



Keeyask Generation Project Terrestrial Effects Monitoring Plan

Colonial Waterbird Habitat Effects Monitoring Report

TEMP-2022-15



KEEYASK GENERATION PROJECT

TERRESTRIAL EFFECTS MONITORING PLAN

REPORT #TEMP-2022-15

COLONIAL WATERBIRD HABITAT EFFECTS MONITORING 2021

Prepared for

Manitoba Hydro

By

Wildlife Resource Consulting Service MB Inc.

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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. 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 are affecting the environment, and whether or not more needs to be done to reduce harmful effects.

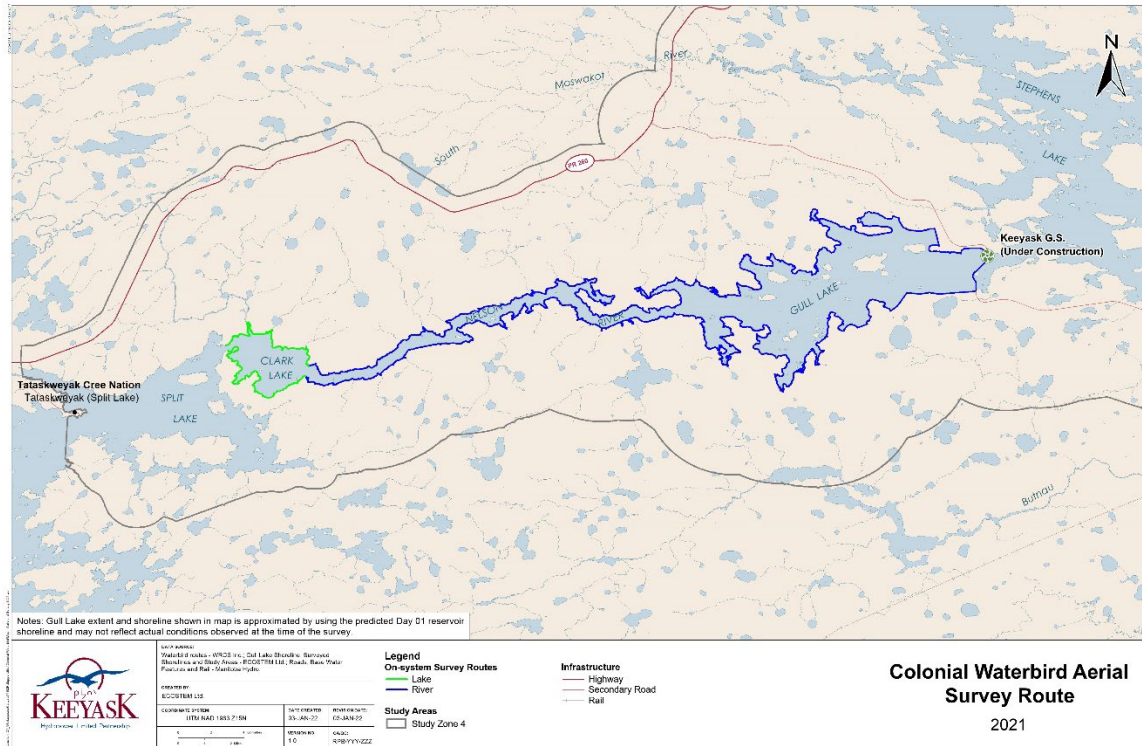
This report describes the results of colonial waterbird (gulls and terns) habitat effects monitoring conducted during the summer of 2021, the eighth summer of Project construction.

Why is the study being done?

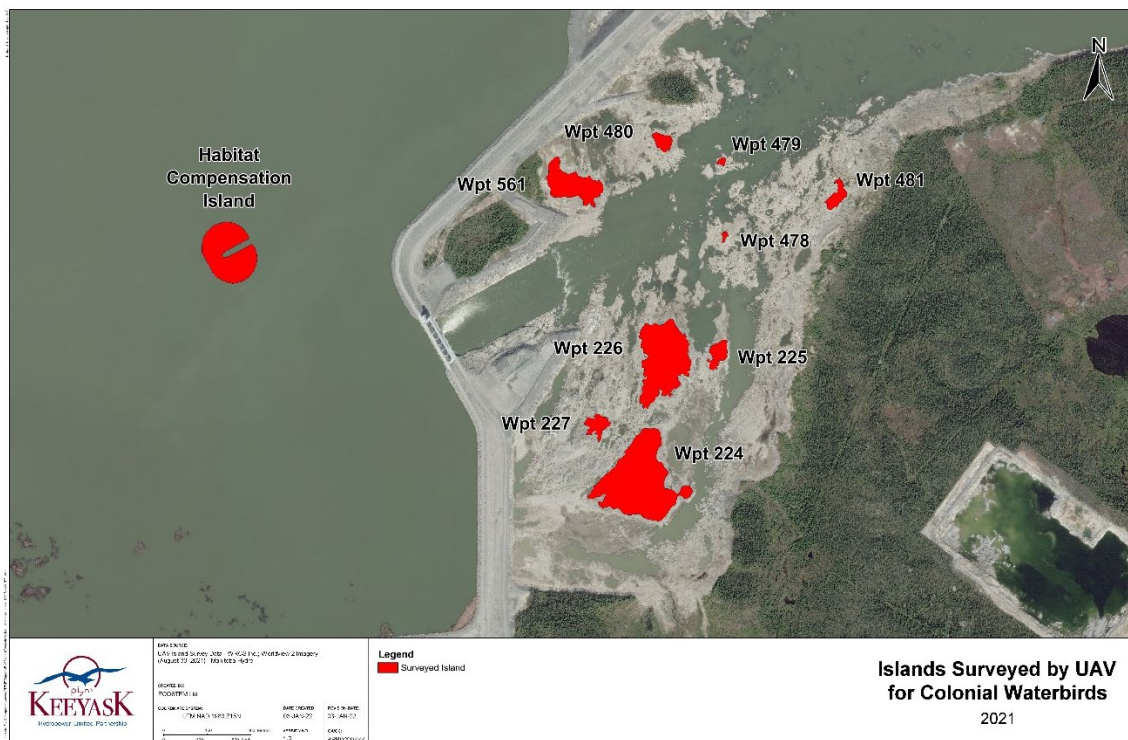
The Project has the potential to affect gull and tern populations through alteration and loss of habitat, as well as noise and light disturbance from construction activities. Monitoring is being done to evaluate Project effects on the number and location of ring-billed gulls and common terns and their breeding habitats. Other colonial waterbird populations (e.g., American white pelican, Bonaparte's gull) are being monitored incidentally.

What was done?

Helicopter surveys of the reservoir and surrounding area (including the former Gull Rapids area and upstream to Clark Lake) and unmanned aerial vehicle (UAV or drone) surveys focused on the former Gull Rapids area were conducted in summer 2021 to determine the numbers of gulls and terns present, where they are found, and what kinds of habitat they are using. UAV surveys allowed the observation of gull and tern nests and chicks, from which productivity (number of chicks produced per nest) could be determined. This is the seventh year of colonial waterbird habitat effects monitoring during the construction period; surveys were also conducted from 2015 to 2020.



Helicopter Survey Route for Colonial Waterbirds in 2021



Islands Surveyed by an Unmanned Aerial Vehicle (Drone) for Colonial Waterbirds in 2021

What was found?

In 2021, low water levels in the Nelson River caused a deterioration of habitat conditions as summer progressed in the former Gull Rapids area. In response, colonial waterbirds, mostly ring-billed gulls and common terns, relocated to nearby islands upstream, as has been observed during previous years when habitat conditions are not suitable for them. One of the islands used was the constructed Habitat Compensation Island, upstream of the Project. The Habitat Compensation Island supported the highest number of common tern nests observed during the previous construction-phase surveys, as well as at least two ring-billed gull nests. The presence of successful nests documented by the UAV survey shows that the Habitat Compensation Island can provide suitable alternate nesting habitat in the former Gull Rapids area.



Common Terns Nesting on the Habitat Compensation Island during UAV Survey in July 2021

What does it mean?

The colonial waterbird population in the former Gull Rapids area and within the newly created reservoir is variable and is affected by water levels in the Nelson River and Project construction. As predicted, Project construction resulted in the loss and degradation of colonial waterbird habitat in the former Gull Rapids area and within the reservoir. Some of these habitat changes were successfully mitigated by the construction of the Habitat Compensation Island. Other, alternate habitat was occupied by gulls and terns upstream of the Project.

What will be done next?

The 2021 colonial waterbird survey was the final construction-phase survey for the Project. As the Project moves into the operation phase, colonial waterbird monitoring will continue during operation for the next 15 years. The next colonial waterbird survey is scheduled for 2022.

STUDY TEAM

We would like to thank Sherrie Mason and Rachel Boone of Manitoba Hydro for reviewing the report. We would also like to thank Dr. James Ehnes, ECOSTEM Ltd., for GIS supported study design and cartography and Unmanned Aerial Imaging Solutions Inc. (UAIS) for the Unmanned Aerial Vehicle (UAV) operations and photography.

Biologists, technicians, and other personnel who designed, participated in, and drafted the study results included:

- Robert Berger, Wildlife Resource Consulting Services MB Inc. (WRCS), Design, analysis, and reporting
- Mark Baschuk, WRCS, Survey personnel, analysis, and reporting
- Maryse Gagne, WRCS, Survey personnel
- Mike Connellan, Unmanned Aerial Imaging Solutions Inc., UAV photography

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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 construction phase of the Project is expected to be completed in spring 2022 and will then shift to the operation phase.

The *Keeyask Generation Project: Response to EIS Guidelines* (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* (TESV). 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 effects monitoring, for the construction phase of the Project.

The Project has the potential to affect colonial waterbird populations through alteration and loss of habitat, as well as sensory disturbance. Three species of colonial waterbirds - 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. Previous colonial waterbird surveys, conducted in 2001-03, 2006, 2011, and 2013-20 have counted between 1,900-7,200 ring-billed and herring gulls, and 10-200 common terns in the Gull Rapids area (KHLP 2012; Stantec 2014; Stantec 2015; WRCS 2016; WRCS 2017; WRCS 2018; WRCS 2019; WRCS 2020; WRCS 2021). 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).

In 2020, colonial waterbird habitat near the Project experienced large changes due to the water-up phase, which included the transfer of water into work areas contained by temporary and permanent structures up to the prevailing upstream water levels; this began on February 26, 2020 and finished by April 16, 2020. The water-up phase inundated some colonial waterbird habitat (island Wpt 83) immediately upstream of the Project powerhouse and spillway and made the constructed Habitat Compensation Island more suitable for colonial waterbirds by surrounding it with water and isolating it from mainland areas (Map 1). Additionally, following the 2020 nesting season, reservoir impoundment began on August 31, 2020 and was completed on September 5, 2020, which further altered some colonial waterbird habitat upstream of the Project.

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). If nesting is not taking place, the group of birds is a congregation. 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; such sites are referred to as loafing sites (Campbell and Lack 1985).

At Gull Rapids, the loss of foraging and breeding habitat, and habitat avoidance due to Project sensory disturbances were anticipated on the local colonial waterbird population during Project construction. Colonial waterbirds receive regulatory protection under the *Manitoba Wildlife Act* (2015) and the federal *Migratory Birds Convention Act* (1994). To monitor potential Project construction effects on colonial waterbirds in the Gull Rapids area, an Unmanned Aerial Vehicle (UAV or drone) was used to determine abundance, distribution, and habitat use of colonial waterbirds.

The primary goal of the colonial waterbird habitat effects monitoring is to evaluate how ring-billed gull and common tern breeding habitat distribution and abundance change due to the Project. Secondly, this study will evaluate how ring-billed gull and common tern habitat effectiveness changes due to Project sensory disturbance, by measuring changes in the distribution and abundance of ring-billed gulls and common terns in the vicinity of Project disturbances. This report contains the results of the seventh year (2021) of the construction-phase Colonial Waterbird Habitat Effects study.

2.0 METHODS

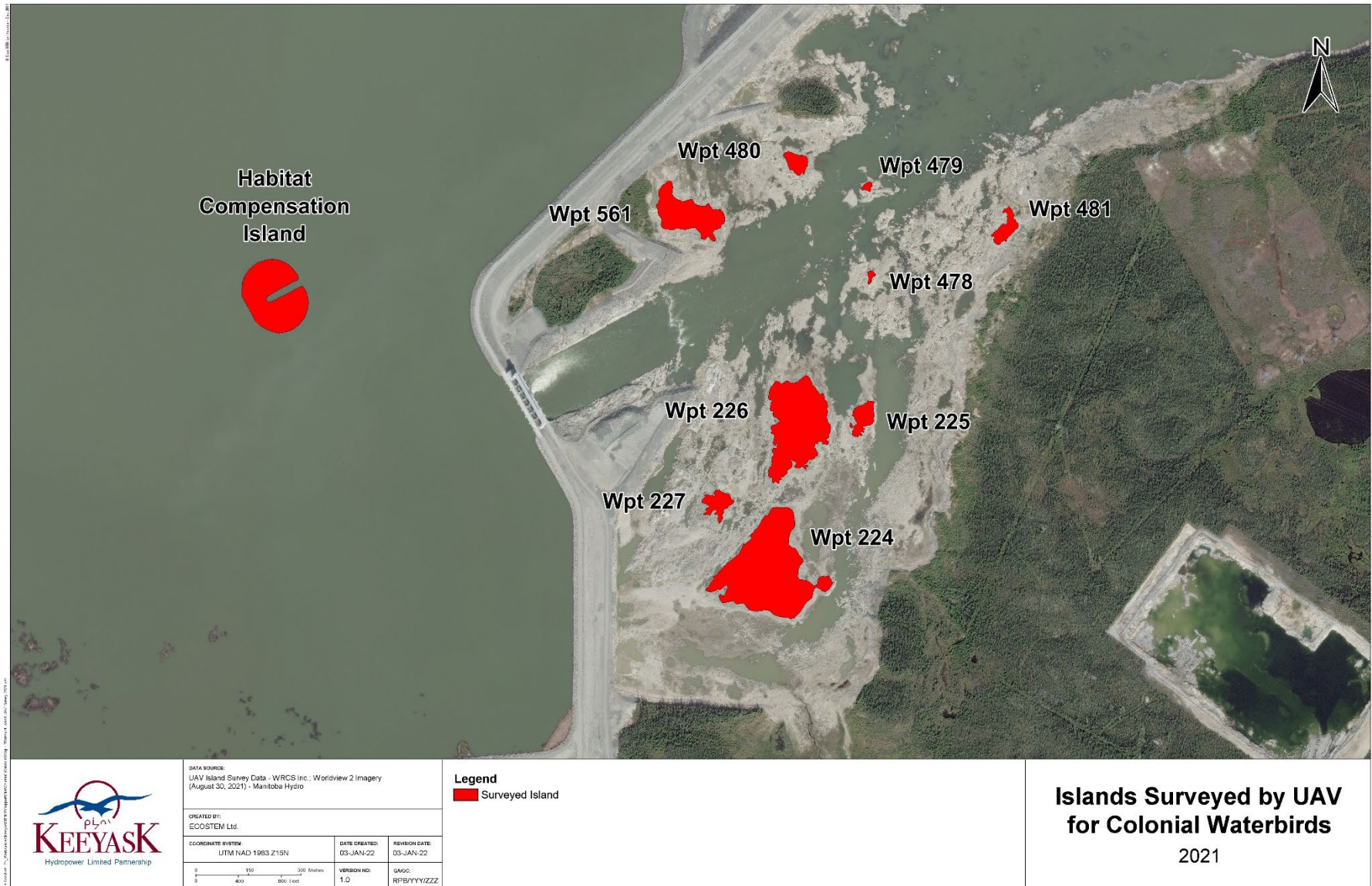
2.1 UNMANNED AERIAL VEHICLE SURVEYS

The distribution and abundance of colonial waterbirds in the former Gull Rapids area was monitored using photographs taken from an Unmanned Aerial Vehicle (UAV or drone). Unmanned Aerial Imaging Solutions Inc. (UAIS) was contracted to conduct UAV flights and produce high-resolution images of colonial waterbird colonies and potential nesting areas in the former Gull Rapids area.

