Table 1.4-4 Definitions of Federal Status Categories for Wildlife	
Status	**Definitions[1]**
Special Concern	A wildlife species that might become "Threatened" or "Endangered" because of a combination of biological characteristics and identified threats.
Data Deficient	A wildlife species for which there is inadequate information to make a direct or indirect, assessment of its risk of extinction.
Not At Risk	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.

[1]Source: *Species at Risk Act* (SARA 2002)

1.4.3 Land Management Plans

The Project falls within the area covered by the South Saskatchewan Regional plan and the South Saskatchewan River Basin Plan. It also includes lands that are subject to two different Integrated Resource Plan (IRP) areas, both of which aim to allow for multiple land uses while protecting the environment. These are the Livingstone-Porcupine Hills Sub-Regional IRP and the Crowsnest Corridor Local Sub-Regional IRP. Each IRP divides land into eight different Land Use Zones, each of which is subject to different management objectives.

A detailed description of land use in the Project area is provided in Consultant Report #12-Land and Resource Use.

2.0 BASELINE WILDLIFE SURVEYS

The primary objective of the baseline wildlife surveys was to describe and map existing wildlife resources in the Project WLSA, including amphibians, reptiles, birds, and mammals, and to evaluate their use and potential use of habitats. Special attention was paid to those species listed as "At Risk", "May Be At Risk" and "Sensitive" in Alberta (AEP, 2010c), all species listed in Schedule 1 of the Canada's SARA (Government of Canada, 2014), and those listed as "At Risk" by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC; COSEWIC, 2014). Species of management concern (*i.e.* those that may be hunted or trapped), and species used and/or valued by First Nations were also considered.

2.1 Wildlife Habitat Delineation

Vegetation classification for the WLSA was based on Archibald *et al.* (1996), who used information on vegetation, soil, site characteristics, and productivity to develop a field guide for ecosite phases in southwestern Alberta. Ecosite-level mapping was considered appropriate for survey planning and data analysis for the Project because it was available for the entire WLSA, it contains a relatively high

level of detail, and it can be combined into broader wildlife habitat types that more accurately reflect wildlife habitat use and distribution in the WLSA. In cases where a habitat type did not correspond to one of the ecosite phases described by Archibald *et al.* (1996), the AVI (Alberta Vegetation Inventory) land description codes were applied (AESRD, 2005). Data were summarized and presented according to broader habitat classes based on ecosite phase mapping of the WLSA. A full description of the methods and classifications are provided in CR #8 – Vegetation and Wetlands.

2.2 Review of Existing Information

Various sources of existing information were reviewed to obtain background information on the WLSA and RSAs including but not limited to:

- North American Breeding Bird Survey (BBS);
- Fish and Wildlife Management Information System (FWMIS);
- Alberta Conservation Association Aerial Ungulate Surveys;
- Committee on the Status of Endangered Wildlife in Canada (COSEWIC);
- federal recovery strategies for species at risk;
- published species habitat use accounts and distribution maps;
- hunting and trapping statistics; and
- available Treaty 7 First Nations Traditional Use Reports, specific to the Grassy Mountain and the Project.

2.2.1 North American Breeding Bird Survey

The North American breeding bird survey (BBS) is a large-scale and long-term bird monitoring program that covers Canada, the United States, and Mexico (Environment Canada 2014). Each year, volunteers survey birds on over 3,000 randomly-selected routes. Each route is 39.4 km long, and along each route, surveyors stop at 800-m intervals to record all birds seen or heard within a 400-m radius during a three-minute period. Surveys start one half hour before local sunrise and are conducted during the peak songbird breeding period, from late May to early July. BBS Route 04-205 follows Highway 40 from Coleman and extends north for 39.4 km (Figure 2.2-1) and borders the western edge of the WLSA. Data for the five most recent years for which data are available (2008-2011 and 2015) were obtained on July 31, 2015.

2.2.2 Fish and Wildlife Management Information System

On June 7, 2016, the FWMIS (AEP, 2016b) was queried to obtain a list of reported wildlife occurrences in the WLSA and to determine whether the Project occurs within any sensitive wildlife ranges. A

query was generated for a rectangular search area that was intended to cover the WLSA and a 1 km zone around it.

2.2.3 Alberta Conservation Association Aerial Ungulate Surveys

The Alberta Conservation Association (ACA) conducts annual aerial ungulate surveys throughout the province, although the 2013 surveys were flown by Alberta Environment and Sustainable Resource Development (AESRD). Information on population sizes and trends are provided by the surveys. This information is then used to make management decisions, such as determining the number of hunting tags that will be allocated for certain species.

The WLSA falls within Wildlife Management Unit (WMU) 303 in the south and WMU 402 in the north (Figure 2.2-2). WMU 306 overlaps part of the WRSA. An aerial survey for mountain goats was conducted in WMU 402 during July 2009. WMUs 306 and 402 were last surveyed for elk during March 2000 (ASRD 2002). Data from these surveys was used to characterise ungulate populations in the region. WMU 303 has not been surveyed recently.

2.2.4 Committee on the Status of Endangered Wildlife in Canada

The COSEWIC database was consulted to obtain species-specific federal conservation status, habitat preferences, sensitivities to disturbance, and other information relevant to the assessment of federally listed wildlife species at risk.

2.2.5 Federal Recovery Strategies for Species at Risk

Recovery strategies are developed for species on SARA's Schedule 1 and are made publically available. Strategies available for SARA-listed species in the WLSA were reviewed to obtain relevant information pertaining to the threats to and requirements of these species.

2.2.6 Published Species Habitat use Accounts and Distribution Maps

Publically available information was consulted to obtain relevant species-specific habitat preference and habitat use data, along with maps of known distributions. This information assisted with determining potential Project impacts on wildlife within the WLSA and GBRSA.

2.2.7 Hunting and Trapping

Hunting is part of Alberta's heritage and provides income and tradition to many residents. AEP issues General and Special Licences that allow hunters the opportunity to harvest various species within specified WMUs throughout the province. WMUs 303, 306 and 402 are covered within the WRSA for the Project (Figure 2.2-2). As a part of the information review process, 7 years of harvest data were compiled from AEP's hunter harvest survey (AEP, 2016c).

2.2.8 Traditional Use Reports

To determine how the Project location may be important to Aboriginal Groups, Traditional Knowledge and Traditional Use (TK/TU) programs were held with Treaty 7 First Nations groups: the Piikani, Kainai, Siksika, Stoney Nakoda, and Tsuut'ina Nations (refer to Section H: Aboriginal Consultation for full details). Based on consultation efforts (from 2013 to ongoing), the Piikani, Kainai, Siksika, and Tsuut'ina Nations were able to generate and provide TU Reports for the Grassy Mountain area.

The TK/TU programs included site visits in June and July 2014, ground-truthing field work in August, September, and October 2014 as well as two workshops with Piikani knowledge holders in June and September 2014. Section H (Aboriginal Consultation) provides further information on the consultation with Piikani. Consultations were also held with members of the Kainai, Siksika, Stoney Nakoda, and Tsuut'ina First Nations (Section H).

A list of wildlife species specifically identified as being potential country foods, culturally, or spiritually important by members of each of these Treaty 7 First Nations groups interviewed during site visits and workshops is provided in Table 2.2-1. A number of these wildlife species or groups were detected in the WLSA during baseline surveys, including moose, deer (mule deer and white-tailed deer), elk, bears (both black and grizzly bears), cougars, Canada lynx, wolves, ground squirrels (gophers), snowshoe hares (rabbits), squirrels, owls, woodpeckers, wild turkeys, American crows, golden eagles, and frogs (Columbia spotted frog, western toad, wood frog). Members of the Kainai, Piikani, and Tsuut'ina Nations noted that eagles are sacred to them and that their feathers are often used in traditional garments.

The Crowsnest Pass area is part of the traditional territory of the Piikani Nation, and many sites in the area are historically and spiritually important to them. Bison were historically hunted in the Crowsnest Pass region by the Piikani, and although bison have been extirpated from the region, several important game species still occur there, including deer, moose, elk, and mountain sheep. American badgers are also important to the Piikani as badger skins have been used in traditional garments (Piikani Nation 2015). Members of the Piikani Nation have noted that it is currently difficult to find good hunting grounds because of various access restrictions (Piikani Nation 2015).

Members of the Kainai Nation also use the Crowsnest Pass area to hunt, gather plants, and travel, as they have for hundreds of years (Kainai Nation 2015). The area also has spiritual and historical importance to them. For example, the remains of several vision quest sites have been found in the Crowsnest Pass area (Kainai Nation 2015). Evidence of vision quest sites, campfire rings, and lodges were also found in the Project area by Kainai technicians during site visits made in 2014 (Kainai Nation 2015). Bison were historically an important species for the Kainai, and bison were frequently

hunted in the Crowsnest Pass area, particularly during the winter when bison often gathered in the valley bottom by the Crowsnest River (Kainai Nation 2015). Currently, the Crowsnest Pass has populations of deer, moose, elk, bighorn sheep, bears, and various birds that are important as sources of food or hides for members of the Kainai Nation.

Table 2.2-1 Wildlife Identified as Valued Components to Treaty 7 First Nations

Wildlife Species	Piikani Nation[1]	Kainai Nation (Blood Tribe[2])	Siksika Nation[3]	Tsuut'ina Nation[4]	Stoney Nakoda First Nation[5]	Samson Cree Nation[5]	Metis Nation of Alberta - Region 3[5]	Metis Nation of BC - Region 4[5]
Birds								
Owl	x	---	---	---	---	---	---	---
Woodpecker	---	x	---	x	---	---	---	---
Wild turkey	---	x	---	---	---	---	x	---
Grouse	x	---	---	---	---	x	x	x
Sprague's pipit	---	---	---	---	---	x	---	---
Crow	---	x	---	---	---	---	---	---
Eagle (golden, bald)	x	x	x	x	---	---	---	---
Furbearers								
Bear (grizzly, black)	x	x	---	x	x	x	x	x
Cougar	---	x	---	x	---	x	---	---
Lynx	---	---	---	x	x	x	---	---
Wolf	x	x	---	x	---	x	---	---
Coyote	---	---	---	---	x	---	---	---
Wolverine	---	---	---	---	---	x	---	---
Otter	x	---	---	---	---	---	---	---
Marten	---	---	---	---	x	---	---	---
Mink	---	---	---	---	x	---	---	---
Skunk	---	---	---	---	---	x	---	---
Gopher	x	---	---	---	---	---	---	---
Badger	x	---	---	---	---	---	---	---
Beaver	x	---	x	---	x	---	---	---
Muskrat	---	---	x	---	---	---	---	---
Porcupine	x	---	---	---	---	---	---	---
Rabbit	x	x	x	x	---	---	---	x
Squirrel	x	x	---	x	x	---	---	---
Mice/Small rodents	---	---	---	x	x	---	---	---
Ungulates								
Buffalo/bison	x	x	x	x	---	---	---	---

Table 2.2-1 Wildlife Identified as Valued Components to Treaty 7 First Nations

Wildlife Species	Piikani Nation[1]	Kainai Nation (Blood Tribe[2])	Siksika Nation[3]	Tsuut'ina Nation[4]	Stoney Nakoda First Nation[5]	Samson Cree Nation[5]	Metis Nation of Alberta - Region 3[5]	Metis Nation of BC - Region 4[5]
Moose	x	x	x	x	x	x	---	x
Bighorn sheep	x	x	x	x	---	x	---	---
Mountain goat	x	---	---	---	----	---	---	---
Deer (mule, white-tailed)	x	x	x	x	x	x	x	x
Elk	x	x	x	x	x	x	x	x
Herptiles								
Frog	x	---	---	x	---	---	---	---
Snake	x	---	---	---	---	---	---	---

[1] Source: Consultation information and Piikani Nation (2015).
[2] Source: Consultation information and Kanai Nation (2015).
[3] Source: Consultation information and SCO (2015).
[4] Source: Consultation information and Tsuut'ina Nation (2015).
[5] Source: Consultation information.

The Crowsnest Pass also served as an important trade route for the Tsuut'ina Nation, and they used the area to hunt game and gather plants (Tsuut'ina Nation 2015). The area is still used for hunting, gathering, and for spiritual purposes, although not to the extent it was prior to the colonization of southwestern Alberta. During the site visit made by members of the Tsuut'ina Nation, several historically-important or sacred sites were identified and these were documented to be registered with Alberta Culture (Tsuut'ina Nation 2015).

