



Keeyask Generation Project
Terrestrial Effects Monitoring Plan

Bank Swallow Habitat Effects Monitoring Report

TEMP-2019-10



KEEYASK GENERATION PROJECT

TERRESTRIAL EFFECTS MONITORING PLAN

REPORT #TEMP-2019-10

BANK SWALLOW MONITORING 2018

Prepared for

Manitoba Hydro

By

Wildlife Resource Consulting Services 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 will affect the environment, and whether or not more needs to be done to reduce harmful effects.

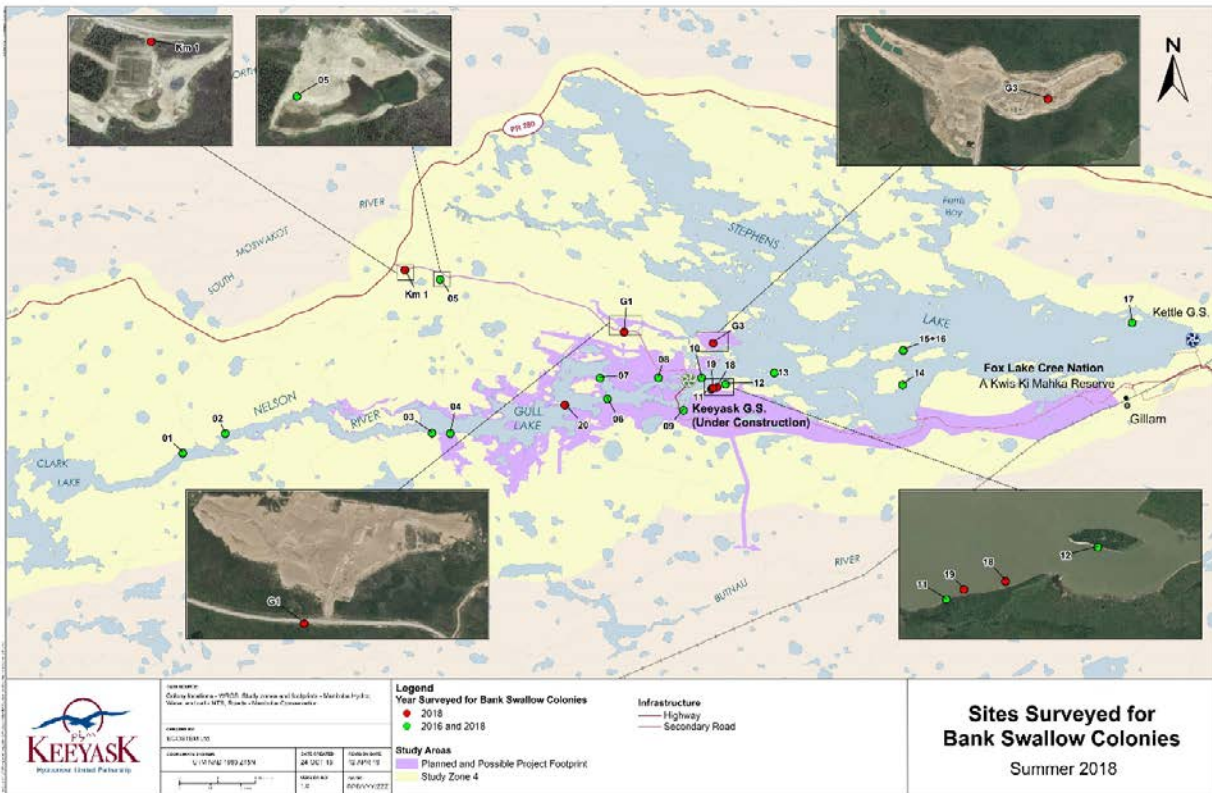
Banks swallows are small, insect-eating birds that excavate nesting burrows in sandy riverbanks and gravel pits. Relatively few bank swallows were observed in the Clark Lake to Stephens Lake area during pre-Project field studies; at most 40 individuals were identified in a single year. Potential construction-related 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.

Why is the study being done?

Bank swallow is a priority bird 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 2018 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 post-construction with a validated habitat quality model.

What was done?

Bank swallow colonies initially identified during aerial surveys in summer 2016 were revisited in 2018 and six new sites were surveyed. Most colonies were surveyed by boat or on foot in June and 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 2018

What was found?

