



Keeyask Generation Project Terrestrial Effects Monitoring Plan

Bald Eagle Habitat Effects Monitoring Report

TEMP-2023-11



KEYYASK GENERATION PROJECT

TERRESTRIAL EFFECTS MONITORING PLAN

REPORT #TEMP-2023-11

BALD EAGLE HABITAT EFFECTS MONITORING YEAR 1 OPERATION 2022

Prepared for

Manitoba Hydro

By

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SUMMARY

Background

Construction of the Keeyask Generation Project (the Project) began in July 2014 and became fully operational in March 2022. The Keeyask Hydropower Limited Partnership (KHLP) was required to prepare a plan to monitor the effects of operation of the generating station on the terrestrial environment, including bald eagles. Monitoring results will help the KHLP, government regulators, members of local First Nation communities, and the general public understand how operation of the generating station will affect bald eagles and their habitat, and whether more needs to be done to reduce potentially harmful effects.

Project operation was anticipated to reduce the amount of bald eagle foraging habitat in the upstream reservoir, which was likely to be offset by increased foraging opportunities in the tailrace area (immediately downstream of the spillway). These habitat changes were predicted to result in a shift of bald eagle use away from the reservoir to areas downstream of the Project. Additionally, the local bald eagle population was not expected to change appreciably.

This report describes the results of bald eagle habitat effects monitoring conducted during the summer of 2022, the first summer of full Project operation, and compares results to previous construction-phase surveys conducted in 2015, 2017, 2019, and 2021.



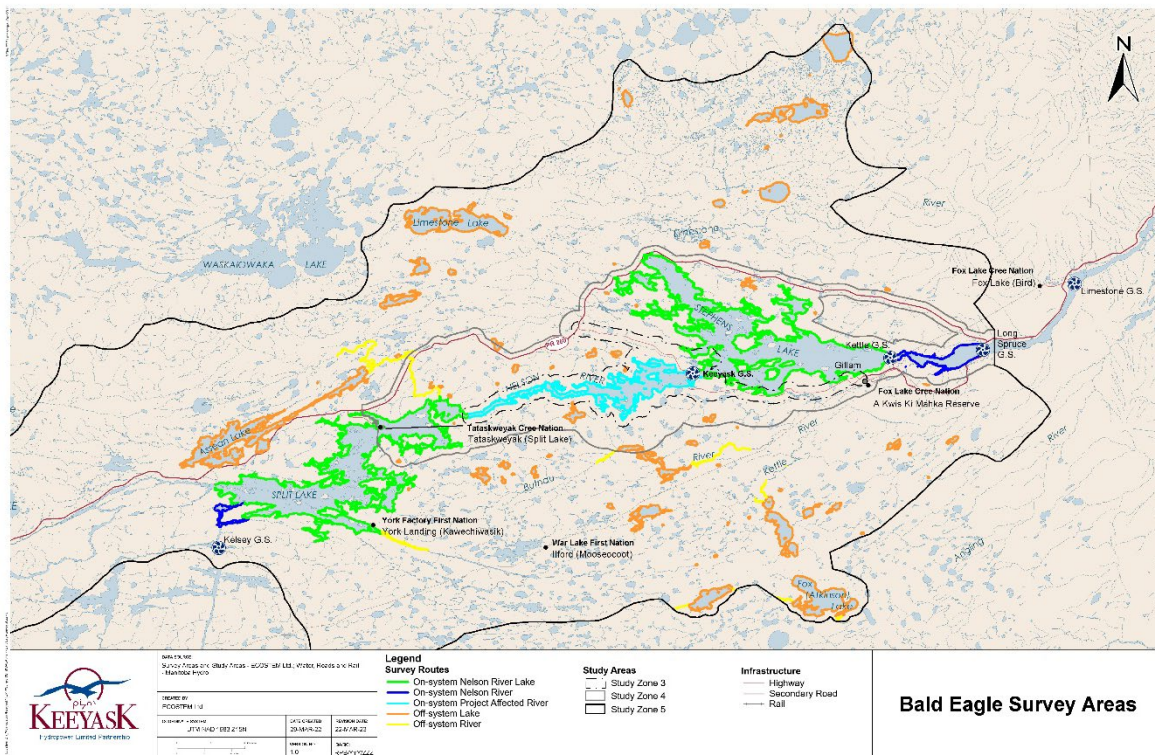
Bald Eagle Attending a Nestling on an Artificial Nesting Platform (installed for the Project) in 2022

Why is the study being done?

The Project has the potential to affect bald eagle populations through alteration and loss of habitat. Bald eagle habitat effects monitoring is being done to evaluate Project effects on the number and location of bald eagles and their breeding habitats.

What was done?

Helicopter-based aerial surveys took place in May, June, and July 2022 to determine the abundance, distribution, and habitat use of bald eagles in Project-affected areas and in reference areas. Bald eagle nests were also monitored for eggs and nestlings to monitor productivity. Previous construction-phase surveys in the same area were conducted in 2015, 2017, 2019, and 2021.



Shorelines Surveyed for Bald Eagles and Nests in 2022

What was found?

A total of 113 bald eagle nests were identified and monitored in 2022, along the surveyed shorelines. Of the 113 nests identified, 66 were occupied by a breeding pair of bald eagles and 31 nests successfully produced 41 late-stage nestlings. Successful bald eagle nests produced 1.32 nestlings per nest.

The distribution and density of nests in the Project-affected hydraulic zone (all areas within 200 m of the actual Project footprint), remained similar in 2022 to previous surveys conducted during construction and pre-construction periods. Bald eagles built nests along the newly expanded shoreline in the reservoir and used two of the Project-constructed artificial nesting platforms.

Within the Nelson River hydraulic zone (mainly Split Lake and Stephens Lake), the percent of successful bald eagle nests was low compared to construction-phase surveys. This may have been a result of the high water levels in the Nelson River in 2022, resulting from large amounts of precipitation in southern Manitoba.

What does it mean?

Project operation did not affect the number, distribution, or success of nests, or the number of chicks produced in 2022. The bald eagle population in the Project-affected hydraulic zone appears to be stable and sustainable, and the artificial nesting platforms are providing successful habitat mitigation.

In other areas of the Nelson River, including Split Lake and Stephens Lake, the high water levels in the spring and summer of 2022 likely reduced the ability of bald eagles to forage, resulting in the relatively high number of unsuccessful nests in these areas.

What will be done next?

The 2022 bald eagle survey was the first operation-phase survey for the Project. During Project operation, bald eagle habitat effects monitoring will continue for the next 15 years. The next bald eagle survey is scheduled for 2023.

STUDY TEAM

We would like to thank Custom Helicopters, and Sherrie Mason and Rachel Boone of Manitoba Hydro for their assistance. We would also like to thank Dr. James Ehnes, of ECOSTEM Ltd. for GIS supported study design and cartography.

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

- Robert Berger, Wildlife Resource Consulting Services MB Ltd. (WRCS), Design, analysis, and reporting
- Mark Baschuk, WRCS, Survey personnel, analysis, and reporting
- Thomas Wood, WRCS, Survey personnel

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1.0 INTRODUCTION

The Keeyask Generation Project (the Project) is a 695-megawatt hydroelectric generating station (GS), located at the former Gull Rapids on the lower Nelson River in northern Manitoba where Gull Lake flows into Stephens Lake. Project construction began in July 2014 and was fully operational in March 2022.

The Keeyask Generation Project: Response to EIS Guidelines (the EIS), completed in June 2012, provides a summary of predicted effects and planned mitigation for Project construction and operation. 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, bald eagle (*Haliaeetus leucocephalus*) habitat effects monitoring, for the operation phase of the Project.

Reservoir creation and Project operation was anticipated to reduce the amount of fast-flowing riverine areas in the Nelson River, resulting in a loss of bald eagle foraging habitat (KHLP 2012). The loss of bald eagle foraging habitat due to reservoir creation was predicted to be offset by the tailrace area, where increased foraging opportunities due to the increased accessibility to fish (KHLP 2012). It was expected that bald eagles that previously foraged between Birthday Rapids and Gull Rapids, would shift away from the reservoir to areas downstream of the Project (KHLP 2012). These changes were not expected to change the local population appreciably.

Overall, the Project was predicted to increase bald eagle habitat by 380 ha (0.03% of habitat in Study Zone 5) as a result of reservoir flooding and expansion creating riparian habitat suitable for nesting and perching (KHLP 2015a). Long-term loss of some perching and nesting trees in the reservoir was anticipated due to shoreline erosion and peatland disintegration (KHLP 2015a). The effect of tree loss is expected to be small as perching and nesting trees will be available in other areas of the new reservoir shorelines.

Previous bald eagle habitat effects monitoring, conducted during Project construction in 2015, 2017, 2019, and 2021 found that the distribution and number of bald eagle nests in the Project-affected hydraulic zone (all areas within 200 m of the Project reservoir footprint), remained similar during construction and during the pre-construction period (WRCS 2016; WRCS 2018; WRCS 2020; WRCS 2022). While Project construction did alter bald eagle habitat in the study area, it did not significantly affect the number, distribution, or success of nests, or the number of chicks produced.

The goal of this monitoring study was to evaluate how Project operation may have affected the abundance, distribution, and reproductive success of nesting bald eagles, and to assess the

effectiveness of Project-installed artificial nesting platforms (Photo 1). This report provides the results of the first year of operation-phase monitoring for the Bald Eagle Habitat Effects Study.



