



Keeyask Generation Project
Terrestrial Effects Monitoring Plan

Colonial Waterbird Habitat Enhancement Monitoring Report
TEMP-2017-07



KEEYASK GENERATION PROJECT

TERRESTRIAL EFFECTS MONITORING PLAN

REPORT #TEMP-2017-07

COLONIAL WATERBIRD HABITAT ENHANCEMENT MONITORING REPORT

Prepared for

Manitoba Hydro

By

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JUNE 2017

This report should be cited as follows:

Wildlife Resource Consulting Services MB Inc. 2017. Keeyask Generation Project Terrestrial Effects Monitoring Plan Report #TEMP-2017-07: Colonial Waterbird Habitat Enhancement Monitoring Report. A report prepared for Manitoba Hydro by Wildlife Resource Consulting Services MB Inc., June 2017.

SUMMARY

Background

Construction of the Keeyask Generation Project (the Project) at Gull Rapids began in July 2014. The Keeyask Hydropower Limited Partnership (KHLP) was required to prepare a plan to monitor the effects of construction and operation of the generating station on the terrestrial environment, including colonial waterbirds. Monitoring results will help the KHLP, government regulators, members of local First Nation communities, and the general public understand how construction and operation of the generating station will affect colonial waterbirds, and whether or not more needs to be done to reduce harmful effects.

The Project has the potential to effect colonial waterbird populations through alteration and loss of habitat, as well as sensory disturbance. Three species of colonial waterbird - ring-billed gull (*Larus delawarensis*), herring gull (*Larus argentatus*), and common tern (*Sterna hirundo*) - commonly breed on rocky islands and reefs in the Nelson River near the Project site. Breeding season surveys conducted in 2001, 2002, 2003, 2006, and 2011 indicate that upwards of 1,500 pairs of ring-billed gulls and 100 pairs of common terns (hereafter referred to as terns) colonise islands in Gull Rapids. Studies in 2013 reported approximately 3,000 pairs of gulls and 50 pairs of terns, while studies in 2014 estimated 6,200 (± 1000) gulls and 23 terns in Gull Rapids. Islands in the Nelson River between Gull Rapids and Birthday Rapids have supported upwards of 1,500 pairs of gulls and 100 pairs of terns.

This report describes the results of colonial waterbird habitat enhancement monitoring conducted during the summer of 2016, the third summer of Project construction. Monitoring for this study occurred at the constructed gull habitat enhancement area and at the tern nesting platforms.

Why is the study being done?

Three species of colonial waterbirds (ring-billed gull, herring gull and common tern) breed near the Project site on the rocky reefs and islands in Gull Rapids. Because active construction for the Project is taking place on some of these traditional nesting islands and reefs, constructed gull and tern nesting habitats have been developed nearby to provide colonial waterbirds with alternate nesting areas, which are not affected by construction activity. This study was focused on whether the newly constructed habitats are successful at attracting nesting colonial waterbirds.

What was done?

Habitat enhancement areas were designed to provide alternate breeding habitat for colonial waterbirds in 2015. The habitat enhancement program continued in 2016, and in early June, these areas were made available to colonial waterbirds for alternate habitat breeding purposes. As described in the Terrestrial Mitigation Implementation Plan developed for the Project, part of

William Smith Island was constructed into a new replacement nesting area for gulls, by clearing trees, providing a rocky substrate, and by placing eight large shipping containers (with rocks placed on top) to provide secure nesting habitat elevated from potential ground predators. Gull decoys and audio equipment that played sounds of breeding gulls were installed to help attract breeding gulls to the area. Cameras were set up on the site to watch for birds, nests, chicks, and predators. In September, the decoys, audio equipment and cameras were removed.

For terns, two floating platforms were deployed in June 2016. Suitability of these wooden platforms for use by terns was enhanced by applying a layer of gravel on the surface on both platforms and pieces of driftwood to one platform. These platforms were towed into the river and anchored in a bay of Gull Lake. Audio equipment that broadcasted sounds of breeding terns was installed to attract breeding terns to the platforms. Tern decoys were present on one of the platforms. Cameras were set up on the platforms to watch for birds, nests, chicks, and predators. In September, the floating platforms, decoys, audio equipment and cameras were removed from Gull Lake.



Habitat Enhancement Area for Gulls on William Smith Island



Floating Platforms for Common Terns in Gull Lake



What was found?

A common tern nest that successfully produced three hatchlings was found on one of the floating platforms. From this nest, one to three young most likely fledged. There was a large increase in overall use, relative to the first year, of the tern platforms. Although only single loafing terns were photographed on the other tern platform on three occasions in June and July, the total use of floating platforms for loafing, feeding young, and possibly for roosting, increased five-fold over 2015 results. The gull habitat enhancement area was not used by gulls in 2016.

What does it mean?

Gull nesting colonies likely did not form at the gull habitat enhancement area because there are still suitable natural islands in the south channel of Gull Rapids, outside of the active construction areas, that remained available for use as nesting habitat. Also, it may take some time for gulls to find and accept the alternate nesting habitat.

The platforms are attractive to terns and are highly likely to be used by nesting terns in future years. The addition of driftwood to the platforms may have assisted in attracting more terns to the platform in 2016 compared to 2015.



Common Tern Chick on Floating Platform on July 6, 2016

What will be done next?

The gull nesting habitat enhancement area will be available for the duration of the Project construction period. The floating platforms will be re-installed in Gull Lake in spring 2017 after ice breakup on the Nelson River. Gull and tern created habitats will continue to be monitored

throughout the construction period to document the use of these areas over time by colonial waterbirds and to ensure that they are not being disturbed.

To provide nesting habitat for displaced gulls and terns within Study Zone 3 during the operation phase of the Project, portions of William Smith Island will be modified and built up to serve as a colonial waterbird nesting area in the future reservoir. In addition, it is predicted in the EIS that some islands could be formed in the future reservoir and become suitable nesting habitat for gulls and terns. In 2016, the gull and tern populations appeared to be well established, widely distributed and plentiful at Gull Rapids and the surrounding region during the early construction period.

