Mount Nansen

2012 Winter Wildlife Tracking Study

Prepared for:

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Whitehorse, Yukon
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EXECUTIVE SUMMARY

Ecological Logistics & Research Ltd. (ELR) was retained by the Yukon Government, Energy, Mines and Resources, Assessment and Abandoned Mines Branch (AAM) to conduct a winter wildlife and track study at the Mount Nansen site, west of Carmacks, Yukon. The primary objective of the study was to collect and document information on the presence, relative abundance, and habitat use by furbearers and other wildlife species within the Mount Nansen site during winter. Information on winter wildlife use in the former mine area is being collected for the eventual fulfillment of baseline data requirements for wildlife as outlined in Section 4.1.9 of the Yukon Environmental and Socio-economic Assessment Board's (YESAB)'s Proponent's Guide to Information Requirements for Executive Committee Project Proposal Submissions.

ELR conducted the Mount Nansen tracking study from March 14-16 and March 23-25, 2012, following snowfall events on March 13 and 22, respectively. A total distance of 37.8 km were surveyed during the two track count sessions at the Mount Nansen site, resulting in a total survey effort of 98.7 km•days when factoring time since the last snowfalls (effort takes into account the track period during which wildlife tracks accumulate in a given area, not simply linear distance). Transects comprised of a total of 155 segments distributed amongst 14 discrete habitat types.

A total of 21 species or species groups were detected during the 2012 tracking study, including 11 species during active transects, and 18 species observed as incidental observations. Species detected included moose, woodland caribou (mountain ecotype), grey wolf, fox, coyote, Canada lynx, porcupine, American marten, fisher, ermine, ptarmigan, spruce grouse, hare, and red squirrel. The overall track density calculated for all species and transects was 6.39 tracks/km/day (TKD) in the study area. Red squirrel and ptarmigan/grouse were detected most frequently, having overall track densities of 3.46 and 1.57 TKD, respectively. Hare had densities of 0.60 TKD, and moose had densities of 0.30 TKD.

Generally, wildlife usage was representative of the habitats observed, and wildlife use in the Mount Nansen area appears to be supported by a moderate abundance of dense conifer and numerous small riparian draws and valleys.

MOUNT NANSEN 2012 WINTER WILDLIFE TRACKING STUDY

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1. Introduction

Ecological Logistics & Research Ltd. (ELR) was retained by the Yukon government, Assessment and Abandoned Mines (AAM) to complete a wildlife tracking study at the Mount Nansen site during the winter of 2012. The abandoned Mount Nansen mine site ('the site') is the location of a gold and silver deposit that was developed and briefly operated as a mine in the late 1990's. AAM has had various studies conducted at the site in recent years with a focus on planning and supporting an upcoming closure and remediation process.

To date, only limited data exists regarding the characteristics of wildlife habitat use in the Mount Nansen area. Accordingly, AAM requested a winter tracking study during 2012 to collect information on wildlife diversity, abundance, and habitat use in the vicinity of the site. Furbearers (i.e. species commonly trapped for fur, including rodents, mustelids, canids, and felids) have a high local value and are likely to be groups of interest during the assessment process; however, there is currently limited data on their occurrence, distribution, or abundance within the mine area.

1.1 Study Area

The Mount Nansen site is located approximately 45 km by road west of the Village of Carmacks, Yukon (Figure 1). The site is located within the Dawson Range, accessible by limited all-season road from Carmacks. Located at the southern extent of the Klondike Plateau Ecoregion, the site is characterized by smooth topped ridges with v-shaped valleys that were within a Beringial area during the most recent glaciation event (YEWG 2004). The site falls within the Dawson Range of mountains, at local elevations ranging from approximately 1,000 to 1,500 metres above sea level.

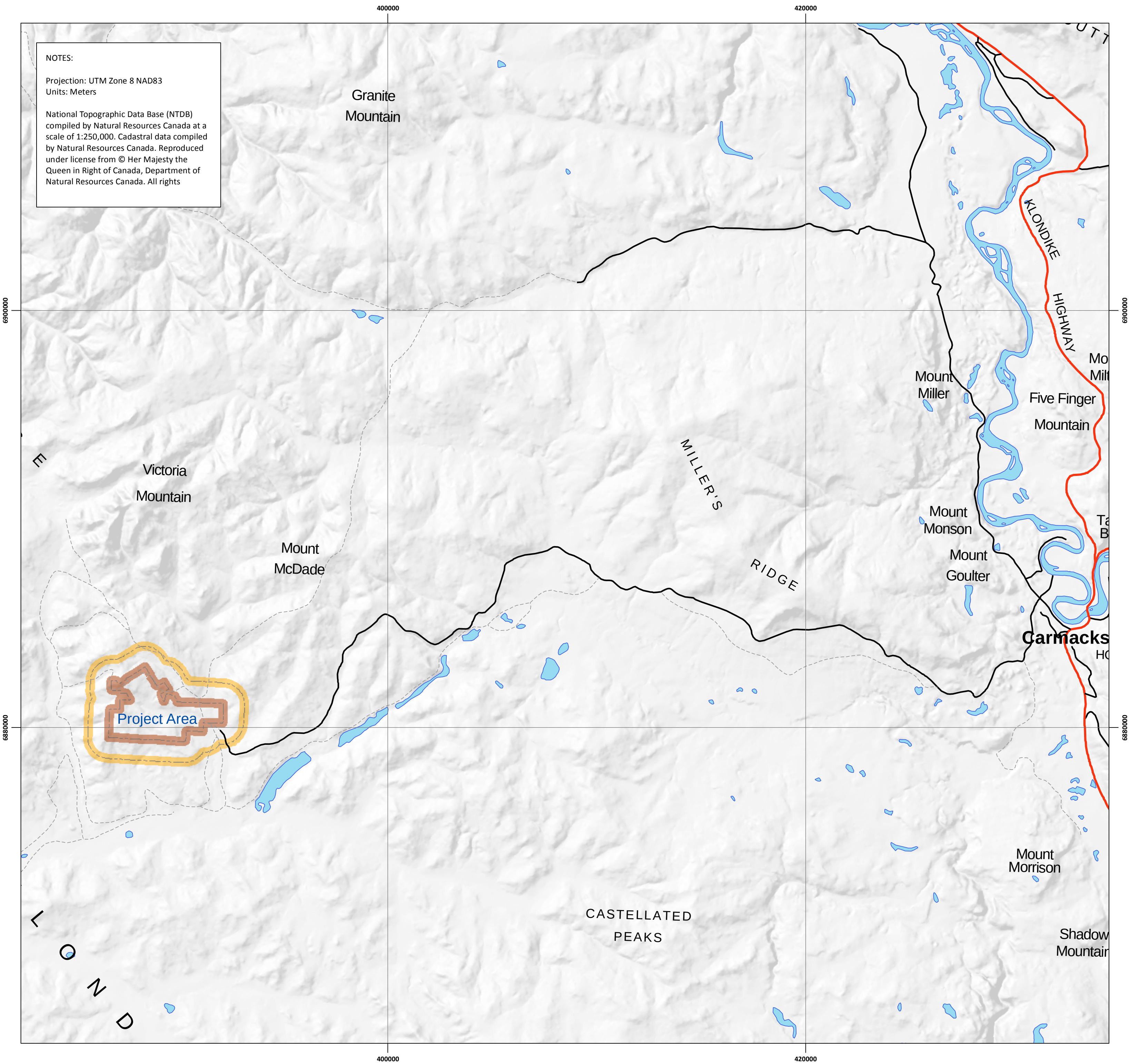
Vegetation in the Mount Nansen area is variable, and includes communities typical of the Boreal, Subalpine, and Alpine ecozones. Generally, the site is dominated by conifer forest cover (primarily white spruce) and shrub communities (dominated by willow and dwarf birch). Wetlands and riparian/seep areas are dominated by shrub or conifer communities according to criteria such as aspect, elevation, slope, and frequency of disturbance (YEWG 2004).

The extent of the Mount Nansen site being considered for closure and reclamation planning activities is defined by the Order in Council (OIC) boundary created under OIC 2006/205 (i.e. land withdrawn from staking). This area covering 11.2 km^2 includes the Brown-McDade Pit, the tailings facility, camp, and mill site, as well as various access roads, exploration trenches, and associated infrastructure (Figure 2). Two small watercourses associated with the site, Dome Creek and Pony Creek, fall within the OIC boundary.

1.2 Objectives

The primary objective of the Mount Nansen winter tracking study was to collect information on the presence, relative abundance, and habitat use by furbearers and other wildlife species within the Mount Nansen site area during winter.

Information on winter wildlife use at the site is being collected for the eventual fulfillment of wildlife baseline data requirements as outlined in Section 4.1.9 of the Yukon Environmental and Socio-economic Assessment Board's (YESAB) Proponent's Guide to Information Requirements for Executive Committee Project Proposal Submissions.



2012 Mount Nansen Winter Wildlife Tracking Study

Ecological Logistics & Research Ltd.

