.71	1024.35	51.94	28.86	28.86	242.38	173.13	274.12	1038.78	894.51
Median	14.43	72.14	25.97	0.00	0.00	138.50	144.28	72.14	274.12	360.69
Standard deviation (n-1)	21.88	432.27	16.65	12.90	12.90	90.46	57.71	105.82	355.98	311.35
Standard error of the mean	9.79	193.32	7.45	5.77	5.77	40.45	25.81	47.33	159.20	139.24
COV (%)	94.79	168.32	60.11	149.07	149.07	75.72	44.44	87.32	86.88	67.86
+50% Mean	34.63	385.21	41.55	12.98	12.98	179.19	194.77	181.79	614.61	688.19
-50% Mean	11.54	128.40	13.85	4.33	4.33	59.73	64.92	60.60	204.87	229.40
Benchmark Exceedance (temporal comparison)	-	Yes	-	Yes	Yes (2013)	-	No	No (both)	-	No
Significant Inter-annual Difference	N/A	No	N/A	No	No	N/A	N/A	N/A	N/A	N/A

Table 19: Summary statistics for Ephemeroptera abundance (density, no. per m^2) in offshore habitat in 2013 (pre-construction), 2014 (Year 1 construction), and 2015 (Year 2 construction).

Site	SPLIT-2013	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**Ephemeroptera Density (no. per m^2)**										
n	5	5	5	5	5	5	5	5	5	5	5
Mean	1281.16	643.47	219.30	64.06	54.82	0.00	1563.37	1093.61	605.96	831.02	282.78
Minimum	375.12	346.26	129.85	8.66	0.00	0.00	0.00	937.79	490.54	692.52	187.56
Maximum	1587.03	1038.78	360.69	95.22	100.99	0.00	2276.66	1240.77	663.67	966.64	375.12
Median	1558.17	533.82	173.13	69.25	43.28	0.00	1817.87	1038.78	620.38	851.22	331.83
Standard deviation (n-1)	520.83	277.07	95.92	36.01	40.03	0.00	894.76	133.56	68.44	115.24	88.70
Standard error of the mean	232.92	123.91	42.90	16.10	17.90	0.00	400.15	59.73	30.61	51.54	39.67
COV (%)	40.65	43.06	43.74	56.21	73.02	-	57.23	12.21	11.29	13.87	31.37
+50% Mean	1921.75	965.20	328.95	96.09	82.24	0.00	2345.05	1640.41	908.93	1246.54	424.17
-50% Mean	640.58	321.73	109.65	32.03	27.41	0.00	781.68	546.80	302.98	415.51	141.39
Benchmark Exceedance (temporal comparison)	-	No	Yes (both)	-	No	Yes (both)	-	No	Yes (2013)	-	Yes
Significant Inter-annual Difference	N/A	N/A	Yes (2013)	N/A	N/A	Yes (2013)	N/A	N/A	Yes	N/A	Yes

Table 20: Summary statistics for percent EPT (EPT index) in offshore habitat in 2013 (pre-construction), 2014 (Year 1 construction), and 2015 (Year 2 construction).

Site	SPLIT-2013	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**Percent EPT (EPT Index)**										
n	5	5	5	5	5	5	5	5	5	5	5
Mean	19.60	8.09	8.14	8.34	5.14	23.62	66.65	75.29	50.75	30.29	13.20
Minimum	5.23	4.14	6.58	2.11	0.00	0.00	0.00	64.89	35.59	27.44	5.49
Maximum	41.79	13.08	10.26	14.63	10.67	66.67	87.40	91.14	69.35	34.46	27.59
Median	17.47	8.44	7.11	8.25	5.83	20.00	81.93	74.16	46.94	28.13	10.92
Standard deviation (n-1)	13.44	3.61	1.87	4.43	4.19	26.53	37.33	10.22	13.06	3.54	8.72
Standard error of the mean	6.01	1.61	0.84	1.98	1.87	11.87	16.70	4.57	5.84	1.58	3.90
COV (%)	68.57	44.63	23.02	53.15	81.38	112.32	56.01	13.57	25.73	11.68	66.02
+50% Mean	29.40	12.14	12.21	12.51	7.72	35.43	99.98	112.94	76.12	45.44	19.80
-50% Mean	9.80	4.05	4.07	4.17	2.57	11.81	33.33	37.65	25.37	15.15	6.60
Benchmark Exceedance (temporal comparison)	-	Yes	Yes (2013)	-	No	Yes (both)	-	No	No (both)	-	Yes
Significant Inter-annual Difference	N/A	No	No	N/A	N/A	No (both)	N/A	N/A	N/A	N/A	Yes

Table 21: Summary statistics for Pisidiidae abundance (density, no. per m^2) in offshore habitat in 2013 (pre-construction), 2014 (Year 1 construction), and 2015 (Year 2 construction).

Site	SPLIT-2013	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**Pisidiidae Density (no. per m^2)**										
n	5	5	5	5	5	5	5	5	5	5	5
Mean	888.73	753.12	352.03	1.73	11.54	0.00	0.00	0.00	0.00	2.89	0.00
Minimum	331.83	259.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maximum	1125.35	1240.77	750.23	8.66	43.28	0.00	0.00	0.00	0.00	14.43	0.00
Median	981.07	649.24	447.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Standard deviation (n-1)	325.60	418.20	327.51	3.87	18.81	0.00	0.00	0.00	0.00	6.45	0.00
Standard error of the mean	145.61	187.02	146.47	1.73	8.41	0.00	0.00	0.00	0.00	2.89	0.00
COV (%)	36.64	55.53	93.03	223.61	162.98	-	-	-	-	223.61	-
+50% Mean	1333.10	1129.67	528.05	2.60	17.31	0.00	0.00	0.00	0.00	4.33	0.00
-50% Mean	444.37	376.56	176.02	0.87	5.77	0.00	0.00	0.00	0.00	1.44	0.00
Benchmark Exceedance (temporal comparison)	-	No	Yes (both)	-	Yes	Yes (both)	-	No	No (both)	-	Yes
Significant Inter-annual Difference	N/A	N/A	No (both)	N/A	No	No (both)	N/A	N/A	N/A	N/A	Yes

Table 22: Summary of benthic invertebrate results for Stephens Lake and reference Split Lake: Year 2 construction (2015) in comparison to pre-construction (2013) and Year 1 construction (2014).

Waterbody	Stephens Lake			Split Lake	Stephens Lake			Split Lake
Site	**3 km**	**11 km**	**25 km**	**CAMP**	**3 km**	**11 km**	**25 km**	**CAMP**
Habitat	**NRSH-PW**	**NRSH-PW**	**NRSH-PW [1]**	**NRSH-PW [1]**	**OS**	**OS**	**OS [1]**	**OS**
Key Metrics								
Total Invertebrate Density	±, ±	**-**, ±	+	**+**	-, **-**	±, ±	±	**-**, **-**
Total Taxonomic Richness	±, ±	±, ±	±	±	**-**, ±	±, ±	±	±, ±
Simpson's Diversity Index	**-**, -	±, ±	±	±	±, ±	**+**, ±	±	±, ±
Additional Metrics								
Ephemeroptera Density	-, **-**	**-**, ±	**+**	+	**-**, -	**-**, ±	**-**	**-**, -
% EPT	-, **-**	±, ±	+	±	+, +	±, ±	**-**	-, ±
Pisidiidae Density	-, ±	±, ±	±	+	-, -	±, ±	**-**	-, -

1. waterbody and habitat sampled in 2014 and 2015 only
± 2015 within benchmark value for previous year
\+ 2015 higher than +50% of mean for previous year
\- 2015 lower than -50% of mean for previous year
red denotes statistical significance
symbol, symbol 2015 vs. 2013, 2015 vs. 2014

FIGURES

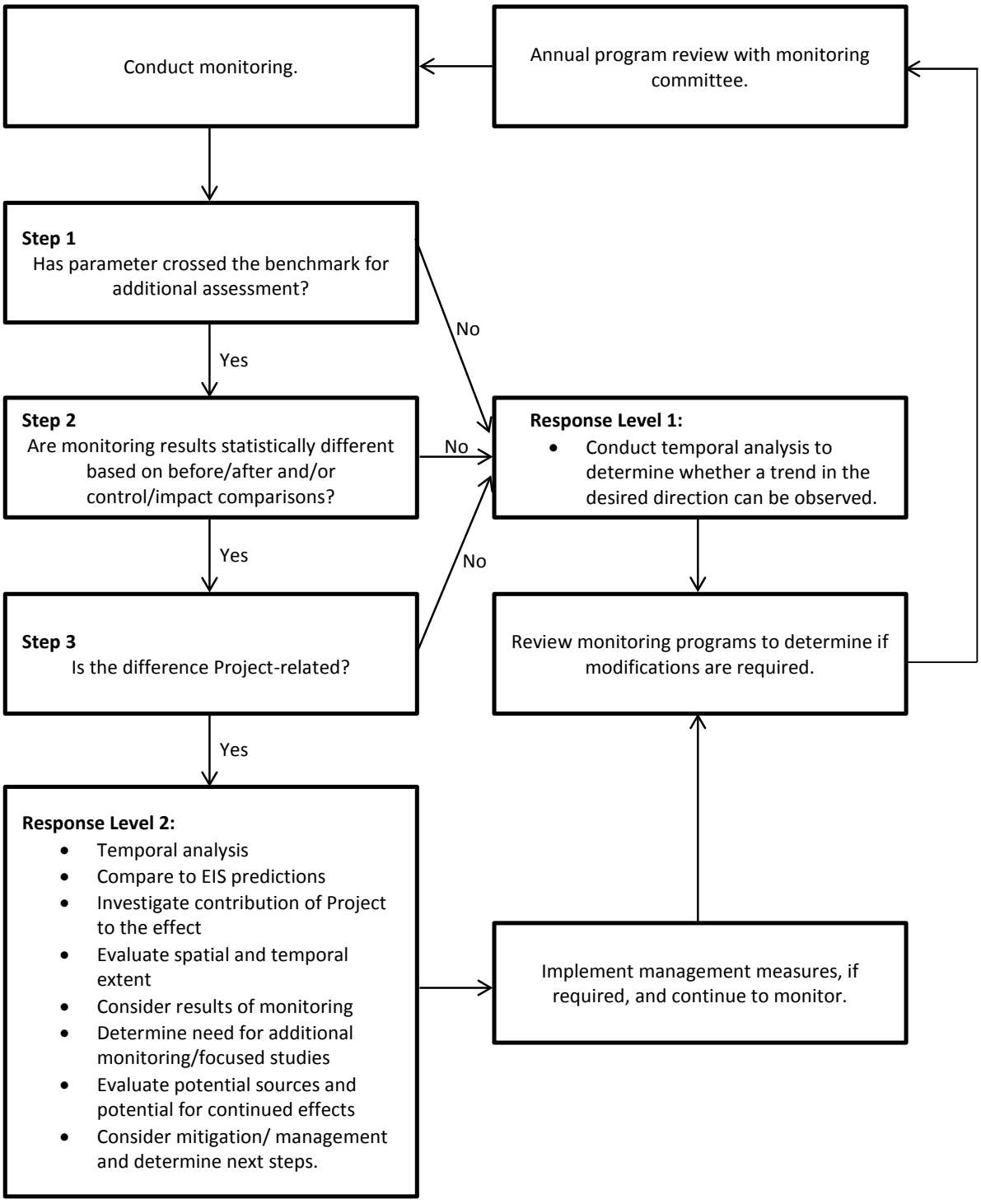


Figure 1: Benthic macroinvertebrate assessment management framework (AMF).

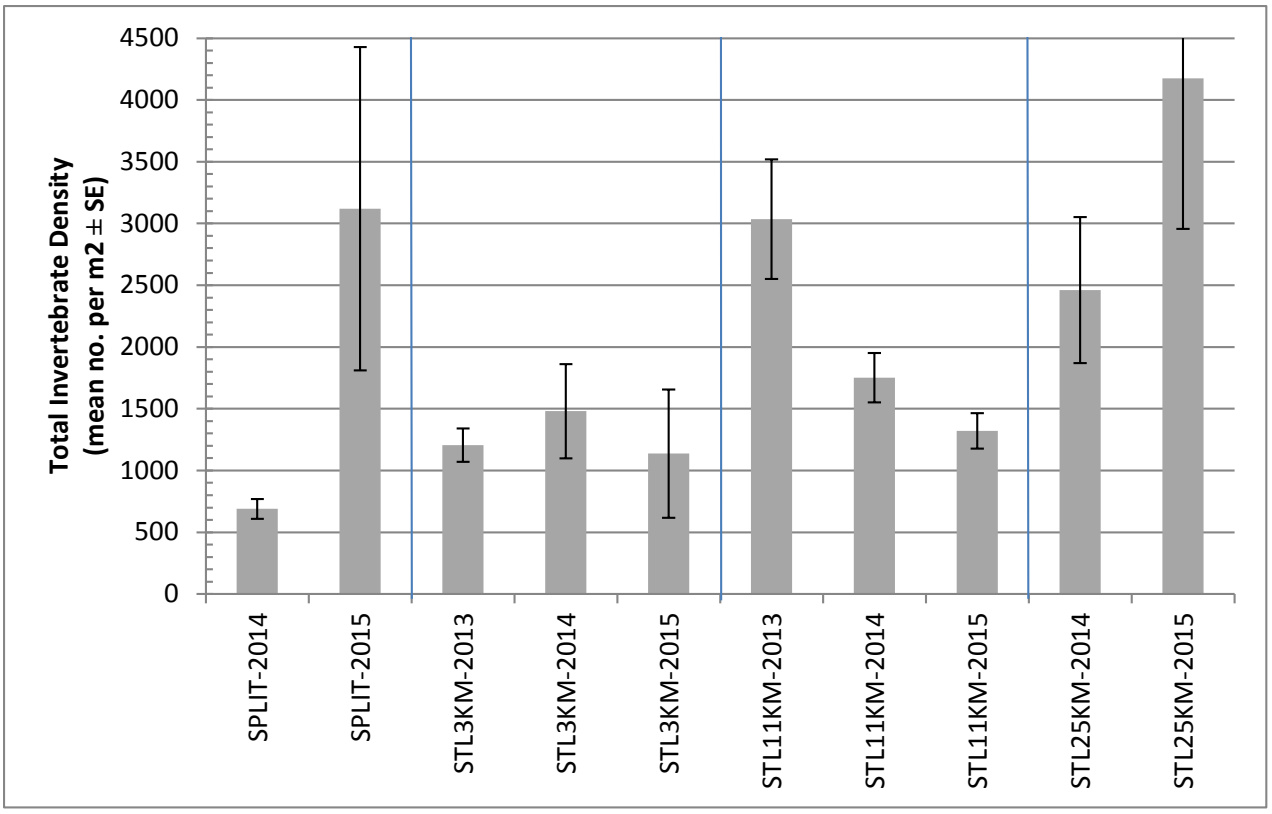


Figure 2: **Total macroinvertebrate abundance (density, mean no. per m2 ± SE) in nearshore habitat in 2013 (pre-construction), 2014 (Year 1 construction), and 2015 (Year 2 construction).**