All 16 of the bank swallow colonies surveyed in 2016 were revisited in 2018, and 6 new colonies were found, 2 of which may have been extensions of a previously-identified nesting site. A total of 149 birds were counted in June and 453 in July. No birds were observed at four sites in June or July. At the remaining colonies, a minimum of 2 individuals were observed in July and a maximum of 95 were observed, also in July. Colonies ranged in size from 1 to 1,694 burrows, not all of which were expected to be occupied. Bank swallow burrows were observed in four Project borrow areas. An estimated 2,261 breeding pairs (or 4,522 adults) inhabited Study Zone 4 in 2018, a 13% increase from 2016.



Field worker near a bank swallow colony during the 2018 survey

What does it mean?

Bank swallows rely on eroding mineral soils and steep banks for nesting habitat. Natural sites tend to support larger colonies but excavations in borrow areas are also used for nesting. While bank swallows may return to sites where they have previously bred successfully, the temporary nature of their nesting habitat means that they are not strongly attached to a particular area. More bank swallows were observed in Study Zone 4 in 2016 and 2018 than were observed incidentally during the pre-Project surveys that began in 2001. The numbers observed during construction monitoring do not likely indicate a large population increase but rather were a result of the more intensive, focused surveys conducted since the bank swallow was first assessed as a species at risk in 2013. To date, one nesting site has been removed for Project-related bank stabilization and four nesting sites have recently been identified in Project borrow areas. The small increase in the number of nesting colonies and in the estimated number of bank swallows in Study Zone 4 that has been observed since 2016 suggest that the population is stable.

What will be done next?

Monitoring that began in 2016 will continue every two years until 2024. A habitat quality model for bank swallow will be developed and will be validated with monitoring data. 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.

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

- Robert Berger (M.N.R.M.) – Design, analysis, and reporting
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- Kaitlin McCormick (B.Sc. Hons.) – Crew leader/survey personnel
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1.0 INTRODUCTION

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

The *Keeyask Generation Project Response to EIS Guidelines* (the EIS), completed in June 2012, provides a summary of predicted effects and planned mitigation for the Project. Technical supporting information for the terrestrial environment, including a description of the environmental setting, effects and mitigation, and a summary of proposed monitoring and follow-up programs is provided in the *Keeyask Generation Project Environmental Impact Statement Terrestrial 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 extends from late May to early August (Taylor 2018). Bank swallow is a priority bird because it was assessed as Threatened by COSEWIC in 2013 (COSEWIC 2013) and was officially listed as Threatened under the federal *Species at Risk Act* 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 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 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 birds.

2.0 METHODS

Surveys for bank swallow were conducted from June 16 to July 9, 2018 in Study Zone 4, mainly at sites along the Nelson River from Birthday Rapids downstream to the Kettle GS area on Stephens Lake (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. All 16 sites identified in 2016 were revisited and 6 new sites were surveyed in 2018. Three of the new sites were in Project borrow areas and three were initially observed during other TEMP field studies.

Most of the 22 bank swallow nesting sites were surveyed by boat on June 16 and 17 and from July 6 to 9, 2018 (Table 1), in the primary breeding season. Six sites were visited on foot during the same periods. At site 09, surveys were conducted with an unmanned aerial vehicle (UAV) on June 28 and July 19 and on foot on July 8. Surveys were conducted between 8:00 a.m. and 12:00 p.m., when observers counted birds and nesting burrows at each colony. At most sites, two observers independently counted the number of bank swallows flying near the colony three times over a 10-minute period. At two sites surveyed in June (05 and Km 1), a single observer counted the number of bank swallows six times over a 10-minute period. The greatest number of birds observed during a single count was recorded for each colony in June and in July. During boat surveys, 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 16 nesting colonies surveyed by boat for additional burrow counts. There were relatively few burrows at five of the six colonies surveyed on foot (05, 08, G1, G3, and Km 1), which were accurately counted on-site and did not require further analyses. UAV photos were taken of the remaining colony.