Client: Yukon

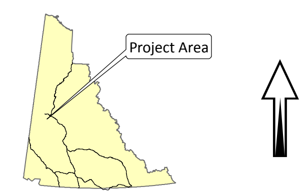
Legend

Roads and Trails

- Limited-use road
- Highway
- Trail
- Water Bodies

Local Boundaries

- OIC Area
- Local Study Area (LSA)



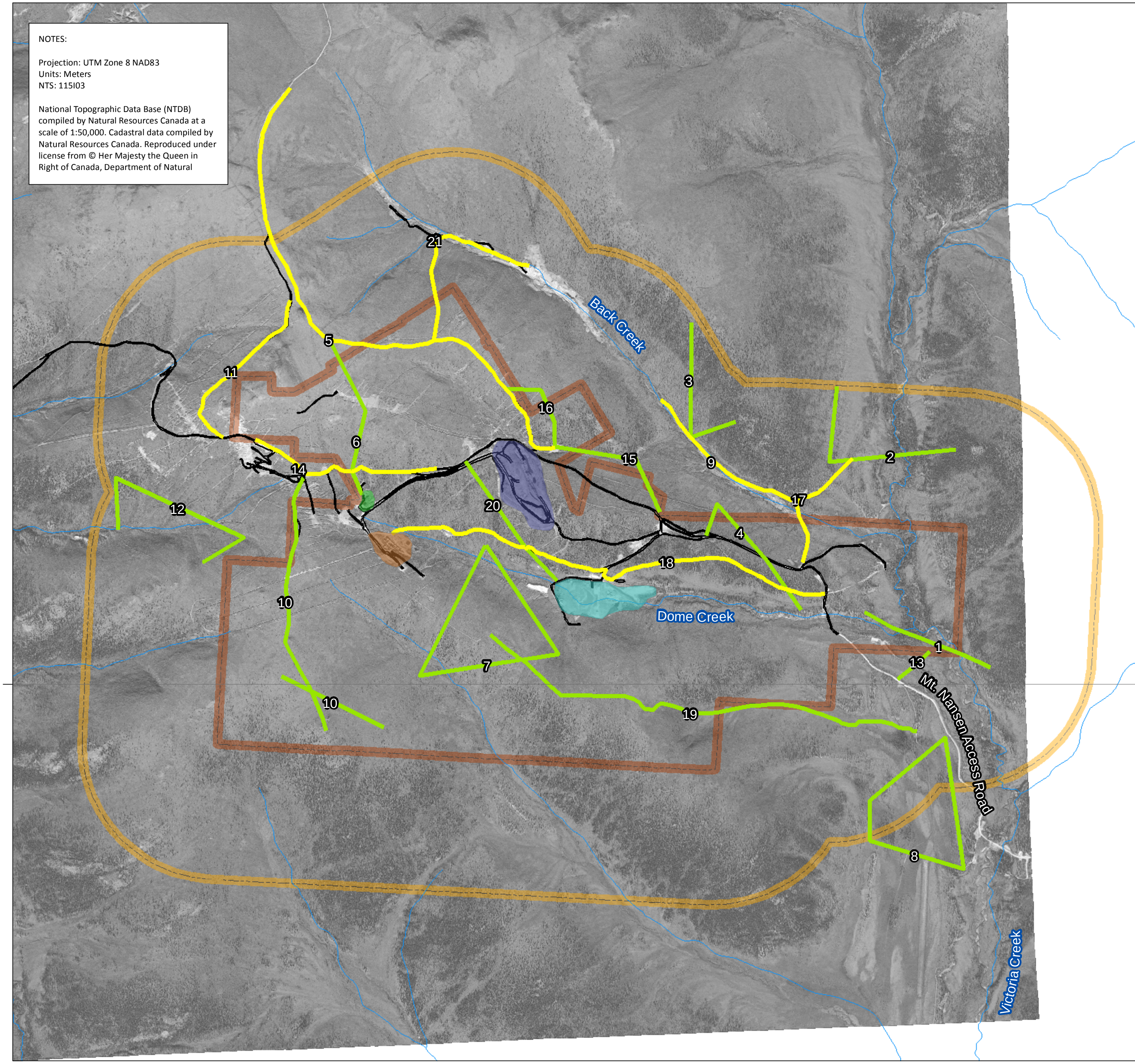
5,200 2,600 0 5,200

Meters

Dec. 10, 2012	Scale: 1:250,000
ELR Project #: 12-123	Rev. #: 2

FIGURE 1

Project Location Overview



2012 Mount Nansen Winter Wildlife Tracking Study

Client:

Legend

- Mt. Nansen Area Roads
- Watercourses
- Water Bodies

Mt Nansen Infrastructure

- Brown-McDade Pit
- Camp
- Mill Area
- Tailings Area

Transect Locations

- Directly through Terrain
- On Un-used Roads/Trails

Local Boundaries

- OIC Area
- Local Study Area (LSA)

Project Area

860 430 0 860
Meters

Dec 10, 2012	Scale: 1:40,000
ELR Project #: 12-123	Rev. #: 2

FIGURE 2

Study Area and Project Track Transect Locations

2. METHODS

2.1 STUDY AREA DELINEATION AND PRE-FIELD TRANSECT LAYOUT

A local study area (LSA) for the 2012 Mount Nansen winter tracking study was established based on the 11.2 km^2 OIC area (within which primary project activities will be centered) with the addition of a 1 km buffer to form a total study area of 31.1 km^2. 1 km is a generally accepted buffer distance for considering local direct effects that have the potential to affect wildlife during future closure activities. The 31.1 km^2 study area also provided an excellent cross-sectional overview of local topography and vegetation habitat types. The OIC and LSA areas are shown in Figure 2.

ELR established a series of transect routes within the LSA prior to conducting the tracking study, from which field studies were intended to be based. These transect routes were established with a focus on:

- Using existing access points where possible (for logistical considerations).
- Providing an adequate cross-section of vegetation habitats within the LSA to provide stratified local-scale information on habitat use. Predictive habitat mapping data developed by EDI Environmental Dynamics Inc. (EDI 2012) for AAM formed the basis for habitat-based transect planning.
- Being of a sufficient total length to provide data on larger-ranging species within the LSA.

A total of 16 3 km transect routes (equilateral triangles with 1 km sides) were established throughout the LSA for use in the tracking study. These transects were oriented to traverse various terrains within the LSA directly, also crossing various roads, trails, and non-linear disturbances within the study area. During implementation of the field program, however; field conditions necessitated the addition of non-triangular transects and the use of unused roads in order to obtain adequate coverage of the LSA (described in Section 3).

2.2 FIELD METHODS

ELR conducted tracking at the site from March 14-16 and March 23-25, 2012, following snowfall events on March 13 and 22, respectively. The intended tracking period for the study was to be between 24 and 72 hours from the most recent snowfall (1-3 days).

Tracking was completed by two experienced biologists, generally working on adjacent portions of single transects to reduce observer bias and maintain proximity for safety reasons. Transects were traversed using snowshoes, backcountry skis and snowmobiles, during which time 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 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 from each other, 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 hare. Older tracks (e.g., crusted over, blown in, or covered by snowfall) were identified where possible and recorded separately as incidental observations. Similarly, visual species sightings and observations of other sign (e.g., scats, beds, etc.) were also recorded as incidental observations.

Pre-planned triangular transects were navigated using a combination of handheld GPS and compass according to pre-established waypoints. Other transects were established along available routes through terrain (using a compass), or along established but un-used trails (i.e. not ploughed, or with no existing human-related tracks). In all cases, actual transect paths were recorded in the field as handheld GPS tracks, while points of interest were recorded as GPS waypoints.

During each transect, vegetation habitat cover data was interpreted and recorded by the observer. Field waypoints were established at each point of change in vegetation habitats (marking the start of a new habitat type), at which time a new segment was also started for data recording (to allow for analysis of tracking data according to habitat type). Pre-defined local habitat data was not available from which to assign local habitat types (e.g. Ecological Land Classification [ELC] polygons), and so ELR established field classifications of habitat according to the most detailed level possible under winter conditions (e.g. conifer vs. shrub, wetland vs. dry/mesic). Detailed information on project habitat classifications is provided in the results section of the report.

2.3 Data Analysis

Spatial data (i.e. GPS tracks and waypoints) from transects were analyzed using ESRI ArcGIS 10 software. Each transect GPS track was superimposed on satellite imagery and segmented according to field habitat observations, waypoint locations, and satellite imagery verification of the habitat type recorded in the field. Segments were 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 was then combined with track count and tracking period data from the field.

For analysis, effort was first calculated over the entire LSA as well as within particular habitats by combining both the distance travelled with the tracking period (the time since last snowfall). This provided a corrected term 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 days (km•days) is calculated according to the following formula:

$$Effort\ (km \bullet day) = Distance\ surveyed\ [km] * Time\ since\ last\ snowfall\ [days]$$

This effort data could then be summarized to determine the total effort in the LSA, in a particular habitat type, or in functional habitat groupings.

Next, for each habitat type identified, track data was standardized for each species (or species group) into units of track density (the number of tracks/kilometer/day or TKD), which is calculated by dividing the number of tracks observed for a species in a particular habitat type by the length of transect in that habitat, and multiplied by the number of days since the last snowfall (as shown below):

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

In order to compare track densities between various habitats in the LSA, transect segment results were grouped according to broad (functional) habitat types (Table 2). This reduced the number of sampling categories and minimized the effects of small sample sizes in less common habitats, thereby increasing the power of the study design and allowing for more meaningful data analysis. Track densities and effort were calculated according to functional habitat groupings.

In order to investigate the potential effect of using unused roads for tracking routes, track densities were also calculated for the dataset with all road transects removed.

3. RESULTS

3.1 SURVEY CONDITIONS AND SUMMARY

Overall, suitable weather conditions were encountered for tracking at the Mount Nansen site, following snowfall events on March 13 and March 22, 2012. Winds were relatively calm, and temperatures favourable for tracking. Very deep snow with limited base did greatly limit tracking efficiency, however. Accordingly, the tracking crew worked where possible to conduct surveys by snowmobile, or to orient the direction of transects such that travel on snowshoe or ski could be conducted efficiently. Snow depths at the site were measured ranging from 43 to 100 cm deep (ground to snow surface).

At the time of survey, high pressure systems dominated the weather in the Mount Nansen area. This calm, sunny weather was good for tracking, but no snowfalls were forecasted to re-start the tracking period. In consideration of these conditions, ELR continued to track on both occasions to beyond the intended 72 hour limit (i.e. as high as 86 hours). One further tracking session had been planned for the site beyond March 25, however temperatures had warmed greatly, and no further snowfall events occurred in the spring of 2012.

3.2 TRACK COUNTS

3.2.1 Effort

A total distance of 37.8 km were surveyed during the two track count sessions at the Mount Nansen site, resulting in a total of 98.7 km•days of survey effort when factoring time since the last snowfalls. These transects comprised of a total of 155 segments distributed amongst 14 discrete habitat types. A summary of track transects is provided in Table 1, while transect locations are shown in Figure 2.

3.2.2 Habitats

When conducting track surveys, it is preferable to establish and organize field transects according to vegetation habitat classifications for a particular area, such as polygons from an ecological land classification (ELC) or terrestrial ecosystem mapping (TEM) program. In the case of the Mount Nansen study, ELR's site transect layout had been based on Predictive Ecosystem Mapping (PEM) that was prepared on behalf of AAM in early 2012 (EDI 2012). Once on site, however, ELR found that the classifications developed through that program did not provide an accurate enough representation of actual local vegetation classifications observed on site. Accordingly, ELR's field program was modified to conduct tracking while also recording vegetation habitat along each transect. As the site was under heavy snow cover during tracking, fine scale habitat observations were not possible (in particular for shrub and alpine communities). Accordingly, units were classified to a higher scale functional level of habitat based on the vegetation observed, as outlined in Table 2, below. A summary of transects according to simplified (i.e. grouped) habitat associations is also provided in Table 3, below.