Photo 1: Artificial Nesting Platform Installed on the Reservoir Shoreline in 2017

2.0 METHODS

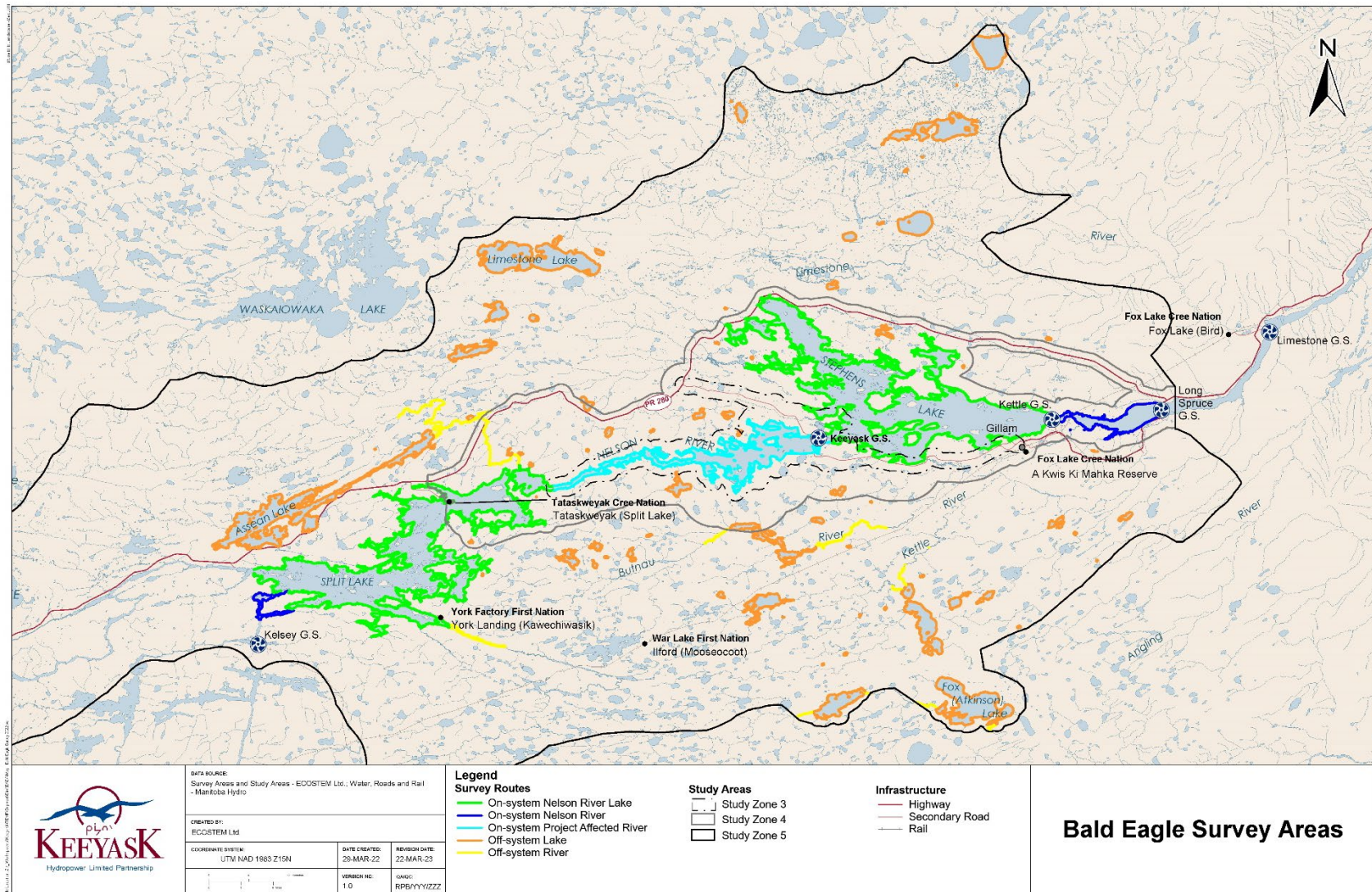
2.1 DATA COLLECTION

Helicopter-based aerial surveys were conducted to monitor the abundance, distribution, reproductive success, and habitat attributes of nesting locations of bald eagle in portions of Study Zone 5 during the 2022 breeding season (Map 1). Identical methods were used during the previous construction-phase surveys in 2015, 2017, 2019, and 2021 (WRCS 2016; WRCS 2018; WRCS 2020; WRCS 2022).

A random, stratified design was used to select waterbodies to be surveyed. Stratified random sampling is a method of sampling that involves the division of a population into smaller groups. These smaller groups (strata) were based on shared characteristics, including size and shoreline length. Waterbodies were classified broadly into either on-system (including Project-affected and Nelson River) or off-system hydraulic zones of influence, grouped into two basic categories (lake or river), and grouped into different size classes (0-10, >10-100, >100-1,000, >1,000-10,000, >10,000-100,000 ha). The Project-affected hydraulic zone includes all areas within 200 m of the actual Project reservoir footprint at the time of the survey (KHLP 2015a). The Nelson River zone included other reaches of the regulated Nelson River system from the Kelsey Generating Station (GS) downstream to the Limestone GS, but outside of the Project footprint. The Off-system zone included randomly selected waterways and waterbodies off the Nelson River system that are unaffected by hydroelectric development. The total shoreline lengths and distribution of waterbodies are presented in Table 1 and Map 1.

Table 1: Shoreline Length (km) and Size Class (ha) of Waterbody Types Surveyed in 2022

Hydraulic Zone	Waterbody Type	Waterbody Size Class (ha)					Total Shoreline Length (km)
		>0-10	>10-100	>100-1000	>1,000-10,000	>10,000-100,000	
Project-affected	River	0	0	0	327	0	327
	Lake	0	0	0	34	1,411	1,445
Nelson River	River	0	0	29	69	0	98
	Lake	18	50	213	606	0	887
Off-system	River	8	85	124	0	0	218
	Total	26	135	366	1,036	1,411	2,974



Map 1: Shorelines Surveyed for Bald Eagles and Nests in 2022

Aerial surveys followed protocols adapted from methods employed by the United States Fish and Wildlife Service (Jurek 1990; Jackman and Jenkins 2004) and the British Columbia Ministry of Environment (BCME 2013). Daily flights were conducted when wind speeds were below 25 km/h and when rain or fog did not restrict observers' ability to count birds or nests. The survey was flown at approximately 100 km/h and at elevations greater than 100 m above ground level (agl) to minimize disturbance to nesting bald eagles and avoid collisions with flying birds.

The aerial survey crew consisted of two observers and the helicopter pilot. The helicopter flew 50-100 m from the shoreline providing observers with a clear view of the trees along the shoreline. During the surveys, bird of prey observations and large stick nests were recorded along with their locations. Nests were named with a unique identification number ending with the year the nest was first observed (e.g., 14-2015, 105-2017). Tree species, nest height and tree heights were estimated using professional judgement and were verified using photography. All observations were georeferenced with a global positioning system (Garmin GPS 64). When a nest was observed, the helicopter slowed and circled the site once to georeference the nest and collect photographs with a Canon EOS Rebel T6i camera. Photography was conducted quickly to minimize disturbing birds and observers retreated if the eagles displayed agitated behaviour. Photographs were reviewed to confirm occupancy, and to verify nest contents.

Additionally, the five artificial nesting platforms installed by the Project in February 2017 were also surveyed during the bald eagle habitat effects monitoring survey in 2022.

The first survey occurred from May 24-27, 2022 and was conducted to locate initial nests and determine occupancy. A nest was considered occupied if at least one adult bald eagle was present at the nest. The second survey in the mid-nesting season occurred from June 15-19, 2022, to determine the contents (e.g., perched adult, incubating adult, nestlings, empty) of nests located in May and to locate any additional nests that were not detected during the first survey. The third and final survey, occurred between July 18-19, 2022, and determined the number of late-stage nestlings, near the fledgling stage of development (Photo 2) and documented any nests that were not detected in the previous surveys.

Bald eagle nests located off the survey route while ferrying between refueling stops were recorded as incidental and excluded from the final productivity analysis. Other bird of prey species and large stick nests observed during the survey were recorded as incidental.



Photo 2: Late-stage Bald Eagle Nestling Observed during the July 2022 Survey

2.2 DATA ANALYSIS

2.2.1 NEST ACTIVITY AND SUCCESS

Based on the results of the surveys, and using accepted standard methods (Jurek 1990; Jackman and Jenkins 2004), occupancy determinations were made for each monitored nest as follows:

- **Active:** Nests were defined as *Active* if there were two sexually mature bald eagle present on or near a nest, or there was at least one bald eagle in incubating posture on a nest (Steenhof and Newton 2007) during any of the three survey visits. Bald eagles are capable of breeding in their fifth year and are unmistakable with their completely white head and tail (McCollough 1989). Nests defined as *Active* were further categorized as:
 - **Active, Successful:** A nest with at least one late-stage nestling (dark plumage, no down present; Photo 2) or as a fledged juvenile observed near the nest (Steenhof and Newton 2007).
 - **Active, Not Successful:** An *Active* nest with two sexually mature bald eagles and where no incubating adult or nestlings were observed.

- **Active, Abandoned:** An *Active* nest containing an incubating adult, eggs or nestlings, where the adults ceased to attend the nest and did not successfully raise nestlings to the near fledging stage.
- **Active, Success Unknown:** An *Active* nest containing an incubating adult, eggs or nestlings, that was not sufficiently monitored to determine reproductive success (*i.e.*, *Active* nests observed in May or June and not observed in July).
- **Inactive:** Nests were defined as *Inactive* when only one or zero sexually mature bald eagles were observed near a sufficiently monitored nest (*i.e.*, nests observed in May and *Active* nests first observed in June).
- **Status Unknown:** Nests were defined as *Status Unknown* when an *Inactive* nest was not sufficiently monitored to determine reproductive success (*i.e.*, *Inactive* nests only observed in June or July).

Percentage of *Active* nests is calculated as:

$$\% \text{ Active nests} = \frac{\text{Total \# Active nests}}{\text{\# Active nests} + \text{\# Inactive nests}}$$

Percentage of *Successful* nests is calculated as:

$$\% \text{ Successful nests} = \frac{\text{Total \# Active, Successful nests}}{\text{\# Active nests}}$$

The percent of active, successful nests observed in the Project-affected zone during Project construction was compared to the off-system and Nelson River hydraulic zones using a Wilcoxon signed-rank test ($\alpha=0.05$).

2.2.2 REPRODUCTIVE SUCCESS

Reproductive success was calculated as the number of nestlings per bald eagle breeding pair (*i.e.*, per *Active* nests) and the number of nestlings per successful bald eagle breeding pair. Nests assessed as *Active*, *Success Unknown* were not included in reproductive success calculations as the number of late stage nestlings in these nests was undetermined. The number of nestlings observed in nests in July was used as the numerator for both calculations.

$$\# \text{ Nestlings/Pair} = \frac{\text{Total \# late stage nestlings in Active nests}}{\text{\# Active nests}}$$

$$\# \text{ Nestlings/Successful pair} = \frac{\text{Total \# late stage nestlings in Active, Successful nests}}{\# \text{ Active, Successful nests}}$$

Because the incubation period for bald eagle eggs is 35 days (Buehler 2000), nests observed to contain nestlings in the June or July survey were either *Active* in May but not detected by the survey team or became active shortly after the May survey. Thus, *Active* nests first observed in June or July were included in occupancy determinations (Photo 3). *Inactive* nests observed for the first time in June or July were deemed *Status Unknown* because, without an observation earlier in the nesting season, there was no way to determine if the nest was used earlier in the season (*i.e.*, it was not known whether a nesting attempt had failed). Nests that did not contain nestlings in July but contained nestlings in June that were less than 10 weeks old, were assessed as *Abandoned*; it is confidently assumed that such nestlings did not survive to the point when they would fledge from the nest.

