



Keeyask Generation Project

Zebra Mussel Monitoring Plan

Zebra Mussel Annual Monitoring Report

ZMMP-2018-01



KEEYASK GENERATION PROJECT

ZEBRA MUSSEL MONITORING PLAN

REPORT #ZMMP-2018-01

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SUMMARY

Zebra mussels are an aquatic, invasive species that grow on hard materials in the water, such as rocks and pipes, and can become so prolific they cause major problems for utilities. Although not found in the Keeyask region, they are found on Lake Winnipeg, which is connected to the Nelson River. The *Zebra Mussel Monitoring Plan* (ZMMP) was developed and is being implemented in accordance with the Keeyask *Environment Act* Licence to monitor and manage the impacts of zebra mussels on the Keeyask Project.

A key component of the ZMMP is to ensure that Keeyask employees and visitors are aware of zebra mussels and the provincial regulations for cleaning watercraft, water-related equipment, trailers, and motor vehicles to prevent them from spreading. Zebra mussel education and awareness was promoted in 2017 at Keeyask in the site orientation session and by displaying aquatic invasive species posters in lunch rooms across the Project site.

A hot water decontamination unit was constructed in 2016 to prevent the spread of zebra mussels to or from Keeyask. All incoming and outgoing watercraft and water-related equipment (anchors, nets, paddles, etc.) were inspected for the presence of zebra mussels and decontaminated, if they were leaving the Nelson River Control Zone. In 2017, thirty-four inspections were conducted and nine hot water decontaminations were performed.

During 2017, water samples were collected from the Nelson River at Keeyask and analysed for zebra mussel “veligers” (microscopic mussel larvae) that would potentially indicate zebra mussels are present in the area. Also in 2017, three monitoring sites were established in the Keeyask reservoir and artificial substrates were deployed to track colonization, if any, by zebra mussels. Finally, in-water infrastructure including safety booms, a floating platform, and buoys were visually inspected for zebra mussels upon removal from the Nelson River at the end of the open-water season. No zebra mussels or veligers were detected during the monitoring conducted in 2017.

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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. Construction of the Project began in July 2014.

Although none of the aquatic invertebrate species identified during the environmental assessment of the Project were listed as invasive in accordance with the Invasive Species Council of Manitoba's listing at the time (KHLP 2012), the Project's *Environment Act* Licence #3107 (Clause 18) directed the Keeyask Hydropower Limited Partnership (KHLP) to develop a Zebra Mussel Monitoring Plan to "*monitor and adaptively manage impacts to the Development (Project) associated with zebra mussels and participate with the Government of Manitoba on treatment programs within the Keeyask reservoir.*"

The *Zebra Mussel Monitoring Plan* (ZMMP) was submitted by the KHLP in December 2015 (KHLP 2015) and was subsequently approved by Manitoba Sustainable Development. This report summarizes the results and activities conducted from April 2017 to March 2018 in accordance with the ZMMP.

2.0 ZEBRA MUSSEL MONITORING 2017

The ZMMP methodology is designed to assess zebra mussel presence using four approaches, as follows:

1. Education and awareness;
2. Water-quality sampling;
3. Colonization/Adult sampling;
4. Visual inspections of in-water infrastructure.

The work undertaken to implement each of these approaches is summarized below.

2.1 EDUCATION AND AWARENESS

In 2017, Keeyask's environmental inspectors received training on the requirements of the various aquatic invasive species legislation, as well as provincially approved inspection and decontamination techniques for zebra mussels and other common aquatic invasive species (AIS).

The site orientation session given to all other Keeyask employees, contractors and visitors includes a section on AIS and provides the regulatory requirements for decontaminating watercraft and water-related equipment. Aquatic invasive species information posters are also displayed in Manitoba Hydro and contractor lunch rooms around the construction site to familiarize people about what to look for and how they can follow-up if they find something.

A decontamination unit was constructed at Keeyask in September 2016 to prevent the transfer of zebra mussels from boats and equipment used elsewhere to Gull and Stephens lakes, as well as to prevent the spread of zebra mussels or veligers from the Keeyask site, should they move into the Keeyask region from further upstream. The unit consists of a hot water (≥ 60 °C) sprayer and a drain pad designed to allow wash water to rapidly infiltrate the ground and prevent it from flowing off the pad. The unit meets the Provincial requirements for AIS decontamination.