Table 1: Bank Swallow Nesting Colonies Surveyed, Summer 2018

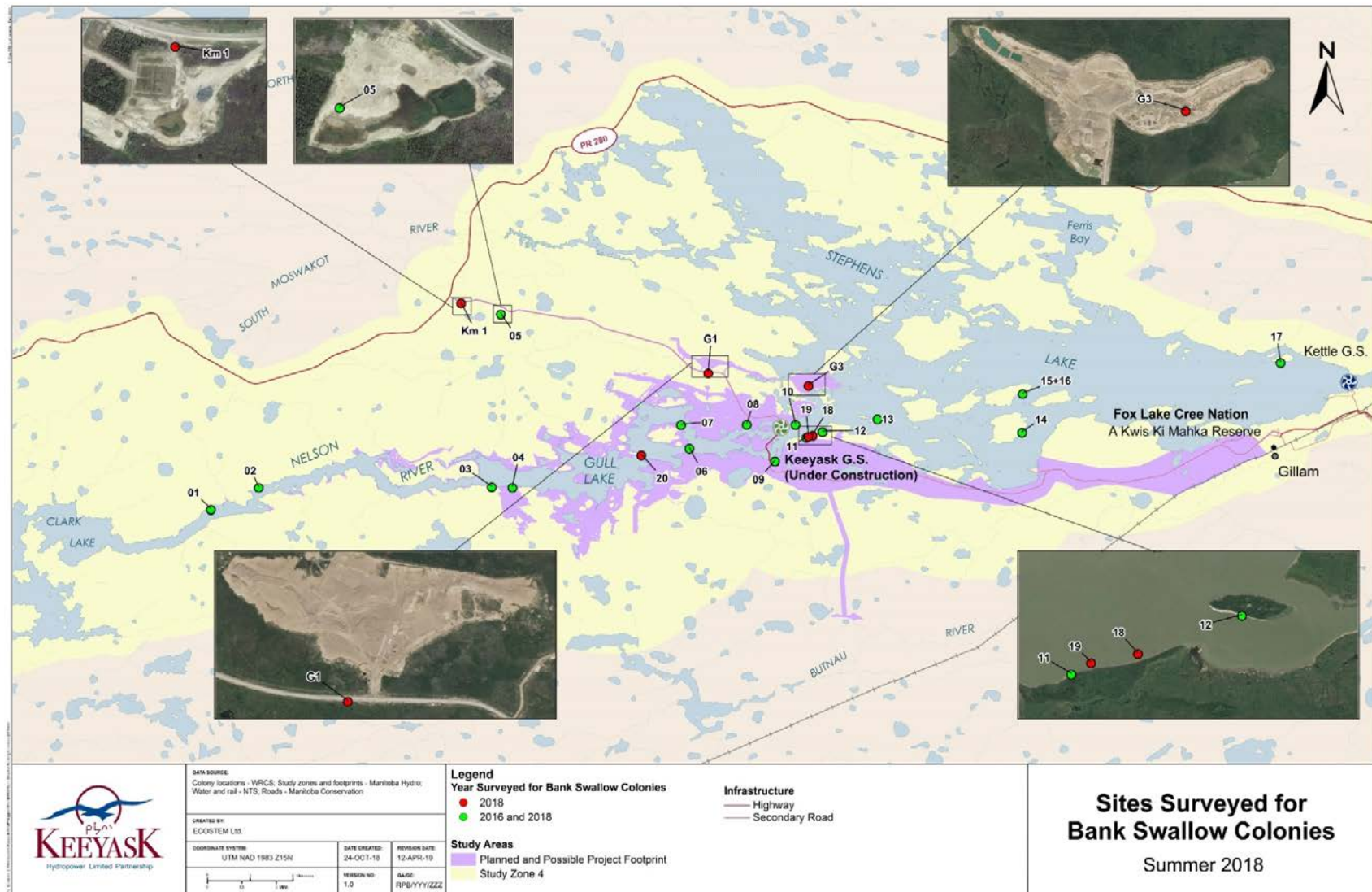
Site ¹	Location	Date Surveyed	Survey Type
01	15 V 328638 6242168	June 17, July 8	Boat
02	15 V 331606 6243531	June 17, July 8	Boat
03	15 V 346017 6243561	June 17, July 8	Boat
04	15 V 347288 6243533	June 17, July 9	Boat
05 ²	15 V 346581 6254245	June 17, July 6	Foot
06	15 V 358235 6245942	June 17, July 9	Boat
07	15 V 357720 6247397	June 17, July 9	Boat
08	15 V 361788 6247421	July 6	Foot
09	15 V 363536 6245149	June 28/July 19, July 7	UAV/Foot
10	15 V 364806 6247412	June 16, July 6	Boat
11	15 V 365483 6246626	June 16, July 6	Boat
12	15 V 366476 6246968	June 16, July 6	Boat
13	15 V 369874 6247761	June 16, July 6	Boat
14	15 V 378819 6246929	June 16, July 6	Boat