UAIS deployed a DJI Mavic Pro quad-copter equipped with a 12 mega-pixel camera to survey islands in the former Gull Rapids area and the Habitat Compensation Island immediately upstream of the Project. Using the software Drone Link, camera parameters, flight path, speed, and altitude were programmed into the UAV to guide it during each flight mission. Nine islands within the Gull Rapids area, known to support colonial waterbirds, and the constructed Habitat Compensation Island, upstream of the Project, were photographed by the UAV platform in a grid pattern to produce overlapping photographs (Map 1). All flights were conducted at approximately 40 m above ground level (agl) to minimize disturbance to waterbird colonies.

UAV surveys were conducted during three periods in 2021: June 3 & 5, June 29-30, and July 20-21, to capture the nesting and brood rearing periods. During each of the survey periods, islands were photographed during the morning (0600-1200 hours) and afternoon (1200-1700 hours). Photographs taken in the morning and afternoon for each survey period were examined to determine the number of colonial waterbirds, nests, hatch-year birds (chicks), and species present on each of the nesting islands in the survey area. A single observer examined the photographs to maintain a consistent interpretation and reduce subjectivity.

The maximum number of birds/nests/chicks observed from the morning or afternoon photographs was used to determine the potential suitability of islands for nesting colonial waterbirds. To describe the difference between morning and afternoon bird abundances, the standard deviations of bird/nests/chicks were calculated using the morning and afternoon data from the same period.



Map 1: Islands Surveyed by UAV in the Former Gull Rapids Area in 2021

2.2 HELICOPTER SURVEY

Helicopter surveys were conducted to monitor the abundance, distribution, and habitat use of colonial waterbirds within and around the Project reservoir during the breeding season (Map 2). The survey area included the reservoir, the former Gull Rapids area, immediately downstream of the Project, and upstream to Clark Lake.

The first survey occurred on June 19, 2021 when gull and tern nests are typically initiated and most gulls and terns are incubating eggs, and the second survey occurred during the typical chick-rearing period on July 18, 2021.

The surveys were conducted when wind speeds were below 25 km/h and when rain or fog did not restrict observers' ability to count birds. The survey was flown at approximately 100 km/h, at elevations no less than 150 m agl, and at distances no closer than 300 m to minimize disturbance to waterbird colonies and avoid collisions with flying birds.

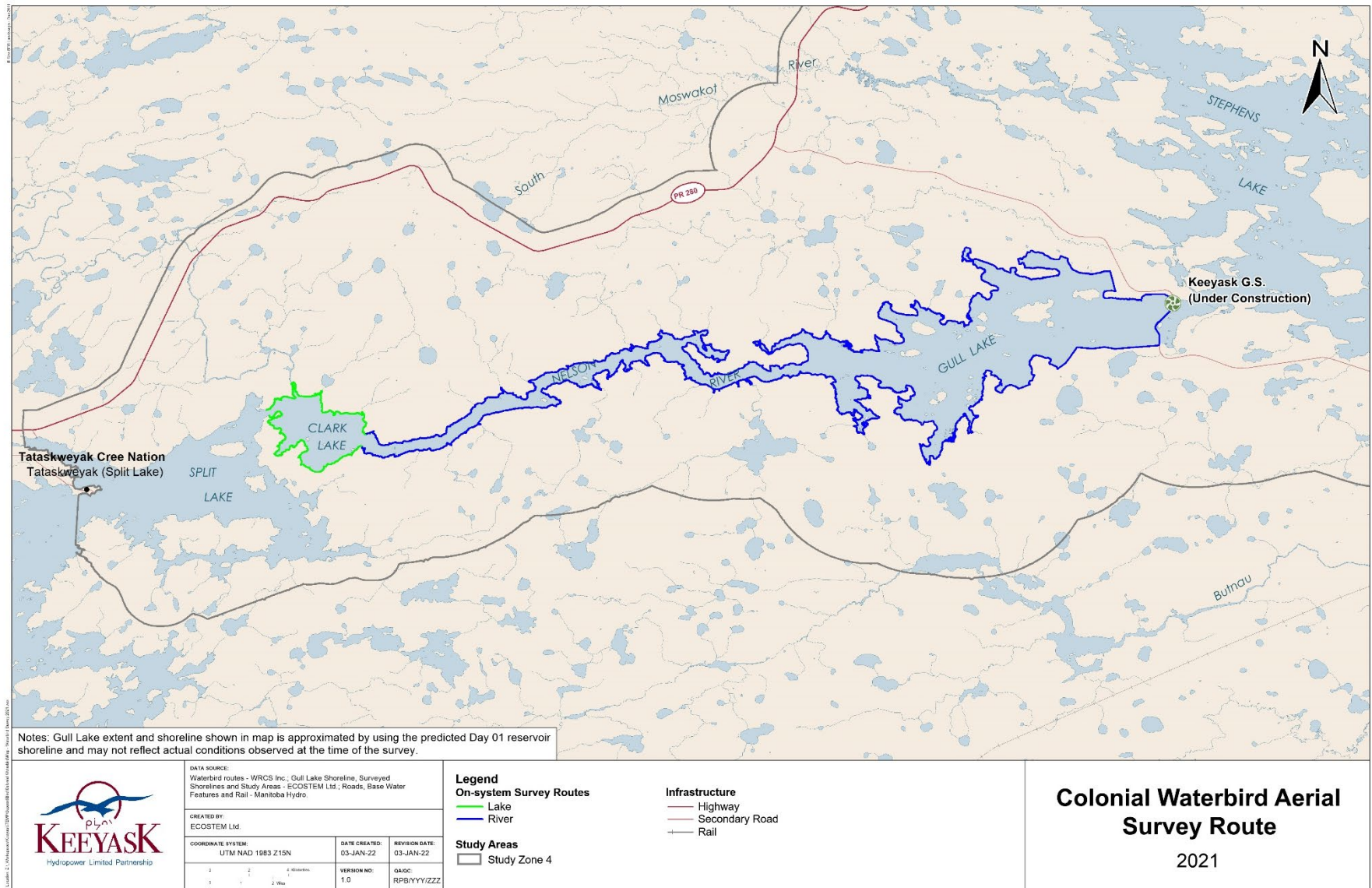
The aerial survey crew consisted of two observers and the helicopter pilot. The observers were seated in the front left and rear left seats and were responsible for preliminary counts of colonial waterbirds and photographing congregations using a Canon Rebel T6i, 24.2-megapixel camera. The helicopter followed a shoreline transect with open water on the left and terrestrial habitat on the right. When colonial waterbirds were spotted on rocky reefs in open water areas, the helicopter departed from the shoreline transect to investigate.

During the survey, numbers of waterbirds at all colony and congregation sites and all dispersed waterbirds were recorded along with their locations. Dispersed birds were single birds and flocks of waterbirds in flight. Congregated birds were groups of birds that showed no indication of nesting (*i.e.*, nests). A group of birds was considered a colony when there were at least two breeding pairs present and signs of nesting. When a congregation of waterbirds was observed the helicopter slowed and circled the site briefly for survey personnel to photograph and count individuals and nests. Preliminary abundance estimates were made by counting all nests and individuals. In-flight counts and photography were conducted quickly to minimize disturbing birds. All observations were georeferenced with a Garmin GPS 64 global positioning system (GPS). Notes on the terrestrial habitat of congregation sites were recorded and island size (ha) was determined from remotely-sensed data. Island sizes were classified as <0.1 ha, 0.1-0.9 ha, 1.0-1.9 ha, 2.0-2.9, 3.0-3.9 ha, and ≥ 4.0 ha.

Although individuals in small congregations of colonial waterbirds could be counted during the aerial survey, their numbers were determined with the in-flight photographs. Photographs were analysed to permit mark-up of the photo to facilitate the counting of adults sitting tight with no nest visible, birds flying, standing, or swimming, and occupied and unoccupied nests in the photographs. Evidence of nesting included presence of visible nests, adults sitting tight, or chicks. On a few occasions the in-flight photographs were of insufficient quality for birds to be counted, thus preliminary observer counts were included in lieu of photographic data in the final abundance estimates.



Photo 1: Colony of Ring-billed Gulls on an Island in the Former Gull Rapids Area on July 21, 2021



Map 2: Colonial Waterbird Helicopter Survey Route and Waterbody Classification in 2021

3.0 RESULTS

3.1 UNMANNED AERIAL VEHICLE SURVEY

As observed in previous years, ring-billed gulls were the most common species of colonial waterbird observed in the former Gull Rapids area in 2021. Most ring-billed gulls, nests, and chicks were observed on one island, Wpt 226 (Map 3), which has supported the majority of ring-billed gulls in previous years. The overall number of ring-billed gulls observed in the former Gull Rapids area was more variable in comparison to other years, with a relatively low number observed during the June 3 and July 21 surveys, but with relatively high numbers observed during the June 30 survey (Figure 1).

Ring-billed gull nests were observed on four of the islands surveyed in the former Gull Rapids area (Map 4). At least two nests were observed on the constructed Habitat Compensation Island. Most ring-billed gull nests, up to 1,518 nests, were observed on island Wpt 226 on the evening of June 24, 2021 (Map 4). Relatively few ring-billed gull chicks were observed (maximum 42), which were all on island Wpt 226. The number of chicks observed in 2021 was less than the number observed in 2018 (1,009) and 2016 (1,774), the same as observed in 2015 (42), and greater than the number observed in 2020 (0) and 2017 (0) (Appendix A).

Common terns were the second most abundant species of colonial waterbird observed in the former Gull Rapids area in 2021 (Table 10). The Habitat Compensation Island supported up to 171 nesting common terns and 11 chicks were observed on the island (Map 4). Nesting common terns have been observed in Gull Rapids in the past, and up to 105 nesting common terns were observed in 2018; but this was the first year that common tern chicks were observed (Appendix A).

The number of herring gulls, nests, and chicks observed in the former Gull Rapids area in 2021 were within the ranges observed during previous surveys from 2015-2020 (Photo 2; Appendix A).

Several flocks of American white pelicans were observed in the former Gull Rapids area in 2021. No signs of nesting were observed, and the greatest number (44) was observed during the July 21 survey (Table 1; Map 3).

Table 1: Maximum Number (Standard Deviation) of Colonial Waterbirds, Nests, and Chicks Observed by UAV in the Morning/Afternoon on Islands in the Former Gull Rapids Area in 2021 for Each Survey Period

Observation	June 3	June 30	July 21
American White Pelican	0 (0)	22 (6)	44 (24)
Common Tern	3 (1)	57 (5)	109 (46)
Common Tern w. Nest	0 (0)	96 (0)	171 (19)
Common Tern Chick	0 (0)	0 (0)	11 (8)
Herring Gull	35 (5)	36 (4)	55 (6)
Herring Gull w. Nest	48 (3)	26 (6)	0 (0)
Herring Gull Chick	0 (0)	16 (5)	16 (7)
Ring-billed Gull	1,259 (132)	3,336 (1,244)	2,436 (752)
Ring-billed Gull w. Nest	282 (32)	1,566 (247)	11 (6)
Ring-billed Gull Chick	0 (0)	0 (0)	42 (2)