The number of late-stage nestlings per active nest observed and the number of late-stage nestlings per active, successful nest observed in the Project-affected hydraulic zone were compared to the values observed in the off-system and Nelson River hydraulic zones using a Wilcoxon signed-rank test ($\alpha=0.05$).



Photo 3: Bald Eagle Nest with Two Chicks, June 2022

3.0 RESULTS

3.1.1 NEST ACTIVITY AND SUCCESS

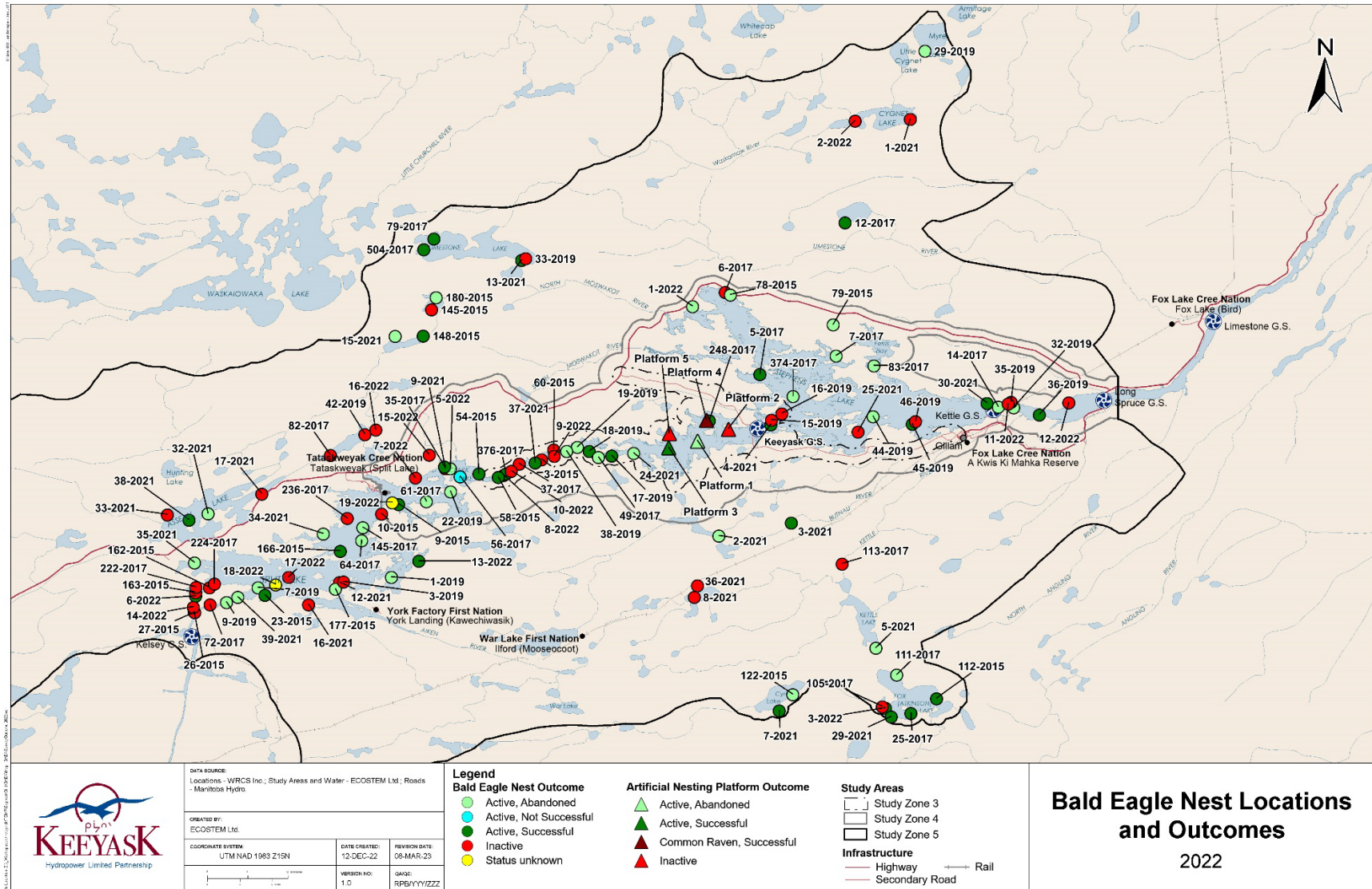
In 2022, a total of 113 bald eagle nests were found and monitored on the shorelines of surveyed waterbodies (Map 2), which was in the range observed previously during the construction-phase surveys from 2015-2021. Of the monitored nests, 19 were observed in the Project-affected zone, 59 were in the Nelson River zone, and 35 were in the Off-system zone (Map 2; Map 3). The distribution of bald eagle nests remained relatively steady in the different hydraulic zones during the initial operation-phase survey. There was no apparent shift in habitat use of bald eagles from the Project-affected zone to other areas (Map 2; Map 3).

The number of active, successful nests in Study Zone 5 in 2022 was lower than the number observed in three of the construction-phase survey years (2017, 2019, 2021), but greater than the number observed in 2015 (Table 2). The number of active, abandoned nests in 2022 was greater than those observed during construction-phase surveys, and was relatively high in the Nelson River zone in comparison to the other hydraulic zones (Table 2).

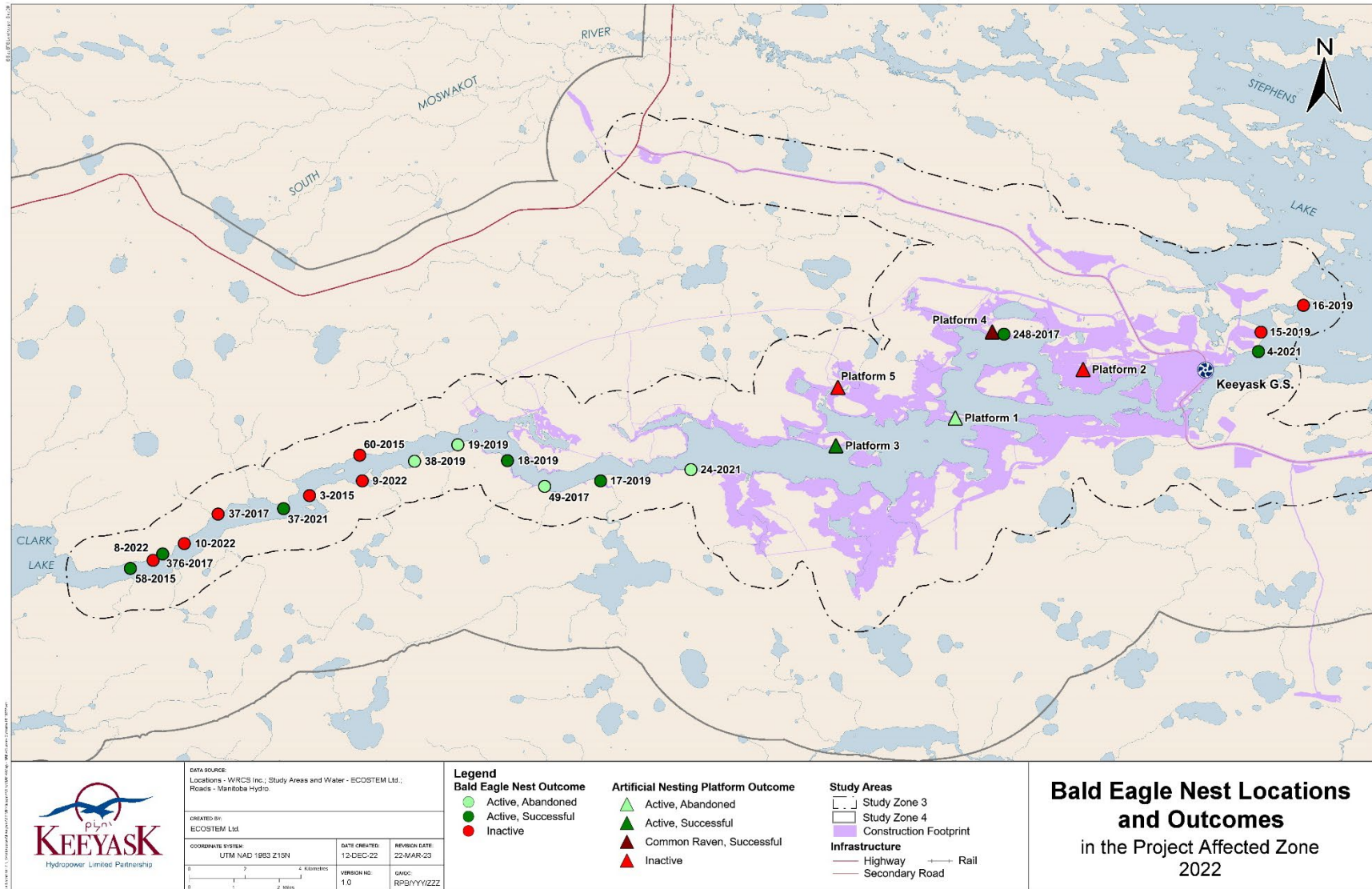
The overall, active nest density (nests/ 100 km of shoreline) in Study Zone 5 was higher in 2022 than the densities observed during construction-phase surveys (Table 3). Within the different hydraulic zones and waterbody types, active nest densities in 2022 were some of the highest observed in the respective areas, but within the ranges observed previously (Table 3).

A small increase of bald eagle nests within the Project-affected zone was observed in 2022, with the number of active nests higher than those observed during construction-phase surveys (Table 4). No changes were observed in the other hydraulic zones, with the number of active nests in the Nelson River and Off-system zones within the ranges observed during construction-phase surveys (Table 4).

The percent of active, successful nests in 2022 was variable between the different hydraulic zones. In the Project-affected zone, the percentage of active, successful nests was higher than those observed during three of the years of construction-phase surveys (2015, 2019, 2021), but lower than in 2017 (Table 4). In the Nelson River zone, the percentage of active, successful nests was the lowest observed to date (Table 4). A relatively large number of active nests were abandoned in this hydraulic zone during the incubation period. Within the Off-system zone, observations were within the ranges observed previously during construction-phase surveys (Table 4). The differences between the percent of active, successful nests in different hydraulic zones was not significant and the percent did not differ between the Project-affected zone and the Nelson River zone ($p=0.25$) or the Project-affected zone and the Off-system zone ($p=0.25$).