Site ¹	Location	Date Surveyed	Survey Type
15+16 ³	15 V 378855 6249312	June 16, July 6	Boat
17	15 V 394806 6251246	June 17, July 6	Boat
18	15 V 365871 6246745	July 6	Boat
19	15 V 365598 6246692	July 6	Boat
20	15 V 355271 6245521	July 9	Boat
G1 ²	15 V 359405 6250597	July 6	Foot
G3 ²	15 V 365611 6249820	July 6	Foot
Km 1 ²	15 V 344120 6254920	June 17, July 8	Foot

1. Sites 01 to 17 were also surveyed in 2016.
2. Project borrow area sites.
3. Sites 15 and 16 were identified separately during field studies in 2016 but were subsequently considered a single colony because site 15 was small (mean of nine burrows). Due to their proximity of about 400 m, the sites may be viewed as a single colony.

Where possible, photos taken at each of 17 colonies were stitched together with Windows Photo Gallery. The resulting panoramas and some individual photos were cropped and 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 the June and July visits.

The mean number of burrows at each colony (the larger of the observations in June or July) 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 was recently 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.



Map 1: Sites Surveyed for Bank Swallow Colonies, Summer 2018

3.0 RESULTS

Twenty-two bank swallow colonies were surveyed in the study area in 2018 (Map 2), sixteen of which were initially identified in 2016. Six new colonies were observed. Three were observed in Project borrow areas and one was found on a peninsula in Gull Lake. Two were found on the south shore of Stephens Lake, near site 11. Approximately 70 m separated the ends of sites 11 and 19 and approximately 150 m separated sites 19 and 18 (see Map 2 inset). The colonies at sites 05, G1, G3, and Km 1 were in borrow areas, at least one of which (site 05) was rehabilitated with planted trees (Photo 1).

Where burrows were observed, the mean number at each colony ranged from 1 to 1,694 (Table 2). The largest colony was located at site 12 on an island in Stephens Lake. The colonies at sites 01, 10, and Km 1 were small, with fewer than five burrows at each. In general, there were fewer burrows at colonies on sloped, shrubby banks (Photo 2) than on steep banks with little vegetation (Photo 3). Most nesting burrows were located near the top of the bank. No burrows were observed at sites 03 or 08, which were identified as nesting areas in 2016.

More burrows were observed in July than in June at all but two sites, likely because additional burrows were excavated as the breeding season progressed. Variations in observer counts (Appendix 2) at sites 14 and 15+16 were likely due in part to differences in shadows and photo angles that could have resulted in more burrows being counted earlier in the season. The lower counts in July could also have been a result of collapsed burrows due to on-going erosion.

The subpopulations of individual colonies in Study Zone 4 ranged from 1 to 847 pairs, based on the largest of the mean numbers of burrows in June or July at each site. The regional bank swallow population in 2018 was estimated at 2,261 breeding pairs or 4,522 individuals. The population increased 13% from 2016, when it was estimated at 2,005 breeding pairs or 4,010 individuals.