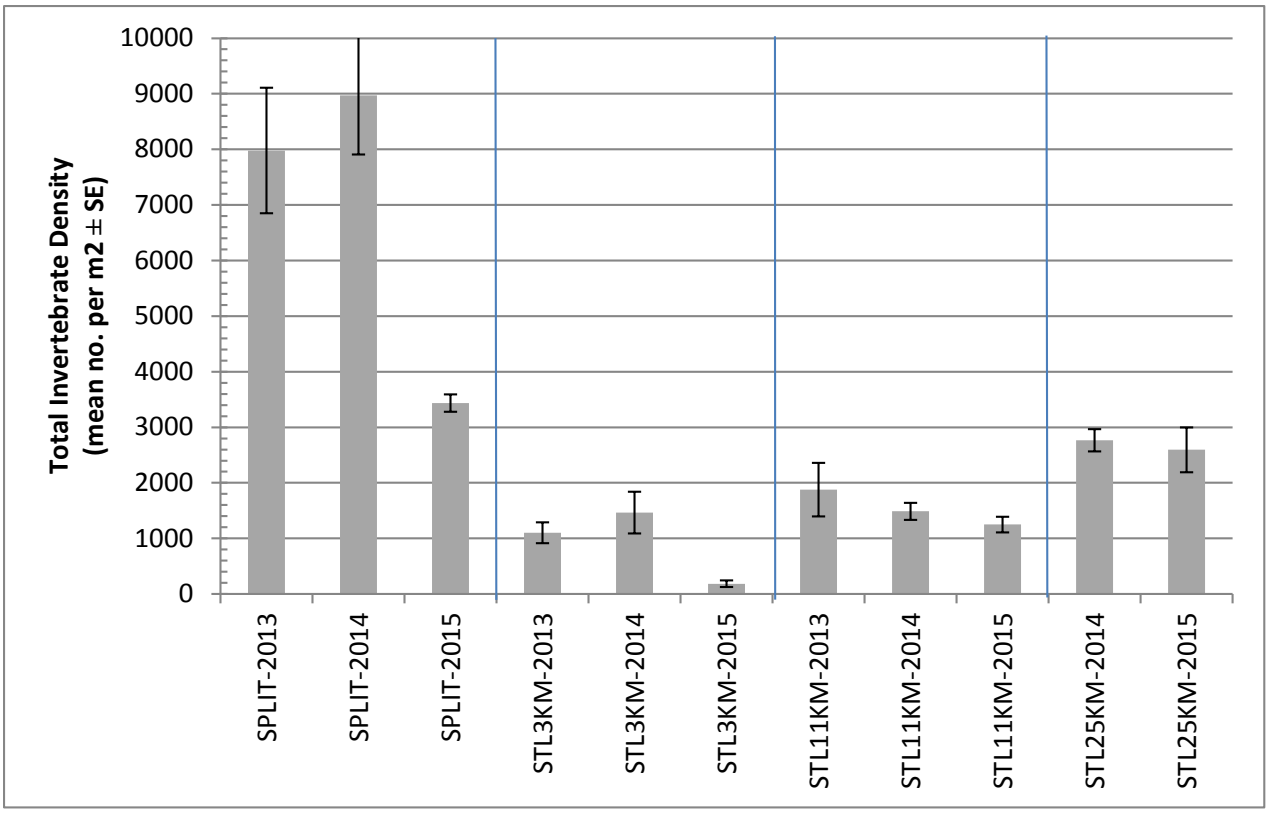


Figure 3: **Total macroinvertebrate abundance (density, mean no. per m^2 ± SE) in offshore habitat in 2013 (pre-construction), 2014 (Year 1 construction), and 2015 (Year 2 construction).**

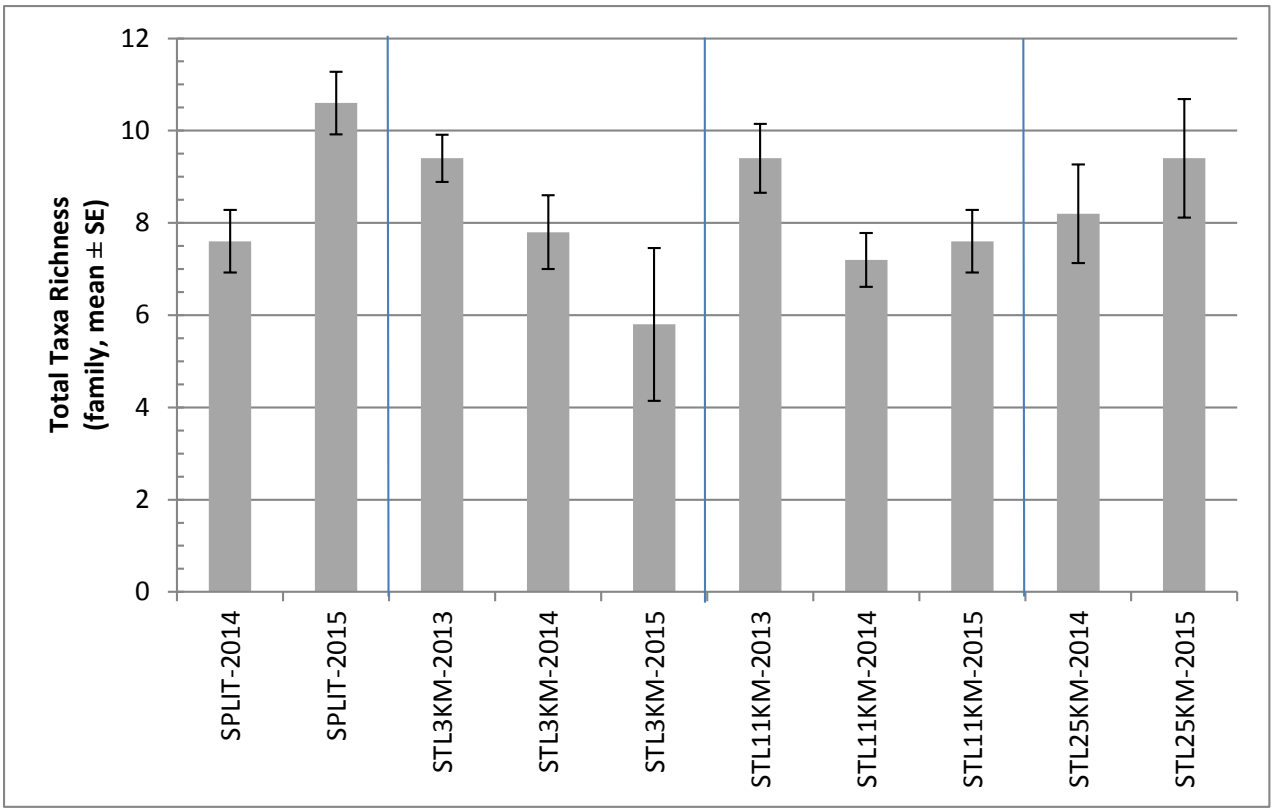


Figure 4: **Total richness (Family-level, mean ± SE) in nearshore habitat in 2013 (pre-construction), 2014 (Year 1 construction), and 2015 (Year 2 construction).**

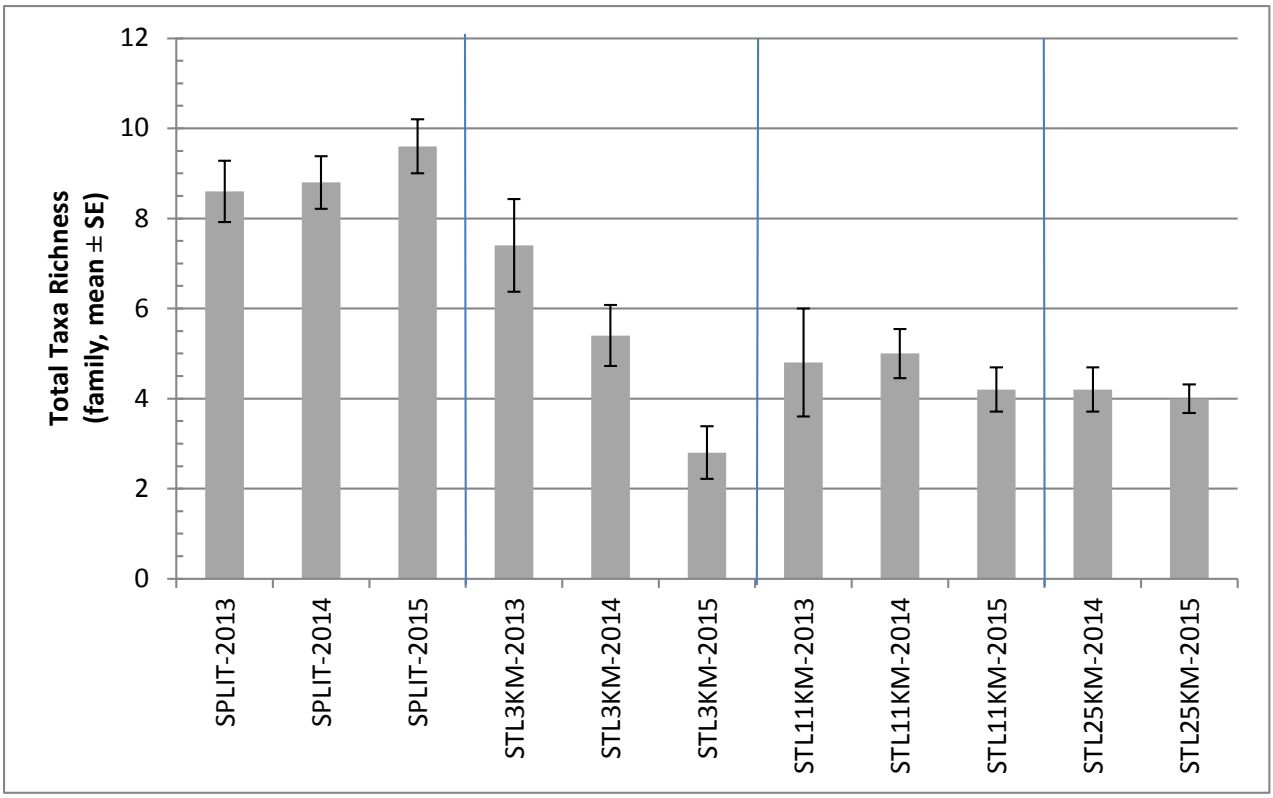


Figure 5: **Total richness (Family-level, mean ± SE) in offshore habitat in 2013 (pre-construction), 2014 (Year 1 construction), and 2015 (Year 2 construction).**

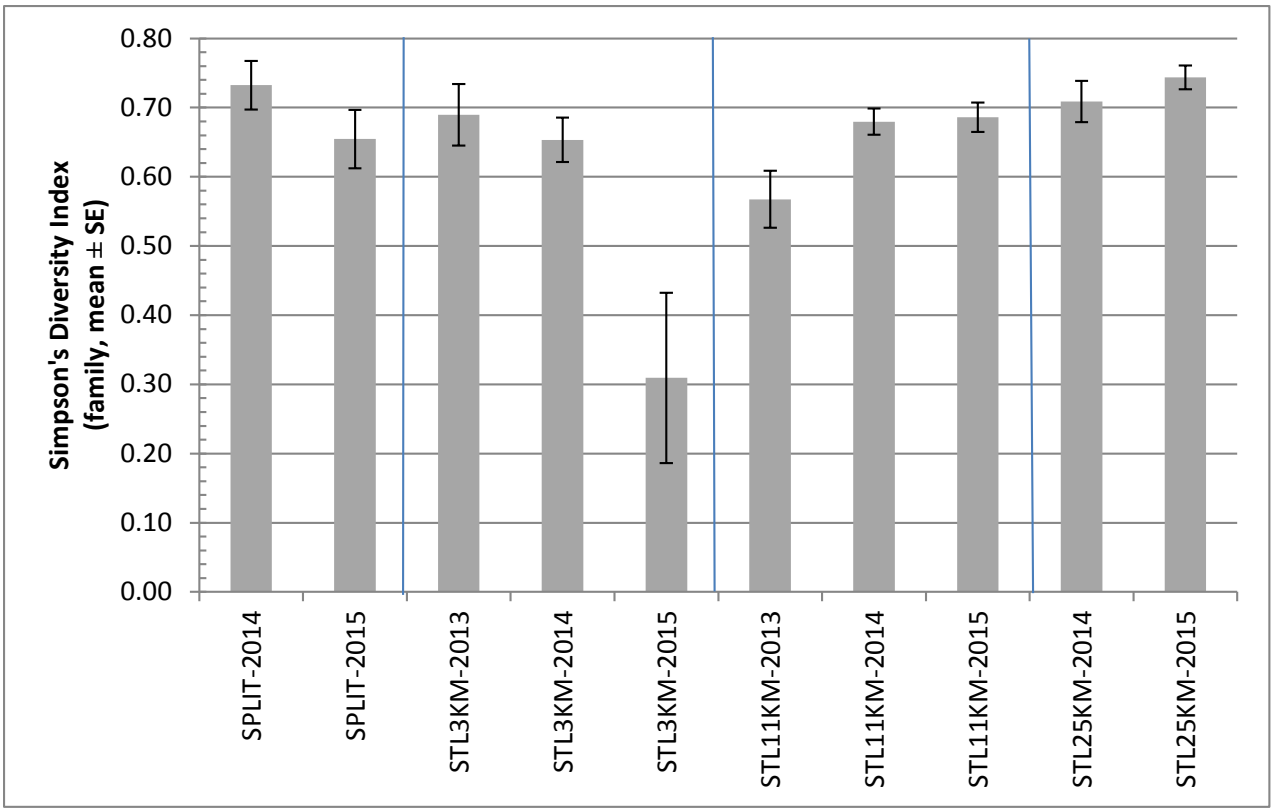


Figure 6: Simpson's diversity index (mean ± SE) in nearshore habitat in 2013 (pre-construction), 2014 (Year 1 construction), and 2015 (Year 2 construction).

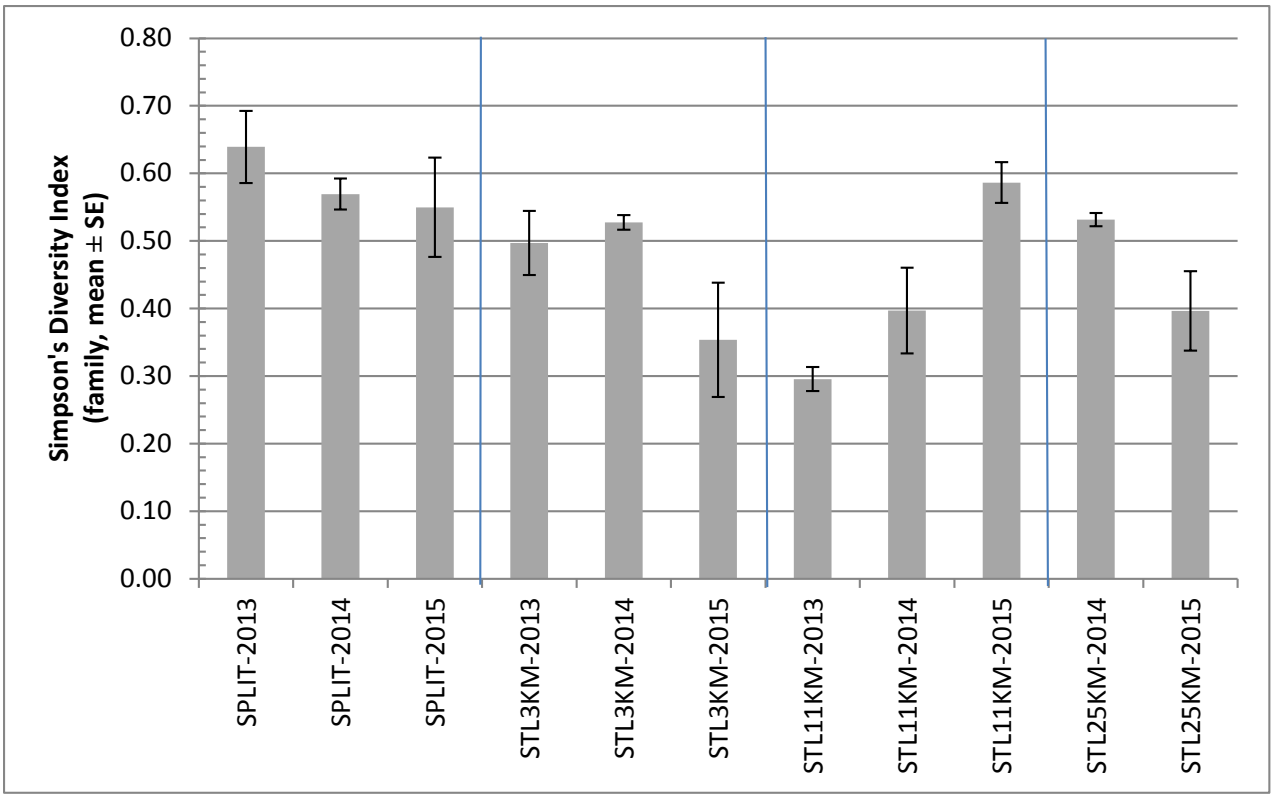


Figure 7: **Simpson's diversity index (mean ± SE) in offshore habitat in 2013 (pre-construction), 2014 (Year 1 construction), and 2015 (Year 2 construction).**

MAPS

DATA SOURCE:
Government of Manitoba, Province of Manitoba, Manitoba Hydro

CREATED BY:
North/South Consultants

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	09-FEB-15	02-JUN-16
0 6 12 Kilometres 0 5 10 Miles	VERSION NO: 1.0	QA/QC: CMP/YYY/ZZZ

Legend

- Town
- Community
- Generating Station (Existing)
- Generating Station (Under Construction)
- Generating Station (Potential)
- Highway
- Rail
- First Nation Reserve

Keeyask Study Area

Map 1: Map of the Keeyask study area showing hydroelectric development.

