



Keeyask Generation Project Terrestrial Effects Monitoring Plan

Bank Swallow Habitat Effects Monitoring Report

TEMP-2022-16



KEEYASK GENERATION PROJECT

TERRESTRIAL EFFECTS MONITORING PLAN

REPORT #TEMP-2022-16

BANK SWALLOW HABITAT EFFECTS MONITORING 2021

Prepared for

Manitoba Hydro

By

Wildlife Resource Consulting Services MB Inc.

June 2022

This report should be cited as follows:

Wildlife Resource Consulting Services MB Inc. 2022. Keeyask Generation Project Terrestrial Effects Monitoring Plan Report #TEMP-2022-16: Bank Swallow Monitoring 2021. A report prepared for Manitoba Hydro by Wildlife Resource Consulting Services MB Inc., June 2022.

SUMMARY

Background

Construction of the Keeyask Generation Project (the Project) at Gull Rapids began in July 2014 and the reservoir was impounded from August 31 to September 5, 2020. 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 will affect the environment, and whether or not more needs to be done to reduce harmful effects.

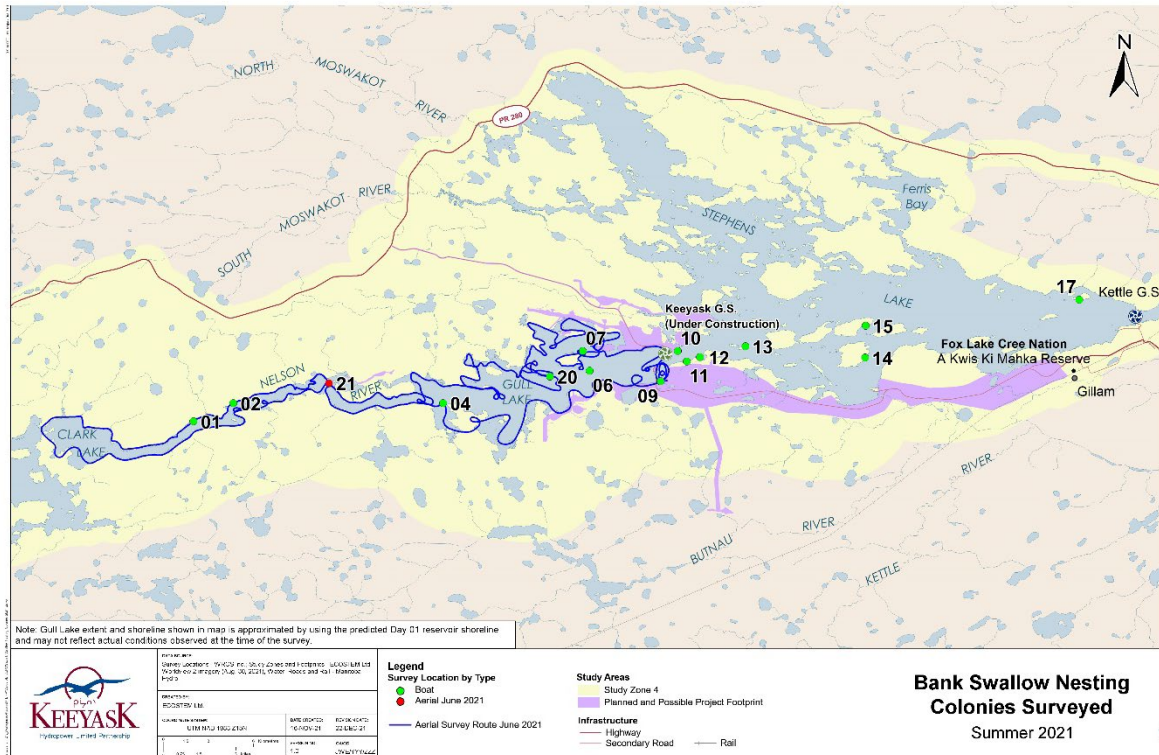
Banks swallows are small, insect-eating birds that excavate nesting burrows in sandy riverbanks and gravel pits. Relatively few bank swallows were observed in the Clark Lake to Stephens Lake area during pre-Project field studies; at most 40 individuals were identified in a single year. Potential construction-related effects on bank swallow identified in the Project's environmental assessment were loss or alteration of some breeding or foraging habitat; sensory disturbances from people, machinery, and equipment near breeding colonies; and possibly increased mortality. Construction monitoring for bank swallows began in 2016 and continued in 2018, 2020, and 2021.

Why is the study being done?

Bank swallow is a priority bird to be monitored because of its designation as Threatened by the Committee on the Status of Endangered Wildlife in Canada in 2013. It was officially listed as Threatened under the federal *Species at Risk Act* in 2017. The main objectives of the 2021 bank swallow studies were to evaluate their presence or absence in the Keeyask region during construction and to assess accidental mortality associated with the Project. Verification of anticipated Project effects will be conducted after construction is completed, using a habitat quality model.

What was done?

Bank swallow colonies initially identified in summer 2016 and/or subsequent monitoring years were surveyed again in 2021. Fourteen colonies were surveyed twice by boat in late June and early July. Birds and nesting burrows were counted, and a series of photographs was taken at most sites. Two observers independently counted the number of swallows flying three times over a 10-minute period. The highest single count of individuals was recorded at each colony. Two independent observers also counted the number of burrows in the photographs, and an estimate of the bank swallow population in the study area (Study Zone 4) was generated with the field and photograph counts.



Sites Surveyed for Bank Swallow Colonies, Summer 2021

What was found?