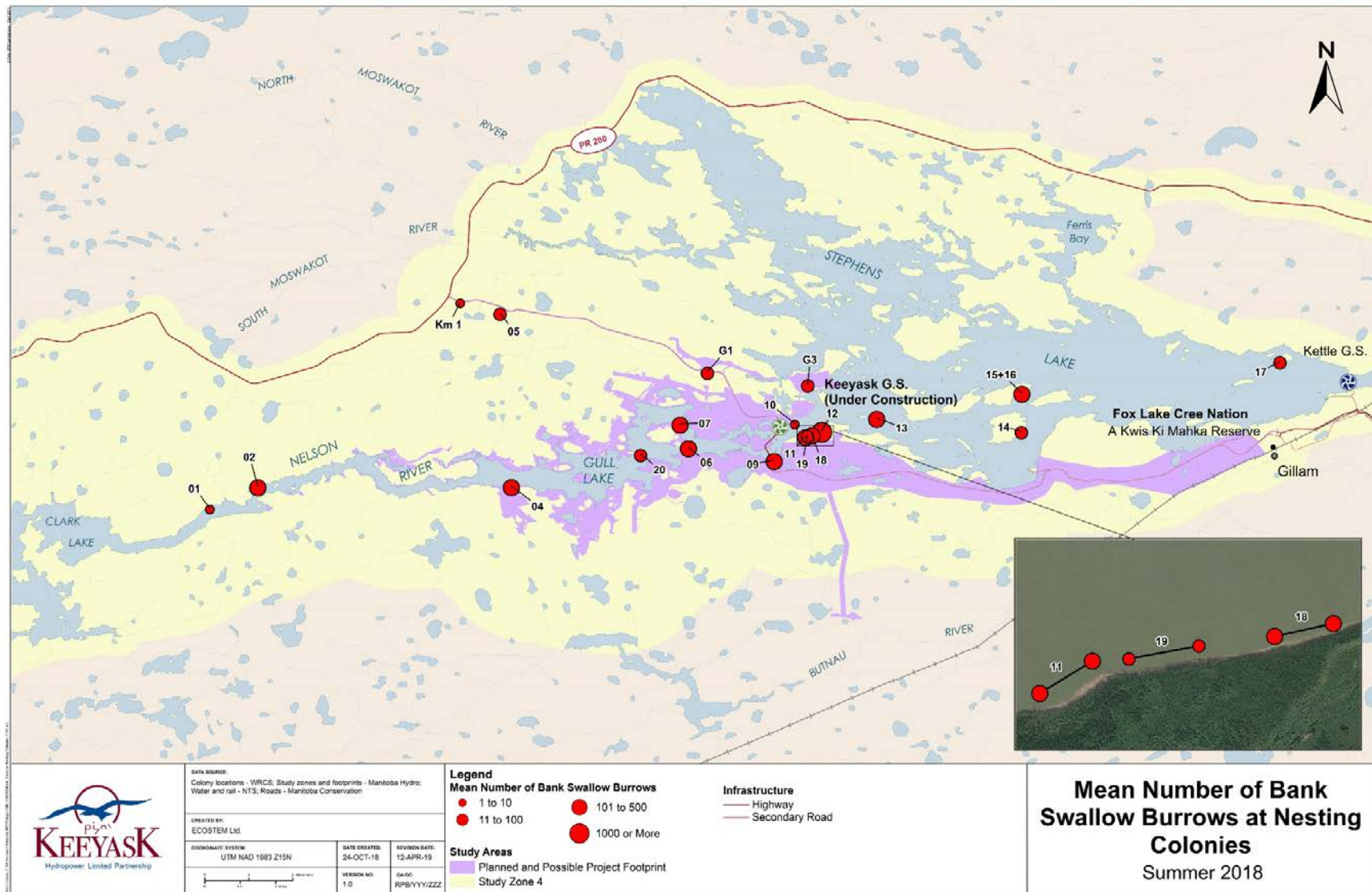
Birds were observed at all but four sites (03, 08, 17, and Km 1) during June or July surveys in 2018. A total of 149 birds were counted in June and 453 in July. Where birds were observed, a minimum of 2 individuals were counted at site 20 in July and a maximum of 95 were observed at site 02, also in July (Table 2).

Table 2: Mean Number of Bank Swallow Burrows at 22 Colonies, Summer 2018

Colony	Survey Period	Mean Number of Burrows	Standard Deviation	95% Confidence Interval	Number of Birds Observed
01	June	3	0	0	5
	July	4	0	0	0
02	June	270	31.1	35	4
	July	357	59.0	67	95
03	June	0	-	-	0
	July ¹	0	-	-	0
04	June	338	26.9	30	13