DATA SOURCE:
Orthophoto: Manitoba Hydro - June 21, 2015

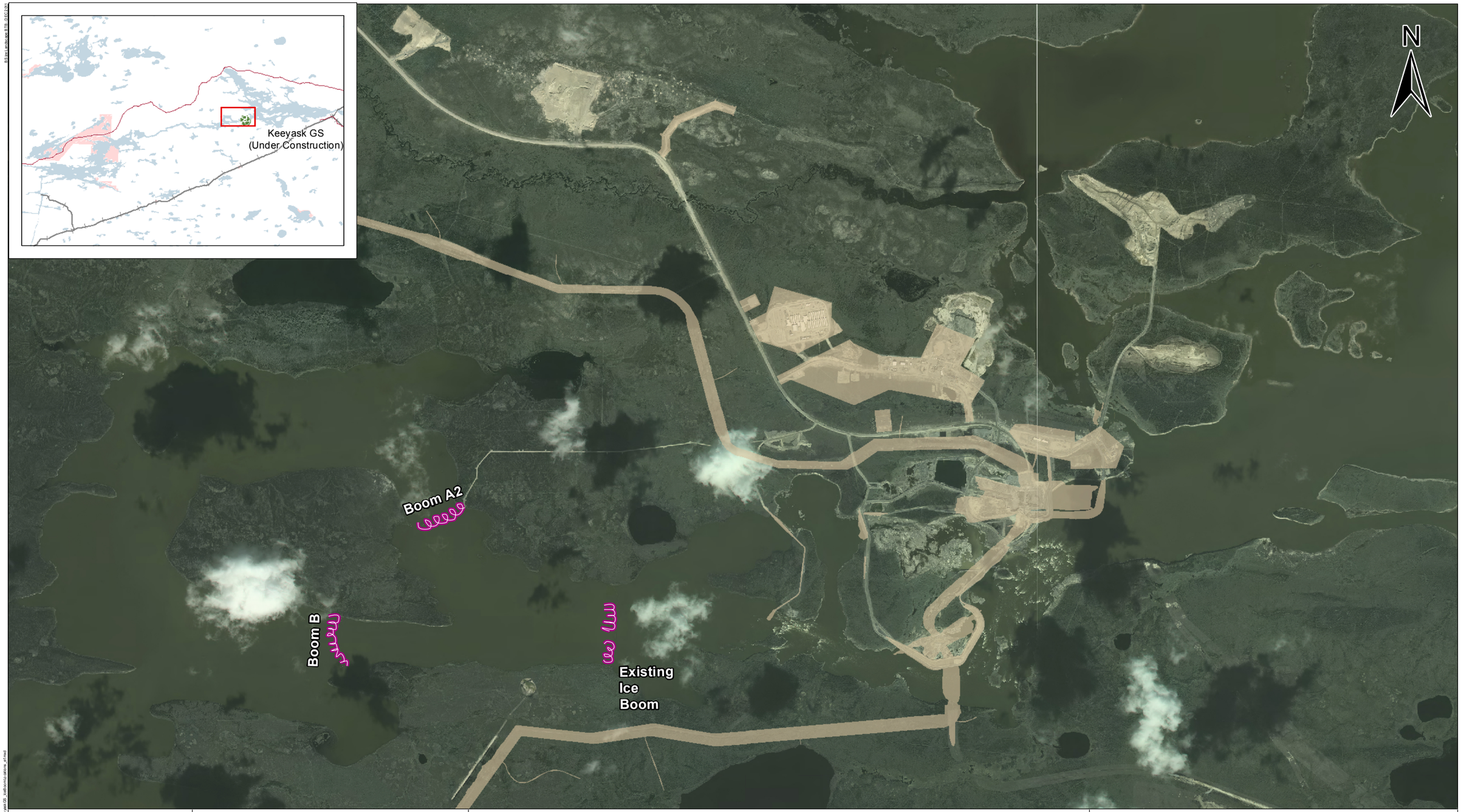
CREATED BY:
North/South Consultants

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	26-FEB-10	30-MAY-16
0 0.15 0.3 Kilometres / 0 0.15 0.3 Miles	VERSION NO: 2.0	QA/QC: PMC/FSV/MWZ

KEEYASK

Construction Site

Map 2: Instream structures at the Keeyask Generating Station site, June 2015.



KEEYASK

DATA SOURCE:
Manitoba Hydro; Government of Manitoba; Government of Canada:
Imagery - 2010 Keeyask 10cm and 1999 Gull 1m (Black an White)

CREATED BY:
Manitoba Hydro - GIS Studies

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	22-MAY-15	06-JAN-16
0 0.4 0.8 Kilometres 0 0.3 0.6 Miles	VERSION NO: 1.0	QA/QC:

Legend

- Ice Boom
- Infrastructure

Keeyask GS
Ice Boom Locations

Map 3: Locations where ice booms were installed, July to August 2015.

N

WASKAMAW RIVER
CYGNET LAKE
LIMESTONE LAKE
WASKAIOWAKA LAKE
North Moswakot River
South Moswakot R.
STEPHENS LAKE
LIMESTONE RIVER
Limestone G.S.
Fox Lake Cree Nation
Fox Lake (Bird)
280
North Access Road
STL11KM-PW
STL25KM-PW
STL3KM-OS
STL11KM-OS
STL25KM-OS
STL3KM-PW
Kettle G.S.
Nelson River
290
Long Spruce G.S.
Keeyask G.S.
(Under Construction)
Fox Lake Cree Nation
A Kwis Ki Mahka Reserve
Gillam
Assean R.
Clark Lake
Nelson River
Birthday Rapids
GULL LAKE
Gull Rapids
Tataskweyak Cree Nation
Tataskweyak (Split Lake)
BURNT-OS
BURNT-PW
Assean Lake
SPLIT-PW
SPLIT-OS
LAKE
SPLIT
BUTNAU RIVER
BUTNAU LAKE
Kettle River
Burntwood River
ODEI RIVER
Anipitapiskow Rapids
First Rapids
Grass River
Sakitowak Rapids
York Factory First Nation
York Landing (Kawechiwasik)
BUTNAU
Aiken River
Moose Nose Lake
Kelsey G.S.
War Lake First Nation
Ilford (Mooseocoot)
Kettle Lake
FOX (ATKINSON) LAKE
GRASS RIVER
Nelson River

KEEYASK

DATA SOURCE:
Government of Manitoba, Province of Manitoba, Manitoba Hydro

CREATED BY:
North/South Consultants

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	09-FEB-15	19-MAY-16
0 5.5 11 Kilometres / 0 4.5 9 Miles	VERSION NO: 1.0	QA/QC: CMP/YYY/ZZZ

Legend

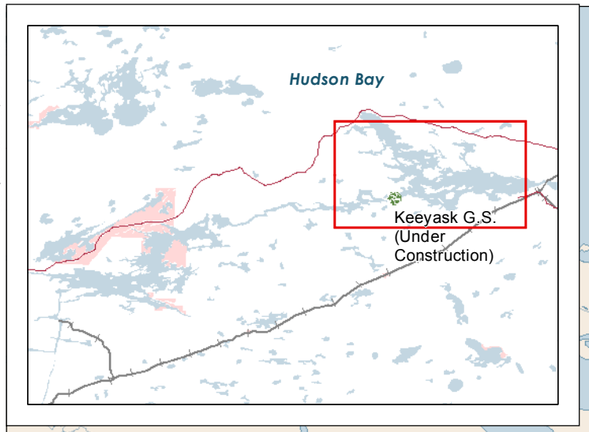
Benthic Macroinvertebrate Sampling Locations

- 2013 (pre-construction)
- 2014 (Year 1 construction)
- 2015 (Year 2 construction)
- Generating Station (Existing)
- Generating Station (Under Construction)
- Generating Station (Potential)
- Highway
- Rail
- First Nation Reserve

Benthic Macroinvertebrate Sampling Locations in the Regional Study Area

Burntwood River to Limestone G.S.

Map 4: Benthic macroinvertebrate sampling locations in the regional study area, 2013 (pre-construction), 2014 (Year 1 construction), and 2015 (Year 2 construction).



N

Sky Pilot Lake

Ferris Bay

STEPHENS LAKE

Wilson Channel

Callan Island

Looking Back Creek

North Access Road

STL3KM-PW

STL3KM-OS

STL11KM-PW

STL11KM-OS

STL25KM-OS

STL25KM-PW

Fox Lake Cree Nation
A Kwis Ki Mahka Reserve

Gillam

Caribou Island

William Smith Island

Gull Rapids

GULL LAKE

South Access Road

Gillrat Lake

Cache Lake

Joslin

KEEYASK

DATA SOURCE:
Government of Manitoba, Province of Manitoba, Manitoba Hydro

CREATED BY:
North/South Consultants

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	09-FEB-15	19-MAY-16
0 1 2 Kilometres / 0 1 2 Miles	VERSION NO: 1.0	QA/QC: CMP/YYY/ZZZ

Legend

Benthic Macroinvertebrate Sampling Locations

- 2013 (pre-construction)
- 2014 (Year 1 construction)
- 2015 (Year 2 construction)
- Keeyask Principal Structures
- Highway
- Rail
- First Nation Reserve

Benthic Macroinvertebrate Sampling Locations

Stephens Lake

Map 5: Benthic macroinvertebrate sampling locations in Stephens Lake, 2013 (pre-construction), 2014 (Year 1 construction), and 2015 (Year 2 construction).

APPENDICES

APPENDIX 1: QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC) PROCEDURES FOR AQUATIC MACROINVERTEBRATE SAMPLE PROCESSING

Detailed sample processing protocols are developed on a by-project-basis depending on the specific needs of each client. The following provides an overview of standard QA/QC procedures employed for each project.

Large &/or Rare Search for Samples Requiring Sub-Sampling

- Sample is washed and sieved using appropriate sized mesh;
- Entire sample is scanned for large &/or rare invertebrates in an appropriately sized tray. This scan is conducted on a per sample basis to avoid under-representing taxa that tend to occur singly or in few numbers that may be missed as a result of sub-sampling;
- Large organisms tend to occur in small numbers (*e.g.*, Belostomatidae, crayfish); these organisms are rare in relation to the overall number of organisms in the sample being processed. Based on the overall number of organisms in the sample, if an organism tends to occur rarely with respect to the rest of the organisms in the sample, this organism is removed (or more, if >1) and retained in a separate vial for taxonomic identification; and
- Large &/or rare organisms are not included in the split correction and this is indicated clearly on the bench sheet. It is noted that there is a separate vial containing large &/or rare organisms.

Sample Processing

Sub-Sampling

- Most samples are sub-sampled (unless requested by the client) to decrease processing time. A minimum of 300 organisms processed ensures the inclusion of more rare taxa and permits comparisons of richness among sites;
- The entire sample is examined in a large tray and estimate the number of splits necessary to produce the appropriate number of aliquots needed to achieve a 300-organism target;
- If a sample contains >300 organisms, large &/or rare invertebrates and any small fish are removed from the whole sample before sub-sampling (see above);
- When >300 organisms are present, the sample is split into halves. In order to reduce any bias created by the mixing/splitting process, the well-cleaned and mixed sample is split using a 1.0 or 4.0 L [specific to sample volume] Folsom Plankton Splitter. Each sub-sample is subsequently sorted until at least 300 animals are counted. When the 300-organism count

is achieved part way through a sub-sample, the remainder of this fraction is sorted so that a known fraction is sorted. All splitting information is recorded on the bench sheet.

- In sparse samples (*i.e.*, containing ~300 animals or less), the entire sample is processed;
- To be counted, a specimen must have enough intact body parts to permit its identification to the targeted level, and it must have a head (this prevents a body and detached head from being counted as two animals);
- Larval exuviae (exoskeleton remains), and empty shells (snails and clams) and cases (caddisflies) are not counted in the 300-fixed count. If there are no "live" molluscs in the sample, a few empty shells are set aside for identification; these are placed into vial with the large &/or rare specimens;
- The taxa Porifera, Nemata, Copepoda, Cladocera, Rotifera, Platyhelminthes, Ostracoda, and non-aquatic (terrestrial) taxa are not included in the 300 organism count because they are not considered as part of the benthic macroinvertebrate community. Typically, they are counted and their numbers recorded on the bench sheet.

Sorting Samples

- Sorting aquatic samples involves removing aquatic macroinvertebrates from organic and inorganic materials within each sample;
- All sorting is conducted with a 3x desktop magnifier or stereomicroscope [specific to Project];
- All sorted samples are checked by a 2nd laboratory technician (QA/QC technician);
- Any additional invertebrates collected during the QA/QC process are combined with the original sample, but counted separately;
- Sorting efficiency must be ≥ 95%. The QA/QC technician checks on a tray-by-tray basis so that the sample is handled as few times as possible; the QA/QC technician will sort any remaining invertebrates from the tray and record the number of missed invertebrates per tray;
- The QA/QC technician will also check the bench sheet data to ensure it matches the sample data; and
- Sorted invertebrate samples are stored in 70% ethanol prior to delivery to the taxonomist.

Verification of Taxonomic Identification

- NSC taxonomists regularly communicate with external taxonomic specialists to ensure accuracy and consistency.

Sample Identifications

- Samples are identified to the appropriate taxonomic level [specific to client] by an in-house or external taxonomist. Ten percent (10%) of the in-house identifications are randomly

selected and sent to an external taxonomy specialist for QA/QC. The accuracy of the sample subset is assessed for identification and enumeration; all unknown invertebrates are sent to an external specialist; incorrect identifications and/or enumeration discrepancies are noted on the laboratory datasheet;

- The target overall accuracy level for in-house invertebrate identifications and enumeration is 95% at the Family level and 90% at the Genus level. Corrected identifications and enumeration values received from the external taxonomist are used in place of in-house data discrepancies. If the average error rate of audited samples is outside the target, the entire project must be re-identified by someone other than the original taxonomist.

Data Processing

- Data from field books and laboratory bench sheets are entered into an MS Excel® data template;
- Data templates specify the Project Name, Study Area, Site Location/Description, GPS coordinates (Global Positioning System), Site Label, Sampling Date, Time of Day, Gear Type, Sieve Mesh Size in Field/Laboratory, Presence or Absence of Vegetation/Algae, Water Temperature, Water Depth, Velocity, Substrate Type, Number of Splits, Taxonomic List, Life Stage, and Enumeration List;
- A 2nd and 3rd technician sequentially verify all entered data and formulae to original field book and laboratory bench sheets (*i.e.*, verification is done twice) and a final verification is conducted by the project biologist and/or report author.

