# CLINTON CREEK SITE

# 2016 - 2018 TERRESTRIAL EXISTING CONDITIONS REPORT

**PREPARED FOR:**

GOVERNMENT OF YUKON
ASSESSMENT AND ABANDONED MINES
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PROJECT NO. 18-278

FEBRUARY, 2020

# CLINTON CREEK SITE - EXISTING TERRESTRIAL CONDITIONS REPORT

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# 1. INTRODUCTION

The Government of Yukon, Assessment and Abandoned Mines Branch (AAM) is preparing for the remediation of the Clinton Creek Site (the Site), an abandoned asbestos mine located approximately 75 km northwest of the City of Dawson, Yukon (100 km by road). The mine operated from 1967 to 1978 and 940,000 tonnes of white chrysotile asbestos was mined from three pits. The Site is located within the traditional territory of Tr'ondëk Hwëch'in First Nation (THFN).

As part of the planning process, Ecological Logistics & Research Ltd. (ELR) was retained by AAM to conduct environmental studies at the Site to gain an understanding of some of the existing environmental conditions. This information will help inform the environmental and socio-economic effects assessment that will be required as part of the Site remediation process.

This report presents information on environmental studies conducted at the site between 2016 and 2018. During the planning process for field studies, ELR reviewed existing information and available literature related to vegetation and wildlife resources. This review included referring to federal and territorial legislation (e.g., *Species at Risk Act* [*SARA*], *Migratory Birds Convention Act, and Wildlife Act* Yukon) and reviewing wildlife status information provided by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

# 2. STUDY PROGRAM OBJECTIVES

The primary objective of the Clinton Creek existing conditions study program was to collect information on existing vegetation and wildlife resources at the Site to adequately describe existing conditions for the purpose of a project assessment by the Yukon Environmental and Socio-economic Board (YESAB). The existing conditions study objectives were based on YESAB's *Proponent's Guide to Information Requirements for Executive Committee Project Proposal Submissions* (2005)*,* including:

- Identifying the occurrence of species at risk in the Project area;
- Identifying movement corridors and critical, key, and sensitive habitats;
- Describing the abundance and distribution of major wildlife species; and,
- Describing vegetation and vegetation assemblages including any identified rare, sensitive, and/or endangered species in the Project area.

# 3. GEOGRAPHIC SCOPE

## 3.1 CLINTON CREEK SITE

The Clinton Creek Site (the Site) is located approximately 75 km northwest of the City of Dawson (Dawson), Yukon and is within the Tr'ondëk Hwëch'in First Nation (THFN) Traditional Territory (Figure 3.1-1). The Site is a former asbestos mine and was operated by the Cassiar Asbestos Corporation Limited for 10 years between 1967 and 1978. Approximately 16 million tonnes of rock were mined from three pits and contained 940,000 tonnes of chrysotile asbestos. Some remedial activities at Site were attempted by the company between 1978 and 1992, then in 2002 the Government of Canada worked to stabilize the Site under the emergency section of the *Canada Water Act*. From 2003, the Government of Yukon has implemented care and maintenance of the Site, and more recently has led the development of a remediation plan funded by the Government of Canada.

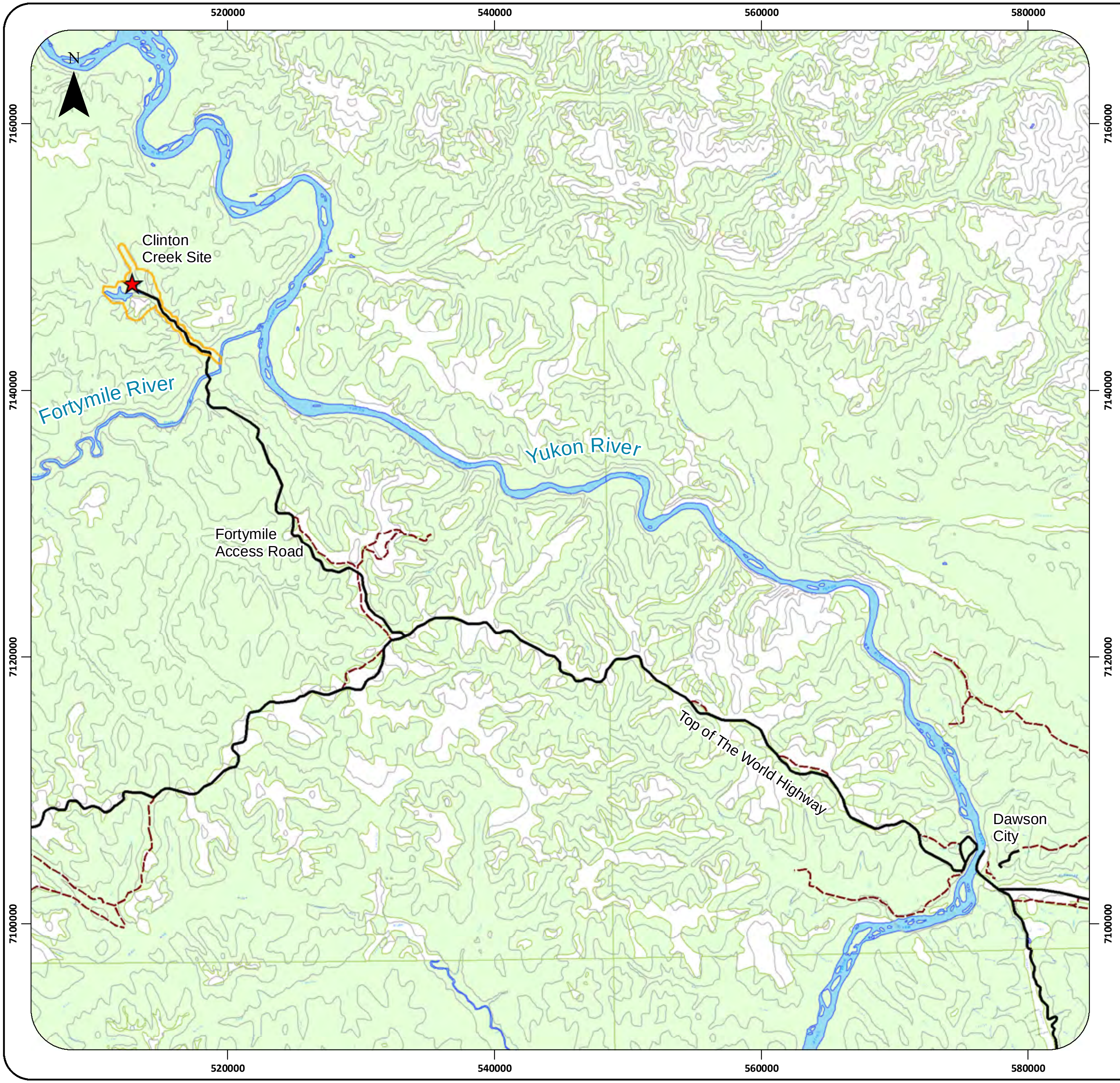
The main features of the Site include open pit quarries containing water (Porcupine Pit and Snowshoe Pit), a waste rock area, a tailings area located between a decommissioned mill site and Wolverine Creek, a disused airstrip, and Hudgeon Lake, a lake that formed along the alignment of Clinton Creek when waste rock migrated into the creek and partially cut off its flow (Figure 3.1-2). Engineered structures currently help maintain flow in Clinton Creek, which flows into the Fortymile River, and in turn into the Yukon River. Two additional small water bodies also exist at the Site; one is an unnamed water body located between lobes of tailings along Wolverine Creek and the other is Porcupine Pond (separate from Porcupine Pit Lake) that is located to the south of the Porcupine Pit Lake and at the toe of the waste rock (Figure 3.1-2).

The Site is located close to the northern boundary of the Klondike Plateau Ecoregion which is characterized by V-shaped valleys and extensive upland boulder fields, having been exposed to a long period of weathering as the area was not glaciated during the last ice age and forms part of Beringia (Yukon Ecoregions Working Group 2004). Boreal coniferous forest accounts for about 60% of the land cover followed by alpine tundra (20%), mixed forest (15%), and wetlands and lakes (5%). Discontinuous permafrost is present throughout the region and is reflected in stunted black spruce woodlands on north facing slopes (Yukon Ecoregions Working Group 2004) as can be seen on the north-facing slopes around Hudgeon Lake and along Clinton Creek. The area typically receives between 300 and 500 mm of precipitation annually with the wettest period being from June through to August. The area experiences wide temperature variations with mean January temperatures ranging from -23 to -32°C, and from 10 to 15°C in July. Extreme temperatures occur in the valleys and range from -60°C to 35°C (Yukon Ecoregions Working Group 2004).

## 3.2 STUDY AREAS

### 3.2.1 Local Study Area

ELR defined a local study area (LSA) to meet spatial requirements for existing conditions investigations at a local level, where effects may reach beyond the proposed remediation footprint. The LSA included the extent of the existing primary Site infrastructure and disturbance (e.g., waste rock, Hudgeon Lake and airstrip), with an additional buffer to account for local scale disturbances (Figure 3.2-1). The setback around the main site infrastructure features was 500 m to take into account the disturbance effects of potentially more intense remediation activities (such as earth moving, blasting, and other industrial equipment usage) on wildlife (e.g. from noise or visual disturbance).




Client:

**LEGEND**

- Wildlife Local Study Area (LSA)
- Clinton Creek Site

**Roads and Trails**

- Roads
- Limited-use roads
- 500 ft Topographic Contour
- Wetlands
- Waterbodies
- Vegetation

0 3.75 7.5 15
Kilometers

Scale: 1:400,000

Drawn by: C. Jastrebski

Approved by: G. Rudman

Date: February 10, 2020

ELR Project: 18-278

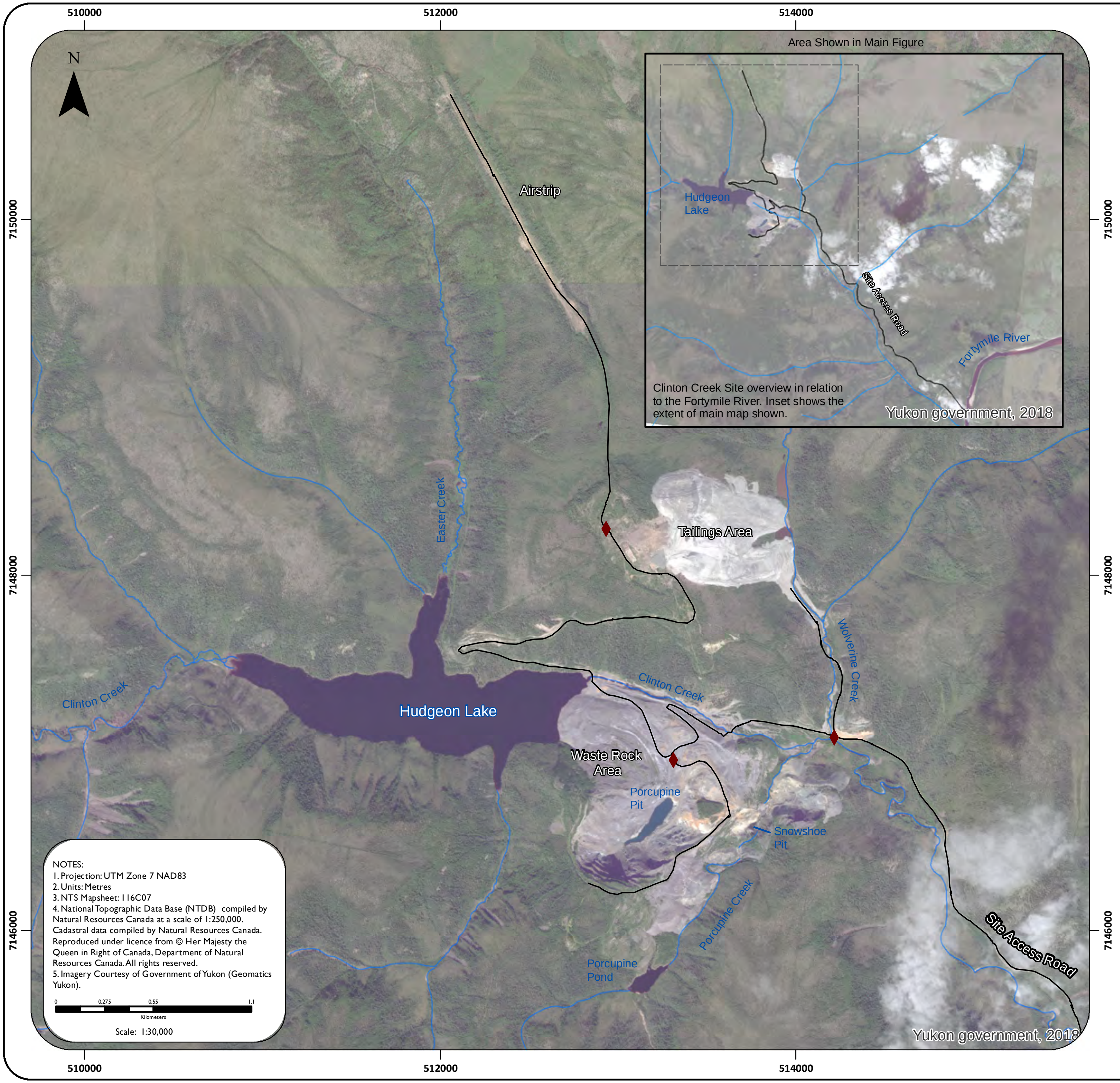
**CLINTON CREEK SITE**

Terrestrial Existing Conditions Studies

**FIGURE 3.1-1**

Clinton Creek Site Regional Overview

Document Path: M:\GIS_Projects\18-278 Clinton Creek 2018 Baseline\Wildlife\Map Files\Report Figures\2020 02 10 Fig 3.1-1 Region Overview.mxd




Ecological Logistics & Research Ltd.

Client:

Yukon

**LEGEND**

- Primary Site Roads
- Watercourses
- Site Gates

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Date: February 10, 2020

ELR Project: 18-278

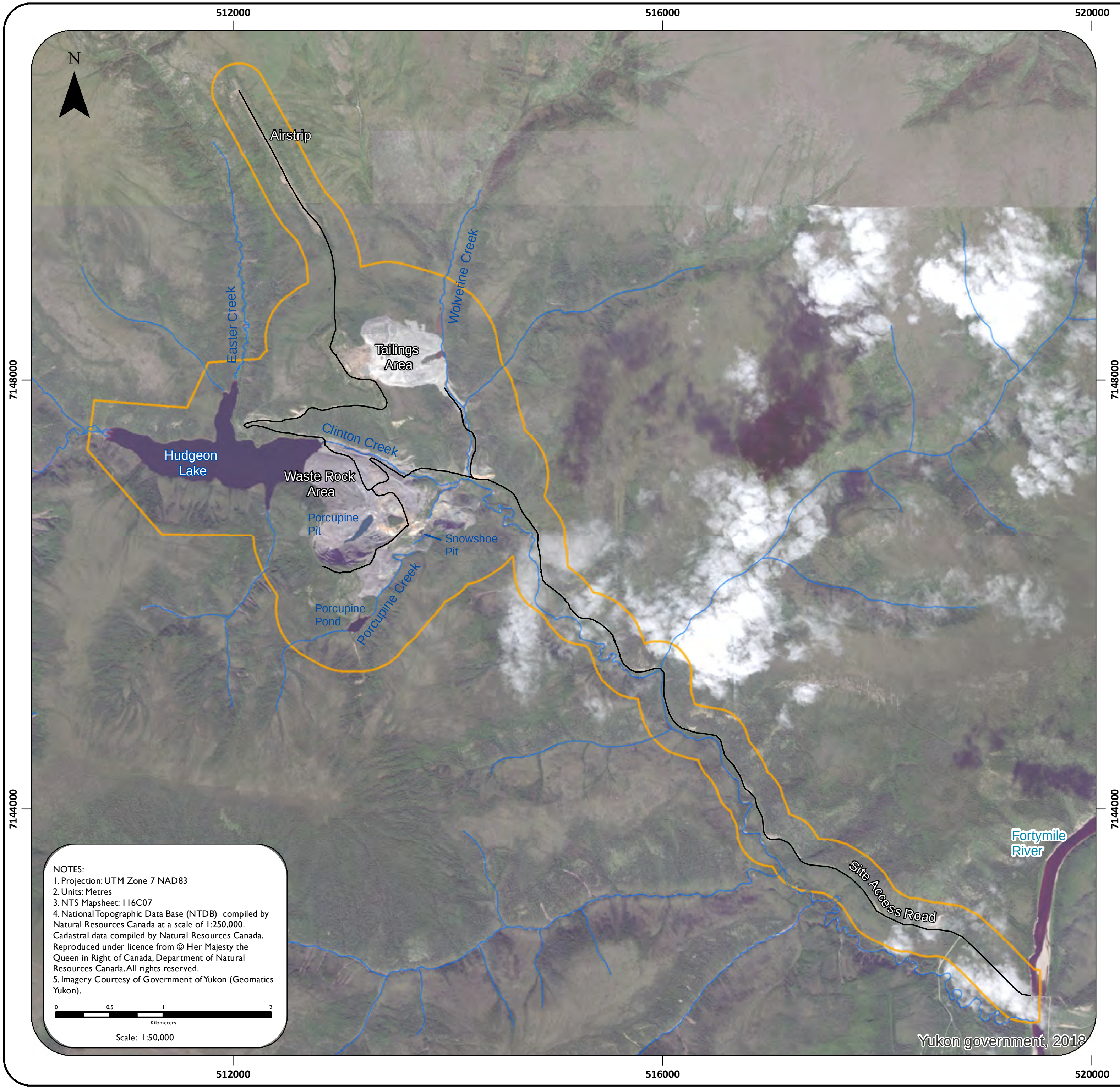
**CLINTON CREEK SITE**

Terrestrial Existing Conditions Studies

**FIGURE 3.1-2**

Clinton Creek Site Local Overview

Document Path: M:\GIS_Projects\18-278 Clinton Creek 2018 Baseline\Wildlife\Map Files\Report Figures\2020 02 10 Fig 3.1-2 lcl overview.mxd




Ecological Logistics & Research Ltd.

Client:

Yukon

**LEGEND**

- Wildlife Local Study Area (LSA)
- Primary Site Roads
- Watercourses

Drawn by: C. Jastrebski

Approved by: G. Rudman

Date: February 10, 2020

ELR Project: 18-278

**CLINTON CREEK SITE**

Terrestrial Existing Conditions Studies

**FIGURE 3.2-1**

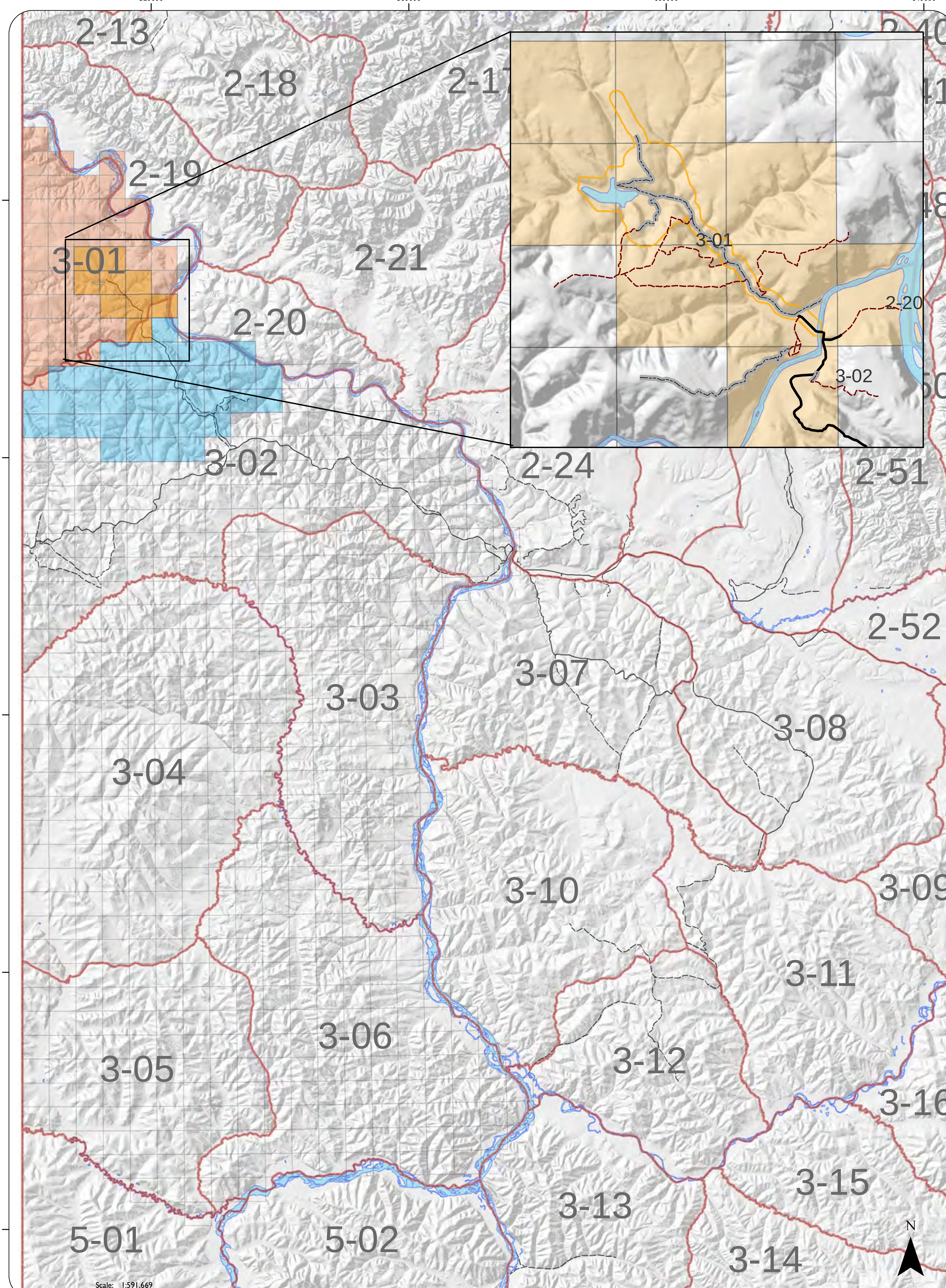
Wildlife Local Study Area (LSA)

Document Path: M:\GIS_Projects\18-278 Clinton Creek 2018 Baseline\Wildlife\Map Files\Report Figures\2020 02 10 Fig 3.2-1 LSA.mxd

A smaller setback of 250 m on either side of the centerline of the main access road to the Site and the airstrip was also established and included as part of the LSA. This was to account for remediation traffic and remediation activities on the access road itself. Any remediation work along the access road is likely to be minimal or short-term (days rather than weeks or months), is not anticipated to involve major earthworks or blasting, and will not likely involve significant removal of vegetation; therefore, the potential effects on vegetation, wildlife or wildlife habitat would be less along this corridor.

### 3.2.2 Moose Survey Regional Study Area

ELR and Government of Yukon defined a regional study area (RSA) for the early winter Moose survey component of the existing conditions studies. This survey was completed by Government of Yukon staff in November 2017. Aerial moose surveys are typically conducted over large areas in order to collect sufficient data to provide robust population estimates. Although the Site was specifically targeted for detailed aerial survey as part of the larger Moose survey at the request of ELR and AAM, the Site itself and LSA were not large enough to provide sufficiently robust population estimates for Moose. Therefore, a 1,328 $km^2$ moose RSA was established that comprised game management subzone (GMS) 3-01 and the northern portion of GMS 3-02 (Figure 3.2-2).

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Client:

Yukon

**LEGEND**

Clinton Creek Site Survey Area

**Base Layers**

Major Road

Limited Use Roads

Waterbodies

Dawson West MMU Study Area

RSA (GMS 3-01 Portion)

RSA (GMS 3-02 Portion)

GMS Boundaries

Clinton Creek Site Survey Area

Wildlife LSA

Drawn by: C. Jastrebski

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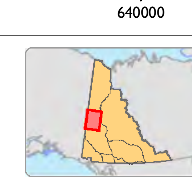
Date: March 29, 2019

ELR Project: 18-278



**CLINTON CREEK SITE**

Terrestrial Existing Conditions Studies

**FIGURE 3.2-2**

Early Winter Moose Survey Study Areas

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# 4. Terrestrial Existing Conditions - Program Scope

## 4.1 Vegetation Resources Scope of Work

The key vegetation work included in the scope of the existing conditions program was to:

- Identify and map vegetation communities within the Clinton Creek Mine area using existing Yukon and BC Ecological Land Classification (ELC) mapping standards (Environment Yukon 2016a; Resource Inventory Committee 1998 a and 1998b);
- Identify soil characteristics within the identified vegetation communities;
- Complete a rare plant survey within the Clinton Creek Mine area to identify any rare plants or identify areas that may contain rare plants; and
- Complete soil and vegetation trace metals analyses on selected plant species and soils collected from the Clinton Creek Mine area.

The above information would be used to characterize existing conditions at the Site which would provide information to help with decisions about future remediation options.

The above scope of work was completed in 2016 including ground truthing of the ELC mapping and is documented in a separate report (Ardea 2020).

## 4.2 Wildlife Resources Scope of Work

ELR organized several field surveys which formed the overall terrestrial wildlife existing conditions program. This was done to target groups of wildlife for which information regarding their abundance and distribution was very limited. These field wildlife surveys included:

- Breeding bird point count surveys;
- Waterfowl surveys (targeting Hudgeon Lake);
- A Sharp-tailed Grouse Survey;
- An early winter Moose survey;
- A winter tracking survey; and
- A remote wildlife camera survey
- Bat investigation surveys (summer 2019)

Bird species, particularly passerines, were surveyed because the Site has high breeding habitat potential for these species which tend to have small enough home ranges to be directly affected by remediation activities (habitat loss or disturbance). Also, several bird species of conservation concern have the potential to occur in the Site area.

Hudgeon Lake is one of the largest lakes in the region for over 200 km, and has the potential to offer breeding and foraging habitat for many different waterfowl species, either summer resident or transitory. Any Site remediation options that involve changing the lake levels may affect the use of the lake by waterfowl.

There was no previous evidence to indicate that Sharp-tailed Grouse (*Tympanuchus phasianellus*) occur on Site. However, Sharp-tailed Grouse had been observed south of the Fortymile River along the access road between the Top of the World Highway and the Fortymile River. In addition, ELR observed some locations around the Site that could potentially provide suitable breeding habitat for the species, including potential locations for leks (display/dancing grounds) used by the male birds to attract the females. Male Sharp-tailed Grouse show fidelity to lek sites, and therefore should lek sites occur at the Site, there would be a potential for effects if they were to overlap with future remediation activities.

Moose (*Alces americanus*) were known to use the Site based on previous observations by field staff and through local knowledge shared by the residents of the Clinton Creek Town Site . Three mineral licks located around the Site had also been identified by ELR field staff and wildlife tracks around these sites indicated that the mineral licks were visited by several wildlife species including Moose. Because Moose are a culturally, economically and ecologically important wildlife species, a survey was recommended by ELR to establish overall Moose densities in the Site area. However, as the Government of Yukon were conducting a regional moose survey of the Dawson West Moose Management Unit as part of their ongoing management program, arrangements were made for Environment Yukon to complete a Moose survey of the Site and RSA as part of their larger 2017 regional survey, and to provide the results of the survey to ELR to include this report. AAM provided partial funding to Environment Yukon to complete this task.

Large omnivores, particularly grizzly bears (*Ursus arctos*) and Grey Wolf (*Canis lupis*), are often termed keystone predators because they are critical to ecosystem diversity and integrity through their control of the numbers of species such as Moose, Caribou (*Rangifer tarandus granti*) and other smaller mammals. Observations of bears, wolves and carnivores such as Canada Lynx (*Lynx canadensis*), or their signs (e.g., scat or tracks) have been made locally by field staff over the years, although there was little information describing the abundance or distribution of these mammals in the area. Although furbearer species are known to exist, as demonstrated by successful traplines in the area, evidence of species such as American Marten (*Martes americana*) and Wolverine (*Gulo gulo*) is often minimal due to the elusive nature of these species. This limits the potential for their detection without using targeted surveys and techniques. A winter track survey and the deployment of remote automated cameras were employed to gain a greater understanding of the diversity of these and other species at the Site, their relative abundance and seasonal use of the Site. The winter track survey provided a 'snapshot' of wildlife occurrence across different habitats and across a larger area over a short period of time (e.g., days), whereas the remote camera survey provided species and seasonal information over the long-term (months to years) of wildlife occurrence at specific and strategically chosen locations at and around the Site.

Bat investigations were completed in the summer of 2019, primarily to establish if bats occurred on Site and, if they were detected, where the roosts may be located. A separate bat investigation report was prepared and submitted to AAM in December 2019.

# 5. FIELD PROGRAM COMPONENTS

## 5.1 BREEDING BIRD POINT COUNT SURVEYS

### 5.1.1 Methods

Breeding bird point count surveys (BBS) were conducted in the spring of both 2016 and 2018. The BBS completed in 2016 was conducted relatively late in the breeding season (late June to early July). Additionally, although survey conditions were within survey protocol limits (i.e., the timing, wind, precipitation and temperatures were acceptable), the surveys were interrupted by precipitation events. For these reasons, ELR recommended additional surveys to be conducted in 2018, closer to the peak breeding season for many songbird species (mid-June).

#### *5.1.1.1 Pre-field Preparation*

For the first set of BBS conducted in 2016, point count sampling locations were selected using Geographic Information System (GIS) software and satellite imagery, with the objective of pre-selecting point count locations stratified to various vegetation types on Site. This method was employed because the first BBS was completed prior to the development of an ecological land classification (i.e., mapping of vegetation habitats; ELC) for the Site.

The second set of BBS was conducted in 2018, after the ELC had been completed. These data were used alongside satellite imagery on the GIS to select point count locations to target specific habitat cover types.

Overall, the aim of both sets of BBS was to complete point counts within a variety of land cover types. For 2016 and 2018, 37 and 28 point locations were selected, respectively at the planning stage.

#### *5.1.1.2 Field Surveys*

Field methods were based on those described in the British Columbia Resource Inventory Committee's Inventory Methods for Forest and Grassland Songbirds (MELP 1999). The survey employed 100 metre (m) radius point counts with a target timing of between 04:00 and 10:00. Navigation between sample points was conducted using a handheld GPS unit and compass. After arriving at a plot and waiting quietly for five minutes while completing basic survey and plot information, bird detections were recorded for 10 minutes, during which time all songs heard or birds observed within a 100 m radius were identified and recorded.

As site and environmental conditions can influence the success and the effectiveness of point counts, ELR collected information describing these conditions during the course of the point counts. This information is regularly collected during point count surveys and can help to provide a context to the data during analysis by indicating how conditions or habitat types may influence the observations (e.g. abundance or diversity of birds). Further, the point count survey in 2016 was completed prior to the completion of vegetation classification and mapping; therefore, site attribute data can inform the analyses of site usage for future assessments of Project-related effects. The survey plot attributes included air temperature, precipitation, cloud cover, Universal Transverse Mercator (UTM) coordinates, photographs and habitat information (e.g., main vegetation cover by type).