Watercraft and equipment users were informed that whenever watercraft/equipment are removed from the Nelson River (including Gull Lake and Stephens Lake), general provisions (*i.e.*, clean, drain, dry) should be performed. In addition, when leaving Keeyask, any watercraft or equipment leaving the Nelson River Control Zone needs to be decontaminated prior to departure unless they can 1) provide proof of an exemption permit issued from Manitoba Sustainable Development or 2) the party has access to decontamination facilities and agrees to provide records to Manitoba Hydro after decontamination in accordance with the provincial *Aquatic Invasive Species Regulation*.

2.1.1 RESULTS

From April 2017 to March 2018, all watercraft and water based equipment was inspected for AIS upon arrival and departure from Keeyask. In total, thirty-four inspections were conducted and nine instances of decontamination (Figure 1) were performed on incoming and outgoing watercraft and water-related equipment.



The decontamination water drains down onto a gravel pad designed to allow rapid infiltration into the ground, preventing it from flowing away from the site.

Figure 1: A boat motor being decontaminated by flushing with hot water (≥ 60 °C) on June 10, 2017

2.1.2 NEXT STEPS

AIS inspections and decontamination will continue in 2018. In the summer, signs will be posted at the main gate as well as the upstream and downstream boat launches to notify site users that Keeyask is in the Nelson River Control Zone, and remind personnel to report for inspection/decontamination of watercraft and water-related equipment when entering and leaving Keeyask. The signs will also list Keeyask's standard AIS requirements when launching or removing watercraft/equipment from the Nelson River.

2.2 VELIGER SAMPLING

Zebra mussel veligers (larval mussels) were sampled upstream of the Keeyask GS construction site on September 18, 2017. As shown on (Figure 2), one sample (tow) was collected from three locations within 7 km upstream of the construction site. Although samples have been previously collected within the water quality polygon, different sites were chosen in 2017 to increase the chances of capturing veligers. Sites were chosen in areas that were near a structure suitable for zebra mussel colonization (i.e., ice booms at GUL-01 and acoustic receiver at GUL-02) and subject to heavy use with the potential for zebra mussel introduction (i.e., Gull Lake boat launch; GUL-03).

Samples were collected with a plankton net consisting of a 30 cm diameter ring with bridle; a 1 meter long, 63 micron mesh net; and a removable weighted cod end for sample retrieval. Samples were collected using both the oblique haul (used in areas of high water velocity; boat remains stationary) and horizontal tow (used in areas of low water velocity; boat is driven) methods. The oblique haul method was used at site GUL-01 due to high water velocity. The net was released and lowered until it was sitting 2 m below the water surface. The net was tied to the stern of the boat and left for 5 minutes. Water velocity was lower at sites GUL-02 and GUL-03 and therefore the horizontal tow method was used. The net was released, allowed to sink ~3 m, and tied to the stern of the boat. The boat was driven slowly (travelling approximately 1 m every 3 seconds) for a total of 20 m.