Bank swallow burrows were observed at all 14 sites surveyed in 2021. A total of 464 birds were counted in June and 496 in July. No birds were observed at one site during either survey. Colonies ranged in size from five to 835 burrows, not all of which were expected to be occupied. An estimated 1,641 breeding pairs (or 3,282 adults) inhabited Study Zone 4 in 2021, a decline of 19% from 2020 and of 18% from 2016, when monitoring studies began. The decline was observed at colonies in the Keeyask reservoir and in Stephens Lake.

Following reservoir impoundment in fall 2020, new shorelines formed rapidly and resulted in the collapse of some unoccupied bank swallow burrows at three sites in the affected area. At the time, the habitat at each of these sites appeared to remain suitable for future nesting. In 2021, a large decrease in the number of burrows and reduced height of the bank was observed at site 06, while a small increase in the number of burrows was observed at sites 04 and 07.

What does it mean?

The small increase in the number of burrows at sites 04 and 07 in the Keeyask reservoir indicates that they remain suitable for nesting, as new burrows were constructed in spring 2021 in place of those lost to erosion during impoundment. The habitat at site 06 appeared to be considerably less suitable for nesting than in previous years due to the reduced height of the bank. However, a few bank swallows were observed at the site in June and July, suggesting that it was still active during

the 2021 breeding season. The decreased number of burrows at colonies in Stephens Lake suggested that the decline in the estimated bank swallow population was not due entirely to reservoir impoundment. There are numerous other natural sites available for nesting in the region, and it is uncertain if the decline in the bank swallow population observed in 2021 could be due to the relocation of colonies to new areas.

Overall, the regional Keeyask bank swallow population appears stable, but it may also be declining. Cumulative threats found elsewhere in North America such as the loss of breeding and foraging habitat, the destruction of nests during aggregate excavation, climatic changes that reduce overwinter survival or reproductive potential, widespread pesticide use that may cause decreases in the abundance or diversity of flying insects, and from other unknown threats during migration and on the wintering grounds, continue to affect this species.

What will be done next?

Long-term monitoring that began in 2016 will continue every two years during operation until 2024. It is also recommended that an aerial survey be conducted in spring 2022 to identify other areas with suitable nesting habitat, to determine whether new areas have been colonized. A habitat quality model for bank swallow will be developed and will be validated with the construction-phase monitoring data. Nesting habitat loss due to Project development will be determined and will be used to quantify the overall loss or alteration of bank swallow habitat.

STUDY TEAM

We would like to thank James Ehnes of ECOSTEM Ltd. for providing maps, and Sherrie Mason and Rachel Boone of Manitoba Hydro for reviewing the report. Biologists, technicians, and other personnel who designed, participated in, and drafted the survey results included:

- Robert Berger, Wildlife Resource Consulting Services MB Inc. (WRCS) – Design and reporting
- Andrea Ambrose (WRCS) – Analysis and reporting
- Mark Baschuk (WRCS) – Survey personnel
- Kevin McRae (WRCS) – Survey personnel
- Maryse Gagné (WRCS) – Survey personnel
- Keegan Neckoway (Tataskweyak Cree Nation) – Boat operator/survey personnel
- Kenneth Ouskan (Tataskweyak Cree Nation) – Boat operator/survey personnel

TABLE OF CONTENTS

1.0	INTRODUCTION.....	1
2.0	METHODS.....	2
3.0	RESULTS.....	5
4.0	DISCUSSION	12
5.0	SUMMARY AND CONCLUSIONS.....	14
6.0	LITERATURE CITED.....	15

LIST OF TABLES

Table 1:	Bank Swallow Nesting Colonies Surveyed, Summer 2021	3
Table 2:	Mean Number of Bank Swallow Burrows at 14 Colonies, Summer 2021.....	5
Table 3:	Estimated Bank Swallow Population in Study Zone 4, 2016, 2018, 2020, and 2021.....	7
Table 4:	Mean Number of Bank Swallow Burrows at 14 Colonies, Summer 2016, 2018, 2020, and 2021	8
Table 5:	Maximum Number of Bank Swallows at 14 Colonies, Summer 2016, 2018, 2020, and 2021.....	10

LIST OF MAPS

Map 1:	Bank Swallow Nesting Colonies Surveyed, Summer 2021	4
Map 2:	Mean Number of Bank Swallow Burrows at Nesting Colonies, Summer 2021	11

LIST OF PHOTOS

Photo 1:	Portion of a Small Bank Swallow Colony at Site 01, June 2021.....	6
Photo 2:	Portion of a Large Bank Swallow Colony at Site 12, July 2021.....	7
Photo 3:	Shoreline at site 06, July 2020 before impoundment (above) and July 2021 after impoundment (below).....	9

LIST OF APPENDICES

Appendix 1: Example Count of Burrows in Photograph.....	17
Appendix 2: Bank Swallow Burrow Counts 2021	19

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. Reservoir impoundment began August 31, 2020 and was completed on September 5, 2020.

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 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, bank swallow (*Riparia riparia*), during the construction and operation phases.

Bank swallows are small, insect-eating birds that migrate to Manitoba in spring (Weatherhead et al. 1985; Committee on the Status of Endangered Wildlife in Canada [COSEWIC] 2013). In the Keeyask region, the breeding season typically extends from late May to early August (Taylor 2018). Bank swallow is a priority bird for Project monitoring because it was assessed as Threatened by COSEWIC in 2013 and was officially listed as Threatened under the federal *Species at Risk Act* (SARA) in 2017. It is not listed as a species at risk under *The Endangered Species and Ecosystems Act* of Manitoba.