STUDY TEAM

We would like to thank Sherrie Mason and Rachel Boone of Manitoba Hydro for reviewing the report. Caroline Walmsley and Megan Anger of Manitoba Hydro, Ben Hofer of Custom Helicopters, and Ron Bretecher of North/South Consultants Inc. are acknowledged for logistical assistance in the field. We would also like to thank Dr. James Ehnes, ECOSTEM Ltd., for cartographic services.

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1.0 INTRODUCTION

Construction of the Keeyask Generation Project (the Project), a 695-megawatt hydroelectric generating station (GS) and associated facilities, began in July 2014. The Project is located at Gull Rapids on the lower Nelson River in northern Manitoba where Gull Lake flows into Stephens Lake, 35 km upstream of the existing Kettle GS.

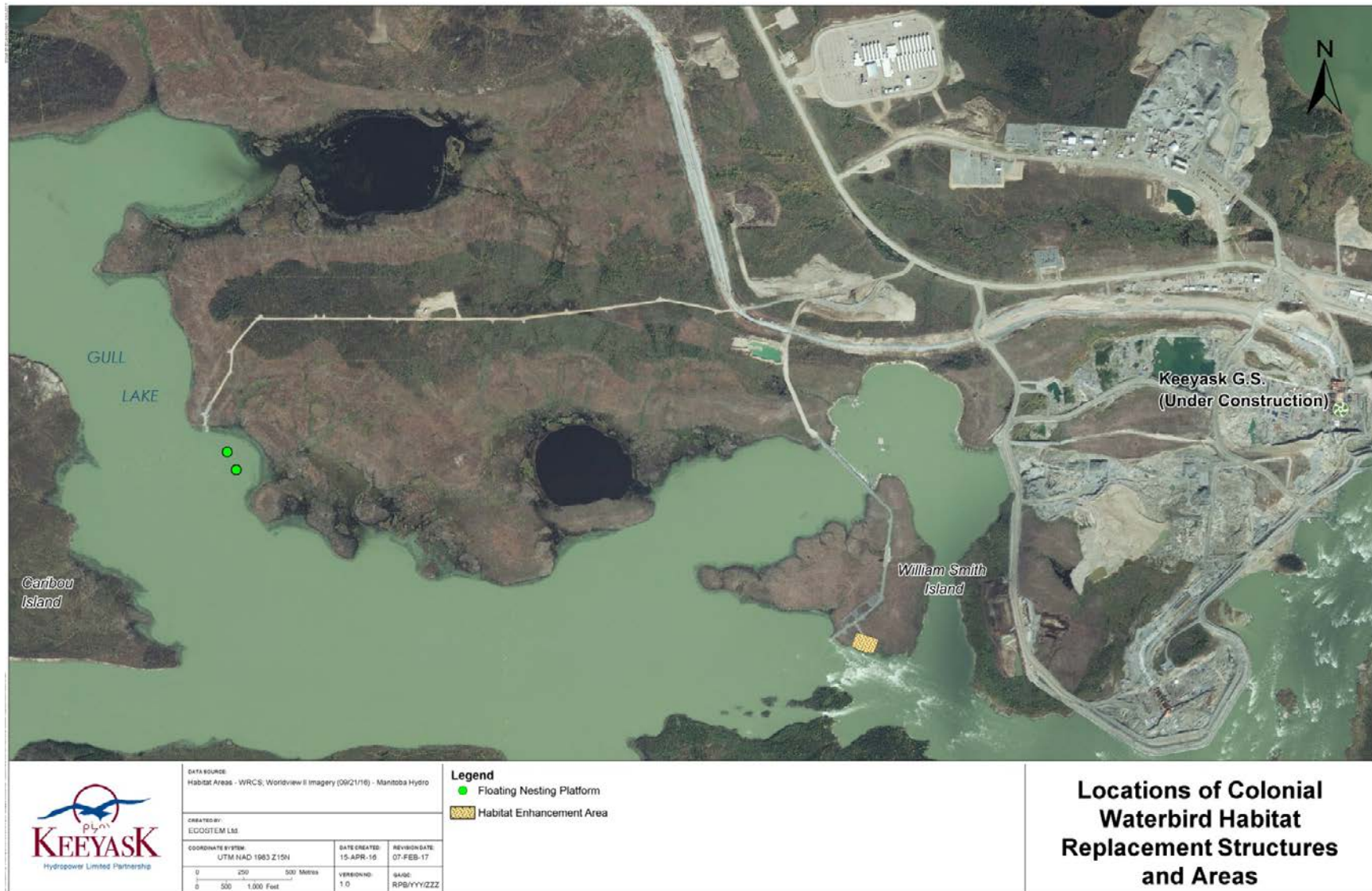
The *Keeyask Generation Project: Response to EIS Guidelines* (the EIS), completed in June 2012, provides a summary of predicted effects and planned mitigation for the Project. Technical supporting information for the terrestrial environment, including a description of the environmental setting, effects and mitigation, and a summary of proposed monitoring and follow-up programs is provided in the *Keeyask Generation Project Environmental Impact Statement: Terrestrial Environment Supporting Volume* (TE SV). The *Terrestrial Effects Monitoring Plan* (TEMP) was developed as part of the licensing process for the Project. Monitoring activities for various components of the terrestrial environment were described, including the focus of this report, colonial waterbird habitat enhancement monitoring, for the construction and operation phases of the Project.