Map 2: Bald Eagle Nest Locations and Outcomes on Surveyed Waterbodies in 2022



Map 3: Bald Eagle Nest Locations and Outcomes in the Project-Affected Hydraulic Zone in 2022

Table 2: Number and Outcomes of Bald Eagle Nests in Study Zone 5 from 2015-2022

Nest Outcome	Number of Bald Eagle Nests				
	2015	2017	2019	2021	2022
Active, Successful	25	36	44	38	31
Active, Not Successful	4	3	4	3	1
Active, Nest Abandoned	13	14	14	21	34
Active, Success Unknown	0	2	0	0	0
Inactive	18	38	43	58	45
Status Unknown	4	4	1	5	2
Total	64	97	106	125	113

Table 3: Active Bald Eagle Nest Density (nests/100 km of shoreline) Within Study Zone 5 from 2015-2022

Hydraulic Zone	Waterbody Type	Nest Density (Nests/100 km)				
		2015	2017	2019	2021	2022
Project-affected	River	4.08	3.67	3.67	2.75	3.67
Nelson River	Lake	0.90	1.45	2.21	1.87	2.08
	River	3.06	7.14	3.06	3.06	3.06
Off-system	Lake	1.69	1.92	1.80	2.25	2.03
	River	0.46	0.46	0.92	1.38	1.38
Total		1.45	1.90	2.14	2.08	2.22

Table 4: Productivity of Bald Eagle Nests During the 2015, 2017, 2019, 2021, and 2022 Breeding Seasons

	2015				2017				2019				2021				2022			
	Project-affected	Nelson River	Off-system	Study Zone 5 (All areas)	Project-affected	Nelson River	Off-system	Study Zone 5 (All areas)	Project-affected	Nelson River	Off-system	Study Zone 5 (All areas)	Project-affected	Nelson River	Off-system	Study Zone 5 (All areas)	Project-affected	Nelson River	Off-system	Study Zone 5 (All areas)
# Nests surveyed	16	26	22	64	23	43	31	97	18	59	29	106	15	64	41	125	19	59	35	113
# Active nests	10	16	16	42	9	28	18	55*	9	34	19	62	9	30	23	62	12	33	21	66
# Active, Successful nests	3	12	10	25	7	17	12	36	4	27	13	44	4	22	12	38	7	12	12	31
% Active, Successful nests	30	75	63	60	78	61	67	67	44	79	68	71	44	73	52	61	58	36	57	47
# Late-stage nestlings	6	20	16	42	11	26	15	52	7	46	22	75	5	33	18	56	9	16	16	41
# Late-stage nestlings/ Active nests	0.60	1.25	1.00	1.00	1.22	0.93	0.83	0.96	0.78	1.35	1.16	1.21	0.56	1.1	0.78	0.9	0.75	0.48	0.76	0.62
# Late-stage nestlings/ Active, Successful nests	2.00	1.67	1.60	1.68	1.57	1.53	1.25	1.44	1.75	1.70	1.69	1.70	1.25	1.5	1.5	1.47	1.29	1.33	1.33	1.32

3.1.2 REPRODUCTIVE SUCCESS

The number of late-stage nestlings per active nest and the number of late-stage nestlings per active, successful nest in Study Zone 5 in 2022 was lower in comparison to the number observed in all years of construction monitoring from 2015-2021 (Table 4). This was a result of a large decline of late-stage nestlings observed in the Nelson River zone, while the numbers observed in Project-affected and Off-system zones remained within the ranges observed previously (Table 4).

The number of late-stage nestlings per active nest, and the number of late-stage nestlings per active, successful nest in the Project-affected zone was not significantly different from those observed in the Nelson River ($p = 1.0$ and $p = 0.31$, respectively) or in the Off-system hydraulic zones ($p = 0.67$ and $p = 0.21$, respectively).

In 2022, two of the artificial nesting platforms installed by the Project in 2017 were used by nesting bald eagles (Table 5). One nest was abandoned by June and the other, on Platform 3, successfully raised one late-stage chick (Table 5; Photo 4). Common ravens also nested in two of the platforms, with one successful nest and another empty nest observed (Table 5).

Table 5: Artificial Nesting Platform Contents during Surveys from 2017-2022. Note: Data from 2015 are absent as the artificial nesting platforms were installed in 2017

Nesting Platform	2017	2019	2021	2022
Platform 1	Empty	Active common raven nest	Potential unused bald eagle nest	Incubating bald eagle in May, nest abandoned by June
Platform 2	Empty	Empty	Empty	Empty
Platform 3	Empty	Some sticks on platform	Potential unused bald eagle nest	Successful bald eagle nest, one late-stage nestling
Platform 4	Some sticks on platform	Some sticks on platform	Active common raven nest	Successful common raven nest
Platform 5	Empty	Empty	Some sticks on platform	Empty common raven nest



Photo 4: Successful Bald Eagle Nest with one Late-stage Nestling in Platform 3, July 2022

4.0 DISCUSSION

Reservoir creation and Project operation was anticipated to reduce the amount of bald eagle foraging habitat, which was predicted to be offset by the tailrace area (KHLP 2012). These habitat changes were anticipated to result in a potential shift of bald eagle use away from the reservoir to areas downstream of the Project (KHLP 2012). Additionally, the local bald eagle population was not expected to change appreciably. These predictions are not strongly supported by the observations made in 2022, which suggest Project operation may have had smaller impacts on the local bald eagle population than predicted in the EIS.

Within the newly created reservoir, bald eagles appeared to occupy newly formed shoreline habitat and use the artificial nesting platforms. This resulted in 2022 having the greatest number of active nests observed in the Project-affected hydraulic zone during all survey periods from 2015-2022. In 2021, the year after the reservoir was filled, nest density in the Project-affected zone decreased as the amount of shoreline was increased, but the use of potential nesting habitat in the newly created reservoir was limited. In 2022, additional nests were constructed along the reservoir shoreline, including two on artificial nesting platforms, increasing the nest density in the Project-affected zone to what had been observed previously during the construction surveys in 2015, 2017, and 2019. Additionally, the number of successful nests and the number of late-stage nestlings in the Project-affected zone in 2022 was consistent with previous survey years, suggesting that sufficient foraging habitat was available to support the breeding bald eagles in this area.

The effective nesting habitat used in the newly formed reservoir may explain why there was no shift of nesting bald eagles from the reservoir to the tailrace area in 2022. Further surveys will determine if a gradual shift in nesting locations occur in the future.

In other areas, including the Nelson River hydraulic zone, there appeared to be a relatively large decrease in the number of successful nests. The number of active nests in the Nelson River zone in 2022 was consistent with previous survey years, but the percent of successful nests was the lowest observed from 2015-2021. The reason for the relatively high number of unsuccessful nests in the Nelson River zone is not clear. The water levels in the Nelson River in 2022 were some of the highest observed during the survey period from 2015-2022 (Appendix 1). These high water levels were due to historic levels of precipitation in southern Manitoba, which flowed through the system, increasing water levels in the Split Lake area by over one metre from May to June in 2022 (Appendix 1). The high water levels may have resulted in lower food availability or reduced foraging efficiency for bald eagles in the Nelson River zone, causing the relatively high number of unsuccessful nests. Higher water flows may reduce foraging efficiency of bald eagles by increasing water depth, turbidity, and velocity (Brown et al. 1998). This trend was not observed in the Project-affected or Off-system zones. The trend may not have been apparent in the Project-affected zone due to the water levels being moderated as a result of the Project (Appendix 1). Water levels in waterbodies in the Off-system zone are generally smaller waterbodies that are more isolated from precipitation effects in southern Manitoba.

Mainly due to the low number of successful nests in the Nelson River hydraulic zone, the number of successful nests and the ratio of late-stage nestlings to active nests in Study Zone 5 in 2022 was below the general threshold of 50% nest success and 0.7 young fledged annually per nest that is required for a bald eagle population to be sustainable (Sprunt et al. 1973; Elliott et al. 1998). However, the results from 2022 are within the ranges presented by Gerard et al. (1992), from a long-term study in Saskatchewan from 1968-1991, that found that bald eagle nest success ranged from 42-88% and averaged one fledged young per successful nest. It appears that in 2022, the local bald eagle population in Study Zone 5 was stable or slightly decreasing due to the high water conditions in the Nelson River.

The artificial nesting platforms were successful in mitigating some of the nesting trees that were lost in the reservoir footprint. Four of the artificial platforms were used in 2022, two by bald eagles and two by common ravens. Due to the philopatric nature of bald eagles, it is likely that the artificial platforms used in 2022 will be occupied in the future. The presence of old common raven's nests in two of the platforms may also make them more appealing for bald eagles to use in the future.

5.0 SUMMARY AND CONCLUSIONS

Project operation did not appear to negatively affect bald eagle nest numbers or productivity in the reservoir and shifting of nests from the reservoir area to the tailrace area were not observed. An increased number of active nests were observed in the reservoir, including in the artificial nesting platforms, suggesting some of the newly created shoreline is suitable for nesting bald eagles.

A decreased number of bald eagle nests and lowered productivity was observed in the Nelson River hydraulic zone of the study area. The precise cause of this is unknown, but may have been related to the high water levels that occurred in the system in late spring/early summer due to excessive flow from southern Manitoba.

There were no significant differences in the percent of active, successful nests or the number of late-stage nestlings produced in the Project-affected zone compared to other zones in the study area. This suggests that sufficient nesting habitat and foraging opportunities exist within the study area to successfully nest and raise young.

The 2022 bald eagle survey was the first operation-phase survey for the Project. Bald eagle habitat effects monitoring will continue annually for the next 4 years, and then every second year until 2036. The next survey is scheduled for 2023.