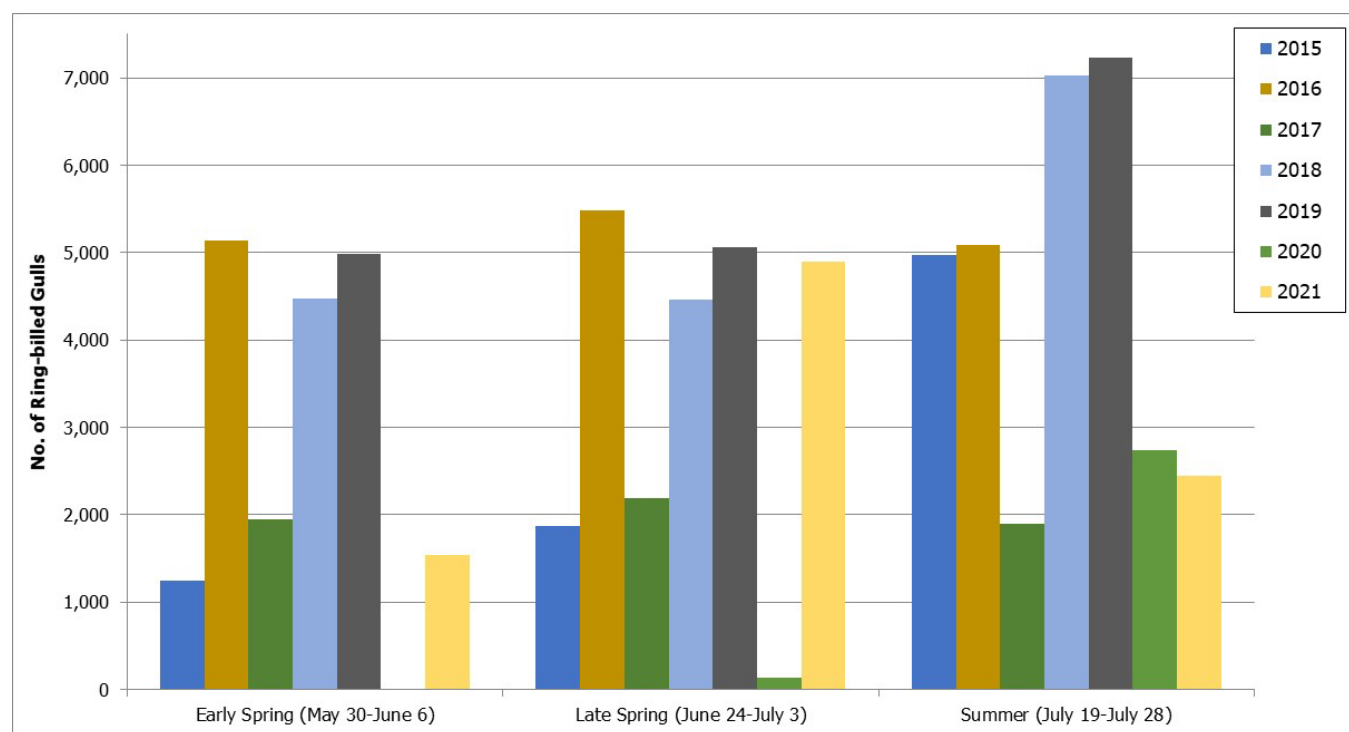
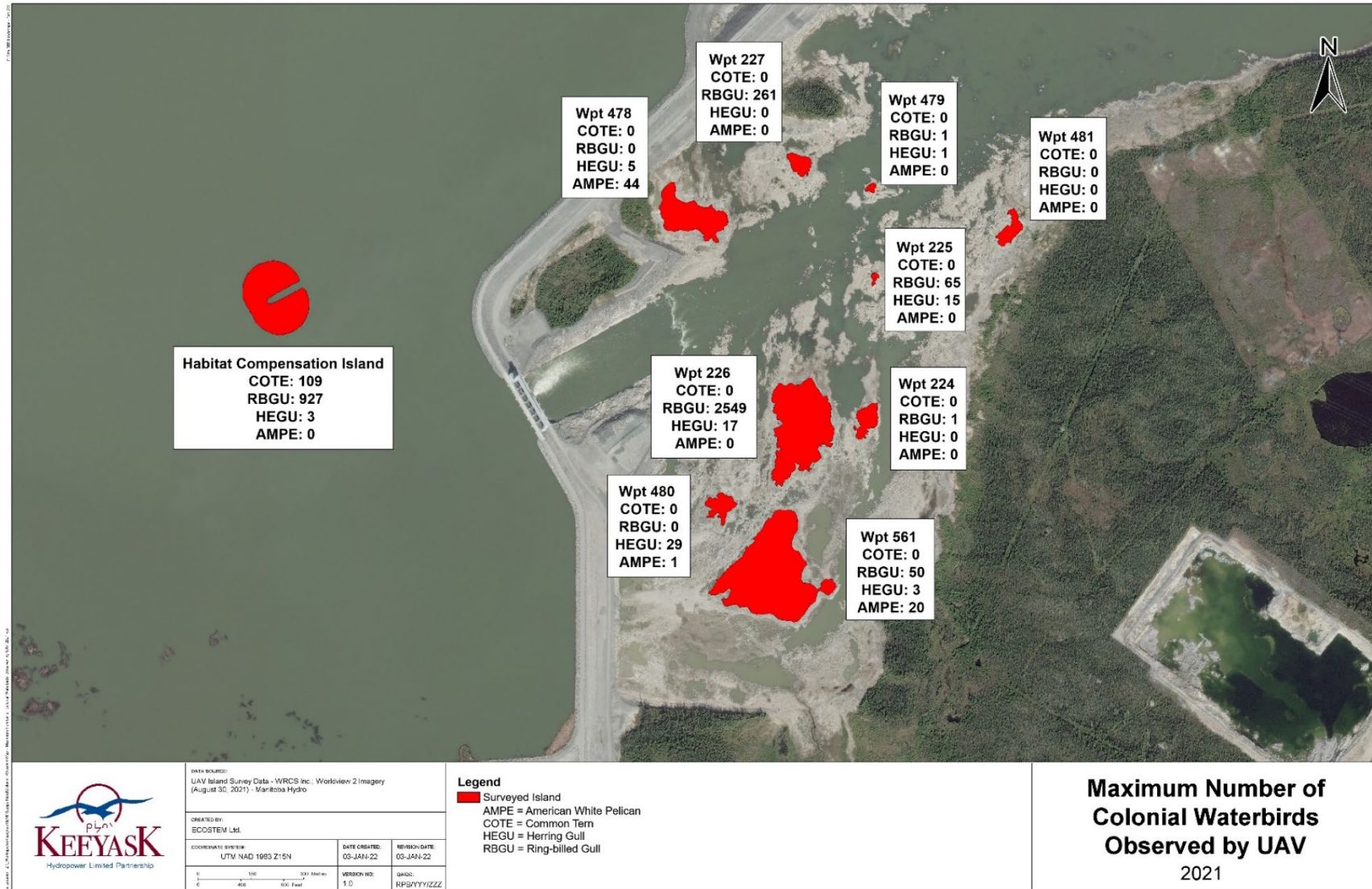
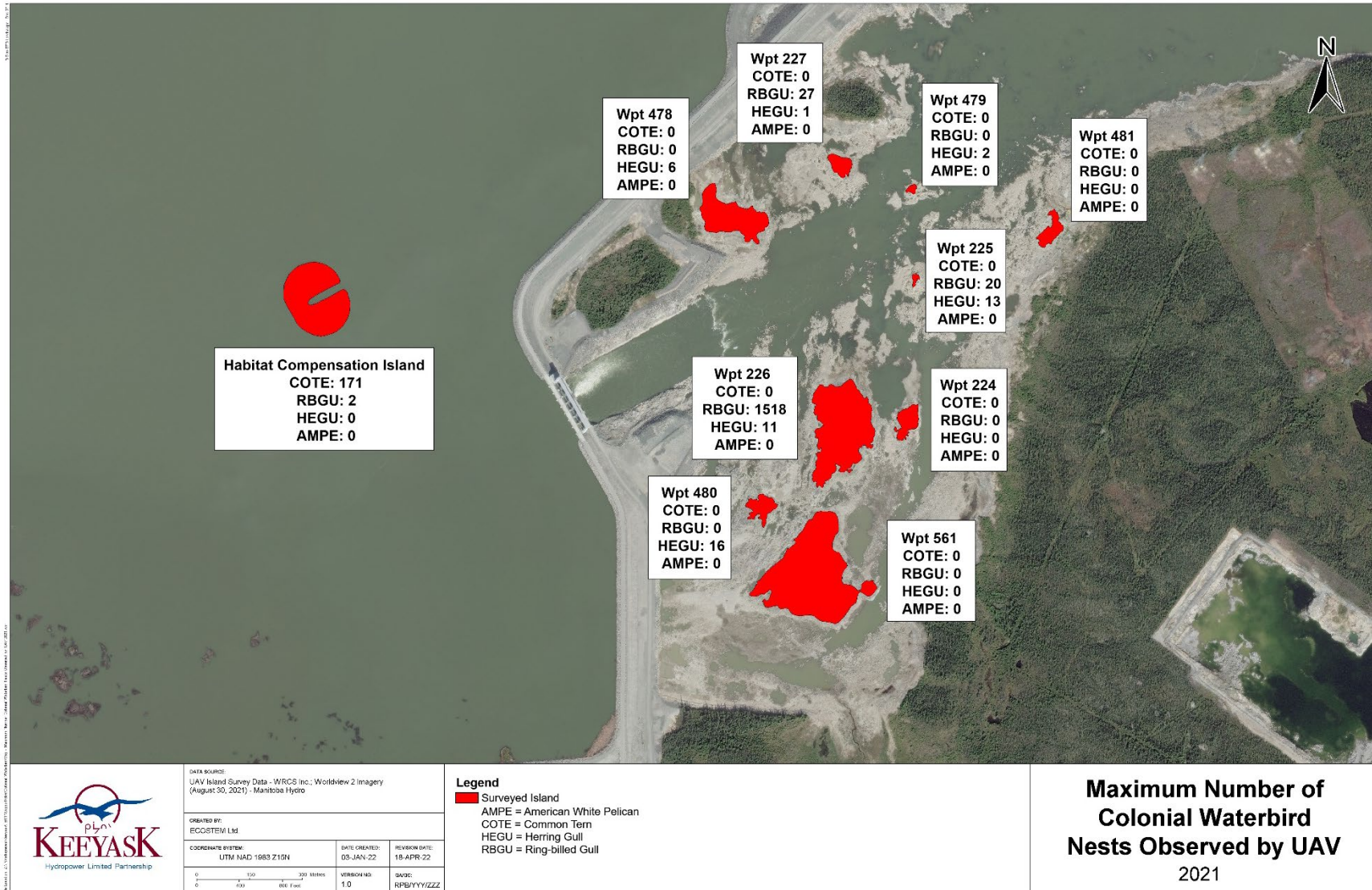


Figure 1: Total Number of Ring-billed Gulls Observed in the Former Gull Rapids Area by UAV During Early Spring, Late Spring, and Summer Surveys from 2015-2021. *Note that the early spring survey was not conducted in 2020.



Note: the maximum number of colonial waterbirds was selected from pooled data from all survey periods (June 3, June 30, July 21) and morning/afternoon periods.

Map 3: Maximum Number of Colonial Waterbirds Observed on Each Island by UAV in the Former Gull Rapids Area in 2021



Note: the maximum number of colonial waterbird nests was selected from pooled data from all survey periods (June 3, June 30, July 21) and morning/afternoon periods.

Map 4: Maximum Number of Colonial Waterbird Nests Observed on Each Island by UAV in the Former Gull Rapids Area in 2021



Photo 2: Common Tern with Two Chicks on the Habitat Compensation Island, July 21, 2021

3.2 HELICOPTER SURVEY

Five species of colonial waterbirds were observed during the 2021 helicopter surveys of the reservoir and surrounding area (Table 2). During both helicopter surveys, in June and July, ring-billed gulls were the most abundant colonial waterbird, with common terns being the second most abundant (Table 2). American white pelican, Bonaparte's gull, and herring gull were less abundant, which was consistent with the findings from previous construction monitoring surveys (Appendix B).

Table 2: Colonial Waterbird Abundance Observed During Helicopter Surveys in 2021

Observation	June 19				July 18			
	Colony	Congregation	Dispersed	Total	Colony	Congregation	Dispersed	Total
Ring-billed Gull	769	3,536	265	4,570	0	2,882	300	3,182
Ring-billed Gull Chick	0	0	0	0	0	70	0	70
Common Tern	0	78	13	91	0	780	140	920
Herring Gull	33	31	0	64	0	26	1	27
Herring Gull Chick	0	0	0	0	0	2	0	2
American White Pelican	0	22	21	43	0	195	3	198
Bonaparte's Gull	0	0	0	0	0	0	1	1
Total	802	3,667	299	4,768	0	3,955	445	4,400

3.2.1 RING-BILLED GULL

Ring-billed gulls were the most common species of colonial waterbird observed in the reservoir and surrounding area in 2021. The total number of ring-billed gulls decreased slightly from June to July, which differed from the previous findings of the surveys conducted from 2015-2019 but was consistent with the findings from 2020 (Figure 2; Table 2; Appendix B).

In June 2021, ring-billed gulls were observed congregating at 14 sites and nesting at 3 sites in and around the reservoir (Map 5). One of the nesting sites included a small island (Wpt 826) that had been recently formed due to reservoir filling, located directly upstream of the Project. The other colonies were located on island Wpt 226 and Wpt 225 in the former Gull Rapids area, where nesting ring-billed gulls have been observed during previous surveys (Map 5).

In July 2021, ring-billed gulls were observed congregating at 24 sites and no nesting was observed (Map 6). Similar to previous surveys, island Wpt 226 supported the greatest number of ring-billed gulls in the area, with 71% of the total number observed in June and 51% in July (Table 3). The Habitat Compensation Island (Wpt 837) supported a relatively high number of ring-billed gulls during both the June and July surveys (Table 3).

No ring-billed gull nesting was observed in July 2021. Up to 70 ring-billed gull chicks were observed on island Wpt 826 (Table 3).

Of the 16 islands where ring-billed gulls were observed in June 2021, 9 (56%) had been used at least once in previous construction years (2015-2020) (Table 4). In July, of the 14 islands used, 8 (57%) were used at least once in previous construction years (2015-2020) (Table 4).