The Project has the potential to effect colonial waterbird populations through alteration and loss of habitat, as well as sensory disturbance. Three species of colonial waterbird - ring-billed gull (*Larus delawarensis*), herring gull (*Larus argentatus*), and common tern (*Sterna hirundo*) - commonly breed on rocky islands and reefs in the Nelson River near the Project site. Breeding season surveys conducted in 2001, 2002, 2003, 2006, and 2011 indicate that upwards of 1,500 pairs of ring-billed gulls and 100 pairs of common terns (hereafter referred to as terns) colonise islands in Gull Rapids (KHLP 2012). Studies in 2013 (Stantec 2014) reported approximately 3,000 pairs of gulls and 50 pairs of terns, while studies in 2014 estimated 6,200 (± 1000) gulls and 23 terns in Gull Rapids (Stantec 2015). Islands in the Nelson River between Gull Rapids and Birthday Rapids have supported upwards of 1,500 pairs of gulls and 100 pairs of terns (KHLP 2012). Other colonial waterbird species that have been observed to breed in the region include Bonaparte's gull (*Chroicocephalus philadelphia*), and Caspian tern (*Sterna caspia*). Colonial waterbirds that occur in the region but for which there is no evidence of breeding include American white pelican (*Pelecanus erythrorhynchos*), black tern (*Chlidonias niger*), and double-crested cormorant (*Phalacrocorax auritus*) (KHLP 2012).

Colonial waterbirds are generally gregarious birds that congregate into conspecific or multi-species groups of nesting birds at colony sites; the congregation of nesting birds is the colony (Kushlan 1986). Waterbird colonies range from a few birds to many thousands, however, two breeding pairs nesting at a site qualify as a colony (Kushlan *et al.* 2002). Conversely, regardless of how many birds are congregated, if nesting is not taking place, the group of birds is not a colony but a congregation or a potential colony. At such sites, if birds are sleeping or resting the site is referred to as a communal roost site. Often confused with roosting, loafing includes activities involved in comfort behaviour (preening, stretching) and digestion; these sites are referred to as loafing sites (Campbell and Lack 1985).

To offset loss of colonial waterbird nesting habitat at Gull Rapids, habitat enhancement areas (e.g., created gull nesting habitat and floating tern platforms) were implemented in 2015 and 2016 and monitored to determine their effectiveness (KHLP 2015). For gulls, the southern shore of William Smith Island (Map 1) was cleared of vegetation and graded with rocky substrate to emulate a natural nesting island in 2015 (Photo 1, Photo 7). At this site large shipping containers were also placed in the graded area and rocky substrate was placed on top to provide nesting habitat elevated from potential terrestrial predators (as the island is physically connected to land north of the Nelson River by the north channel rock groin). Concrete and wooden gull decoys and audio equipment broadcasting breeding gull vocalizations, were installed on top of the containers and at ground-level (Photo 6, Photo 7, Photo 8, Photo 9) to enhance the social attractiveness of the site to gulls.

On June 1, 2016, two floating platforms were deployed for terns approximately five km upstream of Gull Rapids (Map 1). This was after most gulls should have initiated their nests, so as to minimize competition from gulls for the floating platforms. These two platforms provide a total of approximately 50 m² of replacement nesting habitat, designed to accommodate 50 tern pairs per platform. Each floating platform was topped with gravel to emulate natural nesting habitat and equipped with a ramp to allow access to the platform from the water (Photo 10). Audio equipment broadcasting breeding tern vocalizations were installed on both platforms to increase the social attractiveness of the floating platforms to terns (Photo 11, Photo 9, Photo 10, and Photo 11). Tern decoys were only installed on Platform B (Photo 10) and driftwood was only added to the surface of Platform A (Photo 11).



Map 1: Locations of Colonial Waterbird Habitat Enhancement Area/Platforms in 2016



Photo 1: William Smith Island Gull Habitat Enhancement Area



Photo 2: Set-up of William Smith Island Gull Habitat Enhancement Area



Photo 3: Gull decoys on the shipping containers at the Gull Habitat Enhancement Area



Photo 4: Gull decoys on the shipping containers with the Nelson River in the background at the Gull Habitat Enhancement Area

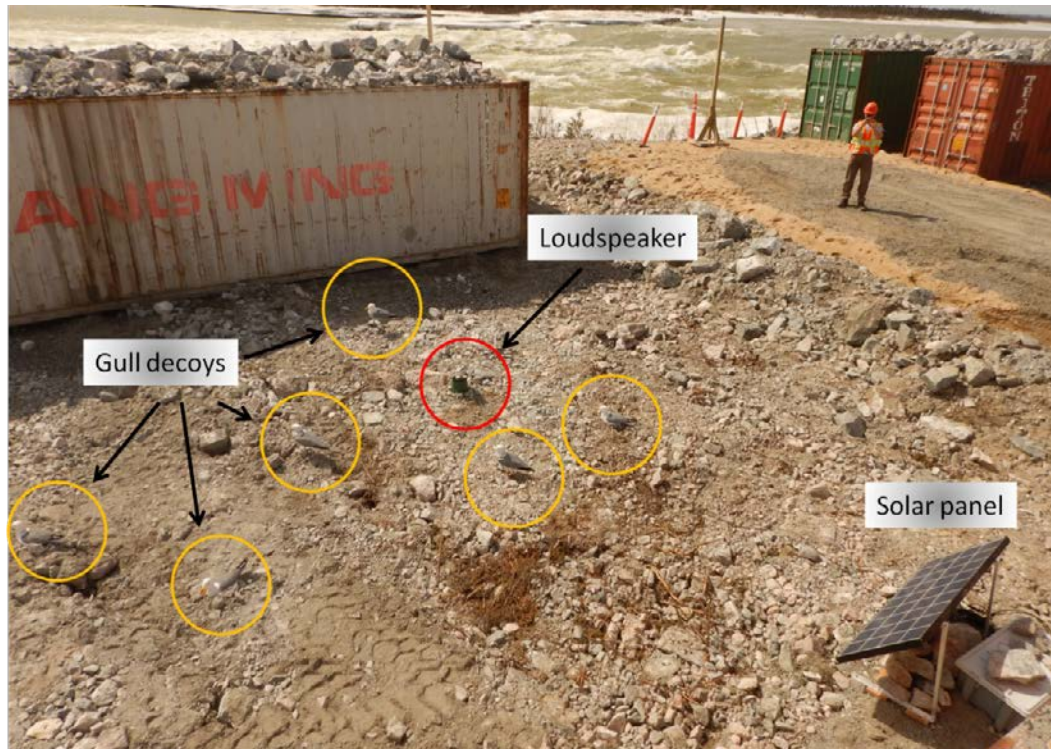


Photo 5: Gull decoys, loudspeaker and solar panel on the ground at the Gull Habitat Enhancement Area.