Bird detections made outside of the 100 m point count radii during, before and after point counts, as well as observations recorded while the crew was moving between plots, were also recorded as incidental observations. These detections are still valuable for describing the species occurring within the LSA and are described as part of a larger set of bird detection data. Incidental bird detections from the BBS were combined with incidental detections from other surveys (e.g., the waterfowl surveys and the Sharp-tailed Grouse survey), and these results have been summarized in the results section.

#### *5.1.1.3 Data Analysis*

Point count plot data were pooled for all point counts completed to evaluate the abundance and diversity of birds. Species richness and individual bird and species densities were calculated at the individual point level. Definitions and formulas used in the analysis of point count data area summarized in Table 5.1-1 below.

**Table 5.1-1: Species Diversity and Abundance Calculations and Descriptors Used to Analyze Breeding Bird Point Count Data Collected in 2016 and 2018 at the Clinton Creek Site**

| Metric | Description | Formula |
|---|---|---|
| Bird abundance (# of individuals/plot) | Absolute count of birds per point count | $= Number\ of\ individuals\ per\ plot$ |
| Bird density (# of individuals/ha) | Number of individuals per hectare | $= \frac{Number\ of\ Individuals}{Area\ (ha)}$ |
| Species richness | Absolute number of species at the point count or LSA area | $= Number\ of\ distinct\ species\ in\ a\ described\ area$ |
| Species evenness (R) | Ratio of the number of species observed to the number of individuals observed | $= \frac{Number\ of\ Species}{Number\ of\ Individuals}$ |
| Species density (# of species/ha) | Number of species per hectare calculated to provide an estimate of how many species an area supports | $= \frac{Number\ of\ Species}{Area\ (ha)}$ |
| Incidental Observations[1] | Incidental bird observations from 2016, 2017 and 2018 | $= Number\ of\ individuals\ detected$ |

*Note:*

*[1] Incidental observations from the BBS, waterfowl and Sharp-tailed Grouse surveys over all years have been summarized together in the results section.*

### 5.1.2 Results

Basic summary statistics are presented in this section for each year of the survey. For more detailed metrics (e.g., abundance and density), the 2016 and 2018 survey results were pooled and the results are presented from Section 5.2.1.3 onwards.

#### *5.1.2.1 2016 Breeding Bird Survey Overview and Species Density*

ELR completed 38 point count survey plots between June 30 and July 5, 2016 (Figure 5.1-1), resulting in a total point count survey area of approximately 119 hectares (ha). All were within the protocol criteria described for wind, precipitation and temperature, but rain showers prevented surveys from starting or caused surveys to be postponed on three of six field days. Drizzle/very light rain occurred during nine of the 38 plots. Four survey plots were completed outside of the LSA (near the Fortymile River); these were completed prior to the LSA boundary being fully refined. These plots fall in similar habitats to survey plots within the LSA and therefore this data has been included in the survey analysis and totals.

In total, ELR detected and positively identified 23 bird species by sight or sound in survey plots. Woodpeckers were detected (drumming) in two of the plots, but were not positively identified to species; these were included in the overall analysis. The overall species density in 2016 was calculated to be 0.19 species/ha with the top five most commonly detected birds being:

1. Swainson's Thrush (*Catharus ustulatus,* n=33)
2. White-winged Crossbill (*Loxia leucoptera,* n=21)
3. Dark-eyed Junco (*Junco hyemalis,* n=18)
4. American Robin (*Turdus migratorius,* n=9)
5. Boreal Chickadee (*Poecile hudsonicus*, n=7)

#### *5.1.2.2 2018 Breeding Bird Survey Overview and Species Density*

ELR completed 29 point count survey plots between June 13 and June 16, 2018 (Figure 5.1-1), resulting in a total point count survey area of approximately 91 ha. Survey conditions overall were very good (all were completed within the survey protocol described for wind, precipitation and temperature) and drizzle/very light rain was noted for nine of the 29 survey plots.

In total, ELR detected and positively identified 18 bird species by sight or sound in survey plots. The overall species density in 2018 was calculated to be 0.20 species/ha, a comparable value to the 2016 survey results, although fewer species were detected overall in 2018.

The top five most detected birds were:

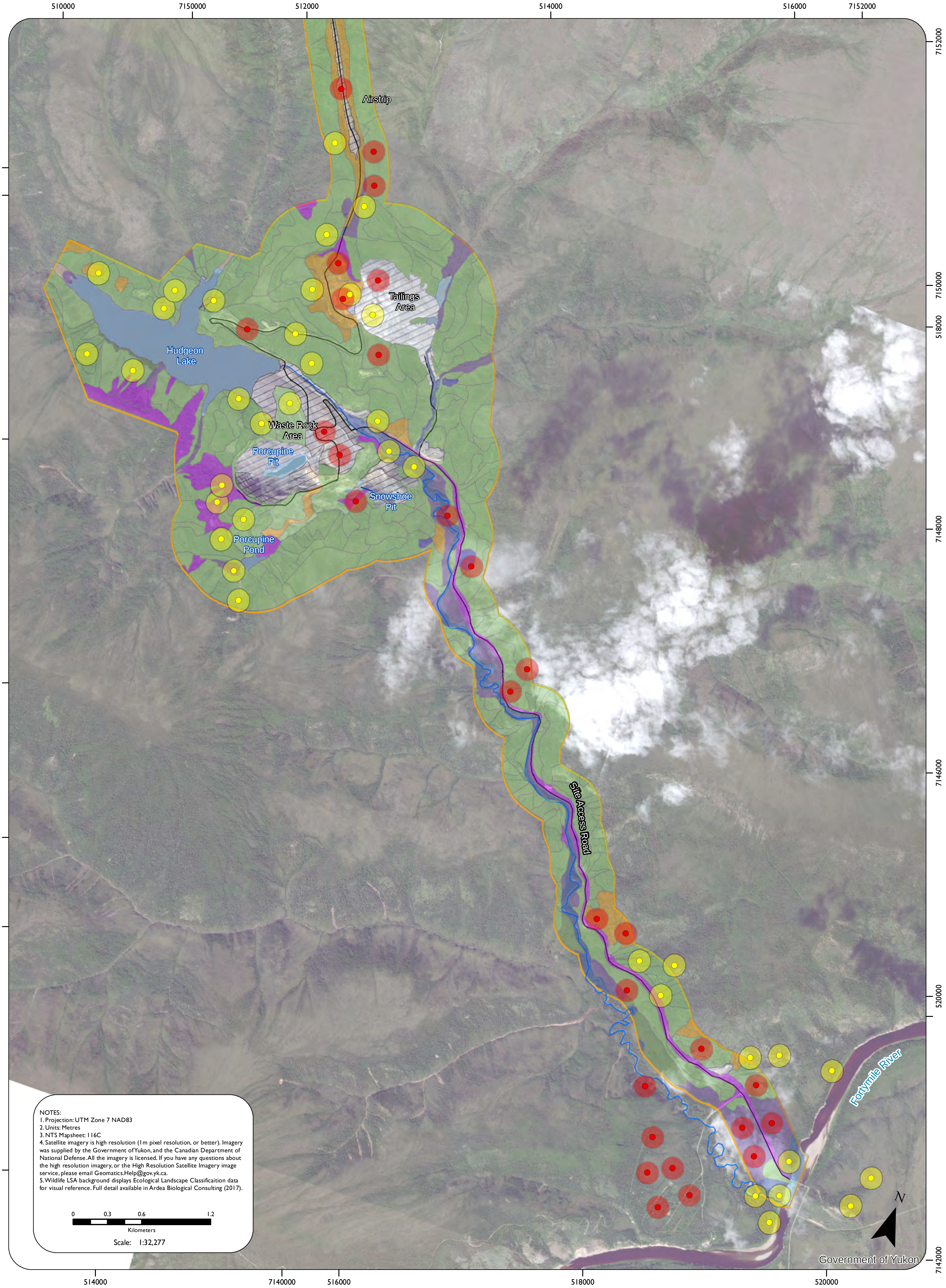
1. Swainson's Thrush (*Catharus ustulatus*, n=20)
2. White-winged crossbill (*Loxia leucoptera*, n=19)
3. Dark-eyed Junco, (*Junco hyemalis,* n=11)
4. American Robin, (*Turdus migratorius*, n=7)
5. Yellow-rumped warbler (*Setophaga coronate*, n=3); Wilson's Warbler (*Cardellina pusilla*, n=3); Ruby-crowned Kinglet (*Regulus calendula,* n=3)

#### *5.1.2.3 Abundance and Density (pooled data)*

The 2016 and 2018 point count survey provided data for 67 plots covering a total of area of 210.5 ha. Of those, 11 were completed in areas influenced by historical anthropogenic activity (e.g., tailings, waste rock, mill site and roads) where there has been limited or no regeneration of vegetation that would provide functional nesting or foraging habitat for most bird species (Figure 5.1-1 and 5.1-2).

ELR identified a total of 26 species within the survey plots including at least two woodpeckers that were heard drumming but were not identified to species. These woodpecker counts (n=2) have been included in the summary statistics as one species. No birds were detected within 11 of the 67 survey plots.

ELR recorded 213 individual bird detections during the point count surveys (from within the 10-minute survey period and the 100 m radius plot area). The number of birds in individual plots ranged from 0 to 12 with a mean value of 3.2 individuals per plot (standard deviation [SD]=±2.3; median=3). The calculated bird density for the total surveyed area (210.5 ha) was 1.01 bird / ha.




Client:

**LEGEND**

- 2018 Breeding Bird Point Count Plot Locations
- 2016 Breeding Bird Point Count Plot Locations
- 2018 Breeding Bird Point Count Plot Diameter (100 m)
- 2016 Breeding Bird Point Count Plot Diameter (100 m)
- Primary Site Roads
- Watercourses
- Wildlife Local Study Area (LSA)

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ELR Project: 18-278.3

**CLINTON CREEK SITE**

Terrestrial Existing Conditions Studies

**FIGURE 5.1-1**

Breeding Bird Point Count Plot Locations

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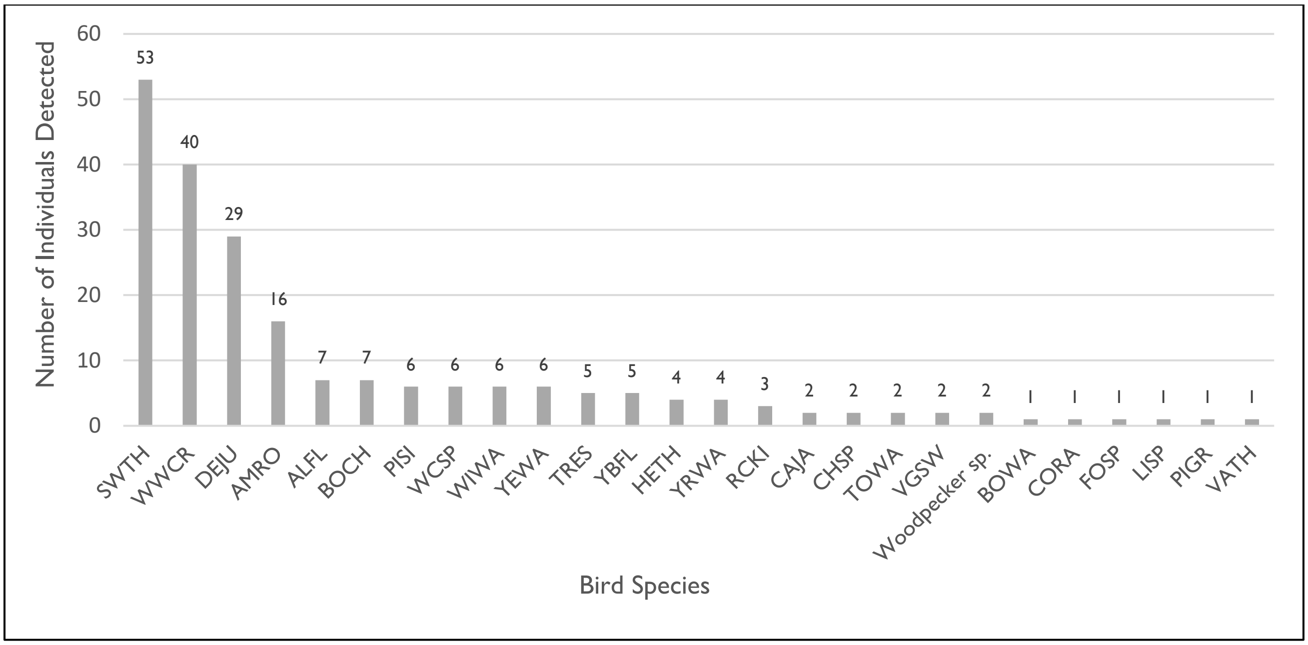
#### 5.1.2.4 *Species Richness, Density, and Evenness (pooled data)*

ELR identified 26 species within point count plots, and a range of between 0 and 8 species in individual plots. The average species density across all plots was 2.3 species/plot (SD=±1.7; median=2). The species density calculated for the total area surveyed (210.5 ha; all plots) was 0.13 species/ha. Species evenness ranged from 0 to 1.0 across plots, with an average of 0.62 (SD=±0.34; median=0.67) across all 67 plots.

#### 5.1.2.5 *Community Descriptions (pooled data)*

The species most commonly detected during point counts (within plots) was Swainson's Thrush (*Catharus ustulatus*; n=53) followed by White-Winged Crossbill (*Loxia leucoptera*; n=40), Dark-Eyed Junco (*Junco hyemalis*; n=29), and American Robin (*Turdus migratorius*; n=16). A summary of the species detected during the point counts ranked according to detection frequency is shown below in Figure 5.1-2. Table 5.1-2 provides a complete summary list of bird detections recorded during the point count surveys including incidental detections (pooled data for 2016 and 2018).




*Note: Species codes are provided in Table 5.1-2*

**Figure 5.1-2: Number of Individual Species Detected for All Point Count Plots (pooled 2016 & 2018 data).**

**Table 5.1-2: Summary of Bird Detections Recorded during the 2016 & 2018 Breeding Bird Surveys and All Incidental Detections Ranked by Total Number of Detections.**

| Common Name | Scientific Name | Species Code | Detections During Point Counts | All Incidental Detections[1] | Total[2] |
|---|---|---|---|---|---|
| Swainson's Thrush | *Catharus ustulatus* | SWTH | 53 | 16 | 69 |
| White-winged Crossbill | *Loxia leucoptera* | WWCR | 40 | 5 | 45 |
| Dark-eyed Junco | *Junco hyemalis* | DEJU | 29 | 9 | 38 |
| Sandhill Cranes | *Antigone canadensis* | SACR | | 30 | 30 |
| American Robin | *Turdus migratorius* | AMRO | 16 | 8 | 24 |
| Bufflehead | *Bucephala albeola* | BUFF | | 22 | 22 |
| Common Raven | *Corvusx corax* | CORA | 1 | 13 | 14 |
| Boreal Chickadee | *Poecile hudsonicus* | BOCH | 7 | 5 | 12 |
| Spotted Sandpiper | *Actitis macularius* | SPSA | | 12 | 12 |
| Pine Siskin | *Spinus pinus* | PISI | 6 | 4 | 10 |
| White-Crowned Sparrow | *Zonotrichia leucophrys* | WCSP | 6 | 4 | 10 |
| Canada Goose | *Branta canadensis* | CAGO | | 9 | 9 |
| Lesser Yellowlegs | *Tringa flavipes* | LEYE | | 9 | 9 |
| Tree Swallow | *Tachycineta bicolor* | TREW | 5 | 4 | 9 |
| Yellow-Rumped Warbler | *Setophaga coronata* | YRWA | 4 | 5 | 9 |
| Alder Flycatcher | *Empidonax alnorum* | ALFL | 7 | 1 | 8 |
| Ruby-Crowned Kinglet | *Regulus calendula* | RCKI | 3 | 5 | 8 |
| Canada Jay | *Perisoreus canadensis* | CAJA | 2 | 5 | 7 |
| Hermit Thrush | *Catharus guttatus* | HETH | 4 | 2 | 6 |
| Unidentified Woodpecker | - | - | 2 | 4 | 6 |
| Wilson's Warbler | *Cardellina pusilla* | WIWA | 6 | | 6 |
| Yellow Warbler | *Setophaga petechia* | YEWA | 6 | | 6 |
| Yellow-Bellied Flycatcher | *Empidonax flaviventris* | YBFL | 5 | 1 | 6 |
| Violet-Green Swallow | *Tachycineta thalassina* | VGSW | 2 | 3 | 5 |
| Chipping Sparrow | *Spizella passerina* | CHSP | 2 | 2 | 4 |
| Green-Winged Teal | *Anas crecca* | GWTE | | 3 | 3 |
| Lincoln's Sparrow | *Melospiza lincolnii* | LISP | 1 | 2 | 3 |
| Townsend's Warbler | *Setophaga townsendi* | TOWA | 2 | 1 | 3 |
| Varied Thrush | *Ixoreus naevius* | VATH | 1 | 2 | 3 |
| American Three-toed Woodpecker | *Picoides dorsalis* | ATTW | | 2 | 2 |
| Common Redpoll | *Acanthis flammea* | CORE | | 2 | 2 |
| Fox Sparrow | *Passerella iliaca* | FOSP | 1 | 1 | 2 |
| Lesser or Greater Scaup | *Aythya spp.* | - | | 2 | 2 |
| Mallard | *Anas platyrhynchos* | MALL | | 2 | 2 |
| Peregrine Falcon | *Falco peregrinus anatum / tundrius* | PEFA | | 2 | 2 |
| Ruffed Grouse | *Bonasa umbellus* | RUGR | | 2 | 2 |
| Trumpeter Swan | *Cygnus buccinator* | TRSW | | 2 | 2 |

| Common Name | Scientific Name | Species Code | Detections During Point Counts | All Incidental Detections[1] | Total[2] |
|---|---|---|---|---|---|
| American Kestrel | *Falco sparverius* | MAKE | | 1 | 1 |
| Bohemian Waxwing | *Bombycilla garrulus* | BOWA | 1 | | 1 |
| Hammond's Flycatcher | *Empidonax hammondii* | HAFL | | 1 | 1 |
| Northern Flicker | *Colaptes auratus* | NOFL | | 1 | 1 |
| Osprey | *Pandion haliaetus* | OSPR | | 1 | 1 |
| Pine Grosbeak | *Pinicola enucleator* | PIGR | 1 | | 1 |
| Red-tailed Hawk | *Buteo jamaicensis* | RTHA | | 1 | 1 |
| Say's Phoebe | *Sayornis saya* | SAPH | | 1 | 1 |
| Townsend's Solitaire | *Myadestes townsendi* | TOWA | | 1 | 1 |
| Western Wood-Pewee | *Contopus sordidulus* | WEWP | | 1 | 1 |
| Wilson's Snipe | *Gallinago delicata* | WISN | | 1 | 1 |
| **Total Number of Species** | | | **26** | **44** | **48** |
| **Total Number of Individuals** | | | **213** | **210** | **423** |

*Notes:*

[1] *Includes all incidental detections from the BBS, waterfowl and Sharp-tailed Grouse surveys.*

[2] *Sum of observations from point counts and incidental detections.*

#### 5.1.2.6 Incidental Sightings (pooled data)

ELR recorded 210 individual birds belonging to 44 species as incidental detections during all bird surveys (Table 5.1-2). 22 of the species recorded as incidental detections were not detected during the point count surveys (within plots) and mostly included shorebirds, waterfowl and raptors, which are species not typically targeted during standard point count surveys. However, six of these 22 incidentally recorded species not detected during point counts were either songbirds (e.g., Say's Phoebe, Townsend's Solitaire) or woodpecker species (e.g., American-Three-toed Woodpecker).

The most numerous species detected incidentally was the Sandhill Crane, with 30 observed flying over Hudgeon Lake on September 1, 2016, shortly after the field crew completed a morning waterfowl survey.

#### 5.1.2.7 Conservation Status of Observed Species

None of the 26 bird species detected by ELR during the point count surveys are considered to be species of conservation concern and listed either under the federal *Species at Risk Act* (SARA 2002) or by the Committee on the Status of Endangered Species in Canada (COSEWIC) as "Special Concern", "Threatened" or "Imperiled". Of the 44 bird species detected as incidentals, only the Peregrine Falcon is considered a species of conservation concern and its location on Site and conservation status are discussed in Section 6.

## 5.2 Waterfowl Surveys

### 5.2.1 Methods

#### *5.2.1.1 Pre-field Preparation*

ELR planned targeted waterfowl surveys for Hudgeon Lake, while incidental observations were to be observed and recorded for other water bodies and watercourses within the LSA including Porcupine Pond, Porcupine Pit Lake, and the unnamed waterbody that has formed between the tailings lobes along the west side of Wolverine Creek. These waterbodies were targeted based on ELR's Site knowledge and a review during project planning stages using satellite imagery on GIS.

#### *5.2.1.2 Field Surveys*

ELR used static observation stations and encounter transects by boat during late spring and fall of 2016, and during spring of 2017, to document waterfowl occurrence on Hudgeon Lake. Surveys were completed in the morning and evenings. Two static observation points were established; one at the east end of Hudgeon Lake and one roughly half way along the southern shore of the lake (Figure 5.2-1). The minimum observation duration at each station was 20 minutes per visit. ELR also followed a standard encounter transect path between observation stations and around the lake, as shown in Figure 5.2-1.

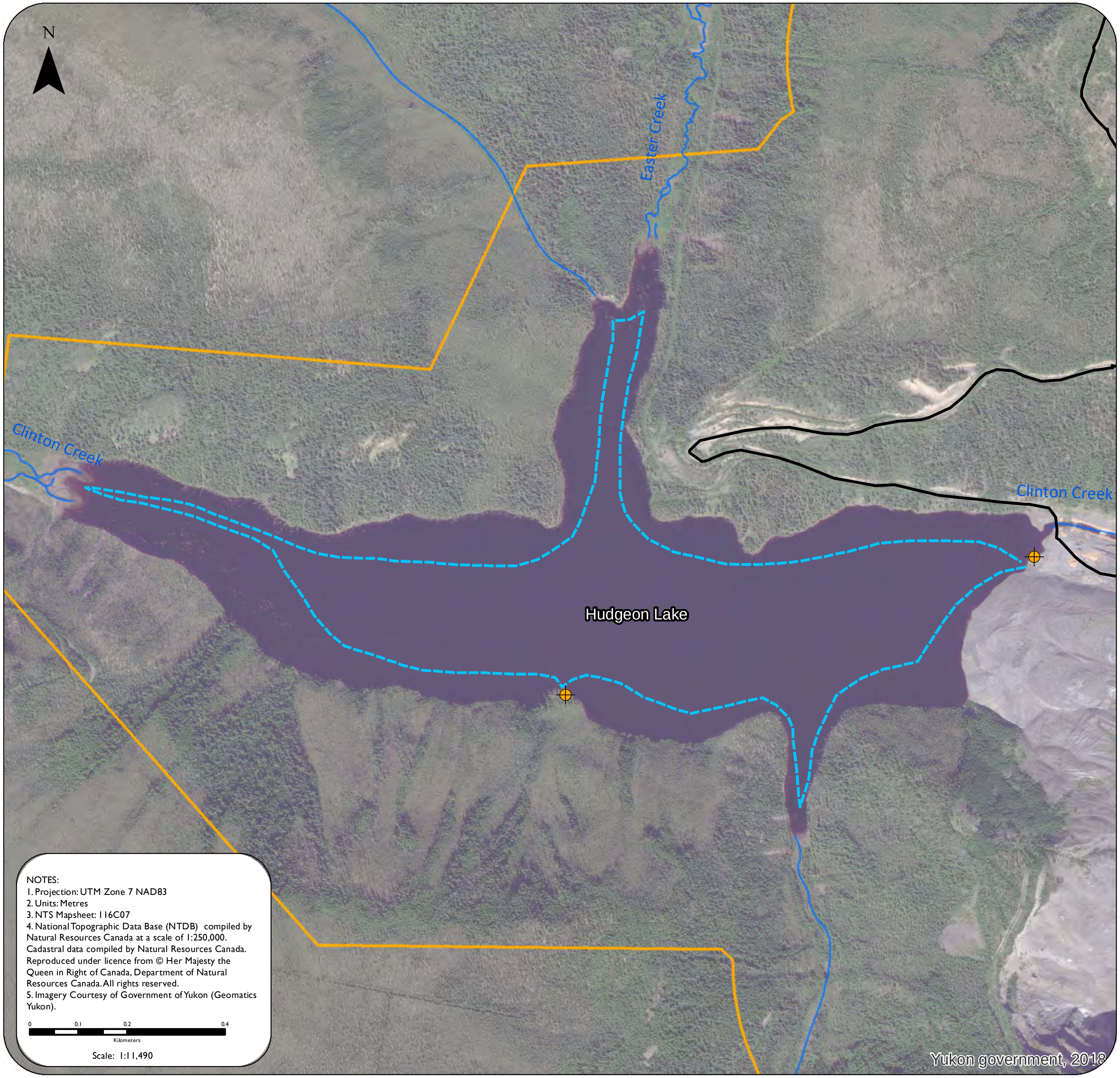
The transect duration was dependent on how long it took to identify the observed species. The crew used a small boat with an outboard motor to move around the lake. Over the course of the transects the field crew travelled slowly (15 km/h or slower) around the lake in a clockwise or counter-clockwise direction, during which time all detected waterfowl were identified and recorded. Care was taken to observe any movement of birds around the lake to avoid double counting. The transect track was recorded using a handheld GPS unit and other information (e.g., weather conditions) was also noted.

#### *5.2.1.3 Data Analysis*

Waterfowl detection data were summarized by observation period (spring or fall) and by the maximum number of individuals detected for each species for each day of the surveys. This provides an indication of seasonal occurrence, the species present and the maximum number of each species encountered.

### 5.2.2 Results

The dates and timing (morning or evening) of waterfowl surveys on Hudgeon Lake are provided in Table 5.2-1. Overall, survey conditions were very good during most of the surveys with very good visibility, mostly no or light wind (<8km/h), and no precipitation. On June 2, 2017, higher winds were experienced towards the end of the encounter transect survey (up to 16 km/h) and on June 4, 2017 there was very light rain during the evening encounter transect on the lake. Static observations and encounter transects were completed in the mornings (between 8:00 am and 11:30 am), evenings (between 7:45 and 9:45 pm), or both. ELR completed a total of 18.2 hours of observation effort on Hudgeon Lake over the two years. Although the static surveys provided some data in 2016, more birds were observed during the transect encounter surveys. For this reason, encounter transects were used as the primary type of survey in 2017. The waterfowl static observation locations and transect locations are presented in Figure 5.2-1




NOTES:
1. Projection: UTM Zone 7 NAD83
2. Units: Metres
3. NTS Mapsheet: 116C07
4. National Topographic Data Base (NTDB) compiled by Natural Resources Canada at a scale of 1:250,000. Cadastral data compiled by Natural Resources Canada. Reproduced under licence from © Her Majesty the Queen in Right of Canada, Department of Natural Resources Canada. All rights reserved.
5. Imagery Courtesy of Government of Yukon (Geomatics Yukon).

0 0.1 0.2 0.4
Kilometers

Scale: 1:11,490

elr Ecological Logistics & Research Ltd.

Client: Yukon

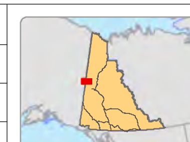
**LEGEND**
- Existing Roads - Clinton Creek
- Watercourses
- Wildlife LSA
- Waterfowl Transect Route
- Static Observation Locations

Drawn by: C. Jastrebski

Approved by: G. Rudman

Date: February 10, 2020

ELR Project: 18-278



**CLINTON CREEK SITE**
Terrestrial Existing Environment Studies

**FIGURE 5.2-1**
Waterfowl Studies

Document Path: M:\GIS_Projects\18-278 Clinton Creek 2018 Baseline\Wildlife\Map Files\Report Figures\2020 02 10 Fig 5.2-1 Waterfowl.mxd

**Table 5.2-1: Waterfowl Survey Effort at Hudgeon Lake (2016 & 2017)**

| Date | Static Observation Effort (hours) | Encounter Transect Observation Effort (hours) | Morning / Evening |
|---|---|---|---|
| **2016** | | | |
| June 29 | 1.6 | | Morning only |
| July 3 | | 0.8 | Evening only |
| July 19 | | 1.0 | Morning only |
| August 31 | 1.3 | 0.4 | Morning & Evening |
| September 1 | 1.0 | 1.8 | Morning & Evening |
| **2017** | | | |
| June 2 | 0.3 | 1.8 | Morning & Evening |
| June 3 | | 3.0 | Morning & Evening |
| June 4 | | 3.3 | Morning & Evening |
| June 5 | | 1.7 | Morning Only |
| **Sub-totals (hours)** | **4.3** | **13.9** | |
| **Total Survey Effort (hours)** | **18.2** | | |

2016 and 2017 waterfowl observations organized by survey day are presented in Table 5.2-2. The highest number of species identified (n=11) and the highest number of individuals counted (n=66) were recorded on the same day (June 3, 2017). The lowest number of species identified (n=2) were recorded on September 1, 2016, while the lowest number of individuals counted (n=5) was on August 31, 2017. The most frequently detected species across both years was Bufflehead (*Bucephala albeola)* followed by Northern Shoveler (*Spatula clypeata*) and Scaup sp. (*Aythya* spp).

Among all survey events across 2016 and 2017, a total of 13 individual birds were counted but were not positively identified because of their position in relation to the observers, they were momentary observations, or because of uncertainty between two or more species. Of the waterfowl species identified on Hudgeon Lake, the Horned Grebe and Red-necked Phalarope are listed as species of conservation concern in the Yukon. More information is provided about these species in Section 6.

**Table 5.2-2: Waterfowl Survey Results for Hudgeon Lake (2016 & 2017)**

| | **Season** | **Spring / Summer 2016** | | | **Fall 2016** | | **Spring 2017** | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Date** | **June 29** | **July 3** | **July 19** | **August 31** | **Sept. 1** | **June 2** | **June 3** | **June 4** | **June 5** |
| **Common Name** | **Scientific Name** | **Highest Daily Count** | | | | | | | | |
| American Wigeon | *Mareca americana* | | | | | | 4 | 2 | 2 | 2 |
| Bufflehead | *Bucephala albeola* | 35 | 27 | 16 | 3 | 3 | 7 | 17 | 17 | 3 |
| Barrow's Goldeneye | *Bucephala islandica* | 1 | | | | | | | | |
| Blue-Winged Teal | *Spatula discors* | 1 | 2 | | | | | 3 | | |
| Canada Goose | *Branta canadensis* | | | 4 | | | 2 | 5 | | |
| Green-winged Teal | *Anas crecca* | 2 | | | | | 1 | 1 | 5 | 2 |
| Horned Grebe | *Podiceps auritus* | | | | | | | 1 | | 1 |
| Mallard | *Anas platyrhynchos* | 5 | | 14 | | | 7 | 1 | 5 | |
| Northern Pintail | *Anas acuta* | | | | 2 | 1 | | | | |
| Northern Shoveler | *Spatula clypeata* | 5 | 2 | 3 | | | 7 | 16 | 7 | 7 |
| Redhead | *Aythya americana* | 5 | | | | | | | | |
| Red-necked Phalarope | *Phalaropus lobatus* | | | | | | | 3 | | |
| Ring-necked Duck | *Aythya collaris* | | | | | | 5 | 5 | 6 | 12 |
| Scaup sp. | *Aythya* sp. | 5 | | 8 | | 3 | 1 | 9 | 3 | 2 |
| White-winged Scoter | *Melanitta deglandi* | | | | | | 1 | | | |
| Unidentified Waterfowl | - | | 2 | 7 | | | 1 | 3 | | |
| Total Identified Species Per Day | | 8 | 3 | 5 | 2 | 3 | 9 | 11 | 7 | 7 |
| Total Individuals Per Day | | 59 | 33 | 52 | 5 | 7 | 36 | 66 | 45 | 29 |

ELR detected 11 waterfowl species on Hudgeon Lake, with the highest frequencies of detection in the late spring and early summer. Bufflehead had the highest number of detections overall, followed by Northern Shoveler and Scaup spp. There is evidence that some waterfowl are breeding at Hudgeon Lake (e.g., Bufflehead) because of the detections of juvenile birds over more than one survey day. There was also evidence that some species use Hudgeon Lake in the spring as a stopover for resting and foraging because of the relatively early date of the detections (early in the breeding season) and because those birds were observed for only a period of one to two days (e.g., Red-necked Phalarope, White-winged Scoter and Horned Grebe) despite surveys of a longer duration.