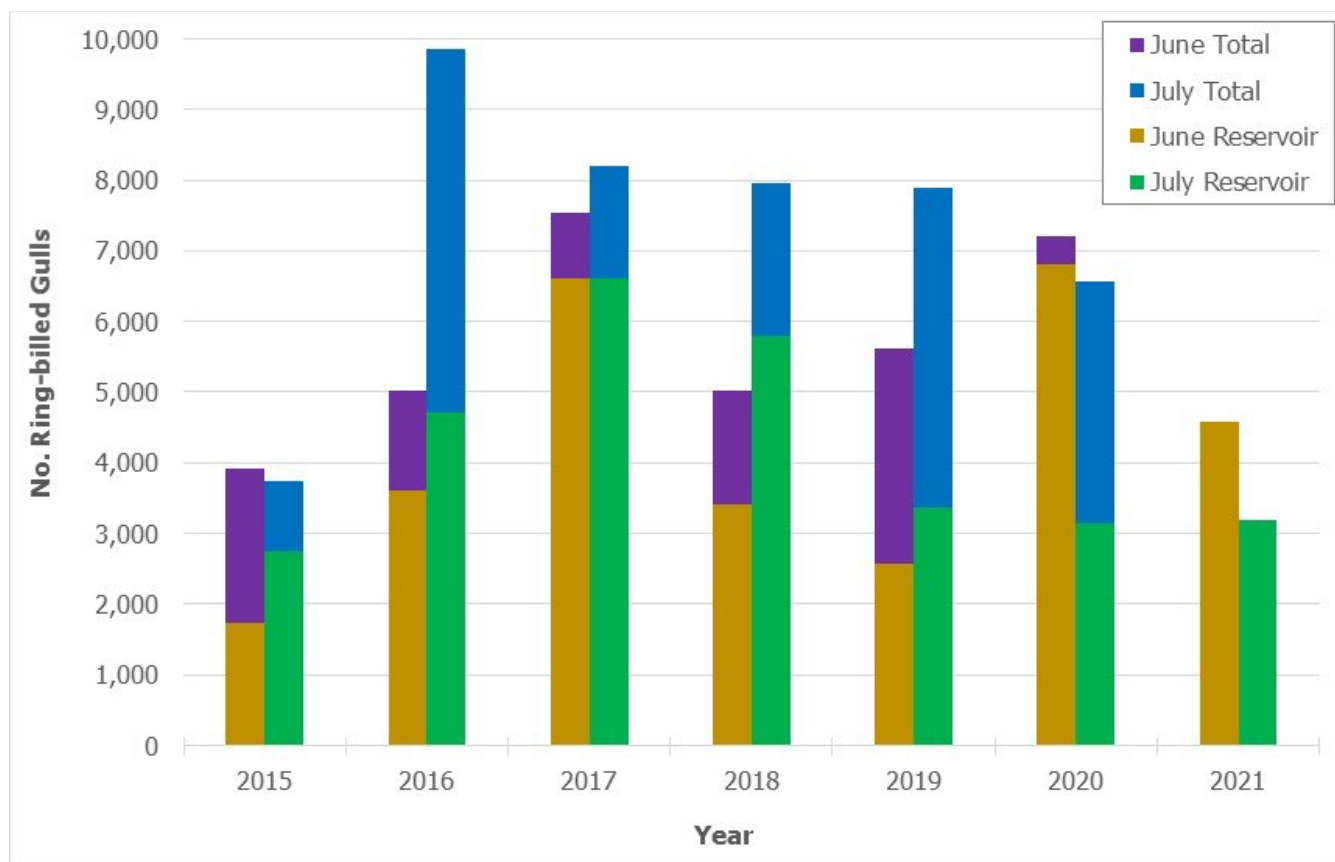
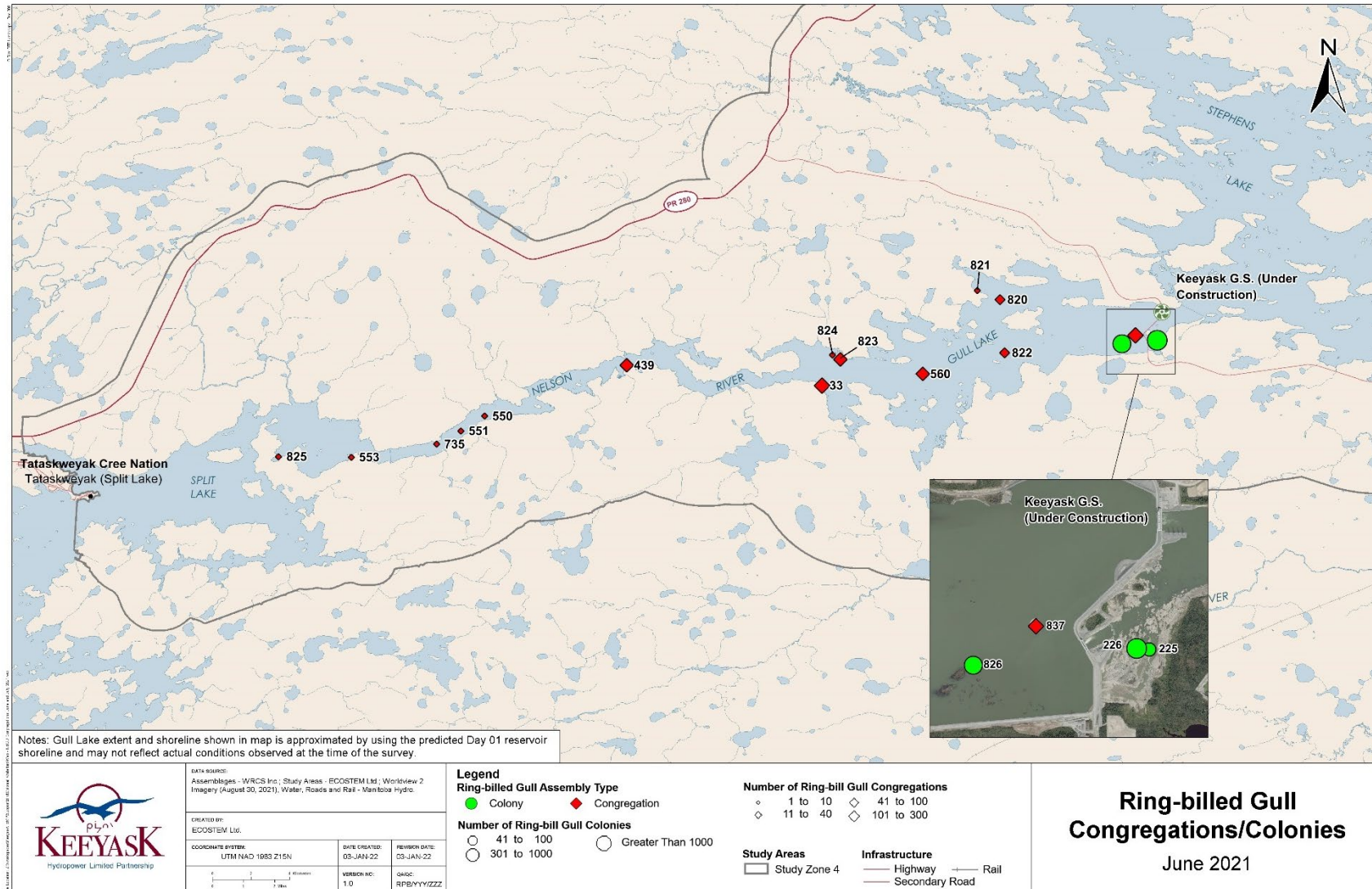
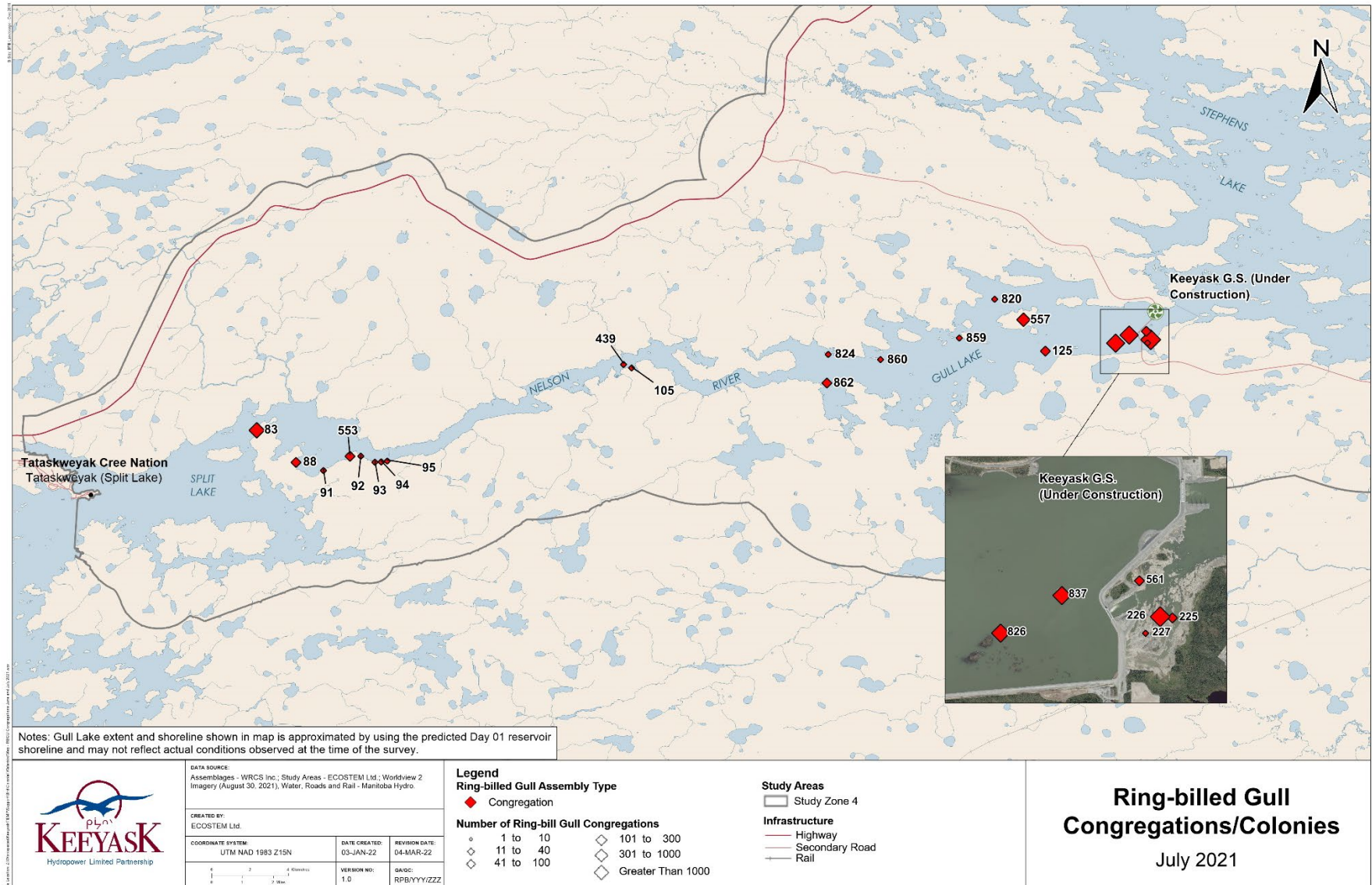


Figure 2: Number of Ring-billed Gulls Observed in the Reservoir (including the Former Gull Rapids Area and Clark Lake) and Total Study Area (Study Zone 5) During Helicopter Surveys in June and July from 2015 to 2021. *Note: Only the reservoir, former Gull Rapids area, and Clark Lake were surveyed in 2021.



Map 5: Ring-billed Gull Colonies and Congregations Observed in and around the Reservoir During Helicopter Surveys in June 2021



Map 6: Ring-billed Gull Colonies and Congregations Observed in and around the Reservoir During Helicopter Surveys in July 2021

Table 3: Ring-billed Gull Congregations/Colonies Observed During the Helicopter Surveys in 2021

Waypoint	June				July			
	Adults (No Nest)	Occupied Nests	Total Adults	Total Chicks	Adults (No Nest)	Occupied Nests	Total Adults	Total Chicks
33	120	0	120	0	0	0	0	0
60	0	0	0	0	10	0	10	0
65	0	0	0	0	8	0	8	0
83	0	0	0	0	120	0	120	0
88	0	0	0	0	18	0	18	0
91	0	0	0	0	10	0	10	0
92	0	0	0	0	3	0	3	0
93	0	0	0	0	4	0	4	0
94	0	0	0	0	4	0	4	0
95	0	0	0	0	1	0	1	0
105	0	0	0	0	6	0	6	0
108	0	0	0	0	40	0	40	0
125	0	0	0	0	15	0	15	0
225	34	18	52	0	36	0	36	0
226	2,461	609	3,070	0	1,479	0	1,479	0
227*	0	0	0	0	7	0	7	0
439	76	0	76	0	10	0	10	0
550	6	0	6	0	0	0	0	0
551	2	0	2	0	0	0	0	0
553	1	0	1	0	35	0	35	0
557	0	0	0	0	60	0	60	0
560	71	0	71	0	0	0	0	0
561	0	0	0	0	19	0	19	0
735	3	0	3	0	0	0	0	0
820	12	0	12	0	8	0	8	0
821	3	0	3	0	0	0	0	0
822	14	0	14	0	0	0	0	0
823	57	0	57	0	0	0	0	0
824	6	0	6	0	1	0	1	0
825	3	0	3	0	0	0	0	0
826	371	142	513	0	322	0	322	70
837*	296	0	296	0	666	0	666	0
Total	3,678	627	4,305	0	2,882	0	2,882	70

Table 4: Waterbody Classification and Island Use by Ring-billed Gulls in June and July 2021

Island	Gathering	Month	System	Flow	Size Class	Island Habitat	Island Size Class (ha)	Years Used 2015-2021
826	Colony	June	On-system	River	>1,000	Floating peat	<0.1	1
225	Colony	June	On-system	River	>1,000	Exposed bedrock	0.1-0.9	7
226	Colony	June	On-system	River	>1,000	50% rock, 50% shrub/deadfall	1.0-1.9	7
550	Congregation	June	On-system	River	>1,000	Exposed bedrock	<0.1	4
551	Congregation	June	On-system	River	>1,000	Exposed bedrock	<0.1	3
553	Congregation	June	On-system	Lake	>1,000	Boulders	<0.1	4
735	Congregation	June	On-system	River	>1,000	Boulders	<0.1	3
821	Congregation	June	On-system	River	>1,000	Floating peat	<0.1	1
822	Congregation	June	On-system	River	>1,000	Floating peat	<0.1	1
823	Congregation	June	On-system	River	>1,000	Floating peat	<0.1	1
824	Congregation	June	On-system	River	>1,000	Floating peat	<0.1	1
826	Congregation	June	On-system	River	>1,000	Floating peat	<0.1	1
560	Congregation	June	On-system	River	>1,000	Treed/cleared	>4.0	4
225	Congregation	June	On-system	River	>1,000	Exposed bedrock	0.1-0.9	7
825	Congregation	June	On-system	Lake	>1,000	Exposed bedrock	0.1-0.9	1
226	Congregation	June	On-system	River	>1,000	50% rock, 50% shrub/deadfall	1.0-1.9	7
820	Congregation	June	On-system	River	>1,000	Treed	1.0-1.9	1
837	Congregation	June	On-system	River	>1,000	Habitat Compensation Island, gravel	1.0-1.9	2
33	Congregation	June	On-system	River	>1,000	Shoreline	NA	NA
439	Congregation	June	On-system	River	>1,000	Shoreline	NA	NA
1	Dispersed	June	On-system	River	>1,000	NA	NA	NA
2	Dispersed	June	On-system	River	>1,000	NA	NA	NA
3	Dispersed	June	On-system	River	>1,000	NA	NA	NA
5	Dispersed	June	On-system	River	>1,000	NA	NA	NA
9	Dispersed	June	On-system	River	>1,000	NA	NA	NA
10	Dispersed	June	On-system	River	>1,000	NA	NA	NA
13	Dispersed	June	On-system	River	>1,000	NA	NA	NA
14	Dispersed	June	On-system	River	>1,000	NA	NA	NA
15	Dispersed	June	On-system	River	>1,000	NA	NA	NA
18	Dispersed	June	On-system	River	>1,000	NA	NA	NA
19	Dispersed	June	On-system	River	>1,000	NA	NA	NA
23	Dispersed	June	On-system	River	>1,000	NA	NA	NA
24	Dispersed	June	On-system	River	>1,000	NA	NA	NA
25	Dispersed	June	On-system	River	>1,000	NA	NA	NA
27	Dispersed	June	On-system	River	>1,000	NA	NA	NA
28	Dispersed	June	On-system	River	>1,000	NA	NA	NA
29	Dispersed	June	On-system	River	>1,000	NA	NA	NA

Island	Gathering	Month	System	Flow	Size Class	Island Habitat	Island Size Class (ha)	Years Used 2015-2021
32	Dispersed	June	On-system	River	>1,000	NA	NA	NA
34	Dispersed	June	On-system	River	>1,000	NA	NA	NA
35	Dispersed	June	On-system	River	>1,000	NA	NA	NA
37	Dispersed	June	On-system	River	>1,000	NA	NA	NA
43	Dispersed	June	On-system	River	>1,000	NA	NA	NA
44	Dispersed	June	On-system	River	>1,000	NA	NA	NA
45	Dispersed	June	On-system	River	>1,000	NA	NA	NA
46	Dispersed	June	On-system	Lake	>1,000	NA	NA	NA
47	Dispersed	June	On-system	Lake	>1,000	NA	NA	NA
48	Dispersed	June	On-system	Lake	>1,000	NA	NA	NA
50	Dispersed	June	On-system	River	>1,000	NA	NA	NA
51	Dispersed	June	On-system	River	>1,000	NA	NA	NA
52	Dispersed	June	On-system	River	>1,000	NA	NA	NA
53	Dispersed	June	On-system	River	>1,000	NA	NA	NA
54	Dispersed	June	On-system	River	>1,000	NA	NA	NA
55	Dispersed	June	On-system	River	>1,000	NA	NA	NA
56	Dispersed	June	On-system	River	>1,000	NA	NA	NA
60	Dispersed	June	On-system	River	>1,000	NA	NA	NA
61	Dispersed	June	On-system	River	>1,000	NA	NA	NA
62	Dispersed	June	On-system	River	>1,000	NA	NA	NA
63	Dispersed	June	On-system	River	>1,000	NA	NA	NA
65	Dispersed	June	On-system	River	>1,000	NA	NA	NA
66	Dispersed	June	On-system	River	>1,000	NA	NA	NA
67	Dispersed	June	On-system	River	>1,000	NA	NA	NA
227	Congregation	July	On-system	River	>1,000	Exposed bedrock	<0.1	6
553	Congregation	July	On-system	Lake	>1,000	Boulders	<0.1	4
824	Congregation	July	On-system	River	>1,000	Treed	<0.1	1
826	Congregation	July	On-system	River	>1,000	Treed	<0.1	1
557	Congregation	July	On-system	River	>1,000	Treed/burned	>4.0	2
557	Congregation	July	On-system	River	>1,000	Treed/burned	>4.0	2
557	Congregation	July	On-system	River	>1,000	Treed/burned	>4.0	2
225	Congregation	July	On-system	River	>1,000	Exposed bedrock	0.1-0.9	7
439	Congregation	July	On-system	River	>1,000	50% bare rock, 50% grass	0.1-0.9	4
862	Congregation	July	On-system	River	>1,000	Treed	1.0-1.9	1
226	Congregation	July	On-system	River	>1,000	50% rock, 50% shrub/deadfall	1.0-1.9	7
561	Congregation	July	On-system	River	>1,000	Exposed bedrock	1.0-1.9	4
820	Congregation	July	On-system	River	>1,000	Treed	1.0-1.9	1
837	Congregation	July	On-system	River	>1,000	Habitat Compensation Island, gravel	1.0-1.9	2
859	Congregation	July	On-system	River	>1,000	Treed	2.0-2.9	1