2.3 Methods

Field surveys were conducted for amphibians, songbirds, owls, and bats (Table 2.3-1). Wildlife cameras were used to determine the occurrence and distribution of mammals and large ground birds (such as grouse and wild turkey) in the WLSA. Incidental observations of wildlife species were also recorded during the field surveys. All field surveys were based on standard survey protocols currently in use in Alberta (*e.g.* Alberta's Sensitive Species Inventory Guidelines [SSIG] [GoA, 2013b]). Standard field work was completed September 2015 to April 2015, aside from winter tracking which was repeatedly postponed/ cancelled due to poor snow conditions in the WLSA. Benga then agreed to conduct winter tracking in January 2016 additional wildlife surveys in 2016 to provide maximum opportunity for observing any species at risk, sensitive species, species with traditional value, and species of management concern. Results presented in the Wildlife baseline are presented as pre-2016 and 2016 results.

Table 2.3-1 Field Surveys Conducted in the Wildlife Local Study Area

Survey	Timing	SSIG[1]	Target Species
Nocturnal amphibian survey	June 2014, May 2016	1.0 Amphibian : Auditory Survey	Columbia spotted frog, western toad, long-toed salamander, and northern leopard frog.
Diurnal visual amphibian survey	May 2016	2.0 Amphibian : Non-Acoustic Survey	Columbia spotted frog, western toad, long-toed salamander, and northern leopard frog.
Breeding songbird survey	June 2014, June 2016	10.0 Boreal and Foothills Breeding Songbird and Woodpeckers	Baltimore oriole, bobolink, brown creeper, Clark's nutcracker, common yellowthroat, least flycatcher, olive-sided flycatcher, pileated woodpecker, and western wood-pewee.
Nocturnal owl survey	April 2015	--	Great horned owl, great gray owl, barred owl, northern pygmy owl
Aerial raptor survey	April 2016	8.0 Boreal and Foothill Raptors	Red-tailed hawk, northern goshawk, golden eagle, bald eagle, and great horned owl.
Raptor essential nest habitat survey	May 2016	8.0 Boreal and Foothill Raptors	Great horned owl, great gray owl, barred owl, northern pygmy owl, and red-tailed hawk
Short-eared owl survey	May – June 2016	6.0 Short-eared Owl	Short-eared owl
Bat survey	August 2014, June-July 2016	16.0 Bats	Little brown myotis, silver-haired bat, and hoary bat.
Wildlife camera trapping	September 2013 – April 2016	--	Large mammals, including grizzly bear, wolverine, bighorn sheep, elk, moose, Canada lynx, bobcat, and fisher.
Winter track survey	January 2016[1]	19.0 Non-invasive Mammal Surveys	Wolverine, Canada lynx, bobcat, moose, bighorn sheep, elk, white-tailed deer and mule deer.
Pellet count survey[2]	May 2016	--	Moose, bighorn sheep, elk, white-tailed deer, mule deer, marten, weasels, coyote, wolf, grouse.

[1] Sensitive Species Inventory Guideline (GOA 2013b)

[2] Due to poor snow conditions again in 2016, the winter track survey was supplemented with a pellet count survey.

2.3.1 Amphibian Survey

2.3.1.1 Field Work

The amphibian survey was conducted to characterize the amphibian community in the WLSA, and to identify habitats important for their persistence in the area. Prior to initiating field work, potential amphibian survey station locations were identified using available aerial imagery. Where possible, stations were placed immediately adjacent to wetlands and in riparian areas. Some survey stations were also placed in upland and disturbed sites to sample seasonal wetlands (*i.e.*, vernal pools) that may function as breeding habitat as well as ephemeral draws that may function as movement corridors. It was assumed that amphibians could be heard up to 400 m from each station under ideal conditions (*i.e.* no excessive wind or precipitation). Therefore, each station covered an area of approximately 50 ha, and were generally spaced a minimum of 800 m apart. Occasionally, stations were placed closer together when there were several wetlands in close proximity. Access routes between survey stations were also surveyed for any amphibians that may have been on the ground.

The nocturnal auditory and diurnal visual amphibian surveys followed Alberta's Sensitive Species Inventory Guidelines (GoA, 2013b) and the North American Amphibian Monitoring Program protocol outlined in Takats and Priestley (2002). The auditory surveys were conducted overnight from one half-hour after sunset to no later than 01h00. Biologists travelled from station to station by an all-terrain vehicle, and conducted five-minute listening sessions following arrival. A waiting period between arrival and data collection was not considered necessary because all amphibian species present in an area typically resumed their activity within the five minute listening period. A compass bearing and distance estimate (m) was recorded for each group of calling amphibians. Calling intensity was divided into three categories:

- category 1: One or a few individuals where their calls do not overlap;
- category 2: Several individuals where calls overlap, but individuals can still be identified; or
- category 3: A full, continuous chorus where individuals cannot be identified.

2.3.1.1.1 2014 Auditory Survey

Forty (40) acoustic monitoring stations overlapping the WLSA were surveyed for amphibians (Figure 2.3-1). All or part of the 400-m sampling radius around these stations occurred within the WLSA. The survey was conducted between June 2 and June 5, 2014 and timed so that any western toad breeding activity in the WLSA could be documented (GoA, 2013b). Weather conditions during the acoustic survey were considered to be favourable, with no precipitation or wind, and temperatures ranging from 5 to 13°C.

2.3.1.1.2 2016 Acoustic Survey and Visual Surveys

All of the known open water features, including ponds, wetlands, lakes, and slow moving sections of creeks and tributaries in the WLSA were surveyed for amphibians using auditory and non-acoustic techniques (n= 20 stations, Figure 2.3-1). Surveys were conducted May 3 - 4, 2016 and May 16 - 18, 2016, timed to overlap with the typical calling and breeding periods of northern leopard frogs, Columbia spotted frogs, and western toads (GoA 2013b), and to overlap with the breeding period of long-toed salamanders and tiger salamanders.

Non-acoustic surveys were conducted during day light hours following methods described in AEP (2013). Additionally, the margins of each waterbody were scanned by two biologists at night upon completion of the auditory survey at each station to visually observe for any adult and larval amphibians that may not have been visually detected during the daytime non-acoustic surveys (*e.g.* long-toed salamander larvae were only detected at night) and which may also have not been actively calling during the auditory surveys.

2.3.1.2 Data Analysis

As so few amphibians were detected in the WLSA, detection data were analyzed based on habitat occupancy for each species.

2.3.2 Breeding Songbird Survey

2.3.2.1 Field Work

Breeding songbird surveys were conducted in the WLSA from June 24 to June 27, 2014, June 1 to June 5, 2016 and June 11 to June 15, 2016. The modified fixed-radius method, which involves sampling circular plots with a fixed radius, was used (Bibby *et al.*, 2000) and the survey was conducted according to the guidelines for surveying boreal and foothills songbirds and woodpeckers as outlined by AEP (2013). The surveys were timed to begin at one half hour before sunrise and to end by 10h00, depending on weather conditions and bird activity, in accordance with AEP (2013). Fifty-two point count stations were surveyed within the WLSA (Figure 2.3-2) in 2014 and 59 stations were surveyed in 2016. The same 52 stations surveyed in 2014 were replicated in 2016 and seven additional stations were added to the 2016 survey to increase spatial distribution near proposed Project disturbances. The placement of points was determined prior to the survey using available aerial imagery and ecosite phase mapping. Survey points were generally placed at least 50-m from habitat edges and from roads and trails.

Upon arrival at a survey station, a two-minute silent period was initiated to allow for any disturbances associated with biologists accessing the site to subside. After the two-minute silent period, all bird vocalizations and visual observations of within a 100-m radius around the survey

point were recorded. Recordings of bird calls were also made with a Zoom H2n Handy Recorder (Zoom Corporation) to allow for later confirmation of any uncertain vocalizations. Birds seen or heard beyond the 100-m radius or during travel between survey stations were recorded as incidental observations.

In addition to the point counts conducted in the WLSA, an additional 18 point counts were conducted up to 2 km beyond the boundaries of WLSA in 2014. Since these data were collected prior to the time when the boundaries of the WLSA were finalized, this information was presented as incidental observations.

2.3.2.2 Data Analysis

Birds detected within the 100-m point count radius were included in the density and habitat-associated analyses. The average density of each species detected within the area was calculated and presented as number of territories/ha.

Total species richness and the Shannon-Wiener Diversity Index (Shannon and Weiner, 1963) were also calculated for each major habitat type surveyed. Only passerines and woodpeckers were included in the species richness and diversity index calculations because the survey was specifically designed to detect these groups. No incidental observations were included. This diversity index a metric that incorporates both species richness and species evenness (*i.e.* how even the relative proportions of all species are in the community) to provide an overall indication of the heterogeneity of the songbird and woodpecker community. The Shannon-Wiener diversity index (H) was calculated using the following equation:

$$H = -\Sigma p_i \ln p_i$$

Where H = diversity index, and p_i = the proportion of the sampled community made up of species i. Communities dominated by one or a few species will have low H values, and communities with high numbers of species, where most species are present in relatively even numbers, will have high H values.

2.3.3 Owl Surveys

2.3.3.1 Nocturnal Owl Survey

2.3.3.1.1 Field Work

A nocturnal owl survey to determine occurrence, relative abundance, and distribution of owls in the WLSA was conducted based on the survey protocol described by Takats *et al.* (2001). The survey was conducted in early spring during the breeding season when owls are most vocal. Eight stations were

surveyed for owls from March 30-31, 2015 while three more were surveyed from April 27-28, 2015 (Figure 2.3-3).

Survey stations were initially selected in the office using satellite imagery so that coverage of the WLSA could be maximized. It was assumed that vocalizing owls could be detected up to 800 m from a survey station (Takats *et al.*, 2001) during ideal survey conditions (*i.e.* low wind and no precipitation); therefore, each survey station covered an area of approximately 200 ha. Survey stations were established at intervals of at least 1.6 km to reduce the probability of detecting an individual owl twice (Takats *et al.*, 2001). Owl vocalizations were broadcast to elicit both vocal and non-vocal responses (*e.g.* approaching the playback source).

Following arrival at each survey station, a two minute period of silence was used to allow owls to recover from being disturbed. Calls from five owl species were then played in 20 second intervals, spaced by one minute silent periods. The calls were played in ascending order of body size as follows: northern pygmy owl, northern saw-whet owl, barred owl, great gray owl, and great horned owl. Each species' call was played for two rounds before proceeding to the next species.

Upon detection of an owl, the bearing and distance to it were recorded. The approximate locations of detected owls were determined from these data and from the survey stations' UTM coordinates. Owls often respond to broadcast recordings by approaching the location of the playback. Therefore, stations where individuals were detected were not necessarily the same as prior to playback. This precluded the ability to accurately associate individual owls with a specific habitat type. Environmental variables including temperature, wind speed, noise, cloud cover, precipitation, and snow cover were recorded for each survey station. Surveys were not conducted during adverse weather conditions (*i.e.* wind speed >20 km/hr or heavy rain).

2.3.3.1.2 Data Analysis

Owl densities were calculated by dividing the total number of owls of each species detected by the total area sampled. While it was not possible to accurately associate individual owls with a specific habitat type, a summary of habitats within 800 m of each owl location was determined.

2.3.3.2 Aerial Raptor Nest Survey

2.3.3.2.1 Field Work

An aerial raptor nest was conducted in the WLSA on April 27, 2016, prior to leaf-out. The survey was conducted during daylight hours, at an altitude of 100 m above ground to minimize disturbance, and an air speed ranging from a hover to 20 km/hr using a Bell 206b Jet Ranger helicopter. A 200-400 mm telephoto zoom lens attached to a DSLR camera body was used from the helicopter to improve sightability and to capture images of nests. A total distance of 54.0 km was surveyed (Figure 2.3-4).

A primary navigator-observer was seated in the front left seat of the helicopter while an observer-recorder was seated in the rear right of the aircraft. The UTM coordinates of raptor nests were recorded on datasheets and a handheld GPS unit. Raptor nests were classified as active or inactive and identified to species when possible. Active nests were those that showed evidence of recent construction, and the presence of eggs or an incubating adult. If the status and species associated with a nest could not be determined during the aerial survey, nest locations were revisited on June 10, 2016 during the breeding season to confirm species and occupancy (GoA, 2013b).

Many raptor nest structures are quite large and conspicuous, making them easy to detect using aerial surveys during leaf off conditions; however, aerial raptor nest surveys are limited to detecting raptors that use conspicuous nests in trees or on cliffs. As such, it is poorly suited to finding species that nest in cavities (American kestrel), barns or enclosed areas (turkey vulture), within the tree canopy (sharp-shinned hawk, Cooper's hawk, northern goshawk, merlin), or on the ground (northern harrier).

Bighorn Sheep and Mountain Goat Ranges were not surveyed as minimum above-ground heights (400 m) prescribed for flying over these sensitive areas are too high for adequately detecting nests (GoA, 2013b). Key Wildlife and Biodiversity Zones were also avoided during the aerial survey as the survey timing coincided with the restricted activity period for Zones south of Highway 1 and west of Highway 2 (December 15 – April 30).