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Appendix 1 : Nelson River Water Levels

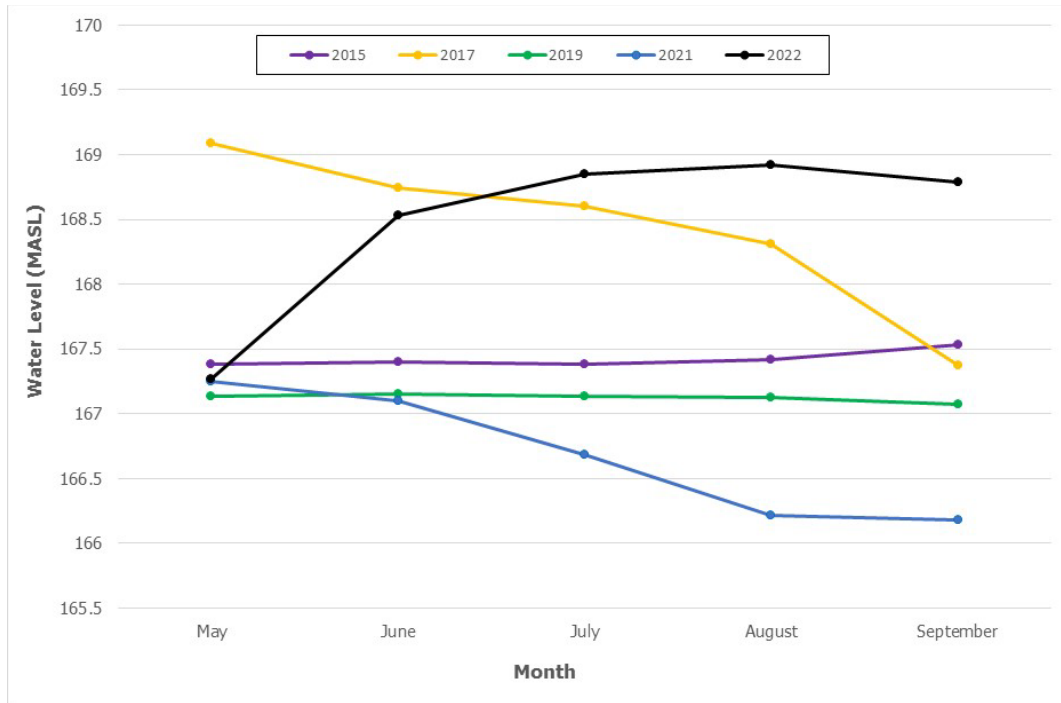


Figure 1: Water Levels in Split Lake during Bald Eagle Surveys from 2015-2022

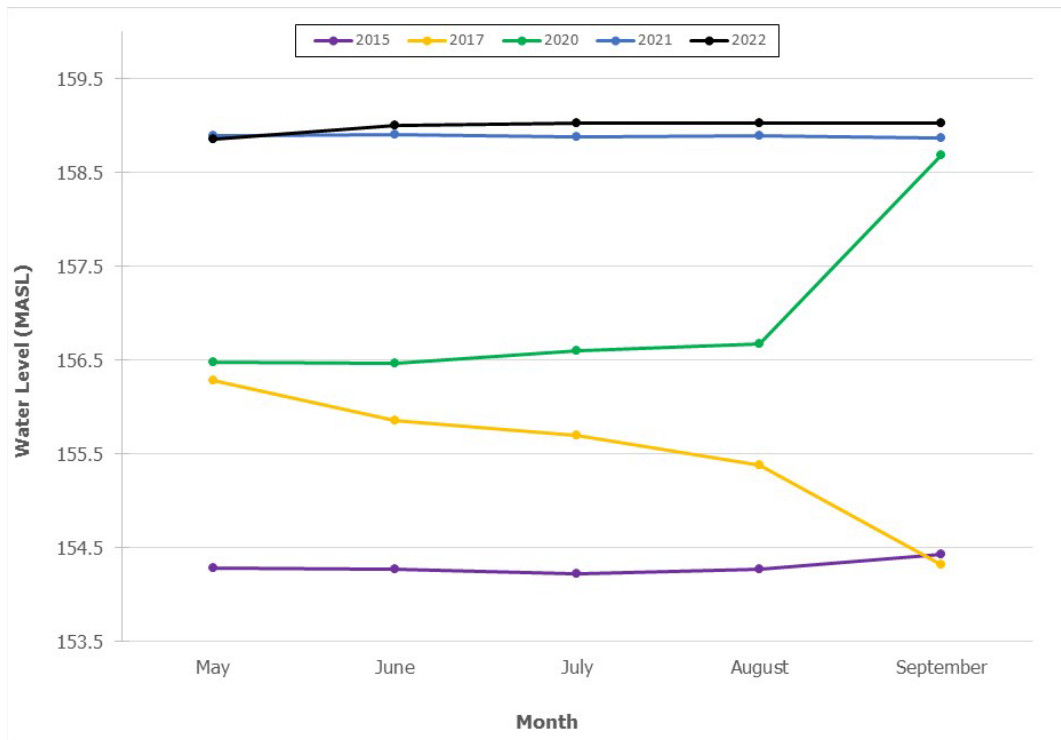


Figure 2: Water Levels in the Former Gull Lake during Bald Eagle Surveys from 2015-2022

Appendix 2 : Bald Eagle Nest-Tree Types, Nest Heights, and Location

Nest	Hydraulic Zone	Location	UTM	Nest Tree Type	Tree height (m)	Nest Height (m)
3-2015	Project-affected	Nelson River, Birthday Rapids	15 V 331640 6242724	Poplar	17	15
8-2015	Nelson River	Split Lake	15 V 314661 6233773	Poplar	8	8
9-2015	Nelson River	Split Lake	14 V 682284 6235714	Poplar	12	12
10-2015	Nelson River	Split Lake	14 V 679877 6234113	Dead Spruce	22	20
2-2017	Nelson River	Nelson River	15 V 365925 6248579	NA	NA	NA
5-2017	Nelson River	Stephens Lake, West shore	15 V 364136 6255411	Spruce	12	11
6-2017	Nelson River	Stephens Lake, North shore	15 V 358991 6267595	Poplar	25	22
7-2017	Nelson River	Stephens Lake, North shore	15 V 375496 6258125	Spruce	12	12
11-2017	Off-system	Cygnnet Lake	15 V 377203 6292419	NA	NA	NA
12-2017	Off-system	Little Limestone Lake	15 V 376851 6277952	Jack Pine	15	14
1-2019	Nelson River	Split Lake	14 V 682158 6224858	Poplar	10	10
7-2019	Nelson River	Split Lake	14 V 662493 6221592	Spruce	12	12
8-2019	Nelson River	Split Lake	14 V 657695 6219760	Poplar	12	12
9-2019	Nelson River	Split Lake	14 V 658045 6218971	Spruce	10	10
10-2019	Nelson River	Split Lake	14 V 661114 6226270	Spruce	10	10
11-2019	Nelson River	Split Lake	14 V 669963 6229782	Spruce	10	10
12-2019	Nelson River	Split Lake	14 V 672103 6230752	Spruce	12	12
1-2021	Off-system	Cygnnet Lake	15 V 386537 6293363	Aspen	5	3
2-2021	Off-system	Butnau lake	15 V 358053 6231361	Aspen	4	4
3-2021	Off-system	Butnau Lake	15 V 368828 6233280	Aspen	5	4
4-2021	Nelson River	Stephens Lake	15 V 365786 6247903	Spruce	15	15
5-2021	Off-system	Kettle Lake	15 V 381433 6214677	Aspen	10	9
6-2021	Off-system	Fox Lake	15 U 379692 6207136	Aspen	15	14
7-2021	Off-system	Cyril Lake	15 U 367032 6205369	Spruce	12	12
8-2021	Off-system	Little Kettle Lake	15 V 354418 6222249	Birch	5	4
9-2021	Nelson River	Split Lake	15 V 317365 6241398	Spruce	15	15
10-2021	Nelson River	Split Lake	14 V 669963 6229782	Aspen	10	8

Nest	Hydraulic Zone	Location	UTM	Nest Tree Type	Tree height (m)	Nest Height (m)
11-2021	Nelson River	Split Lake	14 V 682644 6226890	Spruce	10	10
12-2021	Nelson River	Split Lake	14 V 674529 6223403	Spruce	12	11
1-2022	Nelson River	Stephens Lake	15 V 354138 6265478	Aspen	10	7
2-2022	Off-system	Unnamed Lake	15 V 378357 6293108	Aspen	10	8
3-2022	Off-system	Fox Lake	15 U 382874 6205739	Spruce	8	8
4-2022	Off-system	Fox Lake	15 V 383209 6211170	Aspen	10	8
5-2022	Nelson River	Clark Lake	15 V 318070 6241367	Spruce	8	8
6-2022	Nelson River	Split Lake	14 V 653377 6219513	Aspen	8	8
7-2022	Nelson River	Split Lake	14 V 684406 6239873	Aspen	5	5
8-2022	Project-affected	Nelson River - Keeyask Reach	15 V 326013 6240403	Aspen	6	5
9-2022	Project-affected	Nelson River - Keeyask Reach	15 V 333540 6243250	Aspen	5	5
10-2022	Project-affected	Nelson River - Keeyask Reach	15 V 327136 6240998	Aspen	6	4
11-2022	Nelson River	Nelson River, Downstream of Kettle GS	15 V 401116 6251007	Spruce	8	6
12-2022	Nelson River	Nelson River, Downstream of Kettle GS	15 V 410134 6251167	Spruce	4	4
101-2015	Nelson River	Stephens Lake	15 V 372381 6248802	Dead Jack pine	19	19
102-2015	Project-affected	Nelson River	15 V 358251 6245905	Spruce	NA	10
105-2017	Off-system	Atkinson lake	15 U 382376 6205969	Spruce	8	8
107-2015	Off-system	Myre Lake	15 V 389577 6302739	Spruce	NA	17
107-2017	Off-system	Cyril River	15 U 381232 6207044	Spruce	14	14
108-2015	Off-system	Cygnnet Lake	15 V 380284 6292841	Birch	10	10
111-2017	Off-system	Fox Lake	15 V 384522 6210702	NA	NA	NA
112-2015	Off-system	Atkinson lake	15 U 390456 6207144	Poplar	25	20
113-2017	Off-system	Kettle River	15 V 376411 6227216	Poplar	12	10
115-2015	Off-system	Atkinson lake	15 U 388614 6205029	Poplar	25	20
117-2015	Off-system	Atkinson lake	15 U 383656 6205375	Spruce	20	20
121-2015	Off-system	Fox Lake	15 V 386854 6208149	Spruce	NA	10
122-2015	Off-system	Cyril Lake	15 U 369055 6207763	Poplar	5	5