Few incidental observations of waterfowl were recorded on water bodies other than Hudgeon Lake, but included two Scaup Spp. in June 2016 on the unnamed water body between the lobes of tailings along Wolverine Creek, and three Green-winged Teal on Porcupine Pond in July 2016. An ELR member of field staff also reported seeing one bird (an unidentified waterfowl species) flying out of Porcupine Pit Lake in 2015 during summer water quality sampling activities.

## 5.3 SHARP-TAILED GROUSE LEK SURVEY

### 5.3.1 Methods

#### *5.3.1.1 Pre-field Preparation*

Because Sharp-Tailed Grouse (STGR) had been observed south of the Site (across the Fortymile River and along the Fortymile Access Road), dedicated STGR lek surveys were planned to check for the presence of STGR () within the Site during the early spring when the male STGR go through a breeding display where they perform a "dance" or lek to attract female STGR. Based on previous knowledge of the Site, three potential lek locations were identified for surveys within the previously disturbed area of the Site; these locations were thought to provide the best habitat in which lekking would likely occur and were also located close to potential nesting habitat. These locations were: the mill site area (a slightly hummocky, open area with regenerating vegetation and low to medium height shrubs; the waste rock area (with regenerating vegetation and low shrubs); and, a small, open and hummocky area adjacent to Clinton Creek with grasses and sparsely growing low to medium height shrubs.

#### *5.3.1.2 Field Surveys*

ELR conducted static observations from the survey locations on the mornings of April 27 to 29, 2017 (early spring). This time period coincided with STGR lek surveys that were being conducted by Environment Yukon staff in the Dawson region.

To avoid potentially disturbing lekking birds by driving to the survey locations in a Utility Task Vehicle (UTV), ELR camped close to the survey locations and started static observations of the survey locations between 04:00 and 05:45, and continued observations for at least three to four hours depending on the weather conditions. The survey crew stayed in one place to prevent disturbing or flushing STGR as the birds are easily scared and may not return to the lekking area on the same day. In addition, remaining still at a static observation point allowed the observers to listen and observe for any STGR activity as the sounds from lekking activity can be heard from a distance of 1.5 km on calm days (Ritcey and Drury 2004). Following the initial static observation period, the crew typically remained quietly in the same approximate location for at least another hour. Any detections of STGR were recorded on field sheets along with other location, weather, and descriptive details (e.g., UTM coordinates, vegetation/habitat information and photo numbers).

In addition to the static observations, ELR also completed encounter transects around the Site to look for STGR, later in the mornings on foot and by UTV. The areas searched included the mill site area, disused airstrip, waste rock, and Porcupine Pit Lake area.

As STGR were known to be present along the Fortymile access road (south the of the Fortymile River) the field crew travelled a section of the road to look for STGR on the morning of April 30.

#### *5.3.1.3 Incidental Observations*

Bird species other than STGR detected during the STGR surveys were documented so as to provide a complete list of birds detected on Site and have been included in the results in Section 5.1.

#### *5.3.1.4 Data Analysis*

Sharp-tailed Grouse detections were summarized by the number of individual birds detected along with a description of any detections.

### 5.3.2 Results

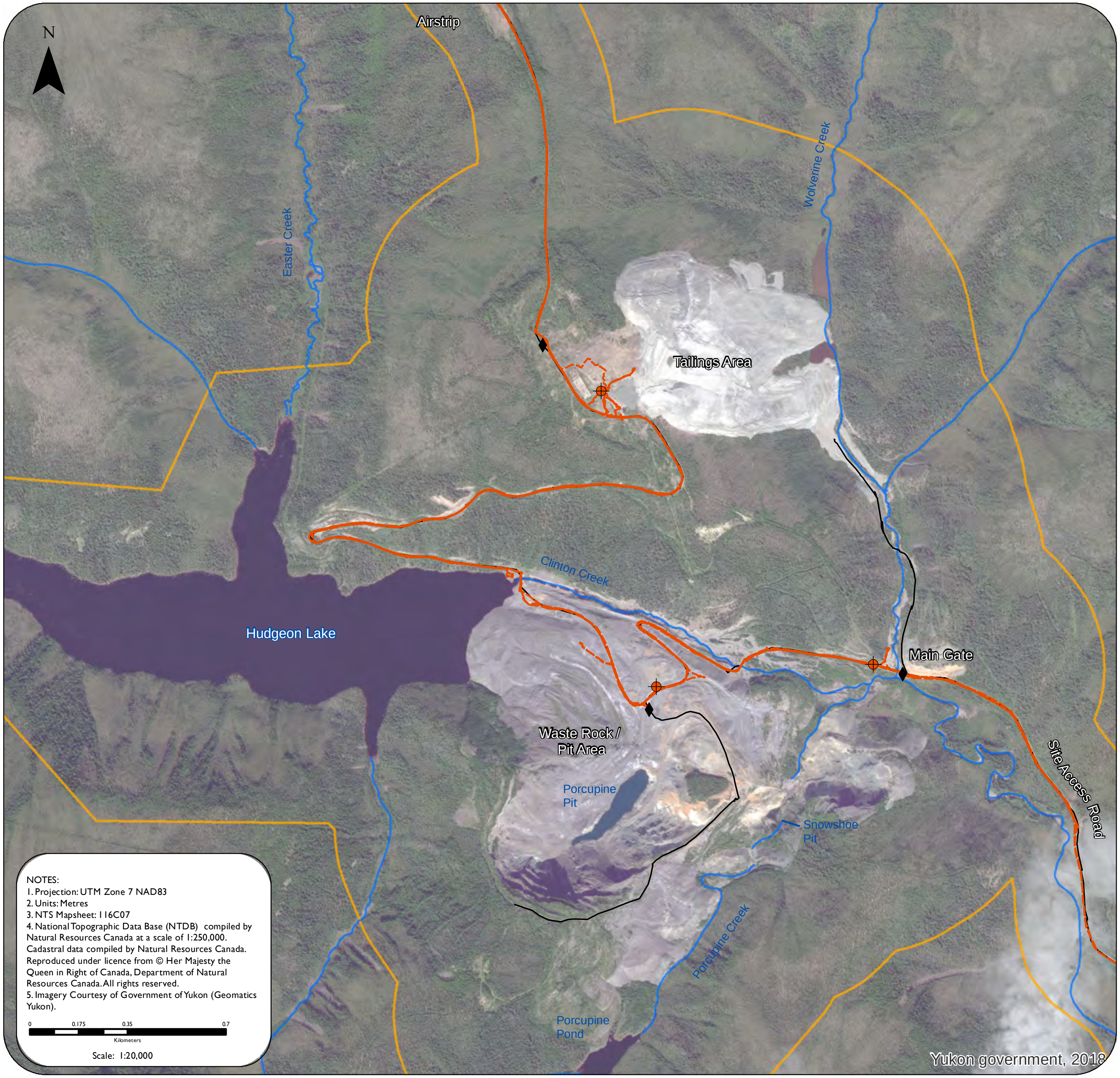
No STGR were detected at any time during ELR's studies at the Site, either during the dedicated STGR survey or as incidentals.

Following the static observations, the field crew completed encounter transects each day according to the protocol described above; however, in consideration of crew safety after observations of both Black and Grizzly Bears on site, a decision was made for the crew to stay within about 100 metres of the UTV during the encounter transects. Therefore, most of the Wolverine Creek valley and the waste rock area adjacent to Porcupine Pond could not be surveyed during this event.

The STGR surveys included nearly 14 hours of static observation effort and approximately 10 hours of encounter transect effort around the Site (mill area, airstrip, waste rock, Porcupine Pit Lake area and access road north of the Fortymile River). A reference location along the Fortymile access road south of the Fortymile River was also surveyed for 2.5 hours. Figure 5.3-1 presents the locations of the static observation points and the encounter transects on Site

The conditions for the lek surveys were variable with morning temperatures ranging from -3.0 to 7.4° Celsius. Snow cover ranged from 60 to 90% depending on elevation and exposure to the sun. There was heavy snowfall for about three hours during the late morning to early afternoon on April 27. Wind speeds were low during all surveys (0 to 7.7 km/h). Visibility was excellent except for the morning of April 30 when it was reduced to about 200 m because of fog.

Five STGR were detected at the off-site reference location, within 300 m of each other along the Fortymile access road (south of the Fortymile River) on April 30; this was at a comparable elevation to the decommissioned mill area at Site (about 658 m above sea level). At the reference site, STGR were located adjacent to an historic spruce burn area with shrubby understory, a habitat often associated with STGR in the boreal region. Similar old burn habitat is not present at the Site. ELR also contacted Environment Yukon staff following the survey event and they indicated that while peak lek activity was slightly delayed in 2017 in the Dawson area, they had observed lekking activity during the same time period of the ELR survey. ELR therefore considers the results of the 2017 STGR lek survey at the Site to be representative.




NOTES:
1. Projection: UTM Zone 7 NAD83
2. Units: Metres
3. NTS Mapsheet: 116C07
4. National Topographic Data Base (NTDB) compiled by Natural Resources Canada at a scale of 1:250,000. Cadastral data compiled by Natural Resources Canada. Reproduced under licence from © Her Majesty the Queen in Right of Canada, Department of Natural Resources Canada. All rights reserved.
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0 0.175 0.35 0.7
Kilometers

Scale: 1:20,000

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Client:

Yukon

- Primary Site Roads
- Watercourses
- Wildlife Local Study Area (LSA)
- Site Gates
- Sharp-tailed Grouse Lek Survey Static Observation Points
- Sharp-tailed Grouse Encounter Transect Locations

Drawn by: C. Jastrebski

Approved by: G. Rudman

Date: February 10, 2020

ELR Project: 18-278

**CLINTON CREEK SITE**

Terrestrial Existing Environment Studies

**FIGURE 5.3-1**

Sharp-Tailed Grouse Survey

### 5.3.3 Summary of Bird Observations from All Survey Programs

When considering all surveys (breeding birds point count, waterfowl, Sharp-tailed Grouse surveys and other incidental observations, ELR detected a total of 58 species of birds within the LSA. Of these 58 species, three are considered to be species of conservation concern (Red-necked Phalarope, Peregrine Falcon and Horned Grebe) and more information is provided about these species in Section 6.

ELR detected 26 bird species during the 2016 and 2018 breeding bird point count surveys. The six most commonly detected bird species during the surveys were all songbirds; Swainson's Thrush, White-winged Crossbill, Dark-eyed Junco, American Robin, Alder Flycatcher and Boreal Chickadee. These six species are associated with forest or forest edge/shrub habitats. With the exception of the Boreal Chickadee and White-winged Crossbill which are resident year-round in the Yukon, these species are migratory.

ELR detected 11 waterfowl species on Hudgeon Lake, with the highest frequencies of detection in the late spring and early summer. Bufflehead had the highest number of detections overall, followed by Northern Shoveler, Mallard and Scaup spp. There is evidence that some waterfowl are breeding at Hudgeon Lake (e.g., Bufflehead) because of the detections of juvenile birds over more than one survey day. There was also evidence that some species use Hudgeon Lake in the spring as a stopover for resting and foraging because of the relatively early date of the detections (early in the breeding season) and because low numbers of birds were only observed on one or two days (e.g., Red-necked Phalarope, White-winged Scoter and Horned Grebe) despite additional survey days prior or after.

No Sharp-tailed Grouse were detected in the LSA, and although some potential habitat exists around the mill area, more suitable habitat exists off-Site and south of the Fortymile River (within old burn areas). Sharp-tailed Grouse were detected at the off-Site reference location during the Sharp-tailed Grouse surveys.

## 5.4 AUTOMATED WILDLIFE CAMERA SURVEY

### 5.4.1 Methods

Remotely triggered cameras provide a non-invasive and relatively inexpensive method for detecting wildlife species, particularly those with large home ranges or that are migratory and can be difficult to observe over short time periods of time (i.e., during discrete temporal surveys). ELR conducted a remote camera survey at the Site to describe the presence, seasonal and relative use of the Site by larger wildlife species that use the area. The target species of the included ungulates, bears and other furbearers (species whose fur is valued commercially, including mustelids, canids and felids). The main survey was conducted over a 24-month period to capture the seasonal variation of wildlife use in the LSA, although one camera was installed at a mineral lick for approximately 33 months.

ELR used Reconyx HC600 Hyperfire™ motion sensing cameras that use a passive infrared sensor to trigger the camera shutter by sensing the heat differential between an animal and the ambient air temperature (Rovero *et al.* 2013). The passive infrared sensor can detect motion within a zone that extends 30.5 m from the camera body and 40° laterally across the camera frame of view (Reconyx 2012). Reconyx cameras are rugged, can be camouflaged, can produce quality pictures day or night, and require minimal maintenance. They also have a very fast trigger speed (0.2 seconds) which helps to capture images of passing wildlife. Although baiting camera stations is a common technique used to attract wildlife (Kelly and Holub 2008), the presence of bait may habituate wildlife to camera stations and create wildlife-human conflicts. Accordingly, ELR used unbaited camera stations to help promote wildlife and human safety and ensure the resulting data represented unbiased and unmodified wildlife behaviour.

#### *5.4.1.1 Site Selection*

Prior to field deployment of cameras, ELR identified candidate camera locations within the LSA using satellite imagery of the LSA and prior knowledge of the Site. Candidate areas were located in the LSA, along potential movement corridors used by wildlife such as creek valleys, draws, linear features (e.g., roads or trails) or mineral licks that were anticipated to concentrate or funnel wildlife movements through a specific area. ELR refined selected camera sites in the field according to local indicators of wildlife use, including game trails, scat, tracks and mineral licks.

#### *5.4.1.2 Camera Deployment and Maintenance*

At each camera site, ELR selected a tree on which to mount the camera that would optimize the field of view and distance of the trigger zone from the camera. Where required, branches and vegetation in the camera's field of view were trimmed to reduce the chance of false triggering. Most of the cameras were secured by using both a Reconyx-supplied bungee cord and hook and a length of steel aircraft cable wrapped around the tree and secured with cable clamps. Two of the cameras (immediately adjacent to the access road) were secured using cinching bicycle locks. All cameras were equipped with 12 AA lithium batteries and a 32 GB SD memory card (allows for approximately 40,000 images based on the image quality settings). The cameras were programmed according to the manufacturer's specifications for trail monitoring and to take three consecutive photos (one image/second), with no 'quiet' period in between trigger events. Once programmed, the field of view and trigger zone were tested and the camera was adjusted accordingly. When the station set up was complete, the cameras were armed and were latched shut. The field crew triggered each camera at a known distance prior to leaving the site to create control images.

After initial deployment cameras were left to capture images for a three to four-month period (i.e., a camera session). ELR conducted a maintenance visit at the end of each camera session. During these visits the crew first approached each camera to trigger the camera as evidence the camera was still functioning at the end of the session. Existing batteries were replaced and each memory card was exchanged with a blank card. A desiccant capsule or pouch was also inserted into the camera body to help reduce moisture accumulation. Once maintenance activities were complete, cameras were tested again to ensure proper functioning and re-armed. Images were retrieved from each memory card and catalogued for data analysis.

#### *5.4.1.3 Data Analysis*

The remotely captured images were first reviewed to ensure the cameras were functional for the session in which they were active. This was done by checking the control images triggered by the crew. Following this initial review, a spreadsheet was created to catalogue wildlife detections and detection attributes including date, species, sex (if detectable), and movement direction. Movement direction was categorized generally as up valley (i.e., wildlife photos indicating travel direction towards higher elevation in the valley), down valley (i.e., wildlife photos indicating travel direction towards lower elevation) or variable. The wildlife images also had to be evaluated to determine if they represented individual detection events. This analysis was performed by comparing sequential images, elapsed time between images and the characteristics of the animal(s) in the images. Wildlife images were defined as individual detection events if:

1. Different species were detected in sequential images (e.g., a set of moose images followed by a set of caribou images);
2. Sequential images of the same species could be differentiated using physical characteristics such as antler formation, body size, sex and coat pattern or location within the image (e.g., if multiple images of caribou were captured during a few minutes, the number of detections would depend on how many unique individuals could be identified);
3. A temporal separation of ≥ 20 minutes occurred between images of the same species or recognizable individual animals (e.g., if a recognizable individual Moose walked out of frame and then back into frame within 20 minutes then this was catalogued as only one detection. If the time frame for the same Moose had been 22 minutes then this was catalogued as two detections); and
4. Multiple individuals were observed in a single image (e.g., four caribou captured in a single image were catalogued as four detected caribou).

Several metrics were calculated to describe wildlife activity at the camera sites. The total number of detections and camera days (CD) were calculated for each camera and for each month of the calendar year. As a measure of effort, a camera day was defined as the 24-hour period that a camera was set and active. Using CD and detection numbers, a detection rate (standardized to 100 CD for comparability) was calculated using the following formula (Kelly and Holub 2008):

$$Detection\ Rate = \frac{\#\ Wildlife\ Detections}{\#\ Camera\ Days} * 100$$

As effort was variable among cameras, the detection rate (rather than total number of observations) provided a comparable measure of activity.

Image data collected from cameras located at mineral licks were analyzed separately from images collected from cameras located along trails because the mineral licks act as a focal point for animals and this would skew the total number of wildlife detections upwards rather than provide representative data of generalized wildlife movements. Trail camera data and mineral lick camera data were pooled separately to calculate several metrics:

1. Total number of camera days, wildlife detections and overall detection rates;
2. Detection rate by camera and by month in order to compare detection rates between areas of the LSA and throughout the year, respectively;
3. Detection rates of species and species groups at the Site overall, at each camera location and in each calendar month; and,
4. The total number of species detected at each camera station.

The number of detections of Caribou, Moose, Grizzly Bear, Black Bear (*Ursus americanus)* and some smaller furbearers (e.g., Canada Lynx, Wolverine and Grey Wolf) provided adequate sample sizes to analyze data for individual species, while some other furbearer sample sizes were small and required analysis at a species group level. Movement attributes for Moose and Caribou were also analyzed to assess potential movement patterns in the LSA.

### 5.4.2 Results

#### *5.4.2.1 Overview*

ELR installed and monitored a total of 13 remote wildlife cameras at the Clinton Creek Site (Figure 5.4-1) during the 24-month study period from June 2016 to June 2018, with the exception of one camera deployed at a mineral lick between September 2015 (shortly after the mineral lick was identified) and June 2018 (a 33-month period). The mineral lick camera locations have not been identified in this report because the mineral licks are heavily used by ungulates (particularly Moose) and so the locations should not be made available to the general public.

Camera locations were established in a variety of habitats including riparian, shrub and forested sites and at three mineral licks identified during previous field visits (Table 5.4-1).

Three cameras were installed along the three main valleys creeks that feed into Hudgeon Lake (Cameras 9, 10 and 7). Two cameras were installed along the main access road (Cameras 6 and 14) and another camera was installed between the access road and Clinton Creek (Camera 5). Two cameras were installed along Wolverine Creek valley, both upstream (Camera 12) and downstream of the tailings (Camera 11). The ninth camera was installed in a riparian area adjacent to Clinton Creek and downstream of the main Site (Camera 1). The tenth camera was installed about 75 m from the west side of the airstrip (#3) and the remaining three cameras were installed at mineral licks.

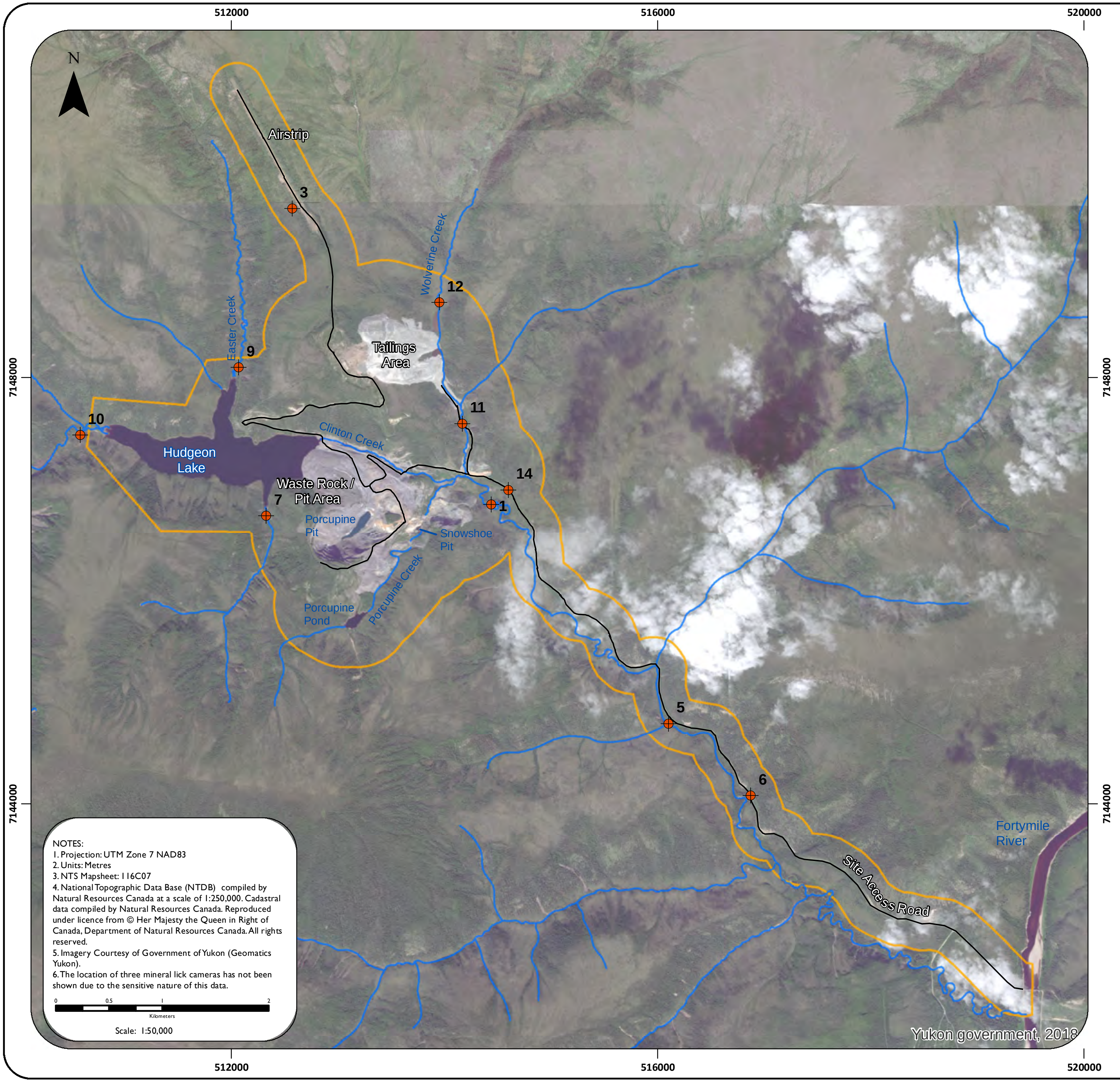
During the survey, the two cameras along the main access road and outside the primary infrastructure area (Camera 6 and Camera 14) were removed from service in October 2017 as the access road is a public highway and there were concerns about privacy for the travelling public, people who lived and trapped locally, and people who were contracted to work at the Site.

Some groups of animals or individual animals would spend extended periods of time (sometimes several hours) at a mineral lick and this would quickly use up the memory space on the memory card or drain the batteries within a single camera session. Therefore, the cameras deployed at the three mineral licks were reprogrammed in late September 2016 to take less frequent images in order to preserve battery life and help maintain image capacity on the memory card for each subsequent camera session. The revised camera settings included a three minute "quiet period" between camera activity events (e.g., a camera would take three images in quick succession, if triggered, and then not take any images for at least 3 minutes).

#### *5.4.2.2 Non-Mineral Lick Cameras*

For the 10 cameras not located at mineral licks the effective number of total Camera Days (CD) per camera ranged from 358 (Camera 6) to 715 (Camera 10) with an average of 631 CD overall (Table 5.4-1). Variation in camera day effort was mostly due to instances of drained batteries, camera or memory card malfunction, and the decision to remove two cameras from the public access road that leads to the Site.

During the 24-month survey, cameras at 10 distinct camera locations captured a total of 2,902 animal detections in 6,066 CD, which resulted in an overall detection rate of 47.8 animals/100 CD. Detection rates ranged from 9.5 animals/100 CD at Camera 11 to 208.3 animals/100 CD at Camera 7 (mainly because of a high number of Caribou passing Camera 7 in November 2017). Camera 9 had the second highest number of detections with 62.5 animals/100 CD (Figure 5.4-2). Additional camera results are provided in the following sections.




elr
Ecological Logistics & Research Ltd.

Client:

Yukon

**LEGEND**

- Wildlife LSA
- Primary Site Roads
- Watercourses
- Remote Camera Locations

Drawn by: C. Jastrebski

Approved by: G. Rudman

Date: February 10, 2020

ELR Project: 18-278

**CLINTON CREEK SITE**

Terrestrial Existing Environment Studies

**FIGURE 5.4-1**

Remote Camera Locations

**Table 5.4-1: Summary of Effort, Detections and Habitat at the Clinton Creek Remote Wildlife Camera Stations**

| Camera ID | Station Name (Deployment Period) | Camera Days | Animal Detections | Overall Detection Rate (Animals/100 CD) | Habitat Descriptions |
|---|---|---|---|---|---|
| 1 | **Upper Clinton Creek** (July 1, 2016 - June 13, 2018) | 712 | 322 | 45.2 | Approximately 15 m from Clinton Creek. Riparian open coniferous forest with tall spruce, willow, alder, balsam poplar, prickly rose and horsetail. |
| 2 | **Mineral Lick #1** (July 2, 2016 - Aug 16, 2018) | 684 | 2799 | 409.2 | Largest of the three mineral licks. Location and full description not provided. |
| 3 | **Airstrip** (June 30, 2016 - June 13, 2018) | 713 | 69 | 9.7 | Approximately 75 m to the west of the disused airstrip. Clearing in spruce forest with mixed understory including prickly rose, willow and feathermoss. |
| 5 | **Lower Clinton Creek** (July 4, 2016 - 13 June, 2018) | 709 | 100 | 14.1 | Approximately 20 m from Clinton Creek in riparian spruce with mixed understory including willow, bearberry, soapberry, coltsfoot, Labrador tea and shrubby cinquefoil. |
| 6 | **Lower Access Road** (July 2, 2016 - October 12, 2017) | 358 | 175 | 48.9 | Facing perpendicular to the access road and within a vegetated area dominated by white spruce, balsam poplar and willow |
| 7 | **South Arm of Hudgeon Lake** (June 29, 2016 - June 14, 2018) | 539 | 1123 | 208.3 | Open spruce with Labrador tea, willow, feathermoss and lichen. |
| 8 | **Mineral Lick #2** (July 3, 2016 - June 15, 2018) | 704 | 418 | 59.4 | Smallest of the three dry mineral licks. Location and full description not provided. |
| 9 | **Easter Creek** (June 29, 2016 - March 2, 2018) | 611 | 382 | 62.5 | Leading into the north arm of Hudgeon Lake. Open riparian shrub with willow, alder, horsetail and some dead standing spruce. |
| 10 | **West Arm of Hudgeon Lake** (June 29, 2016 - June 14, 2018) | 715 | 390 | 54.5 | Approximately 15 m south of Clinton Creek (above Hudgeon Lake). Edge of open stunted spruce and riparian shrub habitat including willow and shrubby cinquefoil |
| 11 | **Lower Wolverine Creek** (June 30, 2016 - June 13, 2018) | 713 | 68 | 9.5 | Camera facing along the access trail approximately 30 m from Wolverine Creek. Non-riparian shrub and stunted spruce in the immediate area. |
| 12 | **Upper Wolverine Creek** (June 30, 2016 - June 13, 2018) | 631 | 76 | 12.0 | Open stunted spruce with willow, Labrador tea, dwarf birch, shrubby cinquefoil, feathermoss and lichen. |
| 14 | **Upper Access Road** (July 1, 2018 -October 11, 2017) | 365 | 197 | 54.0 | Camera facing across the access road. Pole sapling (balsam poplar) with willow and alder in the immediate area. |
| 15 | **Mineral Lick #3** (September 3, 2015 – June 13, 2018) | 1014 | 1721 | 169.7 | Second largest of the three dry mineral licks. Location and full description not provided. |

*Notes:*

*The location of the three Mineral Lick Cameras (#s 2, 8, and 15) have not been identified in the report because this information is considered to be sensitive.*

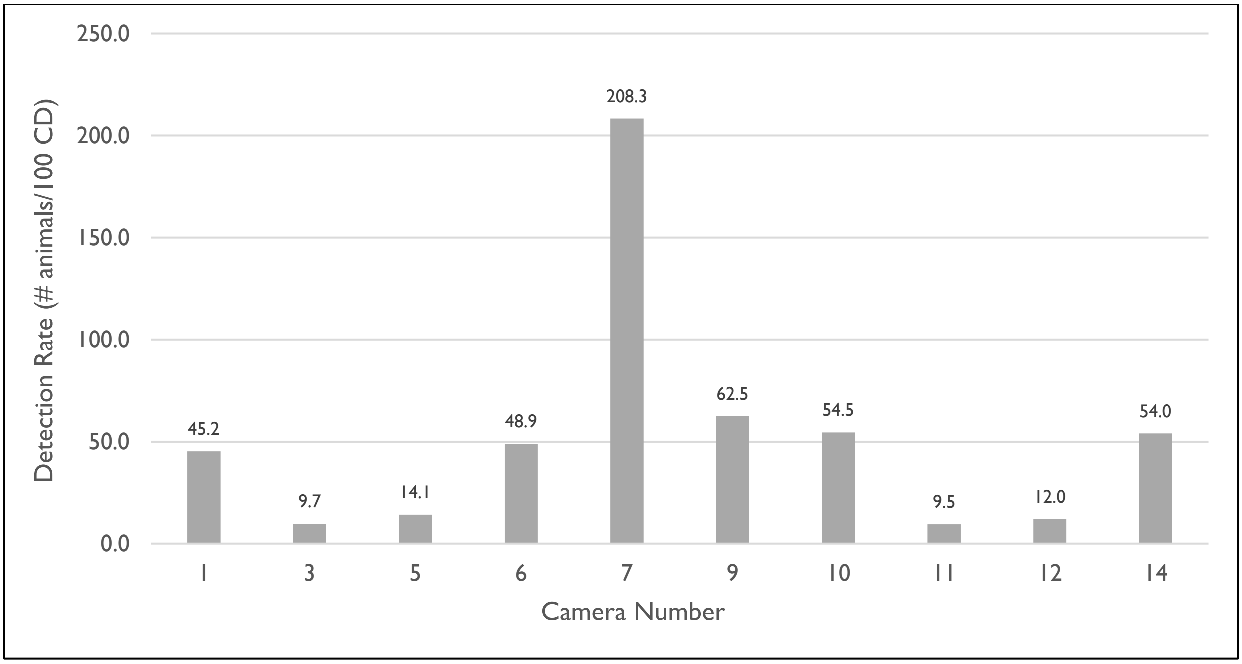



**Figure 5.4-2: Animal Detection Rates at Wildlife Cameras (excluding mineral lick cameras) at the Clinton Creek Site for the period of July 2016 to June 2018.**

### *Seasonal and Year to Year Variation in Detection Rates*

When considering monthly data pooled over the years of the study, the highest monthly detection rate was in November (270.5 detections/100 CD), followed by April, July, and June (51.8, 44.8, and 44.3 detections/100 CD, respectively). When the data is broken down by year, however, some further variation in data appears.