Bank swallows are colonial breeders that excavate nesting burrows in sandy riverbanks and gravel pits (Grieff 2003). Steep, nearly vertical banks are typically selected (Hjertaas 1984; COSEWIC 2013). Many burrows may be excavated in a single colony, but up to two thirds are unoccupied in a typical breeding season (Grieff 2003; Burke 2017). The availability of suitable nesting habitat is a major factor limiting the size and distribution of breeding populations in Canada (COSEWIC 2013).

Relatively few bank swallows were observed in the region during pre-Project field studies for other birds from 2001 to 2014; at most 40 individuals were identified in the Clark, Gull, and Stephens lakes area in a single year. No surveys targeting bank swallow were conducted during the EIS field studies and all observations were incidental. Potential construction-related effects on bank swallow were loss or alteration of some breeding or foraging habitat; sensory disturbances from people, machinery, and equipment near breeding colonies; and possible increased mortality. The objectives of the bank swallow monitoring study, outlined in Section 5.8.6 of the TEMP, were to evaluate their presence or absence in suitable habitat in the study area (Study Zone 4) and to assess accidental mortality, in order to verify anticipated Project effects on these SARA-listed birds.

2.0 METHODS

Surveys for bank swallow were conducted in June and July 2021, mainly at sites along the Nelson River from Birthday Rapids downstream to the Kettle GS area on Stephens Lake in Study Zone 4 (Map 1). In 2016, a preliminary aerial survey was conducted by helicopter to identify bank swallow nesting colonies in the study area. Shorelines on the Nelson River, Gull Lake, and Stephens Lake were surveyed and 17 colonies were identified, including one in a Project borrow area (site 05). Surveys continued in 2018, when an additional six colonies were observed, including three in Project borrow areas (G1, G3, and Km 1). Two sites that were initially identified as separate colonies (sites 15 and 16) were considered a single colony (site 15) due to the continuity of burrows observed along the banks. Two small colonies (sites 03 and 08) were no longer active and were removed from subsequent surveys. Rip rap was placed at site 08 in winter 2017 for bank stabilization and the area was no longer suitable for bank swallow nesting. Seventeen sites were re-visited in 2020. No burrows were found at three Project borrow areas (G1, G3, and Km 1) and a fourth borrow area (site 05) was not revisited; the temporary bank swallow habitat created during Project development was no longer available due to site sloping and rehabilitation activities at these locations. Two sites that were identified as separate colonies in previous survey years (sites 11 and 19) were considered a single colony (site 11) in 2020 due to the continuity of the burrows observed along the bank.

On June 19, 2021, an aerial survey for bank swallows was conducted concurrently with a survey for colonial waterbirds (Wildlife Resource Consulting Services MB Inc. [WRCS] 2022) in the Keeyask reservoir. Known bank swallow nesting sites (01, 02, 04, 06, 07, and 20) were surveyed with a helicopter flown at approximately 100 km/h and at least 150 m above ground level. The survey crew consisted of an observer seated in the front left seat and the pilot. The presence or absence of bank swallow burrows was noted at each site. The Nelson River and island shorelines were also surveyed upstream to Clark Lake, inclusive (Map 1), to search for additional bank swallow colonies.

Known bank swallow nesting sites were surveyed twice by boat from June 25 to 27 and on July 3 and 4, 2021 (Table 1), in the primary breeding season. Observers counted birds and nesting burrows at each colony. Two observers independently counted the number of bank swallows flying near the colony three times over a 10-minute period. The greatest number of birds observed during a single count was recorded for each colony during each site visit. The two observers counted the number of burrows from the boat, which was driven parallel to the colony at a distance ranging from 30 to 50 m offshore. A series of photographs was taken at all active nesting colonies for additional burrow counts. Site 18 and site 11 were considered a single colony (site 11) due to the continuity of burrows along the bank. A total of 14 nesting sites were surveyed, six in the Keeyask reservoir or upstream to Clark Lake, and eight in Stephens Lake.

Photos taken at each colony were magnified in Paint 3D and the number of burrows was counted independently by two observers (Appendix 1). The mean of these counts and the preliminary field