Colony	Survey Period	Mean Number of Burrows	Standard Deviation	95% Confidence Interval	Number of Birds Observed
	July	386	74.8	85	50
05	June ¹	16	-	-	0
	July ¹	26	-	-	3
06	June	218	103.0	117	5
	July	292	55.7	63	21
07	June	327	55.2	62	5
	July	486	81.0	92	28
08	July ¹	0	-	-	0
09	June ¹	129	-	-	-
	July	151	20.6	23	28
10	June	2	0	0	0
	July	5	0.6	1	6
11	June	125	16.3	18	13
	July	169	49.5	56	16
12	June	1,528	240.7	272	57
	July	1,694	208.5	236	56
13	June	135	2.6	3	25
	July	135	42.3	48	16
14	June	53	5.9	7	12
	July	47	16.7	19	5
15+16	June	446	37.6	43	10
	July	424	123.3	140	31
17	June	13	3.2	4	0
	July	14	6.1	7	0
18	July	125	60.8	69	54
19	July	79	17.1	19	0
20	July	11	3.5	4	2
G1	July ¹	33	-	-	15
G3	July ¹	53	-	-	27
Km 1	June ¹	1	-	-	0
	July ¹	3	-	-	0
Total	June				149
	July				453

1. Burrows counted during field survey only.



Map 2: Mean Number of Bank Swallow Burrows at Nesting Colonies, Summer 2018



Red oval indicates bank swallow burrows; note trees planted for site rehabilitation in background.

Photo 1: Borrow Area at Site 05, July 2018



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

Photo 2: Small Bank Swallow Colony at Site 01, July 2018



Red oval indicates bank swallow burrows.

Photo 3: Portion of a Large Bank Swallow Colony at Site 12, June 2018

The mean number of bank swallow burrows increased at 10 of 16 colonies from 2016 to 2018, by as little as 6% at site 12 and by as much as 1,410% at site 09 (Table 3). The mean number of burrows decreased between 4% and 100% at four sites over the same period. As indicated above, no burrows were observed at sites 03 and 08 in 2018, where 1 and 125 burrows, respectively, were counted in 2016. In March 2017, rip rap was placed at site 08 for bank stabilization and the area was no longer suitable for bank swallow nesting (Photo 4). The single burrow initially observed at site 03 in 2016 likely collapsed at some point due to bank erosion (Photo 5).

The number of bank swallows observed increased at 6 of the 16 colonies from 2016 to 2018 (Table 4). The largest increase (200%) was at site 10, where two birds were observed in 2016 and six were observed in 2018. The number of bank swallows decreased between 7% and 100% at six sites. No birds were observed at sites 03 or 17 in either survey year. The largest decrease in the number of birds observed was at site 08, where 21 were observed in 2016 and none were observed in 2018.

Table 3: Mean Number of Bank Swallow Burrows at 16 Colonies, Summer 2016 and Summer 2018

Colony	Mean Number of Burrows ¹		
	2016	2018	Percent Change
01	5	4	+33
02	313	357	+14
03	1	0	-100
04	183	386	+111
05	84	26	-69
06	69	292	+323
07	139	486	+250
08	125	0	-100
09	10	151	+1,410
10	2	5	+150
11	421	169	-60
12	1,600	1,694	+6
13	89	135	+52
14	180	53	-71
15+16	463	446	-4
17	12	14	+17

1. Greatest mean number in June or July.

**Photo 4: Bank Stabilization at Site 08, July 2018**



Photo 5: Bank Erosion at Site 03, June 2018

Table 4: Maximum Number of Bank Swallows at 16 Colonies, Summer 2016 and Summer 2018

Colony	Maximum Number of Bank Swallows ¹		
	2016	2018	Percent Change
01	0	5	-
02	77	95	+23
03	0	0	-
04	34	50	+47
05	31	3	-90
06	11	21	+91
07	35	28	-20
08	21	0	-100
09	12	28	+133
10	2	6	+200
11	77	16	-79
12	225	57	-75
13	27	25	-7
14	7	12	+71
15+16	76	31	-59
17	0	0	-

1. Greatest number in June or July.

4.0 DISCUSSION

A small increase in the estimated bank swallow population was observed in Study Zone 4 from 2016 to 2018. Additionally, nesting burrows were observed at six new sites in 2018. The proximity of sites 18 and 19 to site 11 suggests that they might be extensions of the existing colony. At site 11, 256 fewer burrows were observed in 2018 than in 2016; some breeding pairs from this subpopulation could have re-located nearby, given that a similar number ($n = 204$) of new burrows was observed at sites 18 and 19. Decreased numbers of burrows at this and other sites could be due to localized bank erosion that collapsed older nesting holes. 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).