Photo 6: Ground View of Gull Decoys and Speaker in the Gull Habitat Enhancement Area on William Smith Island



Photo 7: Floating Platforms A (left) and B (right) with Common Tern Decoys and Audio Equipment



Photo 8: Set-up of Floating Tern Platforms in Gull Lake



Photo 9: Set-up of Common Tern Decoys and Audio Equipment on Platforms



Photo 10: Common Tern on Floating Platform B with Decoy Terns and Audio Equipment



Photo 11: Platform A with Driftwood and Audio Equipment

2.0 METHODS

To evaluate the effectiveness of the colonial waterbird habitat enhancement areas in 2016, Reconyx cameras, also known as camera traps or trail cameras, were installed and programmed to capture images at predetermined times of the day. At the William Smith Island gull habitat area, two Reconyx HC850 HyperFire Pro cameras positioned at ground level near the shipping containers captured images at 8 a.m., 12 p.m., 4 p.m., and 8 p.m. from June 5 to August 13. An additional two Reconyx HC600 cameras were positioned at ground level on the access road leading to the area to capture motion and infrared triggered images between June 5 to September 3. These four cameras are also equipped with a 3G cellular modem that transmitted images to Winnipeg.

Two floating platforms for terns were deployed in a bay of Gull Lake on June 2, 2016. A gravel substrate was added to both of the platforms, and to improve the platform set-up design in 2016, tern decoys were distributed over the entire surface of Platform B, instead of a single tight cluster as done in 2015. To examine the effect of tern decoys on platform occupancy, no tern decoys were installed on Platform A. To further improve the habitat quality of Platform A, the platform was visited on June 4 to add driftwood to the platform. Both floating platforms A and B were equipped with a Reconyx PC850 HyperFire Pro camera that captured images at 8 a.m., 12 p.m., 4 p.m., and 8 p.m. from June 2 to August 19. Because nesting terns were not captured by the sole camera on Platform A, an additional camera was installed on July 7. These three cameras were equipped with a 3G cellular modem that transmitted images to Winnipeg.

Images transmitted from the colonial waterbird habitat enhancement areas were reviewed daily to determine the presence/absence of colonial waterbirds, or other wildlife, and their behaviours. All photographs were thoroughly evaluated following completion of the field season. Photographs containing wildlife were recorded as events (e.g., tern events, gray wolf events). The tern platforms were removed after the breeding season, on October 19, for winter storage.

In addition to Reconyx cameras, the constructed gull habitat area and the floating tern platforms were photographed by an Unmanned Aerial Vehicle (UAV) employed in another TEMP study that flew over the sites. UAV photography was conducted on July 20, 2016. UAV deployment and survey methods are detailed in Report #TEMP-2016-06 (WRCS 2017).

3.0 RESULTS

The William Smith Island gull habitat area was not used by gulls for nesting in 2016. One of the two floating platforms was used for nesting by common terns in 2016. The cameras at both sites performed successfully and continued capturing images throughout the 2016 monitoring period.

In 2015, neither the created gull-nesting habitat nor the floating tern platforms successfully attracted nesting birds. At the created gull nesting habitat, colonial waterbirds were not documented nesting in any of the photographs, and no sign of nest development was observed. In contrast, between June 28 and September 1, 2015, 28 images of loafing terns were captured on one platform, and loafing terns were photographed three times on the second. The only evidence of terns potentially using a floating platform as a nesting site in 2015 was captured in a photograph. A tern was photographed sitting tight on the gravel as though it was initiating a nest; however, no eggs or chicks were observed in subsequent photographs.

No gulls were documented using the William Smith Island gull habitat area in 2016. At this site, a total of 1,586 photographs were taken by four cameras over 91 days. Colonial waterbirds were not captured using the site in any of the photographs. Terrestrial mammalian predators including grey wolf (*Canis lupus*) and red fox (*Vulpes vulpes*), and other wildlife such as common raven (*Corvus corax*), common merganser (*Mergus merganser*), and other unidentified birds, were photographed in 35 events (Appendix 1; Table 1). A young grey wolf was photographed walking in the gull habitat area at night (Appendix 2 - Photo 1) on July 3; in the morning, mid-day, and night of August 19; and the morning of August 22 (Appendix A - Table 1). A red fox was photographed walking and running in the gull habitat area (Appendix 2 - Photo 2) in the morning, mid-day, afternoon, and night of August 20; mid-day on August 21; mid-day on August 25; morning of August 26; at noon and in the afternoon of August 30; and in the afternoon of September 2 (Appendix 1 - Table 1). A common merganser hen was photographed walking among the sea-cans (Appendix 2 - Photo 3) on July 17 (Appendix 1 - Table 1). A common raven was photographed walking among the sea-cans (Appendix 2; Photo 4) twice in August (Appendix 1 - Table 1). Unidentified birds were photographed flying over the Nelson River eight times in June and once in July (Appendix 1 - Table 1). Single gulls were photographed flying over William Smith Island three times in both June and July (Appendix 1 - Table 1). Incidentally, cameras at the William Smith Island gull habitat area photographed humans accessing the site on July 21, and August 11, 23, and 24.