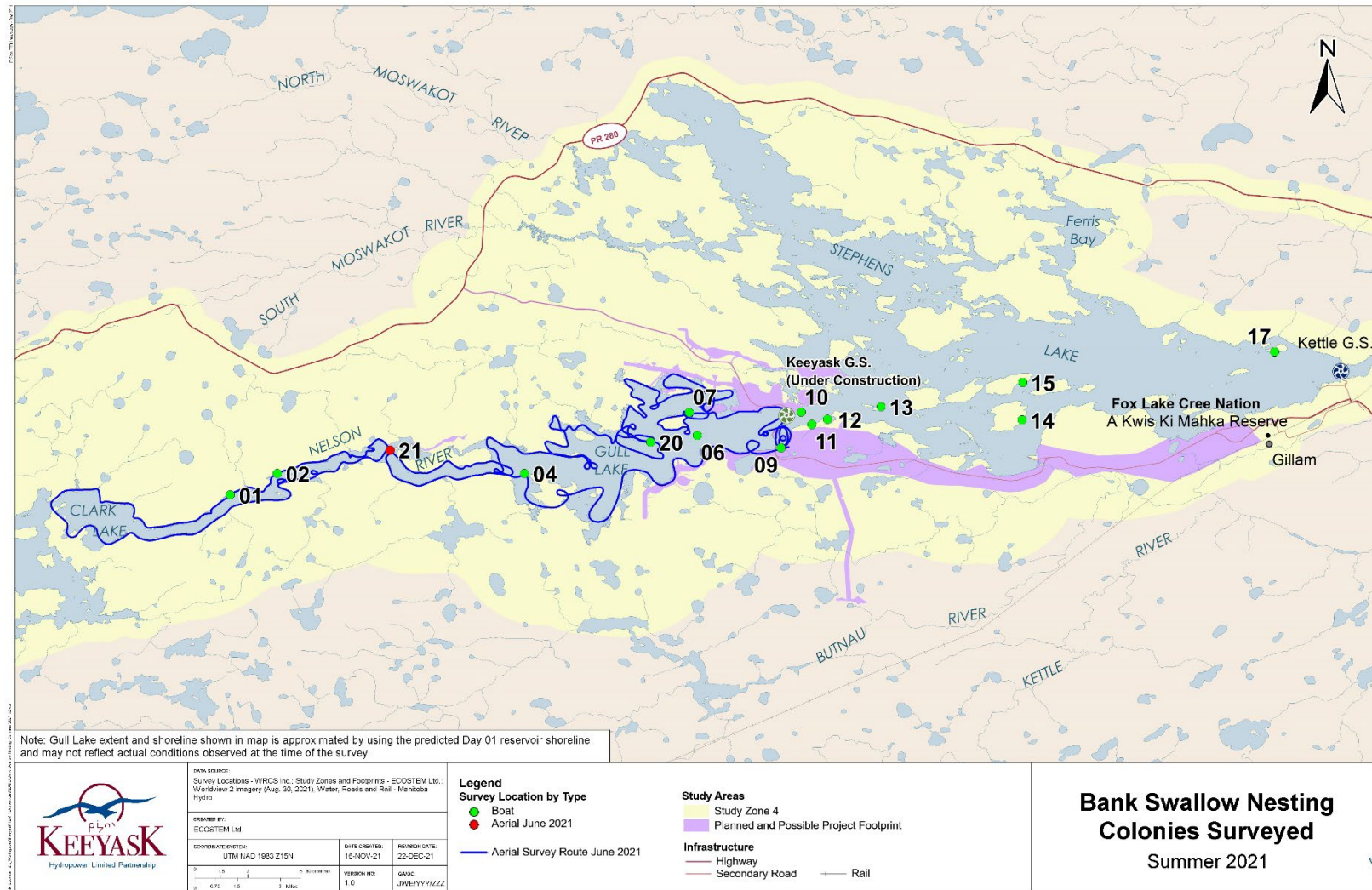
count, plus standard deviation and 95% confidence interval were calculated at each site for each of the two visits.

The mean number of burrows at each colony (the larger of the observations during each site visit) was multiplied by 0.5 to provide an estimate of the number of breeding pairs in Study Zone 4. There are typically more burrows in a colony than there are nesting pairs of bank swallows (Garrison 1999; Falconer et al. 2016; Burke 2017). New burrows are constructed each season (Garrison 1999; Falconer et al. 2016) leaving older, intact burrows unoccupied. In some cases, burrow excavation is abandoned as obstacles are encountered (Garrison 1999; Falconer et al. 2016), resulting in more holes than birds to occupy them. Mean occupancy of bank swallow burrows ranges from 43 to 74% (Garrison 1999; Bird Studies Canada unpubl. data in COSEWIC 2013). It has most recently been suggested that the number of breeding pairs in a colony can be estimated as 50% of the number of burrows (Wright et al. 2011; Falconer et al. 2016). Based on this information, it was assumed that 50% burrow occupancy would provide a reasonably conservative estimate of the bank swallow population in Study Zone 4.

Table 1: Bank Swallow Nesting Colonies Surveyed, Summer 2021

Location	Site	Location	Dates Surveyed
Reservoir or upstream	01	15 V 328638 6242168	June 27, July 4
	02	15 V 331606 6243531	June 27, July 4
	04	15 V 347288 6243533	June 27, July 4
	06	15 V 358235 6245942	June 27, July 4
	07	15 V 357720 6247397	June 27, July 4
	09	15 V 363536 6245149	June 25, July 4
Stephens Lake	10	15 V 364806 6247412	June 26, July 3
	11 ¹	15 V 365483 6246626	June 26, July 3
	12	15 V 366476 6246968	June 26, July 3
	13	15 V 369874 6247761	June 26, July 3
	14	15 V 378819 6246929	June 26, July 3
	15	15 V 378855 6249312	June 26, July 3
	17	15 V 394806 6251246	June 26, July 3
	20	15 V 355237 6245509	June 27, July 4

1. Includes the former Site 18.



Map 1: Bank Swallow Nesting Colonies Surveyed, Summer 2021

3.0 RESULTS

No bank swallow burrows were observed at two of the six known colony sites visited during the June 2021 aerial survey of the Keeyask reservoir and upstream area (sites 04 and 06). Eleven burrows were counted at a previously unidentified site (site 21; see Map 1) but it is unknown if the colony was active as no bank swallows were observed.

Bank swallow burrows were observed at all 14 sites visited by boat in late June and early July 2021 (Map 2). The mean number of burrows at each colony ranged from five to 835 (Table 2). The largest colony was located at site 12 on an island in Stephens Lake. The colonies at sites 01, 06, 10, 17, and 20 were small, with 25 or fewer burrows at each. In general, there were fewer burrows at colonies on sloped, shrubby banks (Photo 1) than on steep banks with little vegetation (Photo 2). Most nesting burrows were located near the top of the bank.