In 2018, 149 birds were counted in June and 453 in July. These numbers are substantially larger than the maximum of 40 individuals counted in July 2011 (Stantec 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.

The mean number of bank swallow burrows increased at 63% of the 16 colonies that were first surveyed in 2016 and then revisited in 2018. The most substantial increase, from 10 burrows to 151, was observed at site 09. Nesting habitat at this site may have been more attractive to bank swallows in the 2018 breeding season. As this site was only surveyed by helicopter during preliminary aerial surveys in 2016 and was photographed by UAV and visited on foot in 2018, the increase in the number of burrows counted could also be due, at least in part, to the improved visibility of burrows during the most recent surveys.

Between 3 and 53 bank swallow burrows were observed in four Project borrow areas. While natural sites tend to support larger colonies, borrow areas can provide important nesting habitat for bank swallows (Burke 2017).

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 or not the increase in colony size several years later might be attributed to con-specific

attraction, high colony productivity and survival, or both. The smallest increase in the mean number of burrows observed from 2016 to 2018 (6%) was at this site.

Field counts of bank swallows are not censuses of subpopulations, but can provide an indication of whether or not a colony is active. No birds were observed in either survey year and a single nesting burrow was observed in 2016 at site 03, suggesting that it was not a significant bank swallow nesting site. The similar number of burrows at site 17 in 2016 and 2018 and the absence of birds both years could indicate that it is not active.

Bank swallow nesting habitat was removed at site 08 due to bank stabilization done for the Project in March 2017. However, more colonies were identified in 2018 than in 2016 in Study Zone 4 and a small increase in the estimated bank swallow population was observed, suggesting that the loss of 125 burrows, at least half of which were likely unoccupied in the summer of 2016, had a minimal effect on bank swallows in the region.

5.0 SUMMARY AND CONCLUSIONS

While substantially more bank swallows were observed in 2016 and 2018 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 2018, the estimated bank swallow population in Study Zone 4 was 4,522 individuals, an increase of 13% from 2016. Burrows were observed at 14 of the 16 sites that were initially surveyed in 2016. Bank swallow burrows were found at six new sites in 2018, two of which may have been extensions of an existing colony.