On the floating platforms, a total of 145 tern events were photographed (Appendix 3 - Table 1). Terns were photographed in 142 events at Platform A between June 9 and August 17 (Appendix 3 - Table 1), and in three events at Platform B between June 5 and July 21 (Appendix 3 - Table 1). On Platform A, 118 events with only adult terns, 10 events with tern chicks and adults, and 17 events with only tern chicks were photographed (Appendix 3 - Table 1). The number of adult terns on Platform A photographed by events was usually between one and seven individuals (Appendix 3 - Table 1), however, events of 11 adult terns on July 27 and August 9, and events of 13 adult terns were photographed on July 31 and August 1 respectively (Photo 12). On Platform B, in each of the three tern events single adult terns were

photographed. For both platforms and only when terns were present (*i.e.*, photos with zero terns excluded from the analysis), the average number of birds photographed was 3.3 terns per event. Terns were photographed during morning, noon, late afternoon, and evening hours (Appendix 3 - Table 1).

A pair of common terns successfully nested on Platform A in 2016. No evidence of nesting terns was observed on Platform B. When Platform A was visited on June 29, a tern nest with three olive coloured eggs with blotches of dark brown was observed (Photo 13). During the brief July 7 visit, all three eggs had hatched. Three downy tern chicks were observed and aged between one and seven days old (Photo 14).



Photo 12: Thirteen Common Tern Adults on Platform A on August 1, 2016



Photo 13: Common Tern Nest Containing Three Eggs on Platform A on June 29, 2016.



Photo 14: Two 1-7 Day Old Common Tern Chicks on Platform A on July 7, 2016.

Tern chicks were first photographed by the camera traps on July 8 (Appendix 3 - Table 1, Appendix 4 - Photo 1). Three tern chicks were photographed on Platform A by the UAV on July 20 (Photo 15). On July 22, the last day that tern chicks were photographed by the camera traps (Appendix 3 - Table 1), all three chicks were visible and were estimated to be between 16 and 23 days old (Appendix 4 - Photo 2).

Adult terns were photographed with food on Platform A on seven occasions from July 26 to August 14 (Appendix 3 - Table 1). In these photographs, adult terns were grasping minnows with their bill while standing on the platform's gravel surface (Photo 22 to Photo 26).

Additional evidence of terns using Platform A as a nesting area was observed. On July 18, terns were observed scraping out a nest on the platform's gravel surface at 8 AM (Photo 27) and sitting tight, as though incubating eggs, throughout the day (Photo 28) and on the following day at 8 AM and 12 PM (Photo 29). An adult tern was photographed scraping the same patch as though it was constructing, or maintaining, a nest on July 21 (Photo 30). No eggs were observed in the nest in all subsequent photographs.



Photo 15: Three 14-21 Day Old Common Tern Chicks and Two Adults on Platform A on July 20, 2016

4.0 SUMMARY AND CONCLUSIONS

During the second year of having the habitat enhancement area and floating platforms available for nesting colonial waterbirds, the William Smith Island gull habitat enhancement area was not used by nesting gulls, whereas one of the floating platforms was successfully used by common terns for nesting. In addition, both floating platforms successfully attracted terns, which were also commonly used as loafing sites. Even though it was predicted that it may take a few breeding seasons for birds to accept the enhancement habitat area and platforms (KHLP 2015), several factors may have contributed to the habitat area not being colonised in 2016.

The primary reason that the gull habitat enhancement area was not used by gulls is most likely the continued availability and distribution of natural nesting habitat at Gull Rapids (in the south channel) and other areas in the region (see 2016 Colonial Waterbird Habitat Effects Monitoring report; WRCS 2017). Although colonial waterbirds were successfully deterred from nesting in active construction areas in the Gull Rapids area by employing falconry, in combination with other bird control methods (see 2016 Environmental Protection Plan Report Manitoba Hydro 2017), several islands and reefs within the southern channel of Gull Rapids, outside of the active construction area, were colonised by ring-billed gulls. Islands and reefs in the southern channel of Gull Rapids contained colonies in previous years (KHLP 2012, Stantec 2014, Stantec 2015, WRCS 2016a). As such, it is not surprising that the same islands and reefs, as well as other neighbouring islands, would continue to be colonised as colony site fidelity is strong in ring-billed gulls (Southern and Southern 1982). Attempted nesting and use of islands for loafing should have occurred regardless of sensory disturbances from adjacent construction activities. Gulls in particular are often tolerant of human disturbances, as they have adapted to using urban landscapes.

In future years of construction, if more natural nesting areas become unavailable to gulls, the attractiveness of the gull habitat enhancement area could be further improved by removing large rocks from the top of the shipping containers and adding a layer of gravel. This will also increase the total area available to nesting gulls and should remove barriers to chicks that could have difficulty moving around the top of the shipping containers before they are capable of flight.

The installation of motion and infrared sensing cameras assisted in monitoring other wildlife visits to the site. On several occasions, grey wolf and red fox were photographed in the gull habitat enhancement area in July and August. Humans were photographed on a few occasions and most were in the late nesting season (late July). Predators may be attracted to the area by the sight of gull decoys or the sound of the gull vocalizations playback. Although the presence of nocturnal predators or humans in the gull habitat enhancement area was not likely to have discouraged gulls from using the area, predators or humans accessing the site in future years may be problematic if gulls have colonised the site. In a potential scenario where gulls are nesting in the area and a terrestrial predator (e.g., grey wolf, red fox) enters the area, outcomes are likely to be severe. Potential negative effects of mammalian predators entering gull colonies observed in other studies include heavy losses of eggs, chicks, and adults (Southern *et al.* 1980, Southern *et al.* 1985), reduced reproductive success (Emlen *et al.* 1966, Southern *et al.*

1985), or in a worst-case scenario, total colony abandonment (Ludwig 1962, Emlen *et al.* 1966, Kadlec 1971, Conover and Miller 1979, Pollett *et al.* 2012).

It has been suggested that breeding gulls may have no other effective defense against intrusion by mammalian predators other than the selection of predator-free colony sites (Southern and Southern 1979). If predator-free colony sites are essential for gulls to successfully reproduce, efforts to provide gulls with suitable replacement habitat must include physical barriers (*i.e.*, open water, fencing) to terrestrial predators.