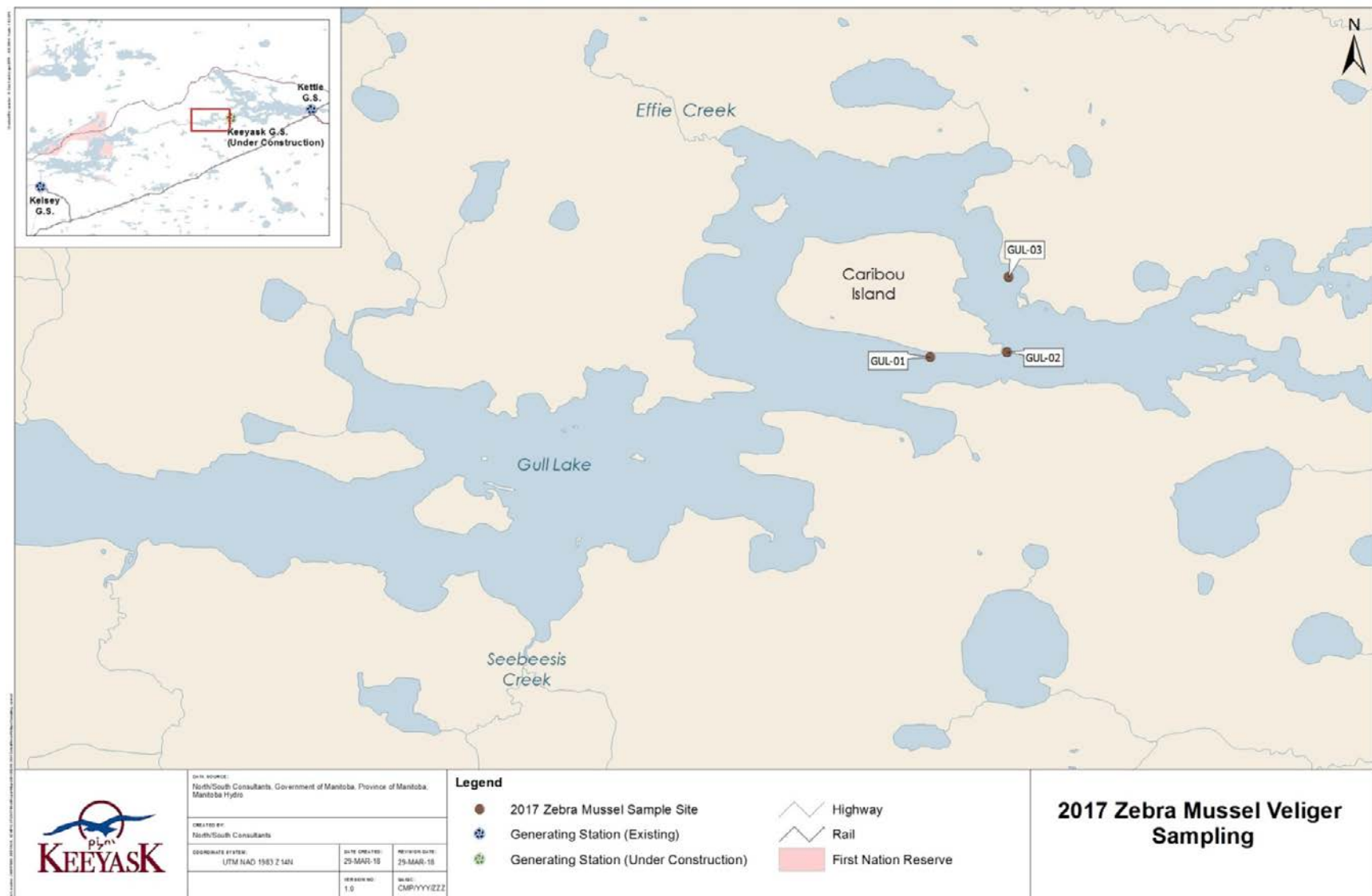


Figure 2: Sampling sites for zebra mussel veliger monitoring in the Keeyask Study Area, September 18, 2017

All sampling information was recorded onto field data sheets that included sample date and time, sample ID, water temperature (°C), location (UTM), Secchi depth (m), water depth (m), water velocity (m/sec), start and end time, and tow distance (m). Site specific data are presented in Table 1.

After retrieval, the entire net was rinsed from the outside to ensure all of the sample material was washed into the cod end. Contents were thoroughly rinsed into a labelled sample jar. Samples were preserved using 70% denatured ethanol (alcohol to sample ratio = 2:1). All samples were stored for transport in a cooler and sent to ALS Laboratories (Winnipeg, MB) for analysis.

2.2.1 RESULTS

No zebra mussel veligers were found in any of the samples collected in September 2017.

2.2.2 NEXT STEPS

Annual sampling for zebra mussel veligers will continue. Sampling will next be conducted in August/September 2018.

Table 1: Site specific data collected at zebra mussel veliger sampling sites upstream of the Keeyask GS construction site during September 2017

Sample ID	Sample Date	Sample Time	Water Temperature (°C)	15V (NAD 83)		Water Velocity (m/s)	Water Depth (m)	Secchi Depth (m)	Sample Method	Duration (min)	Distance (m)
				Easting	Northing						
GUL-01	18-Sep-17	13:35	13	357526	6245924	0.73	7.3	0.5	Oblique	5	N/A
GUL-02	18-Sep-17	13:52	13	358486	6245984	0.42	5.8	0.5	Horizontal	N/A	20
GUL-03	18-Sep-17	14:03	13	358504	6246927	0.17	4.0	0.5	Horizontal	N/A	20

2.3 COLONIZATION/ADULT SAMPLING

Monitoring for adult zebra mussel colonization was done by establishing three sites in the Keeyask reservoir for placement of artificial substrates. Artificial substrates were deployed on June 4, 2017. Sites were located in low-flow areas (0.1-1.0 m/s) with a depth of approximately 4 m (Figure 3) At each site, terra cotta flower pots were used as artificial substrates; they were suspended in series along a rope at 1, 2, and 3 m depths, anchored in place with a cinderblock, and kept suspended in the water column by a buoy at the surface.