Table 1: Summary of 2012 Mt. Nansen Track Transect Data

Transect Number	Transect Date	Transect Time		Most Recent Snowfall		Tracking Period		Snow Depth (cm)	Temp. (°C)	Wind* (Beaufort)	Snow Condition*
		Start	End	Date	Time	Hours	Days				
1	15/03/12	09:45	11:44	13/03/12	10:00	48	2.00	54	-8	1	1
2	16/03/12	12:10	13:20	13/03/12	10:00	74	3.08	43	-6	0	2
3	25/03/12	10:05	11:10	22/03/12	00:00	82	3.42	70	-5	0	2
4	14/03/12	15:15	18:10	13/03/12	10:00	29	1.21	68	-5	0	1
5	16/03/12	17:00	17:20	13/03/12	10:00	79	3.29	75	-8	2	3
6	24/03/12	10:30	11:50	22/03/12	00:00	59	2.46	n/a	-10	2	3
7	23/03/12	14:20	15:45	22/03/12	00:00	38	1.58	n/a	-8	2	2
8	15/03/12	12:45	14:09	13/03/12	10:00	51	2.13	55	-10	2	1
9	25/03/12	09:25	09:50	22/03/12	00:00	81	3.38	58	-5	0	2
10	25/03/12	13:48	14:05	22/03/12	00:00	86	3.58	n/a	0	0	3
11	24/03/12	16:00	16:15	22/03/12	00:00	64	2.67	67	0	3	2
12	24/03/12	13:45	15:01	22/03/12	00:00	62	2.58	100	-5	1	2
13	15/03/12	12:29	12:45	13/03/12	10:00	50	2.08	86	-10	2	1
14	15/03/12	16:00	17:00	13/03/12	10:00	54	2.25	66	-10	4	1
15	16/03/12	17:45	18:50	13/03/12	10:00	80	3.33	73	-10	2	2
16	16/03/12	17:30	19:00	13/03/12	10:00	80	3.33	88	-10	3	2
17	16/03/12	11:30	11:45	13/03/12	10:00	74	3.08	70	-8	0	1
18	16/03/12	09:10	11:00	13/03/12	10:00	70	2.92	72	-5	0	2
19	23/03/12	16:50	17:40	22/03/12	00:00	41	1.71	n/a	-10	1	1
20	24/03/12	10:44	12:04	22/03/12	00:00	59	2.46	73	-8	0	1
21	24/03/12	16:15	16:45	22/03/12	00:00	64	2.67	71	0	3	2

**Snow Conditions: 1= fresh, less than 2 days; 2= recent, > 2 days, > 2 cm, not windblown; 3= old, > 4 days OR windblown OR crusted OR melted out*

**Beaufort Scale: 1= 1-3 km/h; 2= 4-6 km/h; 3= 7-10 km/h; 4= 11-16 km/h; 5= 17-21 km/h; 6= 22-27 km/h/ 7= 28-33 km/h; 8= 34-40 km/h*

Table 2: Summary of Vegetation Habitats and Relative Effort as Recorded During the 2012 Mt. Nansen Tracking Survey

Primary Habitat	Habitat Grouping	Mapping Code	Comparable ELC Classification Units (examples)	# Segments Samples	# Km Sampled	#Km•Days Sampled
Forest	Conifer, Dry/Mesic, Sparse Cover	C-D/M-S	White Spruce/Willow	28	6.71	18.52
	Conifer, Dry-Mesic, Dense Cover	C-D/M-D	White Spruce/Feathermoss	11	3.22	9.05
	Deciduous Forest	Dd	Deciduous	4	0.23	0.66
Shrub	Shrub, Dry-Mesic, Mixed with Conifer	S-D/M-C	Willow/White Spruce; Dwarf Birch/Lichen/Subalpine Fir; Dwarf Birch/Subalpine Fir	35	8.64	23.5
	Shrub, Dry-Mesic, Little or No Conifer	S-D/M-O	Willow/Dwarf Birch; Dwarf Birch/Willow	13	4.58	8.36
	Shrub, Alpine, Open	S-Alp-O	Willow-Carex; Dwarf Birch	6	5.70	17.21
Riparian	Riparian Conifer	RP-C	Conifer Riparian	2	0.48	1.25
	Riparian Shrub	RP-S	Willow/Sedge,	13	2.40	6.75
	Riparian or Drainage Seeps, Alpine	RP-SP	Willow Riparian	6	0.33	0.85
Wetland	Wetlands, Open, Conifer Cover	W-C	Wetland	13	3.50	7.06
Disturbed	Linear Disturbance Actively Used	R-A	Disturbed	5	0.07	0.15
	Linear Disturbance, Inactive	R-I	Disturbed	6	0.43	1.42
	Ingrown Linear Disturbance, Inactive	T-I	Disturbed	7	0.07	0.12
	Non-Linear Disturbance	Dist	Disturbed	6	1.41	3.83
Totals				**155**	**37.78**	**98.72**

Table 3: Track Transect Effort Summary According to Grouped Habitats

Habitat Type	# Segments Sampled	Total Distance Sampled (km)	Total Effort (km•days)
Conifer	39	9.93	27.57
Deciduous	4	0.23	0.66
Shrub	24	2.00	5.54
Riparian	21	3.21	8.85
Wetland	54	18.93	49.07
Disturbed – Linear and Non-Linear	13	3.50	7.06
Total	**155**	**37.8**	**98.7**

3.2.3 Observations

A total of 21 species or species groups of mammals and birds were detected during the 2012 tracking study, including 11 species during active transects, and 18 species observed as incidental observations (Table 4). As mice and vole tracks or sign can be indistinguishable from each other, these observations were considered a species group. Willow ptarmigan and spruce grouse were both visually sighted and were therefore each represented in the overall species observation list (Table 4). However, these species were also grouped in the tracking data (as shown in Tables 5-6) as it is often difficult to distinguish between the species solely on tracks.

During active transects across 37.8 km (98.7 km•days of effort) a total of 631 track detections were recorded, resulting in an overall track density in the LSA of 6.39 TKD (all species combined).

Across all habitats (i.e. grouped), red squirrel and ptarmigan/grouse had the highest observed track densities at 3.46 and 1.57 TKD, respectively. Hare were measured at an overall density of 0.60 TKD, and moose at 0.30 TKD.

Summaries of track densities for all species across all habitat types, as well as summaries by habitat and species for all transects and excluding road transects are presented in Tables 5 through 7, respectively. Raw data (excluding incidentals) is given in Appendix A.

Table 4: Wildlife Species Observed During the 2012 Mount Nansen Track Survey

Common Name	Latin Name	Detected on Active Track Transect	Incidental Observation (Old Track or Visual Observation)
Caribou	*Rangifer tarandus*		✓
Moose	*Alces alces*	✓	✓
Fisher	*Martes pennanti*	✓	✓
American Marten	*Martes americana*	✓	✓
Ermine	*Mustela erminea*	✓	✓
Grey Wolf	*Canis lupus*		✓
Red Fox	*Vulpes vulpes*	✓	✓
Coyote	*Canis latrans*	✓	
Canada Lynx	*Lynx canadensis*	✓	
Porcupine	*Erethizon dorsatum*		✓
Red Squirrel	*Tamiasciurus hudsonicus*	✓	✓
Hare	*Lepus americanus*	✓	✓
Mouse/Vole	various	✓	✓
Grouse/Ptarmigan	*Lagopus lagopus, Falcipennis canadensis*	✓	✓
Great Horned Owl	*Bubo virginianus*		✓
Boreal Owl	*Aegolius funereus*		✓
Redpoll	*Carduelis flammea*		✓
Boreal Chickadee	*Poecile hudsonicus*		✓
Common Raven	*Corvus corax*		✓
Grey Jay	*Perisoreus canadensis*		✓

Table 5: Summary of Track Detections and Overall Track Densities from the 2012 Mount Nansen Track Survey

Species	Caribou	Moose	Grey Wolf	Coyote	Red Fox	Canada Lynx	American Marten	Fisher	Ermine	Ptarmigan /Grouse	Porcupine	Hare	Red Squirrel	Mouse/ Vole	Total
Total # Tracks Observed	0	30	0	3	8	1	15	7	7	155	0	59	342	4	**631**
Average Track Abundance (TKD)	0	0.30	0	0.03	0.08	0.01	0.15	0.07	0.07	1.57	0	0.60	3.46	0.04	**6.39**

Table 6: Habitat and Species Track Densities (TKD) and Species Richness from the 2012 Mount Nansen Track Survey

Habitat	No. Species	Total Track Density (TKD)	Caribou	Moose	Grey Wolf	Coyote	Red Fox	Canada Lynx	American Marten	Fisher	Ermine	Ptarmigan /Grouse	Porcupine	Hare	Red Squirrel	Mouse/ Vole
Conifer, Dry/Mesic, Sparse Cover	7	5.62	0	0.32	0	0	0	0	0.11	0.16	0.00	0.54	0	0.76	3.51	0.22
Conifer, Dry-Mesic, Dense Cover	7	20.89	0	0.77	0	0	0	0	0.88	0.11	0.44	0.66	0	1.44	16.58	0
Deciduous Forest	4	32.03	0	0	0	0	0	0	0	0	0	1.53	0	1.53	28.98	0
Shrub, Dry-Mesic, Mixed with Conifer	7	5.02	0	0.38	0	0.09	0.09	0	0.09	0	0.13	2.09	0	0.72	1.45	0
Shrub, Dry-Mesic, Little or No Conifer	3	4.43	0	0	0	0	0	0	0.12	0	0	3.47	0	0	0.84	0
Shrub, Alpine, Open	3	1.63	0	0	0	0.06	0.29	0	0	0	0	1.28	0	0	0	0
Riparian Conifer	3	28.73	0	0	0	0	0	0	0	0	0	1.60	0	3.99	23.14	0
Riparian Shrub	5	7.26	0	0.89	0	0	0	0	0.30	0.44	0	1.78	0	0	3.85	0
Riparian or Drainage Seeps, Alpine	1	1.18	0	0	0	0	0	0	0	0	0	0	0	1.18	0	0
Wetlands, Open, Conifer Cover	4	3.40	0	0.28	0	0	0	0.14	0	0	0	1.27	0	0	1.70	0
Linear Disturbance Actively Used	1	13.52	0	0	0	0	0	0	0	0	0	0	0	13.52	0	0
Linear Disturbance, Inactive	1	4.21	0	0	0	0	0	0	0	0	0	0	0	4.21	0	0
Ingrown Linear Disturbance, Inactive	0	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non-Linear Disturbance	2	4.18	0	0	0	0	0.26	0	0	0	0	3.92	0	0	0	0