Platform A was successfully used for nesting by common terns in 2016, whereas terns were only photographed loafing on Platform B on three days. Based on a typical incubation period of 21-25 days (Kaufman 2005), the nest on Platform A was initiated between June 6 and June 15. The age of the chicks in the last photograph in which chicks were visible, on July 22, was estimated to be between 16 and 23 days old. The age of fledging for common terns varies widely from 22 to 29 days (Nisbet and Drury 1972, Burger and Gochfeld 1991). It is not known for certain if the chicks survived past July 22 or if they successfully fledged.

Terns take their prey almost exclusively on the wing and consume within a few seconds of capture, unless they are bringing food to the colony to feed young (Nisbet 2002). Furthermore, nesting territories serve as rendezvous points for chick-feeding and roosting for 10-20 days after fledging (Nisbet 2002). Therefore, because adult terns were photographed with minnows in their bills on the platform on seven occasions from July 26 to August 14, this behaviour strongly suggests that at least one chick continued to occupy the platform and was receiving food up to August 14. On August 14 the tern chicks would have been past the age of fledging, being between 38 and 45 days old.

As recommended in 2015 (WRCS 2016b), floating platforms were deployed earlier in June, which may have contributed to a higher-level use and nest success by common terns in 2016. Common tern were photographed in 145 tern events in 2016, compared to only 31 events in 2015, which is nearly a five-fold increase in floating platform use. The average number of birds photographed by event when adult terns were present on the platform, increased from an average of about one tern (maximum = 2) in 2015 to 3.3 terns (maximum = 13) in 2016.

It is not known why Platform B was not used for nesting by terns in 2016, though differences in the features of each platform may have contributed. Only Platform B had tern decoys and driftwood was only added to the surface of Platform A. Although we cannot separate the effect decoys or driftwood had on platform occupancy, it is possible that the lack of driftwood may have caused breeding terns to not accept Platform B's habitat structure. The quality of the platform's nesting habitat should be augmented with driftwood in future years. Photographs of terns loafing on Platform B in June and July suggests that the presence of tern decoys did not dissuade terns from visiting Platform B. Using an adaptive management approach, tern decoys should continue to be installed on only one of the platforms in future years. This may provide more information on whether the decoys are an undesirable element in the provision of alternative replacement habitat for terns.

The effects of a June storm on Platform B demonstrated that nests and eggs on the platforms may be at risk from water inundation and shifting nesting substrate when winds are high. Wooden strip ridges mounted on the main platform surface should restrict the gravel substrate from substantially shifting when the platform is being rocked by waves. The attractiveness of the floating platforms to terns could also be further improved by adding a few large cinderblocks or chick shelters on top of the platform surface (Jarvie and Blokpoel 1996, Environment Canada 2013). The lack of shelter for chicks may have contributed to chicks on Platform A not being photographed; they may have been hiding behind the solar panel rig (in the shade), out of the camera's field of view.

To provide nesting habitat for displaced gulls and terns within Study Zone 3 during the operation phase of the Project, portions of William Smith Island will be modified and built up to serve as a colonial waterbird nesting area in the future reservoir. In addition, it is predicted in the EIS that some islands could be formed in the future reservoir and become suitable nesting habitat for gulls and terns.

Additionally, wider-area aerial surveys for colonial waterbirds, and their nesting habitat, were conducted in 2015 (WRCS 2016a) and 2016 (WRCS 2017). In 2016, the gull and tern populations were well established, widely distributed and plentiful at Gull Rapids and the surrounding region during the early construction period. These surveys will continue annually during construction to monitor potential shifts in colonial waterbird abundance and distribution in the region.

Recommendations to improve the attractiveness of the gull habitat enhancement area, if required in future years, include:

- Continue monitoring intrusions of predators and humans in gull habitat enhancement area through motion and infrared triggered cameras.

Recommendations to improve the performance of the tern nesting platforms include:

- Continue to deploy platforms in late May or early June;
- Install tern decoys on only one platform;
- Prevent shifting nesting substrate on the floating platforms by adding ridges;
- Prevent shifting of driftwood by securing the logs to the base platforms with wood screws; and
- Increase the attractiveness of the floating platforms by placing driftwood, large cinderblocks or chick shelters on the surface of both floating platforms.

5.0 LITERATURE CITED

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APPENDIX 1: WILLIAM SMITH ISLAND GULL HABITAT ENHANCEMENT AREA WILDLIFE EVENTS

Table 1: Events of Wildlife Photographed at the William Smith Island Gull Habitat Enhancement Area

Species	Date	Time	Behaviour
Grey wolf (<i>Canis lupus</i>)	July 3, 2016	11:37 AM	Walking among sea-cans
	August 19, 2016	8:00 AM	Walking among sea-cans
	August 19, 2016	11:07 AM	Walking among sea-cans
	August 19, 2016	11:02 PM	Walking among sea-cans
	August 22, 2016	10:29 AM	Walking among sea-cans
Red fox (<i>Vulpes vulpes</i>)	August 20, 2016	11:56 AM	Running
	August 20, 2016	1:10 PM	Running
	August 20, 2016	4:00 PM	Running
	August 20, 2016	11:52 PM	Running
	August 21, 2016	11:11 AM	Running
	August 21, 2016	11:28 AM	Running
	August 25, 2016	11:13 AM	Walking
	August 25, 2016	11:07 PM	Walking
	August 26, 2016	10:09 AM	Walking
	August 30, 2016	12:00 PM	Walking
	August 30, 2016	3:21 PM	Walking
	September 2, 2016	1:58 PM	Walking
Common merganser (<i>Mergus merganser</i>)	July 17, 2016	5:47 PM	Walking among sea-cans
Common raven (<i>Corvus corax</i>)	August 14, 2016	7:40 AM	Walking among sea-cans
	August 31, 2016	9:21 PM	Walking among sea-cans
Unidentified bird	June 12, 2016	4:00 PM	Flying over the Nelson River
	June 13, 2016	8:00 AM	Flying over the Nelson River
	June 14, 2016	12:00 PM	Flying over the Nelson River
	June 16, 2016	12:00 PM	Flying over the Nelson River
	June 22, 2016	12:00 PM	Flying over the Nelson River
	June 24, 2016	12:00 PM	Flying over the Nelson River
	June 28, 2016	12:00 PM	Flying over the Nelson River
	June 28, 2016	8:00 PM	Flying over the Nelson River
	July 30, 2016	12:00 PM	Flying over the Nelson River
Unidentified gull	June 14, 2016	12:00 PM	Flying over William Smith Island
	June 24, 2016	8:00 AM	Flying over William Smith Island
	June 25, 2016	12:00 PM	Flying over William Smith Island
	July 6, 2016	8:00 PM	Flying over William Smith Island
	July 10, 2016	8:00 AM	Flying over William Smith Island
	July 10, 2016	4:00 PM	Flying over William Smith Island