APPENDIX 2:
MEANS OF BENTHIC MACROINVERTEBRATE METRICS AND SUPPORTING SEDIMENT RESULTS BY REPLICATE STATION FOR 2013 (PRE-CONSTRUCTION), 2014 (YEAR 1 CONSTRUCTION), AND 2015 (YEAR 2 CONSTRUCTION)

Note: results for each site continue over four pages.

Waterbody/ Site Location	Habitat Type	Study Year	Site Type	Site ID	Water Depth	Total Invertebrate Density	Oligochaeta Density	Amphipoda Density	Pisidiidae Density	Gastropoda Density
Units					**meters**	**no. per m^2**	**no. per m^2**	**no. per m^2**	**no. per m^2**	**no. per m^2**
Split Lake	NRSH-PW	2014	reference	SPLIT-PW-REP1	2.6	808	14	115	0	144
Split Lake	NRSH-PW	2014	reference	SPLIT-PW-REP2	2.9	721	0	0	29	29
Split Lake	NRSH-PW	2014	reference	SPLIT-PW-REP3	2.6	649	144	0	14	58
Split Lake	NRSH-PW	2014	reference	SPLIT-PW-REP4	2.4	866	29	0	58	202
Split Lake	NRSH-PW	2014	reference	SPLIT-PW-REP5	2.5	404	14	0	14	14
Split Lake	NRSH-PW	2015	reference	SPLIT-PW-R1	0.9	2323	29	87	43	115
Split Lake	NRSH-PW	2015	reference	SPLIT-PW-R2	1.1	2222	159	14	144	29
Split Lake	NRSH-PW	2015	reference	SPLIT-PW-R3	1.2	1111	289	0	72	43
Split Lake	NRSH-PW	2015	reference	SPLIT-PW-R4	1.0	1659	43	0	0	289
Split Lake	NRSH-PW	2015	reference	SPLIT-PW-R5	1.1	8281	1039	0	1024	390
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL3KM-PW-REP1	3.0	1264	164	9	35	338
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL3KM-PW-REP2	2.8	1524	26	0	26	866
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL3KM-PW-REP3	3.1	727	17	0	52	216
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL3KM-PW-REP4	2.6	1143	35	0	9	511
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL3KM-PW-REP5	2.5	1368	156	0	17	883

Waterbody/ Site Location	Habitat Type	Study Year	Site Type	Site ID	Water Depth	Total Invertebrate Density	Oligochaeta Density	Amphipoda Density	Pisidiidae Density	Gastropoda Density
Units					**meters**	**no. per m^2**	**no. per m^2**	**no. per m^2**	**no. per m^2**	**no. per m^2**
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL3KM-PW-REP1	3.0	779	0	0	0	43
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL3KM-PW-REP2	3.1	476	58	0	29	87
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL3KM-PW-REP3	3.0	2352	231	0	0	289
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL3KM-PW-REP4	2.7	2280	101	0	0	188
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL3KM-PW-REP5	2.2	1515	144	14	14	231
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-3KM-PW-R1	2.4	216	14	0	0	0
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-3KM-PW-R2	2.8	3015	14	14	29	14
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-3KM-PW-R3	2.7	231	29	0	0	72
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-3KM-PW-R4	2.2	1414	101	0	14	245
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-3KM-PW-R5	1.4	808	0	0	0	14
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL11KM-PW-REP1	3.0	3298	78	0	242	416
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL11KM-PW-REP2	2.2	2329	130	0	156	649
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL11KM-PW-REP3	2.2	3740	312	9	139	641
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL11KM-PW-REP4	2.1	1567	78	0	26	476

Waterbody/ Site Location	Habitat Type	Study Year	Site Type	Site ID	Water Depth	Total Invertebrate Density	Oligochaeta Density	Amphipoda Density	Pisidiidae Density	Gastropoda Density
Units					**meters**	**no. per m^2**	**no. per m^2**	**no. per m^2**	**no. per m^2**	**no. per m^2**
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL11KM-PW-REP5	2.6	4242	130	0	35	286
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL11KM-PW-REP1	3.4	1832	58	29	173	390
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL11KM-PW-REP2	2.1	1529	58	0	144	433
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL11KM-PW-REP3	2.0	2496	115	0	159	808
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL11KM-PW-REP4	1.9	1472	0	0	29	606
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL11KM-PW-REP5	1.5	1428	144	0	144	43
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-11KM-PW-R1	3.5	1443	14	87	188	274
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-11KM-PW-R2	1.8	1010	0	0	274	115
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-11KM-PW-R3	2.2	1284	43	0	29	144
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-11KM-PW-R4	1.8	1068	29	0	43	87
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-11KM-PW-R5	1.1	1803	115	0	72	216
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL25KM-PW-REP1	2.9	1169	14	43	188	707
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL25KM-PW-REP2	2.5	2669	462	0	332	1039
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL25KM-PW-REP3	1.9	2727	245	0	274	1197

Waterbody/ Site Location	Habitat Type	Study Year	Site Type	Site ID	Water Depth	Total Invertebrate Density	Oligochaeta Density	Amphipoda Density	Pisidiidae Density	Gastropoda Density
Units					**meters**	**no. per m^2**	**no. per m^2**	**no. per m^2**	**no. per m^2**	**no. per m^2**
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL25KM-PW-REP4	3.2	1313	188	0	216	159
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL25KM-PW-REP5	2.3	4429	476	14	1039	2539
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-25KM-PW-R1	2.0	1457	43	14	620	260
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-25KM-PW-R2	1.3	4357	375	0	361	1068
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-25KM-PW-R3	1.0	3203	130	0	72	1573
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-25KM-PW-R4	2.4	3174	346	0	346	433
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-25KM-PW-R5	1.1	8685	346	29	895	3347
Split Lake	OFFSH	2013	reference	SPLIT-OS-REP1	7.0	4040	14	1544	332	130
Split Lake	OFFSH	2013	reference	SPLIT-OS-REP2	6.3	9248	29	1818	1125	4069
Split Lake	OFFSH	2013	reference	SPLIT-OS-REP3	9.1	7517	58	1919	1111	2626
Split Lake	OFFSH	2013	reference	SPLIT-OS-REP4	6.4	10806	0	895	895	6983
Split Lake	OFFSH	2013	reference	SPLIT-OS-REP5	8.3	8281	29	895	981	5800
Split Lake	OFFSH	2014	reference	SPLIT-OS-REP1	7.2	6175	29	1371	260	3506
Split Lake	OFFSH	2014	reference	SPLIT-OS-REP2	6.8	7012	29	1212	649	4415
Split Lake	OFFSH	2014	reference	SPLIT-OS-REP3	9.3	11311	58	2308	1125	6983
Split Lake	OFFSH	2014	reference	SPLIT-OS-REP4	6.9	11311	29	1241	1241	6896
Split Lake	OFFSH	2014	reference	SPLIT-OS-REP5	8.9	9060	0	1789	491	6233
Split Lake	OFFSH	2015	reference	SPLIT-OS-R1	6.1	3939	14	2193	534	87
Split Lake	OFFSH	2015	reference	SPLIT-OS-R2	5.9	3506	0	1601	750	202
Split Lake	OFFSH	2015	reference	SPLIT-OS-R3	6.5	3477	29	2684	0	29
Split Lake	OFFSH	2015	reference	SPLIT-OS-R4	5.7	3001	29	1616	447	58
Split Lake	OFFSH	2015	reference	SPLIT-OS-R5	5.4	3246	14	2583	29	87
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2013	impact	STL3KM-OS-REP1	6.3	1394	0	9	0	744

Waterbody/ Site Location	Habitat Type	Study Year	Site Type	Site ID	Water Depth	Total Invertebrate Density	Oligochaeta Density	Amphipoda Density	Pisidiidae Density	Gastropoda Density
Units					**meters**	**no. per m^2**	**no. per m^2**	**no. per m^2**	**no. per m^2**	**no. per m^2**
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2013	impact	STL3KM-OS-REP2	6.0	710	9	0	0	164
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2013	impact	STL3KM-OS-REP3	6.0	822	0	0	0	424
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2013	impact	STL3KM-OS-REP4	6.2	900	17	0	0	121
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2013	impact	STL3KM-OS-REP5	6.2	1679	35	0	9	156
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2014	impact	STL3KM-OS-REP1	6.5	404	0	0	14	216
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2014	impact	STL3KM-OS-REP2	6.1	1082	14	29	0	202
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2014	impact	STL3KM-OS-REP3	6.1	1428	0	43	0	491
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2014	impact	STL3KM-OS-REP4	5.1	2684	29	14	43	1630
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2014	impact	STL3KM-OS-REP5	6.3	1731	0	14	0	1111
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2015	impact	STL-3KM-OS-R1	5.7	159	0	0	0	29
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2015	impact	STL-3KM-OS-R2	5.2	346	0	14	0	14
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2015	impact	STL-3KM-OS-R3	5.3	43	0	0	0	0
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2015	impact	STL-3KM-OS-R4	4.9	72	0	0	0	0
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2015	impact	STL-3KM-OS-R5	5.4	303	0	0	0	0

Waterbody/ Site Location	Habitat Type	Study Year	Site Type	Site ID	Water Depth	Total Invertebrate Density	Oligochaeta Density	Amphipoda Density	Pisidiidae Density	Gastropoda Density
Units					**meters**	**no. per m^2**	**no. per m^2**	**no. per m^2**	**no. per m^2**	**no. per m^2**
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2013	impact	STL11KM-OS-REP1	6.6	2190	0	130	0	52
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2013	impact	STL11KM-OS-REP2	7.3	2225	9	130	0	9
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2013	impact	STL11KM-OS-REP3	7.1	2779	26	69	0	9
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2013	impact	STL11KM-OS-REP4	7.2	2199	35	69	0	0
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2013	impact	STL11KM-OS-REP5	6.6	0	0	0	0	0
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2014	impact	STL11KM-OS-REP1	6.4	1284	0	202	0	43
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2014	impact	STL11KM-OS-REP2	6.8	1818	14	361	0	0
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2014	impact	STL11KM-OS-REP3	6.5	1890	14	433	0	0
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2014	impact	STL11KM-OS-REP4	7.6	1140	0	72	0	0
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2014	impact	STL11KM-OS-REP5	6.9	1313	0	72	0	0
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2015	impact	STL-11KM-OS-R1	5.9	1702	0	765	0	29
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2015	impact	STL-11KM-OS-R2	6.3	1111	0	491	0	0
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2015	impact	STL-11KM-OS-R3	6.6	1414	0	433	0	0
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2015	impact	STL-11KM-OS-R4	6.8	895	0	115	0	0

Waterbody/ Site Location	Habitat Type	Study Year	Site Type	Site ID	Water Depth	Total Invertebrate Density	Oligochaeta Density	Amphipoda Density	Pisidiidae Density	Gastropoda Density
Units					**meters**	**no. per m^2**	**no. per m^2**	**no. per m^2**	**no. per m^2**	**no. per m^2**
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2015	impact	STL-11KM-OS-R5	6.1	1125	0	159	0	0
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2014	impact	STL25KM-OS-REP1	9.1	2857	0	1616	14	0
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2014	impact	STL25KM-OS-REP2	9.2	3102	14	2020	0	0
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2014	impact	STL25KM-OS-REP3	8.6	3232	43	2034	0	0
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2014	impact	STL25KM-OS-REP4	9.5	2135	0	1226	0	0
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2014	impact	STL25KM-OS-REP5	9.2	2510	0	1544	0	0
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2015	impact	STL-S-OS-R1	9.0	3434	0	2871	0	0
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2015	impact	STL-S-OS-R2	8.5	2453	0	2005	0	0
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2015	impact	STL-S-OS-R3	8.6	3419	14	2813	0	0
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2015	impact	STL-S-OS-R4	9.3	1255	0	707	0	0
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2015	impact	STL-S-OS-R5	8.9	2409	0	1659	0	0

Waterbody/ Site Location	Habitat Type	Study Year	Site Type	Site ID	Chironomidae Density	Ephemeroptera Density	Plecoptera Density	Trichoptera Density	EPT Density	Ratio of EPT to Chironomidae
Units					**no. per m^2**	**no. per m^2**	**no. per m^2**	**no. per m^2**	**no. per m^2**	**-**
Split Lake	NRSH-PW	2014	reference	SPLIT-PW-REP1	274	216	0	14	231	0.84
Split Lake	NRSH-PW	2014	reference	SPLIT-PW-REP2	390	159	0	0	159	0.41
Split Lake	NRSH-PW	2014	reference	SPLIT-PW-REP3	159	159	0	14	173	1.09
Split Lake	NRSH-PW	2014	reference	SPLIT-PW-REP4	231	245	0	0	245	1.06
Split Lake	NRSH-PW	2014	reference	SPLIT-PW-REP5	144	188	0	14	202	1.40
Split Lake	NRSH-PW	2015	reference	SPLIT-PW-R1	1601	202	0	43	245	0.2
Split Lake	NRSH-PW	2015	reference	SPLIT-PW-R2	1241	433	0	14	447	0.4
Split Lake	NRSH-PW	2015	reference	SPLIT-PW-R3	361	245	0	58	303	0.8
Split Lake	NRSH-PW	2015	reference	SPLIT-PW-R4	822	361	0	14	375	0.5
Split Lake	NRSH-PW	2015	reference	SPLIT-PW-R5	4386	923	0	29	952	0.2
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL3KM-PW-REP1	398	69	0	43	113	0.3
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL3KM-PW-REP2	398	104	0	0	104	0.3
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL3KM-PW-REP3	208	69	0	26	95	0.5
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL3KM-PW-REP4	390	43	0	9	52	0.1
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL3KM-PW-REP5	190	35	0	17	52	0.3
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL3KM-PW-REP1	491	202	0	14	216	0.4
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL3KM-PW-REP2	245	58	0	0	58	0.2
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL3KM-PW-REP3	837	923	0	14	938	1.1
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL3KM-PW-REP4	1183	664	0	87	750	0.6
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL3KM-PW-REP5	462	635	0	14	649	1.4

Waterbody/ Site Location	Habitat Type	Study Year	Site Type	Site ID	Chironomidae Density	Ephemeroptera Density	Plecoptera Density	Trichoptera Density	EPT Density	Ratio of EPT to Chironomidae
Units					**no. per m^2**	**no. per m^2**	**no. per m^2**	**no. per m^2**	**no. per m^2**	**-**
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-3KM-PW-R1	188	0	0	0	0	0.0
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-3KM-PW-R2	2886	14	0	14	29	0.0
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-3KM-PW-R3	115	0	0	0	0	0.0
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-3KM-PW-R4	952	43	0	0	43	0.0
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-3KM-PW-R5	794	0	0	0	0	0.0
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL11KM-PW-REP1	173	2329	0	9	2337	13.5
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL11KM-PW-REP2	147	1229	0	9	1238	8.4
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL11KM-PW-REP3	225	2372	0	9	2381	10.6
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL11KM-PW-REP4	147	788	0	17	805	5.5
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL11KM-PW-REP5	718	3004	0	35	3038	4.2
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL11KM-PW-REP1	216	952	0	0	952	4.4
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL11KM-PW-REP2	58	822	0	0	822	14.3
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL11KM-PW-REP3	188	1226	0	0	1226	6.5
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL11KM-PW-REP4	606	216	0	14	231	0.4

Waterbody/ Site Location	Habitat Type	Study Year	Site Type	Site ID	Chironomidae Density	Ephemeroptera Density	Plecoptera Density	Trichoptera Density	EPT Density	Ratio of EPT to Chironomidae
Units					**no. per m^2**	**no. per m^2**	**no. per m^2**	**no. per m^2**	**no. per m^2**	**-**
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL11KM-PW-REP5	606	375	0	29	404	0.7
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-11KM-PW-R1	519	361	0	0	361	0.7
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-11KM-PW-R2	87	462	0	0	462	5.3
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-11KM-PW-R3	433	592	0	0	592	1.4
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-11KM-PW-R4	346	491	0	14	505	1.5
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-11KM-PW-R5	1039	260	0	0	260	0.3
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL25KM-PW-REP1	0	202	0	0	202	202.0
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL25KM-PW-REP2	505	231	0	43	274	0.5
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL25KM-PW-REP3	491	404	0	14	418	0.9
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL25KM-PW-REP4	101	649	0	0	649	6.4
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL25KM-PW-REP5	101	245	0	0	245	2.4
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-25KM-PW-R1	72	433	0	0	433	6.0
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-25KM-PW-R2	808	1587	0	29	1616	2.0
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-25KM-PW-R3	462	952	0	0	952	2.1