2.3.3.2.2 Data Analysis

Raptor nest data were summarized by plotting the location of nests on a map, calculating raptor nest density (number of nests/km surveyed), and determining habitat associations for each species. Each nest was assigned a species-specific restricted activity buffer, where available, in accordance with the *Integrated Standards and Guidelines Best Management Practices* (GoA, 2013b; GoA, 2013a).

2.3.3.3 Essential Raptor Habitat Survey

2.3.3.3.1 Field Work

Transects were designed to sample habitat in relation to its availability in the WLSA. Power analysis was employed to determine the number of transects required to obtain a statistically meaningful result in a correlation analysis, which could be used to inform habitat suitability models. Power analysis for correlation indicated that 84 transects 500 m in length were required to achieve a statistically meaningful result with an effect size of 0.3 (moderate), a power of 0.8, and significance level of 0.05. During the planning stage, 98 potential transects were selected. Attempts were made to constrain the entire transect to a specific habitat type wherever possible. Access and safety constraints in the field prevented all 98 planned transects from being sampled. A total of 85 transects were surveyed for a total sampled distance of 42.5 km (Figure 2.3-5). For efficiency and safety in the

field, transects were generally paired to allow two surveyors to work independently in close proximity to each other. In two cases, the 500-m transects were split into paired 250-m transects due to topographical constraints.

Field methods were in accordance with the SSIG (GoA, 2013b). Transects were walked slowly at a speed of 0.5 – 1 km/hr. Observers assessed each transect for essential nesting habitat features, including nest structures (*e.g.* large cavities and stick nests), raptor sign (*e.g.* feathers, pellets, plucking posts, and prey remains), mature dead or living balsam poplar trees adjacent to spruce stands, and large conifer trees in stands where conifers are rare. Other non-essential habitat features of note included downed woody debris, understory complexity, woodpecker holes, old stick nests of other bird species, dead stumps and broken off limbs. When essential habitat features were found, a description of the feature was recorded and nests were described, the location was marked on a GPS (UTM NAD 83), habitat type was determined, environmental conditions were noted (air temperature, wind speed, rain, cloud cover), and photographs of nest structures were taken. Incidental sightings of other non-targeted species were also recorded.

The essential habitat surveys were conducted May 18-20, May 25-27, and June 9-10, 2016. Transects were initially walked on May 18-20, 2016 to search for habitat features only. Potential nest sites from the essential habitat survey and the aerial survey were revisited May 25-27 and June 9-10, 2016 to assess the status of the potential nest sites (active, inactive) and species presence, in accordance with Research Permit 57703 (Appendix B).

2.3.3.3.2 Data Analysis

Essential raptor nesting habitat was summarized by plotting the location of essential features on a map and determining habitat associations of the features. As with raptor nests detected during the aerial nest survey, each essential habitat feature was assigned a restricted activity buffer in accordance with the *Integrated Standards and Guidelines Best Management Practices* (GoA, 2013b; GoA, 2013a)

2.3.3.4 Short-eared Owl Survey

2.3.3.4.1 Field Work

All grassland and open area habitats were assessed prior to the survey to determine suitability of the habitats for short-eared owls. Areas of steep terrain were generally considered to be unsuitable for short-eared owls (GoA, 2013b) and were not surveyed. All other grasslands and open areas, such as clear cuts, pasture, perennial forage crop land, clearings, and abandoned well pads, were surveyed. Survey stations (n = 36, Figure 2.3-6) were selected due to their proximity to suitable habitat and ability to attain an appropriate vantage point from which to survey the habitat to ensure optimum

visibility of the landscape. All other habitats adjacent to the surveyed suitable grasslands and clearings and within 400 m of the survey station were also surveyed.

All stations were surveyed three times during the breeding season (May 2-4, May 16-18, and June 11 -14, 2016) using the roadside/point count survey methodology described by AEP (2013) to determine presence/absence of short-eared owls. Surveys commenced one hour before sunset and ended no later than 30 minutes after sunset. A 3-minute point count was conducted at each survey station, during which two observers scanned all habitats with binoculars. Observers recorded all owls detected within 400 m of the survey station (GoA, 2013b). Owls can be detected farther away than 400 m however any owls detected outside of the 400 m radius were recorded separately as incidentals (GoA, 2013b). Weather conditions during the surveys were ideal, with no rain or high winds (> 20 km/hr).

According to AEP (2013), should a short-eared owl be observed during the point count survey, a ground search for a nest would be required. No short-eared owls were detected during the point count surveys, and therefore ground searches were not conducted.

2.3.3.4.2 Data Analysis

No short-eared owls were detected. Surveyed habitats were described in relation to their availability in the WLSA.

2.3.4 Bat Survey

2.3.4.1 Field Work

Mist netting and acoustic monitoring of bats were conducted at selected locations in the WLSA that were considered to be high quality roosting or foraging habitats. Mist netting using six mist nets was conducted at two locations on August 9 and August 10, 2014 (Figure 2.3-7). Two nets were 6 m long, two were 9 m long, and two were 12 m long. All nets were 38-mm mesh, 75/2 black polyester bat mist nets and were 2.6 m tall with four shelves. At each survey station, nets were assembled next to wetlands, and in configurations that partly surrounded the wetlands (following Vonhof, 2002).

Mist nets were constantly monitored to ensure captured bats were removed soon after capture to minimize potential injuries and to limit the number of escapes. Data collected from captured bats included sex, reproductive condition, age class, and forearm length. Trapping and handling procedures followed recommendations from Vonhof (2002) and directives contained in Class Protocol 004: Bat Handling, Capture and Release including the Addendum issued July 12, 2009 that provides guidance to reduce the spread of white nose syndrome (AEP. 2012).

Acoustic monitoring of bats was conducted the nights of August 8 – 9 at five stations in the WLSA (Figure 2.3-7). One additional site was monitored but its location fell outside of WLSA when it was finalized. Two Song Meter™ SM3Bat™ ultrasonic recorders were deployed at two different locations on each of the three survey nights, for a total of six monitoring stations, and were set to record between sunset and sunrise during each survey night.

Additional field surveys are planned for July 2016 following the same methods described above. Five locations will be surveyed with both acoustic monitoring and mistnets in early July and late July. The results of these surveys will be provided in an addendum to the EIA, which is planned to be submitted in January 2017, to provide the final Instream Flow Needs assessment for Gold Creek and Blairmore Creek.

2.3.4.2 Data Analysis

All sound files were recorded in zero crossing format and noise files were filtered using Kaleidoscope Pro™ from Wildlife Acoustics, Inc. Resulting sound files were analyzed using Kaleidoscope Pro™ with assistance from its Western North America classifier. When possible, sound files were identified as big brown bat/silver-haired bat, hoary bat, a high-frequency grouping of little brown myotis/long-legged myotis, and long-eared myotis. Because of the similarities in call characteristics among some species, it was not possible to confidently distinguish between big brown and silver-haired bats, and between the small myotis species with high-frequency calls.

2.3.5 Wildlife Camera Trapping

2.3.5.1 Field Work

Wildlife camera trapping represents a relatively continuous and non-invasive technique that monitors changes in habitat use by wildlife both seasonally and over time at static monitoring sites. It is effective for monitoring larger mammals such moose, elk, deer, wolves and bears although some larger birds such as grouse and wild turkeys can also be monitored. Wildlife cameras are also useful for detecting elusive and sensitive species such as Canada lynx and cougars.

ReconyxTM PC900 HyperFire Professional Covert Infrared wildlife cameras were used to record colour images of wildlife during the day and monochrome images at night. These cameras use infrared technology to avoid potential "startle" responses to flash disturbance at night, and have a range of up to 30.5 m and a 40° field of view. Cameras were checked twice annually (spring and fall) to download images, replace batteries, and maintain the units (*e.g.* reposition cameras shifted by wildlife, remove obstructive vegetation, clean lenses, *etc.*). Because wildlife camera sites only need to be visited by observers twice annually to change batteries and download data from memory cards, human disturbance is minimized.

Fifteen wildlife cameras were deployed in the WLSA (Figure 2.3-8) on September 23 and 24, 2013. Cameras were first checked between June 3 and 6, 2014. At this time, data from one camera (GM09) was not recovered because the camera had been destroyed and the memory card stolen. A replacement camera was set up on November 6, 2014. Two additional cameras stopped recording on November 26 and January 21. During the next check conducted between November 4 and 6, 2014, data were retrieved from all 15 cameras but one camera had stopped recording data on September 30.

To better address the needs for baseline wildlife data collection, an additional 10 cameras were deployed November 4-6, 2014, and two cameras were deployed in the proposed replacement golf course area in the WLSA on April 13, 2016 (Figure 2.3-8). All 27 cameras were checked, and data downloaded in spring of 2016, either on March 30-31, April 15, May 26 or June 2, 2016.

Attempts were made to place cameras throughout the WLSA although final placement was influenced by habitat type, presence of wildlife trails, and access. This approach resulted in the placement of cameras at various distances from the Project footprint, providing suitable geographical coverage of the area and a reasonable sample size for most major habitat types in the WLSA. Four cameras fell outside of the WLSA once the Project Mine Permit Boundary was finalized. These four cameras were all located within approximately 1 km of the western edge of the WLSA and east of the Forestry Trunk Road (Highway 40). Herein, all 27 cameras are referred to as being in the WLSA to ensure that wide ranging species, such as grizzly bears and ungulates, were captured by the full deployment of cameras for the Project. Overall, 67% (18) of the 27 cameras located in the WLSA were placed in undisturbed habitats at least 50 m from a disturbance feature, 26% (7) were located along or within 10 m of a linear disturbance (*e.g.* ATV trails, roads, pipelines and transmission lines), and 8% (2) were in cutblocks.

2.3.5.2 Data Analysis

The number of "camera days" was calculated by summing the number of days (24-hour periods) each camera was functioning for each monitoring cycle. Wildlife cameras may have stopped functioning because of full memory cards, low battery levels, or damage from humans or wildlife. Cameras were also considered non-functional if the lenses were obscured by snow or tree branches, or if the camera shifted so that it was no longer orientated properly. In total, wildlife cameras were actively deployed in the WLSA for 9,684 camera days during the 2013-2015 monitoring period and 7,719 camera days during the 2015-2016 period.

Although data obtained from wildlife camera trapping cannot be used to estimate the true population density of a species, the data can be used to monitor changes in the occurrence (occupancy) or relative abundance of a species over time. By distributing cameras throughout the WLSA, it is possible to spatially analyze changes in wildlife use over time. Species detection frequency, which is based on

the number of individual observations of animals of each species/100 camera days, is used to measure habitat occupancy. Scaling the index to 100 camera days allows for better presentation of data, especially for species that occur at low densities or have low detection rates, and to account for days when a camera may be inoperable (*e.g.* dead batteries, misaligned by wildlife, *etc*.). Other authors have used a similar index as a measure of habitat occupancy (Goad, 2013) or as an index of relative abundance (Jenks *et al.*, 2011). An additional metric that may be useful for tracking changes in habitat occupancy is the percentage of camera locations at which a species is recorded during a particular period (*e.g.* winter, spring, summer, and fall) or habitat type. These metrics have also been used to assess habitat occupancy by various mammalian species (Erb *et al.*, 2012; Rovero *et al.*, 2013) and may be particularly useful for species that are rare or have very low detection rates. This approach is robust enough to account for normal seasonal changes in habitat use and movement patterns.

Ungulates that occur in the WLSA are likely to display seasonal changes in habitat use. Aerial surveys have documented seasonal movements of moose in Alberta (Westworth, 1980), and elk in mountainous areas often migrate to lower elevation habitats during the winter (Boyce *et al.*, 2003). For purposes of monitoring effects of the Project on habitat occupancy over time, there is a need to understand these seasonal patterns and that year over year comparisons are made within the same seasons. Because of the "threatened" status of grizzly bears in Alberta and the recreational and traditional importance of ungulates in the region, detection frequencies for each wildlife species were calculated seasonally based on general grizzly bear, elk, and moose biology (Table 2.3-2; Banfield, 1974; Naughton, 2012; van Beest *et al.*, 2013; Graham and Stenhouse, 2014).

Table 2.3-2 Seasons Used For Analyzing Wildlife Camera Data

Season	Start Date	End Date
Winter	November 15	April 15
Spring	April 16	May 31
Summer	June 1	August 31
Fall	September 1	November 14

Sources: Banfield 1974, Graham and Stenhouse 2014, Naughton 2012, van Beest *et al.* 2013.

2.3.6 Winter Tracking Survey

2.3.6.1 Field Work

A winter tracking survey was planned for 2015; however, the survey could not be conducted because of the lack of suitable snow conditions in the WLSA required for a defensible winter track survey.