APPENDIX 2: PHOTOGRAPHS OF WILDLIFE AT THE WILLIAM SMITH ISLAND GULL HABITAT ENHANCEMENT AREA



Photo 16: Grey wolf (*Canis lupus*) on August 19, 2016 at the William Smith Island Habitat Enhancement Area



Photo 17: Red fox (*Vulpes vulpes*) on August 21, 2016 at the William Smith Island Habitat Enhancement Area



Photo 18: Common merganser (*Mergus merganser*) hen on July 17, 2016 at the William Smith Island Habitat Enhancement Area



Photo 19: Common raven on August 31, 2016 at the William Smith Island Habitat Enhancement Area

APPENDIX 3: COMMON TERN EVENTS PHOTOGRAPHED AT FLOATING PLATFORMS

Table 1: Common Tern Events Captured at Floating Platforms

Date	Time	Platform	Number of Adults	Number of Chicks	Behaviour
June 9, 2016	12 PM	A	2	0	Loafing
July 6, 2016	12 PM	A	2	0	Loafing
July 6, 2016	8 PM	A	1	0	Loafing
July 7, 2016	8 AM	A	1	0	Loafing
July 7, 2016	4 PM	A	2	0	Loafing
July 7, 2016	8 PM	A	1	0	Loafing
July 8, 2016	12 PM	A	0	1	Loafing
July 8, 2016	4 PM	A	1	1	Brooding
July 9, 2016	8 AM	A	1	0	Loafing
July 9, 2016	8 AM	A	0	3	Loafing
July 9, 2016	12 PM	A	1	0	Loafing
July 9, 2016	8 PM	A	1	0	Brooding
July 10, 2016	12 PM	A	1	2	Flying
July 10, 2016	4 PM	A	1	2	Flying
July 10, 2016	8 PM	A	0	2	Walking
July 11, 2016	8 AM	A	1	1	Loafing
July 11, 2016	12 PM	A	1	0	Loafing
July 11, 2016	4 PM	A	1	2	Loafing
July 11, 2016	8 PM	A	0	3	Loafing
July 12, 2016	8 AM	A	1	0	Loafing
July 12, 2016	12 PM	A	1	1	Loafing
July 12, 2016	8 PM	A	2	0	Loafing
July 13, 2016	8 AM	A	0	3	Loafing
July 13, 2016	12 PM	A	1	2	Loafing
July 13, 2016	4 PM	A	1	0	Loafing
July 13, 2016	8 PM	A	1	0	Loafing
July 14, 2016	8 AM	A	1	0	Loafing
July 14, 2016	12 PM	A	1	0	Loafing
July 14, 2016	8 PM	A	0	1	Loafing
July 15, 2016	8 AM	A	0	3	Loafing
July 15, 2016	12 PM	A	0	1	Loafing
July 15, 2016	4 PM	A	0	2	Loafing
July 15, 2016	8 PM	A	0	3	Loafing
July 16, 2016	8 AM	A	0	2	Loafing
July 16, 2016	4 PM	A	0	3	Loafing
July 16, 2016	8 PM	A	0	1	Loafing
July 17, 2016	8 AM	A	0	1	Loafing
July 17, 2016	12 PM	A	2	1	Loafing
July 17, 2016	4 PM	A	0	1	Loafing
July 17, 2016	8 PM	A	2	0	Loafing
July 18, 2016	8 AM	A	2	0	Loafing

Date	Time	Platform	Number of Adults	Number of Chicks	Behaviour
July 18, 2016	12 PM	A	4	0	Loafing
July 18, 2016	4 PM	A	4	0	Loafing
July 18, 2016	8 PM	A	0	1	Loafing
July 19, 2016	8 AM	A	2	0	Loafing
July 19, 2016	12 PM	A	4	0	Loafing
July 19, 2016	4 PM	A	2	0	Loafing
July 19, 2016	8 PM	A	3	0	Loafing
July 20, 2016	8 AM	A	3	0	Loafing & flying
July 20, 2016	12 PM	A	4	0	Loafing
July 20, 2016	4 PM	A	3	0	Loafing & flying
July 21, 2016	12 PM	A	2	0	Loafing
July 21, 2016	4 PM	A	0	3	Loafing
July 21, 2016	8 PM	A	1	2	Loafing
July 22, 2016	8 AM	A	2	0	Loafing
July 22, 2016	12 PM	A	1	3	Loafing
July 22, 2016	4 PM	A	3	1	Loafing
July 22, 2016	8 PM	A	0	2	Loafing
July 23, 2016	8 AM	A	2	0	Loafing
July 23, 2016	12 PM	A	5	0	Loafing
July 23, 2016	4 PM	A	3	0	Loafing
July 23, 2016	8 PM	A	3	0	Loafing
July 24, 2016	12 PM	A	2	0	Loafing
July 24, 2016	4 PM	A	5	0	Loafing
July 25, 2016	8 AM	A	3	0	Loafing
July 25, 2016	12 PM	A	6	0	Loafing
July 25, 2016	4 PM	A	7	0	Loafing & flying
July 25, 2016	8 PM	A	5	0	Loafing & flying
July 26, 2016	8 AM	A	4	0	Loafing
July 26, 2016	12 PM	A	3	0	Bringing food
July 26, 2016	4 PM	A	6	0	Loafing
July 26, 2016	8 PM	A	4	0	Loafing
July 27, 2016	8 AM	A	2	0	Bringing food
July 27, 2016	12 PM	A	11	0	Loafing & flying
July 27, 2016	4 PM	A	5	0	Loafing
July 27, 2016	8 PM	A	1	0	Loafing
July 28, 2016	8 AM	A	2	0	Loafing
July 28, 2016	12 PM	A	4	0	Loafing
July 28, 2016	4 PM	A	6	0	Loafing
July 28, 2016	8 PM	A	3	0	Loafing
July 29, 2016	8 AM	A	4	0	Loafing
July 29, 2016	12 PM	A	7	0	Loafing
July 29, 2016	4 PM	A	4	0	Bringing food
July 29, 2016	8 PM	A	6	0	Loafing