Generally, the observed rates of detection were found to be similar from year to year, with the exception of May, June, and November (Figure 5.4-3). The data show that there was a noticeable spike in detection rate in November 2017, which was attributed to the high number of Caribou detections in 2017 (n=1,303) at cameras located around Hudgeon Lake (particularly Camera 7). This was a discrete event and, based on the 2016 November data, may not be representative of general conditions in November.

There was also a substantial reduction in animal detections rates in May and June from 2017 to 2018. AAM (Pers. Comm. Emilie Hamm, Project Manager) reported there was slightly more human activity at the Site during these months in 2018 compared to 2017 (e.g., site inspections and monitoring activities), this is not considered likely to explain the lower overall detection rates for these months in 2018. The main reason for the differences in detection rates may simply be natural annual variation in animal detections.

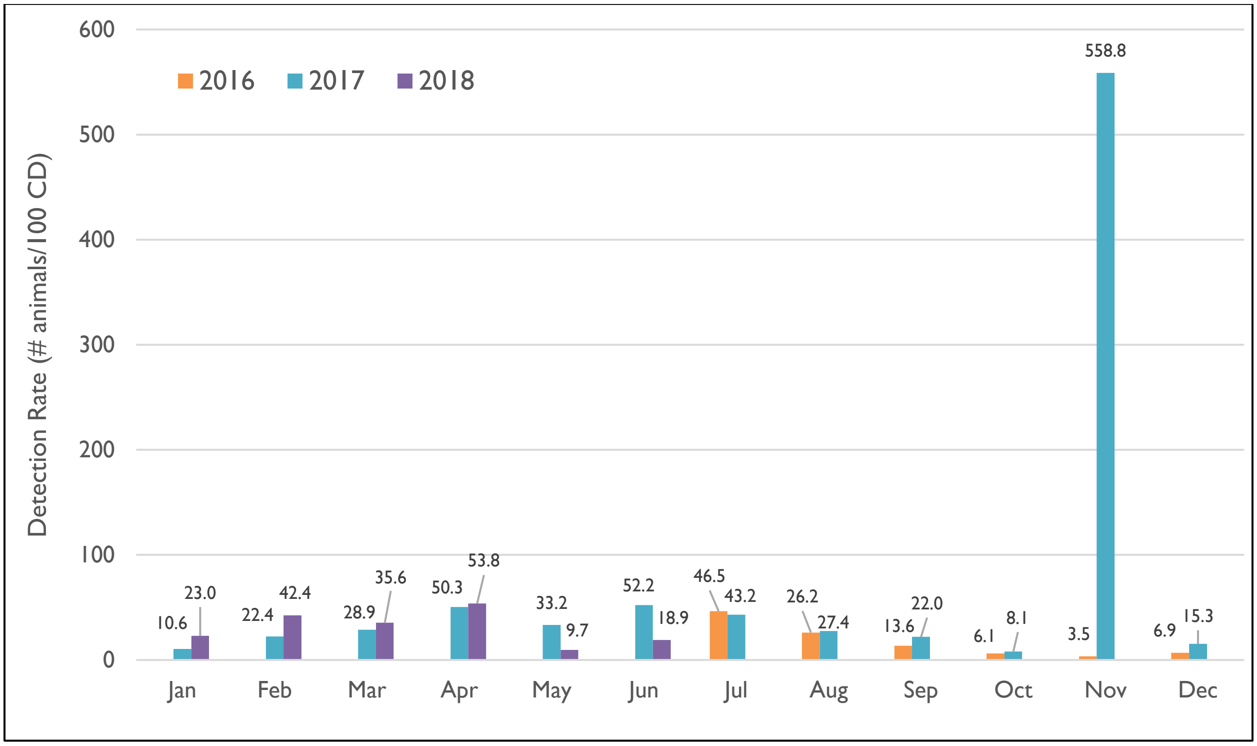



**Figure 5.4-3: Monthly Detection Rates by Year for Wildlife at Remote Camera Stations (excluding mineral lick cameras) at the Clinton Creek Site over the 24-Month Period from July 2016 to June 2018.**

***Species Summaries***

Over the 24-month period of the remote camera survey, a total of 15 species or species groups were detected at non-mineral lick camera locations including Caribou, Moose, Grizzly and Black Bear, Wolverine, Grey Wolf, Red Fox (*Vulpes vulpes*), American Marten, North American Porcupine (Porcupine; *Erethizon dorsatum*), and Canada Lynx (Figure 5.4-4). Several small mammal and bird species were also detected that were not the focus of the survey. The small mammals included Snowshoe Hare (*Lepus americanus),* Red Squirrel (*Tamiascurus hudsonicus*), mice or voles. All bird species have been placed together as one species group as not all the birds detected could be identified to species, however this group did include Canada Jay, Spruce Grouse, Common Raven, American Robin, White-winged Crossbill, Pine Grosbeak, Townsend's Warbler, and waterfowl and shorebird species (e.g., Green-winged Teal, Canada Goose, sandpipers). In total, there were only six animal detections where the animal could not be identified (because it was too dark, the camera lens was misted, only a small part of the animal could be seen, the image was blurred or the animal was too close to the camera). There were also 12 detections of bears where it was difficult to identify the bear as Black Bear or Grizzly Bear because of the angle of the photograph or uncertainty about normal diagnostic features (e.g., presence or absence of a shoulder hump, the size of the claws or the face profile).

**Caribou had the highest species detection rate overall at 23.8 animals/100 CD, mostly because of the high counts of Caribou in November 2017. The second highest detection rate was for Moose (7.5/100 CD) followed by Snowshoe Hare (6.1/100 CD) and Grey Wolf (2.8/100 CD; Figure 5.4-4).**

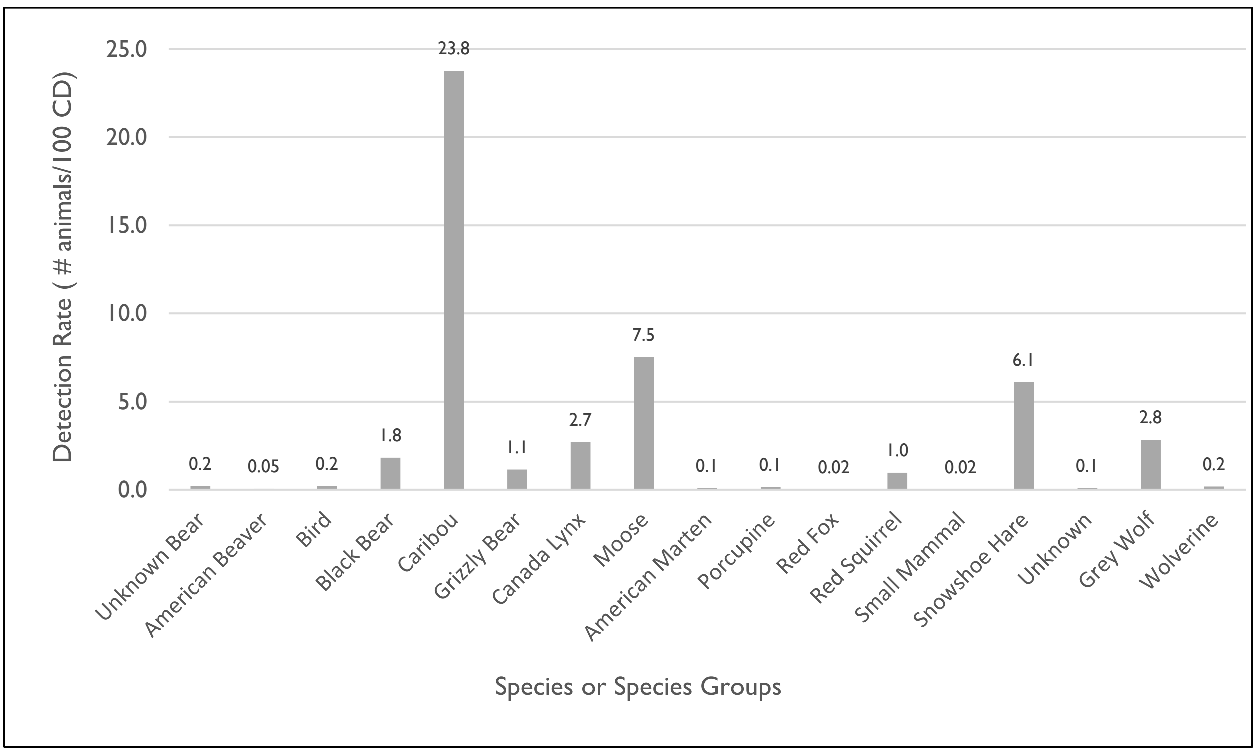



**Figure 5.4-4: Detection Rates for All Species (or species groups) Detected During the Remote Camera Survey (excluding mineral lick cameras) at the Clinton Creek Site between July 2016 and June 2018.**

*Caribou*

Caribou had the highest number of detections overall (n=1,442) and the highest detection rate overall at non-mineral lick cameras (23.8/100 CD). The cameras mostly captured between one and four individuals at a time but a group of 10 Caribou was captured by Camera 7 (south arm of Hudgeon Lake) on the evening of November 2, 2017.

About 70% of all the detected Caribou were photographed by Camera 7 and a large majority of the animals were moving up valley in a southerly direction in early to mid-November, 2017. Camera 7 had a Caribou detection rate of 187.6 Caribou/100 CD. Smaller numbers of Caribou were also detected at Camera 10 (n=269; 37.6 detections/100 CD), Camera 9 (n=112; 18.3 detections/100 CD), Camera 12 (n=23; 3.65 detections/100 CD), Camera 5 (n=16; 2.26 detections/100 CD), Camera 1 (n=6; 0.84 detections/100 CD), Camera 3 (n=4; 0.56 detections/100 CD) and Camera 11 (n=1; 0.14 detections/100 CD). There were no Caribou detections at Camera 6 or Camera 14.

90% of all the Caribou detected at non-mineral lick cameras were detected in November, 2017. Smaller numbers of Caribou were detected between December and May and one individual Caribou was detected along the lower Wolverine Creek trail (Camera 11) on August 1, 2017 (Figure 5.4-5).

It is most likely that the Caribou detected by the remote cameras at the Site are part of the Nelchina or Fortymile Herds as the ranges of these two herds largely overlap with both each other and with the Site. These herds were once designated as Barren-ground Caribou (Government of Yukon 2019a) which is considered to be a species of conservation concern and listed as “Threatened” by COSEWIC. However, in 2016, COSEWIC re-assessed Caribou in Canada and both the Nelchina and Fortymile Caribou Herds were not included in that assessment and are no longer considered to be Barren-ground Caribou, although the reasons for this change are not clear. Currently, the status of these two herds has not been assessed and their designated ecotype (e.g., Barren-ground, Woodland or Northern Mountain) remains unclear. Since 2013, the Fortymile and Nelchina Herds have been expanding their range in the Yukon and the Fortymile Herd range currently resembles the range last seen in the 1960s (Government of Yukon 2018). It is therefore plausible that high numbers of Caribou may occur around the Site but not necessarily every year, nor in the same locations.

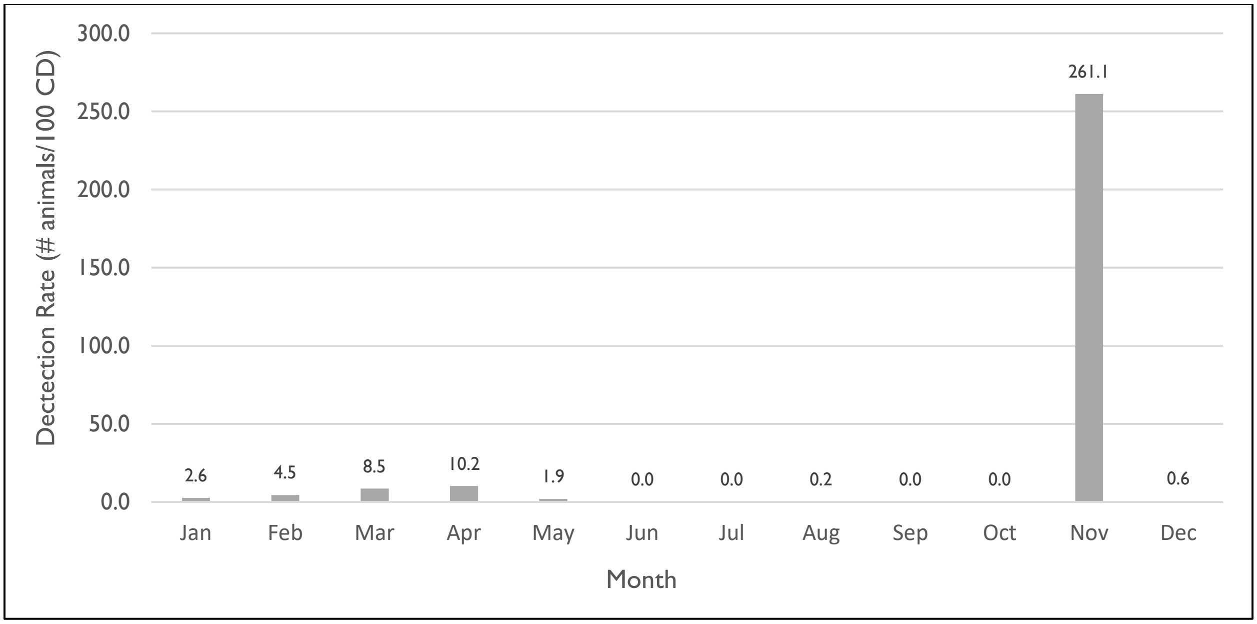



**Figure 5.4-5: Caribou Detection Rates by Month During the Remote Camera Survey (excluding mineral lick cameras) at the Clinton Creek Site Between July 2016 and June 2018**

*Moose*

Moose had the second highest number of detections overall (n=460) and the second highest overall detection rate of all species (7.5/100 CD) at non-mineral lick cameras. The cameras mostly captured single animals (cows=176; bulls=147) and 63 detections of cow/calf pairs. All other detections included single calves, bulls with calves, bulls with cows or those where the sex of the detected Moose could not be determined.

For the seven cameras that were located along creek valleys around Hudgeon Lake, along Wolverine Creek and Clinton Creek the movement of detected Moose was roughly equal between up valley (n=147) and down valley (n=144) with the remaining detections (n=169) being variable.

Moose were detected by all the cameras. The highest number of Moose detections was at Camera 9 along Easter Creek (n=161; 26.4 animals/100 CD) followed by Camera 14 located along the main access road to the Site (n=67; 18.4 animals/100 CD). Other detection rates ranged between 0.42 animals/100 CD at Camera 5 to 9.7 animals/100 CD at Camera 10.

The highest monthly detection rates for Moose at non-mineral cameras occurred in June and July with detection rates of 21.6/100 CD and 23.5/100 CD, respectively. No Moose were detected by cameras in November (Figure 5.4-6).

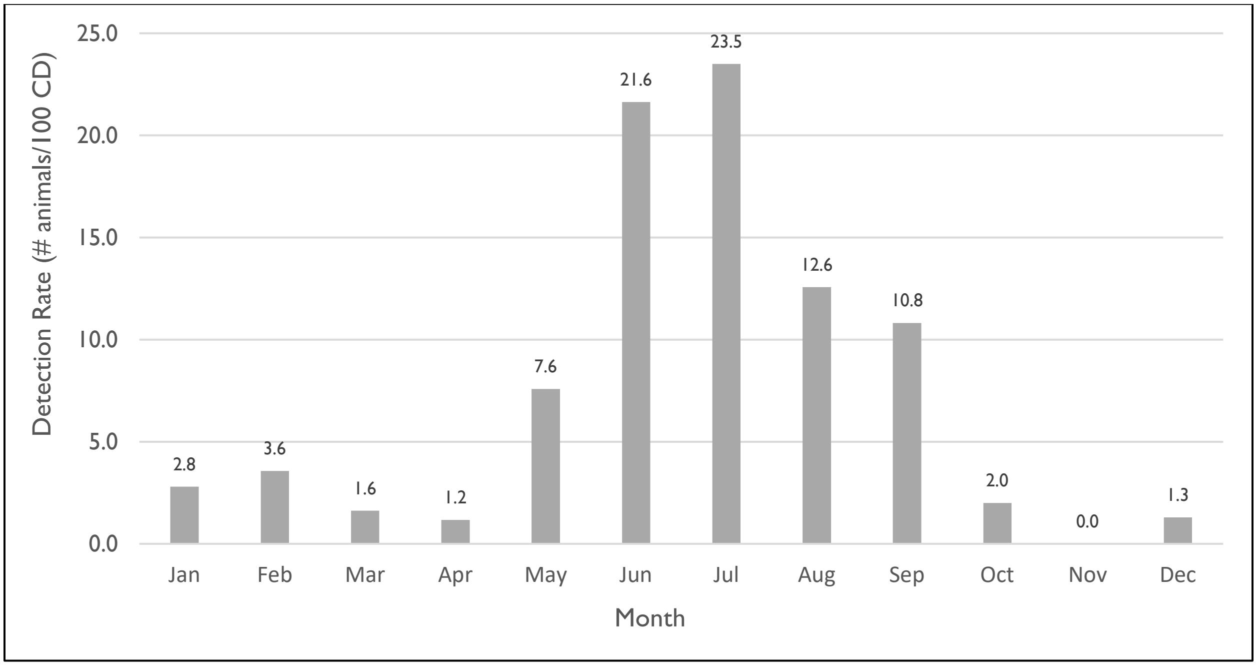



**Figure 5.4-6: Monthly Detection Rates for Moose during the Remote Camera Survey (excluding mineral lick cameras) at the Clinton Creek Site between July 2016 and June 2018.**

<u>Bears</u>

191 bears were detected by wildlife cameras including 110 detections of Black Bear, 69 detections of Grizzly Bear and a total of 12 detections of bears where the species could not be determined. The overall detection rate for all bears across all non-mineral lick cameras, including the 12 bears that were of undetermined species was 3.1 animals/100 CD.

The overall detection rates for Black Bears and Grizzly Bears were 1.8 and 1.1 animals/100 CD, respectively. Bears were detected at all cameras and the highest detections of both Black Bears and Grizzly Bears was at Camera 6 (n=36; 10.1 animals/100 CD and n=25; 6.9 animals/100 CD, respectively). The second highest detection rate for both Black Bears and Grizzly Bears was at Camera 14 (8.22 and 4.38 animals/100 CD, respectively). The lowest detection rate for Black Bears was at Camera 12 (0.48 animals/100 CD) and for Grizzly Bears was at Camera 3 (0.28 animals/100 CD).

The month with the highest rate of detections for all bears was July (n=83; 14.2 animals/100 CD; Figure 5.4-7). Overall, bears were most frequently detected between May and August. No bears were detected between November and March.

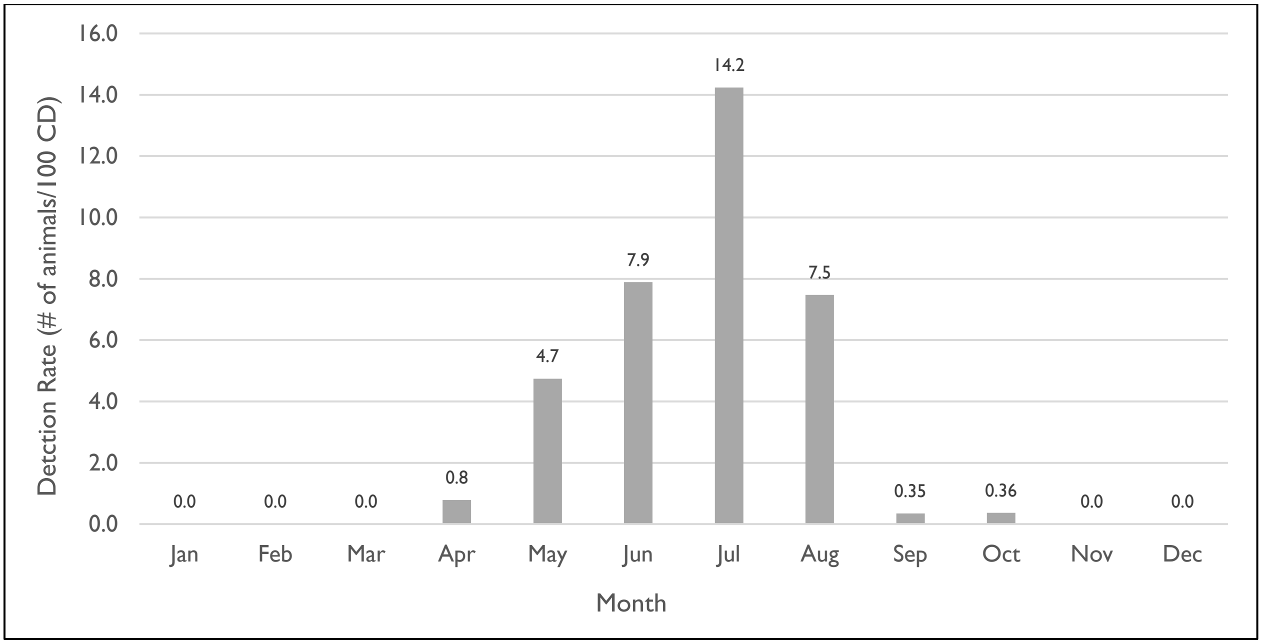



**Figure 5.4-7: Monthly Detection Rates for All Bear Species during the Remote Camera Survey (excluding mineral lick cameras) at the Clinton Creek Site between July 2016 and June 2018.**

The detection rates of Black Bears and Grizzly Bears by month, when considered separately, follow a similar monthly distribution, as shown in Figures 5.4-8 and 5.4-9, respectively.

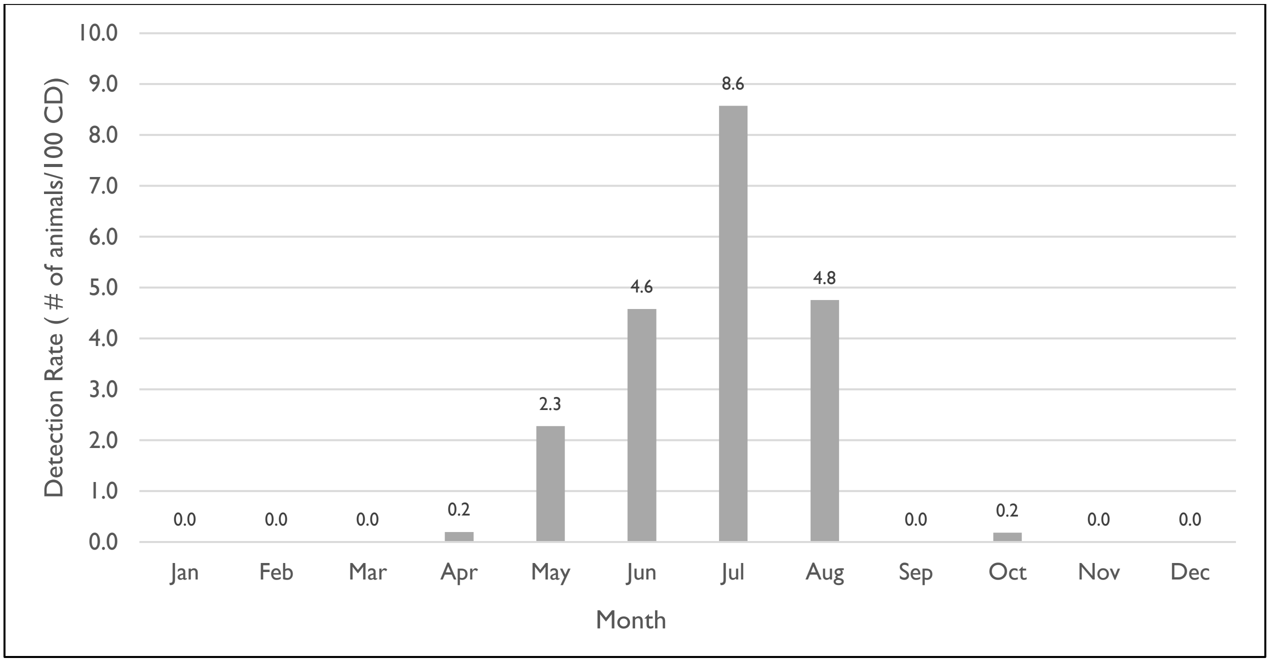



**Figure 5.4-8: Monthly Detection Rates for Black Bears during the Remote Camera Survey (excluding mineral lick cameras) at the Clinton Creek Site between July 2016 and June 2018.**

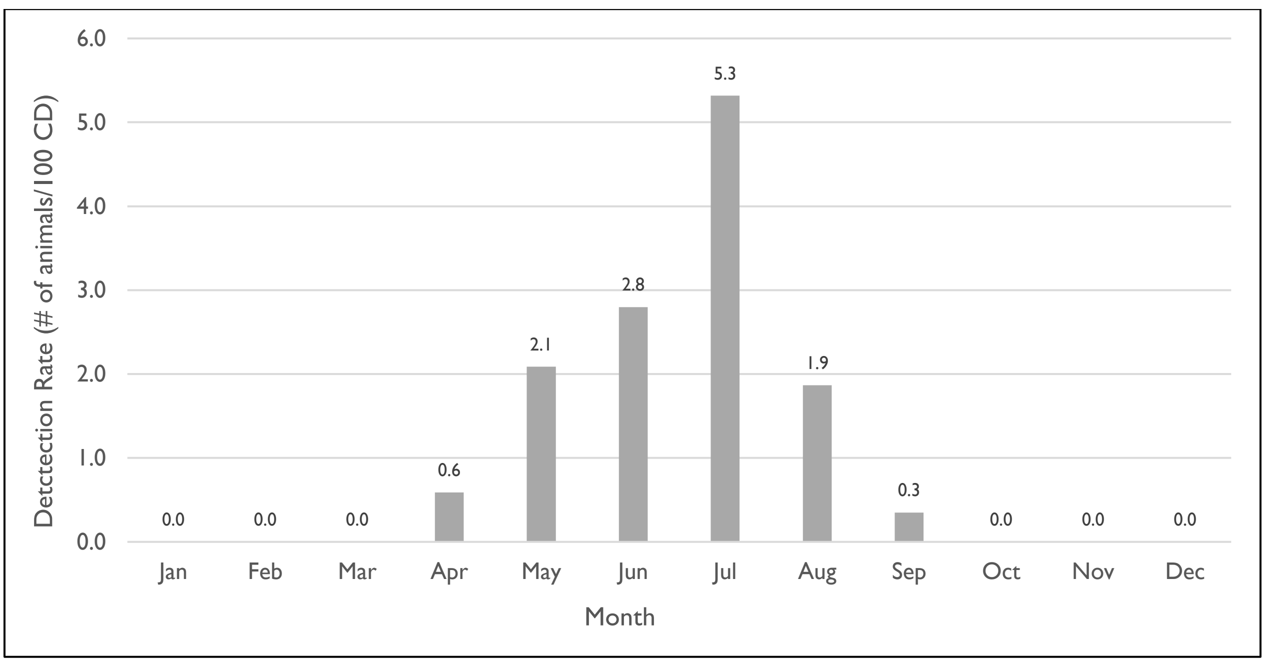



**Figure 5.4-9: Monthly Detection Rates for Grizzly Bears during the Remote Camera Survey (excluding mineral lick cameras) at the Clinton Creek Site between July 2016 and June 2018.**

*Furbearers*

Six furbearer species were detected during the camera survey; Grey Wolf (*Canis lupis*), Canada Lynx (*Lynx canadensis*), Red Fox (*Vulpes vulpes*), American Marten, American Beaver (*Castor canadensis*) and Wolverine (*Gulo gulo*). Of the six furbearer species, Grey Wolves were detected most frequently (n=172) with an overall detection rate of 2.8 animals/100 CD across all non-mineral lick cameras. Canada Lynx had the second highest number of detections (n=164; 2.7 animals/100 CD). Wolverine had the third highest number of detections (n=11; 0.2 animals/100 CD) followed by American Marten (n=5; 0.1 animals/100 CD), American Beaver (n=3; 0.05 animals/100 CD) and Red Fox (n=1; 0.02 animals/100 CD).

Monthly trends in detection rate for all furbearers are presented in Figure 5.4-10. Detection rates were highest in April, February and June, at 13.7, 13.3 and 9.2 animals/100 CD, respectively. January had the lowest detection rate of furbearers at 1.9 animals/100 CD.