Nest	Hydraulic Zone	Location	UTM	Nest Tree Type	Tree height (m)	Nest Height (m)
123-2015	Off-system	Cyril Lake	15 U 367021 6205781	Spruce	NA	11
13-2021	Off-system	Limestone Lake	15 V 328689 6272381	Aspen	12	10
13-2022	Nelson River	Split Lake	14 V 685999 6227588	Aspen	8	5
134-2015	Off-system	Kettle Lake	15 V 378605 6221132	Aspen	NA	10
141-2015	Off-system	Butnau lake	15 V 358778 6230620	Spruce	15	13
14-2017	Nelson River	Nelson River, Kettle GS	15 V 399644 6250541	Jack Pine	24	22
14-2021	Off-system	Limestone Lake	15 V 320678 6274608	Spruce	10	10
14-2022	Nelson River	Split Lake	14 V 653170 6217853	Aspen	8	6
142-2015	Off-system	Small Unnamed Lake 1 km North of Limestone Lake	15 V 330109 6275194	Poplar	18	18
145-2015	Off-system	Small Unnamed Lake 1 km North of Limestone Lake	14 V 684630 6265004	Poplar	25	19
145-2017	Nelson River	Split Lake	14 V 677291 6231852	Jack Pine	10	17
146-2015	Off-system	Crying Lake	14 V 679546 6260750	Spruce	NA	16
147-2015	Off-system	Crying Lake	14 V 680094 6260013	Spruce	12	18
148-2015	Off-system	Crying Lake	14 V 683758 6261010	Birch	15	8
15-2019	Nelson River	Stephens Lake, West Shore	15 V 365884 6248604	Spruce	10	10
15-2021	Off-system	Crying Lake	14 V 679602 6260608	Spruce	10	10
15-2022	Off-system	Assean River	15 V 314929 6243388	Spruce	8	5
156-2015	Off-system	Assean Lake	14 V 658680 6233013	Spruce	NA	9
16-2019	Nelson River	Stephens Lake, West Shore	15 V 367409 6249564	Dead spruce	8	8
16-2021	Nelson River	Split Lake	14 V 670216 6219695	Aspen	15	14
16-2022	Off-system	Assean Lake	14 V 677921 6246500	Aspen	7	6
162-2015	Nelson River	Split Lake	14 V 655325 6220967	Spruce	16	15
163-2015	Nelson River	Split Lake	14 V 653324 6220054	Jack pine	20	15
165-2015	Off-system	Assean Lake	14 V 665241 6238987	Dead Poplar	23	20
166-2015	Nelson River	Split Lake	14 V 674251 6228054	Spruce	15	15
17-2019	Project-affected	Nelson River	15 V 342113 6243255	Poplar	10	10
17-2021	Off-system	Assean Lake	14 V 661852 6235512	Aspen	12	10

Nest	Hydraulic Zone	Location	UTM	Nest Tree Type	Tree height (m)	Nest Height (m)
17-2022	Nelson River	Split Lake	14 V 666894 6223497	Spruce	3	3
176-2015	Nelson River	Nelson River - Split Reach	14 V 683395 6227161	Spruce	NA	15
177-2015	Nelson River	Split Lake	14 V 674005 6222385	Spruce	18	18
178-2015	Project-affected	Nelson River - Keeyask Reach	15 V 328527 6242066	Aspen	NA	11
179-2015	Off-system	Assean Lake	14 V 661620 6238195	Spruce	NA	17
180-2015	Off-system	Small Unnamed Lake 1 km north of Limestone Lake	15 V 315987 6266847	Spruce	21	17
18-2019	Project-affected	Nelson River	15 V 338766 6243978	Poplar	12	12
18-2021	Nelson River	Split Lake	14 V 673807 6236797	Aspen	10	8
18-2022	Nelson River	Split Lake	14 V 665085 6222257	Spruce	5	5
182-2015	Off-system	Little Kettle Lake	15 V 354312 6222230	Birch	4	8
184-2015	Project-affected	Nelson River - Keeyask Reach	15 V 343306 6243780	Aspen	NA	12
185-2015	Project-affected	Nelson River - Keeyask Reach	15 V 336216 6244834	Dead spruce	NA	9
187-2015	Nelson River	Nelson River - Split Reach	14 V 660110 6219633	Aspen	NA	13
188-2015	Off-system	Aiken River	15 V 316663 6215706	Dead Spruce	15	15
19-2019	Project-affected	Nelson River	15 V 336976 6244549	Poplar	10	10
19-2022	Nelson River	Split Lake	14 V 681324 6235916	Spruce	6	6
197-2017	Nelson River	Nelson River, Downstream of Kelsey GS	14 V 652944 6218419	Jack Pine	11	9
20-2019	Nelson River	Clark Lake	15 V 317912 6241304	Spruce	10	10
20-2021	Nelson River	Split Lake	14 V 677862 6239486	Aspen	8	7
21-2019	Nelson River	Clark Lake	15 V 318292 6241456	Spruce	12	12
21-2021	Nelson River	Split Lake	14 V 681138 6238502	Aspen	10	8
22-2019	Nelson River	Split Lake	15 V 318126 6237931	Spruce	8	8
222-2017	Nelson River	Nelson River, Downstream of Kelsey GS	14 V 653283 6220828	Jack Pine	10	15
224-2017	Nelson River	Split Lake	14 V 655977 6221555	Spruce	12	14
23-2015	Nelson River	Split Lake	14 V 663636 6220536	Spruce	20	20
23-2019	Nelson River	Split Lake	15 V 320504 6234713	Poplar	10	10
23-2021	Project-affected	Nelson River	15 V 350353 6244445	Spruce	5	5

Nest	Hydraulic Zone	Location	UTM	Nest Tree Type	Tree height (m)	Nest Height (m)
236-2017	Nelson River	Split Lake	14 V 674846 6233002	Poplar	15	12
24-2021	Project-affected	Nelson River	15 V 345367 6243656	Aspen	12	10
243-2017	Nelson River	Split Lake	15 V 315327 6240803	Spruce	12	12
246-2017	Project-affected	Nelson River, Between Birthday Rapids and Gull Rapids	15 V 354727 6245558	Dead spruce	12	8
248-2017	Project-affected	Gull Lake	15 V 356627 6248525	Poplar	12	6
25-2017	Off-system	Atkinson lake	15 U 386618 6204993	Dead Poplar	10	10
25-2019	Project-affected	Nelson River	15 V 338743 6244928	Spruce	10	10
25-2021	Nelson River	Stephens Lake	15 V 378792 6246835	Aspen	15	13
26-2015	Nelson River	Split Lake	14 V 653365 6217146	Spruce	15	15
26-2021	Nelson River	Split Lake	14 V 684323 6226407	Spruce	15	15
268-2017	Nelson River	Nelson River	15 V 408327 6249812	NA	NA	NA
27-2015	Nelson River	Split Lake	14 V 653439 6217073	Spruce	15	15
27-2019	Off-system	Cyril Lake	15 U 366808 6206441	Birch	8	8
27-2021	Nelson River	Split Lake	14 V 683518 6223144	Spruce	15	15
28-2021	Nelson River	Split Lake	14 V 678663 6219996	Spruce	15	15
288-2017	Nelson River	Nelson River	15 V 408327 6249812	NA	NA	NA
29-2019	Off-system	Myre Lake	15 V 388732 6303481	Tamarack	8	8
29-2021	Off-system	Fox Lake	15 U 383721 6204439	Spruce	8	7
30-2019	Nelson River	Stephens Lake, North Shore	15 V 396635 6251473	Spruce	10	10
30-2021	Nelson River	Nelson River	15 V 397970 6251077	Spruce	12	12
31-2019	Nelson River	Nelson River	15 V 403274 6249424	Spruce	12	12
31-2021	Off-system	Myre Lake	15 V 392121 6305555	Aspen	15	13
32-2019	Nelson River	Nelson River	15 V 401947 6250462	Spruce	10	10
32-2021	Off-system	Assean Lake	14 V 654151 6231901	Spruce	15	15
33-2019	Off-system	Limestone Lake	15 V 329283 6272613	Spruce	12	12
33-2021	Off-system	Assean Lake	14 V 648143 6231187	Aspen	10	8

Nest	Hydraulic Zone	Location	UTM	Nest Tree Type	Tree height (m)	Nest Height (m)
339-2017	Off-system	Cyril Lake	15 U 364556 6205708	NA	NA	NA
34-2017	Nelson River	Split Lake	14 V 681769 6238256	Spruce	21	21
34-2019	Off-system	Limestone Lake	15 V 323941 6276081	Spruce	10	10
34-2021	Nelson River	Split Lake	14 V 671506 6230369	Aspen	12	10
35-2017	Nelson River	Split Lake	15 V 317211 6241629	Spruce	15	15
35-2019	Nelson River	Nelson River	15 V 401555 6251251	Spruce	15	15
35-2021	Nelson River	Split Lake	14 V 652767 6224436	Spruce	10	10
36-2019	Nelson River	Nelson River	15 V 405775 6249358	Poplar	15	15
36-2021	Off-system	Little Kettle Lake	15 V 354857 6223967	Hydro Tower	15	13
37-2017	Project-affected	Nelson River, Upstream of Birthday Rapids	15 V 328353 6242063	Poplar	15	15
37-2019	Nelson River	Stephens Lake	15 V 378665 6249295	Spruce	10	10
37-2021	Project-affected	Nelson River	15 V 330704 6242254	Aspen	12	10
374-2017	Nelson River	Stephens Lake	15 V 369091 6252145	Spruce	10	8
376-2017	Project-affected	Nelson River	15 V 326359 6240629	Poplar	12	10
38-2019	Project-affected	Nelson River	15 V 335418 6243959	Poplar	10	10
38-2021	Off-system	Assean Lake	14 V 651407 6230689	Aspen	12	11
39-2015	Nelson River	Nelson River - Split Reach	14 V 667630 6229507	Spruce	NA	9
39-2019	Nelson River	Clark Lake	15 V 319619 6240109	Spruce	12	12
39-2021	Nelson River	Split Lake	14 V 659617 6219909	Spruce	8	8
40-2017	Project-affected	Nelson River, Between Birthday Rapids and Gull Rapids	15 V 345303 6244529	Poplar	18	17
40-2019	Off-system	Aiken River	15 V 313434 6216803	Transmission Tower	20	20
42-2019	Off-system	Assean Lake	14 V 676381 6245669	Poplar	10	10
43-2019	Nelson River	Stephens Lake	15 V 376188 6247244	Spruce	10	10
44-2019	Nelson River	Stephens Lake	15 V 381018 6249126	Poplar	15	15
45-2019	Nelson River	Stephens Lake	15 V 386873 6247984	Dead Spruce	8	8
46-2019	Nelson River	Stephens Lake	15 V 387334 6248399	Poplar	15	15