Date	Time	Platform	Number of Adults	Number of Chicks	Behaviour
July 30, 2016	8 AM	A	3	0	Bringing food
July 30, 2016	12 PM	A	5	0	Loafing
July 30, 2016	8 PM	A	2	0	Loafing & flying
July 31, 2016	8 AM	A	3	0	Loafing
July 31, 2016	12 PM	A	3	0	Loafing
July 31, 2016	4 PM	A	13	0	Loafing
July 31, 2016	8 PM	A	3	0	Loafing
August 1, 2016	8 AM	A	1	0	Loafing
August 1, 2016	12 PM	A	6	0	Loafing
August 1, 2016	4 PM	A	13	0	Loafing
August 1, 2016	8 PM	A	5	0	Loafing
August 2, 2016	8 AM	A	2	0	Loafing
August 2, 2016	12 PM	A	5	0	Loafing
August 2, 2016	4 PM	A	4	0	Loafing
August 3, 2016	12 PM	A	5	0	Loafing
August 3, 2016	4 PM	A	7	0	Loafing
August 3, 2016	8 PM	A	2	0	Loafing
August 4, 2016	12 PM	A	3	0	Bringing food
August 4, 2016	4 PM	A	3	0	Loafing
August 4, 2016	8 PM	A	6	0	Loafing & flying
August 5, 2016	8 AM	A	2	0	Loafing
August 5, 2016	12 PM	A	3	0	Loafing
August 5, 2016	4 PM	A	4	0	Loafing
August 5, 2016	8 PM	A	4	0	Loafing
August 6, 2016	12 PM	A	8	0	Loafing
August 6, 2016	4 PM	A	5	0	Loafing
August 6, 2016	8 PM	A	4	0	Loafing & flying
August 7, 2016	8 AM	A	3	0	Loafing & flying
August 7, 2016	12 PM	A	7	0	Loafing
August 7, 2016	4 PM	A	4	0	Loafing
August 7, 2016	8 PM	A	4	0	Loafing
August 8, 2016	12 PM	A	5	0	Loafing
August 8, 2016	4 PM	A	3	0	Loafing
August 8, 2016	8 PM	A	1	0	Loafing
August 9, 2016	12 PM	A	1	0	Loafing
August 9, 2016	4 PM	A	11	0	Loafing
August 9, 2016	8 PM	A	2	0	Loafing
August 10, 2016	8 AM	A	2	0	Loafing
August 10, 2016	12 PM	A	5	0	Loafing
August 10, 2016	4 PM	A	5	0	Loafing
August 10, 2016	8 PM	A	2	0	Loafing
August 11, 2016	12 PM	A	1	0	Loafing
August 11, 2016	4 PM	A	3	0	Loafing

Date	Time	Platform	Number of Adults	Number of Chicks	Behaviour
August 11, 2016	8 PM	A	1	0	Loafing
August 12, 2016	8 AM	A	9	0	Loafing
August 12, 2016	12 PM	A	9	0	Preening
August 12, 2016	4 PM	A	2	0	Loafing
August 12, 2016	8 PM	A	2	0	Loafing
August 13, 2016	8 AM	A	2	0	Loafing
August 13, 2016	12 PM	A	4	0	Bringing food
August 13, 2016	4 PM	A	1	0	Loafing
August 13, 2016	8 PM	A	2	0	Loafing
August 14, 2016	4 PM	A	3	0	Bringing food
August 14, 2016	8 PM	A	4	0	Loafing
August 16, 2016	4 PM	A	1	0	Loafing
August 16, 2016	8 PM	A	1	0	Loafing
August 17, 2016	8 AM	A	1	0	Loafing
August 17, 2016	4 PM	A	2	0	Loafing
June 5, 2016	12 PM	B	1	0	Loafing
July 16, 2016	8 PM	B	1	0	Loafing
July 21, 2016	12 PM	B	1	0	Loafing

APPENDIX 4: PHOTOGRAPHS OF COMMON TERN EVENTS AT FLOATING PLATFORMS



Photo 20: Three Common Tern Chicks on Platform A on July 9, 2016



(Note: one chick is partly obscured by another in the corner of the platform. Adult watching from the rail.)

Photo 21: Three Common Tern Chicks on Platform A on July 22, 2016



Photo 22: Common Tern with Food for Chicks on Platform A on July 26, 2016



Photo 23: Common Tern with Food for Chicks on Platform A on July 27, 2016



Photo 24: Common Tern with Food for Chicks on Platform A on July 29, 2016



Photo 25: Common Tern with Food for Chicks on Platform A on August 13, 2016



Photo 26: Common Tern with Food for Chicks on Platform A on August 14 2016



Photo 27: Common Terns Constructing a Potential Nest on Platform A on July 18, 2016



Photo 28: Common Tern Sitting Tight on a Potential Nest on Platform A on July 18, 2016.



Photo 29: Common Tern Sitting Tight on a Potential Nest on Platform A on July 19, 2016



Photo 30: Common Terns Constructing/Maintaining a Potential Nest on Platform A on July 21, 2016