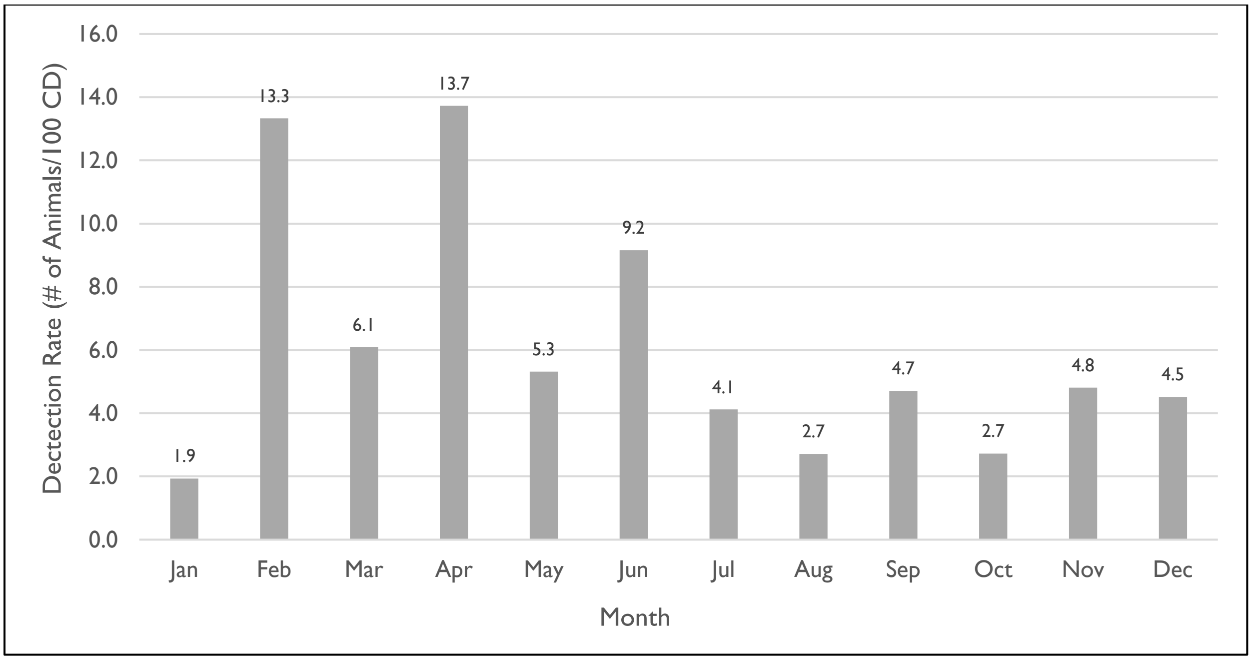



**Figure 5.4-10: Combined Furbearer Detection Rates by Month During the Remote Camera Survey (excluding mineral lick cameras) at the Clinton Creek Site Between July 2016 and June 2018.**

Of the six detected furbearer species, there were sufficient detections of Grey Wolf, Canada Lynx and Wolverine (≥10 detections) to perform an analysis separately for these species and these results are presented below.

*Grey Wolf*

Grey Wolves were detected most frequently of the six furbearer species (n=172), which consisted primarily of detections of single Grey Wolves. There were also detections of pairs of Grey Wolves and packs of three and four Grey Wolves. Grey Wolves were detected at all the cameras except Cameras 1 and 12. Camera 9 had the highest number and rate of detections (n=64; 10.5 animals/100 CD). Camera 7 and Camera 10 both had the second highest number of detections of Grey Wolves (n=29 at both), which resulted in detection rates of 5.38 and 4.06 animals/100 CD at Cameras 7 and 10, respectively. Camera 11 and Camera 14 had 18 and 17 detections, respectively with detection rates of 2.52 and 4.66 animals/100 CD, respectively. Cameras 5 and 6 each had seven detections each of Grey Wolves with detection rates of 0.99 and 1.96 animals/100 CD, respectively. Camera 3 had one Grey Wolf detection with a detection rate of 0.1 animals/100 CD.

Grey Wolves were detected during each month of the year and the months having the highest rates of detection were February, April and June (10.2, 7.6 and 5.6 animals/100 CD, respectively; Figure 5.4-11).

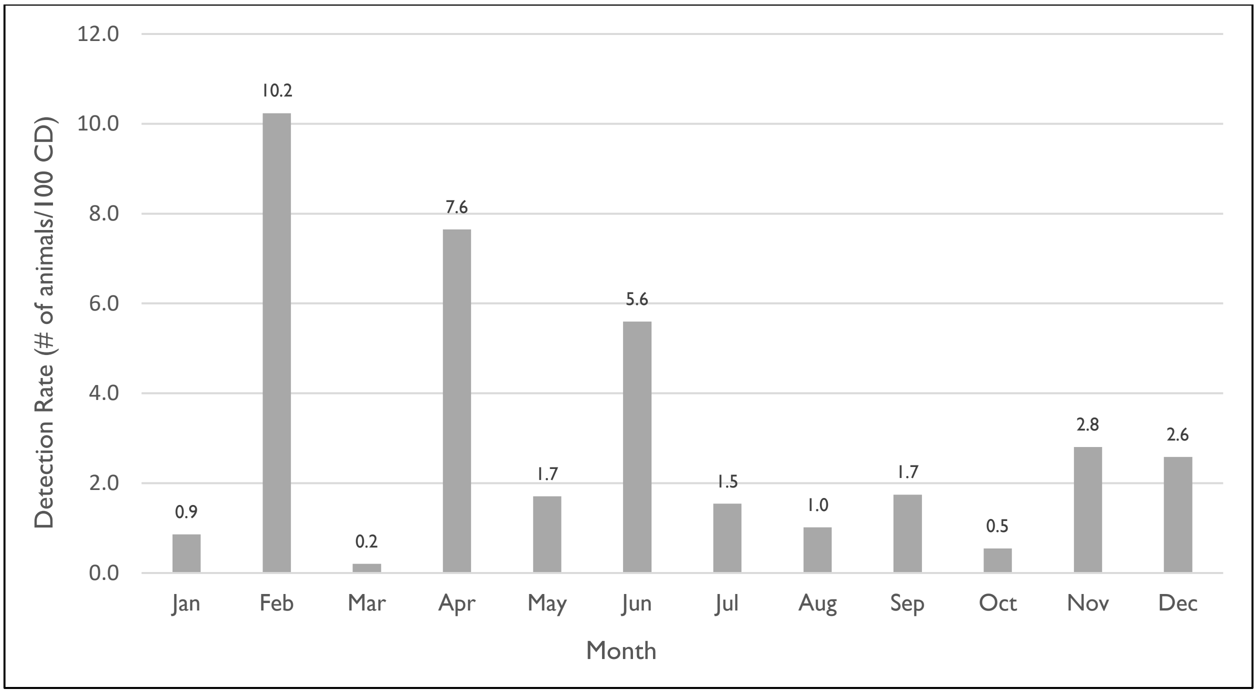



**Figure 5.4-11: Grey Wolf Detection Rates by Month During the Remote Camera Survey (excluding mineral lick cameras) at the Clinton Creek Site Between July 2016 and June 2018.**

*Canada Lynx*

Canada Lynx had the second highest number of detections of the six furbearer species (n=164) resulting in a detection rate of 2.7 animals/100 CD across all cameras. All but one of the detections was of a single Canada Lynx, with the other being of two Canada Lynx. Canada Lynx were detected at all ten non-mineral lick cameras. Camera 6 had the highest number and rate of detections (n=38; 10.61 animals/100 CD). Camera 14 had the second highest number and rate of Canada Lynx detections (n=36; 9.86 animals/100 CD). Camera 7 had the third highest number and rate of detections (n=32; 5.94 animals/100 CD), while Camera 12 had the lowest number and rate of Canada Lynx detections (n=2; 0.32/animals/100 CD).

Canada Lynx were detected during every month of the year, with the highest number of detections occurring in April (5.29 animals/100 CD) followed by March (4.88 animals/100 CD) and May (3.61 animals/100 CD). The lowest monthly detection rate was in January with 1.08 animals/100 CD (Figure 5.4-12).

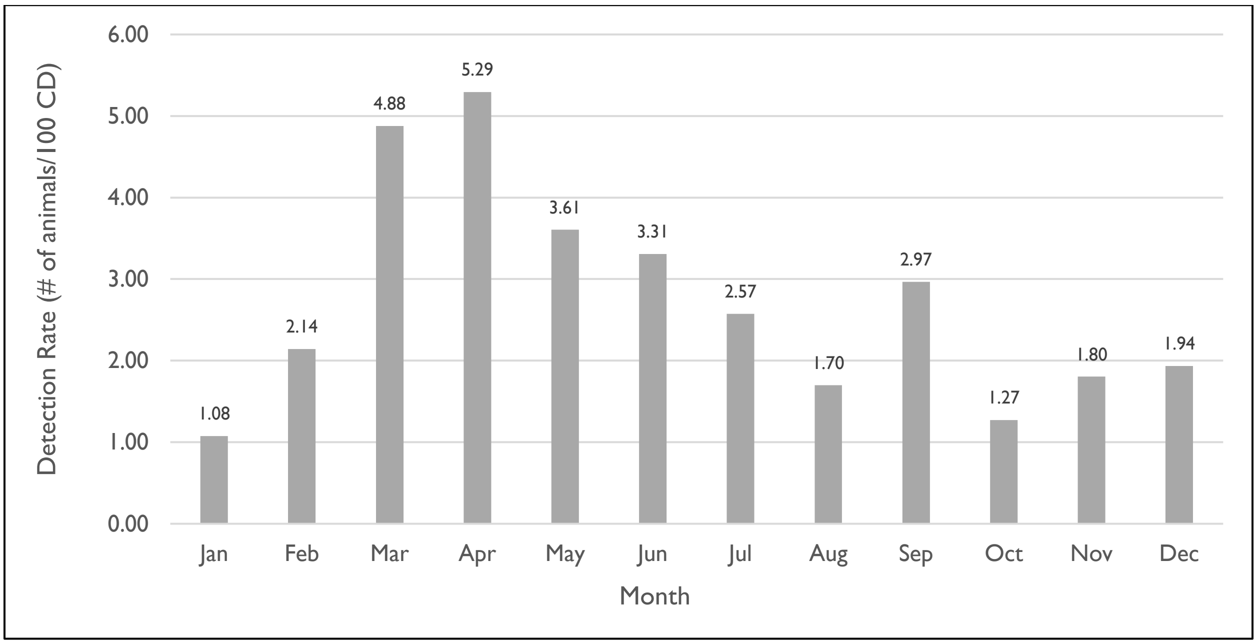



**Figure 5.4-12: Canada Lynx Detection Rates by Month During the Remote Camera Survey (excluding mineral lick cameras) at the Clinton Creek Site Between July 2016 and June 2018.**

*Wolverine*

Wolverines had the third highest number of detections of the six furbearer species (n=11) and only single Wolverines were detected at five of the ten non-mineral lick cameras. Six of the 11 detections were at Camera 9 (0.98 animals/100 CD). Two Wolverines were detected at Camera 5 (0.28 animals/100 CD) and one Wolverine was detected at Camera 7 (0.19 animals/100 CD), Camera 11 (0.14 animals/100 CD) and Camera 14 (0.27 animals/100 CD). Wolverines were only detected in February, March, April and October, with the highest detection rate occurring in March (0.8 animals/100 CD). The lowest detection rate occurred in October (0.2 animals/100 CD; Figure 5.4-13).

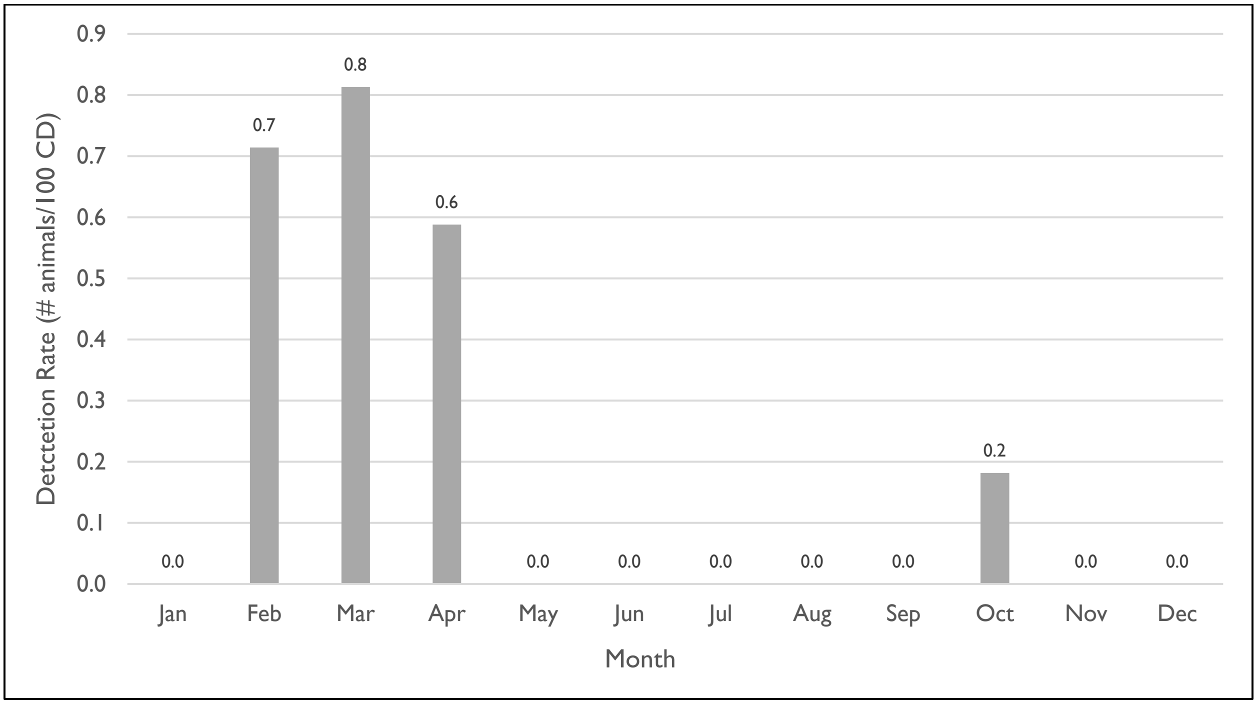



**Figure 5.4-13: Wolverine Detection Rates by Month During the Remote Camera Survey (excluding mineral lick cameras) at the Clinton Creek Site Between July 2016 and June 2018.**

#### *5.4.2.3 Mineral Lick Cameras*

The three mineral lick cameras captured a total of 4,961 animal events over 2,416 CD, which resulted in an overall detection rate of 205.3 animals/100 CD. The number of CDs at the largest, medium and small mineral licks were 698, 1,014, and 704, respectively (average of 805.3 CD). Detection rates ranged from 59.4 animals/100 CD at the smallest of the three mineral licks to 401 animals/100 CD at the largest of the three mineral licks (Figure 5.4-14). Additional mineral lick camera results are provided in the following sections.

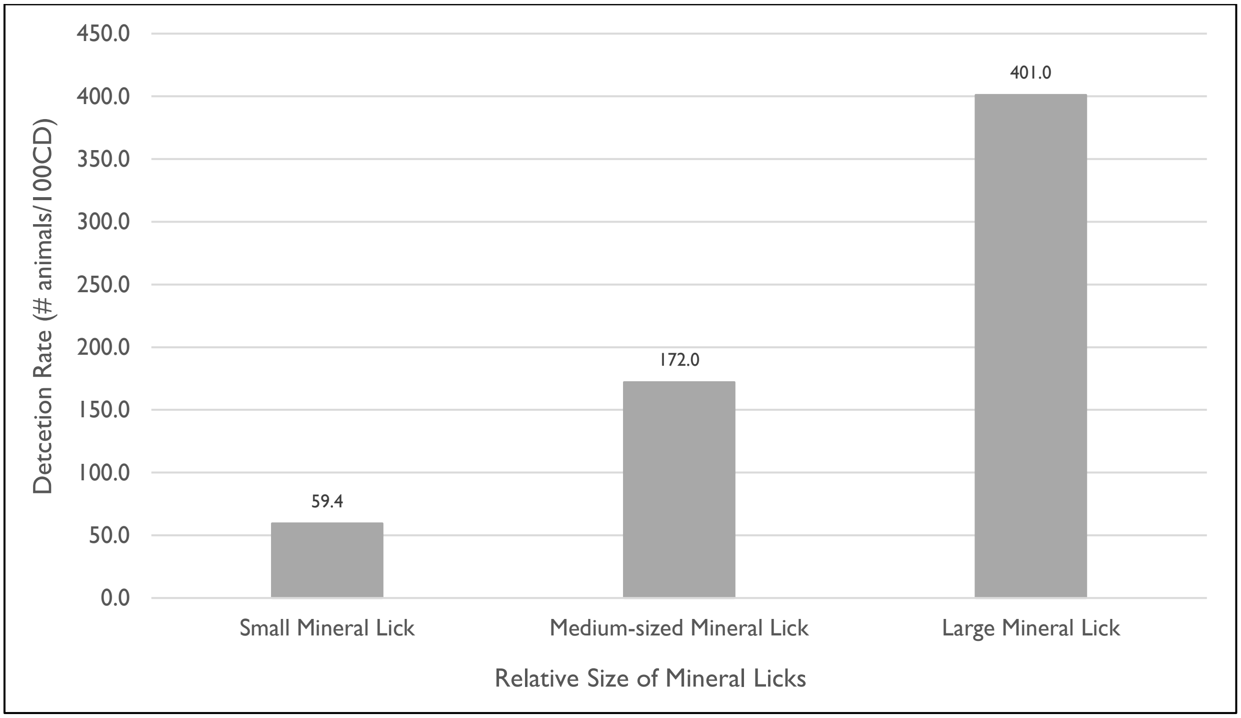



**Figure 5.4-14: Overall (or species group) Detection Rates at the Three Mineral Lick Cameras During the Remote Camera Survey at the Clinton Creek Site (September 2015 to June 2018)**

### *Seasonal Variation*

Combined detection rates for the mineral lick cameras peaked over the late spring and summer (between May and August) with the highest detection rate being in June (693.2 animals/100 CD) followed by July (556.6 animals/100 CD) and May (327.2 animals/100 CD). The lowest animal detection rate across all three mineral lick cameras was in December (32.3 animals/100 CD; Figure 5.4-15).

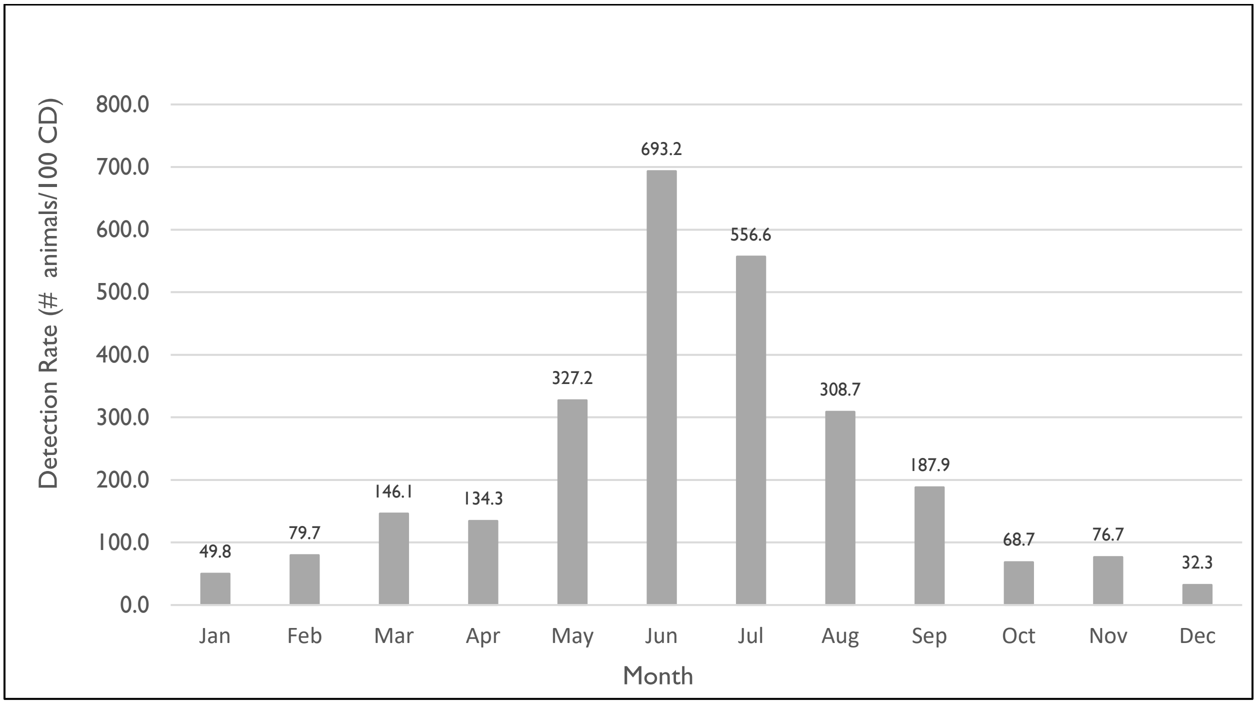



**Figure 5.4-15: Combined Monthly Wildlife Detection Rates For Three Mineral Lick Cameras Located at the Clinton Creek Site between September 2015 and June 2018**

### *Species Summaries*

15 species or species groups were detected at the mineral lick cameras. Moose were detected the most (n=3,220; 133.3 animals/100 CD) followed by Caribou (n=569; 23.6 animals/100 CD) and Snowshoe Hare (n=514; 21.3 animals/100 CD). Other species detected by the mineral lick cameras included Black Bear (n=38), Grizzly Bear (n=23), Wolverine (n=2), American Marten (n=1), Red Squirrel (n=70), and Grey Wolf (n=109; Figure 5.4-16). Overall, Moose accounted for about 65% of all animal detections at the three mineral licks.

Four bears were detected that could not be identified to species, and there were two other animal detections where the species could not be identified because only the animals' eyes could be seen in the photo. Where birds could be identified to species these included passerines (e.g., Canada Jay, Common Raven, White-winged Crossbill, and American Robin), waterfowl (e.g., Canada Goose, Green-winged Teal and Northern Shoveler) and shorebirds (e.g., Spotted Sandpiper).

It should be noted that although 15 species or species groups were detected by cameras at mineral licks, not all the species were observed to scrape, bite or lick the licks. Moose and Caribou were observed engaging in these activities. To a lesser degree, Snowshoe Hare and White-winged Crossbills also appeared to engage in these activities. Other species seemed to be passing through the mineral lick areas and were more likely "in frame" because they were following a scent (e.g., wolves or bears following Moose or Caribou) or the field of view of the camera also included habitat features other than the mineral lick (e.g., open water) and so some species, not typically associated with mineral licks, would be detected (e.g., American Beaver and Waterfowl).

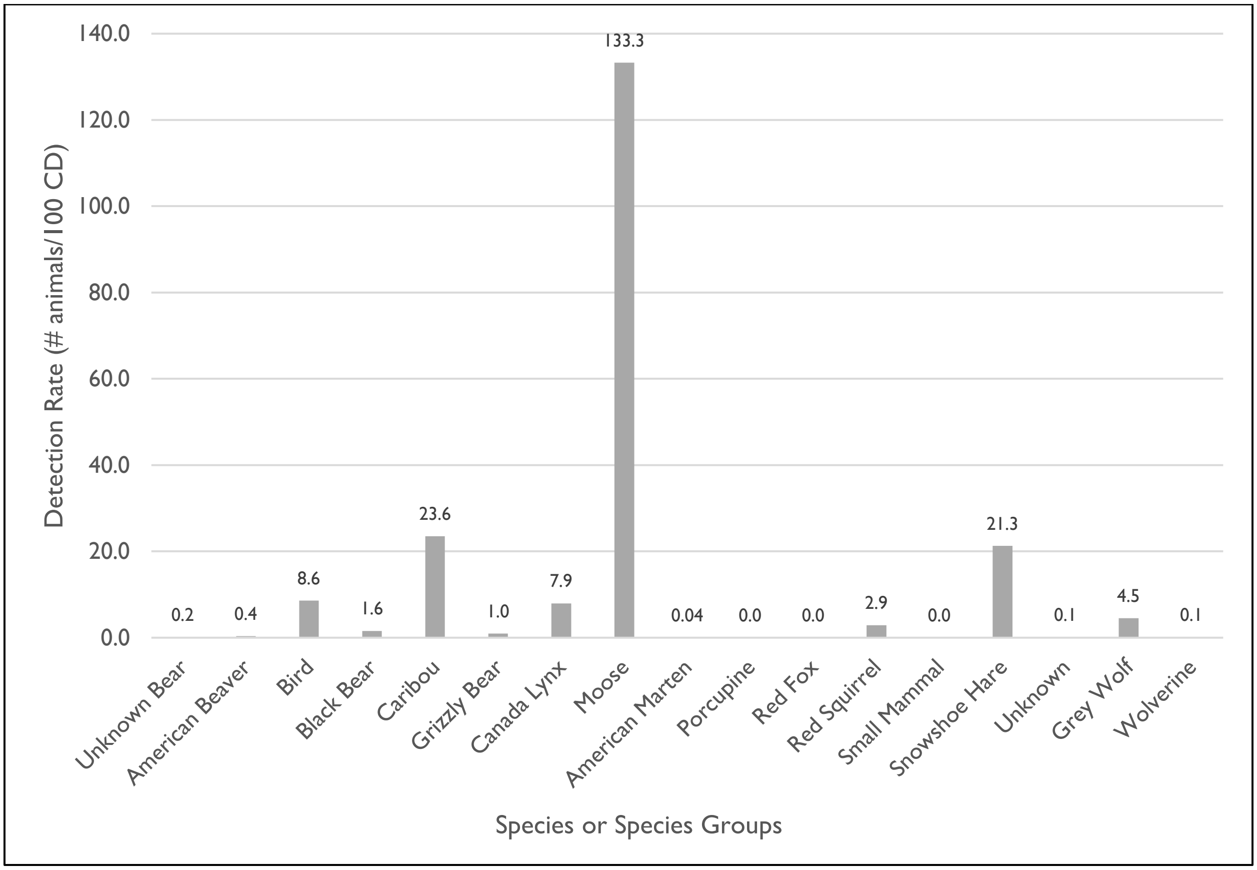



**Figure 5.4-16: Species (or species group) Detection Rates for Three Mineral Lick (combined) During the Remote Camera Survey at the Clinton Creek Site Between September 2015 and June 2018.**

*Moose*

Moose had the highest number and rate of detections at the mineral lick cameras (n=3,220; 133.3/100 CD). Moose detections were primarily of a single animal; however, groups of up to four Moose were also detected including cow-calf pairs. Confirmed detections of bulls (n=1,340) equated to about 42% of all Moose detections although not all the detected Moose could be sexed.

Moose were detected at all three mineral lick cameras, with about 65% of detections of this species being at the largest of the three mineral licks (detection rate of 300 animals/100 CD).

Moose were detected by cameras during all months of the year (Figure 5.4-17). The highest monthly detection rates for Moose occurred from May to September, with the highest monthly detection rate occurring in June (614.8 animals/100 CD). The lowest detection rates for Moose occurred in November and December with detection rates of 1.4 and 6.5 animals/100 CD, respectively.

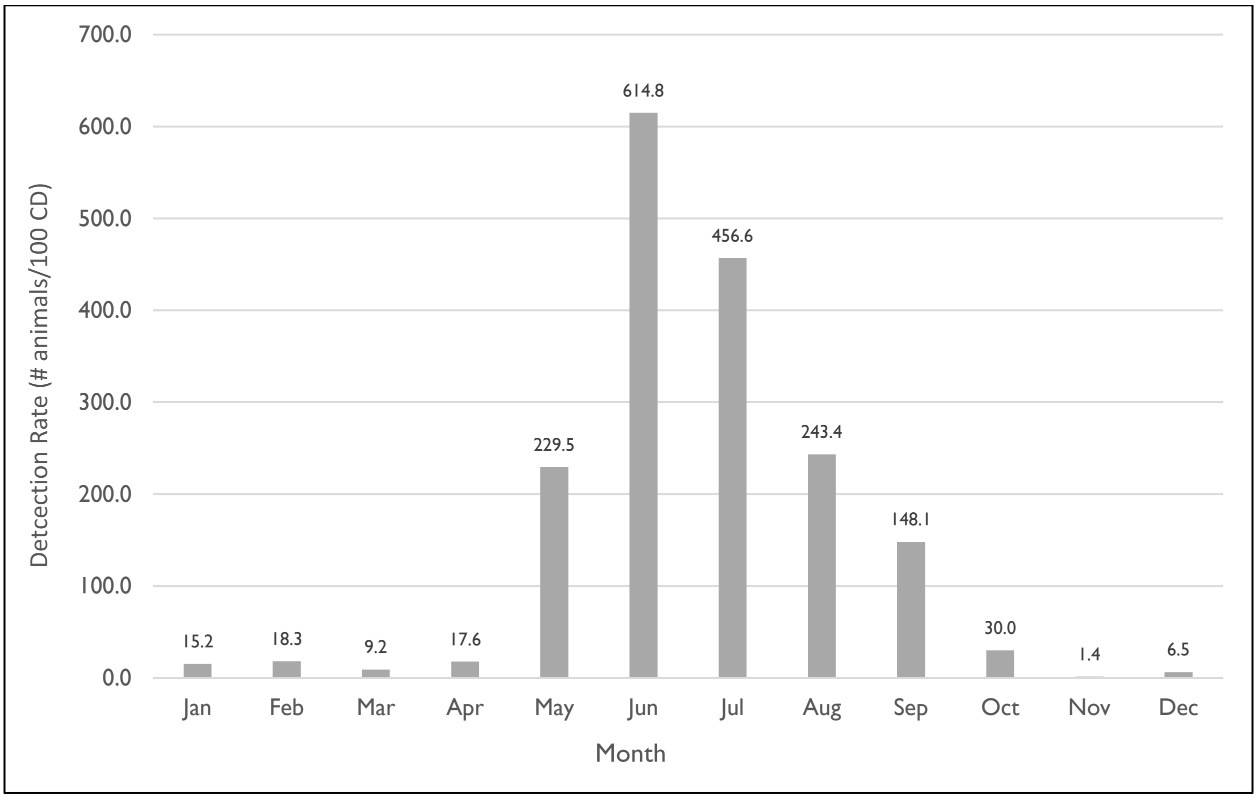



**Figure 5.4-17: Combined Monthly Moose Detection Rates at Three Mineral Licks During the Remote Camera Survey at the Clinton Creek Site Between September 2015 and June 2018.**

*Caribou*

Caribou had the second highest number and rate of detections at mineral lick cameras (n=569; 23.6 animals/100 CD). Caribou were detected at all three mineral licks with the highest number of detections at the largest mineral lick (n=437; 81.5 animals/100 CD). However, a higher rate of detections was observed at the medium-sized mineral lick (98.6 animals/100 CD). Groups of up to 10 Caribou were detected by the mineral lick cameras.

Caribou were detected from November through to May only, with the highest detection rates occurring in March and April (86.6 and 75.7 animals/100 CD, respectively). The month with the third highest Caribou detection rate was November (58.6 animals/100 CD; Figure 5.4-18).