Nest	Hydraulic Zone	Location	UTM	Nest Tree Type	Tree height (m)	Nest Height (m)
471-2017	Nelson River	Split Lake	14 V 671930 6237600	NA	NA	NA
47-2017	Project-affected	Nelson River, Between Birthday Rapids and Gull Rapids	15 V 351444 6243204	Poplar	15	14
49-2017	Project-affected	Nelson River, Between Birthday Rapids and Gull Rapids	15 V 340108 6243053	Poplar	14	9
504-2017	Off-system	Limestone Lake	14 V 682700 6273844	Spruce	10	8
51-2015	Nelson River	Nelson River - Split Reach	14 V 685522 6240305	White Birch	NA	13
52-2015	Nelson River	Nelson River - Clark Reach	15 V 318195 6242330	Dead spruce	NA	15
526-2017	Project-affected	Nelson River	15 V 355220 6245543	Fallen Spruce	0	0
53-2015	Nelson River	Nelson River - Clark Reach	15 V 320986 6241438	Aspen	NA	12
54-2015	Nelson River	Clark Lake	15 V 322348 6240594	Dead Poplar	12	12
56-2015	Nelson River	Nelson River, Upstream of Birthday Rapids	15 V 323548 6239832	Dead Poplar	8	10
56-2017	Nelson River	Clark Lake	15 V 319532 6240180	Dead Spruce	17	12
57-2015	Project-affected	Nelson River - Keeyask Reach	15 V 324876 6240384	Aspen	NA	13
58-2015	Project-affected	Nelson River, Upstream of Birthday Rapids	15 V 325196 6240113	Spruce	18	18
59-2015	Project-affected	Nelson River, Upstream of Birthday Rapids	15 V 329843 6242553	Poplar	18	16
60-2015	Project-affected	Nelson River, Between Birthday Rapids and Gull Rapids	15 V 333445 6244175	Poplar	15	8
61-2015	Project-affected	Nelson River, Between Birthday Rapids and Gull Rapids	15 V 334823 6244238	Poplar	15	15
61-2017	Nelson River	Split Lake	15 V 314486 6236485	Poplar	24	17
62-2015	Project-affected	Nelson River - Keeyask Reach	15 V 336306 6244924	Dead spruce	NA	11
64-2015	Project-affected	Nelson River - Keeyask Reach	15 V 339842 6243587	Spruce	NA	11
64-2017	Nelson River	Split Lake	14 V 677277 6229913	Spruce	15	15
66-2015	Project-affected	Nelson River, Between Birthday Rapids and Gull Rapids	15 V 346126 6245094	Poplar	15	15
67-2015	Project-affected	Nelson River - Keeyask Reach	15 V 346802 6244984	Dead Aspen	NA	16
68-2015	Project-affected	Nelson River - Keeyask Reach	15 V 350494 6244389	Aspen	NA	10
69-2015	Project-affected	Nelson River - Keeyask Reach	15 V 355163 6245525	Fallen Dead Spruce	NA	3
72-2017	Nelson River	Split Lake	14 V 655600 6218443	Poplar	20	17

Nest	Hydraulic Zone	Location	UTM	Nest Tree Type	Tree height (m)	Nest Height (m)
78-2015	Nelson River	Stephens Lake, North shore	15 V 359753 6267215	Spruce	25	25
79-2015	Off-system	Small Unnamed Lake 5 km North of Stephens Lake	15 V 375091 6262798	Spruce	15	15
79-2017	Off-system	Limestone Lake	14 V 684074 6275540	Spruce	19	15
80-2017	Off-system	Limestone Lake	15 V 322842 6274576	Poplar	16	12
82-2015	Nelson River	Stephens Lake, Ferris Bay	15 V 380257 6257025	Spruce	12	12
82-2017	Off-system	Assean Lake	14 V 671532 6242142	Poplar	15	10
83-2017	Nelson River	Stephens Lake	15 V 381119 6256687	NA	NA	NA
86-2015	Nelson River	Nelson River - Stephens Reach	15 V 398576 6251004	Spruce	NA	8
87-2015	Nelson River	Nelson River, Kettle GS	15 V 400115 6250447	Spruce	24	24
88-2015	Nelson River	Nelson River - Long Spruce Reach	15 V 402169 6250771	Spruce	NA	16
92-2015	Nelson River	Nelson River, Downstream of Kettle GS	15 V 406511 6249127	Spruce	20	17
97-2015	Nelson River	Nelson River	15 V 375454 6244746	Spruce	NA	18

Appendix 3 : Nest Contents and Outcomes of Bald Eagle Nests

Table 1: Bald Eagle Nest Outcomes and Number of Years Nests were Active and Successful from 2015 to 2021. Note: data may not be available for all survey years as nests disintegrated and went missing.

Hydraulic Zone	2015	2017	2019	2021	2022	No. Years Active	No. Years Successful
Nelson River	Active, Successful	Active, Successful	Active, Successful	Active, Successful	Active, Successful	5	5
Nelson River	Active, Successful	Active, Successful	Active, Successful	Active, Successful	Active, Successful	5	5
Nelson River	Active, Successful	Active, Abandoned	Active, Successful	Active, Successful	Active, Successful	5	4
Off-system	Active, Nest Abandoned	Active, Successful	Active, Successful	Active, Successful	Active, Abandoned	5	3
Nelson River	Active, Successful	Active, Successful	Active, Not Successful	Active, Successful	Active, Abandoned	5	3
Off-system	Active, Successful	Active, Successful	Active, Successful	Active, Not Successful	Active, Abandoned	5	3
Off-system	Active, Nest Abandoned	Active, Successful	Active, Successful	Active, Successful	Active, Successful	5	3
Nelson River	-	Active, Successful	Active, Successful	Active, Abandoned	Active, Abandoned	5	2
Off-system	Active, Successful	Active, Abandoned	Active, Abandoned	Active, Abandoned	Active, Successful	5	2
Nelson River	Active, Successful	Active, Successful	Active, Successful	Active, Successful	-	4	4
Nelson River	Active, Successful	Active, Successful	Active, Successful	Active, Successful	-	4	4
Off-system	-	Active, Success Unknown	Active, Successful	Active, Successful	Active, Successful	4	3
Nelson River	-	Active, Successful	Active, Abandoned	Active, Successful	Active, Successful	4	3
Nelson River	Active, Successful	Active, Successful	Active, Successful	Active, Not Successful	Inactive	4	3
Off-system	Active, Successful	Active, Successful	Active, Not Successful	Active, Successful	-	4	3
Off-system	Active, Successful	Active, Successful	Active, Successful	Active, Abandoned	-	4	3
Project-affected	-	Active, Successful	Active, Abandoned	Active, Abandoned	Active, Successful	4	2
Nelson River	-	Active, Success Unknown	Active, Successful	Active, Successful	Active, Abandoned	4	2
Nelson River	-	Active, Abandoned	Active, Successful	Active, Successful	Active, Abandoned	4	2
Project-affected	Active, Successful	Active, Successful	Active, Successful	Inactive	-	3	3
Nelson River	-	-	Active, Successful	Active, Successful	Active, Successful	3	3
Nelson River	-	-	Active, Successful	Active, Successful	Active, Successful	3	3
Off-system	Active, Successful	Active, Successful	Active, Successful	-	-	3	3
Off-system	Active, Successful	Active, Successful	Active, Successful	-	-	3	3

Hydraulic Zone	2015	2017	2019	2021	2022	No. Years Active	No. Years Successful
Off-system	-	Active, Successful	Active, Successful	Inactive	Active, Successful	3	3
Off-system	-	Active, Successful	Active, Abandoned	Inactive	Active, Successful	3	2
Nelson River	Active, Successful	Inactive	Active, Successful	Inactive	Active, Abandoned	3	2
Project-affected	Active, Nest Abandoned	Active, Successful	Active, Successful	-	-	3	2
Nelson River	-	-	Active, Successful	Active, Successful	Active, Abandoned	3	2
Off-system	-	Active, Abandoned	Inactive	Active, Successful	Active, Successful	3	2
Nelson River	-	Active, Successful	Active, Abandoned	Active, Successful	Inactive	3	2
Nelson River	-	-	Active, Successful	Active, Successful	Active, Abandoned	3	2
Project-affected	-	-	Active, Successful	Active, Successful	Active, Abandoned	3	2
Nelson River	-	-	Active, Successful	Active, Successful	Active, Abandoned	3	2
Nelson River	Inactive	Active, Successful	Active, Successful	Active, Abandoned	Inactive	3	2
Nelson River	Active, Not Successful	Active, Abandoned	Active, Successful	Inactive	Common Raven, Successful	3	1
Nelson River	-	Active, Successful	Active, Abandoned	Inactive	Active, Abandoned	3	1
Project-affected	Active, Nest Abandoned	Active, Successful	Active, Abandoned	-	-	3	1
Project-affected	Active, Successful	Active, Not Successful	Active, Abandoned	Inactive	Inactive	3	1
Nelson River	-	Active, Abandoned	Active, Successful	Inactive	Active, Not Successful	3	1
Project-affected	-	Active, Successful	Inactive	Active, Abandoned	Active, Abandoned	3	1
Project-affected	-	-	Active, Not Successful	Active, Abandoned	Active, Successful	3	1
Off-system	Active, Not Successful	Active, Successful	Active, Abandoned	Inactive	Inactive	3	1
Nelson River	-	Active, Abandoned	Active, Successful	Inactive	Active, Abandoned	3	1
Off-system	-	Active, Abandoned	Status Unknown	Active, Abandoned	Active, Abandoned	3	0
Nelson River	-	Active, Successful	Active, Successful	Inactive	Inactive	2	2
Project-affected	-	Active, Successful	Active, Successful	-	-	2	2
Off-system	-	-	-	Active, Successful	Active, Successful	2	2
Off-system	-	-	Active, Successful	Active, Successful	-	2	2
Off-system	-	-	-	Active, Successful	Active, Successful	2	2
Nelson River	Active, Successful	Active, Successful	-	-	-	2	2
Off-system	Active, Successful	Active, Successful	-	-	-	2	2
Off-system	Active, Successful	Active, Successful	-	-	-	2	2