Island	Gathering	Month	System	Flow	Size Class	Island Habitat	Island Size Class (ha)	Years Used 2015-2021
860	Congregation	July	On-system	River	>1,000	Treed	3.0-3.9	1
83	Congregation	July	On-system	Lake	>1,000	Shoreline	NA	NA
88	Congregation	July	On-system	Lake	>1,000	Shoreline	NA	NA
91	Congregation	July	On-system	Lake	>1,000	Shoreline	NA	NA
92	Congregation	July	On-system	River	>1,000	Shoreline	NA	NA
93	Congregation	July	On-system	River	>1,000	Shoreline	NA	NA
94	Congregation	July	On-system	River	>1,000	Shoreline	NA	NA
94	Congregation	July	On-system	River	>1,000	Shoreline	NA	NA
95	Congregation	July	On-system	River	>1,000	Shoreline	NA	NA
105	Congregation	July	On-system	River	>1,000	Shoreline	NA	NA
125	Congregation	July	On-system	River	>1,000	Shoreline	NA	NA
50	Dispersed	July	On-system	River	>1,000	NA	NA	NA
51	Dispersed	July	On-system	River	>1,000	NA	NA	NA
52	Dispersed	July	On-system	River	>1,000	NA	NA	NA
53	Dispersed	July	On-system	River	>1,000	NA	NA	NA
54	Dispersed	July	On-system	River	>1,000	NA	NA	NA
57	Dispersed	July	On-system	River	>1,000	NA	NA	NA
58	Dispersed	July	On-system	River	>1,000	NA	NA	NA
61	Dispersed	July	On-system	River	>1,000	NA	NA	NA
62	Dispersed	July	On-system	River	>1,000	NA	NA	NA
63	Dispersed	July	On-system	River	>1,000	NA	NA	NA
68	Dispersed	July	On-system	River	>1,000	NA	NA	NA
69	Dispersed	July	On-system	River	>1,000	NA	NA	NA
70	Dispersed	July	On-system	River	>1,000	NA	NA	NA
75	Dispersed	July	On-system	River	>1,000	NA	NA	NA
77	Dispersed	July	On-system	River	>1,000	NA	NA	NA
78	Dispersed	July	On-system	Lake	>1,000	NA	NA	NA
79	Dispersed	July	On-system	Lake	>1,000	NA	NA	NA
80	Dispersed	July	On-system	Lake	>1,000	NA	NA	NA
82	Dispersed	July	On-system	Lake	>1,000	NA	NA	NA
84	Dispersed	July	On-system	Lake	>1,000	NA	NA	NA
86	Dispersed	July	On-system	Lake	>1,000	NA	NA	NA
89	Dispersed	July	On-system	Lake	>1,000	NA	NA	NA
100	Dispersed	July	On-system	River	>1,000	NA	NA	NA
103	Dispersed	July	On-system	River	>1,000	NA	NA	NA
106	Dispersed	July	On-system	River	>1,000	NA	NA	NA
109	Dispersed	July	On-system	River	>1,000	NA	NA	NA
110	Dispersed	July	On-system	River	>1,000	NA	NA	NA
111	Dispersed	July	On-system	River	>1,000	NA	NA	NA
113	Dispersed	July	On-system	River	>1,000	NA	NA	NA

Island	Gathering	Month	System	Flow	Size Class	Island Habitat	Island Size Class (ha)	Years Used 2015-2021
114	Dispersed	July	On-system	River	>1,000	NA	NA	NA
116	Dispersed	July	On-system	River	>1,000	NA	NA	NA
118	Dispersed	July	On-system	River	>1,000	NA	NA	NA
121	Dispersed	July	On-system	River	>1,000	NA	NA	NA
122	Dispersed	July	On-system	River	>1,000	NA	NA	NA
126	Dispersed	July	On-system	River	>1,000	NA	NA	NA
127	Dispersed	July	On-system	River	>1,000	NA	NA	NA
128	Dispersed	July	On-system	River	>1,000	NA	NA	NA

*Nesting observed during the UAV survey, see Section 3.1



Photo 3: Ring-billed Gulls Loafing on the Habitat Compensation Island, July 18, 2021

3.2.2 COMMON TERN

Common terns were the second most abundant species of colonial waterbird observed in and around the reservoir in 2021 (Table 2).

The number of common terns observed in June and July 2021 were within the ranges observed during previous surveys from 2015-2020 (Figure 3). The total number of common terns counted increased substantially in July and was the second greatest number recorded during construction surveys from 2015-2020 (Figure 3).

In June 2021, common terns were observed congregating at three sites and no nesting was observed (Map 7; Table 5). The two largest congregations observed in June 2021 (Wpt 819 and 826) were located on floating peat islands within Gull Lake that were created with the newly formed reservoir and had not been used previously (Photo 4; Map 7; Table 6).

In July 2021, common terns were observed congregating at 16 sites and no nesting was observed during the helicopter survey (Map 8; Table 5). However, common terns were observed nesting on the constructed Habitat Compensation Island during the UAV survey (see Section 3.1). The largest congregations of common terns were observed on a floating peat island in Gull Lake (Wpt 124) and on the Habitat Compensation Island (Wpt 837) (Map 8; Table 5; Table 6).

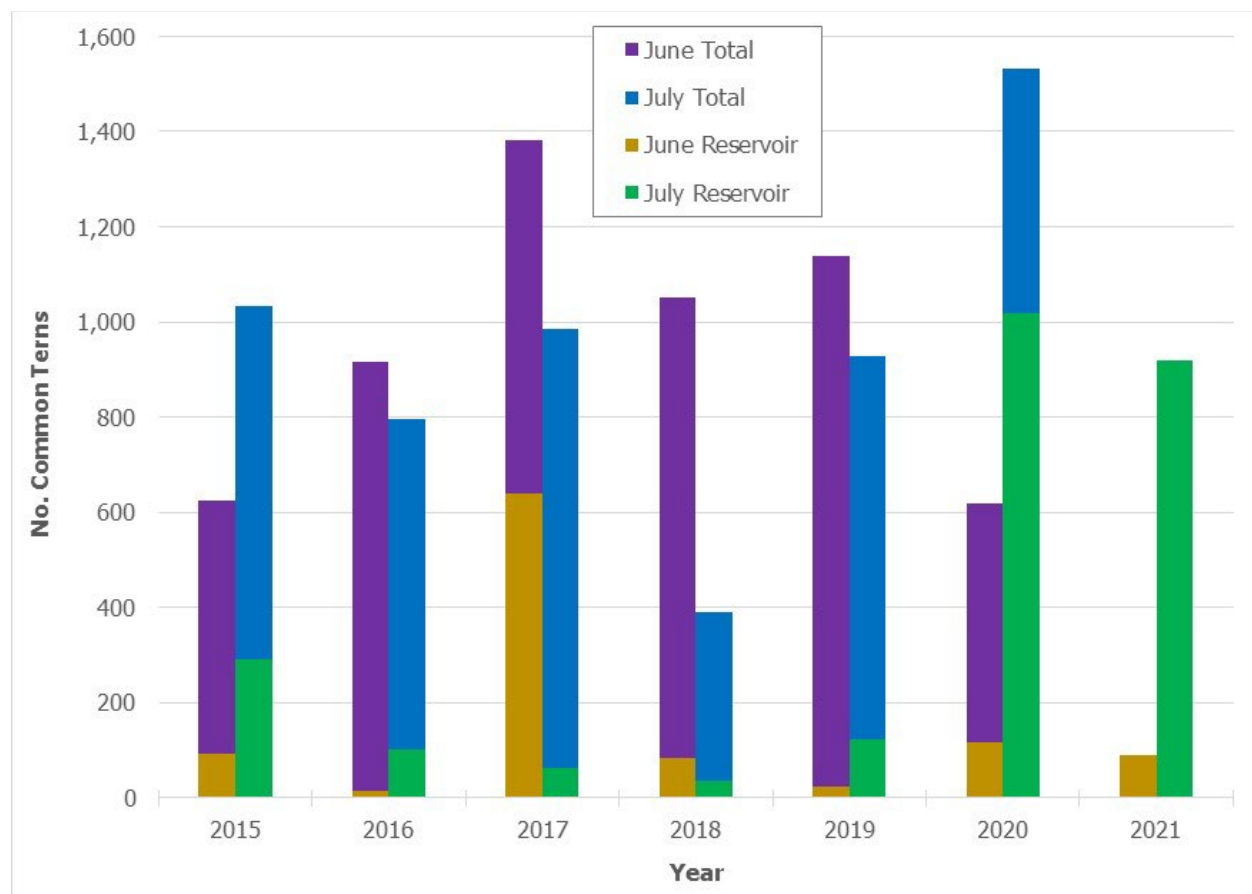
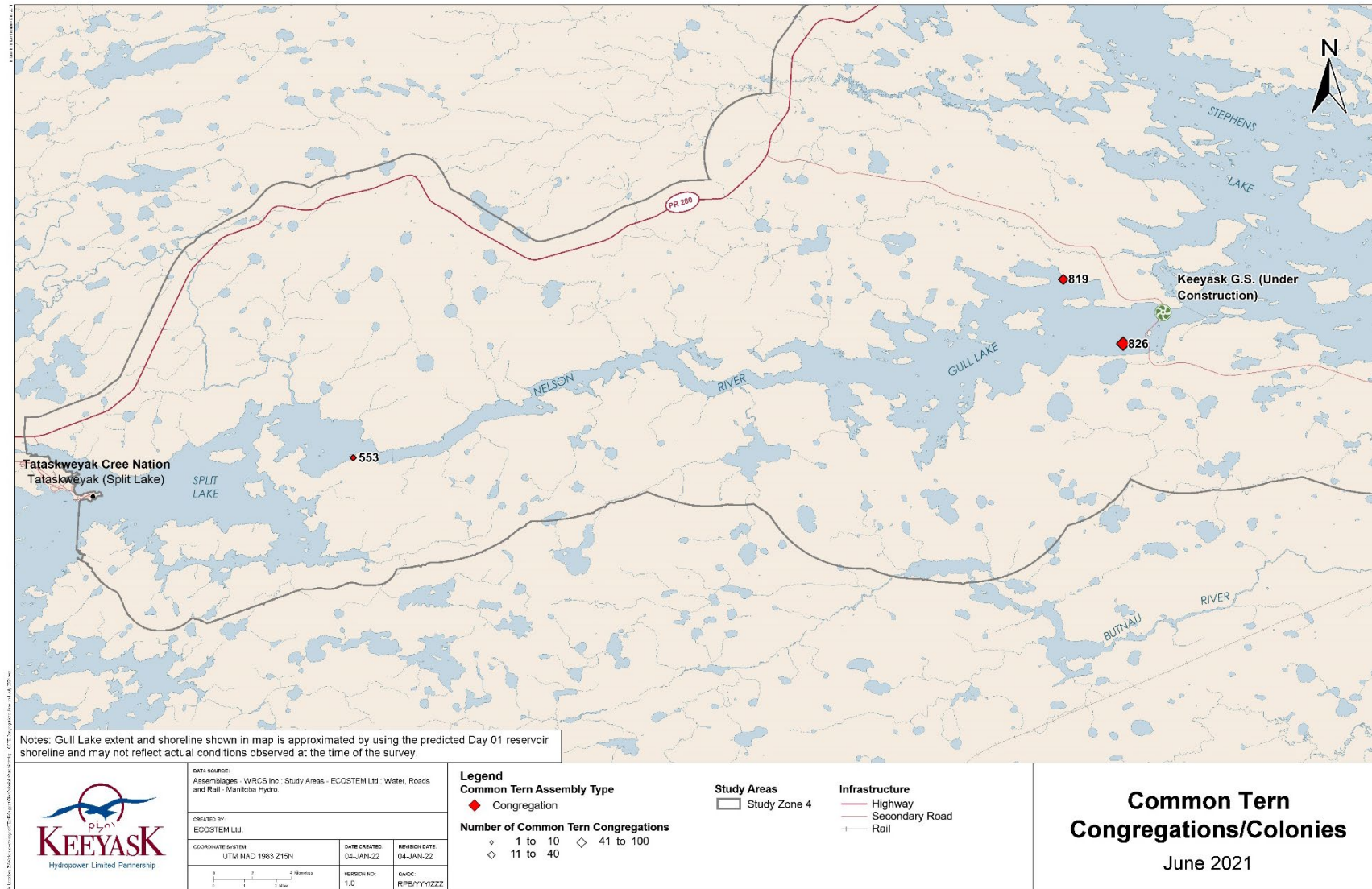
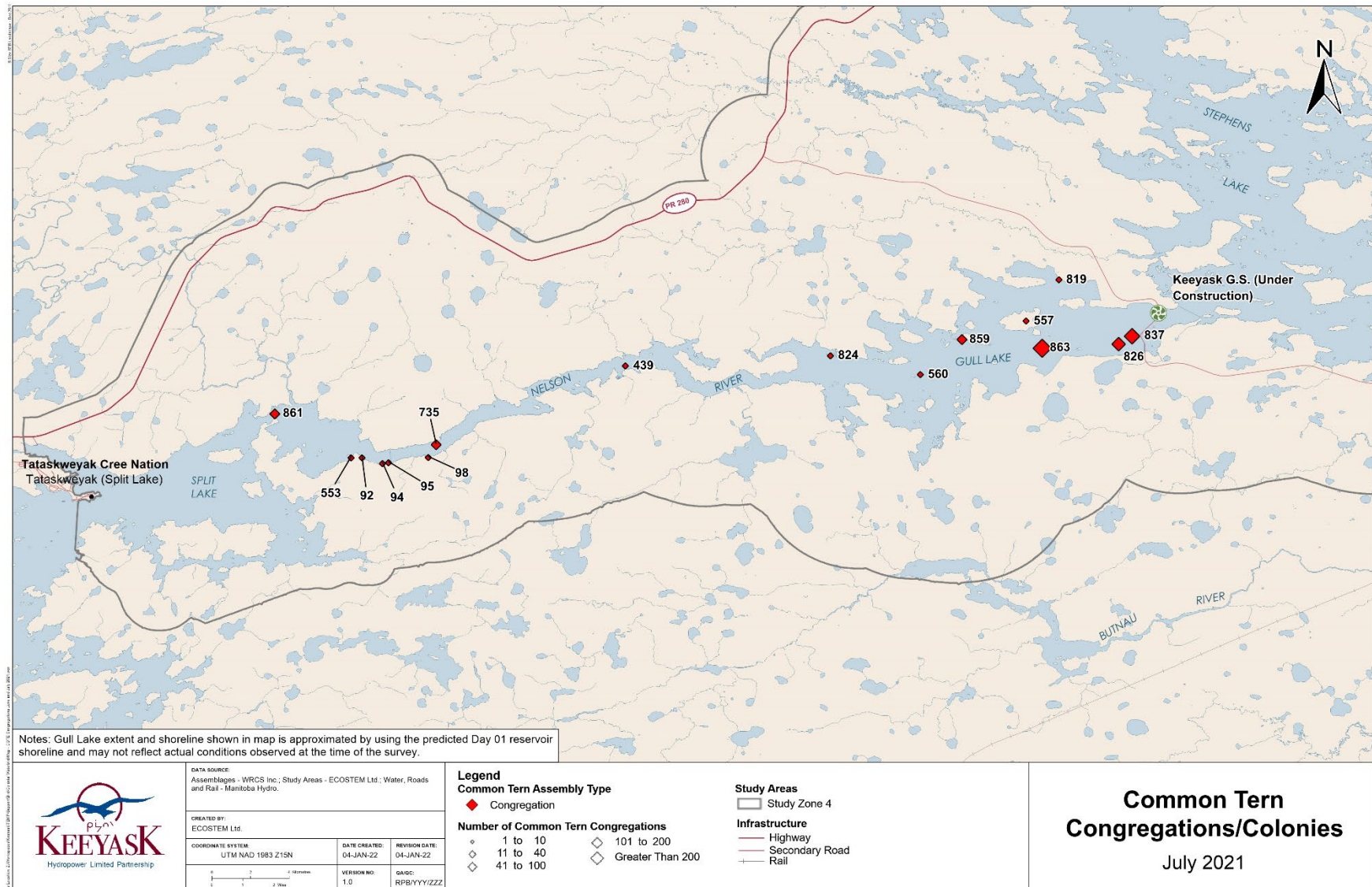


Figure 3: Number of Common Terns Observed in the Reservoir (including the Former Gull Rapids Area and Clark Lake) and Total Study Area (Study Zone 5) During Helicopter Surveys in June and July from 2015 to 2021. *Note: Only the reservoir, former Gull Rapids area, and Clark Lake were surveyed in 2021.