Table 7: Habitat and Species Track Densities (TKD) and Species Richness from the 2012 Mount Nansen Track Survey – Exclusive of Road Transects

Habitat	No. Species	Total Track Density (TKD)	Caribou	Moose	Grey Wolf	Coyote	Red Fox	Canada Lynx	American Marten	Fisher	Ermine	Ptarmigan /Grouse	Porcupine	Hare	Red Squirrel	Mouse/ Vole
Conifer, Dry/Mesic, Sparse Cover	5	3.78	0	0.32	0	0	0	0	0.11	0.16	0	0	0	0.27	2.92	0
Conifer, Dry-Mesic, Dense Cover	7	16.25	0	0.77	0	0	0	0	0.77	0.11	0.44	0.66	0	1.22	12.27	0
Deciduous Forest	3	32.03	0	0	0	0	0	0	0	0	0	1.53	0	1.53	28.98	0
Shrub, Dry-Mesic, Mixed with Conifer	8	4.72	0	0.38	0	0.09	0.09	0	0.09	0	0.13	2.09	0	0.43	1.45	0
Shrub, Dry-Mesic, Little or No Conifer	3	2.63	0	0	0	0	0	0	0.12	0	0	1.67	0	0	0.84	0
Shrub, Alpine, Open	2	0.64	0	0	0	0.06	0	0	0	0	0	0.58	0	0	0	0
Riparian Conifer	3	28.73	0	0	0	0	0	0	0	0	0	1.60	0	3.99	23.14	0
Riparian Shrub	3	4.15	0	0.74	0	0	0	0	0	0	0	1.78	0	0	1.63	0
Riparian or Drainage Seeps, Alpine	1	1.18	0	0	0	0	0	0	0	0	0	0	0	1.18	0	0
Wetlands, Open, Conifer Cover	4	3.40	0	0.28	0	0	0	0.14	0	0	0	1.27	0	0	1.70	0
Linear Disturbance Actively Used	1	13.52	0	0	0	0	0	0	0	0	0	0	0	13.52	0	0
Linear Disturbance, Inactive	1	4.21	0	0	0	0	0	0	0	0	0	0	0	4.21	0	0
Ingrown Linear Disturbance, Inactive	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non-Linear Disturbance	1	3.66	0	0	0	0	0	0	0	0	0	3.66	0	0	0	0

The highest overall track densities (all species) recorded amongst the habitats surveyed were 32.02 TKD in deciduous forest, 28.73 TKD in riparian conifer, and 20.89 TKD in dense dry/mesic conifer. The high total track densities observed in these habitats were largely influenced by high track densities for red squirrel (28.98, 23.14, and 16.58 TKD, respectively; Table 6). The fourth highest overall track density of 13.52 TKD was observed in active road areas, where tracks consisted entirely of hare.

3.2.3.1 Ungulates

Moose were detected on transects in 5 habitat types within the LSA, and incidentally in 10 of 14 habitats surveyed. Moose track densities were highest in riparian shrub and dense conifer habitats (0.89 and 0.77 TKD, respectively). Lower densities of moose were found in sparse conifer, shrub-conifer mixes, and open wetland habitats. A summary of moose observations on track transects is shown in Figure 3, while data summaries are provided in Tables 6 and 7.

Caribou were not detected on transects, but were observed incidentally at several locations in the northwest portion of the study area. Numerous tracks, feeding craters, and scat were observed along an unused road in sparse to dense conifer habitats. Several tracks were observed in alpine shrub habitat, and several additional tracks and feeding craters were observed in conifer habitats along Transect 12 (Figure 2). A summary of caribou observations is shown in Figure 3.

3.2.3.2 Canids

Grey wolf, coyote, and red fox were all detected during the Mount Nansen Tracking study. Grey wolf were not detected on active track transects, but were detected three times as incidental observations. One track was observed on the site access road, while two sets of tracks were observed crossing and travelling along an unused road in subalpine habitat near the center of the LSA.

Coyote were detected at low density (0.09 and 0.06 TKD) in shrub habitats with conifer, and in alpine shrub habitats, respectively.

Red fox were detected at densities ranging from 0.09 to 0.29 TKD in mixed shrub/conifer, alpine shrub, and disturbed habitats. Incidental observations of fox were also within the same habitat types (primarily along roads and in disturbed areas).

A summary of canid observations is shown in Figure 4, while data summaries are provided in Tables 6 and 7.

3.2.3.3 Mustelids

Three mustelid species were detected both during transects and as incidental observations: American marten, fisher, and ermine. Marten were the most common mustelid, with highest track densities of 0.88 and 0.30 TKD observed in dense conifer and riparian shrub habitats, respectively. Marten were also detected at lower densities, and incidentally, in sparse conifer, shrub, wetland, and disturbed habitats.

Fisher were detected in riparian shrub and both sparse and dense conifer habitats at densities of 0.44, 0.16, and 0.11 TKD, respectively. Additionally, incidental observations of fisher were made in wetland and shrub habitats (with conifer).

Ermine were only detected on transects in dense conifer and in mixed shrub/conifer habitats, at densities of 0.44 and 0.13 TKD, respectively. Ermine were also observed incidentally in riparian seep and wetland areas. A summary of mustelid observations is shown in Figure 5, while data summaries are provided in Tables 6 and 7.

3.2.3.4 Felids

One detection of a Canada Lynx was made during the tracking study, in a conifer dominated wetland habitat. The resulting density for this habitat type is 0.14 TKD (Figure 6).

3.2.3.5 Lagomorphs

Hare were the third most abundant species group detected during the tracking study. Hare were detected in eight of 14 habitat types, occurring most frequently in active and inactive road areas, as well as riparian conifer habitats (13.52, 4.21, and 3.99 TKD, respectively). Hare were also detected in both sparse and dense conifer habitats, deciduous forest, shrub/conifer mixed habitat, and riparian seeps.

3.2.3.6 Rodents

Red squirrel was the most abundant species detected during track transects, and were detected on transects in eight of 14 habitat types surveyed. Red squirrel track densities were highest in deciduous forest, riparian conifer, and dense conifer habitats, with track densities of 28.98, 23.14, and 16.58 TKD, respectively. Moderate track densities were also recorded in sparse conifer forest, riparian shrub, wetland, and shrub/conifer mixes.

Porcupine were not detected on any track transects, however porcupine tracks were observed twice incidentally in dense conifer forest between the pit and tailings areas (Figure 6). Both tracks and feeding sign were observed.

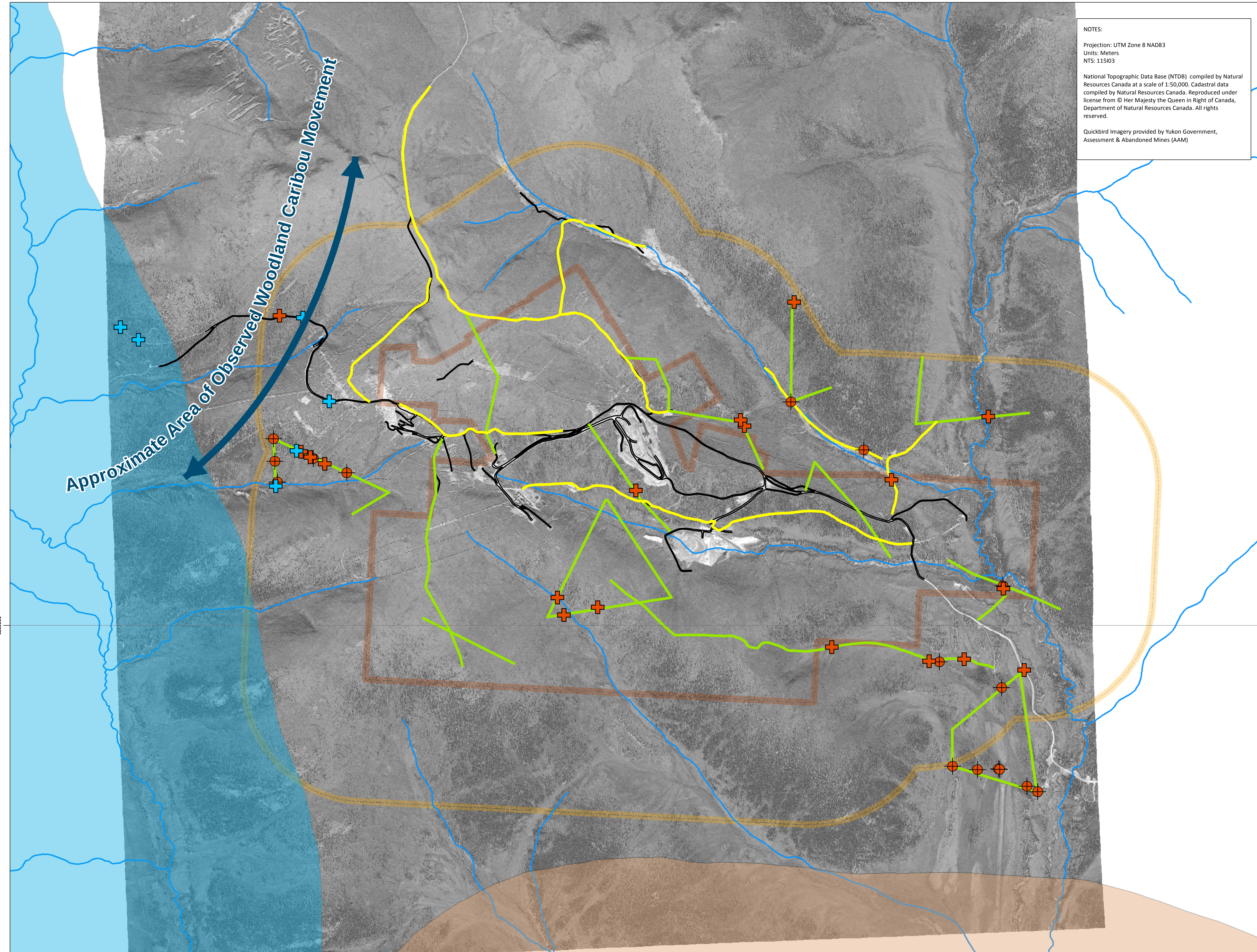
Small mammals (mice and voles) were only detected on transects in sparse conifer dry/mesic habitat, at an overall density of 0.22 TKD.