Waterbody/ Site Location	Habitat Type	Study Year	Site Type	Site ID	Chironomidae Density	Ephemeroptera Density	Plecoptera Density	Trichoptera Density	EPT Density	Ratio of EPT to Chironomidae
Units					**no. per m^2**	**no. per m^2**	**no. per m^2**	**no. per m^2**	**no. per m^2**	**-**
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-25KM-PW-R4	534	1486	0	14	1500	2.8
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-25KM-PW-R5	2395	1529	0	0	1529	0.6
Split Lake	OFFSH	2013	reference	SPLIT-OS-REP1	216	1587	0	101	1688	7.8
Split Lake	OFFSH	2013	reference	SPLIT-OS-REP2	462	1558	0	58	1616	3.5
Split Lake	OFFSH	2013	reference	SPLIT-OS-REP3	418	1298	0	58	1356	3.2
Split Lake	OFFSH	2013	reference	SPLIT-OS-REP4	346	1587	0	87	1674	4.8
Split Lake	OFFSH	2013	reference	SPLIT-OS-REP5	144	375	0	58	433	3.0
Split Lake	OFFSH	2014	reference	SPLIT-OS-REP1	159	808	0	0	808	5.1
Split Lake	OFFSH	2014	reference	SPLIT-OS-REP2	72	534	0	58	592	8.2
Split Lake	OFFSH	2014	reference	SPLIT-OS-REP3	231	491	0	87	577	2.5
Split Lake	OFFSH	2014	reference	SPLIT-OS-REP4	173	1039	0	58	1096	6.3
Split Lake	OFFSH	2014	reference	SPLIT-OS-REP5	144	346	0	29	375	2.6
Split Lake	OFFSH	2015	reference	SPLIT-OS-R1	563	361	0	43	404	0.7
Split Lake	OFFSH	2015	reference	SPLIT-OS-R2	592	130	0	101	231	0.4
Split Lake	OFFSH	2015	reference	SPLIT-OS-R3	404	159	0	72	231	0.6
Split Lake	OFFSH	2015	reference	SPLIT-OS-R4	505	274	0	29	303	0.6
Split Lake	OFFSH	2015	reference	SPLIT-OS-R5	245	173	0	58	231	0.9
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2013	impact	STL3KM-OS-REP1	493	69	0	43	113	0.2
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2013	impact	STL3KM-OS-REP2	424	95	0	9	104	0.2
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2013	impact	STL3KM-OS-REP3	364	9	0	9	17	0.0
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2013	impact	STL3KM-OS-REP4	684	52	0	26	78	0.1
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2013	impact	STL3KM-OS-REP5	1324	95	0	43	139	0.1
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2014	impact	STL3KM-OS-REP1	173	0	0	0	0	0.0

Waterbody/ Site Location	Habitat Type	Study Year	Site Type	Site ID	Chironomidae Density	Ephemeroptera Density	Plecoptera Density	Trichoptera Density	EPT Density	Ratio of EPT to Chironomidae
Units					**no. per m^2**	**no. per m^2**	**no. per m^2**	**no. per m^2**	**no. per m^2**	**-**
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2014	impact	STL3KM-OS-REP2	721	101	0	14	115	0.2
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2014	impact	STL3KM-OS-REP3	794	87	0	14	101	0.1
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2014	impact	STL3KM-OS-REP4	909	43	0	14	58	0.1
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2014	impact	STL3KM-OS-REP5	505	43	0	58	101	0.2
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2015	impact	STL-3KM-OS-R1	87	0	0	43	43	0.5
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2015	impact	STL-3KM-OS-R2	289	0	0	14	14	0.1
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2015	impact	STL-3KM-OS-R3	0	0	0	29	29	29.0
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2015	impact	STL-3KM-OS-R4	58	0	0	14	14	0.3
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2015	impact	STL-3KM-OS-R5	289	0	0	0	0	0.0
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2013	impact	STL11KM-OS-REP1	173	1801	0	0	1801	10.4
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2013	impact	STL11KM-OS-REP2	242	1818	0	0	1818	7.5
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2013	impact	STL11KM-OS-REP3	390	2277	0	0	2277	5.8
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2013	impact	STL11KM-OS-REP4	164	1922	0	0	1922	11.7
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2013	impact	STL11KM-OS-REP5	0	0	0	0	0	-

Waterbody/ Site Location	Habitat Type	Study Year	Site Type	Site ID	Chironomidae Density	Ephemeroptera Density	Plecoptera Density	Trichoptera Density	EPT Density	Ratio of EPT to Chironomidae
Units					**no. per m^2**	**no. per m^2**	**no. per m^2**	**no. per m^2**	**no. per m^2**	**-**
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2014	impact	STL11KM-OS-REP1	72	938	0	14	952	13.2
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2014	impact	STL11KM-OS-REP2	188	1241	0	0	1241	6.6
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2014	impact	STL11KM-OS-REP3	216	1226	0	0	1226	5.7
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2014	impact	STL11KM-OS-REP4	29	1039	0	0	1039	36.0
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2014	impact	STL11KM-OS-REP5	173	1024	0	0	1024	5.9
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2015	impact	STL-11KM-OS-R1	289	606	0	0	606	2.1
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2015	impact	STL-11KM-OS-R2	101	491	0	0	491	4.9
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2015	impact	STL-11KM-OS-R3	317	664	0	0	664	2.1
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2015	impact	STL-11KM-OS-R4	144	620	0	0	620	4.3
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2015	impact	STL-11KM-OS-R5	303	649	0	0	649	2.1
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2014	impact	STL25KM-OS-REP1	245	967	0	0	967	3.9
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2014	impact	STL25KM-OS-REP2	216	851	0	0	851	3.9
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2014	impact	STL25KM-OS-REP3	231	909	0	0	909	3.9
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2014	impact	STL25KM-OS-REP4	173	736	0	0	736	4.3

Waterbody/ Site Location	Habitat Type	Study Year	Site Type	Site ID	Chironomidae Density	Ephemeroptera Density	Plecoptera Density	Trichoptera Density	EPT Density	Ratio of EPT to Chironomidae
Units					**no. per m^2**	**no. per m^2**	**no. per m^2**	**no. per m^2**	**no. per m^2**	**-**
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2014	impact	STL25KM-OS-REP5	274	693	0	0	693	2.5
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2015	impact	STL-S-OS-R1	188	375	0	0	375	2.0
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2015	impact	STL-S-OS-R2	260	188	0	0	188	0.7
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2015	impact	STL-S-OS-R3	404	188	0	0	188	0.5
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2015	impact	STL-S-OS-R4	202	332	0	14	346	1.7
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2015	impact	STL-S-OS-R5	390	332	0	14	346	0.9

Waterbody/ Site Location	Habitat Type	Study Year	Site Type	Site ID	Percent Ephemeroptera	Percent EPT (EPT Index)	Percent of Oligochaeta and Chironomidae	Total Richness (Family-level)	EPT Richness (Family-level)	Simpson's Diversity Index
Units					%	%	%	-	-	-
Split Lake	NRSH-PW	2014	reference	SPLIT-PW-REP1	26.8	28.6	35.7	8	2	0.77
Split Lake	NRSH-PW	2014	reference	SPLIT-PW-REP2	22.0	22.0	54.0	6	1	0.64
Split Lake	NRSH-PW	2014	reference	SPLIT-PW-REP3	24.4	26.7	46.7	10	2	0.81
Split Lake	NRSH-PW	2014	reference	SPLIT-PW-REP4	28.3	28.3	30.0	7	1	0.78
Split Lake	NRSH-PW	2014	reference	SPLIT-PW-REP5	46.4	50.0	39.3	7	2	0.65
Split Lake	NRSH-PW	2015	reference	SPLIT-PW-R1	8.70	10.56	70.19	11	2	0.51
Split Lake	NRSH-PW	2015	reference	SPLIT-PW-R2	19.48	20.13	62.99	11	2	0.64
Split Lake	NRSH-PW	2015	reference	SPLIT-PW-R3	22.08	27.27	58.44	11	1	0.77
Split Lake	NRSH-PW	2015	reference	SPLIT-PW-R4	21.74	22.61	52.17	8	1	0.67
Split Lake	NRSH-PW	2015	reference	SPLIT-PW-R5	11.15	11.50	65.51	12	2	0.67
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL3KM-PW-REP1	5.48	8.9	44.52	11	3	0.79
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL3KM-PW-REP2	6.82	6.8	27.84	8	1	0.61
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL3KM-PW-REP3	9.52	13.1	30.95	9	3	0.78
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL3KM-PW-REP4	3.79	4.5	37.12	10	3	0.69
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL3KM-PW-REP5	2.53	3.8	25.32	9	2	0.57
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL3KM-PW-REP1	25.93	27.8	62.96	6	2	0.53
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL3KM-PW-REP2	12.12	12.1	63.64	6	1	0.68
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL3KM-PW-REP3	39.26	39.9	45.40	9	2	0.70
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL3KM-PW-REP4	29.11	32.9	56.33	10	4	0.64
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL3KM-PW-REP5	41.90	42.9	40.00	8	2	0.71

Waterbody/ Site Location	Habitat Type	Study Year	Site Type	Site ID	Percent Ephemeroptera	Percent EPT (EPT Index)	Percent of Oligochaeta and Chironomidae	Total Richness (Family-level)	EPT Richness (Family-level)	Simpson's Diversity Index
Units					%	%	%	-	-	-
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-3KM-PW-R1	0.00	0.00	93.33	3	0	0.24
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-3KM-PW-R2	0.48	0.96	96.17	8	1	0.08
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-3KM-PW-R3	0.00	0.00	62.50	5	0	0.67
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-3KM-PW-R4	3.06	3.06	74.49	11	2	0.52
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-3KM-PW-R5	0.00	0.00	98.21	2	0	0.04
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL11KM-PW-REP1	70.60	70.9	7.61	8	3	0.48
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL11KM-PW-REP2	52.79	53.2	11.90	8	2	0.63
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL11KM-PW-REP3	63.43	63.7	14.35	9	2	0.56
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL11KM-PW-REP4	50.28	51.4	14.36	10	3	0.69
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL11KM-PW-REP5	70.82	71.6	20.00	12	5	0.48
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL11KM-PW-REP1	51.97	52.0	14.96	8	1	0.66
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL11KM-PW-REP2	53.77	53.8	7.55	6	1	0.62
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL11KM-PW-REP3	49.13	49.1	12.14	7	2	0.71

Waterbody/ Site Location	Habitat Type	Study Year	Site Type	Site ID	Percent Ephemeroptera	Percent EPT (EPT Index)	Percent of Oligochaeta and Chironomidae	Total Richness (Family-level)	EPT Richness (Family-level)	Simpson's Diversity Index
Units					**%**	**%**	**%**	**-**	**-**	**-**
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL11KM-PW-REP4	14.71	15.7	41.18	6	2	0.68
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL11KM-PW-REP5	26.26	28.3	52.53	9	3	0.73
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-11KM-PW-R1	25.00	25.00	37.00	7	1	0.76
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-11KM-PW-R2	45.71	45.71	8.57	6	1	0.69
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-11KM-PW-R3	46.07	46.07	37.08	7	1	0.67
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-11KM-PW-R4	45.95	47.30	35.14	8	1	0.67
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-11KM-PW-R5	14.40	14.40	64.00	10	1	0.64
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL25KM-PW-REP1	17.28	17.28	1.23	8	2	0.76
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL25KM-PW-REP2	8.65	10.27	36.22	10	4	0.76
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL25KM-PW-REP3	14.81	15.34	26.98	11	2	0.73
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL25KM-PW-REP4	49.45	49.45	21.98	5	1	0.69
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL25KM-PW-REP5	5.54	5.54	13.03	7	1	0.60
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-25KM-PW-R1	29.70	29.70	7.92	7	1	0.70

Waterbody/ Site Location	Habitat Type	Study Year	Site Type	Site ID	Percent Ephemeroptera	Percent EPT (EPT Index)	Percent of Oligochaeta and Chironomidae	Total Richness (Family-level)	EPT Richness (Family-level)	Simpson's Diversity Index
Units					%	%	%	-	-	-
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-25KM-PW-R2	36.42	37.09	27.15	12	2	0.77
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-25KM-PW-R3	29.73	29.73	18.47	7	1	0.74
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-25KM-PW-R4	46.82	47.27	27.73	8	1	0.72
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-25KM-PW-R5	17.61	17.61	31.56	13	2	0.79
Split Lake	OFFSH	2013	reference	SPLIT-OS-REP1	39.29	41.79	5.71	10	3	0.69
Split Lake	OFFSH	2013	reference	SPLIT-OS-REP2	16.85	17.47	5.30	10	2	0.72
Split Lake	OFFSH	2013	reference	SPLIT-OS-REP3	17.27	18.04	6.33	9	2	0.76
Split Lake	OFFSH	2013	reference	SPLIT-OS-REP4	14.69	15.49	3.20	7	2	0.55
Split Lake	OFFSH	2013	reference	SPLIT-OS-REP5	4.53	5.23	2.09	7	2	0.48
Split Lake	OFFSH	2014	reference	SPLIT-OS-REP1	13.08	13.08	3.04	8	1	0.61
Split Lake	OFFSH	2014	reference	SPLIT-OS-REP2	7.61	8.44	1.44	10	3	0.56
Split Lake	OFFSH	2014	reference	SPLIT-OS-REP3	4.34	5.10	2.55	10	3	0.60
Split Lake	OFFSH	2014	reference	SPLIT-OS-REP4	9.18	9.69	1.79	9	2	0.59
Split Lake	OFFSH	2014	reference	SPLIT-OS-REP5	3.82	4.14	1.59	7	2	0.48
Split Lake	OFFSH	2015	reference	SPLIT-OS-R1	9.16	10.26	14.65	11	1	0.64
Split Lake	OFFSH	2015	reference	SPLIT-OS-R2	3.70	6.58	16.87	11	1	0.71
Split Lake	OFFSH	2015	reference	SPLIT-OS-R3	4.56	6.64	12.45	9	1	0.39
Split Lake	OFFSH	2015	reference	SPLIT-OS-R4	9.13	10.10	17.79	8	1	0.65
Split Lake	OFFSH	2015	reference	SPLIT-OS-R5	5.33	7.11	8.00	9	1	0.36
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2013	impact	STL3KM-OS-REP1	4.97	8.07	35.40	9	3	0.59
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2013	impact	STL3KM-OS-REP2	13.41	14.63	60.98	8	3	0.59
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2013	impact	STL3KM-OS-REP3	1.05	2.11	44.21	5	2	0.54
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2013	impact	STL3KM-OS-REP4	5.77	8.65	77.88	5	2	0.40

Waterbody/ Site Location	Habitat Type	Study Year	Site Type	Site ID	Percent Ephemeroptera	Percent EPT (EPT Index)	Percent of Oligochaeta and Chironomidae	Total Richness (Family-level)	EPT Richness (Family-level)	Simpson's Diversity Index
Units					%	%	%	-	-	-
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2013	impact	STL3KM-OS-REP5	5.67	8.25	80.93	10	3	0.37
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2014	impact	STL3KM-OS-REP1	0.00	0.00	42.86	3	0	0.53
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2014	impact	STL3KM-OS-REP2	9.33	10.67	68.00	6	2	0.51
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2014	impact	STL3KM-OS-REP3	6.06	7.07	55.56	5	2	0.57
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2014	impact	STL3KM-OS-REP4	1.61	2.15	34.95	7	2	0.52
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2014	impact	STL3KM-OS-REP5	2.50	5.83	29.17	6	2	0.51
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2015	impact	STL-3KM-OS-R1	0.00	27.27	54.55	3	0	0.60
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2015	impact	STL-3KM-OS-R2	0.00	4.17	83.33	5	0	0.30
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2015	impact	STL-3KM-OS-R3	0.00	66.67	0.00	2	0	0.45
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2015	impact	STL-3KM-OS-R4	0.00	20.00	80.00	2	0	0.32
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2015	impact	STL-3KM-OS-R5	0.00	0.00	95.24	2	0	0.09
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2013	impact	STL11KM-OS-REP1	82.21	82.21	7.91	6	1	0.31
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2013	impact	STL11KM-OS-REP2	81.71	81.71	11.28	6	1	0.32