Map 7: Common Tern Colonies and Congregations Observed in and around the Reservoir During Helicopter Surveys in June 2021



Map 8: Common Tern Colonies and Congregations Observed in and around the Reservoir During Helicopter Surveys in July 2021

Table 5: Common Tern Congregations/Colonies Observed in and around the Reservoir During the Helicopter Surveys in 2021

Waypoint	June				July			
	Adults (No Nest)	Occupied Nests	Total Adults	Total Chicks	Adults (No Nest)	Occupied Nests	Total Adults	Total Chicks
60	0	0	0	0	30	0	0	0
81	0	0	0	0	25	0	0	0
92	0	0	0	0	6	0	0	0
94	0	0	0	0	4	0	0	0
95	0	0	0	0	2	0	0	0
98	0	0	0	0	2	0	0	0
124	0	0	0	0	420	0	0	0
439	0	0	0	0	2	0	0	0
553	1	0	0	0	3	0	0	0
557	0	0	0	0	5	0	0	0
560	0	0	0	0	1	0	0	0
735	0	0	0	0	26	0	0	0
819	20	0	0	0	5	0	0	0
824	0	0	0	0	1	0	0	0
826	57	0	0	0	65	0	0	0
837*	0	0	0	0	183	0	0	0
Total	78	0	0	0	780	0	0	0

*Nesting observed during the UAV survey, see Section 3.1

Table 6: Waterbody Classification and Island Use by Common Terns in June and July 2021

Island	Gathering	Month	System	Flow	Size Class	Island Habitat	Island Size Class (ha)	Years Used 2015-2021
553	Congregation	June	On-system	Lake	>1,000	Boulders	<0.1	4
819	Congregation	June	On-system	River	>1,000	Floating peat	<0.1	1
826	Congregation	June	On-system	River	>1,000	Floating peat	<0.1	1
1	Dispersed	June	On-system	River	>1,000	NA	NA	NA
3	Dispersed	June	On-system	River	>1,000	NA	NA	NA
4	Dispersed	June	On-system	River	>1,000	NA	NA	NA
12	Dispersed	June	On-system	River	>1,000	NA	NA	NA
25	Dispersed	June	On-system	River	>1,000	NA	NA	NA
26	Dispersed	June	On-system	River	>1,000	NA	NA	NA
52	Dispersed	June	On-system	River	>1,000	NA	NA	NA
57	Dispersed	June	On-system	River	>1,000	NA	NA	NA
64	Dispersed	June	On-system	River	>1,000	NA	NA	NA
861	Congregation	July	On-system	Lake	>1,000	Exposed bedrock	<0.1	1
863	Congregation	July	On-system	River	>1,000	Floating peat	<0.1	1
553	Congregation	July	On-system	Lake	>1,000	Boulders	<0.1	4
735	Congregation	July	On-system	River	>1,000	Boulders	<0.1	3
819	Congregation	July	On-system	River	>1,000	Floating peat	<0.1	1
824	Congregation	July	On-system	River	>1,000	Treed	<0.1	1
826	Congregation	July	On-system	River	>1,000	Treed	<0.1	1
837	Congregation	July	On-system	River	>1,000	Habitat Compensation Island, gravel	1.0-1.9	2
439	Congregation	July	On-system	River	>1,000	50% bare rock, 50% grass	0.1-0.9	4
859	Congregation	July	On-system	River	>1,000	Treed	2.0-2.9	1
557	Congregation	July	On-system	River	>1,000	Treed/burned	>4.0	2
560	Congregation	July	On-system	River	>1,000	Treed/cleared	>4.0	4
92	Congregation	July	On-system	River	>1,000	Shoreline	NA	NA
94	Congregation	July	On-system	River	>1,000	Shoreline	NA	NA
95	Congregation	July	On-system	River	>1,000	Shoreline	NA	NA
98	Congregation	July	On-system	River	>1,000	Shoreline	NA	NA
50	Dispersed	July	On-system	River	>1,000	NA	NA	NA
57	Dispersed	July	On-system	River	>1,000	NA	NA	NA
58	Dispersed	July	On-system	River	>1,000	NA	NA	NA
59	Dispersed	July	On-system	River	>1,000	NA	NA	NA
64	Dispersed	July	On-system	River	>1,000	NA	NA	NA
66	Dispersed	July	On-system	River	>1,000	NA	NA	NA
67	Dispersed	July	On-system	River	>1,000	NA	NA	NA
68	Dispersed	July	On-system	River	>1,000	NA	NA	NA

Island	Gathering	Month	System	Flow	Size Class	Island Habitat	Island Size Class (ha)	Years Used 2015-2021
70	Dispersed	July	On-system	River	>1,000	NA	NA	NA
71	Dispersed	July	On-system	River	>1,000	NA	NA	NA
72	Dispersed	July	On-system	River	>1,000	NA	NA	NA
73	Dispersed	July	On-system	River	>1,000	NA	NA	NA
75	Dispersed	July	On-system	River	>1,000	NA	NA	NA
77	Dispersed	July	On-system	River	>1,000	NA	NA	NA
84	Dispersed	July	On-system	Lake	>1,000	NA	NA	NA
85	Dispersed	July	On-system	Lake	>1,000	NA	NA	NA
87	Dispersed	July	On-system	Lake	>1,000	NA	NA	NA
89	Dispersed	July	On-system	Lake	>1,000	NA	NA	NA
90	Dispersed	July	On-system	Lake	>1,000	NA	NA	NA
99	Dispersed	July	On-system	River	>1,000	NA	NA	NA
102	Dispersed	July	On-system	River	>1,000	NA	NA	NA
110	Dispersed	July	On-system	River	>1,000	NA	NA	NA
111	Dispersed	July	On-system	River	>1,000	NA	NA	NA
112	Dispersed	July	On-system	River	>1,000	NA	NA	NA
113	Dispersed	July	On-system	River	>1,000	NA	NA	NA
115	Dispersed	July	On-system	River	>1,000	NA	NA	NA
117	Dispersed	July	On-system	River	>1,000	NA	NA	NA
119	Dispersed	July	On-system	River	>1,000	NA	NA	NA
120	Dispersed	July	On-system	River	>1,000	NA	NA	NA
123	Dispersed	July	On-system	River	>1,000	NA	NA	NA
126	Dispersed	July	On-system	River	>1,000	NA	NA	NA
127	Dispersed	July	On-system	River	>1,000	NA	NA	NA
128	Dispersed	July	On-system	River	>1,000	NA	NA	NA



Photo 4: Common Terns Congregating on a Recently formed Peat Island, July 18, 2021

3.2.3 HERRING GULL

The number of herring gulls observed in June 2021 was the greatest number observed in the reservoir and surrounding area during any of the previous construction surveys from 2015-2020 (Figure 4). The number observed during July decreased as has been observed during previous surveys and was within the range observed previously (Figure 4).

In June 2021, herring gulls were observed nesting on four islands within the former Gull Rapids area and congregating on six islands (Map 9; Table 7). All of the islands used by herring gulls in June were in the former Gull Rapids area and had been used at least once in previous construction years (2015-2020) (Map 9; Table 8).

In July 2021, herring gulls were observed congregating on four islands and no nesting was observed (Table 7). On one island in the former Gull Rapids area (Wpt 478) two herring gull chicks were observed. All of the islands used by herring gulls in July were in the former Gull Rapids area and had been used at least once in previous construction years (2015-2020) (Map 9; Table 8).

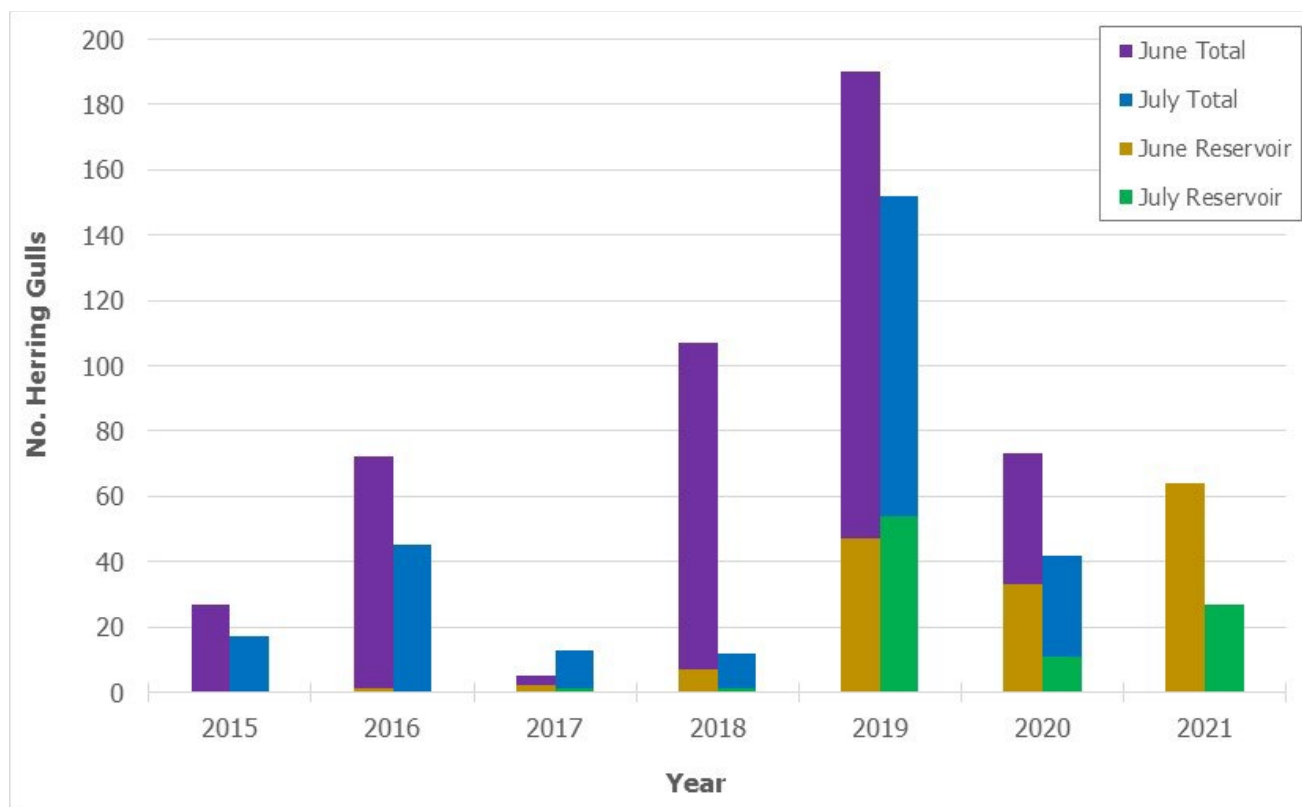
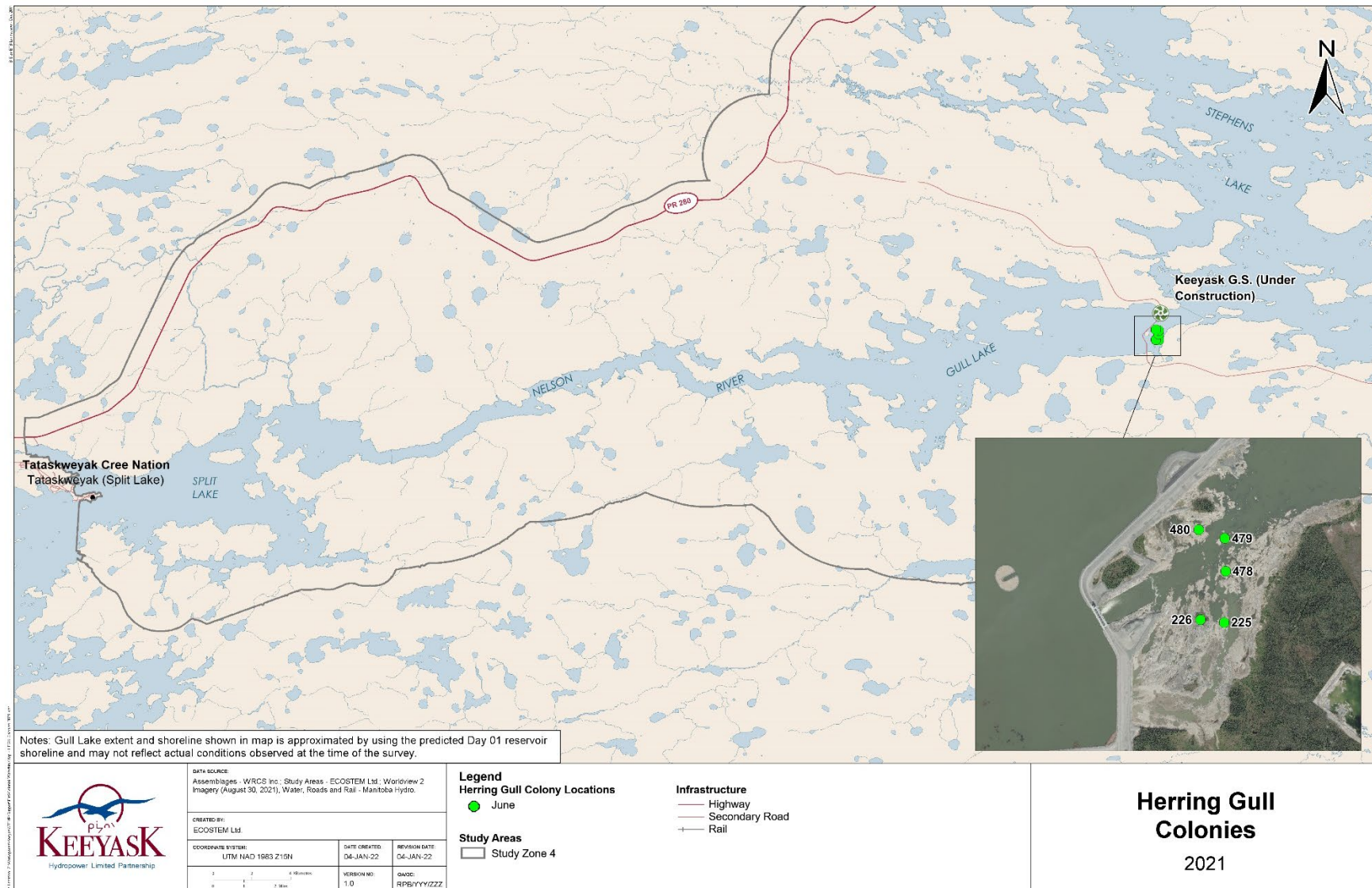


Figure 4: Number of Herring Gulls Observed in the Reservoir (including the Former Gull Rapids Area and Clark Lake) and Total Study Area (Study Zone 5) During Helicopter Surveys in June and July from 2015 to 2021. *Note: Only the reservoir, former Gull Rapids area, and Clark Lake were surveyed in 2021.



Map 9: Herring Gull Colonies Observed During Helicopter Surveys in 2021* Note: no active herring gull nests were observed in July.