The mean number of burrows observed was greater during the second survey than the first at all but three sites, likely because additional burrows were excavated as the breeding season progressed. Variations in observer counts at sites 04, 11, and 12 were likely due in part to differences in shadows, photo angles, and direction of travel that could have resulted in more burrows being counted earlier in the season. The lower counts during the second survey could also have been a result of collapsed burrows due to ongoing erosion.

Bank swallows were observed at all colony sites except site 10 during at least one of the two surveys in 2021. A total of 464 birds were counted during the first survey and 496 during the second. Where birds were observed, a minimum of one individual was recorded at sites 01 and 06 during the first survey and a maximum of 120 were counted at site 02 during the second survey (Table 2).

Table 2: Mean Number of Bank Swallow Burrows at 14 Colonies, Summer 2021

Colony	Survey Date	Mean Number of Burrows	Standard Deviation	95% Confidence Interval	Number of Birds Observed
01	June 27	5	1.5	2	1
	July 4	5	–	–	0
02	June 27	342	167.1	189	47
	July 4	413	45.4	51	120
04	June 27	302	87.9	99	40
	July 4	246	54.8	62	106
06	June 27	7	2.1	2	1
	July 4	8	3.8	4	4
07	June 27	233	42.8	48	57
	July 4	381	36.2	41	80
09	June 25	110	10.1	11	6
	July 4	126	58.9	67	0

Colony	Survey Date	Mean Number of Burrows	Standard Deviation	95% Confidence Interval	Number of Birds Observed
10	June 26	5	1.0	1	0
	July 3	6	2.6	3	0
11 ¹	June 26	403	83.1	94	75
	July 3	400	33.9	38	61
12	June 26	835	15.3	17	101
	July 3	728	93.2	105	61
13	June 26	168	58.3	66	57
	July 3	223	55.1	62	27
14	June 26	113	8.9	10	0
	July 3	122	27.1	31	10
15	June 26	310	32.0	36	62
	July 3	421	29.7	34	25
17	June 26	8	2.0	2	3
	July 3	11	5.0	6	0
20	June 27	24	6.5	7	14
	July 4	25	12.1	14	2

1. Includes the former Site 18.



Red oval indicates bank swallow burrows; note toppled trees and bank erosion.

Photo 1: Portion of a Small Bank Swallow Colony at Site 01, June 2021



Red oval indicates bank swallow burrows.

Photo 2: Portion of a Large Bank Swallow Colony at Site 12, July 2021

The regional bank swallow population was estimated at 1,641 breeding pairs or 3,282 individuals in 2021 (Table 3). The population increased from 2016 to 2018 and then declined in 2020 and 2021. The estimated number of breeding pairs was 18% lower in 2021 than when surveys began in 2016.

Table 3: Estimated Bank Swallow Population in Study Zone 4, 2016, 2018, 2020, and 2021

Year	Number of Breeding Pairs	Number of Individuals	Percentage Change from Previous Year
2016	2,005	4,010	–
2018	2,261	4,522	+13
2020	2,033	4,066	-10
2021	1,641	3,282	-19

The subpopulations of individual colonies in Study Zone 4 ranged from three to 418 breeding pairs in 2021, based on the largest of the mean numbers of nesting burrows during two surveys at each site. The mean number of bank swallow burrows increased at four of the 14 colonies from 2020 to 2021, by as little as 5% at site 04 and by as much as 150% at site 01 (Table 4), where a maximum of five burrows were observed over the survey period. The mean number of burrows decreased between 5% and 98% at nine sites from 2020 to 2021. Site 20 was not surveyed in 2020 but the mean number of burrows was 127% greater in 2021 than in 2018 at this small colony. The colony at site 06, on the southeastern shore of what was a single large island in Gull Lake before the reservoir was impounded (Map 2), was substantially smaller and spanned a shorter distance in 2021 (approximately 20 m) than in 2020 (approximately 140 m). The height of the

bank in 2021 was also reduced (Photo 3) relative to 2020. At site 07, which was on the same large island in Gull Lake as site 06 before impoundment, a small increase in the mean number of burrows was observed. There also was relatively little change in the mean number of burrows at sites 04 and 09, which were in the reservoir or upstream of it.

Table 4: Mean Number of Bank Swallow Burrows at 14 Colonies, Summer 2016, 2018, 2020, and 2021

Location	Colony	Mean Number of Burrows ¹				Percentage Change 2020–2021
		2016	2018	2020	2021	
Reservoir or upstream	01	5	4	2	5	+150
	02	313	357	505	413	-18
	04	183	386	288	302	+5
	06	69	292	343	8	-98
	07	139	486	359	381	+6
	09	10	151	132	126	-5
Stephens Lake	10	2	5	14	6	-57
	11 ²	421	373	537	403	-25
	12	1,600	1,694	956	835	-13
	13	89	135	186	223	+20
	14	180	53	174	122	-30
	15	463	446	547	421	-23
	17	12	14	24	11	-54
	20	–	11	–	25 ³	–

1. Greatest mean number observed during the first and second surveys.
2. Includes the former Site 18 for all survey years.
3. 127% increase from 2018.