A summary of rodent track densities is provided in Table 6 and 7.

3.2.3.7 Avian Species

Ptarmigan and grouse were the second most abundant species group detected during the tracking study, and also were the most widely distributed among habitat types (being detected on transects in 10 of 14 habitats). Ptarmigan and grouse track density was highest in disturbed habitats, as well as dry/mesic shrub habitats both without and with conifer (at track densities of 3.92, 3.47, and 1.53 TKD, respectively).

In addition to grouse and ptarmigan, several avian species were noted incidentally. A great horned owl was heard calling from the Victoria Creek area at the southeast extent of the LSA on March 14, and a boreal owl was observed in subalpine shrub/conifer habitat adjacent to transect 10 on March 25. Throughout the site, common redpoll, grey jay, common raven, boreal chickadee, and magpie were also observed.



2012 Mount Nansen Winter Wildlife Tracking Study

Ecological Logistics & Research Ltd.

Client: Yukon

Legend

- Mt. Nansen Area Roads
- Watercourses
- Water Bodies

Local Boundaries

Type

- OIC
- RLSA

Transect Locations

Type of Transect

- Directly through Terrain
- On Un-used Roads/Trails

Incidental Observations

Species

- Moose
- Woodland Caribou

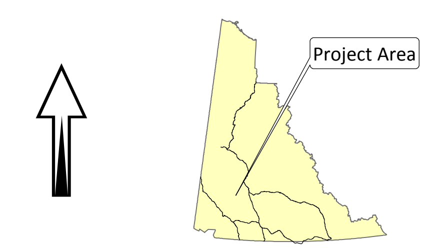
Track Detections

- Moose

Wildlife Key Area Polygons

Species

- Moose Late Winter Habitat
- Woodland Caribou Winter Habitat



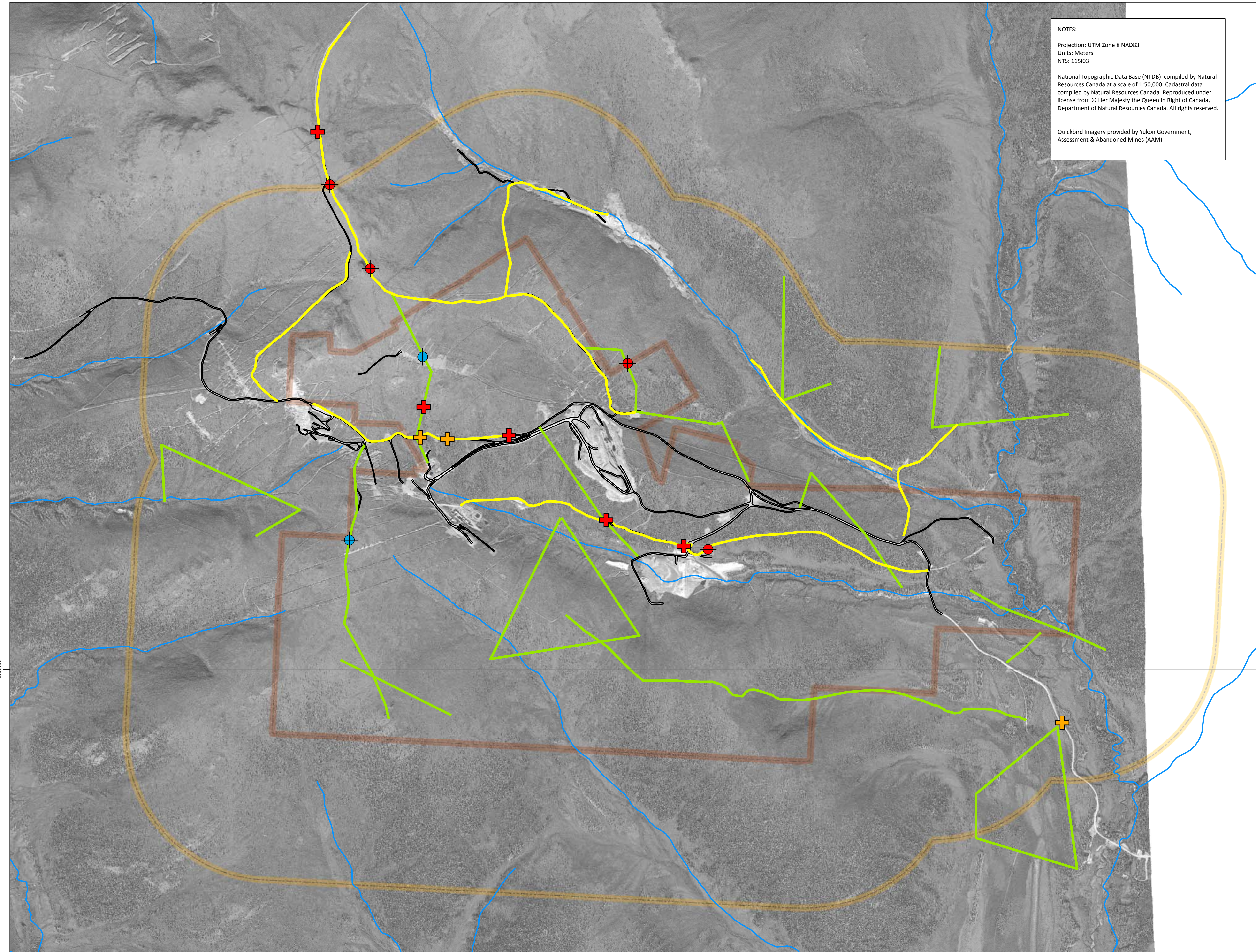
Scale: 1:30,000

0 0.125 0.25 0.5 0.75 1 Kilometers

Date: Dec. 10, 2012	Drawn by: CJJ
ELR Project #:12-123	Rev. #:

FIGURE 3

Location of Ungulate Detections and Incidental Observations



2012 Mount Nansen Winter Wildlife Tracking Study

Ecological Logistics & Research Ltd.

Client: Yukon

Legend

- Mt. Nansen Area Roads
- Watercourses
- Water Bodies

Local Boundaries

Type

- OIC
- RLSA

Transect Locations

Type of Transect

- Directly Through Terrain
- On Un-used Roads/Trails

Incidental Observations

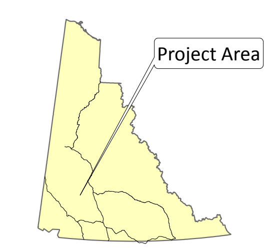
Species

- Red Fox
- Grey Wolf

Track Detections

Species

- Coyote
- Red Fox



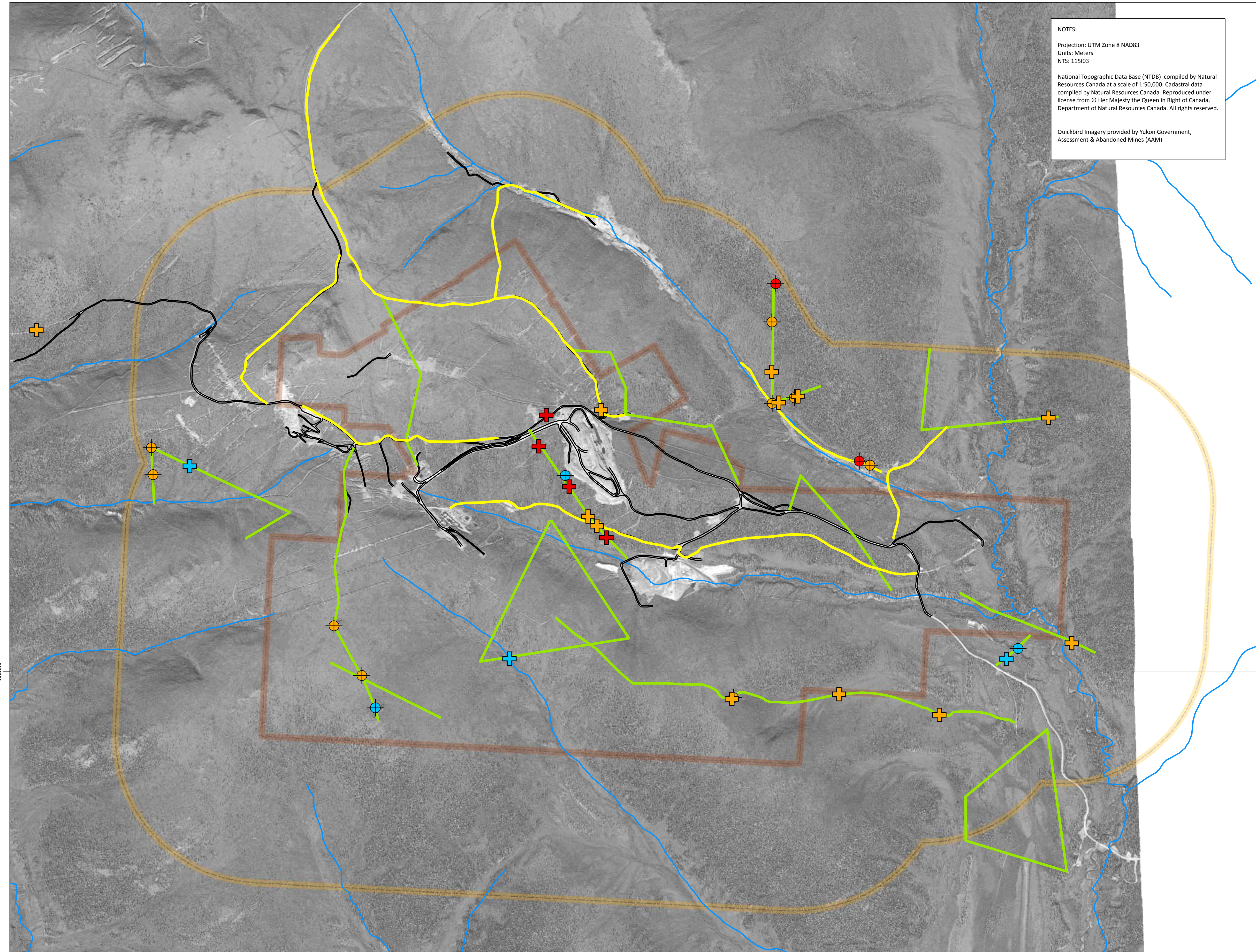
Scale: 1:25,000

0 0.125 0.25 0.5 0.75 1 Kilometers

Date: Dec. 10, 2012	Drawn by: CJJ
ELR Project #:12-123	Rev. #:

FIGURE 4

Location of Canid Detections and Incidental Observations



2012 Mount Nansen Winter Wildlife Tracking Study

Ecological Logistics & Research Ltd.