Waterbody/ Site Location	Habitat Type	Study Year	Site Type	Site ID	Percent Ephemeroptera	Percent EPT (EPT Index)	Percent of Oligochaeta and Chironomidae	Total Richness (Family-level)	EPT Richness (Family-level)	Simpson's Diversity Index
Units					%	%	%	-	-	-
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2013	impact	STL11KM-OS-REP3	81.93	81.93	14.95	6	1	0.31
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2013	impact	STL11KM-OS-REP4	87.40	87.40	9.06	6	2	0.24
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2013	impact	STL11KM-OS-REP5	0.00	0.00	0.00	0	0	-
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2014	impact	STL11KM-OS-REP1	73.03	74.16	5.62	6	2	0.44
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2014	impact	STL11KM-OS-REP2	68.25	68.25	11.11	6	1	0.49
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2014	impact	STL11KM-OS-REP3	64.89	64.89	12.21	5	1	0.52
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2014	impact	STL11KM-OS-REP4	91.14	91.14	2.53	3	1	0.16
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2014	impact	STL11KM-OS-REP5	78.02	78.02	13.19	5	1	0.37
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2015	impact	STL-11KM-OS-R1	35.59	35.59	16.95	6	1	0.64
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2015	impact	STL-11KM-OS-R2	44.16	44.16	9.09	4	1	0.60
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2015	impact	STL-11KM-OS-R3	46.94	46.94	22.45	3	1	0.64
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2015	impact	STL-11KM-OS-R4	69.35	69.35	16.13	4	1	0.48
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2015	impact	STL-11KM-OS-R5	57.69	57.69	26.92	4	1	0.58

Waterbody/ Site Location	Habitat Type	Study Year	Site Type	Site ID	Percent Ephemeroptera	Percent EPT (EPT Index)	Percent of Oligochaeta and Chironomidae	Total Richness (Family-level)	EPT Richness (Family-level)	Simpson's Diversity Index
Units					%	%	%	-	-	-
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2014	impact	STL25KM-OS-REP1	33.84	33.84	8.59	5	1	0.56
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2014	impact	STL25KM-OS-REP2	27.44	27.44	7.44	5	1	0.50
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2014	impact	STL25KM-OS-REP3	28.13	28.13	8.48	5	1	0.52
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2014	impact	STL25KM-OS-REP4	34.46	34.46	8.11	3	1	0.55
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2014	impact	STL25KM-OS-REP5	27.59	27.59	10.92	3	1	0.53
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2015	impact	STL-S-OS-R1	10.92	10.92	5.46	4	1	0.29
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2015	impact	STL-S-OS-R2	7.65	7.65	10.59	3	1	0.31
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2015	impact	STL-S-OS-R3	5.49	5.49	12.24	4	1	0.31
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2015	impact	STL-S-OS-R4	26.44	27.59	16.09	4	1	0.59
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2015	impact	STL-S-OS-R5	13.77	14.37	16.17	5	1	0.48

Waterbody/ Site Location	Habitat Type	Study Year	Site Type	Site ID	Total Organic Carbon	Sand	Silt	Clay
Units					%	%	%	%
Split Lake	NRSH-PW	2014	reference	SPLIT-PW-REP1	3.97	25.9	49.1	25.0
Split Lake	NRSH-PW	2014	reference	SPLIT-PW-REP2	1.51	55.0	30.0	15.0
Split Lake	NRSH-PW	2014	reference	SPLIT-PW-REP3	2.21	40.6	40.0	19.4
Split Lake	NRSH-PW	2014	reference	SPLIT-PW-REP4	1.65	33.6	47.3	19.1
Split Lake	NRSH-PW	2014	reference	SPLIT-PW-REP5	1.51	41.4	40.2	18.4
Split Lake	NRSH-PW	2015	reference	SPLIT-PW-R1	2.67	24.5	53.0	22.5
Split Lake	NRSH-PW	2015	reference	SPLIT-PW-R2	3.26	29.3	46.6	24.0
Split Lake	NRSH-PW	2015	reference	SPLIT-PW-R3	2.78	29.6	57.6	12.8
Split Lake	NRSH-PW	2015	reference	SPLIT-PW-R4	1.67	41.8	41.8	16.4
Split Lake	NRSH-PW	2015	reference	SPLIT-PW-R5	2.17	58.2	29.8	12.0
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL3KM-PW-REP1	1.48	12.6	42.8	44.6
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL3KM-PW-REP2	1.13	11.4	42.8	45.8
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL3KM-PW-REP3	1.14	9.4	38.2	52.4
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL3KM-PW-REP4	1.25	10.2	40.7	49.1
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL3KM-PW-REP5	1.41	12.5	42.8	44.7
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL3KM-PW-REP1	1.96	3.5	61.2	35.3
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL3KM-PW-REP2	1.67	11.8	50.8	37.3
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL3KM-PW-REP3	3.13	7.8	43.5	48.6
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL3KM-PW-REP4	2.84	9.6	52.2	38.2
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL3KM-PW-REP5	2.28	18.2	42.1	39.7
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-3KM-PW-R1	6.83	7.4	48.7	43.9
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-3KM-PW-R2	0.89	30.6	20.3	49.1
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-3KM-PW-R3	1.16	21.6	40.4	38.0
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-3KM-PW-R4	4.89	12.2	51.1	36.8
Stephens Lake 3 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-3KM-PW-R5	1.36	8.7	33.0	58.3

Waterbody/ Site Location	Habitat Type	Study Year	Site Type	Site ID	Total Organic Carbon	Sand	Silt	Clay
Units					%	%	%	%
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL11KM-PW-REP1	1.97	4.0	71.0	25.0
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL11KM-PW-REP2	0.49	75.7	16.5	7.8
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL11KM-PW-REP3	1.57	54.6	33.5	11.9
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL11KM-PW-REP4	1.68	49.6	40.3	10.1
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2013	impact	STL11KM-PW-REP5	3.61	10.3	71.6	18.1
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL11KM-PW-REP1	2.47	35.7	51.0	13.3
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL11KM-PW-REP2	1.26	52.9	34.9	12.2
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL11KM-PW-REP3	1.59	54.6	35.2	10.2
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL11KM-PW-REP4	1.64	55.5	36.1	8.4
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL11KM-PW-REP5	5.60	10.6	51.4	37.9
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-11KM-PW-R1	2.35	1.2	83.1	15.7
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-11KM-PW-R2	1.04	65.0	26.5	8.5
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-11KM-PW-R3	3.78	3.8	87.7	8.5
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-11KM-PW-R4	3.16	18.8	70.3	10.9
Stephens Lake 11 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-11KM-PW-R5	2.87	40.8	42.7	16.5
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL25KM-PW-REP1	0.36	54.0	18.8	27.2
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL25KM-PW-REP2	2.52	74.1	17.7	8.3
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL25KM-PW-REP3	0.35	90.4	5.4	4.2
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL25KM-PW-REP4	2.15	65.7	27.4	6.9
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2014	impact	STL25KM-PW-REP5	0.40	90.1	4.7	5.2

Waterbody/ Site Location	Habitat Type	Study Year	Site Type	Site ID	Total Organic Carbon	Sand	Silt	Clay
Units					%	%	%	%
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-25KM-PW-R1	0.74	16.0	25.1	58.9
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-25KM-PW-R2	0.90	78.2	15.4	6.4
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-25KM-PW-R3	0.24	87.4	9.7	2.9
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-25KM-PW-R4	1.80	72.0	19.5	8.5
Stephens Lake 25 km downstream of Gull Rapids	NRSH-PW	2015	impact	STL-25KM-PW-R5	0.53	88.6	7.7	3.7
Split Lake	OFFSH	2013	reference	SPLIT-OS-REP1	1.08	17.8	66.0	16.2
Split Lake	OFFSH	2013	reference	SPLIT-OS-REP2	1.15	17.6	79.7	2.7
Split Lake	OFFSH	2013	reference	SPLIT-OS-REP3	1.04	19.0	50.5	30.4
Split Lake	OFFSH	2013	reference	SPLIT-OS-REP4	1.01	19.5	55.2	25.3
Split Lake	OFFSH	2013	reference	SPLIT-OS-REP5	1.05	19.0	55.6	25.4
Split Lake	OFFSH	2014	reference	SPLIT-OS-REP1	1.34	19.5	50.0	30.5
Split Lake	OFFSH	2014	reference	SPLIT-OS-REP2	1.31	14.8	56.6	28.6
Split Lake	OFFSH	2014	reference	SPLIT-OS-REP3	1.32	17.7	53.5	28.8
Split Lake	OFFSH	2014	reference	SPLIT-OS-REP4	1.10	24.2	54.8	20.9
Split Lake	OFFSH	2014	reference	SPLIT-OS-REP5	1.33	16.4	52.2	31.4
Split Lake	OFFSH	2015	reference	SPLIT-OS-R1	1.53	11.9	77.7	10.3
Split Lake	OFFSH	2015	reference	SPLIT-OS-R2	1.31	18.8	58.7	22.5
Split Lake	OFFSH	2015	reference	SPLIT-OS-R3	1.08	22.1	59.0	18.8
Split Lake	OFFSH	2015	reference	SPLIT-OS-R4	1.24	12.9	62.4	24.7
Split Lake	OFFSH	2015	reference	SPLIT-OS-R5	1.24	15.2	71.3	13.5
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2013	impact	STL3KM-OS-REP1	1.16	1.1	45.3	53.7
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2013	impact	STL3KM-OS-REP2	0.75	2.1	40.2	57.6
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2013	impact	STL3KM-OS-REP3	1.59	3.5	21.5	75.0
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2013	impact	STL3KM-OS-REP4	1.16	1.7	52.3	46.1
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2013	impact	STL3KM-OS-REP5	0.93	1.9	26.7	71.4
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2014	impact	STL3KM-OS-REP1	1.67	14.8	46.8	38.5
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2014	impact	STL3KM-OS-REP2	2.43	9.6	51.8	38.6

Waterbody/ Site Location	Habitat Type	Study Year	Site Type	Site ID	Total Organic Carbon	Sand	Silt	Clay
Units					%	%	%	%
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2014	impact	STL3KM-OS-REP3	0.77	45.2	30.6	24.2
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2014	impact	STL3KM-OS-REP4	0.96	2.2	61.3	36.5
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2014	impact	STL3KM-OS-REP5	1.51	4.1	59.9	36.0
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2015	impact	STL-3KM-OS-R1	3.75	0.5	64.6	34.9
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2015	impact	STL-3KM-OS-R2	4.98	3.5	65.6	30.8
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2015	impact	STL-3KM-OS-R3	2.23	8.8	48.8	42.4
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2015	impact	STL-3KM-OS-R4	0.27	0.8	49.5	49.7
Stephens Lake 3 km downstream of Gull Rapids	OFFSH	2015	impact	STL-3KM-OS-R5	0.59	4.3	27.2	68.6
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2013	impact	STL11KM-OS-REP1	1.11	0.5	73.7	25.8
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2013	impact	STL11KM-OS-REP2	1.36	0.5	75.7	23.7
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2013	impact	STL11KM-OS-REP3	1.23	0.6	75.1	24.3
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2013	impact	STL11KM-OS-REP4	1.20	0.5	69.8	29.7
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2013	impact	STL11KM-OS-REP5	1.30	0.3	68.1	31.7
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2014	impact	STL11KM-OS-REP1	1.48	0.5	67.4	32.1
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2014	impact	STL11KM-OS-REP2	5.71	0.1	59.9	40.0
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2014	impact	STL11KM-OS-REP3	1.30	0.4	67.3	32.3
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2014	impact	STL11KM-OS-REP4	1.28	0.3	68.6	31.2
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2014	impact	STL11KM-OS-REP5	1.27	0.2	68.2	31.6
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2015	impact	STL-11KM-OS-R1	1.38	1.4	97.5	1.1
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2015	impact	STL-11KM-OS-R2	1.22	0.9	89.5	9.7

Waterbody/ Site Location	Habitat Type	Study Year	Site Type	Site ID	Total Organic Carbon	Sand	Silt	Clay
Units					%	%	%	%
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2015	impact	STL-11KM-OS-R3	1.40	1.0	98.5	0.5
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2015	impact	STL-11KM-OS-R4	1.19	0.6	84.8	14.6
Stephens Lake 11 km downstream of Gull Rapids	OFFSH	2015	impact	STL-11KM-OS-R5	1.19	0.6	77.1	22.2
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2014	impact	STL25KM-OS-REP1	1.88	0.1	76.7	23.1
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2014	impact	STL25KM-OS-REP2	1.93	0.2	76.6	23.2
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2014	impact	STL25KM-OS-REP3	2.23	0.3	71.5	28.2
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2014	impact	STL25KM-OS-REP4	2.01	0.1	66.2	33.6
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2014	impact	STL25KM-OS-REP5	2.09	0.1	72.3	27.6
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2015	impact	STL-S-OS-R1	2.04	0.3	89.1	10.6
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2015	impact	STL-S-OS-R2	2.09	0.4	94.3	5.4
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2015	impact	STL-S-OS-R3	2.22	0.2	85.2	14.6
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2015	impact	STL-S-OS-R4	2.11	0.3	85.9	13.9
Stephens Lake 25 km downstream of Gull Rapids	OFFSH	2015	impact	STL-S-OS-R5	2.00	0.4	82.3	17.3

APPENDIX 3:
SUMMARY STATISTICS FOR ADDITIONAL METRICS BY HABITAT TYPE FOR 2013 (PRE-CONSTRUCTION), 2014 (YEAR 1 CONSTRUCTION), AND 2015 (YEAR 2 CONSTRUCTION)

Nearshore Habitat

Site	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric						**Water Depth (m)**				
n	5	5	5	5	5	5	5	5	5	5
Mean	2.60	1.07	2.79	2.81	2.30	2.41	2.18	2.10	2.55	1.56
Minimum	2.40	0.93	2.50	2.23	1.37	2.14	1.47	1.13	1.90	1.03
Maximum	2.90	1.17	3.08	3.07	2.80	3.00	3.43	3.50	3.20	2.40
Median	2.60	1.10	2.82	3.03	2.40	2.18	2.00	1.83	2.50	1.27
Standard deviation (n-1)	0.19	0.09	0.25	0.36	0.58	0.37	0.74	0.87	0.51	0.62
Standard error of the mean	0.08	0.04	0.11	0.16	0.26	0.17	0.33	0.39	0.23	0.28
COV (%)	7.20	8.27	9.11	12.69	25.06	15.36	34.12	41.56	19.91	39.73
+50% Mean	3.90	1.60	4.18	4.22	3.45	3.62	3.27	3.15	3.82	2.34
-50% Mean	1.30	0.53	1.39	1.41	1.15	1.21	1.09	1.05	1.27	0.78
Benchmark Exceedance (temporal comparison)	-	Yes	-	No	No (both)	-	No	No (both)	-	No
Significant Inter-annual Difference	N/A	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Nearshore Habitat