A winter tracking survey was conducted on March 30 - 31, 2016, within the timing window provided by the GoA (2013) for this survey type. Many methods may be used to survey for mammal species, including pellet/scat surveys, aerial surveys, remote cameras, and winter tracking, although winter tracking is the preferred method provided snow conditions are favourable (GoA, 2013). Winter track surveys were conducted to characterize the relative abundance, distribution, and winter habitat use of mammals in the WLSA. Winter track counts cannot be used to accurately estimate wildlife densities, but they are useful for estimating relative abundance and habitat associations for resident wildlife species. Track surveys were conducted using a tracked side-by-side off-road vehicle and on foot along linear features (*e.g.* roads and seismic lines) that ranged from approximately 5 m to 10 m in width. Nine transects, ranging from 1.25 km to 5.71 km in length, were surveyed for wildlife tracks (Figure 2.3-9) for a total sampling effort of 26.95 km. GoA (2013) states that "a minimum of one 10 km transect be placed on the landscape" for projects looking at impacts on the scale of a local study area. Due to the steep and varied terrain in the WLSA and high potential for avalanches in this mountainous environment, 10 km straight line transects could not be conducted safely. The average snow depth recorded during the winter track survey was 37.1 cm. Transects were established to sample habitats in proportion to their availability in the WLSA as snow conditions allowed.

Several species that leave very similar tracks could only be identified to group, including deer and grouse.

2.3.6.2 Data Analysis

The number of days since snowfall during the winter track survey ranged from 2 to 3 days as snow obliterating events including high winds and warming temperatures limited the window of time available to conduct this survey. To account for track accumulation and variable transect length, the data were converted to a standardized measure as follows:

$$Relative\ Track\ Density\ (tracks/km/day) = \frac{No.\ of\ Tracks}{Length\ (km)\ x\ Days\ Since\ Last\ Snowfall}$$

The relative track frequency was calculated for each species by habitat type.

2.3.7 Pellet Count Survey

Pellet/scat surveys are a systematic method of measuring cumulative winter habitat use by wildlife, particularly ungulates, large carnivores, furbearers, and grouse. These surveys are a comparatively 'low-impact' method, requiring a single visit by observers in the spring prior to the start of the growing season. Pellet/scat surveys are one of four suitable methods recognized by GoA (2013b) for

surveying mammals at the local study area scale. Pellet/scat surveys, like winter tracking and wildlife cameras, allow for detection of numerous species while minimizing disturbance to mammals.

2.3.7.1 Field Work

Power analysis was used to determine the minimum number of plots required to obtain a statistically meaningful result. This analysis was based on sampling nine habitat types, and a moderate effect size (f = 0.25) was used to detect an effect at a significance level of 0.05 with high power (0.8). From this analysis, a minimum of 28 plots per habitat type needed to be surveyed. This minimum number of plots was achieved for all sampled habitat types except deciduous forest due to limited availability of this habitat type in the WLSA (Table 2.4-1). Potential sampling locations were selected to represent the various habitat types present in the WLSA using available ecosite mapping (CR # 8 – Vegetation and Wetlands).

Sixty (60) transects (420 plots) were sampled in representative habitat types in the WLSA between May 2 - 6, 2016 (Figure 2.3-10). Each transect was 150 m in length, comprised of seven 50-m^2 circular plots spaced at 25-m intervals. A 2-m wide strip (36 m^2) centered on each transect was also searched as the observer traveled between circular plots. This resulted in a sampling effort of 566 m^2/transect and a total sampling effort of 33,960 m^2 (3.4 ha) for 9 km of transects across 420 plots the WLSA. For snowshoe hares, individual pellets were counted from 1 m^2 circular plots centered on the plot centers of the 50-m^2 circular plots, resulting in a total search area of 7 m^2/transect.

All pellet groups (*e.g.* ungulates, snowshoe hares) and scats (*e.g.* carnivores, furbearers) encountered along each transect were counted. In the case of pellet groups, at least one-half of the group must have been located within the circular plot or strip-transect boundaries to be counted. White-tailed deer and mule deer both occur in the WLSA and, because their pellets could not be distinguished, deer pellet groups were combined for the analysis. Similarly, grouse pellets could not be distinguished to the species level and were grouped for the analysis.

2.3.7.2 Data Analysis

Pellet group and scat count densities (number of pellet groups or scats/ha) were calculated and summarized by habitat type to determine habitat use and relative abundance.

2.3.8 Incidental Wildlife Observations

Incidental observations of wildlife were recorded during all surveys conducted in the WLSA by noting the location (*i.e.* UTM coordinates), species, type of sign (*i.e.* scat, tracks, browsing, *etc.*), date, and when possible, the habitat where the observation occurred.

2.3.9 Wildlife Biodiversity

Biodiversity can be defined as the "*variety and variability among all living organisms and the ecological complexes in which they occur*" (Probst and Crow, 1991). It includes diversity among individuals, populations, species, communities, and ecosystems, as well as the various relationships among these groups. Biodiversity is important for maintaining ecological integrity by providing redundancy. Several species often contribute to the same ecological processes, or provide similar ecological functions, so that the loss of a single species should not substantially undermine the ecosystem. However, some species are unique in the niches they fill, and their extirpation from an area can have a cascading effect (*i.e.* keystone species).

Biodiversity resources and indicators were selected to cover the range of potential effects on biodiversity in the WLSA and GBRSA. Resources were selected to cover three ecological levels: landscape (terrain and disturbance features, CR #8 – Vegetation and Wetlands); habitat (composition and structure, CR #8 – Vegetation and Wetlands); and species (species within taxonomic groups).

Wildlife biodiversity was defined and assessed at the species level. Two wildlife diversity indicators were selected: total species richness and relative breeding bird diversity. The total species richness indicator examined the relationship between habitats and the diversity of select taxonomic groups (mammals, birds, and herptiles) in the WLSA and GBRSA based on a compilation of field data collected at the local study area level and desktop review information from field guide books, taxonomic keys, and scientific reviews. The selected taxonomic groups included those with the best available information to link individual species to preferred habitat types, ecosite phases or ELC classes.

Potential species occurrence, based on a compilation of field data and desktop review information, was used in conjunction with observations from the Project's field surveys, rather than field observations alone, because not all habitats and locations could be surveyed in all seasons, which could lead to field data underestimating species richness. Habitat types, ecosite phases, and ELC classes were assigned total species richness (diversity) rankings based on the number of species that could potentially occur in each. The ranks of low (0-19 species), moderate-low (20-44 species), moderate (45-70 species), moderate-high (71-90 species), and high (>90 species) were developed based on statistical distribution of species richness values. These relative diversity rankings were mapped for the WLSA and GBRSA to assess Project impacts on wildlife biodiversity at Year 14 and Year 27.

2.3.10 Wildlife Research Permits

Several field studies in the WLSA were conducted under Wildlife Research Permits issued by AEP. These included the spring 2014 (RP No. 55000) and 2015 nocturnal owl surveys (RP No. 55984), spring 2016 nest search survey (RP No. 57703), and 2014 and 2016 bat mistnetting surveys (RP No. 53092, CL

No. 55091; RP No. 57701, CL No. 57702) (Appendix B). All field data collected under these research permits were entered into the appropriate loadforms and submitted to AEP.

2.4 Baseline Wildlife and Wildlife Habitat

2.4.1 Habitat Availability

At the landscape level, 16 habitat types comprised of 17 ecosite phases in the Montane Natural Subregion (2,716.1 ha or 48.1%), 10 ecosite phases in the Subalpine Natural Subregion (1,790.5 ha or 31.7%), and 17 anthropogenic disturbances and non-vegetated lands (1,027.3 ha or 18.2%) characterize the WLSA at baseline (Table 2.4-1). Rock/barren areas and waterbodies comprise only 48.6 ha (0.9%) and 61.8 ha (1.1%) of the WLSA, respectively. At the habitat type scale, most of the WLSA is characterized by coniferous (2,836.6; 50.2%) or mixed coniferous and mixed deciduous (1,282.4 ha; 22.7%) forests. Deciduous forests account for only 79.2 ha (1.4 %) of the WLSA (Table 2.4-1). This landscape diversity provides suitable habitat for a wide range of wildlife species.

Of the coniferous habitat types present in the WLSA, moderate mixed coniferous forest has the largest areal extent (1,375.8 ha, 24.4%), followed by closed mixed coniferous (419.5 ha, 7.4 %), open pine (516.7 ha, 9.2%), open mixed conifer (440.5 ha, 7.8%), and closed spruce (79.4 ha, 1.4%) (Table 2.4-1). Closed mixedwood and open mixedwood habitats account for 991.2 ha (17.6%) and 291.2 ha (5.2%) of the WLSA, respectively. Most of the deciduous forest present is characterized as open (51.6 ha, 0.9%) with only 27.6 ha (0.5%) classified as closed deciduous forest. Treed wetlands are uncommon and account for only 4.8 ha (0.1%) of the WLSA (Table 2.4-1). Non-forested natural habitat types include grasslands and shrub lands and account for 290.3 ha (5.1%) and 17.9 ha (0.3%) of the WLSA, respectively.

Anthropogenic pre-disturbances associated with historical mining activities, account for 18.2% (1,029.5 ha) of the WLSA. Some of these pre-disturbance habitats can provide suitable habitat for wildlife on a seasonal or year-round basis. Other anthropogenic pre-disturbances associated with clearcuts (239.6 ha, 4.2%), and other vegetated clearings associated with linear features (*e.g.* transmission lines or pipelines), well sites, or golf courses account for 277.8 ha (5.0 %) of the WLSA (Table 2.4-1).

Table 2.4-1 Wildlife Habitat Types and Ecosite Phases Present in the Wildlife Local Study Area

Habitat Type	Ecosite Phase	Natural Subregion	Ecological Site Description	Area	
				Total (ha)	% of Total
Open Pine	a1	MN	Limber pine/Juniper	57.1	1.0
	a1	SA	Lichen/Lodgepole pine	20.3	0.4
	b1	MN	Bearberry/Lodgepole pine	313.2	5.5
	b1	SA	Bearberry-hairy wild rye/Lodgepole pine	126.0	2.2
Subtotal Open Pine				**516.7**	**9.2**
Open Deciduous	b2	MN	Bearberry/Aspen	22.5	0.4
	c3	MN	Canada buffaloberry - hairy wild rye/Aspen	29.1	0.5
Subtotal Open Deciduous				**51.6**	**0.9**
Open Mixedwood	b3	MN	Bearberry/Aspen-white spruce-lodgepole pine	34.8	0.6
	c4	MN	Canada buffaloberry-hairy wild rye/Aspen, white spruce, lodgepole pine, Douglas fir	256.4	4.5
Subtotal Open Mixedwood				**291.2**	**5.2**
Open Mixed Coniferous	c1	MN	Canada buffaloberry-hairy wild rye/Douglas fir	228.2	4.0
	c2	MN	Canada buffaloberry-hairy wild rye/Lodgepole pine	212.3	3.8
Subtotal Open Mixed Coniferous				**440.5**	**7.8**
Moderate Mixed Coniferous	e1	SA	False azalea-grouseberry/Lodgepole pine	1,127.9	20.0
	e3	SA	False azalea-grouseberry/Engelmann spruce	220.2	3.9
	e4	SA	False azalea-grouseberry/Subalpine fir	27.7	0.5
Subtotal Moderate Mixed Coniferous				**1,375.8**	**24.4**

Table 2.4-1 Wildlife Habitat Types and Ecosite Phases Present in the Wildlife Local Study Area

Habitat Type	Ecosite Phase	Natural Subregion	Ecological Site Description	Area	
				Total (ha)	% of Total
Closed Deciduous	**f1**	**MN**	**Balsam poplar**	**27.6**	**0.5**
Closed Mixedwood	d1	MN	Creeping mahonia-white meadowsweet/ Douglas fir	121.0	2.1
	d2	MN	Creeping mahonia-white meadowsweet/Lodgepole pine	659.0	11.7
	e2	MN	Thimbleberry-pine grass/Aspen	95.2	1.7
	e3	MN	Thimbleberry-pine grass/White spruce	115.9	2.1
Subtotal Closed Mixedwood				**991.2**	**17.6**
Closed Spruce	g1	MN	Horsetail/White spruce-balsam poplar	49.4	0.9
	g2	MN	Horsetail/White Spruce	20.6	0.4
	h1	SA	Horsetail/Engelmann spruce	9.3	0.2
Subtotal Closed Spruce				**79.4**	**1.4**
Closed Mixed Coniferous	d3	MN	Creeping mahonia-white meadowsweet/White spruce	11.6	0.2
	e1	MN	Thimbleberry-pine grass/Lodgepole pine	319.8	5.7
	f1	SA	Thimbleberry/Lodgepole pine	56.8	1.0
	f2	SA	Thimbleberry/Subalpine fir-Engelmann spruce	31.4	0.6
Subtotal Closed Mixed Coniferous				**419.5**	**7.4**
Grassland	HG	MN	Natural grassland	119.5	2.1
	HG	SA	Natural grassland	170.8	3.0
Subtotal Grassland				**290.3**	**5.1**
Upland Shrub	**SC**	**MN**	**Closed shrubland**	**0.2**	**0.0**
Shrubby Wetland	FONS	MN	Shrubby fen	17.6	0.3
	SO	MN	Open shrubland	0.3	0.01
Subtotal Shrubby Wetland				**17.9**	**0.3**