Client: Yukon

Legend

Mt. Nansen Area Roads

Water Bodies

Watercourses

Local Boundaries

Type

OIC

RLSA

Transect Locations

Type of Transect

Directly Through Terrain

On Un-used Roads/Trails

Incidental Observations

Marten

Ermine

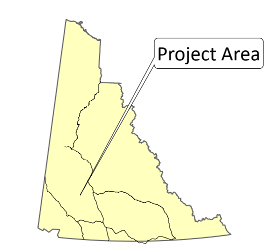
Fisher

Track Detections

Marten

Ermine

Fisher



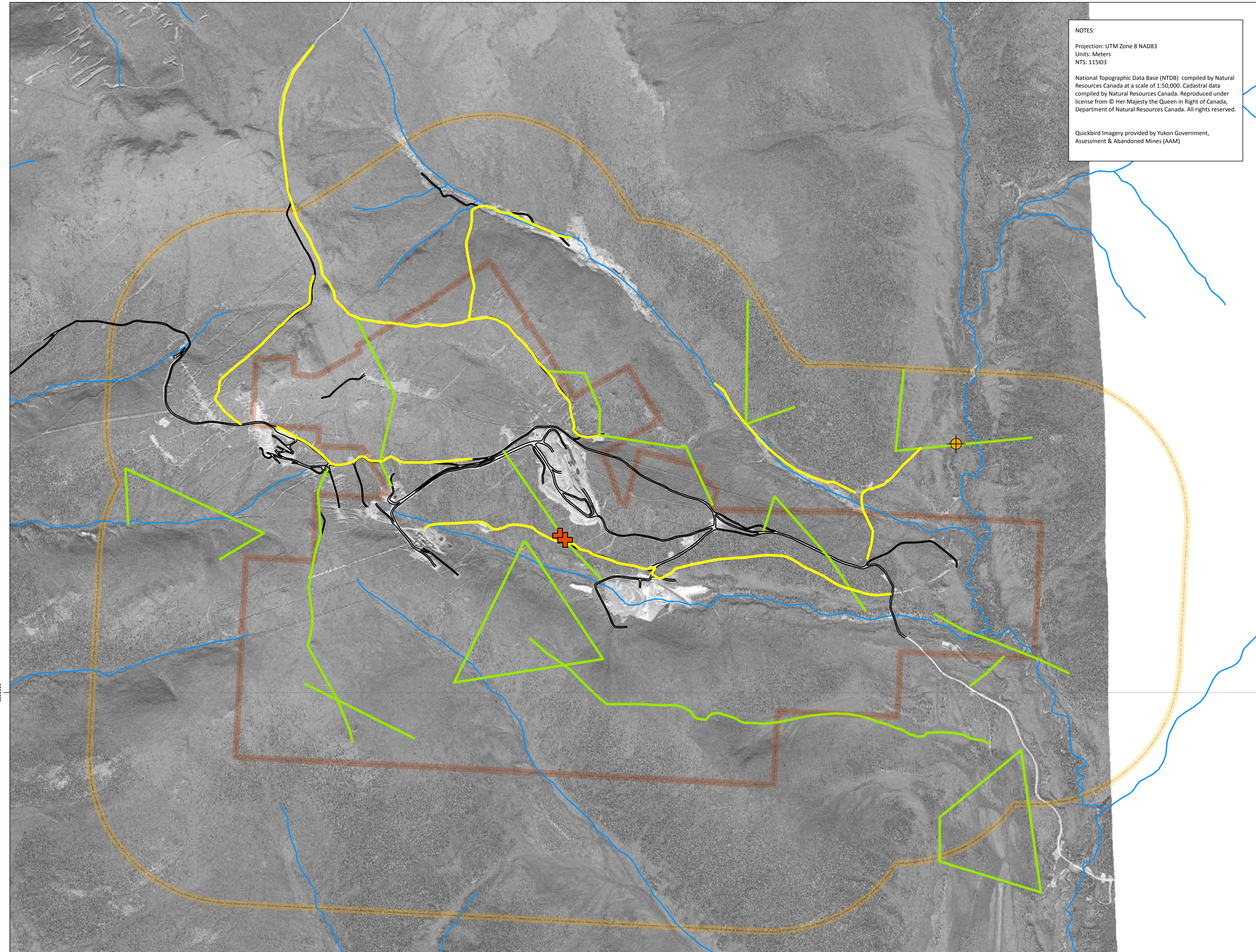
Scale: 1:25,000

0 0.125 0.25 0.5 0.75 1 Kilometers

Date: Dec 10, 2012	Drawn by: CJJ
ELR Project #:12-123	Rev. #:

FIGURE 5

Location of Mustelid Detections and Incidental Observations



2012 Mount Nansen
Winter Wildlife Tracking Study

Ecological Logistics & Research Ltd.

Client:

Yukon

Legend

- Mt. Nansen Area Roads
- Water Bodies
- Watercourses

Local Boundaries

Type

- OIC
- RLSA

Transect Locations

Type of Transect

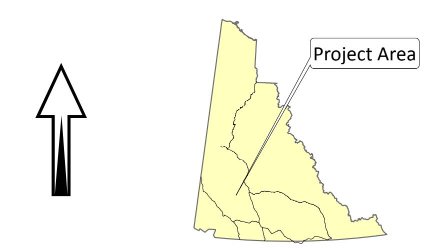
- Directly Through Terrain
- On Un-used Roads/Trails

Incidental Observations

- Porcupine

Track Detections

- Canada lynx



Scale: 1:25,000

0 0.125 0.25 0.5 0.75 1 Kilometers

Date: Dec. 15, 2012	Drawn by: CJJ
ELR Project #:12-123	Rev. #:

FIGURE 6

Location of Porcupine/Lynx Detections and Observations

4. Discussion

4.1 Survey Conditions

Snow conditions at the Mount Nansen site influenced both the level of effort and layout of the 2012 tracking study, and also have the potential to have influenced study results. Snow depths recorded from various transect locations across the site ranged from 43 to 100 cm, with an overall average depth of 70 cm. More importantly, no base or crust layers were observed within the LSA, resulting in difficult conditions for tracking, but assumedly also for wildlife in the area. The distribution or movement patterns of medium to large wildlife can be influenced by snow conditions, either through limiting their overall movement frequency or through wildlife selecting areas of lower snow depths.

Wildlife species such as small mammals and mustelids can also spend larger proportions of time beneath the surface of the snow when snow levels are greater, in particular when crust or ice layers in the snow pack are less pronounced. ELR observed this trend while conducting the Mount Nansen track study, as both small mammal and ermine tracks were observed to frequently tunnel beneath the surface. An ermine was also observed while on site, alternating between sub-surface and surface snow movements.

It is also important to note that later season tracking surveys often record lower track frequencies than early season tracking surveys (Thompson et al. 1989). This can often be attributed to reduced movements or selective habitat usage as discussed above, but also can be the result of regular over-wintering mortality that occurs each year (actual densities are reduced through the winter period). To that end, tracking studies are regularly conducted in both early and late winter, and one must take caution to compare data amongst studies appropriately.

4.2 Potential Road and Trail Effects

Deep snow conditions and limited survey time necessitated the use of un-used roads within the LSA during the Mount Nansen winter track survey. The use of these roads allowed for a large increase in the overall area surveyed with relatively little additional effort as these transects could be surveyed efficiently using a snowmobile. While these road transects were meant to focus on the various landscapes surrounding each corridor, consideration had to be given to the potential effects of those road corridors themselves on the data collected. For example, vegetation cover adjacent to roads and trails can be different from the surrounding habitats (e.g. shrub cover), and road features provide both a natural corridor and edge effect. This has the potential to alter local habitat use through the provision of forage vegetation or by attracting edge-loving species, and the provision of a corridor path that can be used by wildlife.

In recognition of potential road effects, ELR calculated track densities for the LSA transects with both direct transects (i.e. off of roads or trails) and road-based transects combined, then also for direct transects independently (shown earlier in Tables 6 and 7). In total, road transects accounted for approximately 38% of the total tracking distance (14.28 km of 37.8 km total), and 42% of the total tracking effort (42.29 km•days of 98.74 km•days total).

When comparing the two datasets (i.e. Table 6 vs. Table 7), we found that overall track density was reduced in 7 of 14 habitat types, and species richness was reduced in 5 habitat types. When examining individual species detections, we found that the largest overall reductions in track density were for red squirrel, ptarmigan/grouse, and hare. More minor reductions in the track density of marten and red fox were observed, with only minimal reductions for fisher and moose.

While some species were observed using roads and trails as movement corridors within the LSA (fox and grey wolf tracks), the road effects noted during the current study appear to be a related to two primary effects: the preferential use of edge habitats, likely as a result of favourable feeding habitat (e.g. ptarmigan and hare); and, the indirect effect of trail transects that traversed large distances through dense, mature conifer forest (e.g. resulting in high numbers of red squirrel crossings).

4.3 WILDLIFE DISTRIBUTION AND DENSITY

Overall, the observed track density across all transects of 6.39 TKD suggests moderate overall winter habitat use in the LSA. Deciduous forest, riparian conifer, and dry/mesic dense conifer were found to have the highest overall track densities; however this trend was largely due to the high density of red squirrel tracks detected in these habitats. Both dense and sparse dry/mesic conifer habitats, shrub/conifer mix, and riparian shrub habitats had the highest species richness, having between 5 and 8 species per habitat (not including incidental observations).

By comparison, 2012 results from the Mount Nansen site were lower than results from two similar studies within the Yukon. A 2008 study at the Ketza River Mine site revealed an overall track density of 17.04 TKD, while a 2012 study at the Faro Mine Complex revealed an overall track density of 13.73 TKD (EBA 2008, ELR 2012).

At the Ketza River Mine site, riparian and fir/moss habitats were found to have the highest combination of species richness and track density. At the Faro Mine Complex, the highest species richness was detected in deciduous and shrub habitats (both riparian and non-riparian), while the highest track densities were detected in pine, deciduous, and mixed forests.