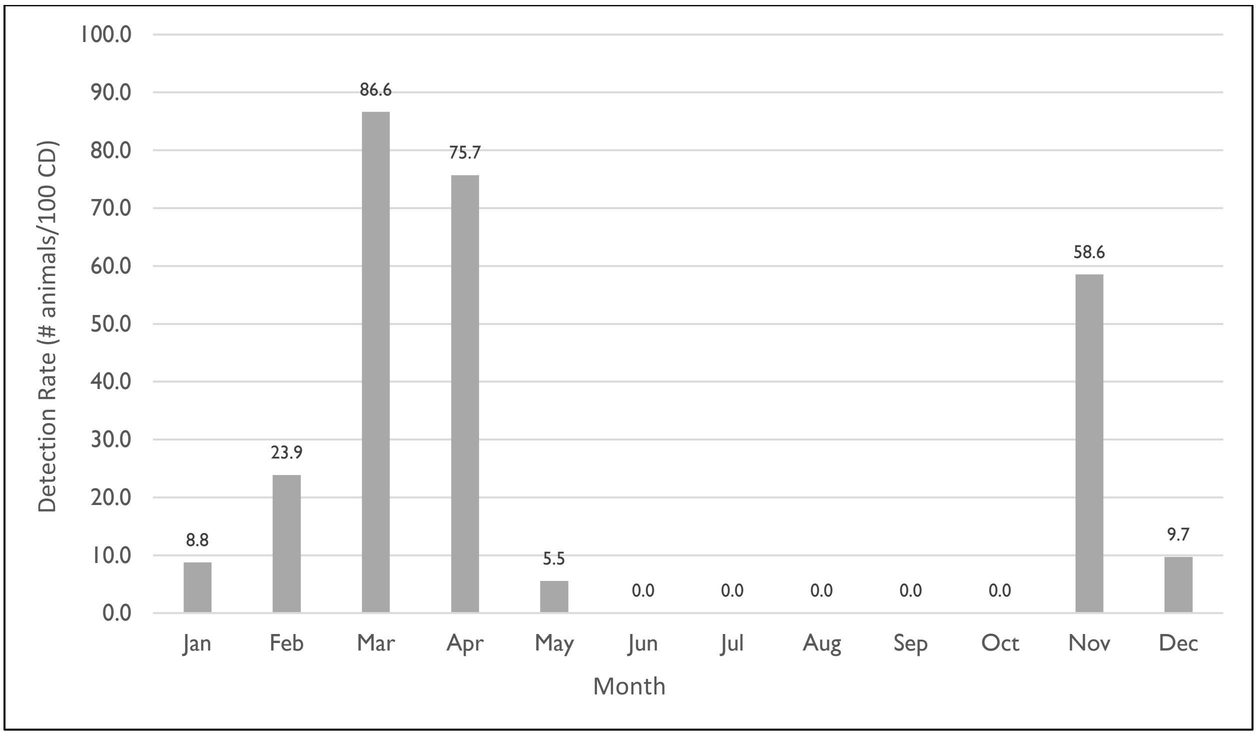



**Figure 5.4-18: Combined Monthly Caribou Detection Rates at Three Mineral Licks During the Remote Camera Survey at the Clinton Creek Site Between September 2015 and June 2018.**

*Bears*

There were a total of 65 detections of bears at the mineral lick cameras; 38 Black Bears, 23 Grizzly Bears and 4 bears where the species could not be determined. The overall combined detection rate for bears for mineral lick cameras was 2.7 animals/100 CD. Both species were detected at all three cameras. The largest of the three mineral licks had the highest detection rate for both Black Bears and Grizzly Bears at 5.4 and 3.3 animals/100 CD, respectively.

Black Bears were detected by mineral lick cameras between May and August with the highest detection rate occurring in July (9.2 animals/100 CD; Figure 5.4-19). Grizzly Bears were detected between April and August, also with a highest detection rate in July (6.4 animals/100 CD; Figure 5.4-20).

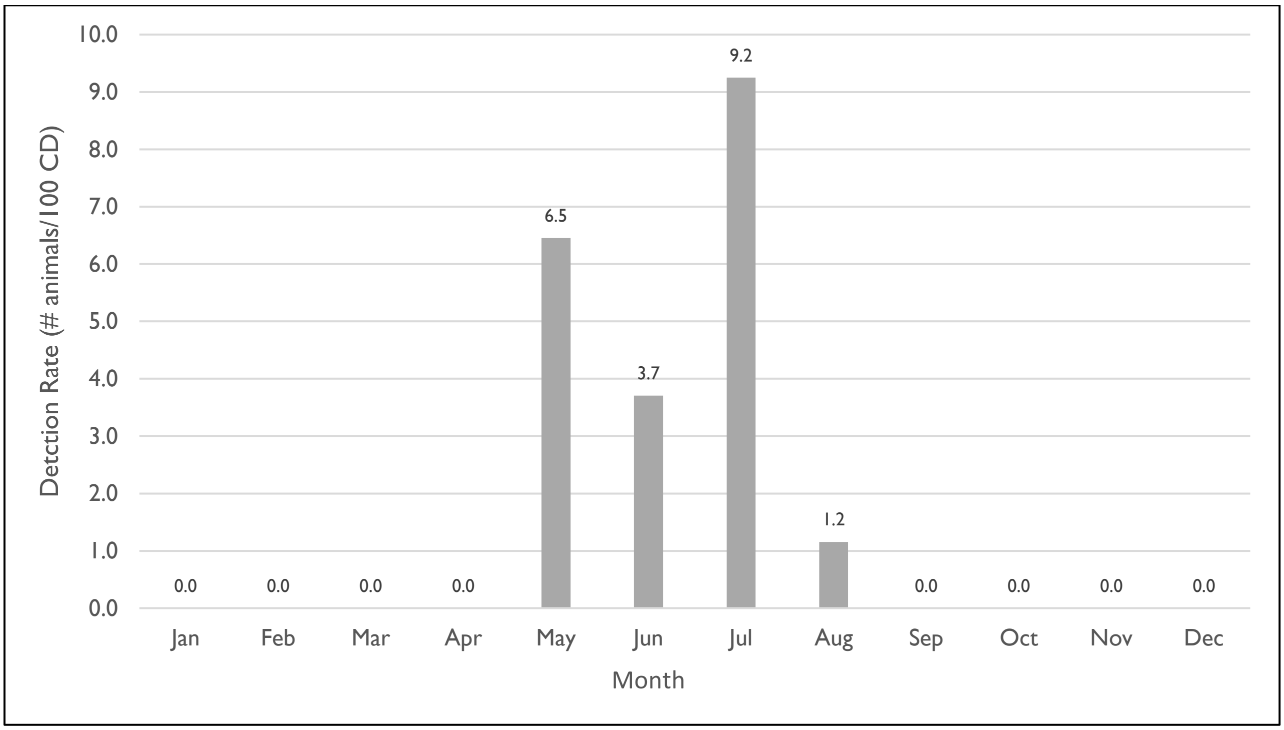



**Figure 5.4-19: Combined Monthly Black Bear Detection Rates at Three Mineral Licks During the Remote Camera Survey at the Clinton Creek Site Between September 2015 and June 2018.**

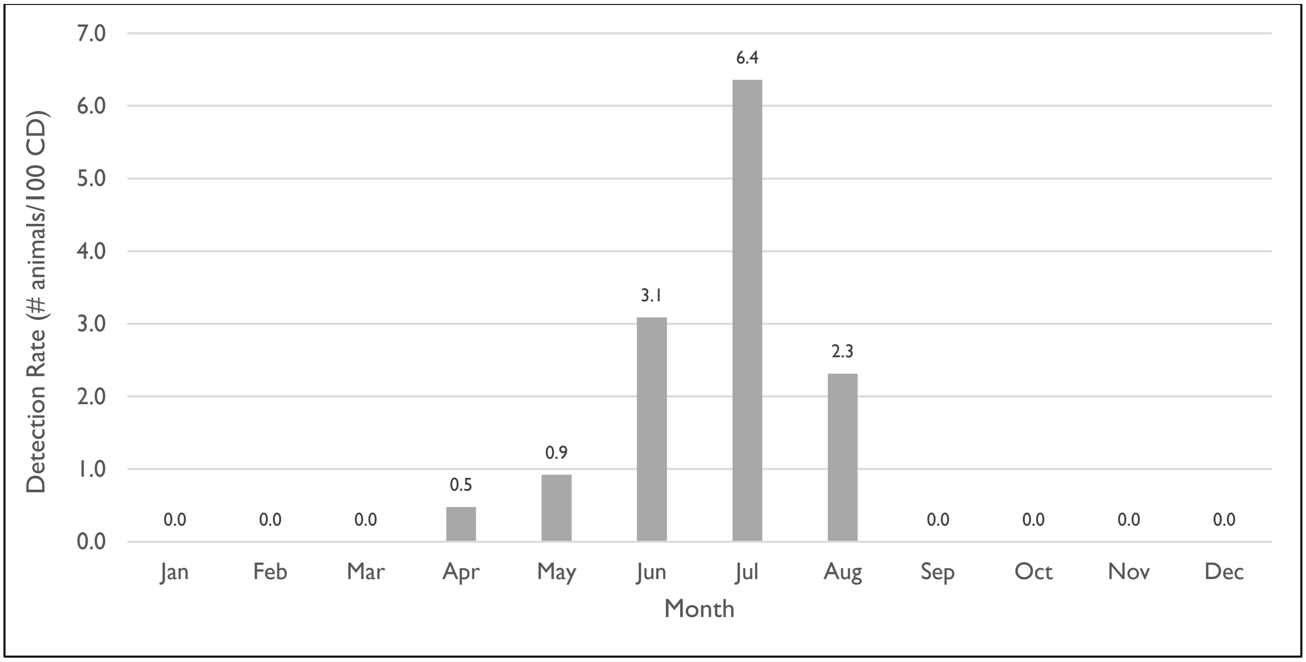



**Figure 5.4-20: Combined Monthly Grizzly Bear Detection Rates at Three Mineral Licks During the Remote Camera Survey at the Clinton Creek Site Between September 2015 and June 2018.**

*Furbearers*

Five furbearer species were detected by the mineral lick cameras; Canada Lynx (n=193), Grey Wolf (n=110), American Beaver (n=9), Wolverine (n=2) and American Marten (n=1). Canada Lynx and Grey Wolf had the highest detection rates at 7.9 and 4.5 animals/100 CD, respectively. American Marten had the lowest detection rate at 0.04 animals/100 CD. Furbearers were detected in all months with the highest detection rates occurring in March, April and June (33.6, 22.4 and 22.2 animals/100 days, respectively; Figure 5.4-21).

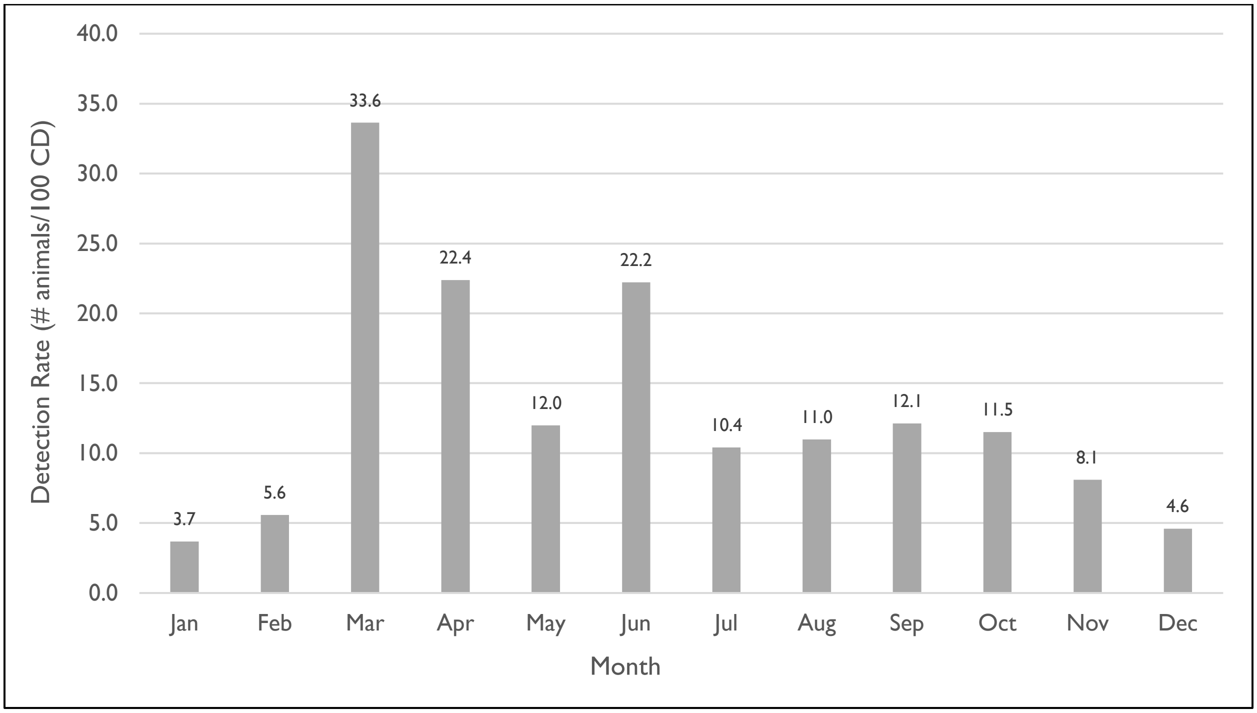



**Figure 5.4-21: Combined Monthly Furbearer Detection Rates at Three Mineral Licks During the Remote Camera Survey at the Clinton Creek Site Between September 2015 and June 2018.**

Of all the furbearer detections Canada Lynx and Grey Wolf were considered to be sufficiently high (≥10 detections) for species-level analysis.

*Canada Lynx*

Canada Lynx were detected at each of the mineral licks with the highest detection rate occurring at the smallest of the three mineral licks (16.8 animals/100 CD). Canada Lynx were detected during all months with the highest detection rate occurring in March (28.6 animals/100 CD). The second highest detection rate was in September (11.7 animals/100 CD) and the lowest detection rate was in both December and January (2.8 animals/100 CD; Figure 5.4-22).

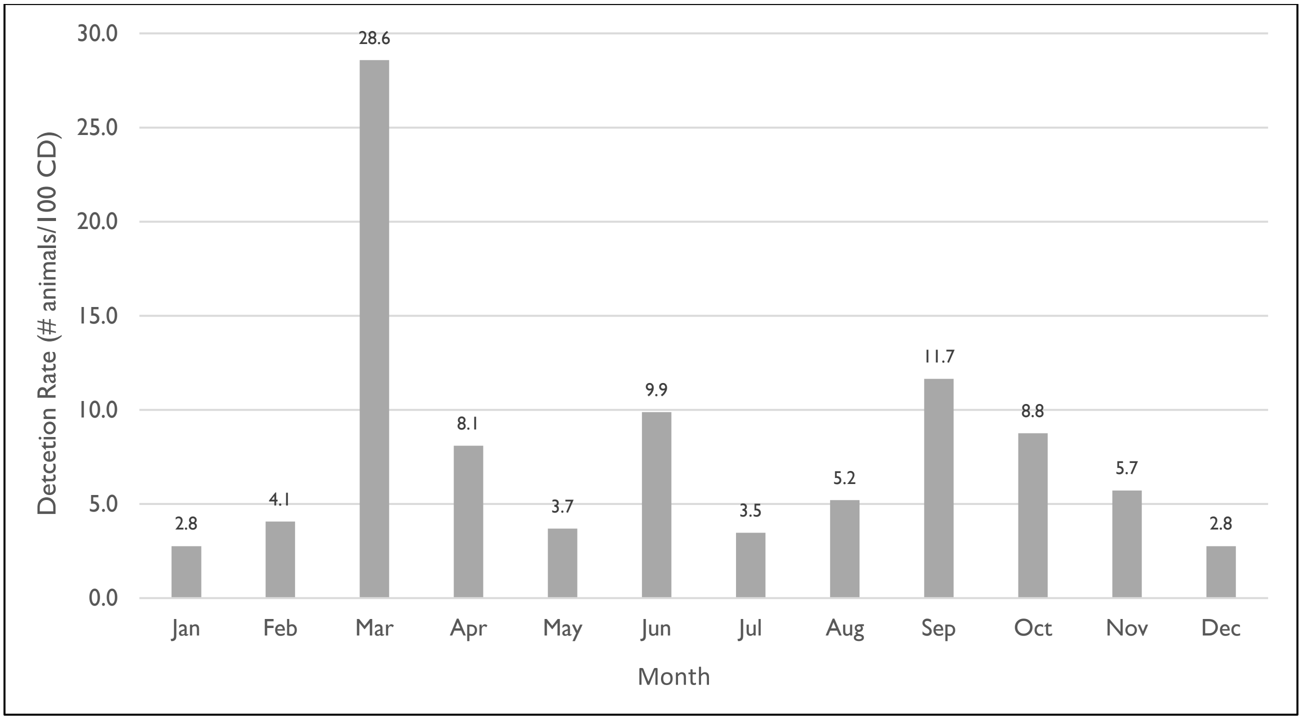



**Figure 5.4-22: Monthly Canada Lynx Detection Rates at the Three Mineral Licks (pooled data) During the Remote Camera Survey at the Clinton Creek Site Between September 2015 and June 2018.**

*Grey Wolf*

Grey Wolves were detected at each of the mineral licks with the highest detection rate occurring at the largest of the three mineral licks (15.6 animals/100 CD). Grey Wolves were detected during all months except September, with the highest monthly detection rates occurring in April (13.8 animals/100 CD) and June (10.5 animals/100 CD; Figure 5.4-23).

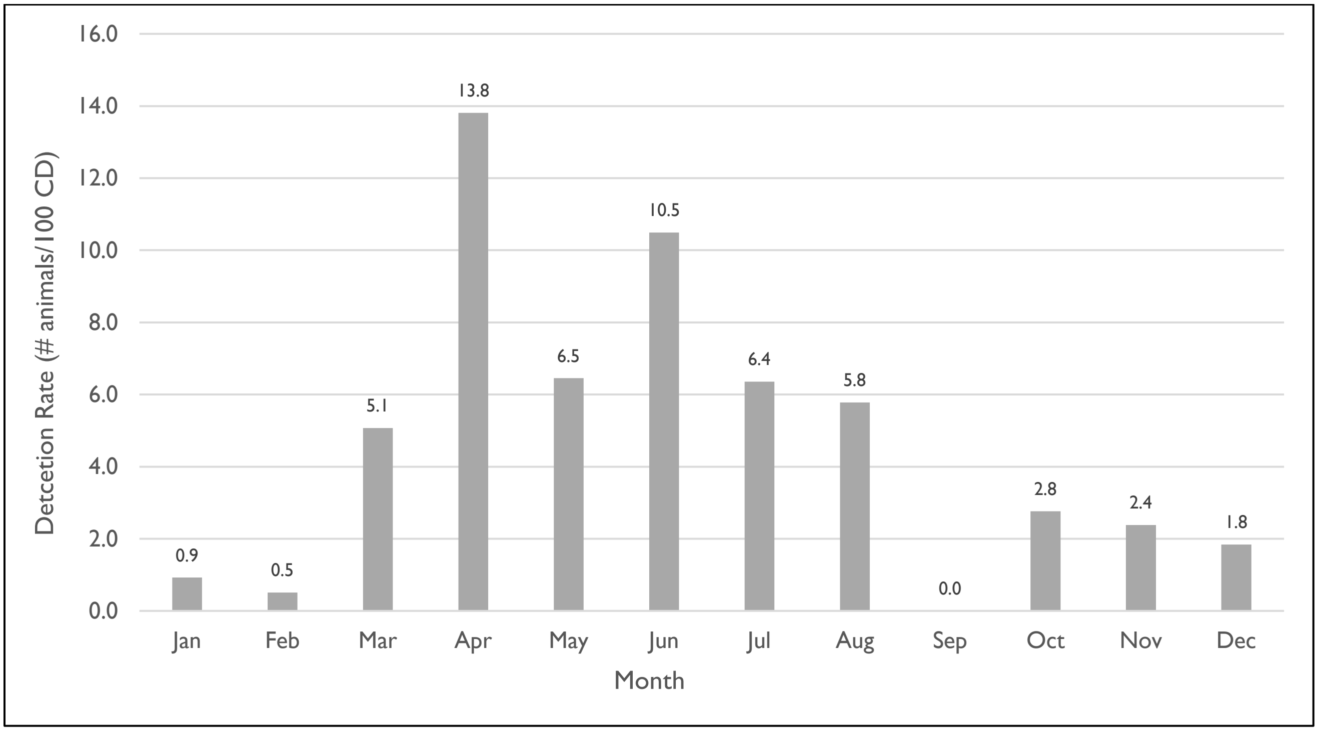



**Figure 5.4-23: Monthly Grey Wolf Detection Rates at Three Mineral Licks (combined) During the Remote Camera Survey at the Clinton Creek Site Between September 2015 and June 2018.**

### 5.4.3 Summary of Remote Wildlife Camera Observations

In total, 15 species or species groups (e.g., birds) were detected at both non-mineral lick cameras and mineral lick cameras over the survey period. For the non-mineral lick cameras, the highest rate of detection was for Caribou, largely because a large herd of Caribou passed by Camera 7 near the southern arm of Hudgeon Lake in early to mid-November 2017. Moose had the second highest detection rate followed by Snowshoe Hare. Of all the species detected, Wolverine and Grizzly Bear are considered to be species of conservation concern and are discussed in more detail in Section 6.

## 5.5 WILDLIFE WINTER TRACKING SURVEY

The primary objective of the winter tracking survey was to collect information on the presence, relative abundance, and habitat use by furbearers and other wildlife species within the LSA during a point in time during the winter.

### 5.5.1 Methods

#### *5.5.1.1 Pre-Field Planning*

During the planning phase of the project, ELR established a series of transect routes within the LSA, on which the field tracking would be based. These transect routes were established with a focus on:

1. Using existing access points (for reasons of logistics and efficiency);
2. Crossing the different habitat types within the LSA to provide local-scale information on relative habitat use by wildlife; and
3. Being of sufficient total length to provide data on larger-ranging species within the LSA.

For this survey, transect route layout was based on pre-existing ELC data that had been developed for the Site in 2016. At that time, 29 ecosystem habitat types had been established within the project LSA. ELR established 22 transects, varying in length from 369 to 2194 m to provide suitable representation of these ecosystem habitat types within the LSA.

#### *5.5.1.2 Field Methods*

ELR conducted the winter track survey from November 18 to 22 following a snowfall event on November 17. The intended tracking period for the survey was to be between 12 and 120 hours (0.5 to 5 days) from the time of the most recent snowfall or wind event that would completely or partially cover existing tracks in the snow. Tracking was completed by two experienced biologists, generally working on separate transects relatively close together and remaining in contact through handheld radios and satellite communications (Garmin® Inreach device) for safety reasons. Transects were traversed on foot, while snowmobiles were used for transportation between transects. During the transects each fresh wildlife track encountered along the observer's path was identified and enumerated into transect counts. Fresh tracks consisted of those tracks that had been created since the most recent snowfall or wind event. Each intersection of a fresh track by the observers' path was recorded as a single observation. In the case where multiple tracks along the same path were indistinguishable, or where the number of individuals could not be determined, a 'trail' was recorded. For data analysis, a trail consisted of three individual crossings, or five crossings in the case of a Snowshoe Hare. Older tracks (e.g., crusted over, blown in, or partly covered by snowfall) were identified where possible and recorded separately as incidental observations. Similarly, species sightings and observations of other sign (e.g., scats, beds, heavy browse) were also recorded as incidental observations. Such incidental observations do not contribute to the relative habitat use, but do provide information on general habitat use.

The pre-established transects were used as a guide in the field and were navigated using a combination of a handheld GPS unit and compass. The actual transect paths taken by the observers were recorded using a handheld GPS unit. During each transect, vegetation habitat cover data was recorded by the observer and field waypoints were recorded at each point of change in habitat (marking the transition to a new habitat type), at which time a new segment of transect was also started for data recording (to allow for analysis of tracking data according to habitat type).

In addition to tracks and recording habitat segments, the following data were recorded for each transect:

- Start and end time for the transect
- Snow depth
- Time since the most recent snowfall or wind event (to calculate tracking period and in turn tracking effort per transect).
- Weather conditions

#### *5.5.1.3 Data Analysis*

Spatial data (GPS track files and waypoints) from transects were analyzed using ESRI ArcGIS 10.6 software. GPS track files and waypoints (marking habitat transition points in the field) from each transect were superimposed on the ELC data and aerial imagery, and these tracks were then segmented and classified according to a combination of field habitat observations, photographs, and ELC classification. Track segments were then assigned habitat codes and individual identifiers, and linear distances for each segment were calculated using the software. Habitat and distance data for each transect segment were then combined with track counts and tracking period data from the field.

In order to compare track densities between various habitats in the LSA, ELR grouped transect segment results according to habitat types. Due to the relatively large number of ecosystem habitat types in the LSA (29) ELR grouped these into 11 broader (functional) habitat groups. This reduced the number of sampling categories thereby increasing the power of the survey design to allow for more meaningful data analysis, in particular for those habitats that occur infrequently in the LSA. Track densities and effort were calculated using the functional habitat groups and were used to discuss relative abundance and habitat use by wildlife.

For analysis, ELR first calculated effort for individual tracking segments by multiplying the distance travelled with the tracking period (the time since last snowfall). This provided a corrected period of effort that takes into account both the linear distance surveyed as well as the time period during which wildlife had the opportunity to create fresh tracks. This effort, referred to in units of kilometer (km) days (km x days; km•days) is calculated according to the following formula:

$$Effort\ (km * day) = Distance\ surveyed\ (km) * Time\ since\ last\ snow\,fall\ (days)$$

These effort data could then be summarized to determine the total effort across LSA or in functional habitats.

Next, ELR calculated track densities (the number of tracks/km/day; TKD) for each functional habitat type identified or for species/species groups across the LSA. Densities were calculated by dividing the total number of tracks observed in a particular functional habitat or area by the effort in kilometer days:

$$Track\ Density\ (Tracks/km/day\ [TKD]) = \frac{Number\ of\ tracks\ observed}{Distance\ [km] * Time\ since\ last\ snowfall\ [days]}$$

### 5.5.2 Results

#### *5.5.2.1 Survey Conditions*

Overall, the weather conditions during the tracking surveys were very good and although temperatures were generally low (-25 to -40°C), low snow depths in the LSA during the survey allowed observers to walk the transects without wearing snowshoes or skis while being able to observe tracks in fresh snow following a snowfall event on November 17, 2018. Winds were calm and transect average snow depths ranged from 16 to 31 cm (Table 5.5-1)

#### *5.5.2.2 Deviations from the Sampling Plan*

Generally, ELR was able to adhere to the original survey plan (planned transects). The main variation from the pre-field plan was that an area north and south of Hudgeon Lake was not surveyed as planned because this would have required travelling across Hudgeon Lake and the ice thickness on the lake was considered to be not adequate (approximately 8") for the safe passage of snowmobiles. ELR had pre-planned more transects than needed for the total required survey effort, therefore although the area immediately north and south of Hudgeon Lake was not surveyed, transects in similar habitats were surveyed in other parts of the LSA.

#### *5.5.2.3 Tracking Survey Data*

A total linear distance of 33.22 km was surveyed over five days within the LSA during the tracking survey, resulting in a total effort of 93.07 km•days after factoring in the time since the most recent snowfall or wind. These transects were comprised of a total of 189 individual habitat segments distributed amongst 22 transects. A summary of the data for individual transects is provided in Table 5.5-1, while transect locations are shown in Figure 5.5-1.

During the field survey, ELR found that the previously developed ELC classifications on which the transect layout had been based were generally representative of observed field habitats in most cases. However, the transition points recorded between adjacent vegetation habitats (using a handheld GPS unit) by ELR biologists played an important role in refining the boundaries between adjacent habitats during the post-field analysis. Photos 21-36 at the end of this report demonstrate the 11 functional habitats observed during the tracking survey.

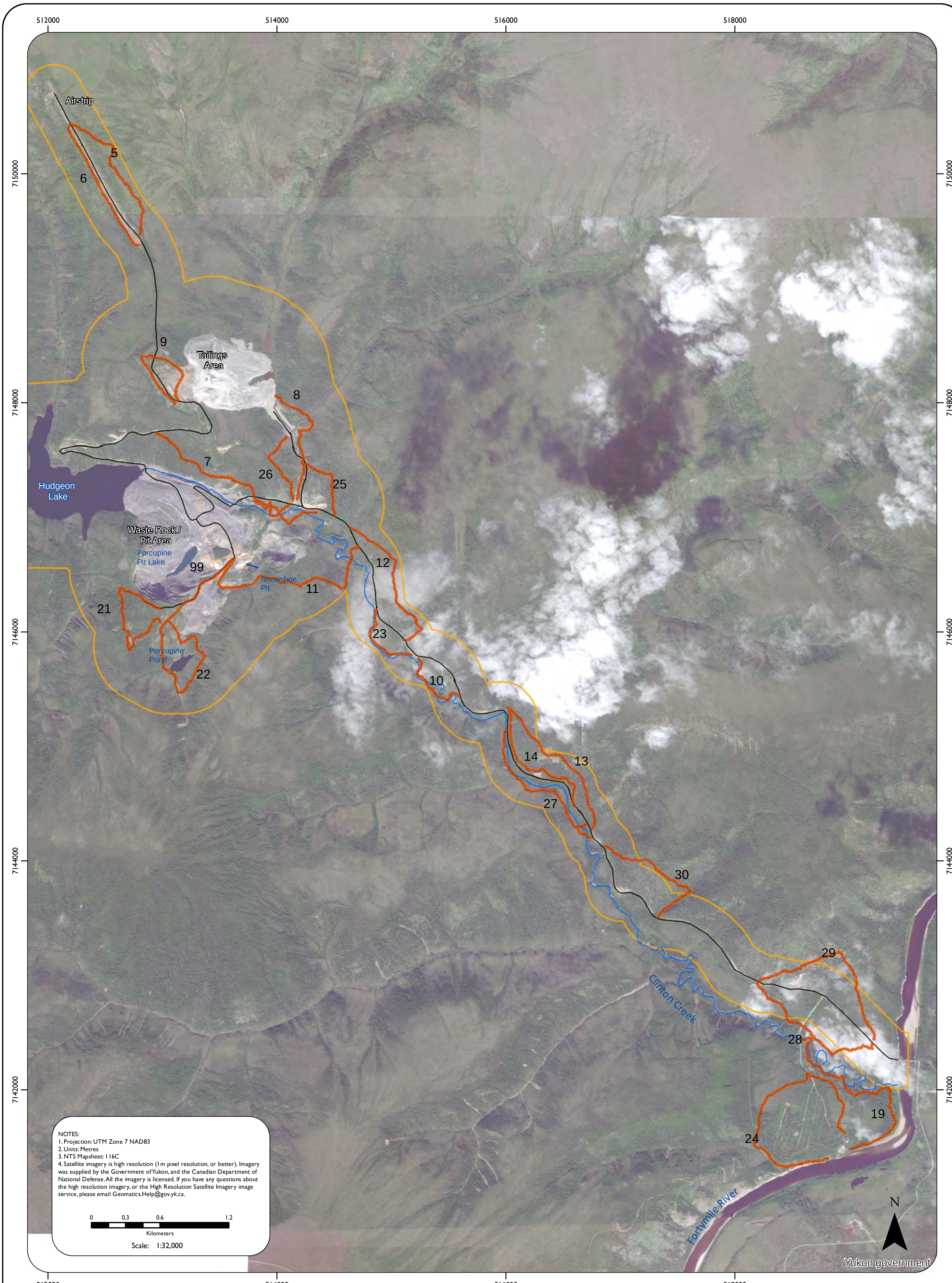
Overall, ELR successfully surveyed all major vegetated habitat types within the LSA. Rock outcrops, cut banks, roads, mudflats and gravel bars were deliberately avoided because the main purpose of the surveys was to target vegetated habitat. However, at a local scale, some vegetated areas that were sampled had previously been identified in the ELC mapping as anthropogenic (e.g., areas of the waste rock).

ELR did attempt to proportionally over-sample the more infrequently occurring functional habitats (i.e., those habitats that covered a smaller proportion of the LSA) in order to increase the sample size, thereby providing more data to represent these habitats. Conversely, ELR also made an attempt to limit the sampling of frequently occurring habitats (e.g., conifer forest) to more evenly distribute effort in the LSA. Overall, the grouping of similar functional habitats allowed for better representation of infrequently occurring habitats within the data. A summary of tracking effort according to functional habitat groupings is provided in Table 5.5-2. A summary of the birds and mammals detected during the tracking survey is provided in Table 5.5-3.