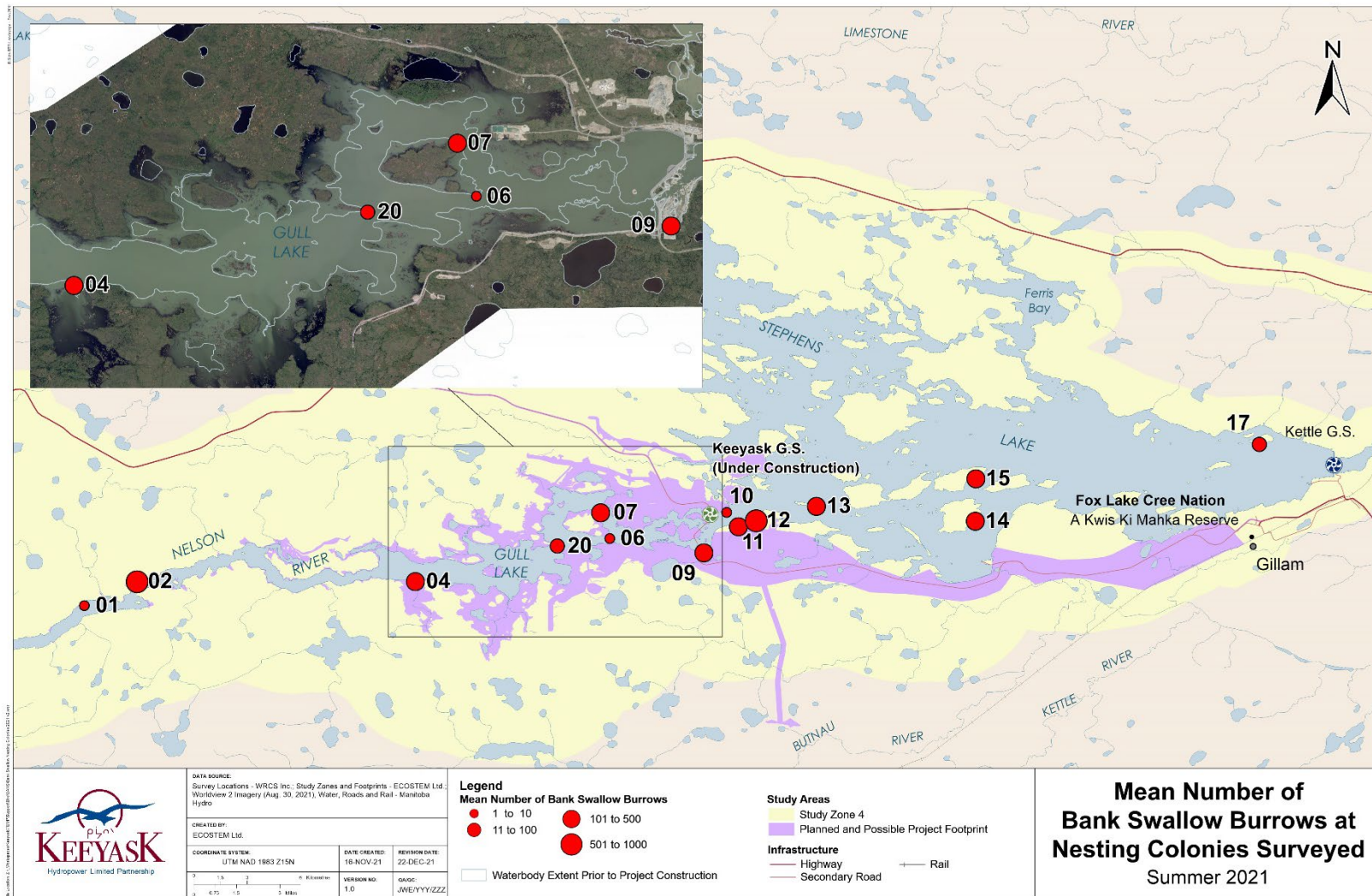
Photo 3: Shoreline at site 06, July 2020 before impoundment (above) and July 2021 after impoundment (below)

The number of bank swallows observed increased at four of the 14 colonies from 2020 to 2021 (Table 5). The largest increase (418%) was at site 13, where 27 or fewer birds were observed in previous survey years. The number of bank swallows decreased between 8% and 95% at six sites. The largest decrease in the number of birds observed was at site 06 in the reservoir, where considerably fewer burrows were observed than in previous years.

Table 5: Maximum Number of Bank Swallows at 14 Colonies, Summer 2016, 2018, 2020, and 2021

Location	Colony	Maximum Number of Bank Swallows ¹				Percentage Change 2020–2021
		2016	2018	2020	2021	
Reservoir or upstream	01	0	5	0	1	–
	02	77	95	171	120	-30
	04	34	50	74	106	+43
	06	11	21	79	4	-95
	07	35	28	189	80	-58
	09	12	28	3	6	+100
Stephens Lake	10	2	6	0	0	0
	11 ²	77	70	119	75	-37
	12	225	57	110	101	-8
	13	27	25	11	57	+418
	14	7	12	4	10	+150
	15	76	31	68	62	-9
	17	0	0	0	3	–
	20	–	2	–	14 ³	–

1. Greatest number observed during the first and second surveys.
2. Includes the former Site 18 for all survey years.
3. 600% increase from 2018.