Table 2.4-1 Wildlife Habitat Types and Ecosite Phases Present in the Wildlife Local Study Area

Habitat Type	Ecosite Phase	Natural Subregion	Ecological Site Description	Area	
				Total (ha)	% of Total
Treed Wetland	**STNN**	**MN**	**Wooded swamp**	**4.8**	**0.1**
Rock Barren	**NMR**	**-**	**Talus slope, rock slide**	**48.6**	**0.9**
Waterbody	**NWF, NWL, NWR**	**-**	**Rivers, lakes, and flooded areas**	**63.9**	**1.1**
Anthropogenic Disturbance	AIF	-	Farmstead	2.2	0.0
	AIH	-	Permanent rights-of-way (roads, highways, rail)	124.8	2.2
	AII	-	Industrial (*e.g.* plant sites)	0.2	0.0
	AIM	-	Historical surface mines	165.2	2.9
	ASC	-	Cities, towns, villages, hamlets	180.4	3.2
	CC	-	Clearcut	239.7	4.2
	CIP	-	Pipelines/transmission lines seeded to grass	47.9	0.8
	CIW	-	Geophysical activities/well sites seeded grass	17.3	0.3
	CL, CO	-	Clearing	212.4	3.8
	CP	-	Perennial forage crop (agriculture)	37.3	0.7
Subtotal Anthropogenic Disturbance				**1,027.3**	**18.2**
Total				**5,646.4**	**100.0**

2.4.2 Wildlife Species of Concern

Sixty-one (61) wildlife species with special status at either the provincial or federal levels may exist within the GBRSA of the Project (Table 2.4-2). These include four amphibians, two reptiles, 11 mammals, and 44 birds. Of the 61 species, 8 species have provincial designations of either "At Risk", "May Be At Risk" or "Threatened", while an additional 15 species have status designations of "Special Concern", "Threatened" or "Endangered" at the federal level. Eight of the wildlife species that have risk designations of "At Risk" or higher at the provincial level and are of "Special Concern" or higher federally (SARA and COSEWIC) have been confirmed to occur in the area either through

baseline wildlife surveys conducted in WLSA and GBRSA, incidental observations, and other available information sources (*e.g.* FWMIS, North American BBS) are indicated in bold text in Table 2.4-2.

Table 2.4-2 Summary of Provincial and Federal Special Status Wildlife Species That May Occur in the Grizzly Bear Regional Study Area for the Grassy Mountain Coal Project

Common Name	Provincial Status[1]	Federal Status[2]	Probability of Occurrence	Key Habitat Requirements
Amphibians and Reptiles				
Columbia spotted frog	Sensitive	Not At Risk	Confirmed[3]	Permanent water bodies in mixed coniferous/ subalpine forests; 995 - >2,150 m in elevation.
Northern leopard frog	At Risk	Special Concern – SARA Schedule 1	Low[4]	Permanent water bodies (*e.g.* streams, marshes) with abundant aquatic vegetation.
Long-toed Salamander	Sensitive	Not At Risk	Confirmed	Under rocks, rotting logs, debris; near ponds, lakes, streams.
Western toad	**Sensitive**	**Special Concern**	**Confirmed**	**Ponds, streams, rivers, lakes; overwinter in sandy upland forest.**
Plains garter snake	Sensitive	-	Low	Edges of water bodies/marshes to forage. Hibernates in karst sinkholes, burrows, rock piles.
Wandering garter snake	Sensitive	-	Confirmed	Often near water and hibernates communally in natural crevices and small mammal burrows.
Birds				
Green-winged Teal	Sensitive	-	Moderate	Wooded ponds and streams. Nests in upland areas with dense shrub or sedge cover
American kestrel	Sensitive	-	Confirmed	Open habitats, grasslands, burned areas, pastures, and parkland. Nests in tree cavities.
American white pelican	Sensitive	Not At Risk	Low	Marshes, lakes, rivers. Nests on the ground on islands surrounded by freshwater.
Baird's sparrow	Sensitive	Special Concern	Confirmed-	Grasslands, pastures, open habitats.
Bald eagle	Sensitive	Not At Risk	Confirmed	Forages in lakes and rivers with treed shorelines. Nests in mature trees along the edges of forests.
Baltimore oriole	Sensitive	-	Moderate	Breeds in forests dominated by deciduous trees. Nests near water and forest edges of forest.

Table 2.4-2 Summary of Provincial and Federal Special Status Wildlife Species That May Occur in the Grizzly Bear Regional Study Area for the Grassy Mountain Coal Project

Common Name	Provincial Status[1]	Federal Status[2]	Probability of Occurrence	Key Habitat Requirements
Barn swallow	**Sensitive**	**Threatened**	**Confirmed**	**Agricultural fields, open areas, uses overhanging structures near human activity for nesting.**
Barred owl	Sensitive	-	Confirmed	Mature and old mixedwood forests, with large trees containing large cavities for nesting.
Black tern	Sensitive	Not At Risk	Moderate	Shallow wetlands, marshes and ponds with emergent vegetation.
Black-backed woodpecker	Sensitive	-	Confirmed	Mature coniferous forests, standing dead trees.
Bobolink	Sensitive	Threatened	Low	Open fallow fields, tall-grass and mixed-grass prairies, and damp meadows.
Brewer's sparrow	Sensitive	-	Low	Semi-arid plains, short grass and low shrubs, sagebrush, thickets of dwarf birch and willow.
Broad-winged hawk	Sensitive	-	Moderate	Mature and old-growth forests with openings. Nests in tall deciduous trees.
Brown creeper	Sensitive	-	Moderate	Closed canopy, mature and old-growth coniferous and mixed coniferous-deciduous forests.
Clark's nutcracker	Sensitive	-	Confirmed	Mature coniferous and mixed-coniferous forest with large pines.
Common nighthawk	**Sensitive**	**Threatened – SARA Schedule 1**	**Confirmed**	**Cutblocks, forest clearings, prairies, rock outcrops. Nests near logs, boulders, and shrubs.**
Common yellowthroat	Sensitive	-	Confirmed	Wetlands, early successional forests, and forests with high densities of undergrowth vegetation.
Ferruginous hawk	At Risk	Threatened – SARA Schedule 1	Low	Grasslands, treeless areas, uncultivated pasture/ prairie. Nests in isolated trees, on ground, or cliffs.
Golden eagle	Sensitive	Not At Risk	Confirmed	Grasslands, open areas, rivers, mountainous areas, bogs. Nests on cliff edges and tall trees.
Great blue heron	Sensitive	-	Low	Open habitats, streams, ponds, lakes, rivers, marshes, wet meadows, upland fields.
Harlequin duck	Sensitive	-	Confirmed	Clear, rocky streams and rivers with fast, powerful currents.

Table 2.4-2 Summary of Provincial and Federal Special Status Wildlife Species That May Occur in the Grizzly Bear Regional Study Area for the Grassy Mountain Coal Project

Common Name	Provincial Status[1]	Federal Status[2]	Probability of Occurrence	Key Habitat Requirements
Horned grebe	Sensitive	Special Concern	Low	Open water, ponds, marshes, lakes. Nests in marshy ponds with emergent vegetation.
Least flycatcher	Sensitive	-	High	Mature deciduous forest with brushy understory/ open areas created by fire and human disturbance.
Lesser scaup	Sensitive	-	Moderate	Shallow water habitats with tall, dense herbaceous vegetation near forest cover.
Long-billed curlew	Sensitive	Special Concern – SARA Schedule 1	Low	Dry short grass/mixed grass prairie, rolling terrain, low cover/little to no shrubby vegetation.
Northern goshawk	Sensitive	Not At Risk	Moderate	Nests in mature mixedwood forests with high canopy closure. Forages in clearings and wetlands.
Northern harrier	Sensitive	Not At Risk	Moderate	Open areas, shallow wetlands, marshes, meadows, and farmland. Nests on the ground.
Northern pintail	Sensitive	-	Moderate	Shallow ponds, marshes, and lakes with emergent vegetation, usually with drier margins.
Northern pygmy owl	Sensitive	-	Moderate	Mature and old-growth forest, open forest. Forages in open areas.
Olive-sided flycatcher	**May Be At Risk**	**Threatened – SARA Schedule 1**	**Confirmed**	**Semi-open coniferous/mixedwood forests along edges/openings, near water with tall trees/snags.**
Osprey	Sensitive	-	Confirmed	Open water, lakes, and rivers containing fish. Nests in trees around water bodies.
Peregrine falcon	At Risk	Special Concern – SARA Schedule 1	Low	Open areas near water. Nests on cliff edges and artificial nest structures.
Pied-billed grebe	Sensitive	-	Low	Wetlands, shallow lakes. Nests in dense stands of emergent vegetation along wetland edges.
Pileated woodpecker	Sensitive	-	Confirmed	Mature/old-growth deciduous, coniferous, and mixedwood forests. Nests in cavities in large trees.

Table 2.4-2 Summary of Provincial and Federal Special Status Wildlife Species That May Occur in the Grizzly Bear Regional Study Area for the Grassy Mountain Coal Project

Common Name	Provincial Status[1]	Federal Status[2]	Probability of Occurrence	Key Habitat Requirements
Prairie falcon	Sensitive	Not At Risk	Low	Open grasslands and farmland, native rangelands. Nests on cliff edges.
Sandhill crane	Sensitive	-	Low	Open meadows, wet forested areas, often near small ponds or marshes.
Sharp-tailed grouse	Sensitive	-	Confirmed, but rare	Open grassland and brushland areas with scattered patches of trees.
Short-eared Owl	**May Be At Risk**	**Special Concern – SARA Schedule 1**	**Confirmed, but rare**	**Open areas (fields, grasslands), marshes. Nests on the ground.**
Sora	Sensitive	-	Confirmed	Shallow and moderately deep water (marshes, ponds) with emergent vegetation.
Swainson's hawk	Sensitive	-	Moderate	Grassland, farmland, and open areas. Nests in trees and shrubs.
Trumpeter swan	Threatened	Not at Risk	Low	Isolated, small/medium-sized shallow lakes/ponds with well-developed aquatic plant communities.
Upland sandpiper	Sensitive	-	Low	Grassy fields/meadows where grass is 10-20 cm tall with areas of open ground/few shrubs/trees.
Western tanager	Sensitive	-	High	Mature and old-growth coniferous, mixedwood and deciduous forest.
Western wood pewee	Sensitive	-	Confirmed	Mature deciduous and mixed forests, forest edges, and riparian zones. Absent from dense forest.
Mammals				
Little brown myotis	**Secure**	**Endangered – SARA Schedule 1**	**Confirmed**	**Roosts under loose bark on trees, tree cavities, buildings, bridges, caves. Forages near water.**
Hoary bat	Sensitive	-	Confirmed	Open grassy areas in coniferous and deciduous forests. Forages near farmlands. Roosts in trees.
Silver-haired Bat	Sensitive	-	High	Water for foraging. Roosts in tree cavities, under loose bark. Hibernates in caves, mines, buildings.
Water vole	Sensitive	-	High	Alpine and subalpine streams and lakes. Clear, swift streams with gravel bottoms.

Table 2.4-2 Summary of Provincial and Federal Special Status Wildlife Species That May Occur in the Grizzly Bear Regional Study Area for the Grassy Mountain Coal Project

Common Name	Provincial Status[1]	Federal Status[2]	Probability of Occurrence	Key Habitat Requirements
Red-tailed chipmunk	Sensitive	Not at Risk	Moderate[5]	Coniferous mountain forests and boulder covered slopes below tree line.
American badger	**Sensitive**	**Special Concern**	**Confirmed**	**Open spaces, grasslands, prairies, treeless slopes, riparian meadows.**
Bobcat	Sensitive	-	Confirmed	Coniferous/deciduous forests, brushy areas in coulees. Dens in rocky crevices, hollow logs.
Canada lynx	Sensitive	Not At Risk	Confirmed	Coniferous forest with downed woody debris and dense understory.
Fisher	Sensitive	-	Moderate	Dense mature and old-growth coniferous forest. Generally avoids logged and burned areas.
Wolverine	**May Be At Risk**	**Special Concern**	**Confirmed[6]**	**Large areas of remote wilderness in the foothills and mountains. Avoids human development.**
Grizzly bear	**Threatened**	**Special Concern**	**Confirmed**	**Open slopes, alpine meadows, cutblocks, burns, riparian areas, mature forest, and disturbed sites.**

Bold: SARA- and COSEWIC-listed species that have been confirmed in the GBRSA

[1] *Alberta Wild Species General Status Listing* (AEP, 2010c)

[2] COSEWIC/SARA status. Species with SARA status are indicated with SARA Schedule 1.