Site	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**Oligochaeta Density (no. per m^2)**									
n	5	5	5	5	5	5	5	5	5	5
Mean	40.40	311.63	79.64	106.76	31.74	145.43	75.02	40.40	277.01	248.15
Minimum	0.00	28.86	17.31	0.00	0.00	77.91	0.00	0.00	14.43	43.28
Maximum	144.28	1038.78	164.47	230.84	100.99	311.63	144.28	115.42	476.11	375.12
Median	14.43	158.70	34.63	100.99	14.43	129.85	57.71	28.86	245.27	346.26
Standard deviation (n-1)	58.96	419.71	73.81	87.52	40.03	96.47	56.25	44.93	194.74	151.11
Standard error of the mean	26.37	187.70	33.01	39.14	17.90	43.14	25.16	20.10	87.09	67.58
COV (%)	145.95	134.68	92.68	81.98	126.13	66.34	74.98	111.23	70.30	60.89
+50% Mean	60.60	467.45	119.46	160.15	47.61	218.14	112.53	60.60	415.51	372.23
-50% Mean	20.20	155.82	39.82	53.38	15.87	72.71	37.51	20.20	138.50	124.08
Benchmark Exceedance (temporal comparison)	-	Yes	-	No	Yes (both)	-	No	Yes (2013)	-	No
Significant Inter-annual Difference	N/A	Yes	N/A	N/A	No (both)	N/A	N/A	No	N/A	N/A

Nearshore Habitat – continued

Site	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**Amphipoda Density (no. per m^2)**									
n	5	5	5	5	5	5	5	5	5	5
Mean	23.08	20.20	1.73	2.89	2.89	1.73	5.77	17.31	11.54	8.66
Minimum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maximum	115.42	86.57	8.66	14.43	14.43	8.66	28.86	86.57	43.28	28.86
Median	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Standard deviation (n-1)	51.62	37.62	3.87	6.45	6.45	3.87	12.90	38.71	18.81	12.90
Standard error of the mean	23.08	16.83	1.73	2.89	2.89	1.73	5.77	17.31	8.41	5.77
COV (%)	223.61	186.26	223.61	223.61	223.61	223.61	223.61	223.61	162.98	149.07
+50% Mean	34.63	30.30	2.60	4.33	4.33	2.60	8.66	25.97	17.31	12.98
-50% Mean	11.54	10.10	0.87	1.44	1.44	0.87	2.89	8.66	5.77	4.33
Benchmark Exceedance (temporal comparison)	-	No	-	Yes	Yes (2013)	-	Yes	Yes (both)	-	No
Significant Inter-annual Difference	N/A	N/A	N/A	No	No	N/A	No	No (both)	N/A	N/A

Nearshore Habitat – continued

Site	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**Gastropoda Density (no. per m^2)**									
n	5	5	5	5	5	5	5	5	5	5
Mean	89.45	173.13	562.67	167.36	69.25	493.42	455.91	167.36	1128.23	1335.99
Minimum	14.43	28.86	216.41	43.28	0.00	285.66	43.28	86.57	158.70	259.70
Maximum	201.99	389.54	882.96	288.55	245.27	649.24	807.94	274.12	2539.24	3347.18
Median	57.71	115.42	510.73	187.56	14.43	476.11	432.83	144.28	1038.78	1067.64
Standard deviation (n-1)	80.59	159.03	303.16	101.30	102.22	154.49	283.57	76.75	883.35	1239.66
Standard error of the mean	36.04	71.12	135.58	45.30	45.71	69.09	126.81	34.32	395.05	554.39
COV (%)	90.09	91.86	53.88	60.53	147.61	31.31	62.20	45.86	78.29	92.79
+50% Mean	134.18	259.70	844.01	251.04	103.88	740.13	683.86	251.04	1692.35	2003.98
-50% Mean	44.73	86.57	281.34	83.68	34.63	246.71	227.95	83.68	564.12	667.99
Benchmark Exceedance (temporal comparison)	-	Yes	-	Yes	Yes (both)	-	No	Yes (both)	-	No
Significant Inter-annual Difference	N/A	No	N/A	No	Yes (2013)	N/A	N/A	No (both)	N/A	N/A

Nearshore Habitat – continued

Site	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**Chironomidae Density (no. per m^2)**									
n	5	5	5	5	5	5	5	5	5	5
Mean	239.50	1682.25	316.83	643.47	986.84	282.20	334.72	484.76	239.50	854.11
Minimum	144.28	360.69	190.44	245.27	115.42	147.16	57.71	86.57	0.00	72.14
Maximum	389.54	4385.96	398.20	1183.06	2885.50	718.49	605.96	1038.78	504.96	2394.97
Median	230.84	1240.77	389.54	490.54	793.51	173.13	216.41	432.83	100.99	533.82
Standard deviation (n-1)	99.23	1580.94	107.70	368.62	1122.69	245.96	254.72	349.49	239.38	900.62
Standard error of the mean	44.37	707.02	48.17	164.85	502.08	110.00	113.91	156.30	107.06	402.77
COV (%)	41.43	93.98	33.99	57.29	113.77	87.16	76.10	72.10	99.95	105.45
+50% Mean	359.25	2523.37	475.24	965.20	1480.26	423.30	502.08	727.15	359.25	1281.16
-50% Mean	119.75	841.12	158.41	321.73	493.42	141.10	167.36	242.38	119.75	427.05
Benchmark Exceedance (temporal comparison)	-	Yes	-	Yes	Yes (both)	-	No	Yes (2013)	-	Yes
Significant Inter-annual Difference	N/A	Yes	N/A	No	No (both)	N/A	N/A	No	N/A	No

Nearshore Habitat – continued

Site	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**Plecoptera Density (no. per m^2)**									
n	5	5	5	5	5	5	5	5	5	5
Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Minimum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maximum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Median	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Standard deviation (n-1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Standard error of the mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
COV (%)	-	-	-	-	-	-	-	-	-	-
+50% Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
-50% Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Benchmark Exceedance (temporal comparison)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Significant Inter-annual Difference	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Nearshore Habitat – continued

Site	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**Trichoptera Density (no. per m^2)**									
n	5	5	5	5	5	5	5	5	5	5
Mean	8.66	31.74	19.04	25.97	2.89	15.58	8.66	2.89	11.54	8.66
Minimum	0.00	14.43	0.00	0.00	0.00	8.66	0.00	0.00	0.00	0.00
Maximum	14.43	57.71	43.28	86.57	14.43	34.63	28.86	14.43	43.28	28.86
Median	14.43	28.86	17.31	14.43	0.00	8.66	0.00	0.00	0.00	0.00
Standard deviation (n-1)	7.90	18.81	16.65	34.45	6.45	11.29	12.90	6.45	18.81	12.90
Standard error of the mean	3.53	8.41	7.45	15.40	2.89	5.05	5.77	2.89	8.41	5.77
COV (%)	91.29	59.27	87.43	132.64	223.61	72.44	149.07	223.61	162.98	149.07
+50% Mean	12.98	47.61	28.57	38.95	4.33	23.37	12.98	4.33	17.31	12.98
-50% Mean	4.33	15.87	9.52	12.98	1.44	7.79	4.33	1.44	5.77	4.33
Benchmark Exceedance (temporal comparison)	-	Yes	-	No	Yes (both)	-	No	Yes (both)	-	No
Significant Inter-annual Difference	N/A	No	N/A	N/A	No (both)	N/A	N/A	No (both)	N/A	N/A

Nearshore Habitat – continued

Site	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**EPT Density (no. per m^2)**									
n	5	5	5	5	5	5	5	5	5	5
Mean	201.99	464.57	83.10	522.28	14.43	1959.83	727.15	435.71	357.80	1206.14
Minimum	158.70	245.27	51.94	57.71	0.00	805.06	230.84	259.70	201.99	432.83
Maximum	245.27	952.22	112.53	937.79	43.28	3038.43	1226.34	591.53	649.24	1615.88
Median	201.99	375.12	95.22	649.24	0.00	2337.26	822.37	461.68	274.12	1500.46
Standard deviation (n-1)	36.78	282.98	29.10	370.85	20.40	913.45	406.10	128.80	182.04	505.33
Standard error of the mean	16.45	126.55	13.01	165.85	9.12	408.51	181.61	57.60	81.41	225.99
COV (%)	18.21	60.91	35.02	71.01	141.42	46.61	55.85	29.56	50.88	41.90
+50% Mean	302.98	696.85	124.65	783.41	21.64	2939.75	1090.72	653.57	536.70	1809.21
-50% Mean	100.99	232.28	41.55	261.14	7.21	979.92	363.57	217.86	178.90	603.07
Benchmark Exceedance (temporal comparison)	-	Yes	-	Yes	Yes (both)	-	Yes	Yes (2013)	-	Yes
Significant Inter-annual Difference	N/A	Yes	N/A	No	Yes (2014)	N/A	No	Yes	N/A	Yes

Nearshore Habitat – continued

Site	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**Ratio of EPT to Chironomidae**									
n	5	5	5	5	5	5	5	5	5	5
Mean	0.96	0.41	0.28	0.77	0.01	8.44	5.25	1.82	42.45	2.70
Minimum	0.41	0.15	0.13	0.24	0.00	4.23	0.38	0.25	0.54	0.64
Maximum	1.40	0.84	0.46	1.41	0.05	13.50	14.25	5.33	201.99	6.00
Median	1.06	0.36	0.27	0.63	0.00	8.41	4.40	1.37	2.43	2.06
Standard deviation (n-1)	0.37	0.27	0.12	0.48	0.02	3.77	5.66	2.03	89.22	2.00
Standard error of the mean	0.16	0.12	0.05	0.22	0.01	1.68	2.53	0.91	39.90	0.90
COV (%)	38.27	66.71	41.16	63.17	177.55	44.63	107.85	111.26	210.18	74.12
+50% Mean	1.44	0.61	0.42	1.15	0.02	12.66	7.87	2.73	63.67	4.05
-50% Mean	0.48	0.20	0.14	0.38	0.01	4.22	2.62	0.91	21.22	1.35
Benchmark Exceedance (temporal comparison)	-	Yes	-	Yes	Yes (both)	-	No	Yes (both)	-	Yes
Significant Inter-annual Difference	N/A	Yes	N/A	No	Yes (2014)	N/A	N/A	No (both)	N/A	No

Nearshore Habitat – continued

Site	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**Percent Ephemeroptera**									
n	5	5	5	5	5	5	5	5	5	5
Mean	29.60	16.63	5.63	29.67	0.71	61.58	39.17	35.43	19.15	32.06
Minimum	22.00	8.70	2.53	12.12	0.00	50.28	14.71	14.40	5.54	17.61
Maximum	46.43	22.08	9.52	41.90	3.06	70.82	53.77	46.07	49.45	46.82
Median	26.79	19.48	5.48	29.11	0.00	63.43	49.13	45.71	14.81	29.73
Standard deviation (n-1)	9.71	6.26	2.72	11.87	1.33	9.69	17.62	14.84	17.58	10.69
Standard error of the mean	4.34	2.80	1.22	5.31	0.60	4.33	7.88	6.64	7.86	4.78
COV (%)	32.80	37.66	48.32	40.03	188.12	15.73	44.98	41.88	91.81	33.33
+50% Mean	44.40	24.94	8.44	44.50	1.06	92.37	58.75	53.14	28.72	48.08
-50% Mean	14.80	8.31	2.81	14.83	0.35	30.79	19.58	17.71	9.57	16.03
Benchmark Exceedance (temporal comparison)	-	No	-	Yes	Yes (both)	-	No	No (both)	-	Yes
Significant Inter-annual Difference	N/A	N/A	N/A	No	Yes (2014)	N/A	N/A	N/A	N/A	No

Nearshore Habitat – continued

Site	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**Percent of Oligochaeta + Chironomidae**									
n	5	5	5	5	5	5	5	5	5	5
Mean	41.13	61.86	33.15	53.67	84.94	13.64	25.67	36.36	19.89	22.57
Minimum	30.00	52.17	25.32	40.00	62.50	7.61	7.55	8.57	1.23	7.92
Maximum	54.00	70.19	44.52	63.64	98.21	20.00	52.53	64.00	36.22	31.56
Median	39.29	62.99	30.95	56.33	93.33	14.35	14.96	37.00	21.98	27.15
Standard deviation (n-1)	9.39	6.88	7.74	10.58	15.70	4.50	19.92	19.61	13.38	9.49
Standard error of the mean	4.20	3.08	3.46	4.73	7.02	2.01	8.91	8.77	5.98	4.24
COV (%)	22.84	11.12	23.34	19.72	18.48	32.95	77.62	53.94	67.29	42.03
+50% Mean	61.70	92.79	49.73	80.50	127.41	20.47	38.50	54.54	29.83	33.85
-50% Mean	20.57	30.93	16.58	26.83	42.47	6.82	12.83	18.18	9.94	11.28
Benchmark Exceedance (temporal comparison)	-	Yes	-	Yes	Yes (both)	-	Yes	Yes (2013)	-	No
Significant Inter-annual Difference	N/A	Yes	N/A	No	Yes (both)	N/A	No	No	N/A	N/A

Nearshore Habitat – continued

Site	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**EPT Richness (Family level)**									
n	5	5	5	5	5	5	5	5	5	5
Mean	1.60	1.60	2.40	2.20	0.60	3.00	1.80	1.00	2.00	1.40
Minimum	1.00	1.00	1.00	1.00	0.00	2.00	1.00	1.00	1.00	1.00
Maximum	2.00	2.00	3.00	4.00	2.00	5.00	3.00	1.00	4.00	2.00
Median	2.00	2.00	3.00	2.00	0.00	3.00	2.00	1.00	2.00	1.00
Standard deviation (n-1)	0.55	0.55	0.89	1.10	0.89	1.22	0.84	0.00	1.22	0.55
Standard error of the mean	0.24	0.24	0.40	0.49	0.40	0.55	0.37	0.00	0.55	0.24
COV (%)	34.23	34.23	37.27	49.79	149.07	40.82	46.48	0.00	61.24	39.12
+50% Mean	2.40	2.40	3.60	3.30	0.90	4.50	2.70	1.50	3.00	2.10
-50% Mean	0.80	0.80	1.20	1.10	0.30	1.50	0.90	0.50	1.00	0.70
Benchmark Exceedance (temporal comparison)	-	No	-	No	Yes (both)	-	No	Yes (2013)	-	No
Significant Inter-annual Difference	N/A	N/A	N/A	N/A	Yes (2013)	N/A	N/A	Yes	N/A	N/A

Offshore Habitat

Site	SPLIT-2013	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric						**Water Depth (m)**					
n	5	5	5	5	5	5	5	5	5	5	5
Mean	7.42	7.82	5.91	6.14	6.02	5.31	6.95	6.84	6.33	9.13	8.84
Minimum	6.30	6.80	5.40	5.98	5.10	4.90	6.58	6.40	5.90	8.63	8.47
Maximum	9.10	9.30	6.47	6.30	6.47	5.73	7.28	7.57	6.77	9.53	9.33
Median	7.00	7.20	5.90	6.16	6.13	5.33	7.06	6.83	6.33	9.17	8.87
Standard deviation (n-1)	1.23	1.19	0.41	0.13	0.53	0.30	0.33	0.45	0.35	0.32	0.34
Standard error of the mean	0.55	0.53	0.18	0.06	0.24	0.13	0.15	0.20	0.16	0.14	0.15
COV (%)	16.60	15.17	6.90	2.12	8.88	5.62	4.71	6.61	5.49	3.54	3.90
+50% Mean	11.13	11.73	8.86	9.21	9.03	7.97	10.42	10.26	9.50	13.69	13.26
-50% Mean	3.71	3.91	2.95	3.07	3.01	2.66	3.47	3.42	3.17	4.56	4.42
Benchmark Exceedance (temporal comparison)	-	No	No (both)	-	No	No (both)	-	No	No (both)	-	No
Significant Inter-annual Difference	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Offshore Habitat – continued