Map 2: Mean Number of Bank Swallow Burrows at Nesting Colonies, Summer 2021

4.0 DISCUSSION

Overall, the regional Keeyask bank swallow population appears stable, but it may also be declining. A small decrease in the estimated bank swallow population was observed in Study Zone 4 from 2018 to 2020 and a larger decrease was observed from 2020 to 2021. Reduced numbers of burrows at most sites could be due to the collapse of older nesting holes as a result of localized bank erosion. This process "refreshes" the bank face, maintaining it at the steep angle required for bank swallow nesting (Garrison 1999; Florsheim et al. 2008; Falconer et al. 2016). Bank swallows often return to previous nesting sites (Falconer et al. 2016; Government of Canada 2019) but because of the unstable nature of their nesting habitat, colony sites may change from year to year, or individuals will relocate if habitat becomes unsuitable (Government of Canada 2019). The increased number of burrows at eight sites from 2018 to 2020 and similar regional population estimates in 2016, 2018, and 2020 suggest that some individuals nest at different sites from year to year. Cumulative threats found elsewhere in North America such the loss of breeding and foraging habitat, destruction of nests during aggregate excavation, climatic changes that reduce overwinter survival or reproductive potential, widespread pesticide use that may cause decreases in the abundance or diversity of flying insects, and from other unknown threats during migration and on the wintering grounds, will continue to affect this species (COSEWIC 2013).

In September 2020, bank undercutting and erosion were noted underneath the existing bank swallow burrows at sites 04, 06, and 07 during reservoir impoundment, resulting in the collapse of up to half of the unoccupied burrows at each location (WRCS 2021). The steep, sandy banks required for bank swallow nesting persisted at each site. As such, the burrows' collapse was expected to have little or no effect on the regional population, given that new burrows are typically constructed each year (Garrison 1999; Falconer et al. 2016). While the remaining habitat appeared to be suitable for nesting at the time of the impoundment monitoring survey, it was uncertain if these sites would continue to be suitable in the future. The small increase in the number of burrows at sites 04 and 07, both within the reservoir, indicates that they remain suitable for nesting, as new burrows were constructed in spring 2021 in place of those lost to erosion. At site 04, no burrows were observed during the initial June 2021 aerial survey but more burrows were counted during subsequent 2021 boat surveys than the previous year, before the reservoir was impounded. If all or most of the burrows at sites 04 and 07 had collapsed following impoundment, all burrows observed at these colonies in summer 2021 would have been newly constructed and would likely be more than 50% occupied, suggesting that the local bank swallow population is larger than estimated. A large decrease in the number of burrows was observed at site 06, also within the reservoir. Approximately 350 burrows, at least half of which were likely unoccupied during the breeding period, collapsed during or after reservoir impoundment in 2020; only eight burrows were counted the following year. The site appears to be considerably less suitable for nesting than in previous years due to the reduced height of the bank following impoundment. However, a small number of bank swallows were observed at the site during the first and second boat surveys (one and four, respectively), suggesting that it was still active during the 2021 breeding season. The mean number of burrows decreased at six of seven colonies in

Stephens Lake, suggesting that the decline in the estimated bank swallow population from 2020 to 2021 was not due entirely to reservoir impoundment. There are numerous other natural sites available for nesting in the region, and it is uncertain if the decline in the bank swallow population observed in 2021 could be due to the relocation of colonies to new areas.

The large colony at site 12 was formed from erosion processes shortly after a small peninsula separated from the mainland and formed two islands on Stephens Lake circa 2005. There was no evidence of bank swallow colonies on the small island in 2008. A small to moderate-sized cluster of nesting burrows was first observed in 2011, suggesting that the colony formed between 2009 and 2011. Substantial numbers of burrows were recorded on this island in 2016 and 2018. The size of the pioneering bank swallow colony is unclear, and it is unknown whether the increase in colony size several years later might be attributed to con-specific attraction, high colony productivity and survival, or both. There was a small increase (6%) in the mean number of burrows observed at this site from 2016 to 2018, a 44% decrease from 2018 to 2020, and a 13% decrease from 2020 to 2021. The cause of the decline is unknown, as the colony is in Stephens Lake and was not affected by reservoir impoundment. As indicated above, localized bank erosion may have caused burrows to collapse. The decline was the smallest among the colonies in Stephens Lake, and site 12 remained the largest colony in the study area in terms of the mean number of burrows.

In 2021, 464 birds were counted during the first survey and 496 during the second. These numbers are substantially larger than the maximum of 40 individuals observed in July 2011 (Stantec Consulting Ltd. 2013) during helicopter surveys conducted between Clark Lake and Stephens Lake from 2005 to 2012. More bank swallows than expected were counted along the lower Nelson River during Manitoba Breeding Bird Atlas surveys conducted from 2010 to 2014, because its steep, sandy banks provide high-quality habitat for nesting pairs (Taylor 2018). As such, bank swallows were likely more numerous in the Keeyask region than suggested by incidental observations during pre-construction bird surveys, and the numbers observed during construction monitoring do not necessarily indicate a large population increase. They are likely a result of the more intensive, species-specific surveys conducted since bank swallows were assessed as Threatened by COSEWIC in 2013.

A bank swallow mortality was reported in May 2017, when an individual was found trapped under a box. Another mortality was noted in August 2020, near the site support office. Its cause was unknown.

5.0 SUMMARY AND CONCLUSIONS

There is a large bank swallow population in the Keeyask region. While substantially more bank swallows were observed during construction monitoring than during pre-construction surveys, the increase was more likely attributable to the increased survey effort during the latter studies than to a large population increase. In 2021, the estimated bank swallow population in Study Zone 4 was 3,282 individuals, a decrease of 19% from the previous year. The estimated population was 18% lower in 2021 than when surveys began in 2016. Overall, the regional Keeyask bank swallow population appears stable, but it may also be declining.

Bank swallows rely on eroding mineral soils and steep sandy banks to form suitable nesting habitat substrate, especially in the Keeyask region. Following reservoir impoundment in fall 2020, new shorelines formed rapidly and abruptly altered unoccupied bank swallow burrows in the affected area. The existing unoccupied burrows at three sites within the reservoir area were affected, and at the time, the habitat at each appeared to remain suitable for future nesting. The large decrease in the number of burrows and reduced height of the bank at one site in 2021 indicate that the quality of nesting habitat has declined substantially at this location but may still be suitable for a few nesting pairs. The habitat at the other two sites appeared to remain suitable, and a small increase in the number of burrows was observed at each.