[3] Confirmed – Baseline surveys or other information sources such as the North American BBS, FWMIS or published literature indicate a species is present; High – Species likely occurs if suitable habitat is present; Moderate – Species may occasionally range into or breed in area. Available habitat is of moderate quality; Low – Species is rare and available habitat is scarce or of low quality.

[4] Likely extirpated from region.

[5] Known to occur in Waterton National Park and the West Castle Valley.

[6] Species has ranged into WLSA but appears to be rare.

2.4.3 Wildlife Occurrence and Habitat Use

Field results were prepared prior to the addition of 2016 field surveys. As the additional results do not change the assessments, the 2016 results are presented separately rather than being amalgamated with the earlier results.

2.4.3.1 Amphibians and Reptiles

2.4.3.1.1 2014 Results

In 2014, 31.6% (1,785.8 ha) of the WLSA representing potential amphibian habitat was sampled during the nocturnal amphibian survey. Amphibians were detected at five (5) of the 42 stations (12%) in the WLSA (Figure 2.4-1). Additionally, two wood frogs were detected calling at one station located outside of the WLSA but were reported as incidentals (Figure 2.4-1). Wood frogs were detected at two stations (4.8%) while boreal chorus frogs were heard at only one station (2.4%) (Figure 2.4-1). The calling index for the boreal chorus frog group was 1 while the calling index for the wood frog groups varied from 1 to 3. The relatively low number of wood frog and boreal chorus frog observations likely resulted from the timing of the amphibian surveys relative to their reproductive periods since the amphibian survey was more focused on detecting toads that breed later in the year. Neither wood frogs nor boreal chorus frogs are species of concern at the provincial, federal, or global levels.

Columbia spotted frogs were heard calling at one location in the WLSA (Figure 2.4-1). The identity of the Columbia spotted frogs was also confirmed visually, as six frogs were observed in a small treed swamp (Photo 2.4-1). The calling index for the Columbia spotted frog groups was 1.

Columbia spotted frogs may be more abundant in the WLSA than suggested by survey results. They have quiet, low calls that often cannot be heard beyond 30 m (James, 1998). Additionally, they breed early during the year, typically as soon as suitable water bodies start to thaw (Russell and Bauer, 2000); consequently, some groups of Columbia spotted frogs may have stopped calling by the time the survey was conducted.

Photo 2.4-1 Confirmed Columbia spotted frog breeding area in the WLSA, June 5, 2014.

Columbia spotted frogs have a general provincial status of "Sensitive" (Table 2.4-3). In Alberta, they primarily occur in the Rocky Mountains and tend to be associated with cool, slow-moving, or still water bodies. They are highly aquatic but may use upland habitats to move among breeding ponds, summer habitats, and overwintering habitats.

Table 2.4-3 Reptile and Amphibian Species Detected in the Wildlife Local Study Area with Applicable Conservation Status

Species	Provincial Status		COSEWIC Designation	2014 Survey	2016 Survey	FWMIS
	General	Legislated				
Boreal chorus frog	Secure	-	-	X	-	-
Western toad	Sensitive	-	Special Concern	X	X	X
Columbia spotted frog	Sensitive	-	Not at Risk	X	X	X
Long-toed salamander	Sensitive	Special Concern	Not at Risk	?	X	X
Western tiger salamander	Secure	-	Special Concern	?	-	-
Wandering garter snake	Sensitive	-	-	-	-	X
Wood frog	Secure	-	-	X	-	-

? Salamander larvae were not identified to species, and are either long-toed or tiger salamander.

Several young salamander larvae were also observed in an impounded area of an unnamed tributary of Blairmore Creek in the WLSA during the amphibian survey (Figure 2.4-1, Photo 2.4-2). Larvae could not be distinguished between western tiger and long-toed salamanders in the field and were therefore recorded only as salamanders.

Photo 2.4-2 Salamander larva detected in an impounded area of an unnamed tributary of Blairmore Creek in the WLSA, June 5, 2014.

Long-toed salamanders have a general provincial status of "Sensitive" and a legislated provincial status as a species of "Special Concern", and western tiger salamanders have a COSEWIC rating of "Special Concern" (Table 2.4-1). The WLSA is within the reported ranges of both tiger and long-toed salamanders; the western tiger salamander has been documented in Bellevue (Paton 2002), and the long-toed salamander has been reported to occur in the Crowsnest Pass, including along the Forestry Trunk Road located just west of the WLSA (Paton, 2002; Pearson, 2003; Pearson, 2005; AEP, 2010d; FWMIS – *July 30, 2015*).

Although no western toads were heard calling during the nocturnal amphibian survey, they were observed incidentally along cutlines and trails between amphibian survey points (Figure 2.4-1, Photo 2.4-3). Western toads were also observed during the bat survey in August 2014 and the owl survey in April 2015. As a group, toads have very low detection probabilities, even when they are relatively abundant (MacKenzie *et al.*, 2002; Hecnar and Casper, 2009). Western toad breeding activity can also be highly compressed (a matter of days) and weather dependent. They may only call

over a short breeding period (unlike boreal chorus frogs that may call until August). The presence of juvenile western toads (Photo 2.4-4) indicates that suitable breeding habitat is present in the WLSA.

Photo 2.4-3 An adult western toad observed incidentally along a cutline in the WLSA near Blairmore Creek, June 3, 2014.

Photo 2.4-4 A juvenile western toad observed near a wetland in the WLSA, June 5, 2014.

As toads overwinter beneath the frost line (unlike wood frogs and boreal chorus frogs that have antifreeze mechanisms and are able to overwinter near the surface), they emerge later in the spring. Wood frog breeding activity is usually complete before toads emerge. Since wood frog vocalization was documented, it is possible that the toads were not yet reproductively active during the survey. Although auditory surveys were conducted at night as recommended by GoA (2013) and Takats and Priestley (2002), western toads can be diurnal at higher altitudes and latitudes in Alberta (Russell and Bauer, 2000).

Western toads are not an obligate forest species, and appear to be habitat generalists at multiple spatial scales (*e.g.* microsite and landscape scales). Western toads will likely exploit all habitat types available on the landscape, although they may preferentially select treeless habitats including anthropogenic clearings like cutblocks and seismic lines (Long and Prepas, 2012) or habitats with deciduous tree cover (Browne *et al.*, 2009).

The western toad population in Canada has been split into two discrete conservation units based on physiological and behavioural differences, primarily the presence of vocal sacs and distinct breeding calls. Western toads in the WLSA would likely belong to the vocal population, which is listed as "Special Concern" by COSEWIC (COSEWIC, 2002). Provincially, the western toad is listed as "Sensitive" and "Near Threatened" globally because of declines throughout the southern part of its geographic range (Hammerson *et al.*, 2004).

Northern leopard frogs, which have a legislated provincial status of "Threatened," historically occurred in southwest Alberta although they have disappeared from the region (AESRD, 2003; Pearson, 2005); consequently, it is not likely they occur in the WLSA.

No reptile species were observed during the amphibian survey, nor were any seen incidentally during other surveys conducted in the WLSA. A query of the FWMIS database (AEP, 2015a) indicates that wandering garter snakes have occurred in the WLSA in the past. Painted turtles may also occur in the WLSA, but it is unclear whether they colonized the area naturally or are the result of introductions (Pearson, 2005).

2.4.3.1.2 2016 Results

All known open water features, including ponds, wetlands, lakes, and slow moving sections of creeks and tributaries, were surveyed for amphibians using auditory and non-acoustic techniques in 2016. Overall, 11.3% (640.5ha) of the WLSA was sampled, including all major wildlife habitat types, during the 2016 acoustic amphibian survey.

Three species of amphibians were detected at ten of the 20 survey stations (Table 2.4-1, Figure 2.4-2). Columbia spotted frogs were detected at six stations, long-toed salamanders were detected at seven stations, and western toads were detected at three stations. Western toads were detected during the auditory survey, while all other amphibian detections were visual.

Columbia spotted frogs were detected in two historical end pit lakes, one pond, two unnamed tributaries of Blairmore creek (Photo 2.4-5), and in an impounded area of an unnamed tributary of Blairmore Creek within the WLSA. One Columbia spotted frog egg mass was located in a treed wetland and approximately 25 adult Columbia spotted frogs were detected in one of the historical end pit lakes.

Photo 2.4-5 Columbia spotted frog in tributary of Blairmore Creek in the WLSA on May 4, 2016

Of the seven survey stations where long-toed salamanders were identified in 2016, adults were detected at six and larvae were detected at four. Long-toed salamanders (Photo 2.4-6) were found in the littoral zone of three end pit lakes, one pond, an ephemeral ditch near Blairmore Creek, and in two impounded areas of an unnamed tributary of Blairmore Creek during the amphibian survey in 2016. The long-toed salamander egg mass (Photo 2.4-7), along with two adults, was detected in the ephemeral ditch near Blairmore Creek.

Photo 2.4-6 Adult long-toed salamander in WLSA on May 4, 2016.

Photo 2.4-7 Long-toed salamander egg mass in ephemeral ditch near Blairmore Creek in the WLSA on May 4, 2016

Adult western toads were detected in two historical end pit lakes and one pond. No western toad egg masses or juveniles were detected in 2016.

No wood frogs, boreal chorus frogs, or reptiles were detected during the 2016 surveys.

2.4.3.2 Birds

The presence in the WLSA of all bird species, including those protected under the federal *Migratory Birds Convention Act*, was discerned through spring breeding songbird surveys, raptor surveys, and

incidental observations during all other wildlife field surveys conducted during spring, summer, fall, and winter.

2.4.3.2.1 Songbirds

2.4.3.2.1.1 Spring 2014 Results

During the spring 2014 breeding bird survey, 14 of the 16 habitats mapped in the WLSA were sampled (161.2 ha or 2.9%, Table 2.4-4). The upland shrub and shrubby wetland types, collectively comprised only 0.3% of the WLSA; consequently, these habitat types were not sampled. Sampling intensity was generally conducted in proportion to the amount of habitat available.

Table 2.4-4 Major Habitat Types Sampled During the Spring Breeding Bird Survey in the Wildlife Local Study Area - 2014

Habitat Type	Area Surveyed (ha)	Available Habitat (ha)	% of Available Habitat
Open pine	4.8	516.7	0.9
Open deciduous	1.2	51.6	2.3
Open mixedwood	4.1	291.2	1.4
Open mixed coniferous	4.8	440.5	1.1
Moderate mixed coniferous	53.2	1,375.8	3.9
Closed deciduous	2.0	27.6	7.4
Closed mixedwood	37.0	991.2	3.7
Closed spruce	0.1	79.4	0.1
Closed mixed coniferous	2.8	419.5	0.7
Grassland	8.3	290.3	2.9
Upland shrub	0.0	0.2	0.0
Shrubby wetland	0.0	17.9	0.0
Treed wetland	0.9	4.8	18.8
Rock/barren	5.7	48.6	11.6
Waterbody	0.3	63.9	0.5
Anthropogenic disturbance	36.0	1,027.3	3.5
Total	**161.2**	**5,646.4**	**2.9**

Including systematic observations only (*i.e.* birds detected within 100 m of each point count station), 291 birds representing 34 species were detected during the songbird survey (Table 2.4-5). The Swainson's thrush was the most common species recorded, followed by the yellow-rumped warbler, chipping sparrow, dark-eyed junco, ruby-crowned kinglet and American robin. In addition to the systematic observations, one bald eagle, two female Barrow's goldeneyes, one mountain bluebird, and one spotted sandpiper were observed within the WLSA.

At-risk species heard and/or observed within the WLSA during the breeding bird survey (Table 2.4-5, Figure 2.4-3) included five olive-sided flycatchers and three common nighthawks, both of which are listed as "Threatened" by SARA. Additionally, one bald eagle, one western wood-pewee and one sora were detected, all of which have a general provincial status of "Sensitive" (AEP 2010). All other bird species recorded have a general provincial status of "Secure" or "Undetermined".