Site	SPLIT-2013	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**Oligochaeta Density (no. per m^2)**										
n	5	5	5	5	5	5	5	5	5	5	5
Mean	25.97	28.86	17.31	12.12	8.66	0.00	13.85	5.77	0.00	11.54	2.89
Minimum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maximum	57.71	57.71	28.86	34.63	28.86	0.00	34.63	14.43	0.00	43.28	14.43
Median	28.86	28.86	14.43	8.66	0.00	0.00	8.66	0.00	0.00	0.00	0.00
Standard deviation (n-1)	21.40	20.40	12.07	14.49	12.90	0.00	15.73	7.90	0.00	18.81	6.45
Standard error of the mean	9.57	9.12	5.40	6.48	5.77	0.00	7.03	3.53	0.00	8.41	2.89
COV (%)	82.40	70.71	69.72	119.52	149.07	-	113.54	136.93	-	162.98	223.61
+50% Mean	38.95	43.28	25.97	18.18	12.98	0.00	20.78	8.66	0.00	17.31	4.33
-50% Mean	12.98	14.43	8.66	6.06	4.33	0.00	6.93	2.89	0.00	5.77	1.44
Benchmark Exceedance (temporal comparison)	-	No	No (both)	-	No	Yes (both)	-	Yes	Yes (both)	-	Yes
Significant Inter-annual Difference	N/A	N/A	N/A	N/A	N/A	No (both)	N/A	No	No (both)	N/A	No

Offshore Habitat – continued

Site	SPLIT-2013	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**Amphipoda Density (no. per m^2)**										
n	5	5	5	5	5	5	5	5	5	5	5
Mean	1413.90	1584.14	2135.27	1.73	20.20	2.89	79.64	227.95	392.43	1688.02	2011.20
Minimum	894.51	1211.91	1601.45	0.00	0.00	0.00	0.00	72.14	115.42	1226.34	706.95
Maximum	1918.86	2308.40	2683.52	8.66	43.28	14.43	129.85	432.83	764.66	2034.28	2871.08
Median	1543.74	1370.61	2192.98	0.00	14.43	0.00	69.25	201.99	432.83	1615.88	2005.42
Standard deviation (n-1)	493.60	465.99	514.46	3.87	16.45	6.45	53.85	164.94	265.13	342.48	895.53
Standard error of the mean	220.75	208.40	230.07	1.73	7.36	2.89	24.08	73.76	118.57	153.16	400.49
COV (%)	34.91	29.42	24.09	223.61	81.44	223.61	67.62	72.36	67.56	20.29	44.53
+50% Mean	2120.84	2376.21	3202.91	2.60	30.30	4.33	119.46	341.93	588.64	2532.03	3016.79
-50% Mean	706.95	792.07	1067.64	0.87	10.10	1.44	39.82	113.98	196.21	844.01	1005.60
Benchmark Exceedance (temporal comparison)	-	No	Yes (2013)	-	Yes	Yes (both)	-	Yes	Yes (both)	-	No
Significant Inter-annual Difference	N/A	N/A	No	N/A	No	No (both)	N/A	No	Yes (2013)	N/A	N/A

Offshore Habitat – continued

Site	SPLIT-2013	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**Gastropoda Density (no. per m^2)**										
n	5	5	5	5	5	5	5	5	5	5	5
Mean	3921.40	5606.53	92.34	322.02	730.03	8.66	13.85	8.66	5.77	0.00	0.00
Minimum	129.85	3505.89	28.86	121.19	201.99	0.00	0.00	0.00	0.00	0.00	0.00
Maximum	6982.92	6982.92	201.99	744.46	1630.31	28.86	51.94	43.28	28.86	0.00	0.00
Median	4068.56	6232.69	86.57	164.47	490.54	0.00	8.66	0.00	0.00	0.00	0.00
Standard deviation (n-1)	2691.54	1563.89	65.80	265.36	623.61	12.90	21.73	19.36	12.90	0.00	0.00
Standard error of the mean	1203.69	699.39	29.43	118.67	278.89	5.77	9.72	8.66	5.77	0.00	0.00
COV (%)	68.64	27.89	71.26	82.40	85.42	149.07	156.87	223.61	223.61	-	-
+50% Mean	5882.10	8409.80	138.50	483.03	1095.05	12.98	20.78	12.98	8.66	0.00	0.00
-50% Mean	1960.70	2803.27	46.17	161.01	365.02	4.33	6.93	4.33	2.89	0.00	0.00
Benchmark Exceedance (temporal comparison)	-	No	Yes (both)	-	Yes	Yes (both)	-	No	Yes (2013)	-	No
Significant Inter-annual Difference	N/A	N/A	Yes (2014)	N/A	No	Yes (2014)	N/A	N/A	No	N/A	N/A

Offshore Habitat – continued

Site	SPLIT-2013	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**Chironomidae Density (no. per m^2)**										
n	5	5	5	5	5	5	5	5	5	5	5
Mean	317.41	155.82	461.68	657.89	620.38	144.28	193.91	135.62	230.84	227.95	288.55
Minimum	144.28	72.14	245.27	363.57	173.13	0.00	0.00	28.86	100.99	173.13	187.56
Maximum	461.68	230.84	591.53	1324.45	908.93	288.55	389.54	216.41	317.41	274.12	403.97
Median	346.26	158.70	504.96	493.42	721.38	86.57	173.13	173.13	288.55	230.84	259.70
Standard deviation (n-1)	134.18	57.17	140.62	391.56	290.17	135.34	141.00	80.72	100.48	37.34	102.53
Standard error of the mean	60.01	25.57	62.89	175.11	129.77	60.53	63.06	36.10	44.93	16.70	45.85
COV (%)	42.28	36.69	30.46	59.52	46.77	93.81	72.71	59.52	43.53	16.38	35.53
+50% Mean	476.11	233.73	692.52	986.84	930.57	216.41	290.86	203.43	346.26	341.93	432.83
-50% Mean	158.70	77.91	230.84	328.95	310.19	72.14	96.95	67.81	115.42	113.98	144.28
Benchmark Exceedance (temporal comparison)	-	Yes	Yes (2014)	-	No	Yes (both)	-	No	Yes (2014)	-	No
Significant Inter-annual Difference	N/A	No	Yes	N/A	N/A	Yes (2013)	N/A	N/A	No	N/A	N/A

Offshore Habitat – continued

Site	SPLIT-2013	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**Plecoptera Density (no. per m^2)**										
n	5	5	5	5	5	5	5	5	5	5	5
Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Minimum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maximum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Median	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Standard deviation (n-1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Standard error of the mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
COV (%)	-	-	-	-	-	-	-	-	-	-	-
+50% Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
-50% Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Benchmark Exceedance (temporal comparison)	-	No	No (both)	-	No	No (both)	-	No	No (both)	-	No
Significant Inter-annual Difference	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Offshore Habitat – continued

Site	SPLIT-2013	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**Trichoptera Density (no. per m^2)**										
n	5	5	5	5	5	5	5	5	5	5	5
Mean	72.14	46.17	60.60	25.97	20.20	20.20	0.00	2.89	0.00	0.00	5.77
Minimum	57.71	0.00	28.86	8.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maximum	100.99	86.57	100.99	43.28	57.71	43.28	0.00	14.43	0.00	0.00	14.43
Median	57.71	57.71	57.71	25.97	14.43	14.43	0.00	0.00	0.00	0.00	0.00
Standard deviation (n-1)	20.40	32.90	27.75	17.31	21.88	16.45	0.00	6.45	0.00	0.00	7.90
Standard error of the mean	9.12	14.71	12.41	7.74	9.79	7.36	0.00	2.89	0.00	0.00	3.53
COV (%)	28.28	71.26	45.80	66.67	108.33	81.44	-	223.61	-	-	136.93
+50% Mean	108.21	69.25	90.89	38.95	30.30	30.30	0.00	4.33	0.00	0.00	8.66
-50% Mean	36.07	23.08	30.30	12.98	10.10	10.10	0.00	1.44	0.00	0.00	2.89
Benchmark Exceedance (temporal comparison)	-	No	No (both)	-	No	No (both)	-	Yes	Yes (2014)	-	Yes
Significant Inter-annual Difference	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No	No	N/A	Yes

Offshore Habitat – continued

Site	SPLIT-2013	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**EPT Density (no. per m^2)**										
n	5	5	5	5	5	5	5	5	5	5	5
Mean	1353.30	689.64	279.89	90.03	75.02	20.20	1563.37	1096.49	605.96	831.02	288.55
Minimum	432.83	375.12	230.84	17.31	0.00	0.00	0.00	952.22	490.54	692.52	187.56
Maximum	1688.02	1096.49	403.97	138.50	115.42	43.28	2276.66	1240.77	663.67	966.64	375.12
Median	1615.88	591.53	230.84	103.88	100.99	14.43	1817.87	1038.78	620.38	851.22	346.26
Standard deviation (n-1)	531.71	274.20	76.07	46.05	47.19	16.45	894.76	129.45	68.44	115.24	92.94
Standard error of the mean	237.79	122.63	34.02	20.59	21.11	7.36	400.15	57.89	30.61	51.54	41.57
COV (%)	39.29	39.76	27.18	51.15	62.91	81.44	57.23	11.81	11.29	13.87	32.21
+50% Mean	2029.95	1034.45	419.84	135.04	112.53	30.30	2345.05	1644.74	908.93	1246.54	432.83
-50% Mean	676.65	344.82	139.95	45.01	37.51	10.10	781.68	548.25	302.98	415.51	144.28
Benchmark Exceedance (temporal comparison)	-	No	Yes (both)	-	No	Yes (both)	-	No	Yes (2013)	-	Yes
Significant Inter-annual Difference	N/A	N/A	Yes (2013)	N/A	N/A	Yes (2013)	N/A	N/A	Yes	N/A	Yes

Offshore Habitat – continued

Site	SPLIT-2013	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**Ratio of EPT to Chironomidae**										
n	5	5	5	5	5	5	5	5	5	5	5
Mean	4.47	4.94	0.64	0.15	0.11	5.96	8.86	13.48	3.10	3.72	1.16
Minimum	3.00	2.50	0.39	0.05	0.00	0.00	5.84	5.67	2.09	2.53	0.46
Maximum	7.80	8.20	0.94	0.24	0.20	29.00	11.68	36.00	4.86	4.25	2.00
Median	3.50	5.09	0.60	0.11	0.13	0.25	8.95	6.62	2.14	3.94	0.89
Standard deviation (n-1)	1.99	2.45	0.20	0.09	0.08	12.88	2.66	12.97	1.37	0.68	0.66
Standard error of the mean	0.89	1.10	0.09	0.04	0.04	5.76	1.33	5.80	0.61	0.30	0.30
COV (%)	44.46	49.56	31.57	57.53	72.00	216.13	30.08	96.20	44.08	18.28	57.32
+50% Mean	6.71	7.42	0.97	0.22	0.17	8.94	13.29	20.22	4.65	5.58	1.74
-50% Mean	2.24	2.47	0.32	0.07	0.06	2.98	4.43	6.74	1.55	1.86	0.58
Benchmark Exceedance (temporal comparison)	-	No	Yes (both)	-	No	Yes (both)	-	Yes	Yes (both)	-	Yes
Significant Inter-annual Difference	N/A	N/A	Yes (both)	N/A	N/A	No (both)	N/A	No	Yes (both)	N/A	Yes

Offshore Habitat – continued

Site	SPLIT-2013	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric						**Percent Ephemeroptera**					
n	5	5	5	5	5	5	5	5	5	5	5
Mean	18.52	7.61	6.38	6.18	3.90	0.00	66.65	75.07	50.75	30.29	12.85
Minimum	4.53	3.82	3.70	1.05	0.00	0.00	0.00	64.89	35.59	27.44	5.49
Maximum	39.29	13.08	9.16	13.41	9.33	0.00	87.40	91.14	69.35	34.46	26.44
Median	16.85	7.61	5.33	5.67	2.50	0.00	81.93	73.03	46.94	28.13	10.92
Standard deviation (n-1)	12.71	3.79	2.59	4.49	3.76	0.00	37.33	10.26	13.06	3.54	8.22
Standard error of the mean	5.68	1.70	1.16	2.01	1.68	0.00	16.70	4.59	5.84	1.58	3.68
COV (%)	68.60	49.84	40.62	72.66	96.41	-	56.01	13.67	25.73	11.68	63.98
+50% Mean	27.79	11.41	9.57	9.26	5.85	0.00	99.98	112.60	76.12	45.44	19.28
-50% Mean	9.26	3.80	3.19	3.09	1.95	0.00	33.33	37.53	25.37	15.15	6.43
Benchmark Exceedance (temporal comparison)	-	Yes	Yes (2013)	-	No	Yes (both)	-	No	No (both)	-	Yes
Significant Inter-annual Difference	N/A	No	No	N/A	N/A	Yes (2013)	N/A	N/A	N/A	N/A	Yes

Offshore Habitat – continued

Site	SPLIT-2013	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**Percent of Oligochaeta + Chironomidae**										
n	5	5	5	5	5	5	5	5	5	5	5
Mean	4.53	2.08	13.95	59.88	46.11	62.62	8.64	8.93	18.31	8.71	12.11
Minimum	2.09	1.44	8.00	35.40	29.17	0.00	0.00	2.53	9.09	7.44	5.46
Maximum	6.33	3.04	17.79	80.93	68.00	95.24	14.95	13.19	26.92	10.92	16.17
Median	5.30	1.79	14.65	60.98	42.86	80.00	9.06	11.11	16.95	8.48	12.24
Standard deviation (n-1)	1.80	0.68	3.92	20.08	15.74	38.02	5.53	4.63	6.76	1.32	4.44
Standard error of the mean	0.81	0.31	1.75	8.98	7.04	17.00	2.47	2.07	3.02	0.59	1.99
COV (%)	39.75	32.87	28.09	33.54	34.13	60.71	63.98	51.78	36.94	15.11	36.66
+50% Mean	6.79	3.12	20.93	89.82	69.16	93.94	12.96	13.40	27.46	13.06	18.16
-50% Mean	2.26	1.04	6.98	29.94	23.05	31.31	4.32	4.47	9.15	4.35	6.05
Benchmark Exceedance (temporal comparison)	-	Yes	Yes (both)	-	No	No (both)	-	No	Yes (both)	-	No
Significant Inter-annual Difference	N/A	No	Yes (2014)	N/A	N/A	N/A	N/A	N/A	No (both)	N/A	N/A

Offshore Habitat – continued

Site	SPLIT-2013	SPLIT-2014	SPLIT-2015	STL3KM-2013	STL3KM-2014	STL3KM-2015	STL11KM-2013	STL11KM-2014	STL11KM-2015	STL25KM-2014	STL25KM-2015
Metric	**EPT Richness (Family level)**										
n	5	5	5	5	5	5	5	5	5	5	5
Mean	2.20	2.20	1.00	2.60	1.60	0.00	1.00	1.20	1.00	1.00	1.00
Minimum	2.00	1.00	1.00	2.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00
Maximum	3.00	3.00	1.00	3.00	2.00	0.00	2.00	2.00	1.00	1.00	1.00
Median	2.00	2.00	1.00	3.00	2.00	0.00	1.00	1.00	1.00	1.00	1.00
Standard deviation (n-1)	0.45	0.84	0.00	0.55	0.89	0.00	0.71	0.45	0.00	0.00	0.00
Standard error of the mean	0.20	0.37	0.00	0.24	0.40	0.00	0.32	0.20	0.00	0.00	0.00
COV (%)	20.33	38.03	0.00	21.07	55.90	-	70.71	37.27	0.00	0.00	0.00
+50% Mean	3.30	3.30	1.50	3.90	2.40	0.00	1.50	1.80	1.50	1.50	1.50
-50% Mean	1.10	1.10	0.50	1.30	0.80	0.00	0.50	0.60	0.50	0.50	0.50
Benchmark Exceedance (temporal comparison)	-	No	Yes (both)	-	No	Yes (both)	-	No	No (both)	-	No
Significant Inter-annual Difference	N/A	N/A	Yes (both)	N/A	N/A	Yes (2013)	N/A	N/A	N/A	N/A	N/A

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