Table 7: Herring Gulls and Colonies Observed in and around the Reservoir During the Helicopter Surveys in 2021

Waypoint	June				July			
	Adults (No Nest)	Occupied Nests	Total Adults	Total Chicks	Adults (No Nest)	Occupied Nests	Total Adults	Total Chicks
225	12	10	0	0	0	0	0	0
226	0	2	0	0	0	0	0	0
227*	3	0	0	0	0	0	0	0
478	6	6	0	0	5	0	0	2
479	2	4	0	0	1	0	0	0
480	19	0	0	0	15	0	0	0
481	0	0	0	0	5	0	0	0
Total	42	22	0	0	26	0	0	2

*Nesting observed during the UAV survey, see Section 3.1

Table 8: Waterbody Classification and Island Use by Herring Gulls in 2021

Island	Gathering	Month	System	Flow	Size Class	Island Habitat	Island Size Class (ha)	Years Used 2015-2021
478	Colony	June	On-system	River	>1,000	Exposed bedrock	<0.1	7
225	Colony	June	On-system	River	>1,000	Exposed bedrock	0.1-0.9	7
479	Colony	June	On-system	River	>1,000	Exposed bedrock	0.1-0.9	6
226	Colony	June	On-system	River	>1,000	50% rock, 50% shrub/deadfall	1.0-1.9	7
480	Congregation	June	On-system	River	>1,000	Exposed bedrock	0.1-0.9	6
227	Congregation	June	On-system	River	>1,000	Exposed bedrock	<0.1	6
478	Congregation	June	On-system	River	>1,000	Exposed bedrock	<0.1	7
479	Congregation	June	On-system	River	>1,000	Exposed bedrock	<0.1	7
225	Congregation	June	On-system	River	>1,000	Exposed bedrock	0.1-0.9	7
480	Congregation	June	On-system	River	>1,000	Exposed bedrock	0.1-0.9	6
478	Congregation	July	On-system	River	>1,000	Exposed bedrock	<0.1	7
479	Congregation	July	On-system	River	>1,000	Exposed bedrock	<0.1	7
481	Congregation	July	On-system	River	>1,000	Exposed bedrock	<0.1	3
480	Congregation	July	On-system	River	>1,000	Exposed bedrock	0.1-0.9	6
74	Dispersed	July	On-system	River	>1,000	NA	NA	NA

3.2.4 BONAPARTE'S GULL

A single Bonaparte's gull was observed near the reservoir in 2021. This is consistent with previous construction surveys (2015-2020) as Bonaparte's gulls are typically observed in off-system areas (Figure 5).



Figure 5: Number of Bonaparte's Gulls Observed in the Reservoir (including the Former Gull Rapids Area and Clark Lake) and Total Study Area (Study Zone 5) During Helicopter Surveys in June and July from 2015 to 2021. *Note: Only the reservoir, former Gull Rapids area, and Clark Lake were surveyed in 2021.

3.2.5 AMERICAN WHITE PELICAN

The number of American white pelicans observed in the regional study area in June 2021 was within the range that has been observed during previous construction surveys (Figure 6). In July 2021, the number of pelicans increased, and was within the range that has been observed during previous surveys (Figure 6).

The largest concentration of American white pelicans observed in June and July were observed in the former Gull Rapids area (Photo 5; Map 10; Table 9). American white pelicans were also concentrated in areas of fast flowing water on the Nelson River (Map 10).

All of the islands used by American white pelicans in June and July 2021 had been used at least once in previous years (2015-2020) and primarily consisted of exposed bedrock (Table 10).

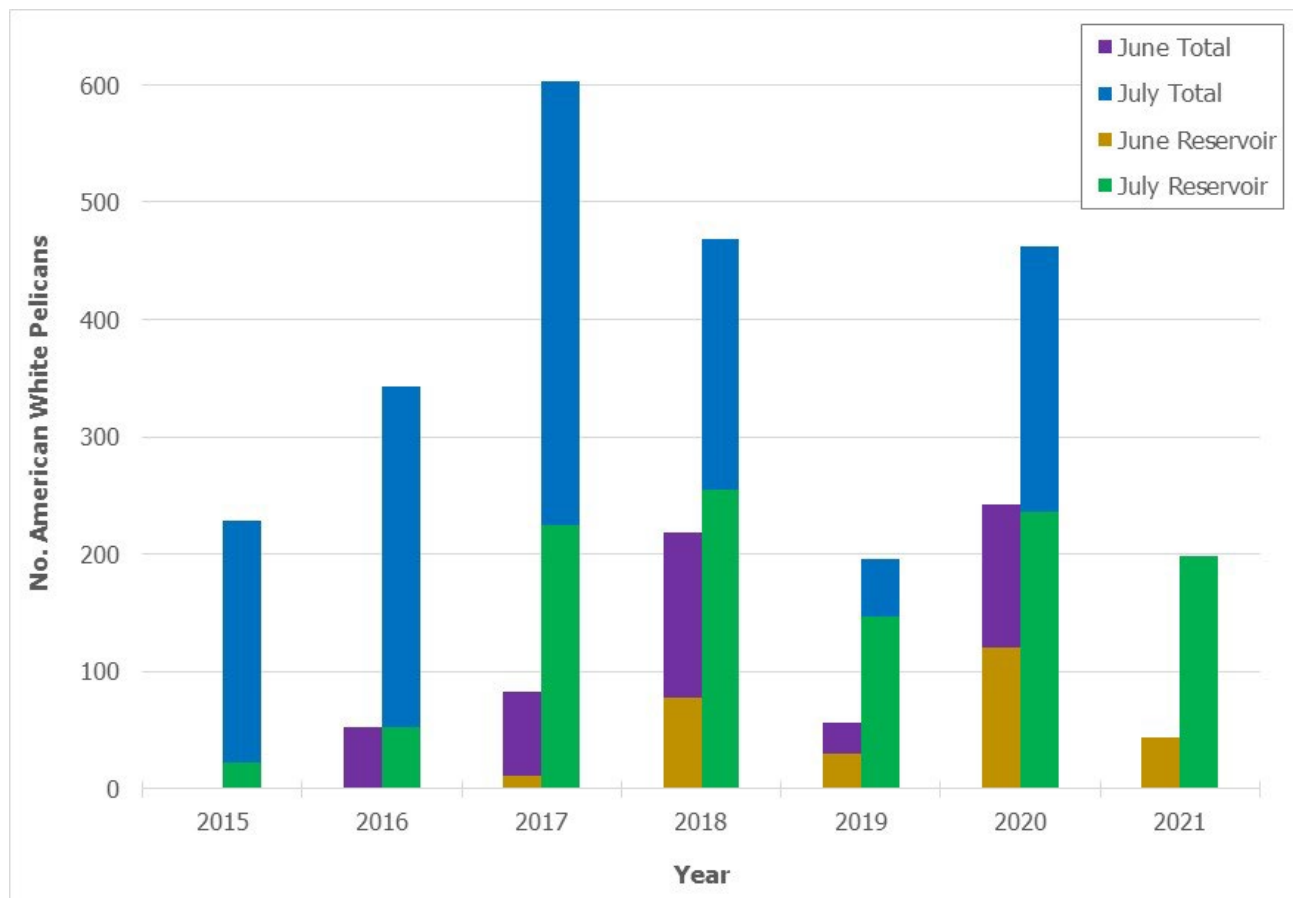
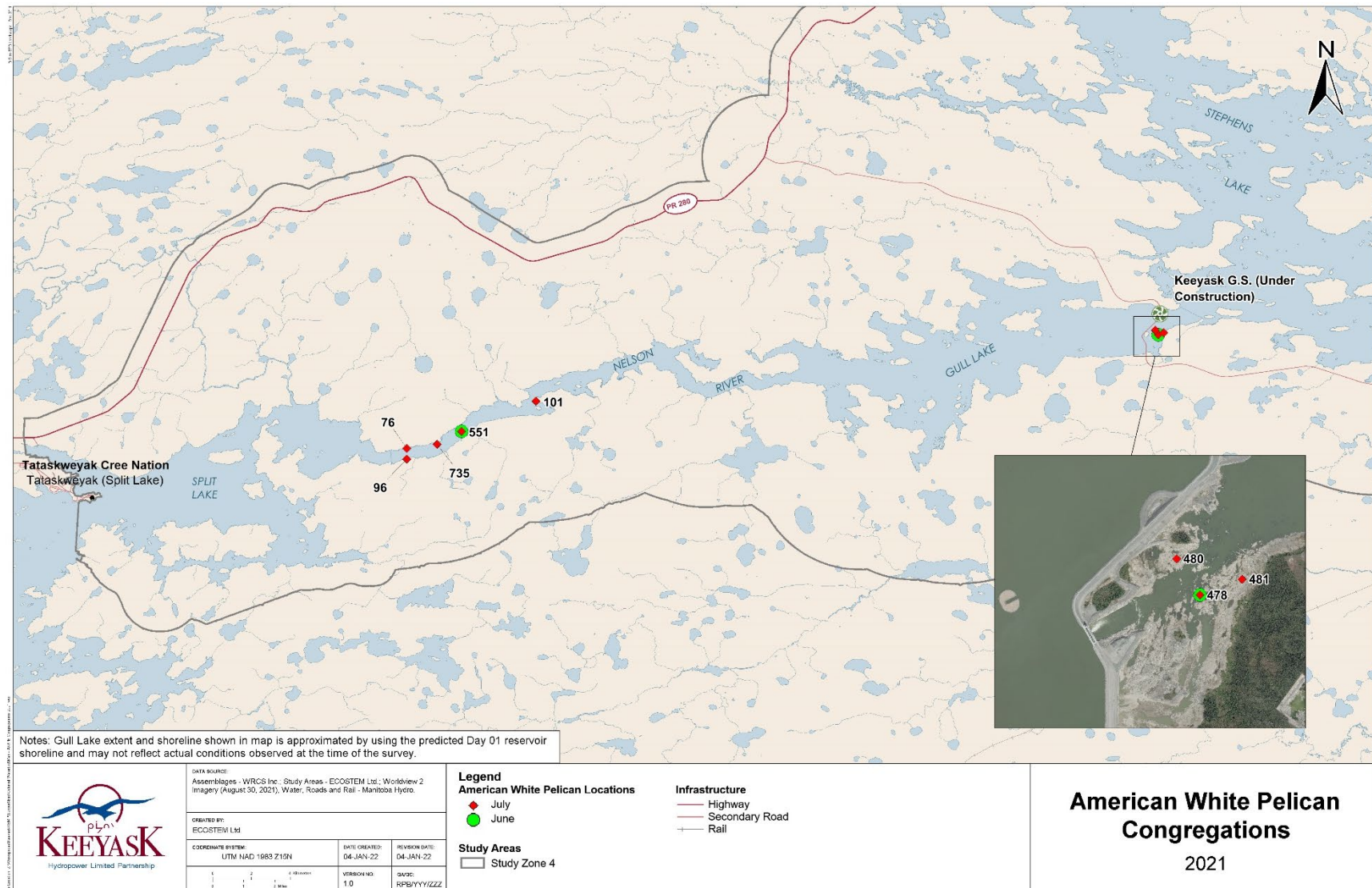


Figure 6: Number of American White Pelicans Observed in the Reservoir (including the Former Gull Rapids Area and Clark Lake) and Total Study Area (Study Zone 5) During Helicopter Surveys in June and July from 2015 to 2021. *Note: Only the reservoir, former Gull Rapids area, and Clark Lake were surveyed in 2021.



Map 10: American White Pelican Observations Made During the Helicopter Surveys in 2021

Table 9: American White Pelican Observations Made During the Helicopter Surveys in 2021

Waypoint	June				July			
	Adults (No Nest)	Occupied Nests	Total Adults	Total Chicks	Adults (No Nest)	Occupied Nests	Total Adults	Total Chicks
76	0	0	0	0	6	0	0	0
96	0	0	0	0	54	0	0	0
101	0	0	0	0	8	0	0	0
478	21	0	0	0	20	0	0	0
480	0	0	0	0	5	0	0	0
481	0	0	0	0	89	0	0	0
551	1	0	0	0	11	0	0	0
735	0	0	0	0	2	0	0	0
Total	22	0	0	0	195	0	0	0

Table 10: Waterbody Classification and Island Use by American White Pelicans in 2021

Island	Month	Gathering	System	Flow	Size Class	Island Habitat	Island Size Class (ha)	Years Used 2015-2021
478	June	Congregation	On-system	River	>1,000	Exposed bedrock	<0.1	7
551	June	Congregation	On-system	River	>1,000	Exposed bedrock	<0.1	3
38	June	Dispersed	On-system	River	>1,000	NA	NA	NA
57	June	Dispersed	On-system	River	>1,000	NA	NA	NA
478	July	Congregation	On-system	River	>1,000	Exposed bedrock	<0.1	7
481	July	Congregation	On-system	River	>1,000	Exposed bedrock	<0.1	3
551	July	Congregation	On-system	River	>1,000	Exposed bedrock	<0.1	3
735	July	Congregation	On-system	River	>1,000	Boulders	<0.1	3
480	July	Congregation	On-system	River	>1,000	Exposed bedrock	0.1-0.9	6
76	July	Congregation	On-system	River	>1,000	NA	NA	NA
96	July	Congregation	On-system	River	>1,000	NA	NA	NA
101	July	Congregation	On-system	River	>1,000	NA	NA	NA
73	July	Dispersed	On-system	River	>1,000	NA	NA	NA
100	July	Dispersed	On-system	River	>1,000	NA	NA	NA



Photo 5: Congregation of American White Pelicans in Former Gull Rapids Area, July 18, 2021

4.0 DISCUSSION

An estimated 2.9 ha of colonial waterbird habitat was anticipated to be lost during Project construction, resulting in the displacement of 800-1,500 pairs of ringed-billed gulls and 30-100 pairs of terns (KHLP 2012). A colonial waterbird survey conducted in 2014, during the pre-construction period, estimated 6,200 ($\pm 1,000$) gulls (ring-billed and herring gulls) in the Gull Rapids area (Stantec 2015). Colonial waterbird surveys conducted during the construction period, from 2015-2021, showed that the colonial waterbird population in the Gull Rapids area and regional study area has been variable. Colonial waterbird populations in Gull Rapids and the regional study area were affected by water level changes, both natural and from Project construction, as well as the loss and alteration of nesting habitat, and sensory disturbance from Project construction.

The construction of cofferdams in 2014 resulted in the diversion of the north channel of the Nelson River into the south channel at Gull Rapids; subsequently, the south channel was diverted through the Project spillway in 2018, resulting in a changed water regime downstream of the spillway in the south channel. These changes led to colonial waterbirds that previously used these areas to relocate to other islands in the Gull Rapids area, elsewhere in the Nelson River and potentially Spilt Lake (WRCS 2016). During Project construction from 2015-2020, colonial waterbird populations were primarily affected by water levels in the Nelson River and to a lesser degree by sensory disturbance from Project construction (WRCS 2017; WRCS 2018; WRCS 2019; WRCS 2020). As observed in years with higher-than-average water levels (*i.e.*, 2017 and 2020), most available habitat in the former Gull Rapids area and some habitat in the Nelson River, was under water and could not be used by colonial waterbirds (WRCS 2018; WRCS 2020). As the islands in Gull Rapids typically provided the preferred nesting habitat for ring-billed gulls and common terns, when this habitat was unsuitable, birds relocated to nearby islands that were directly upstream (WRCS 2018; WRCS 2020). Conversely, during years with average water levels (*i.e.*, 2018 and 2019), larger amounts of habitat were available in the former Gull Rapids area and ring-billed gulls nested on the islands in the area and produced relatively high numbers of chicks (WRCS 2019; WRCS 2020).

As predicted in the EIS, operation of the spillway in 2018 and reservoir impoundment in September 2020, resulted in degradation of habitat downstream of the Project and the loss of colonial waterbird habitat upstream of the Project, respectively (KHLP 2012). Some upstream islands that had been previously used by nesting colonial waterbirds were permanently inundated after reservoir filling. During the summer of 2021, water levels in the Nelson River decreased and resulted in the closure of the spillway and a reduction of water levels around the traditional nesting islands in the former Gull Rapids area, downstream of the spillway. In June 2021, water levels were sufficiently high to create attractive nesting habitat for ring-billed gulls on some of the islands and relatively high numbers of nesting birds were observed. However, by July the water levels had receded enough to connect islands to the mainland, deteriorating habitat conditions, and likely contributed to the low productivity and relatively low number of gulls observed at the time.