**Table 5.5-1: Summary Transect Information for the November 2017 Clinton Creek Site Winter Track Study**

| Transect # | Date Surveyed | Transect Time | | Date of Last Snow | Time of Last Snow | Time Since Last Snow (hours) | Decimal Days Since Last Snow | Average Snow Depth (cm) | Temp (°C) | Wind (km/h) | Snow Conditions* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Start | End | | | | | | | | |
| 5 | 18/11/2017 | 10:03 | 11:03 | 17/11/2017 | 14:00 | 18 | 0.75 | 30.9 | -16 | 0 | 1 |
| 6 | 18/11/2017 | 9:50 | 10:45 | 17/11/2017 | 14:00 | 18 | 0.75 | 26.0 | -16 | 1-3 | 1 |
| 7 | 19/11/2017 | 10:07 | 13:04 | 17/11/2017 | 14:00 | 44 | 1.83 | 26.5 | -26 | 0 | 1 |
| 8 | 19/11/2017 | 10:30 | 12:05 | 17/11/2017 | 14:00 | 45 | 1.88 | 24.1 | -25 | 1-3 | 1-2 |
| 9 | 18/11/2017 | 13:00 | 13:32 | 17/11/2017 | 14:00 | 23 | 0.96 | 27.9 | -16 | 1-3 | 1 |
| 10 | 20/11/2017 | 16:20 | 17:00 | 17/11/2017 | 14:00 | 74 | 3.08 | 25.4 | -26 | 0 | 2 |
| 11 | 19/11/2017 | 14:35 | 17:05 | 17/11/2017 | 14:00 | 49 | 2.04 | 27.9 | -24 | 0 | 2 |
| 12 | 19/11/2017 | 14:40 | 16:26 | 17/11/2017 | 14:00 | 49 | 2.04 | 22.4 | -25 | 0 | 2 |
| 13 | 18/11/2017 | 14:40 | 16:40 | 17/11/2017 | 14:00 | 25 | 1.04 | 24.1 | -26 | 0 | 1 |
| 14 | 18/11/2017 | 14:40 | 16:08 | 17/11/2017 | 14:00 | 25 | 1.04 | 27.1 | -26 | 0 | 1 |
| 19 | 21/11/2017 | 13:25 | 15:30 | 17/11/2017 | 14:00 | 95 | 3.96 | 21.0 | -34 | 1-3 | 2-3 |
| 21 | 20/11/2017 | 10:30 | 13:18 | 17/11/2017 | 14:00 | 69 | 2.88 | 24.1 | -26 | 0 | 2 |
| 22 | 20/11/2017 | 10:20 | 12:42 | 17/11/2017 | 14:00 | 68 | 2.83 | 28.8 | -26 | 0 | 2 |
| 23 | 20/11/2017 | 16:15 | 16:55 | 17/11/2017 | 14:00 | 70 | 2.92 | 27.3 | -26 | 0 | 2 |
| 24 | 21/11/2017 | 12:45 | 15:00 | 17/11/2017 | 14:00 | 95 | 3.96 | 19.7 | -34 | 0 | 2 |
| 25 | 20/11/2017 | 14:38 | 15:35 | 17/11/2017 | 14:00 | 73 | 3.04 | 25.4 | -26 | 0 | 2 |
| 26 | 20/11/2017 | 14:30 | 15:33 | 17/11/2017 | 14:00 | 73 | 3.04 | 24.1 | -25 | 0 | 2 |
| 27 | 22/11/2017 | 9:40 | 12:00 | 17/11/2017 | 14:00 | 116 | 4.83 | 26.7 | -22 | 0 | 3 |
| 28 | 22/11/2017 | 12:55 | 14:44 | 17/11/2017 | 14:00 | 119 | 4.96 | 19.1 | -22 | 1 | 3 |
| 29 | 22/11/2017 | 12:55 | 14:22 | 17/11/2017 | 14:00 | 119 | 4.96 | 16.1 | -26 | 1-3 | 2 |
| 30 | 22/11/2017 | 9:45 | 11:28 | 17/11/2017 | 14:00 | 116 | 4.83 | 21.6 | -27 | 0 | 3 |
| 99 | 20/11/2017 | 12:45 | 13:00 | 17/11/2017 | 14:00 | 71 | 2.96 | 24.1 | -25 | 0 | 2 |

*Note: *Snow Conditions: 1 = fresh, less than two days; 2 = Recent, > 2 days, > 2 cm, not windblown; 3 = Old, >4days OR windblown OR crusted OR melted out*




Ecological Logistics & Research Ltd.

Client:

Yukon

**LEGEND**

- Wildlife LSA
- Winter Track Transect Locations
- Primary Site Roads
- Watercourses

Drawn by: C. Jastrebski
Approved by: G. Rudman
Date: February 10, 2020
ELR Project: 18-278.3

**CLINTON CREEK SITE**
Terrestrial Existing Environment Studies

**FIGURE 5.5-1**
Winter Track Study Transect Locations

Document Path: M:\GIS_Projects\18-278 Clinton Creek 2018 Baseline\Wildlife\Map Files\Report Figures\2020 02 10 Fig 5.5-1 Winter Track.mxd

**Table 5.5-2: Summary of Functional Habitat Groupings and Related Track Survey Effort for 2017 Winter Track Survey**

| Functional Habitat Grouping (ELR) | Field Habitat Types Included in Functional Grouping | Functional Habitat Code | # of Segments Sampled | Linear Distance Sampled (km) | Sample Effort (Km•Days) | % of Total Tracking Effort | Approximate % of 2016 ELC area |
|---|---|---|---|---|---|---|---|
| Mature Deciduous | Aspen/Birch with Spruce<br>Partly Cleared Alder/Balsam Poplar<br>Balsam Poplar with Regenerating Spruce<br>Balsam Poplar with Prickly Rose & Willow | MD | 7 | 1.55 | 6.08 | 6.5 | 0.8 |
| Deciduous Pole Sapling | Deciduous Pole Sapling | DPS | 30 | 4.69 | 8.91 | 9.6 | 0.9 |
| Mature Conifer, Mixed Understory | Mature Spruce with Birch<br>Mature Spruce with Aspen & Birch<br>Pole Spruce<br>White Spruce with Labrador Tea<br>White Spruce with Soapberry | MC/M | 41 | 5.77 | 14.40 | 15.5 | 52.3 |
| Mature Conifer, Open Understory | Mature White Spruce<br>White Spruce, some Labrador Tea<br>Open Slide within White Spruce<br>Riparian Spruce with Open Understory | MC/O | 43 | 8.85 | 23.98 | 25.8 | 6.67 |
| Open Aspen | Trembling Aspen<br>Trembling Aspen with Prickly Rose<br>Trembling Aspen with Spruce | OA | 20 | 2.66 | 9.85 | 10.6 | 0.9 |
| Open Stunted or Regenerating Conifer | Regenerating Spruce<br>Black Spruce Bog<br>Black Spruce Fen<br>Open Low Spruce with Birch and Willow | OC/S | 21 | 4.52 | 17.34 | 18.6 | 16.2 |
| Open Juniper | Juniper Reedgrass<br>Juniper Reedgrass with some Spruce | OJ | 3 | 0.48 | 0.96 | 1.0 | 0.9 |
| Open Wetland | Sedge Marsh<br>Grass Meadow | OW | 2 | 0.16 | 0.30 | 0.3 | 0.02 |

| Functional Habitat Grouping (ELR) | Field Habitat Types Included in Functional Grouping | Functional Habitat Code | # of Segments Sampled | Linear Distance Sampled (km) | Sample Effort (Km•Days) | % of Total Tracking Effort | Approximate % of 2016 ELC area |
|---|---|---|---|---|---|---|---|
| Riparian Shrub | Willow with Spruce<br>Willow, Bluejoint Reedgrass<br>Willow with Low Shrubs | RS | 6 | 1.95 | 4.22 | 4.5 | 0.62 |
| Shrub Non-Riparian | Shrub Birch<br>Open Ground, Low Shrub<br>Shrub on Previously Disturbed Areas (e.g., Mill Site, Waste Rock) | SNR | 7 | 1.14 | 2.63 | 2.8 | 16.6 |
| Shrub Thicket | Alder/Birch Thicket<br>Alder/Birch with some Spruce<br>Alder/Birch with Spruce and Balsam Poplar | ST | 8 | 1.46 | 4.41 | 4.7 | 3.2 |
| **Totals** | | | **188** | **33.23** | **93.08** | **100** | **99.1*** |

*Notes:*

**Gravel bars, mudflats and exposed soil account for approximately 0.9% of the total 2016 ELC area and were not targeted during the tracking surveys.*

### Table 5.5-3: Summary of Birds and Mammals Detected During the Winter Track Survey

| Common Name | Scientific Name | Detected on Transect | Incidental Detections |
|---|---|---|---|
| American Marten | *Martes americana* | ✓ | ✓ |
| Canada Lynx | *Lynx canadensis* | ✓ | ✓ |
| Caribou | *Rangifer tarandus granti* | ✓ | |
| Ermine | *Mustela erminea* | ✓ | ✓ |
| Mice/Voles | - | ✓ | |
| Ptarmigan / Grouse | - | ✓ | |
| Red Fox | *Vulpes vulpes* | ✓ | |
| Red Squirrel | *Tamiascurus hudsonicus* | ✓ | |
| Northern River Otter | *Lontra canadensis* | ✓ | |
| Snowshoe Hare | *Lepus americanus* | ✓ | |
| Wolverine | *Gulo gulo* | ✓ | |

The overall track density (TD) across all transects was 28.8 TKD, with this value primarily due to the high number of recorded Snowshoe Hare tracks (n=2,427; Table 5.5-4). Without Snowshoe Hare tracks the overall TD at the Site would have been 2.8 TKD.

The highest TD was observed in the functional habitat of mature conifer with mixed understory (48.2 TKD) which was primarily comprised of Snowshoe Hare tracks (42.1 TKD). The second highest TD was observed in Open Aspen habitat (35.8 TKD); again, largely comprised of Snowshoe Hare tracks (32.1 TKD). Mature conifer with open understory had the third highest density of tracks (31.7 TKD) and deciduous pole sapling had the fourth highest density of tracks (28.06 TKD) (Figure 5.5-2). The highest number of species or species groups (n=8) were detected within open aspen habitat, followed by seven species (or species groups) in both mature conifer with mixed understory, and in mature conifer with open understory. The lowest number of species detected was in the open wetland habitat (n=1; Snowshoe Hare).

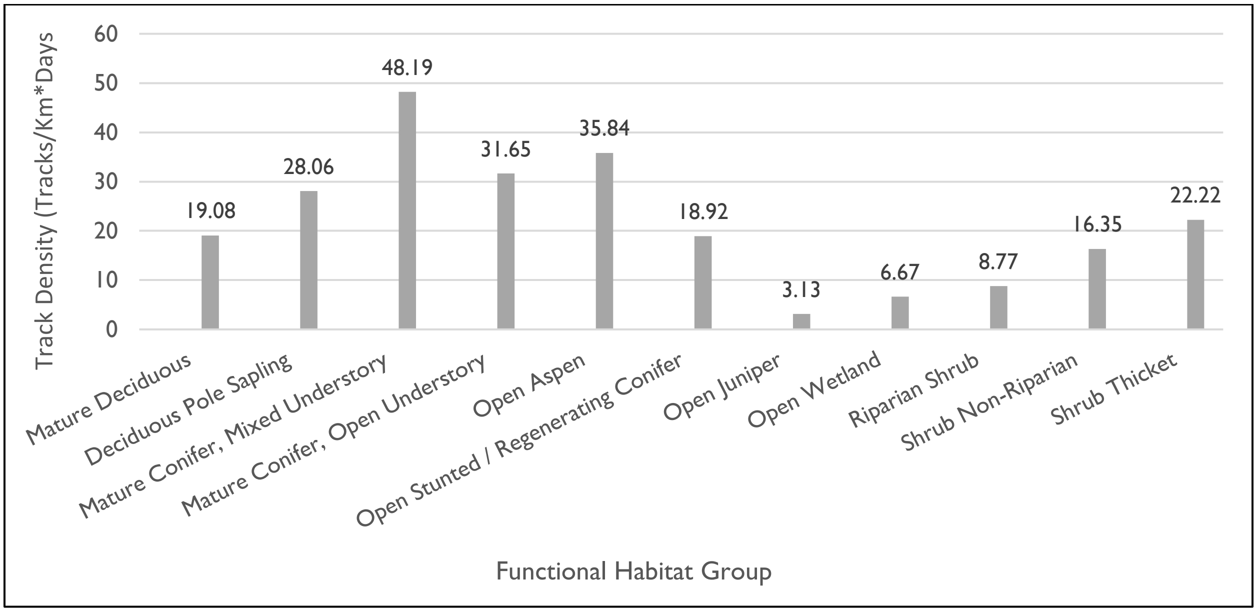



**Figure 5.5-2: Wildlife Track Densities (TKD) by Functional Habitat from the Winter Track Survey at the Clinton Creek Site in November, 2017.**

### *Ungulates*

Three ungulate tracks were detected in total (all Caribou), resulting in a TD of 0.03 TKD (calculated across all transects; Table 5.5-4). The three tracks were all observed within open aspen habitat north of the mine access road (Transect 30; Table 5.5-5).

### *Canids*

Five Red Fox tracks were detected during the tracking survey resulting in an overall TD of 0.05 TKD (calculated across all transects; Table 5.5-4). The tracks were all recorded within mature conifer with open understory habitat (0.21 TKD; Table 5.5-5). Four sets of tracks were detected along transect 10 and one along transect 19.

**Table 5.5-4: Summary of Winter Track Detections and Track Densities Among all Sampled Habitats at the Clinton Creek Site**

| Species | Red Fox | American Marten | Ermine | Snowshoe Hare | Red Squirrel | Canada Lynx | Ptarmigan / Grouse | Northern River Otter | Wolverine | Mice / Voles | Caribou | Total (all species) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Total # of Tracks Observed** | 5 | 26 | 25 | 2427 | 161 | 16 | 10 | 3 | 1 | 6 | 3 | **2683** |
| **Tracks Per Km•Day** | 0.05 | 0.28 | 0.27 | 26.08 | 1.73 | 0.17 | 0.11 | 0.03 | 0.01 | 0.06 | 0.03 | **28.83** |

**Table 5.5-5: Summary of Species Richness and Track Densities by Functional Habitat at the Clinton Creek Site**

| Functional Habitat Group | Number of Species | Total Track Density | Red Fox | American Marten | Ermine | Snowshoe Hare | Red Squirrel | Canada Lynx | Ptarmigan / Grouse | Northern River Otter | Wolverine | Mice / Voles | Caribou |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mature Deciduous | 4 | 19.08 | 0.00 | 0.00 | 0.00 | 17.11 | 1.64 | 0.16 | 0.00 | 0.16 | 0.00 | 0.00 | 0.00 |
| Deciduous Pole Sapling | 5 | 28.06 | 0.00 | 0.00 | 0.22 | 26.71 | 0.56 | 0.22 | 0.34 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mature Conifer, Mixed Understory | 7 | 48.19 | 0.00 | 0.90 | 0.07 | 42.08 | 4.38 | 0.21 | 0.00 | 0.14 | 0.00 | 0.42 | 0.00 |
| Mature Conifer, Open Understory | 7 | 31.65 | 0.21 | 0.21 | 0.38 | 28.44 | 2.34 | 0.04 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 |
| Open Aspen | 8 | 35.84 | 0.00 | 0.41 | 0.10 | 32.08 | 2.23 | 0.51 | 0.10 | 0.00 | 0.10 | 0.00 | 0.30 |
| Open Stunted / Regenerating Conifer | 6 | 18.92 | 0.00 | 0.12 | 0.23 | 18.05 | 0.17 | 0.06 | 0.29 | 0.00 | 0.00 | 0.00 | 0.00 |
| Open Juniper | 2 | 3.13 | 0.00 | 0.00 | 0.00 | 2.08 | 0.00 | 1.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Open Wetland | 1 | 6.67 | 0.00 | 0.00 | 0.00 | 6.67 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Riparian Shrub | 4 | 8.77 | 0.00 | 0.47 | 1.66 | 6.40 | 0.00 | 0.24 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Shrub Non-Riparian | 3 | 16.35 | 0.00 | 0.00 | 0.38 | 15.59 | 0.00 | 0.38 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Shrub Thicket | 2 | 22.22 | 0.00 | 0.00 | 0.00 | 21.77 | 0.45 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

### *Mustelids*

Four species of mustelids were detected during the winter tracking survey; Ermine, Wolverine, Northern River Otter and American Marten. Of these, American Marten and Ermine were the most frequently observed 0.28 and 0.27 TKD, respectively (calculated across all transects).

American Marten was mostly detected within mature conifer with mixed understory habitat (0.90 TKD) followed by riparian shrub (0.47 TKD) and open aspen habitat (0.41 TKD; Table 5.5-5). Ermine were mostly detected within riparian shrub habitat (1.66 TKD) followed by both mature conifer with open understory and non-riparian shrub (0.38 TKD in both; Table 5.5-5).

Three Northern River Otter tracks were recorded, resulting in an overall TD of 0.03 TKD. These tracks were detected along transect 24 (Figure 5.5-1), two within mature conifer with mixed understory habitat (0.14 TKD) and one within mature deciduous habitat (0.16 TKD). The tracks were observed at least 400 m from any open water and it was believed that a small group of Northern River Otters was travelling between water bodies (between open creeks) or travelling to a different section of the same water body (e.g., moving farther along the Fortymile River).

One Wolverine track was recorded along Transect 24 (Figure 5.5-1) within open aspen habitat (0.10 TKD; Table 5.5-5). The Wolverine is listed as 'Special Concern' under the federal Species at Risk Act (SARA; Government of Canada 2002) and is discussed further in Section 6.

One incidental American Marten track (on transect 12) and one incidental Ermine track (transect 26) were also recorded during the survey.

### *Felids*

Canada Lynx were detected 16 times with an overall TD of 0.17 TKD (calculated across all transects), occurring in all functional habitats except open wetland and shrub thicket. They were detected most frequently within open juniper habitat (1.04 TKD) followed by open aspen habitat (0.51 TKD; Table 5.5-5).

Three incidental Canada Lynx tracks were also recorded during the surveys with one track each on transects 13, 30 and 99 (Figure 5.5-1).

### *Lagomorphs*

Snowshoe Hare was the most detected species during the survey with 2,427 tracks recorded, equating to an overall TD of 26.08 TKD (calculated across all transects). Snowshoe Hare tracks were detected in all 11 functional habitats with the highest rate of detection in mature conifer with mixed understory (42.08 TKD) followed by open aspen (32.08 TKD) and mature conifer with open understory (28.44 TKD; Table 5.5-5).

### *Rodents*

The Red Squirrel was the most frequently detected rodent and second most frequently detected species overall with 161 tracks recorded 1.73 TKD (calculated across all transects). Red Squirrel tracks were detected in all functional habitats except open juniper, open wetland, riparian shrub and non-riparian shrub. The highest density of Red Squirrel track detections was in mature conifer with mixed understory (4.38 TKD) followed by mature conifer with open understory (2.34 TKD) and open aspen (2.23 TKD; Table 5.5-5).

There were six detections of mice/voles equating to an overall TD of 0.06 TKD (calculated across all transects). Mice/vole tracks were only detected within the mature conifer with mixed understory functional habitat (0.42 TKD; Table 5.5-5). It is likely that this species group would have been under recorded as most mice and vole species in the winter create trails and tunnels through vegetation and under the snow and so trail detection for this group would be expected to be low.

***Ptarmigan/Grouse***

Ten tracks of ptarmigan/grouse were detected, resulting in an overall TD of 0.11 TKD (calculated across all transects). The highest densities of ptarmigan/grouse were recorded in deciduous pole sampling (0.34 TKD) and open stunted / regenerating conifer (0.29 TKD) functional habitats (Table 5.5-5).

### 5.5.3 Summary of Observations

In total, 11 species (or species groups) were detected during the winter tracking survey. The most frequently detected species was Snowshoe Hare (in all functional habitats), followed by Red Squirrel, American Marten and Ermine. The mature conifer with mixed understory functional habitat had the highest overall wildlife track density, followed by open aspen, then mature conifer with open understory (Table 5.5-5).

No Moose were detected during the survey and this aligns with the wildlife camera results where no Moose were detected in November by the cameras located along wildlife trails (although there were three detections of Moose in November by wildlife cameras located at mineral licks). Conversely, the wildlife cameras had detected hundreds of Caribou moving around the southern perimeter of Hudgeon Lake in early November, 2017 but there were no detections of Caribou by wildlife cameras that occurred during the same time period that the wildlife tracking survey was in progress (between November 18 and 22, 2017). This illustrates the point that wildlife track surveys provide useful data when sufficient spatial effort is employed, but that they provide data over a limited period of time (typically days), whereas wildlife cameras can provide useful time series data for long, continuous periods of time (e.g., multiple years), but that the data have a limit spatially. These two studies complement each other well in the overall understanding of wildlife presence and activity.

## 5.6 Late Fall/Early Winter Moose Survey

ELR had recommended to AAM that a winter aerial survey for Moose be completed as a component of the environmental baseline studies program being planned for the remediation process at the Site. It was known from other data collected at Clinton Creek (e.g., remote wildlife camera photographs and observations by field staff) that Moose occur in the Site area for large parts of the year, especially during spring through to fall. Obtaining a more thorough understanding of the Moose populations at the Site and in the surrounding region would provide data to help inform the environmental assessment of the preferred mine remediation option.

Environment Yukon periodically completes large scale moose surveys, and one had been planned for the early winter of 2017 in the west Dawson West Moose Management Unit (MMU), large area that includes the Site. Following discussions with Environment Yukon, ELR recommended that for cost efficiency and to allow for easy comparison with regional data, that it would be most effective for AAM to support the Environment Yukon regional survey rather than complete a standalone survey. Accordingly, ELR, AAM, and Environment Yukon worked together to incorporate the collection of Moose data for the Clinton Creek Site into the larger Dawson West MMU survey organized and executed by Environment Yukon.

The survey was completed in November of 2017 and the survey and data analytical methods used by Environment Yukon are summarized in the following sections.

### 5.6.1 Methods

#### *5.6.1.1 Pre-Field Planning and Survey Area Definition*

During initial survey planning, Environment Yukon (EY) divided the Dawson West MMU survey area into 607 uniform square blocks of 4 km by 4 km (16 $km^2$) that the overall survey would be based on. Because of the way large scale model-based surveys work, however, simply surveying the MMU would not necessarily provide the resolution required for the Site itself. This is because a certain level of effort (surveyed blocks) is required within any given area to provide enough statistical confidence to estimate population metrics for that area. Accordingly, for the Clinton Creek Site the intent was to 1) develop a focal regional study area (RSA) as a subset of the MMU for which EY could survey more intensively, thereby being able to provide population metrics specific to the Site region, which could then be compared to the MMU as a whole, and 2) to define a series of blocks overlapping with the Site infrastructure where each block could be surveyed at 100% intensity to collect data on Moose occurrence at the time of the survey.

The RSA as defined in Section 3.2.2 of this report was developed for assessing Moose population metrics in relation to the Site. This included the entirety of GMS 3-01 and a portion of GMS 3-02, totaling 83 blocks or 1,328 $km^2$ of total area (Figure 3.2-2). The target was to survey a sufficient number of blocks within this RSA to be able to calculate Moose population metrics at a sufficient confidence level.

Nine survey blocks overlapped directly with the LSA and existing Site infrastructure area, including the access road to the Site from the Fortymile River Bridge. These nine blocks made up the intensive survey area, and the target was to fully survey these blocks to provide data on moose habitat use at the Site at the time of the survey (Figure 3.2-2).

Environment Yukon's overall target for the Dawson West MMU was to survey about one third of the blocks within the Dawson West MMU survey area (about 200 blocks).

#### *5.6.1.2 Field Survey Methods*

During the planning process, the survey blocks were assigned a stratification of having high, moderate, low or very low anticipated Moose numbers based on known landscape characteristics and prior local knowledge of the surveyors. In some cases more information was required to refine the assignment of the stratification level, in which case a pre-census stratification (designation) survey was completed where three observers overflew the survey blocks in question using a fixed-wing aircraft (Cessna 206), and with a search intensity of between 0.12 to 0.17 minutes/$km^2$. These blocks were then stratified based on the number of Moose observed, tracks, the habitat and available local knowledge.

Stratification data was used throughout the survey to determine which blocks to sample during the survey process, in conjunction with the ongoing data as it was collected. An iterative process was used to select blocks to be surveyed based on the following criteria:

Initially, landscape characteristics, local knowledge and information from the stratification survey were used to generate a map of blocks to be surveyed in the first few days of the survey. This first phase of survey blocks were distributed across the survey area and covered a range of available habitat and moose densities anticipated by the survey crew.

Survey data from the first phase of the survey were used to fit the best model describing moose abundance in the surveyed blocks. The model was then used to predict the number of Moose in the remaining unsampled blocks. The survey blocks to be flown on subsequent days were selected mainly based on where the level of uncertainty in the model predictions was greatest. This process of adding the previous day's data to the model to predict Moose densities and indicate the blocks that should be surveyed the following day.

This iterative process was continued in order to sample the blocks with the greatest uncertainty (differences between the model prediction values and the estimates based on local knowledge or incidental observations).

During the main portion of the Moose survey, helicopters were used (Bell 206) using three observers and a pilot, with an attempt to count every Moose within the selected survey blocks at a survey intensity of about two minutes per $km^2$. All observed Moose were classified by age (adult or calf) and sex. It was also possible to reliably distinguish yearling bulls from adults based on antler size, and so the total number of yearlings in the population was also estimated.

#### *5.6.1.3 Data Analysis and Model Structure*

Data collected from the Moose survey were used as input to a predictive model to obtain Moose population and composition estimates for a given area using a PSCL and VGAM software package for R models (Zeiles *et al.* 2008, Yee 2010). These were used to generate the following population estimates and metrics for the defined study areas:

- Total predicted population
- Total number of large bulls
- Total number of calves
- Total number of cows
- Total number of small bulls
- Total number of yearlings
- Total number of mature cows
- Total number of cows with one calf
- Total number of cows with two calves
- The number of calves per 100 adult cows
- The number of yearlings per 100 adult cows
- The number of adult bulls per 100 adult cows
- The proportion of large bulls in the Moose population
- The proportion of mature cows in the Moose population
- The proportion of yearlings in the Moose population
- The proportion of calves in the Moose population
- Yearling recruitment
- Twinning rate (the proportion of cows with calves that had twins)

The model also uses a figure of total habitable area in its calculations, which adjusts the model total area to exclude habitats such as water bodies, steep slopes, and areas above treeline that are not considered to provide suitable habitat. This is done to improve the quality of population metrics.

During the analysis, a sightability correction factor (SCF) is applied to the data to correct for moose that may not have been observed within surveyed blocks. As some moose are missed by observers during aerial surveys, correction factors are developed by re-surveying known areas several times at a higher search intensity to develop a ratio of how many moose had been missed. For the 2017 Dawson West MMU survey a SCF from the recent Dawson Goldfields MMU survey was used by EY.

The full details of the model inputs, functions and co-variates will be available from Environment Yukon when the survey paper is produced and made available to the public in the future

### 5.6.2 Results

The Environment Yukon Moose survey was completed in November 2017 under generally good weather conditions. Visibility was high to moderate with good light, except on the last two days when there were overcast conditions. Low cloud was sometimes present along the Yukon River or surrounding the higher mountain peaks. The temperature ranged from -10 to -35°C and snow cover was generally complete and fresh (<4 days old) in most surveyed blocks and 15 to 90 cm deep.

Environment Yukon surveyed 167 blocks out of a total of 607 survey blocks (28%) over ten days between November 10 and 19, 2017. The total area considered to be habitable by Moose in the MMU was 9,095 $km^2$ of the total of 9,255.9 $km^2$ (Table 5.6-1)

Within the Site RSA (GMS 3-01 and the northern portion of GMS 3-02), 36 blocks were surveyed out of a total of 83 (43%). The total area considered to be habitable by Moose in the RSA was 1,234 $km^2$ (of 1,328 $km^2$ total) of which 576 $km^2$ was surveyed (47%). EY was not able to provide analysis results for the RSA as one single area, and so the results for GMS 3-01 and the northern portion of GMS 3-02 are provided separately here for the purpose of this report.

Local to the Site, EY also surveyed 8 of the 9 total blocks that had been included in the intensive Site survey area. During the survey EY decided that one of the nine blocks overlapped too much with the Yukon and Fortymile Rivers and so that one block was not surveyed, allowing more survey effort to be directed elsewhere. The remaining eight blocks that overlapped with the Site were surveyed at 100% intensity.

Table 5.6-1 provides a summary of the total Moose survey effort for the entire Dawson West MMU survey, as well as the RSA and local Site area that were agreed upon as part of the terrestrial studies program. For the MMU in total, the breakdown of blocks sampled per probability strata is also presented.

**Table 5.6-1: 2017 Dawson West Early Winter Moose Survey Effort by Study Area**

| Metric | Dawson West MMU Survey Area | RSA | | Clinton Creek Site Area |
|---|---|---|---|---|
| | | GMS 3-01 | Northern GMS 3-02 | |
| Total Number of Blocks in Area | 607 | 45 | 38 | 9 |
| Total Number of Block Surveyed | 167 | 18 | 18 | 8 |
| % of Blocks Surveyed | 28 | 40 | 47 | 89 |
| Number of Very High Probability Blocks Surveyed | 60 | - | - | - |
| Number of High Probability Blocks Surveyed | 77 | - | - | - |
| Number of Medium Probability Blocks Surveyed | 17 | - | - | - |
| Number of Low Probability Blocks Surveyed | 13 | - | - | - |

Table 5.6-2 provides a summary of Moose population and composition estimates for the entire Dawson West MMU, the two components of the Site RSA, and for the Clinton Creek Site Area. Moose composition data estimates for GMS 3-01 and the northern section of GMS 3-02 were calculated by the model, but were provided with caution as these areas, in isolation, are too small to provide statistically robust data (Environment Yukon, unpublished data). No Moose composition data was provided for the eight surveyed blocks in the Clinton Creek Site Area as this area is extremely small and only two Moose (two lone cows) were observed among all eight surveyed blocks.

All the estimates presented in Table 5.6-2 are based on a confidence interval of 90%, meaning that there is 90% confidence that the estimates predicted by the model fall within a low and high range and that the estimates presented are based on the median (50%) value within that range. All the population estimates, including the range of estimates and confidence intervals provided by Environment Yukon, are appended to this report (Appendix A).