Table 2.4-5 Conservation Status and Relative Abundance of Birds in the Wildlife Local Study Area[1] - 2014

Species	Provincial Status	COSEWIC - SARA	Point Counts (No.)	Density (No./ha)	Incidentals (No.)
American crow[2]	Secure	-	3	0.020	-
American robin	Secure	-	16	0.10	-
Bald eagle[2]	Sensitive	Not At Risk	0	-	1
Barrow's goldeneye	Secure	-	0	-	2
Black-billed magpie[2]	Secure	-	1	0.006	-
Black-capped chickadee	Secure	-	8	0.050	-
Brown-headed cowbird[2]	Secure	-	4	0.025	-
Cassin's vireo	Undetermined	-	1	0.006	-
Cedar waxwing	Secure	-	8	0.05	-
Chipping sparrow	Secure	-	23	0.14	-
Common nighthawk	Sensitive	Threatened – SARA Schedule 1	0	-	3
Common raven[2]	Secure	-	5	0.031	-
Dark-eyed junco	Secure	-	22	0.14	-
Golden-crowned kinglet	Secure	-	4	0.025	-
Hermit thrush	Secure	-	2	0.012	-

Table 2.4-5 Conservation Status and Relative Abundance of Birds in the Wildlife Local Study Area[1] - 2014

Species	Provincial Status	COSEWIC - SARA	Point Counts (No.)	Density (No./ha)	Incidentals (No.)
MacGillivray's warbler	Secure	-	1	0.006	-
Mountain bluebird	Secure	-	0	-	1
Mountain chickadee	Secure	-	3	0.02	-
Northern flicker	Secure	-	1	0.006	-
Olive-sided flycatcher	May Be At Risk	Threatened – SARA Schedule 1	5	0.031	-
Orange-crowned warbler	Secure	-	2	0.012	-
Pacific wren	Secure	-	2	0.012	-
Pacific slope flycatcher	Undetermined	-	1	0.006	-
Red-breasted nuthatch	Secure	-	5	0.031	-
Red-naped sapsucker	Undetermined	-	1	0.006	-
Red-winged blackbird[2]	Secure	-	4	0.025	-
Ruby-crowned kinglet	Secure	-	20	0.12	-
Sora	Sensitive	-	1	0.006	-
Spotted sandpiper	Secure	-	0	-	1
Swainson's thrush	Secure	-	55	0.34	-
Townsend's solitaire	Secure	-	4	0.025	-
Townsend's warbler	Secure	-	7	0.044	-
Tree swallow	Secure	-	12	0.074	-
Varied thrush	Secure	-	2	0.012	-
Vesper sparrow	Secure	-	4	0.025	-
Warbling vireo	Secure	-	16	0.10	-
Western wood-pewee	Sensitive	-	1	0.006	-
White-crowned sparrow	Secure	-	7	0.043	-
Yellow-rumped warbler	Secure	-	40	0.25	-

[1] Based on June 2014 field survey data.
[2] Not protected under the *Migratory Birds Convention Act*

Results from North American BBS Route 04-205 and incidental bird sightings made within 2 km of the WLSA are summarized in Table 2.4-6. An average of 38 species and 277 individual birds were reported for BBS Route 04-205 over the five years for which data were available. The most common species, when considering the mean number of individuals detected each year, were the ruby-crowned kinglet and the pine siskin. American robins, Swainson's thrushes, chipping sparrows, yellow-rumped warblers, and brown-headed cowbirds were also commonly recorded.

An average of three barn swallows, a "Threatened" species in Canada (COSEWIC, 2011), was documented on the BBS route each year (Table 2.4-6), which also has a general status of "Sensitive" in Alberta. Common nighthawks and olive-sided flycatchers were also recorded along the BBS route. Other "Sensitive" species in Alberta recorded along the route include the bald eagle, Clark's nutcracker, common yellowthroat, pileated woodpecker, and western wood-pewee (Table 2.4-7).

No harlequin ducks, sharp-tailed grouse, short-eared owls, or ospreys were observed during the bird surveys or on BBS Route 04-205; however, a query of the FWMIS database indicates that they have occurred in the area. With the exception of the short-eared owl, these species all have a general status of "Sensitive," in Alberta while the harlequin duck is legally designated as a species of "Special Concern" in the province. Short-eared owls have a general provincial status of "May be at Risk," and have been listed as a species of "Special Concern" in Canada (COSEWIC, 2008).

Table 2.4-6 Birds Detected at Point Counts Located Outside of the Wildlife Local Study Area and Along North American BBS Route 04-205 from 2008-2011 and 2014

Species	2014 Point Counts	BBS Route 04-205				
		2008	2009	2010	2011	2014
American crow[4]	5	2	8	5	4	11
American robin	8	24	20	34	24	19
Bald eagle[1, 4]	0	0	0	0	1	0
Barn swallow[1, 2]	0	3	3	5	4	0
Black-capped chickadee	3	4	4	1	5	14
Blue jay[4]	0	0	0	0	0	1
Boreal chickadee	0	0	0	0	2	0
Brown-headed cowbird[4]	1	10	21	21	31	16
Canada goose	0	0	0	2	0	0
Cassin's finch	0	2	2	2	2	0
Cassin's vireo	0	2	1	0	0	0

Table 2.4-6 Birds Detected at Point Counts Located Outside of the Wildlife Local Study Area and Along North American BBS Route 04-205 from 2008-2011 and 2014

Species	2014 Point Counts	BBS Route 04-205				
		2008	2009	2010	2011	2014
Cedar waxwing	2	1	3	2	0	0
Chipping sparrow	7	13	25	20	15	7
Clark's nutcracker[1,4]	0	0	0	0	3	0
Clay-coloured sparrow	0	1	1	3	0	8
Cliff swallow	0	0	0	0	4	0
Common nighthawk[1, 2]	0	1	0	0	0	0
Common raven[4]	0	9	6	6	3	0
Common yellowthroat[1]	0	0	0	1	0	0
Dark-eyed junco	8	7	4	6	15	0
Dusky flycatcher	0	1	1	2	1	5
Eastern kingbird	0	0	0	0	1	0
European starling[4]	0	5	0	3	0	0
Evening grosbeak	0	0	1	0	0	0
Fox sparrow	0	0	0	0	0	2
Golden-crowned kinglet	1	0	0	1	0	2
Golden-crowned sparrow	0	0	0	0	0	1
Gray jay	1	3	4	4	4	6
Hairy woodpecker	0	0	1	0	0	0
Hermit thrush	0	0	0	3	5	3
House finch	0	1	0	0	0	0
House sparrow[4]	0	4	1	3	0	4
House wren	1	0	3	7	9	1
Lincoln's sparrow	0	0	0	0	2	7
Mallard	0	0	0	0	2	0
Mountain bluebird	0	0	2	0	2	0
Mountain chickadee	3	1	8	4	2	10
Northern flicker	0	0	0	1	0	1

Table 2.4-6 Birds Detected at Point Counts Located Outside of the Wildlife Local Study Area and Along North American BBS Route 04-205 from 2008-2011 and 2014

Species	2014 Point Counts	BBS Route 04-205				
		2008	2009	2010	2011	2014
Northern rough-winged swallow	0	0	0	5	0	0
Northern waterthrush	0	0	0	1	1	0
Olive-sided flycatcher[2, 3]	2	0	3	0	2	10
Orange-crowned warbler	0	1	0	0	2	0
Pileated woodpecker	0	1	1	0	0	1
Pine siskin	1	57	81	7	12	8
Red-breasted nuthatch	1	12	9	1	3	0
Red-naped sapsucker	0	0	0	0	3	0
Red-tailed hawk[4]	0	0	2	3	2	1
Ruby-crowned kinglet	9	30	36	53	28	11
Ruffed grouse[4]	0	2	1	2	3	1
Song sparrow	0	0	1	0	0	7
Spotted sandpiper	1	3	2	2	3	0
Swainson's thrush	20	50	30	3	13	17
Tennessee warbler	1	0	0	0	0	0
Townsend's solitaire	0	11	8	6	4	0
Townsend's warbler	0	0	2	0	0	0
Tree swallow	0	1	1	1	5	0
Varied thrush	0	0	2	9	12	3
Warbling vireo	3	4	9	3	6	5
Western wood-pewee[2]	0	1	1	2	2	4
White-crowned sparrow	5	0	3	6	12	12
Wilson's warbler	0	2	9	2	4	9
Yellow-rumped warbler	11	10	23	31	28	0
Yellow warbler	0	0	0	1	0	0

[1] Species with a general provincial status of "Sensitive."
[2] Species designated as "Threatened" by COSEWIC and listed on Schedule 1 of SARA.
[3] Species with a general provincial status of "May be at Risk.
[4] Not protected under the *Migratory Birds Convention Act*

Bird species density, species richness, and diversity for each major habitat type are summarized in Table 2.4-7. The waterbody habitat type (lakes, rivers, and flooded areas) had the highest number of birds detected/ha surveyed (46.6 birds/ha). This high number is likely a result of the presence of a flock of approximately ten tree swallows that were observed foraging over a small waterbody. The treed wetland (7.8 birds/ha) and open mixed coniferous (4.8 birds/ha) also had high numbers of birds/ha surveyed.

The Shannon's diversity index (H) was highest for the closed mixedwood habitat type (H = 2.8), followed by the open mixed coniferous habitat type (H = 2.6) and the moderate mixed coniferous and anthropogenic disturbance habitat types (H = 2.4) (Table 2.4-7). Habitats with the lowest diversity indices included the waterbody (H = 0.6, two species) and grassland (H = 0.7, two species) types. Vesper's sparrows and mountain bluebirds were associated with grasslands while tree swallows and red-winged blackbirds were associated with waterbodies. Although songbird diversity was low in these habitats, other types of birds use those two habitat types for foraging or nesting. For example, sora, ring-necked ducks, spotted sandpipers, and Barrow's goldeneye have been observed near waterbodies in the WLSA while raptors (such as golden eagles) likely hunt over open grasslands.

Provincial and federal "at-risk" bird species may occur in a variety of habitat types found in the WLSA.

Olive-sided flycatchers (SARA Schedule 1 – Threatened) were associated with moderate mixed coniferous forests, open mixed coniferous forests, and open pine forest. They were frequently located close to habitat 'edges,' where the forest met either a patch of grassland or a patch of very young conifer saplings. This species is typically associated with coniferous forests (Kirk *et al.* 1996), as they build their nests in conifers. However, they do prefer to forage in more open habitats such as wetlands, shrubby areas, and very young forests, and are therefore most common where a forest borders on an opening created by a meadow or wetland (FAN 2007). They also frequently occur in newly burned habitats and in harvested forests with some residual live trees (Smucker *et al.*, 2005; Schiek and Song, 2006). Olive-sided flycatchers also tend to sing and forage from tall, dead tree snags, so habitats with them are particularly valuable (Wright, 1997). The WLSA has the potential to provide suitable habitat for olive-sided flycatchers since it is dominated by coniferous forests interspersed, with open meadows/grasslands and harvested areas.

Barn swallows, which are listed as "Threatened" under COSEWIC and are not listed under SARA, are generally found in a large variety of habitats, although they require open areas for foraging, horizontal structures for nesting (which are usually human-made structures such the sides of buildings), and source of mud to build their nests with (Brown and Bomberger Brown, 1999). They do not appear to be common in the WLSA, but they may nest on some of the abandoned mining buildings in the area.

The western wood-pewee (a provincially "Sensitive" species, not federally listed) detected during the 2014 survey was associated with an 'edge' habitat, specifically where a coniferous forest bordered on a hillside meadow. This species can occur in a wide variety of habitats, but generally prefers forest edges and riparian zones and avoids very dense forests (Bemis and Rising, 1999). This species is declining in Alberta and across Canada, possibly because of habitat loss in their breeding and overwintering ranges.

Clark's nutcrackers (a provincially "Sensitive" species, not federally listed) were not detected during the 2014 breeding bird survey although three were reported along BBS Route 04-205 in 2011. In Alberta, this species is largely restricted to the Rocky Mountain Natural Region (FAN, 2007). They occur in coniferous forests and feed primarily on large pine seeds (FAN, 2007). The species is listed as "Sensitive" in Alberta because two of the tree species it relies on (limber pine and whitebark pine) are declining in Alberta. Both of these pine species (which have a legislated provincial status of "Endangered") occur in the WLSA at low densities (CR # 8 – Vegetation and Wetlands).

One common yellowthroat was detected on BBS Route 04-205, although this species was not detected during the 2014 songbird survey conducted for the project. This species is considered "Sensitive" in Alberta (not federally listed) because of population declines and threats to its habitat. Common yellowthroats are frequently associated with wetlands, but they also breed in other habitats with dense, low-lying vegetation (Guzy and Ritchison, 1999).