The development of the Project and alteration of the water regime was anticipated to create a more lacustrine environment in the former Gull Rapids area and transform the islands into peninsulas, creating unsuitable habitat for colonial waterbirds (KHLP 2012). The frequency of this occurring during Project operation will depend on water levels in the Nelson River and the operation of the spillway.

In 2021, as with other years when habitat was unsuitable, ring-billed gulls and common tern were displaced to nearby islands upstream of the Project, including the Habitat Compensation Island. Several floating islands consisting of peat supported nesting ring-billed gulls and congregating common terns. These islands will likely only support colonial waterbirds over the short term as they are expected to disintegrate over time. The Habitat Compensation Island supported congregations of ring-billed gulls in 2020 (WRCS 2021) and in 2021 supported the highest number of common tern nests observed during the construction-phase surveys, as well as at least two ring-billed gull nests. The presence of successful common tern nests, and ring-billed gull nests indicate that the Habitat Compensation Island will provide alternate nesting habitat in the Gull Rapids area. It is suspected that few ring-billed gulls used the island for nesting due to preference for a different nesting substrate, other than the gravel present on the island. Over time as organic material accumulates on the island, there will likely be more nesting by ring-billed gulls. In the fall of 2021, woody debris removed from the reservoir by Manitoba Hydro's Waterways Management Program was placed on the surface of the Habitat Compensation Island in a random, scattered manner in an effort to help naturalize the newly constructed habitat area.

Other species of colonial waterbirds, including herring gulls, American white pelicans, and Bonaparte's gulls did not appear to be displaced by Project construction or reservoir filling. The number of herring gulls observed in the reservoir and surrounding area in 2021 was the greatest number observed during any of the construction surveys from 2015-2020. However, herring gull nests initiated in the former Gull Rapids area in 2021 did not appear to be successful, likely due to the deterioration of the habitat as summer progressed.

The number of American white pelicans observed during construction surveys increased from 2015 to 2017 and then remained stable into 2021, suggesting that there were no effects due to Project construction. American white pelicans have not been observed nesting in the area and may be less susceptible to changes in island habitat availability for that reason. American white pelicans have also been undergoing a population and range expansion in North America, which could contribute to the greater number of birds observed during the construction period (King and Anderson 2005).

Bonaparte's gulls, which typically use select, off-system lakes, were not affected by the Project or changes in the reservoir.

Helicopter surveys and UAV surveys will continue during Project operation. Data collected by these surveys will provide further insight into the potential long-term effects of the Project on colonial waterbird nesting, productivity, and population trends in the former Gull Rapids area and within the reservoir.

5.0 SUMMARY AND CONCLUSIONS

Project construction resulted in the loss and degradation of colonial waterbird habitat in the former Gull Rapids area and within the reservoir. Some of these habitat changes were successfully mitigated by the construction of the Habitat Compensation Island that supported both common terns and ring-billed gulls in 2021.

During Project construction, colonial waterbird populations varied annually, typically in response to water levels, which influenced the amount and quality of available habitat. Sensory disturbance from Project construction also appeared to affect colonial waterbirds in the former Gull Rapids area. During years with average water levels, colonial waterbirds, mainly ring-billed gulls, nested successfully in the former Gull Rapids area and produced relatively high numbers of chicks.

During years with higher-than-average or below-average water levels in the Nelson River, colonial waterbird habitat in the former Gull Rapids area was unsuitable for nesting colonial waterbirds and generally had limited use by congregating birds. This resulted in other islands, upstream of the Project being used by colonial waterbirds, including the Habitat Compensation Island. In 2021, the Habitat Compensation Island successfully supported high numbers of common tern nests and some ring-billed gull nests. It is anticipated that over time the island will become more attractive to nesting ring-billed gulls in the area.

The 2021 colonial waterbird survey was the final construction-phase survey for the Project. As the Project moves into the operation phase, colonial waterbird monitoring will continue during operation for the next 15 years. The next colonial waterbird survey is scheduled for 2022.

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Appendix A: UAV Survey Results 2015-2021

Table 1: Colonial Waterbirds Enumerated from Images of Islands in Gull Rapids taken by a UAV from 2015-2021. *Note the early spring survey was not conducted in 2020.

Species	03-Jun-2021	30-Jun-2021	21-Jul-2021	03-Jul-2020	28-Jul-2020	03-Jun-2019	24-Jun-2019	24-Jul-2019	6-Jun-2018	29-Jun-2018	20-Jul-2018	30-May-2017	28-Jun-2017	19-Jul-2017	03-Jun-2016	27-Jun-2016	20-Jul-2016	04-Jun-2015	25-Jun-2015	27-Jul-2015
Ring-billed Gull	1,541	4,902	2,447	134	2,744	1,628	1,240	7,227	1,565	1,288	7,030	1,884	1,334	1,900	4,291	4,730	5,092	1,210	1,792	4,978
Ring-billed Gull Chick	0	0	42	0	0	0	1	474	0	36	1,009	0	0	0	0	52	1,774	0	10	42
Ring-billed Gull w. Nest	282	1,566	11	0	0	3,364	3,820	0	2,909	3,171	0	71	852	0	851	759	0	38	81	0
Common Tern	3	57	109	0	0	0	0	0	3	60	49	10	2	1	47	138	25	61	60	3
Common Tern Chick	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Common Tern w. Nest	0	96	171	0	0	0	0	0	0	105	0	0	21	0	0	10	0	0	0	0
Herring Gull	17	15	29	5	16	8	31	47	25	33	64	5	27	7	8	10	11	0	0	0
Herring Gull Chick	0	8	8	0	0	0	19	20	0	24	24	0	0	0	0	4	1	0	0	0
Herring Gull w. Nest	16	11	0	2	0	41	27	0	34	8	0	4	10	1	19	8	0	0	0	0
American White Pelican	0	20	44	24	113	1	0	69	0	23	52	0	5	36	0	0	0	0	0	0

Table 2: Colonial Waterbirds Enumerated from Images of Islands in Gull Rapids taken by a UAV in 2021.

Island	Observation	June 3 2021		June 30 2021		July 21 2021	
		Morning	Evening	Morning	Evening	Morning	Evening
Wpt 224	American White Pelican	0	0	0	0	0	0
	Common Tern	0	0	0	0	0	0
	Common Tern w. Nest	0	0	0	0	0	0
	Common Tern Chick	0	0	0	0	0	0
	Herring Gull	0	0	0	0	0	0
	Herring Gull w. Nest	0	0	0	0	0	0
	Herring Gull Chick	0	0	0	0	0	0
	Ring-billed Gull	1	0	0	0	0	0
	Ring-billed Gull w. Nest	0	0	0	0	0	0
	Ring-billed Gull Chick	0	0	0	0	0	0
Wpt 225	American White Pelican	0	0	0	0	0	0
	Common Tern	0	0	0	0	0	0
	Common Tern w. Nest	0	0	0	0	0	0
	Common Tern Chick	0	0	0	0	0	0
	Herring Gull	10	5	15	11	12	13
	Herring Gull w. Nest	13	11	7	0	0	0
	Herring Gull Chick	0	0	8	6	2	1
	Ring-billed Gull	13	36	24	14	32	65
	Ring-billed Gull w. Nest	4	7	14	20	10	0
	Ring-billed Gull Chick	0	0	0	0	0	5
Wpt 226	American White Pelican	0	0	0	0	0	0
	Common Tern	0	0	0	0	0	0
	Common Tern w. Nest	0	0	0	0	0	0
	Common Tern Chick	0	0	0	0	0	0
	Herring Gull	10	17	5	8	5	3
	Herring Gull w. Nest	11	10	2	4	0	0
	Herring Gull Chick	0	0	0	0	1	0
	Ring-billed Gull	966	1,117	2,549	1,042	856	1,133
	Ring-billed Gull w. Nest	265	210	1,183	1,518	0	0
	Ring-billed Gull Chick	0	0	0	0	42	34
Wpt 227	American White Pelican	0	0	0	0	0	0
	Common Tern	0	0	0	0	0	0
	Common Tern w. Nest	0	0	0	0	0	0
	Common Tern Chick	0	0	0	0	0	0
	Herring Gull	0	0	0	0	0	0
	Herring Gull w. Nest	0	1	0	0	0	0
	Herring Gull Chick	0	0	0	0	0	0
	Ring-billed Gull	71	56	38	2	87	261

Island	Observation	June 3 2021		June 30 2021		July 21 2021	
		Morning	Evening	Morning	Evening	Morning	Evening
Wpt 478	Ring-billed Gull w. Nest	13	20	18	27	0	0
	Ring-billed Gull Chick	0	0	0	0	0	0
	American White Pelican	0	0	14	1	9	44
	Common Tern	0	0	0	0	0	0
	Common Tern w. Nest	0	0	0	0	0	0
	Common Tern Chick	0	0	0	0	0	0
	Herring Gull	2	3	5	3	3	5
	Herring Gull w. Nest	6	6	5	3	0	0
	Herring Gull Chick	0	0	2	2	5	2
	Ring-billed Gull	0	0	0	0	0	0
	Ring-billed Gull w. Nest	0	0	0	0	0	0
	Ring-billed Gull Chick	0	0	0	0	0	0
	American White Pelican	0	0	0	0	0	0
	Common Tern	0	0	0	0	0	0
Wpt 479	Common Tern w. Nest	0	0	0	0	0	0
	Common Tern Chick	0	0	0	0	0	0
	Herring Gull	0	1	0	0	0	0
	Herring Gull w. Nest	2	1	1	1	0	0
	Herring Gull Chick	0	0	0	0	0	0
	Ring-billed Gull	1	0	0	0	0	0
	Ring-billed Gull w. Nest	0	0	0	0	0	0
	Ring-billed Gull Chick	0	0	0	0	0	0
	American White Pelican	0	0	0	1	1	0
	Common Tern	0	0	0	0	0	0
Wpt 480	Common Tern w. Nest	0	0	0	0	0	0
	Common Tern Chick	0	0	0	0	0	0
	Herring Gull	6	8	11	9	29	25
	Herring Gull w. Nest	16	15	11	10	0	0
	Herring Gull Chick	0	0	6	1	8	3
	Ring-billed Gull	0	0	0	0	0	0
	Ring-billed Gull w. Nest	0	0	0	0	0	0
	Ring-billed Gull Chick	0	0	0	0	0	0
	American White Pelican	0	0	0	0	0	0
	Common Tern	0	0	0	0	0	0
Wpt 481	Common Tern w. Nest	0	0	0	0	0	0
	Common Tern Chick	0	0	0	0	0	0
	Herring Gull	0	0	0	0	0	0
	Herring Gull w. Nest	0	0	0	0	0	0
	Herring Gull Chick	0	0	0	0	0	0
	Ring-billed Gull	0	0	0	0	0	0
	American White Pelican	0	0	0	0	0	0
	Common Tern	0	0	0	0	0	0

Island	Observation	June 3 2021		June 30 2021		July 21 2021	
		Morning	Evening	Morning	Evening	Morning	Evening
Wpt 561	Ring-billed Gull w. Nest	0	0	0	0	0	0
	Ring-billed Gull Chick	0	0	0	0	0	0
	American White Pelican	0	0	0	20	0	0
	Common Tern	0	0	0	0	0	0
	Common Tern w. Nest	0	0	0	0	0	0
	Common Tern Chick	0	0	0	0	0	0
	Herring Gull	0	1	0	0	3	0
	Herring Gull w. Nest	0	0	0	0	0	0
	Herring Gull Chick	0	0	0	0	0	0
	Ring-billed Gull	10	15	17	0	9	50
	Ring-billed Gull w. Nest	0	0	0	0	0	0
	Ring-billed Gull Chick	0	0	0	0	0	0
	American White Pelican	0	0	0	0	0	0
	Common Tern	3	1	50	57	44	109
Wpt 837 (Habitat Compensation Island)	Common Tern w. Nest	0	0	96	96	171	144
	Common Tern Chick	0	0	0	0	0	11
	Herring Gull	0	0	0	0	3	0
	Herring Gull w. Nest	0	0	0	0	0	0
	Herring Gull Chick	0	0	0	0	0	0
	Ring-billed Gull	11	35	708	519	389	927
	Ring-billed Gull w. Nest	0	0	1	1	1	2
	Ring-billed Gull Chick	0	0	0	0	0	0

Appendix B: Colonial Waterbird Abundance Observed during Helicopter Surveys 2015-2020

Table 1: Colonial Waterbird Abundance Observed During Helicopter Surveys in 2020

Species	June			July		
	Congregated Birds	Dispersed Birds	Total	Congregated Birds	Dispersed Birds	Total
Ring-billed Gull	6,477	720	7,197	5,639	929	6,568
Common Tern	552	68	620	1,270	263	1,533
American White Pelican	196	46	242	366	96	462
Bonaparte's Gull	43	0	43	75	237	312
Herring Gull	68	5	73	42	0	42
Total	7,336	839	8,175	7,392	1,525	8,917

Table 2: Colonial Waterbird Abundance Observed During Helicopter Surveys in 2019

Species	June			July		
	Congregated Birds	Dispersed Birds	Total	Congregated Birds	Dispersed Birds	Total
Ring-billed Gull	5,513	103	5,616	7,685	199	7,884
Common Tern	1,072	67	1,139	920	8	928
Herring Gull	184	6	190	152	0	152
Bonaparte's Gull	16	9	25	18	6	24
American White Pelican	41	15	56	146	50	196
Total	6,826	200	7,026	8,921	263	9,184

Table 3: Colonial Waterbird Abundance Observed During Helicopter Surveys in 2018

Species	June			July		
	Congregated Birds	Dispersed Birds	Total	Congregated Birds	Dispersed Birds	Total
Ring-billed Gull	4,597	417	5,014	7,943	3	7,946
Common Tern	1,006	46	1,052	391	0	391
Herring Gull	107	0	107	12	0	12
Bonaparte's Gull	12	21	33	16	12	28
American White Pelican	194	24	218	425	44	469
Total	5,916	508	6,424	8,787	59	8,846

Table 4: Colonial Waterbird Abundance Observed During Helicopter Surveys in 2017

Species	June			July		
	Congregated Birds	Dispersed Birds	Total	Congregated Birds	Dispersed Birds	Total
Ring-billed Gull	5,835	1,708	7,543	7,780	422	8,202
Common Tern	1,377	4	1,381	979	5	984
Bonaparte's Gull	50	30	80	0	31	31
Herring Gull	5	0	5	13	0	13
American White Pelican	37	46	83	393	210	603
Total	7,304	1,788	9,092	9,165	668	9,833

Table 5: Colonial Waterbird Abundance Observed During Helicopter Surveys in 2016

Species	June			July		
	Congregated Birds	Dispersed Birds	Total	Congregated Birds	Dispersed Birds	Total
Ring-billed Gull	5,217	359	5,576	12,087	1,229	13,316
Common Tern	861	54	915	579	218	797
Bonaparte's Gull	55	44	99	58	62	120
Herring Gull	67	5	72	42	3	45
American White Pelican	0	52	52	0	343	343
Black Tern	0	0	0	0	8	8
Total	6,200	514	6,714	12,766	1,863	14,629

Table 6: Colonial Waterbird Abundance Observed During Helicopter Surveys in 2015

Species	June			July		
	Congregated Birds	Dispersed Birds	Total	Congregated Birds	Dispersed Birds	Total
Ring-billed Gull	3,026	894	3,925	3,439	302	3,741
Common Tern	451	173	624	572	461	1,033
Bonaparte's Gull	26	137	163	0	56	56
Herring Gull	23	4	27	9	8	17
American White Pelican	0	1	1	228	0	228
Total	3,526	1,209	4,740	4,248	827	5,075