4.3.1 Ungulates

Moose were the most widely occurring and most frequently detected ungulate in the LSA during the tracking study. Moose tracks were detected at an overall density of 0.30 TKD across all transects, and moose tracks were observed regularly through the site. Track densities were highest in riparian shrub habitat, dense dry/mesic conifer forest, and shrub/conifer mixed habitats. From ELR's observations in the LSA, moose appear to be using habitat in nearly all of the riparian areas and draws associated with Victoria, Back, Dome and Pony Creeks, as well as other small draws, seeps, and valleys with browse availability (primarily willow) and cover. Moose tracks were also observed in conifer habitats, many of which were hillsides adjacent to riparian areas. While moose were found throughout the area at low to medium elevations, moose occurrence appeared to be concentrated in the southeast portion of the LSA. This observed distribution pattern was found to correspond roughly with the presence of a late winter wildlife key area for moose, the northern boundary of which is just south of the LSA (Figure 3).

Woodland caribou were detected within the study area, however observations were at the western extent of the study area, and largely outside of the OIC area (Figure 3). No 'new' caribou tracks were detected during track transects, however older caribou tracks, scat, and feeding craters were all observed in dense conifer and conifer/shrub mixed forest. These observations are consistent with the winter feeding habits of woodland caribou, relying heavily on ground lichens in mature conifer forests during winter. From the tracks observed, it appeared as though a group of caribou had travelled through the west extent of the LSA from north to southwest, as shown in Figure 3. Based on the available information, the caribou observed most likely are part of the Klaza caribou herd, whose winter territory overlaps with the LSA (extent of known winter range shown in Figure 3).

4.3.2 Canids

Grey wolves are known to utilize roads and linear corridors for movement through the landscape, and this behavior was observed through tracks during the Mount Nansen tracking study. While no tracks were detected on transects, the three incidental track occurrences were all on unused roads, where tracks followed the corridor for small to moderate distances (Figure 4).

While foxes and coyotes were not detected moving along roadways or linear corridors, several detections and incidental observations were in the vicinity of roads and mine infrastructure. These species are generalist feeders, and are likely taking advantage of prey species such as ptarmigan, hare, and squirrel that may be concentrated around areas of disturbance.

4.3.3 Mustelids

Fishers were detected in both conifer and riparian habitats within the study area, and at moderate track densities compared to marten. Differentiation between fisher and marten tracks can be difficult as an overlap in track size exists between mature male marten and female fisher (there is a track width overlap between the species from approximately 3.5 inches wide to 4.25 inches wide). Track patterns tend to differ between the species, with fisher alternating between two, three, and four track patterns frequently, while marten tend to primarily use a two track pattern. For the current study, a combination of track size and pattern was used for identification; however tracks that could not be positively identified as fisher were classified as marten (i.e. if in the intermediate track width range and without distinguishing pattern features).

Fisher generally occur in mature forests with dense canopies and a high level of habitat complexity. Their presence across several LSA habitat types suggests the presence of quality habitat and a suitable abundance of prey items. Fishers are also specialist predators on porcupine, which were detected incidentally in the LSA (discussed below).

Marten, while still reliant on complex habitats, mature forest cover, and suitable prey base, are sometimes more generalist in nature than fishers. The highest marten track density of 0.88 TKD observed in dense dry/mesic conifer habitat in comparison to other LSA habitats is likely the product of complex habitat, thermal and snow cover, and an abundance of prey items such as red squirrel or hare (more likely the former as hare densities were found to be low in the LSA). The overall marten track density of 0.15 TKD recorded in the current study was lower than expected. In comparison, a concurrent study at the Faro Mine Complex revealed a Marten track density of 0.77 TKD.

The occurrence of ermine detections in the LSA were lower than expected, having been detected in only two habitats (dense dry/mesic conifer and conifer/shrub mix) and recorded incidentally in two other habitats (riparian shrub and open wetland). The highest track density of 0.44 TKD was lower than predicted, however; as noted incidentally during the study, ermine were observed to be frequently moving below the surface of the snow, therefore perhaps explaining the low occurrence of detections.

While wolverine are known to inhabit the LSA (EDI 2010, ELR unpublished data), no signs of wolverine presence or activity were observed during the 2012 tracking study. Wolverines have very large home ranges that can range to as wide as 100-500 km^2, and therefore the absence of track observations does not exclude their presence in or use of the LSA. Due to this large home range size, ground tracking surveys are not well suited to determining wolverine presence or density. Instead, aerial winter track surveys, baited camera stations or hair snag stations tend to be used to estimate density or habitat use of this species.

4.3.4 Felids

The observation of only one Canada lynx track during the tracking study (in wetland habitat) suggests that densities of lynx are currently low in the vicinity of the LSA. Lynx populations are known to cycle in response to populations of snowshoe hare, and can go through three to five year low periods. While hare were detected in several habitats during the 2012 study, hare track densities were found to be relatively low at the Mount Nansen site, which may be influencing the local density of lynx as well (as described below).

4.3.5 Lagomorphs

While hare were observed in eight of 14 habitats in the LSA, the overall track density of 0.60 TKD is lower than is to be expected at the Mount Nansen site. While individual habitat densities were observed to be as high as 13.5 TKD (along actively used roads), most habitat track densities were low. For comparison, a track study by EBA (2008) at the Ketza River Mine measured hare mean track density to be 4.24 TKD across habitats, while a tracking study by ELR (2012) at the Faro Mine Complex measured hare density to be 2.90 TKD, roughly seven and five times the density observed at the Mount Nansen site. Several studies in the oilsands region of Alberta have found hare densities to range from 4.8 TKD to as high as 194 TKD (Golder 2009, Stantec 2010). The low densities of hare tracks observed at the Mount Nansen are not believed to be the result of natural hare population cycling, as the most recent peak of the 10-year hare cycle was likely around 2009/2010 (Krebs et al. 2001, Environment Yukon 2012). Additionally, the hare track density of 2.90 TKD at the Faro Mine Complex was recorded roughly concurrently with the Mount Nansen track study, indicating that populations were strong elsewhere at the same time. Rather, it appears that this low density could be at least in part to due a lack of preferred habitats in the Mount Nansen area (i.e. deciduous, mixed, or suitable shrub habitats).

4.3.6 Rodents

Red squirrel were the most frequently detected species during the Mount Nansen tracking study, with an average track density of 3.46 TKD across all LSA habitats, and having particularly high densities deciduous forest and dense conifer covers (riparian conniver and dense dry/mesic conifer). Red squirrels generally have a preference for mature conifer forests (spruce, pine) as these habitats provide a more consistent supply of cones for food, thermal and visual cover, as well as a thick canopy for movement above ground. As a comparison, measured squirrel track densities at the Mount Nansen site were generally four to seven times higher than those measured at the Ketza River Mine in similar habitats (mean track density of 3.54 TKD; EBA 2008), but less than those densities recorded at the Faro Mine Complex during 2012 (mean track density of 6.15 TKD; ELR 2012). Red squirrel track densities were also comparable to measurements in some boreal areas of Alberta (e.g. Golder 2009). The overall high density is believed to be a factor of the abundance of dense spruce forest within the LSA, and suggests that an excellent prey base is available for species groups such as raptors, mustelids, and canids.

While only detected incidentally, porcupine were confirmed to be present in the LSA, however only in dense dry/mesic conifer habitat. Porcupine are likely to spend a large proportion of time feeding in trees or in dens, and may not move large distances in deep snow conditions on a regular basis. Accordingly, the low density of tracks observed may not be representative of their density in the LSA.

4.3.7 Avifauna

Both ptarmigan and spruce grouse were observed throughout the LSA and across nearly all habitat types, with spruce grouse primarily occurring in more dense conifer-dominated habitats and ptarmigan in open areas and near disturbances with available shrub habitat. Ptarmigan and grouse track densities were lower than those observed at the Ketza River Mine (EBA 2008), with the latter ranging from 0.17 to 73 TKD across various habitats.

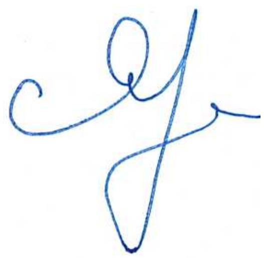
5. LIMITATIONS AND DISCLAIMER

This report has been prepared for Yukon government, Energy, Mines and Resources, Assessment and Abandoned Mines (AAM), for application to the Mount Nansen Remediation Project. The contents of this report have been prepared for the sole use of AAM or its agents, for application to the aforementioned project. ELR is not responsible for the report contents or for any information within the report when the report is used or relied upon by any Party other than AAM. This report has been prepared according to current professional standards, and using the information available as of the date of issue.

6. CLOSURE

We are pleased to present this 2012 Mount Nansen winter wildlife tracking survey report to the Government of Yukon, Assessment and Abandoned Mines Branch. We trust this report meets your requirements for this project, but we encourage you to contact us should you have any questions or comments regarding the project or report content.

Sincerely,



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867.668.6386
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PHOTOGRAPHS

Photo 1: View of typical dense dry/mesic conniver habitat at the Mount Nansen site. This habitat type is similar to the white spruce/willow ELC association. Photo taken March 25, 2012.

Photo 2: View of typical dry/mesic shrub with conifer at the Mount Nansen site. This habitat is similar to the willow/white spruce ELC association. Photo taken March 15, 2012.

Photo 3: View of typical open wetland habitat at the Mount Nansen site. Note the old (incidental) moose track observation in the right foreground. Photo taken March 23, 2012.

Photo 4: View of typical deciduous habitat at the Mount Nansen site. Note the numerous hare tracks in the photo. Photo taken March 24, 2012.

Photo 5: View of an un-used linear feature that was used for a transect. Note the willow lining each side of the clearing that was considered for potential edge effects. Also note the hare track in the foreground. Photo taken March 24, 2012.

Photo 6: Caribou scat as observed in the west of the LSA. Photo taken March 24, 2012.

Photo 7: View of a typical moose bedding area observed at the Mount Nansen site. Photo taken March 24, 2012.

Photo 8: View of a fisher track observed at the Mount Nansen site in disturbed riparian area. Note the rapidly changing track pattern within the short distance shown in the photo. Photo taken March 25, 2012.

Photo 9: View of an ermine track as observed at the Mount Nansen site on March 24, 2012.

Photo 10: View of typical habitat associations at the Mount Nansen site. Note the transition from conniver to shrub, wetland, and shrub leading from the background to foreground. Photo taken March 23, 2012.