**Table 5.6-2: 2017 Early Winter Moose Survey Population Estimates and Metrics for the Dawson West MMU, RSA, and Clinton Creek Site Area**

| Model Outputs | Dawson West MMU Survey Area | RSA | | Clinton Creek Site Area[A] | Yukon Territory Average |
|---|---|---|---|---|---|
| | | GMS 3-01 | Northern GMS 3-02 | | |
| Total Habitable Area (km$^2$) | 9,095.3 | 669.9 | 564.4 | 129.0 | - |
| Number of Moose per 1,000 km$^2$ of Habitable Area | 188.9 | 210.6 | 389.8 | 16.3 | 100-250 |
| Total Number of Moose | 1,717.8 | 141.0 | 220.0 | 2.1 | - |
| Total Number of Large Bulls | 530.5 | 33.7 | 67.4 | 0 | - |
| Total Number of Calves | 174.7 | 11.6 | 20.0 | 0 | - |
| Total Number of Cows | 914.7 | 88.4 | 124.2 | 2.1 | - |
| Total Number of Small Bulls | 94.7 | 5.3 | 10.5 | 0 | - |
| Total Number of Yearlings | 189.5 | 10.5 | 21.1 | 0 | - |
| Total Number of Mature Cows | 821.0 | 82.1 | 113.7 | - | - |
| Total Number of Cows with One Calf | 150.5 | 11.6 | 15.8 | 0 | - |
| Total Number of Cows with Two Calves | ***11*** | 0.0 | 2.1 | 0 | - |
| Number of Calves/100 Adult Cows | 21.4 | ***14.61*** | ***17.76*** | - | 10-50 |
| Number of Yearlings /100 Adult Cows | 23.15 | ***13.33*** | ***18.64*** | - | 5-40 |
| Number of Adult Bulls/100 Adult Cows | 64.77 | ***40.91*** | ***59.17*** | - | 27-117 |
| % of Large Bulls in Population | 31 | ***24*** | ***30*** | - | - |
| % of Mature Cows in Population | 48 | ***59*** | ***51*** | - | - |
| % of Yearlings in Population | 11 | ***8*** | ***10*** | - | - |
| % of Calves in Population | 10 | ***9*** | ***9*** | - | - |
| Yearling Recruitment[B] | 0.12 | ***0.09*** | ***0.1*** | - | - |
| % Twinning Rate[C] | 7 | ***0*** | ***12*** | - | - |

*Notes:*

*Values in **bold italic** font should be treated with caution either because of the low numbers encountered during the survey or because of the relatively small geographical area being used in isolation for the estimates.*

*- = Metric not calculated due to insufficient data*

*[A] Population composition estimates for the Clinton Creek Site Area survey blocks have not been provided as the geographical area is too small and the actual number of Moose observed is too low to provide robust estimates.*

*[B] The number of yearlings per 100 adult cows*

*[C] Of all the cows that had calves, the percentage of cows that had twins.*

Moose densities in the Yukon generally range between 100 and 250 Moose/1,000 km$^2$ (Environment Yukon 2016b). Both the GMS 3-01 portion of the RSA (the area that includes the Clinton Creek Site) and the entire Dawson West MMU were found to have Moose densities that fall within this territorial average density range (210.6 and 188.9 Moose/1,000 km$^2$, respectively). The GMS 3-02 portion of the RSA (located to the south of the Site) had a higher than average Moose density at 389.8 Moose/1,000 km$^2$.

While the Moose population metrics calculated for GMS 3-01 should be viewed with caution (because of the relatively small area), the results suggest that this area has mixed population health. For example, the number of bulls per 100 cows in this area is 40.91 (Yukon range is 27 to 117 bulls per 100 adult cows for areas that are hunted). Population management intervention is likely to occur when the ratio of bulls to 100 adult cows drops below 30 (Environment Yukon 2016b). The estimated number of calves per 100 adult cows (14.61) was also near the low end of the Yukon range of 10 to 50 calves per 100 adult cows. Additionally, the estimated number of yearlings per 100 adult cows (13.33) was also near the low end of the Yukon range of 5 to 40 (Environment Yukon 2016b), and is lower than that for the entire MMU (23.15, indicating slightly above average recruitment for the MMU), although the numbers can vary widely year to year (Environment Yukon 2016b).

Along with a much higher population estimate, the population health metrics for the RSA portion of GMS 3-02 were also higher than for GMS 3-01. For example, the number of bulls per 100 cows was 59.17 (64.77 in the MMU) and the estimated number of calves per 100 adult cows was slightly higher (17.76), but still below the value of 21.4 for the MMU. A similar trend was noted for the estimated number of yearlings per 100 adult cows; 18.64 compared to 23.15 for the MMU.

### 5.6.3 Summary of Observations

Only two Moose (individual cows) were observed within the eight survey blocks that overlap the Clinton Creek Site Area (this equates to an estimated density of 16 Moose/1,000 km$^2$). This low Moose count fits with the wildlife camera results, with no Moose having been detected in November by the cameras located along wildlife trails (although there were three detections of Moose in November by wildlife cameras located at mineral licks). In addition, no Moose tracks were detected during the wildlife track survey that overlapped with the period of time of the aerial Moose survey. Typically, Moose move to higher ground in November (which helps with detecting and counting the Moose) and so these results reinforce the importance of looking at the overall Moose densities across a wider regional area. The camera, aerial survey, and winter track study also help to provide multiple lines of evidence to show the seasonality of habitat use in the Site by Moose during the year.

From the region, the two portions that comprise the RSA (GMS 3-01 and part of GMS 3-02) and overlap with the LSA, Moose density estimates were 210.6 and 389.8 Moose/1,000 km$^2$, suggesting healthy, and average to above-average numbers.

# 6. Species of Conservation Concern Identified at the Clinton Creek Site

Three bird species and two mammal species of conservation concern were identified during the various survey conducted at the Clinton Creek Site. These species were the Red-necked Phalarope, Horned Grebe, Peregrine Falcon, Grizzly Bear and Wolverine. The conservation status and other additional information for each of these species is provided below.

## 6.1 Red-necked Phalarope

Three Red-necked Phalarope were detected near the west end of Hudgeon Lake on June 3, 2017 during a waterfowl encounter transect. The three birds were observed foraging as a group. This species is listed as "No Status" on the Species at Risk Public Registry (Government of Canada 2018) under SARA, and is listed as "Special Concern" by COSEWIC. "Special Concern" is defined as "a wildlife species that may become a threatened or endangered species because of a combination of biological characteristics and identified threats" (Environment Canada 2009).

The Red-necked Phalarope is a migratory species that typically arrives in central Yukon to breed and rear young between mid to late May and leaves the Yukon between late July to mid-August (Alexander *et al.* 2002) to migrate south to Mexico and Central America. Typical breeding habitat includes lakes and wetlands associated with the Arctic tundra or tundra-forest boundary. The red-necked Phalarope's diet typically consists of aquatic invertebrates and some flying insects and the birds often swim in small circles to help draw aquatic insects to the surface (Cornell 2018); this behaviour was observed by ELR on Hudgeon Lake.

The three Red-necked Phalaropes observed on site were only seen on one day (encounter transects were conducted on the previous or subsequent days with no observations). This indicates that the birds were likely migrating north to breed and used Hudgeon Lake as a temporary resting and foraging location.

## 6.2 Horned Grebe

One Horned Grebe was observed on both June 3 and June 5, 2017 on Hudgeon Lake during waterfowl encounter transect surveys. Horned Grebes are listed as "Special Concern" both under SARA and by COSEWIC. This species is migratory and typically arrives in central Yukon by the third week of May and departs for wintering grounds (west coast North America and the southeast U.S.A.) by late August (Alexander *et al.* 2003). Horned Grebes typically feed on aquatic insects, fish, crustaceans and other small aquatic animals. Although it is possible that this species breeds at Hudgeon Lake, it is more likely that the individual detected was using Hudgeon Lake as a resting and foraging stopover en route to more suitable habitat as this species generally prefers shallow lakes and wetlands (Cornell Lab of Ornithology 2018) and Hudgeon Lake is known to be over 30 m deep in some locations (ELR, unpublished data).

## 6.3 Peregrine Falcon

Two Peregrine Falcons were observed at the northern edge of the Porcupine Pit Lake quarry on June 29, 2016. On July 24, 2016 one bird was observed at the Porcupine Pit Lake quarry and a second one was heard calling from the pit but not observed. In 2018, one adult Peregrine Falcon was observed at the northeast side of Porcupine Pit Lake quarry on June 15 while the ELR crew walked along the eastern perimeter of the pit. In both years, efforts were made to locate a nest in the pit quarry but none were found. In June 2016, residents of the Clinton Creek Town Site told ELR field staff that Peregrine Falcons had been seen at the Porcupine Pit Lake quarry during the previous twelve years but not necessarily every year.

Peregrine Falcons are listed as "Special Concern" on the Species at Risk Pubic Registry (Government of Canada 2018) under SARA but listed as "Not at Risk" by COSEWIC. "Not at Risk" is defined by COSEWIC as "A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances" (Environment Canada 2009).

Peregrine Falcons are migratory and typically arrive in the Yukon from mid-April and depart for the southern U.S.A. and Mexico from early September (Alexander *et al.* 2003). Peregrine Falcons usually create nests or shallow scrapes on cliff ledges and human-made structures including buildings, bridges and in quarries. They feed on a large variety of birds including waterfowl, gulls and songbirds and are also known to eat bats and steal prey from other raptors.

Based on the observations of the Peregrine Falcons in 2016 and 2018 and the observations shared by the residents of the Clinton Creek Town Site, ELR believes that Peregrine Falcons use the Porcupine Pit Lake quarry most years to breed and rear young.

### 6.4 WOLVERINE

There were 11 detections of Wolverine by wildlife cameras and one track detection during the wildlife track survey on Site. Wolverine are listed under SARA and COSEWIC as "Special Concern" which is defined as "a wildlife species that may become a threatened or endangered species because of a combination of biological characteristics and identified threats" (Environment Canada 2009). Wolverine are typically elusive, solitary animals with home ranges than extend to 1,500 km$^2$ for male Wolverines and up to 400 km$^2$ for females, including both tundra and forested habitats. Wolverines are carnivores, opportunistic hunters and scavengers and prey on smaller mammals year-round (e.g., Snowshoe Hare and rodents) as well as feed on the carcasses of larger animals (e.g., Moose and Caribou). Females typically den among large rocks and boulders, in snow holes or under logs, and prefer denning habitats where the snow lasts through to April (COSEWIC 2014). Two to three young (kits) are typically born between February and April (Alaska Department of Fish and Game 2008).

### 6.5 GRIZZLY BEAR

Grizzly Bears were detected 69 times at non-mineral lick cameras during the remote wildlife camera survey, and several observations of Grizzly Bears were made by ELR staff during various field events between 2016 and 2018. The western population of Grizzly Bears is listed under SARA and by COSEWIC as "Special Concern". Grizzly Bears are large omnivores (generally 45 to 385 kg) and can live in a range of habitats from forests through to sub-alpine and alpine, depending on the availability of food. Their diet will vary according to the habitat they are in and will include a variety of berry species, plants with starchy roots (e.g., *Hedysarum* spp.), horsetail (*Equisetum* spp.), Ground Squirrels, Hoary Marmots, salmon, newborn Moose and Caribou, as well as carcasses from the kills of other wildlife (Government of Yukon 2019b).

Yukon Grizzly Bears will spend between five and eight months in winter dens, typically between October and April, and males generally emerge before females. The reproduction rate of Grizzly Bears in the north is characteristically low as they typically breed for the first time at eight years old and then every three to four years thereafter (Government of Yukon 2019b). Between one and four cubs are born in the dens between January and February.

# 7. CLOSURE

Ecological Logistics & Research Ltd. prepared this terrestrial existing conditions report for the Government of Yukon, Assessment and Abandoned Mines Branch. This report summarizes the efforts and results of a wildlife study program at the Clinton Creek Site from 2016-2018. We trust this report meets the needs of describing this work at this time, but please do not hesitate to contact the undersigned should you require further information or clarification.

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## Personal Communication

Hamm, E. 2019. Project Manager, Assessment and Abandoned Mines Branch. Email communication regarding on-site human activities during May and June 2017 and 2018. March 6, 2019.

## PHOTOGRAPHS


**Photo 1:** View of a cow Moose travelling down valley, taken by wildlife camera #1 on July 7, 2018.


**Photo 2:** View of Black Bear taken by wildlife camera #1 (near Clinton Creek and downstream of the mine site) on July 7, 2018.


**Photo 3:** View of a Grey Wolf taken by wildlife camera #3. Photo taken on April 11, 2017.


**Photo 4:** View of a cow and calf Moose taken by wildlife camera #3. Photo taken on July 31, 2016.


**Photo 5:** View of a Wolverine travelling up valley, taken by wildlife camera #5. Photo taken on April 18, 2018.


**Photo 6:** View of a Canada Lynx travelling down valley, taken by wildlife camera #5. Photo taken on May 4, 2018.


**Photo 7:** View of a Grey Wolf travelling up valley, taken by wildlife camera #6. Photo taken on April 27, 2017.


**Photo 8:** View of a Grizzly Bear travelling down valley, taken by wildlife camera #6. Photo taken on June 7, 2017.


**Photo 9:** View of Caribou travelling up valley, taken by wildlife camera #7. Photo taken on November 2, 2017.


**Photo 10:** View of a Grey Wolf travelling down valley, taken by wildlife camera #7. Photo taken on June 4, 2018.


**Photo 11:** View of a bull Moose travelling down valley, taken by wildlife camera #9. Photo taken on September 15, 2016.


**Photo 12:** View of a bull Caribou travelling up valley, taken by wildlife camera #9. Photo taken on April 2, 2017.


**Photo 13:** View of a Canada Lynx travelling up valley, taken by wildlife camera #14. Photo taken on March 22, 2017.


**Photo 14:** View of a sow Black Bear and two cubs travelling up valley, taken by wildlife camera #14. Photo taken on July 24, 2016.


**Photo 15:** View of an American Marten taken by wildlife camera #11. Photo taken on October 26, 2017.


**Photo 16:** View of a cow Moose travelling up valley, taken by wildlife camera #11. Photo taken on July 5, 2017.


**Photo 17:** View of a Grizzly Bear travelling up valley, taken by wildlife camera #10. Photo taken on July 7, 2017.


**Photo 18:** View of Caribou travelling down valley, taken by wildlife camera #10. Photo taken on June 4, 2018.


**Photo 19:** View of two rutting Caribou taken by wildlife camera #12. Photo taken on November 7, 2017.


**Photo 20** View of a bull Moose travelling down valley, taken by wildlife camera #12. Photo taken on May 26, 2018.

**Photo 21:** View of deciduous pole sapling functional habitat at the edge of the disused airstrip (transect 6). Photo taken on November 18, 2017.

**Photo 22:** View of mature deciduous forest at the lower reaches of Clinton Creek (transect 19). Photo taken on November 21, 2017.

**Photo 23:** View of mature conifer with mixed understory functional habitat, north of the mine access road (transect 13). Photo taken on November 18, 2017.

**Photo 24:** View of mature conifer with open understory functional habitat, north of the mine access road (transect 14). Photo taken on November 18, 2017.

**Photo 25:** View towards open aspen functional habitat, west of the Fortymile River (transect 24). Photo taken on November 21, 2017.

**Photo 26:** View of open/stunted regenerating conifer functional habitat. West of Wolverine Creek (transect 26). Photo taken on November 20, 2017.

**Photo 27:** View of open juniper functional habitat (the juniper is under the snow). Photo taken on November 19, 2017.

**Photo 28:** View of shrub thicket functional habitat near Porcupine Pond (transect 22). Photo taken on November 20, 2017.

**Photo 29:** View of riparian shrub functional habitat adjacent to Wolverine Creek (transect 8). Photo taken on November 19, 2017.

**Photo 30:** View of open wetland functional habitat adjacent to Clinton Creek (transect 7). Photo taken on November 19, 2017.

**Photo 31:** View of non-riparian shrub functional habitat near Porcupine Pond (transect 22). Photo taken on November 20, 2017.

**Photo 32:** View of Ermine tracks near Wolverine Creek (transect 8). Photo taken on November 19, 2017.

**Photo 33:** View of Northern River Otter trail above the Fortymile River (transect 24). Photo taken on November 21, 2017.

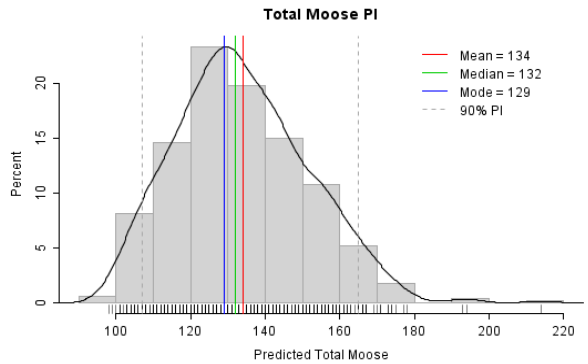
**Photo 34:** View of Caribou trail on the north side of the Site access road (transect 30). Photo taken on November 22, 2017.

**Photo 35:** View of Canada Lynx track (centre) near the disused airstrip (transect 5). Photo taken on November 18, 2017.

**Photo 36:** View of bounding Snowshoe Hare trail on the south side of Clinton Creek (transect 27). Photo taken on November 22, 2017)

# APPENDIX A: GOVERNMENT OF YUKON, DEPARTMENT OF ENVIRONMENT. MOOSE DATA FOR THE DAWSON WEST MMU, NOVEMBER 2017.

# GMS 301




GMS 301: 45 Survey units
18 Survey units samp
83 moose counted (2

| | No SCF Results | | | SCF Results using SCF 1.0526* | | |
|---|---|---|---|---|---|---|
| | 5% | **50%** | 95% | **50% (SCF =** | **Lower CI** | **Higher CI** |
| **Total Moose** | 109 | **134** | 166 | **141.0** | 114.7 | 174.7 |
| **Total Area (km$^2$)** | 669.9 | 669.9 | 669.9 | 669.9 | | |
| **Density Total Area (moose/1000 k** | 162.7 | 200.0 | 247.8 | **210.6** | | |

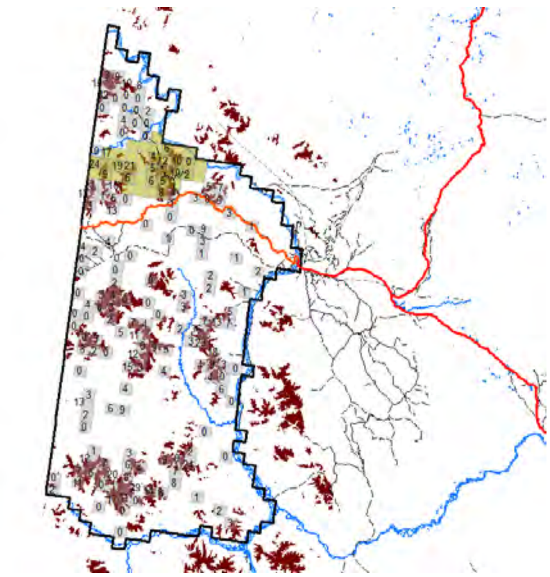
Area very small - caution with using composition

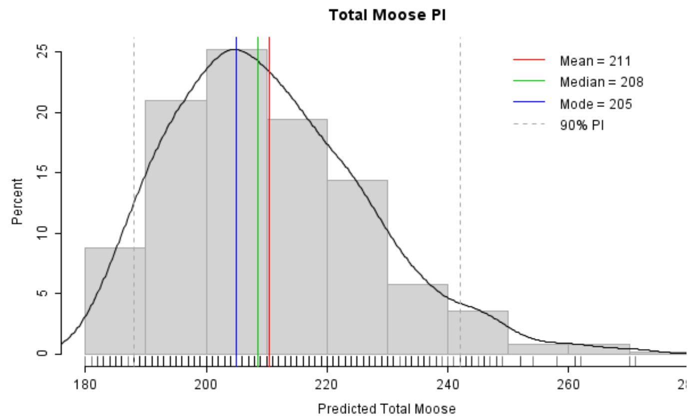
| | 5% | **50%** | 95% | **50% (SCF =** | **Lower CI** | **Higher CI** |
|---|---|---|---|---|---|---|
| **Total.pred** | 110.95 | 133 | 165.05 | **140.0** | 116.8 | 173.7 |
| **Total Large Bulls** | 25 | 32 | 43 | **33.7** | 26.3 | 45.3 |
| **Total Calves** | 7 | 11 | 18 | **11.6** | 7.4 | 18.9 |
| **Total Cows** | 69 | 84 | 104.05 | **88.4** | 72.6 | 109.5 |
| **Total Small Bulls** | 3 | 5 | 9 | **5.3** | 3.2 | 9.5 |
| **Total Yearlings** | 6 | 10 | 18 | **10.5** | 6.3 | 18.9 |
| **Total Mature Cows** | 65 | 78 | 98 | **82.1** | 68.4 | 103.2 |
| **Total Cows with 1 Calf** | 7 | 11 | 17 | **11.6** | 7.4 | 17.9 |
| **Total Cows with 2 Calves** | 0 | 0 | 2 | **0.0** | 0.0 | 2.1 |
| **Calves/100 Adult Cows** | 9.46 | 14.61 | 21.18 | assumes same ratio | | |
| **Yearlings/100 Adult Cows** | 7.79 | 13.33 | 23.53 | assumes same ratio | | |
| **Adult Bulls/100 Adult Cows** | 32.93 | 40.91 | 51.15 | assumes same ratio | | |
| **% Large Bulls** | 0.2 | 0.24 | 0.28 | assumes same ratio | | |
| **% Mature Cows** | 0.54 | 0.59 | 0.64 | assumes same ratio | | |
| **% Yearlings** | 0.05 | 0.08 | 0.13 | assumes same ratio | | |
| **% Calves** | 0.06 | 0.09 | 0.12 | assumes same ratio | | |
| **Yearling Recruitment** | 0.05 | 0.09 | 0.14 | assumes same ratio | | |
| **Twining_Rate** | 0 | 0 | 0.13 | assumes same ratio | | |

# GMS 302 Clinton Creek portion only (Subset 3)

GMS 302 Clinton Creek portion only (N part of GMS 302)

Area is very small - caution with using composition data






Subset 3: 38 Survey units
18 Survey units sampled
169 moose counted (51 adult bulls)

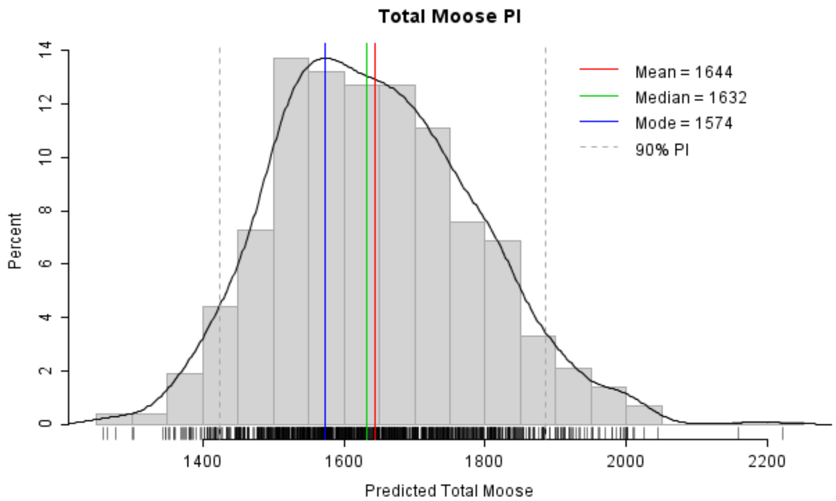
| | No SCF Results | | | SCF Results using SCF 1.0526* | | |
|---|---|---|---|---|---|---|
| | 5% | **50%** | 95% | **50% (SCF =** | **Lower CI** | **Higher CI** |
| **Total Moose** | 188 | 209 | 242 | **220.0** | 197.9 | 254.7 |
| **Total Area (km$^2$)** | 569.9 | 569.9 | 569.9 | **569.9** | | |
| **Total Habitable (km$^2$)** | 564.4 | 564.4 | 564.4 | **564.4** | | |
| **Density Total Area (moose/1000 km$^2$)** | 329.9 | 366.7 | 424.6 | **386.0** | | |
| **Density Habitable Area (moose/1000 km$^2$)** | 333.1 | 370.3 | 428.8 | 389.8 | | |

*as per Dawson Gold Fields MMU results (confirmed by Northern Regional Bio - Sep 18/18

Area very small - caution with using composition

| | 5% | **50%** | 95% | **50% (SCF =** | **Lower CI** | **Higher CI** |
|---|---|---|---|---|---|---|
| **Total.pred** | 189.95 | 211 | 247.05 | **222.1** | 199.9 | 260.0 |
| **Total Large Bulls** | 56 | 64 | 75 | **67.4** | 58.9 | 78.9 |
| **Total Calves** | 16 | 19 | 25 | **20.0** | 16.8 | 26.3 |
| **Total Cows** | 105 | 118 | 137 | **124.2** | 110.5 | 144.2 |
| **Total Small Bulls** | 8 | 10 | 14 | **10.5** | 8.4 | 14.7 |
| **Total Yearlings** | 16 | 20 | 28 | **21.1** | 16.8 | 29.5 |
| **Total Mature Cows** | 96 | 108 | 125 | **113.7** | 101.0 | 131.6 |
| **Total Cows with 1 Calf** | 12 | 15 | 19 | **15.8** | 12.6 | 20.0 |
| **Total Cows with 2 Calves** | 2 | 2 | 3 | **2.1** | 2.1 | 3.2 |
| **Calves/100 Adult Cows** | 14.85 | **17.76** | 21.7 | assumes same ratio | | |
| **Yearlings/100 Adult Cows** | 14.67 | **18.64** | 25 | assumes same ratio | | |
| **Adult Bulls/100 Adult Cows** | 52.21 | **59.17** | 66.39 | assumes same ratio | | |
| **% Large Bulls** | 0.28 | **0.3** | 0.32 | assumes same ratio | | |
| **% Mature Cows** | 0.48 | **0.51** | 0.54 | assumes same ratio | | |
| **% Yearlings** | 0.08 | **0.1** | 0.12 | assumes same ratio | | |
| **% Calves** | 0.08 | **0.09** | 0.11 | assumes same ratio | | |
| **Yearling Recruitment** | 0.09 | **0.1** | 0.13 | assumes same ratio | | |
| **Twining_Rate** | 0.1 | **0.12** | 0.19 | assumes same ratio | | |

# Dawson West MMU 2017




| | No SCF Results | | | SCF Results using SCF 1.0526* | | |
|---|---|---|---|---|---|---|
| | 5% | **50%** | 95% | **50% (SCF =** | Lower CI | Higher CI |
| **Total Moose** | 1426 | 1632 | 1869 | **1717.8** | 1501.0 | 1967.3 |
| **Total Area (km$^2$)** | 9255.9 | 9255.9 | 9255.9 | **9255.9** | | |
| **Total Habitable (km$^2$)** | 9095.3 | 9095.3 | 9095.3 | **9095.3** | | |
| **Density Total Area (moose/1000 km$^2$)** | 154.1 | 176.3 | 201.9 | **185.6** | | |
| **Density Habitable Area (moose/1000 km$^2$)** | 156.8 | 179.4 | 205.5 | **188.9** | | |

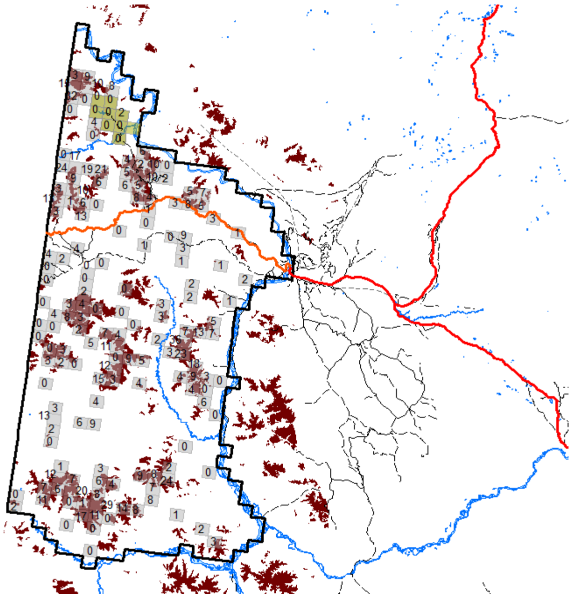
*as per Dawson Gold Fields MMU results (confirmed by Northern Regional Bio - Sep 18/18

| | 5% | **50%** | 95% | 50% (SCF = | Lower CI | Higher CI |
|---|---|---|---|---|---|---|
| **Total.pred** | 1428 | 1630 | 1874.1 | **1715.7** | 1503.1 | 1972.7 |
| **Total Large Bulls** | 441 | 504 | 585.05 | **530.5** | 464.2 | 615.8 |
| **Total Calves** | 140 | 166 | 200.05 | **174.7** | 147.4 | 210.6 |
| **Total Cows** | 755 | 869 | 1004.05 | **914.7** | 794.7 | 1056.9 |
| **Total Small Bulls** | 77 | 90 | 108 | **94.7** | 81.1 | 113.7 |
| **Total Yearlings** | 154 | 180 | 216 | **189.5** | 162.1 | 227.4 |
| **Total Mature Cows** | 673.95 | 780 | 897.1 | **821.0** | 709.4 | 944.3 |
| **Total Cows with 1 Calf** | 121 | 143 | 172 | **150.5** | 127.4 | 181.0 |
| **Total Cows with 2 Calves** | 8 | 11 | 16 | **Sampled size too small to estimate accurately** | | |
| **Calves/100 Adult Cows** | 19.2 | **21.4** | 23.64 | assumes same ratio | | 21.28 |
| **Yearlings/100 Adult Cows** | 20.13 | **23.15** | 26.81 | assumes same ratio | | 23.08 |
| **Adult Bulls/100 Adult Cows** | 59.88 | **64.77** | 70.03 | assumes same ratio | | 64.62 |
| **% Large Bulls** | 0.29 | **0.31** | 0.32 | assumes same ratio | | |
| **% Mature Cows** | 0.46 | **0.48** | 0.49 | assumes same ratio | | |
| **% Yearlings** | 0.1 | **0.11** | 0.12 | assumes same ratio | | |
| **% Calves** | 0.09 | **0.1** | 0.11 | assumes same ratio | | |
| **Yearling Recruitment** | 0.11 | **0.12** | 0.14 | assumes same ratio | | |
| **Twining_Rate** | 0.05 | **0.07** | 0.1 | assumes same ratio | | |

# Clinton Creek Mine Site Local Study Area (Subset 2)

2017 Sample units local to the Clinton Creek Mine Site Study Area

**Note:** Area is so small that using composition data should be avoided



Subset 2: 9 Survey units
8 Survey units sampled
2 moose counted (2 lone cows)

| | No SCF Results | | | SCF Results using SCF 1.0526* | | |
|---|---|---|---|---|---|---|
| | 5% | **50%** | 95% | **50% (SCF =** | **Lower CI** | **Higher CI** |
| **Total Moose** | 2 | 2 | 5 | **2.1** | 2.1 | 5.3 |
| **Total Area (km$^2$)** | 134.1 | 134.1 | 134.1 | **134.1** | | |
| **Total Habitable (km$^2$)** | 129.0 | 129.0 | 129.0 | **129.0** | | |
| **Density Total Area (moose/1000 km$^2$)** | 14.9 | 14.9 | 37.3 | **15.7** | | |
| **Density Habitable Area (moose/1000 km$^2$)** | 15.5 | 15.5 | 38.8 | **16.3** | | |

*as per Dawson Gold Fields MMU results (confirmed by Northern Regional Bio - Sep 18/18