Hydraulic Zone	2015	2017	2019	2021	2022	No. Years Active	No. Years Successful
Off-system	-	-	-	Active, Successful	Active, Successful	2	2
Off-system	-	-	-	Active, Successful	Active, Successful	2	2
Nelson River	Inactive	Inactive	Inactive	Active, Successful	Active, Successful	2	2
Nelson River	Active, Successful	Active, Abandoned	Inactive	-	-	2	1
Off-system	-	Active, Abandoned	Active, Successful	Status Unknown	Inactive	2	1
Nelson River	Active, Successful	Active, Not Successful	Inactive	-	-	2	1
Project-affected	Inactive	Inactive	Active, Abandoned	Inactive	Active, Successful	2	1
Project-affected	-	-	Inactive	Active, Successful	Active, Abandoned	2	1
Nelson River	-	Status unknown	Active, Successful	Inactive	Active, Abandoned	2	1
Nelson River	-	-	-	Active, Successful	Active, Abandoned	2	1
Nelson River	-	-	Active, Not Successful	Active, Successful	-	2	1
Project-affected	-	-	Inactive	Active, Abandoned	Active, Successful	2	1
Project-affected	Active, Nest Abandoned	Active, Successful	-	-	-	2	1
Off-system	-	-	-	Active, Abandoned	Active, Successful	2	1
Off-system	-	-	-	Active, Successful	Active, Abandoned	2	1
Nelson River	-	-	-	Active, Abandoned	Active, Successful	2	1
Off-system	-	-	-	Active, Successful	Active, Abandoned	2	1
Nelson River	-	-	Active, Successful	Inactive	Active, Abandoned	2	1
Nelson River	-	-	Active, Successful	Inactive	Active, Abandoned	2	1
Nelson River	-	Inactive	Active, Abandoned	Inactive	Active, Successful	2	1
Nelson River	Active, Successful	Active, Not Successful	Inactive	Inactive	-	2	1
Off-system	-	-	Active, Abandoned	Inactive	Active, Abandoned	2	0
Nelson River	-	Inactive	Active, Abandoned	Active, Abandoned	Inactive	2	0
Off-system	Active, Nest Abandoned	Active, Abandoned	Inactive	Inactive	-	2	0
Off-system	-	-	-	Active, Abandoned	Active, Abandoned	2	0
Project-affected	Active, Nest Abandoned	Inactive	Inactive	Active, Not Successful	Inactive	2	0
Project-affected	-	Inactive	Inactive	Inactive	Active, Successful	1	1
Nelson River	-	-	Inactive	Active, Successful	-	1	1
Project-affected	Active, Successful	-	-	-	-	1	1



Hydraulic Zone	2015	2017	2019	2021	2022	No. Years Active	No. Years Successful
Nelson River	-	Active, Successful	-	-	-	1	1
Nelson River	-	-	Active, Successful	-	-	1	1
Project-affected	-	-	-	Status Unknown	Active, Successful	1	1
Project-affected	-	Inactive	Inactive	Active, Successful	Inactive	1	1
Nelson River	-	Active, Successful	Inactive	-	-	1	1
Nelson River	-	-	-	Inactive	Active, Successful	1	1
Nelson River	-	Active, Successful	-	-	-	1	1
Off-system	-	-	Active, Successful	Inactive	-	1	1
Nelson River	-	-	-	Active, Successful	Inactive	1	1
Project-affected	-	Inactive	Inactive	Inactive	Active, Successful	1	1
Nelson River	-	Active, Successful	Inactive	-	-	1	1
Project-affected	-	-	-	Active, Successful	-	1	1
Nelson River	-	-	-	Active, Successful	-	1	1
Nelson River	Inactive	Inactive	Active, Successful	Inactive	Inactive	1	1
Nelson River	-	-	Active, Successful	Inactive	Inactive	1	1
Nelson River	-	-	Active, Successful	Inactive	Inactive	1	1
Off-system	Active, Successful	Inactive	Inactive	-	-	1	1
Off-system	Active, Successful	Inactive	-	-	-	1	1
Off-system	-	Inactive	Active, Successful	-	Inactive	1	1
Off-system	-	Inactive	Active, Successful	Inactive	-	1	1
Nelson River	-	-	-	Active, Successful	-	1	1
Nelson River	-	Active, Successful	-	-	-	1	1
Project-affected	-	Inactive	Inactive	Inactive	Active, Abandoned	1	0
Nelson River	Active, Nest Abandoned	-	-	-	-	1	0
Off-system	Inactive	Inactive	Status Unknown	Inactive	Active, Abandoned	1	0
Project-affected	Active, Nest Abandoned	-	-	-	-	1	0
Project-affected	Active, Nest Abandoned	-	-	-	-	1	0
Project-affected	Active, Not Successful	-	-	-	-	1	0
Nelson River	Active, Nest Abandoned	-	-	-	-	1	0



Hydraulic Zone	2015	2017	2019	2021	2022	No. Years Active	No. Years Successful
Project-affected	-	Active, Not Successful	-	-	-	1	0
Nelson River	Active, Nest Abandoned	-	-	-	-	1	0
Nelson River	-	-	-	Status Unknown	Active, Abandoned	1	0
Nelson River	-	-	-	Inactive	Active, Abandoned	1	0
Off-system	-	-	-	Inactive	Active, Abandoned	1	0
Nelson River	-	-	Inactive	Inactive	Active, Abandoned	1	0
Off-system	-	-	-	Active, Abandoned	Common Raven, Successful	1	0
Project-affected	-	-	-	Inactive	Active, Abandoned	1	0
Nelson River	Status Unknown	Active, Abandoned	-	-	-	1	0
Off-system	Active, Nest Abandoned	Inactive	Inactive	-	-	1	0
Nelson River	Inactive	Active, Abandoned	Inactive	Inactive	Inactive	1	0
Nelson River	-	-	-	Active, Abandoned	Inactive	1	0
Off-system	Active, Not Successful	Inactive	Inactive	-	-	1	0
Off-system	-	-	-	Active, Abandoned	-	1	0
Off-system	Inactive	Inactive	Active, Abandoned	Inactive	Common Raven, Successful	1	0
Nelson River	-	-	-	Active, Abandoned	Inactive	1	0
Off-system	-	-	-	Active, Abandoned	Inactive	1	0
Off-system	-	-	-	Active, Abandoned	Common Raven, Successful	1	0
Off-system	-	-	-	Active, Abandoned	Inactive	1	0
Nelson River	-	-	Inactive	Active, Abandoned	-	1	0
Project-affected	-	Inactive	Inactive	Inactive	Inactive	0	0
Project-affected	-	Inactive	Inactive	Inactive	Common Raven, Successful	0	0
Project-affected	-	Inactive	Inactive	Inactive	Inactive	0	0
Nelson River	Inactive	Inactive	-	-	-	0	0
Nelson River	Inactive	Inactive	-	-	-	0	0
Off-system	-	Inactive	Inactive	Inactive	-	0	0
Project-affected	Inactive	Inactive	-	-	-	0	0
Project-affected	Inactive	Inactive	-	-	-	0	0
Nelson River	Inactive	Inactive	-	-	-	0	0



Hydraulic Zone	2015	2017	2019	2021	2022	No. Years Active	No. Years Successful
Nelson River	-	-	Status Unknown	Inactive	Inactive	0	0
Off-system	-	-	Inactive	Inactive	Inactive	0	0
Off-system	-	-	Inactive	-	-	0	0
Project-affected	-	Inactive	Inactive	-	-	0	0
Nelson River	-	-	Inactive	-	-	0	0
Nelson River	Inactive	Status unknown	Status Unknown	-	-	0	0
Nelson River	-	-	Inactive	-	-	0	0
Off-system	-	-	-	Status Unknown	Inactive	0	0
Nelson River	-	-	Inactive	Inactive	Inactive	0	0
Off-system	-	Status unknown	-	-	-	0	0
Off-system	-	-	-	Inactive	Inactive	0	0
Off-system	-	-	Inactive	Inactive	Inactive	0	0
Nelson River	-	-	Inactive	Inactive	-	0	0
Nelson River	-	-	Inactive	-	-	0	0
Nelson River	-	-	-	Inactive	-	0	0
Nelson River	-	-	-	Inactive	-	0	0
Nelson River	-	Status unknown	-	-	-	0	0
Nelson River	-	-	-	Inactive	-	0	0
Nelson River	Inactive	Inactive	Inactive	Inactive	Inactive	0	0
Project-affected	-	-	Inactive	-	-	0	0
Project-affected	-	Inactive	Inactive	-	-	0	0
Nelson River	-	-	Inactive	-	-	0	0
Nelson River	-	Inactive	Inactive	Inactive	Inactive	0	0
Nelson River	-	-	-	Inactive	-	0	0
Nelson River	-	-	-	Status Unknown	-	0	0
Nelson River	-	-	Inactive	-	-	0	0
Nelson River	-	Inactive	Inactive	Inactive	-	0	0
Project-affected	Status Unknown	Inactive	-	-	-	0	0
Project-affected	Status Unknown	-	-	-	-	0	0



Hydraulic Zone	2015	2017	2019	2021	2022	No. Years Active	No. Years Successful
Off-system	Status Unknown	-	-	-	-	0	0
Off-system	-	-	-	Inactive	Inactive	0	0
Off-system	Inactive	Inactive	-	-	-	0	0
Off-system	Inactive	-	-	-	-	0	0
Off-system	Inactive	-	-	-	-	0	0
Off-system	-	Inactive	Inactive	Inactive	Inactive	0	0
Project-affected	Inactive	-	-	-	-	0	0
Nelson River	-	-	-	Inactive	-	0	0
Nelson River	-	-	-	Inactive	Inactive	0	0
Nelson River	-	-	Inactive	Inactive	-	0	0
Nelson River	-	-	Inactive	-	-	0	0
Nelson River	-	-	Inactive	-	-	0	0
Off-system	-	Inactive	-	-	-	0	0
Nelson River	-	Inactive	Inactive	Inactive	Inactive	0	0
Nelson River	-	-	-	-	Active, Abandoned	1	0
Off-system	-	-	-	-	Inactive	0	0
Off-system	-	-	-	-	Active, Successful	1	1
Off-system	-	-	-	-	Inactive	0	0
Nelson River	-	-	-	-	Active, Abandoned	1	0
Nelson River	-	-	-	-	Active, Successful	1	1
Nelson River	-	-	-	-	Inactive	0	0
Project-affected	-	-	-	-	Inactive	0	0
Project-affected	-	-	-	-	Inactive	0	0
Project-affected	-	-	-	-	Inactive	0	0
Nelson River	-	-	-	-	Inactive	0	0
Nelson River	-	-	-	-	Inactive	0	0
Nelson River	-	-	-	-	Active, Successful	1	1
Nelson River	-	-	-	-	Inactive	0	0
Off-system	-	-	-	-	Inactive	0	0



Hydraulic Zone	2015	2017	2019	2021	2022	No. Years Active	No. Years Successful
Off-system	-	-	-	-	Inactive	0	0
Nelson River	-	-	-	-	Inactive	0	0
Nelson River	-	-	-	-	Status Unknown	0	0
Nelson River	-	-	-	-	Status Unknown	0	0