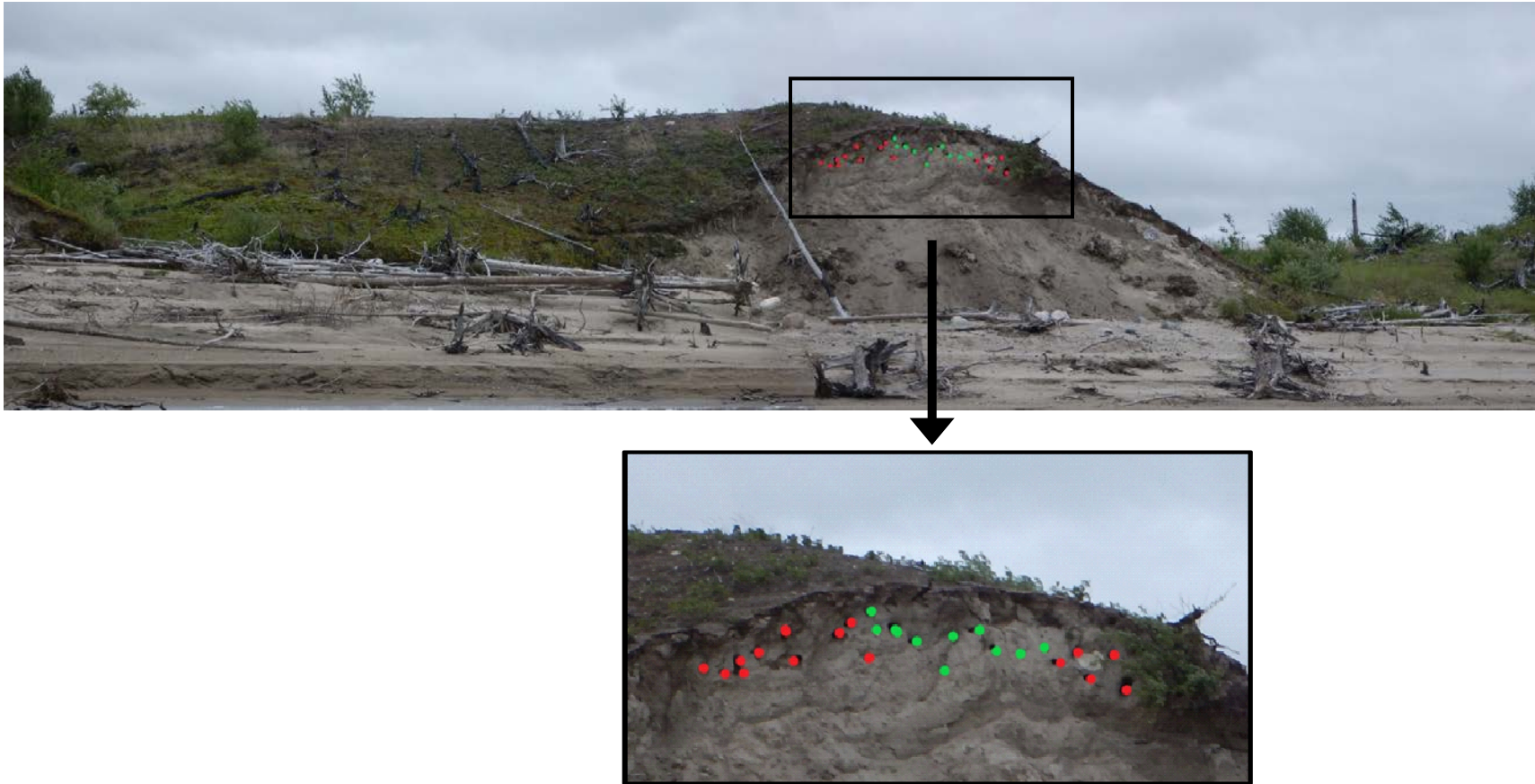
Bank swallows rely on eroding mineral soils and steep banks to form suitable nesting habitat substrate, especially in the Keeyask region. To date, one bank swallow nesting site has been removed for Project-related bank stabilization. Slopes in inactive borrow areas or in unused sections of borrow areas can provide alternative breeding habitat for bank swallows affected by construction activity; excavations in Project borrow areas provided temporary nesting habitat at four sites. Because a small increase in the number of nesting colonies and in the estimated number of individuals in Study Zone 4 has been observed since 2016, the population appears to be stable and Project effects on bank swallows appear to be minimal.

Monitoring that began in 2016 will continue every two years until 2024. 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.

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APPENDIX 1: EXAMPLE COUNT OF BURROWS IN PANORAMIC PHOTOGRAPH



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

APPENDIX 2: BANK SWALLOW BURROW COUNTS 2018

Colony	Survey Date	Observer 1 (Field Count)	Observer 2 (Photo Count)	Observer 3 (Photo Count)
01	June 17	3	3	3
	July 8	4	4	4
02	June 17	305	261	88
	July 8	425	317	330
03	June 17	0	0	0
	July 8 ¹	0	-	-
04	June 17	360	346	308
	July 8	300	433	426
05 ¹	June 17	16	-	-
	July 6	26	-	-
06	June 17	320	220	114
	July 9	350	239	287
07	June 17	367	264	350
	July 9	400	496	561
08 ¹	July 6	0	-	-
09	June 28 ¹	129	-	-
	July 7/19	132	173	149
10	June 16	2	2	2
	July 6	4	5	5
11	June 16	112	143	119
	July 6	225	151	131
12	June 16	1,250	1,657	1,676
	July 6	1,900	1,699	1,483
13	June 16	138	133	134
	July 6	180	130	96
14	June 17	60	51	49
	July 6	66	37	37
15+16 ²	June 17	404	459	476
	July 6	529	454	288
17	June 17	17	12	11
	July 6	17	18	7
18	July 6	55	167	152
19	July 6	63	97	77
20	July 9	13	13	7
G1 ¹	July 6	33	-	-
G3 ¹	July 6	53	-	-
Km 1 ¹	June 17	1	-	-
	July 8	3	-	-

1. Burrows counted during field survey only. 2. Sites 15 and 16 were identified separately during field studies in 2016 but were subsequently considered a single colony due to their proximity (approximately 400 m).