APPENDIX 1: RAW TRANSECT TRACK COUNT DATA

Transect	Segment Number	Habitat	Length (m)	Effort (km•Days)	Moose	Grey Wolf	Coyote	Red Fox	Lynx	Amer. Mart.	Fisher	Ermine	Ptarmigan	Hare	Red Squirrel	Mouse/ Vole
1	1-1	RP-S	0.07	0.15	1											
1	1-2	RP-C	0.21	0.42									2		12	
1	1-3	RP-S	0.22	0.43											7	
1	1-4	Dd	0.04	0.07												
1	1-5	C-D/M-S	0.05	0.10											3	
1	1-6	RP-S	0.22	0.44									5			
1	1-7	C-D/M-S	0.23	0.47											7	
2	2-1	W-C	0.24	0.74					1							
2	2-2	RP-C	0.27	0.83										5	17	
2	2-3	C-D/M-D	0.26	0.79										4	14	
2	2-4	W-C	0.09	0.28									8		1	
2	2-5	C-D/M-O	0.65	2.00												
3	3-1	RP-S	0.06	0.22									3		2	
3	3-2	C-D/M-S	0.09	0.32						1						
3	3-3	C-D/M-D	0.20	0.68						3			4		8	
3	3-4	RP-S	0.06	0.22	2										2	
3	3-5	S-D/M-C	0.07	0.25											4	
3	3-6	C-D/M-S	0.49	1.68						1	3				4	
3	3-7	C-D/M-D	0.19	0.65							1	1			10	
3	3-8	S-D/M-C	0.04	0.12												
4	4-1	R-A	0.02	0.02												
4	4-2	C-D/M-S	0.02	0.03											4	
4	4-3	R-I	0.01	0.01												
4	4-4	C-D/M-S	0.06	0.08												

Transect	Segment Number	Habitat	Length (m)	Effort (km•Days)	Moose	Grey Wolf	Coyote	Red Fox	Lynx	Amer. Mart.	Fisher	Ermine	Ptarmigan	Hare	Red Squirrel	Mouse/ Vole
4	4-5	S-D/M-O	0.09	0.11												
4	4-6	T-I	0.01	0.02												
4	4-7	S-D/M-O	0.15	0.18												
4	4-8	T-I	0.02	0.02												
4	4-9	S-D/M-O	0.07	0.09												
4	4-10	S-D/M-C	0.14	0.17												
4	4-11	T-I	0.01	0.01												
4	4-12	S-D/M-O	0.20	0.24												
4	4-13	T-I	0.01	0.01												
4	4-14	S-D/M-O	0.02	0.02											3	
4	4-15	R-A	0.02	0.03												
4	4-16	S-D/M-C	0.15	0.18												
4	4-17	C-D/M-D	0.16	0.19											7	
4	4-18	T-I	0.01	0.01												
4	4-19	C-D/M-D	0.02	0.03									2		2	
4	4-20	W-C	0.11	0.14									1		1	
5	5-1	S-Alp-O	1.42	4.67				4								
5	5-2	S-Alp-O	0.46	1.52				1								
5	5-3	S-Alp-O	1.48	4.87									3			
5	5-4	S-D/M-C	0.41	1.34												
5	5-5	C-D/M-S	0.43	1.42									7			
6	6-1	S-Alp-O	0.49	1.20			1						10			
6	6-2	Dist	0.12	0.29												
6	6-3	S-D/M-C	0.36	0.88									7			
6	6-4	RP-SP	0.06	0.14												

Transect	Segment Number	Habitat	Length (m)	Effort (km•Days)	Moose	Grey Wolf	Coyote	Red Fox	Lynx	Amer. Mart.	Fisher	Ermine	Ptarmigan	Hare	Red Squirrel	Mouse/ Vole
6	6-5	R-I	0.06	0.15												
6	6-6	S-D/M-O	0.08	0.21									14			
6	6-7	R-A	0.01	0.02												
6	6-8	S-D/M-C	0.11	0.28									8			
6	6-9	Dist	0.09	0.22									7			
7	7-1	S-D/M-O	0.62	0.99												
7	7-2	RP-S	0.12	0.19												
7	7-3	C-D/M-S	0.24	0.37												
7	7-4	RP-S	0.11	0.17												
7	7-5	S-D/M-O	0.46	0.73												
7	7-6	S-D/M-C	0.14	0.23											2	
7	7-7	C-D/M-S	0.12	0.20												
7	7-8	W-C	0.09	0.14												
7	7-9	S-D/M-C	0.22	0.34												
7	7-10	W-C	0.10	0.15												
7	7-11	C-D/M-S	0.13	0.21												
7	7-12	C-D/M-S	0.11	0.17											3	
7	7-13	S-D/M-C	0.14	0.22												
7	7-14	S-D/M-C	0.33	0.53									1			
7	7-15	S-D/M-C	0.17	0.26												
8	8-1	S-D/M-C	0.16	0.34	2										1	
8	8-2	W-C	0.15	0.31												
8	8-3	C-D/M-S	0.19	0.40											5	
8	8-4	W-C	0.41	0.88	1										1	
8	8-5	C-D/M-S	0.11	0.24	3										1	

Transect	Segment Number	Habitat	Length (m)	Effort (km•Days)	Moose	Grey Wolf	Coyote	Red Fox	Lynx	Amer. Mart.	Fisher	Ermine	Ptarmigan	Hare	Red Squirrel	Mouse/ Vole
8	8-6	S-D/M-C	0.18	0.37	2										1	
8	8-7	R-I	0.01	0.02												
8	8-8	S-D/M-C	0.11	0.23	1											
8	8-9	R-I	0.01	0.01												
8	8-10	C-D/M-S	0.23	0.49	1										6	
8	8-11	C-D/M-S	0.38	0.82	2										15	
8	8-12	W-C	0.15	0.32											7	
8	8-13	S-D/M-C	0.47	1.00											3	
8	8-14	R-A	0.01	0.02												
8	8-15	S-D/M-C	0.18	0.37												
9	9-1	RP-S	0.36	1.21						2	2				3	
9	9-2	RP-S	0.74	2.49	1						1				4	
9	9-3	C-D/M-D	0.17	0.58						1					3	
10	10-1	S-D/M-C	0.23	0.84						1						
10	10-2	S-D/M-C	0.61	2.19									11			
10	10-3	S-D/M-C	0.33	1.20								2				
10	10-4	S-D/M-C	0.60	2.14						1						
10	10-5	S-D/M-C	0.70	2.51			2									
10	10-6	R-I	0.34	1.21										6		
11	11-1	S-Alp-O	1.39	3.71												
12	12-1	RP-SP	0.06	0.16												
12	12-2	S-D/M-C	0.12	0.32	1								17			
12	12-3	RP-SP	0.03	0.09												
12	12-4	S-D/M-C	0.10	0.27												
12	12-5	RP-SP	0.05	0.13												

Transect	Segment Number	Habitat	Length (m)	Effort (km•Days)	Moose	Grey Wolf	Coyote	Red Fox	Lynx	Amer. Mart.	Fisher	Ermine	Ptarmigan	Hare	Red Squirrel	Mouse/ Vole
12	12-6	S-D/M-C	0.41	1.05												
12	12-7	S-D/M-C	0.13	0.34												
12	12-8	RP-SP	0.06	0.16												
12	12-9	S-D/M-C	0.07	0.19	2											
12	12-10	RP-SP	0.07	0.17										1		
12	12-11	C-D/M-D	0.22	0.58	4					2					43	
12	12-12	C-D/M-D	0.18	0.48	3					2					8	
12	12-13	S-D/M-C	0.17	0.44	1										21	
12	12-14	RP-S	0.04	0.09	2											
13	13-1	RP-S	0.13	0.26									4			
13	14-1	S-D/M-C	0.79	1.78										7		
13	13-2	S-D/M-C	0.07	0.15								1				
13	14-2	S-D/M-O	0.67	1.52												
13	13-3	W-C	0.12	0.25												
15	15-1	S-D/M-C	0.15	0.49									1			
15	15-2	T-I	0.01	0.03												
15	15-3	S-D/M-C	0.13	0.44												
15	15-4	S-D/M-O	0.10	0.35												
15	15-5	RP-S	0.06	0.20												
15	15-6	Dd-P	0.07	0.22									1		16	
15	15-7	C-D/M-S	0.24	0.79												
15	15-8	C-D/M-S	0.30	0.99											1	
16	16-1	S-D/M-C	0.51	1.68				2					4			
16	17-1	C-D/M-O	0.30	0.93									3			
16	16-2	C-D/M-O	0.12	0.39												

Transect	Segment Number	Habitat	Length (m)	Effort (km•Days)	Moose	Grey Wolf	Coyote	Red Fox	Lynx	Amer. Mart.	Fisher	Ermine	Ptarmigan	Hare	Red Squirrel	Mouse/ Vole
16	17-2	RP-S	0.22	0.68											8	
16	16-3	Dd	0.06	0.19												
16	17-3	C-D/M-O	0.32	0.97												
16	16-4	C-D/M-O	0.09	0.30											4	
17	17-4	W-C	0.16	0.50												
18	18-1	C-D/M-O	0.37	1.08												
18	18-2	Dist	0.12	0.34									1			
18	18-3	C-D/M-O	0.74	2.15										5	4	4
18	18-4	C-D/M-O	0.35	1.02										4	7	
18	18-5	Dist	0.36	1.04				1								
18	18-6	C-D/M-O	0.16	0.45												
18	18-7	C-D/M-D	0.75	2.18												
18	18-8	C-D/M-D	0.62	1.81										2	36	
19	19-1	S-D/M-O	1.17	2.00												
19	19-2	S-D/M-O	0.58	0.98						1					4	
19	19-3	W-C	1.69	2.88	1										2	
20	20-1	Dist	0.05	0.12									7			
20	20-2	S-D/M-C	0.10	0.23										2		
20	20-3	R-I	0.01	0.02												
20	20-4	C-D/M-D	0.43	1.06								3		7	19	
20	20-5	C-D/M-S	0.02	0.05												
20	20-6	T-I	0.01	0.02												
20	20-7	C-D/M-S	0.17	0.41										5	1	
20	20-8	R-A	0.03	0.08										2		
20	20-9	S-D/M-C	0.05	0.13										8	2	

Transect	Segment Number	Habitat	Length (m)	Effort (km•Days)	Moose	Grey Wolf	Coyote	Red Fox	Lynx	Amer. Mart.	Fisher	Ermine	Ptarmigan	Hare	Red Squirrel	Mouse/ Vole
20	20-10	W-C	0.09	0.22												
20	20-11	Dd	0.07	0.17										1	3	
20	20-12	W-C	0.10	0.24												
21	21-1	S-Alp-O	0.46	1.24									9			
21	21-2	S-D/M-O	0.35	0.94									15			
21	21-3	Dist	0.68	1.82												