Figure 3: Location of sites in the Keeyask reservoir where artificial substrates were deployed to monitor for zebra mussel colonization



Figure 4: Deploying the artificial substrates at the Keeyask reservoir south shore site (ZM3) on June 4, 2017

All three sites were checked monthly during the open-water period for presence/absence of zebra mussels and a photograph was taken of each side of the substrate. If present, adult zebra mussels were to be counted and recorded. Site visits also included visual inspections of adjacent rocks, crevices, woody debris, docks, and vegetation for the presence of zebra mussels. On September 25, 2017, the artificial substrate and anchors (cinderblocks) were removed for the season and were inspected for the presence of zebra mussels and photographed on all sides.

Over the course of the monitoring season, several issues were encountered with the design of the monitoring equipment and anchor system. On July 21, 2017, one of the substrates at ZM1 (Figure 3) was found to be damaged and had to be replaced. On the same day, the monitoring equipment at the south shore site (ZM3) could not be located and new sample substrate was deployed on July 22, 2017. The original substrates that had been lost were recovered at the end of the monitoring season when all of the sites were removed on September 25, 2017. During the

removals on September 25, 2017, the equipment at the north shore site (ZM2) could not be found so end-of-season checks could not be conducted for that site.

2.3.1 RESULTS

During each site visit in 2017 to inspect and/or remove the artificial substrates (Figure 5) (and cinderblock), and inspect of the surrounding, natural substrates, there was no evidence of zebra mussel colonization (adult or juvenile).



Note: There were many aquatic invertebrates on the substrate but no evidence of zebra mussel colonization.

Figure 5: Photo of a monitoring substrate being checked for colonization by zebra mussels at the Keeyask reservoir north shore site (ZM2) on July 21, 2017

2.3.2 NEXT STEPS

Monitoring will take place again in 2018. In order to prevent the loss of apparatus going forward, separate lines will be used to suspend each pot (substrate) in the water column and they will be anchored in such a way that there is no need to remove the cinderblock each time they are

checked. A more robust anchor line will also be used to prevent it from wear and tear and reduce the potential for the substrates to be lost.

2.4 VISUAL INSPECTIONS OF IN-WATER INFRASTRUCTURE

Keeyask site staff undertook visual inspections of in-water infrastructure for signs of zebra mussels. In 2017, this included inspecting:

- a floating wooden platform that is deployed in the Keeyask reservoir in the spring/summer to provide temporary nesting habitat for common terns;
- sections of the seasonal safety boom (Figure 6) that had been removed from the Nelson River for dry storage over the winter; and
- warning buoys (Figure 7) that are deployed downstream of Gull Rapids during the open-water season, but had been removed for the winter.

The underwater portion of the tern nesting platform and warning buoys, as well as all sections of the safety boom that had been in the river, were carefully inspected for the presence of adult mussels or byssal threads (a tuft of hair-like fibers that zebra mussels use to attach to underwater surfaces). The platform, buoys, and safety boom were also inspected for the presence of young zebra mussels by running a hand over the surfaces, as newly settled mussels on smooth surfaces can feel like sandpaper.



Figure 6: Parts of the open-water safety boom that had been removed for winter storage were visually inspected for the presence of adult and juvenile zebra mussels



Figure 7: Warning buoys that are deployed downstream of Gull Rapids during the open-water season were removed for winter storage and were visually inspected for the presence of adult and juvenile zebra mussels

2.4.1 RESULTS

In 2017, no adult or juvenile zebra mussels or evidence of byssal threads were found on any surfaces of the in-water infrastructure.

2.4.2 NEXT STEPS

In-water infrastructure will be inspected again at the end of the open water season in 2018, once it is removed for the season.

3.0 CONCLUSIONS

The Keeyask ZMMP was implemented in 2017 in accordance with the Keeyask *Environment Act* Licence, and included education and awareness activities to mitigate the introduction of zebra mussels at the Keeyask site, as well as to conduct veliger sampling, colonization sampling, and visual inspections of in-water infrastructure as means to locate zebra mussels, if any, at the Keeyask site.

To date, no zebra mussels or veligers have been found at Keeyask. Monitoring will continue in 2018 following the same approach.

4.0 LITERATURE CITED

Keeyask Hydropower Limited Partnership. 2012. Keeyask Generation Project Environmental Impact Statement: Response to EIS Guidelines, Winnipeg, Manitoba. June 2012. 1,200 pp.

Keeyask Hydropower Limited Partnership (KHLP), 2015. Keeyask Generation Project: Zebra Mussel Monitoring Plan. Winnipeg, Manitoba. June 2015.