It is recommended that long-term monitoring that began in 2016 continue every two years until 2024, as outlined in the TEMP. It is also recommended that an aerial survey be conducted in spring 2022 to identify new areas with suitable nesting habitat, to determine whether colonies have relocated in the region. A habitat quality model for bank swallow will be developed and validated with these data. The validated habitat quality model will be applied to the post-Project terrestrial habitat map to identify and measure suitable nesting habitat. Nesting habitat loss due to Project infrastructure and indirect Project effects on terrestrial habitat and surface water types included in the model will be determined and will be used to quantify the loss or alteration of bank swallow habitat.

6.0 LITERATURE CITED

- Burke, T. 2017. Bank swallow (*Riparia riparia*) breeding in aggregate pits and natural habitats. M.Sc. thesis, Environmental and Life Sciences M.Sc. Graduate Program, Trent University, Peterborough, ON. 99 pp.
- COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2013. COSEWIC assessment and status report on the Bank Swallow *Riparia riparia* in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. 48 pp.
- Falconer, M., Richardson, A., Heagy, A., Tozer, D., Stewart, B., McCracken, J., and Reid, R. 2016. Recovery strategy for the bank swallow (*Riparia riparia*) in Ontario. Ontario Recovery Strategy Series. Prepared for Ontario Ministry of Natural Resources and Forestry, Peterborough, ON. 70 pp.
- Florsheim, J.L., Mount, J.F., and Chin, A. 2008. Bank erosion as a desirable attribute of rivers. *BioScience* 58(6): 519–529.
- Garrison, B.A. 1999. Bank swallow (*Riparia riparia*). In *The Birds of North America*. Edited by A.F. Poole and F.B. Gill. Cornell Lab of Ornithology, Ithaca, NY.
- Government of Canada. 2019. *Species at Risk Act* Public Registry, Residence Descriptions. Description of residence for bank swallow (*Riparia riparia*) in Canada. 7 pp.
- Grieff, G.D. 2003. Bank swallow. In *The Birds of Manitoba*. Edited by P. Taylor. Manitoba Naturalists Society, Winnipeg, MB. pp. 282–283.
- Hjertaas, D.G. 1984. Colony site selection in bank swallows. M.Sc. thesis, Department of Biology, The University of Saskatchewan, Saskatoon, SK. 129 pp.
- Stantec Consulting Ltd. 2013. Avian 2011 field studies report. Report #TERR-11-01. Keeyask Project Environmental Studies Program. Draft Report prepared for Manitoba Hydro by Stantec Consulting Ltd., Winnipeg, MB. 132 pp.
- Taylor, P. 2018. Bank swallow. In *The Atlas of the Breeding Birds of Manitoba, 2010–2014*. Edited by C. Artuso, A.R. Couturier, K.D. DeSmet, R.F. Koes, D. Lepage, J. McCracken, R.D. Mooi, and P. Taylor. Bird Studies Canada, Winnipeg, MB. Available from <https://www.birdatlas.mb.ca/accounts/speciesaccount.jsp?sp=BANS&lang=en> [accessed September 17, 2018].
- Weatherhead, P.J. 1985. Risks of clustering in thermally-stressed swallows. *The Condor* 87: 443–444.
- Wright, D.H., Lomeli, H., Hofmann, P.S., and Nguyen, C. 2011. Burrow occupancy and nesting phenology of bank swallows along the Sacramento River. *California Fish and Game* 97(3): 138–147.

WRCS (Wildlife Resource Consulting Services MB Inc.). 2021. Keeyask Generation Project Terrestrial Effects Monitoring Plan Report #TEMP-2021-12: Bank Swallow Monitoring 2020. A report prepared for Manitoba Hydro by Wildlife Resource Consulting Services MB Inc., June 2021.

WRCS. Keeyask Generation Project Terrestrial Effects Monitoring Plan Report #TEMP-2022-14: Colonial Waterbird Habitat Effects Monitoring 2021. A report prepared for Manitoba Hydro by Wildlife Resource Consulting Services MB Inc., June 2022.

APPENDIX 1: EXAMPLE COUNT OF BURROWS IN PHOTOGRAPH



Note: Alternating colours were used for each group of 10 burrows to facilitate counting.

APPENDIX 2: BANK SWALLOW BURROW COUNTS 2021

Colony	Survey Date	Observer 1 (Field Count)	Observer 2 (Photo Count)	Observer 3 (Photo Count)
01	June 27	7	5	4
	July 4	5	–	–
02	June 27	150	418	457
	July 4	406	461	371
04	June 27	205	376	326
	July 4	188	297	253
06	June 27	8	5	9
	July 4	6	12	5
07	June 27	186	242	270
	July 4	419	376	347
09	June 25	99	119	112
	July 4	188	118	71
10	June 26	6	5	4
	July 3	5	9	4
11 ¹	June 26	318	484	406
	July 3	383	439	378
12	June 26	841	847	818
	July 3	760	801	623
13	June 26	230	161	114
	July 3	269	238	162
14	June 26	123	110	106
	July 3	150	120	96
15	June 26	341	312	277
	July 3	387	443	432
17	June 26	8	10	6
	July 3	16	11	6
20	June 27	24	30	17
	July 4	12	36	26

1. Includes the former Site 18.