Table 2.4-7 Songbird and Woodpecker Species Richness (SR) and Diversity (H) in the Wildlife Local Study Area

Habitat Type	Area (ha) Surveyed	No. of Birds	No. of Birds/ha	SR	SR/ha Surveyed	H	Songbird/Woodpecker Species Detected
Open Pine	4.8	19	4.0	10	2.1	2.1	American crow, brown-headed cowbird, cedar waxwing, dark-eyed junco, mountain chickadee, olive-sided flycatcher, ruby-crowned kinglet, Swainson's thrush, warbling vireo, yellow-rumped warbler
Open Deciduous	1.1	4	3.6	4	3.6	1.4	MacGillivray's warbler, red-naped sapsucker, warbling vireo, yellow-rumped warbler
Open Mixedwood	4.1	12	2.9	6	1.5	1.7	American robin, black-capped chickadee, cedar waxwing, dark-eyed junco, Swainson's thrush, yellow-rumped warbler
Open Mixed Coniferous	4.8	23	4.8	16	3.3	2.6	Black-capped chickadee, brown-headed cowbird, Cassin's vireo, chipping sparrow, common raven, golden-crowned kinglet, northern flicker, orange-crowned warbler, olive-sided flycatcher, red-breasted nuthatch, ruby-crowned kinglet, varied thrush, warbling Vireo, white-crowned sparrow, yellow-rumped warbler.
Moderate Mixed Coniferous	53.2	96	1.8	20	0.4	2.4	American crow, American robin, black-capped chickadee, cedar waxwing, chipping sparrow, common raven, dark-eyed junco, golden-crowned kinglet, hermit thrush, olive-sided flycatcher, Pacific wren, Pacific-slope flycatcher, red-breasted nuthatch, ruby-crowned kinglet, Swainson's thrush, Townsend's solitaire, Townsend's warbler, warbling vireo, white-crowned sparrow, yellow-rumped warbler.
Closed Deciduous	2.0	3	1.5	3	1.5	1.1	MacGillivray's warbler, mountain chickadee, yellow-rumped warbler

Table 2.4-7 Songbird and Woodpecker Species Richness (SR) and Diversity (H) in the Wildlife Local Study Area

Habitat Type	Area (ha) Surveyed	No. of Birds	No. of Birds/ha	SR	SR/ha Surveyed	H	Songbird/Woodpecker Species Detected
Closed Mixedwood	37.0	67	1.8	22	0.6	2.8	American crow, American robin, black-capped chickadee, cedar waxwing, chipping sparrow, common raven, dark-eyed junco, mountain chickadee, orange-crowned warbler, Pacific wren, red-breasted nuthatch, ruby-crowned kinglet, Swainson's thrush, Townsend's solitaire, varied thrush, vesper sparrow, warbling vireo, white-crowned sparrow, western wood-pewee, yellow-rumped warbler.
Closed Spruce	0.1	0	0	0	0	0	-
Closed Mixed Coniferous	2.8	4	1.4	3	1.1	1.0	Chipping sparrow, Swainson's thrush, yellow-rumped warbler
Grassland	8.3	2	0.2	2	0.2	0.7	Dark-eyed junco, vesper sparrow
Upland Shrub	0	0	0	0	0	0	-
Shrubby Wetland	0	0	0	0	0	0	-
Treed Wetland	0.9	7	7.8	4	4.4	1.4	American robin, black-capped chickadee, Swainson's thrush, Townsend's warbler
Rock/Barren	5.7	6	1.1	5	0.9	1.6	American crow, black-billed magpie, Swainson's thrush, yellow-rumped warbler
Waterbody	0.3	14	46.6	2	6.7	0.6	Red-winged blackbird, tree swallow
Anthropogenic Disturbance	36.0	33	0.9	14	0.4	2.4	American robin, black-capped chickadee, brown-headed cowbird, chipping sparrow, dark-eyed junco, hermit thrush, red-breasted nuthatch, ruby-crowned kinglet, Swainson's thrush, tree swallow, vesper sparrow, warbling vireo, white-crowned sparrow, yellow-rumped warbler

2.4.3.2.1.2 Spring 2016

Additional songbird surveys were conducted in the WLSA during the spring of 2016 to supplement the data collected in 2014 in accordance with GoA (2013) Sensitive Species Inventory Guidelines. Additional data collection in 2016 sought to ensure that surveys were conducted at least twice at the same survey stations during the breeding season.

During the spring 2016 breeding bird survey, 15 of the 16 habitats mapped in the WLSA were sampled (185.4 ha or 3.3%, Table 2.4-8). Sampling intensity was generally in proportion to the amount of habitat available.

Table 2.4-8 Major Habitat Types Sampled During the Spring Breeding Bird Survey in the Wildlife Local Study Area - 2016

Habitat Type	Area Surveyed (ha)	Available Habitat (ha)	% of Available Habitat
Open pine	5.3	516.7	1.0
Open deciduous	0.9	51.6	1.7
Open mixedwood	8.9	291.2	3.1
Open mixed coniferous	7.0	440.5	1.6
Moderate mixed coniferous	53.4	1,375.8	3.9
Closed deciduous	2.0	27.6	7.2
Closed mixedwood	44.7	991.2	4.5
Closed spruce	4.9	79.4	6.2
Closed mixed coniferous	3.7	419.5	0.9
Grassland	9.4	290.3	4.5
Upland shrub	-	0.2	0.0
Shrubby wetland	1.3	17.9	7.3
Treed wetland	0.9	4.8	18.8
Rock/barren	5.7	48.6	11.7
Waterbody	2.3	63.9	3.6
Anthropogenic disturbance	35.0	1,027.3	3.4
Total	**185.4**	**5,646.4**	**3.3**

Including systematic observations only (*i.e.* birds detected within 100 m of each point count station), 631 birds representing 66 species were detected during the 2016 songbird survey (Table 2.4-9). Ruby-

crowned kinglet was the most common species recorded, followed by chipping sparrow, yellow warbler, American robin, dark-eyed junco, and hermit thrush. In addition to the systematic observations, three red-tailed hawks including an active nest (see Section 2.4.3.2.4.1.2) were observed within the WLSA.

Of the 66 species identified in 2016, 29 were also detected during the 2014 survey. The greater number of species and different community of species detected in 2016 compared to 2014 may be due to a combination of factors, including increased survey effort, earlier survey timing, and/or observer bias.

At-risk species heard and/or observed within the WLSA during the 2016 survey (Table 2.4-9, Figure 2.4-3) included 10 olive-sided flycatchers, which is listed as "Threatened" by COSEWIC and "May Be At Risk" in Alberta. Additionally, one Baird's sparrow (COSEWIC – Special Concern), one barn swallow (COSEWIC – Threatened), one black-backed woodpecker, one Clark's nutcracker, sixteen common yellowthroats, four grasshopper sparrows, and five least flycatchers were detected, all of which have a general provincial status of "Sensitive" (AEP 2010). All other identified bird species have a general provincial status of "Secure" or "Undetermined".

Olive-sided flycatchers (Threatened, SARA – Schedule 1; Alberta - May Be At Risk) were associated with open mixed coniferous, moderate mixed coniferous forests, closed mixed coniferous forests, grassland and anthropogenic disturbance habitats in the 2016 surveys. Olive-sided flycatchers were generally associated with edge habitats, occurring along the forest edge transition zone to other open or disturbed habitat types such as grasslands and anthropogenic disturbances (*e.g.* cutblocks) (Figure 2.4-3). This species typically nests in coniferous forests (Kirk *et al.*, 1996) but forages in more open habitats.

Baird's sparrow (COSEWIC – Special Concern; Alberta – Sensitive) was located in the WLSA for the first time in 2016. They were observed singing at a survey station in closed mixedwood forest along Blairmore Creek and adjacent to grassland habitat (Figure 2.4-3). This species breeds predominantly in large patches of mixed grass and fescue prairie with sparse shrubs.

Least flycatchers (Alberta – Sensitive) were documented in the WLSA for the first time in 2016. Least flycatchers were observed singing in open mixedwood, closed mixedwood, closed spruce, shrubby wetland and anthropogenic disturbance habitat in the WLSA. They were most frequently detected in the lower elevation Montane Natural Subregion (4 of 5 observations). Least flycatchers generally occupy forests with a deciduous component near clearings or open habitats. They typically construct their nests in young deciduous trees in deciduous or mixedwood forests. In the WLSA, least flycatchers were always located in close proximity to open habitats, such as cutblocks and shrubby wetlands (Figure 2.4-3).

Clark's nutcracker (Alberta – Sensitive) was detected at one location in 2016 in a moderate mixed coniferous forest habitat type at high elevation in the Subalpine Natural Subregion (Figure 2.4-3). Clark's nutcrackers rely on almost exclusively pine seeds for their diet and their presence is generally correlated with pine-dominated coniferous stands. They also forage on limber and whitebark pine seeds, which occur at low densities in the WLSA (CR #8 – Vegetation and Wetlands), and are an important seed disperser for these two federally Endangered (COSEWIC – limber pine, SARA Schedule 1 – whitebark pine) and provincially At Risk conifer species.

Table 2.4-9 Conservation Status and Relative Abundance of Birds in the Wildlife Local Study Area[1] - 2016

Species	Provincial Status	COSEWIC - SARA	Point Counts (No.)	Density (No./ha)	Incidentals (No.)
Alder flycatcher	Secure	-	2	0.01	-
American pipit	Secure	-	18	0.10	-
American robin	Secure	-	52	0.28	-
American three-toed woodpecker	Secure	-	1	0.005	-
American tree sparrow	Secure	-	1	0.005	-
Baird's sparrow	Sensitive	Special Concern	1	0.005	-
Barn swallow	Sensitive	Threatened	1	0.005	-
Black-backed woodpecker	Sensitive	-	1	0.005	-
Black-capped chickadee	Secure	-	19	0.10	-
Blue jay[2]	Secure	-	1	0.005	-
Bohemian waxwing	Secure	-	1	0.005	-
Brown-headed cowbird[2]	Secure	-	8	0.04	-
Bufflehead	Secure	-	-	-	3
Cassin's vireo	Undetermined	-	5	0.03	-
Cedar waxwing	Secure	-	4	0.02	3
Chipping sparrow	Secure	-	63	0.34	-
Clark's nutcracker[2]	Sensitive	-	1	0.005	-
Clay-coloured sparrow	Secure	-	1	0.005	-
Common raven[2]	Secure	-	10	0.05	-

Table 2.4-9 Conservation Status and Relative Abundance of Birds in the Wildlife Local Study Area[1] - 2016

Species	Provincial Status	COSEWIC - SARA	Point Counts (No.)	Density (No./ha)	Incidentals (No.)
Common yellowthroat	Sensitive	-	16	0.09	-
Dark-eyed junco	Secure	-	50	0.27	-
Dusky flycatcher	Secure	-	3	0.02	-
Eastern kingbird	Secure	-	1	0.005	-
Fox sparrow	Secure	-	1	0.005	-
Golden-crowned kinglet	Secure	-	12	0.06	-
Golden-crowned sparrow	Secure	-	2	0.01	-
Grasshopper sparrow	Sensitive	-	4	0.02	-
Hermit thrush	Secure	-	40	0.22	-
House finch	Secure	-	1	0.005	-
House sparrow[2]	Secure	-	1	0.005	-
House wren	Secure	-	2	0.01	-
Least flycatcher	Sensitive	-	5	0.03	-
Lincoln's sparrow	Secure	-	2	0.01	-
MacGillivray's warbler	Secure	-	1	0.005	-
Magnolia warbler	Secure	-	3	0.02	-
Marsh wren	Secure	-	1	0.005	-
Nashville warbler	Secure	-	4	0.02	-
Northern flicker	Secure	-	1	0.005	-
Northern waterthrush	Secure	-	3	0.02	-
Olive-sided flycatcher	May Be At Risk	Threatened – Schedule 1	10	0.05	-
Orange-crowned warbler	Secure	-	1	0.005	-
Pacific slope flycatcher	Undetermined	-	10	0.05	-
Pacific wren	Secure	-	1	0.005	-
Pine grosbeak	Secure	-	2	0.01	-

Table 2.4-9 Conservation Status and Relative Abundance of Birds in the Wildlife Local Study Area[1] - 2016

Species	Provincial Status	COSEWIC - SARA	Point Counts (No.)	Density (No./ha)	Incidentals (No.)
Purple finch	Secure	-	4	0.02	-
Red-breasted nuthatch	Secure	-	14	0.08	-
Red-naped sapsucker	Undetermined	-	1	0.005	-
Red-tailed hawk[2]	Secure	-	0	-	3
Red-winged blackbird[2]	Secure	-	2	0.01	-
Ruby-crowned kinglet	Secure	-	69	0.37	1
Ruffed grouse[2]	Secure	-	1	0.005	-
Steller's jay[2]	Secure	-	2	0.01	-
Swainson's thrush	Secure	-	8	0.04	1
Townsend's solitaire	Secure	-	33	0.18	-
Townsend's warbler	Secure	-	17	0.09	-
Tree swallow	Secure	-	1	0.005	-
Varied thrush	Secure	-	3	0.02	-
Veery	Secure	-	2	0.01	-
Vesper sparrow	Secure	-	1	0.005	-
Warbling vireo	Secure	-	17	0.09	-
Western bluebird	Secure	-	2	0.01	1
Western kingbird	Secure	-	2	0.01	-
White-breasted nuthatch	Secure	-	1	0.005	-
White-crowned sparrow	Secure	-	3	0.02	-
White-throated sparrow	Secure	-	1	0.005	-
Wilson's warbler	Secure	-	5	0.03	-
Yellow warbler	Secure	-	53	0.29	-
Yellow-rumped warbler	Secure	-	19	0.10	-

[1] Based on June 2016 field survey data.
[2] Not protected under the *Migratory Birds Convention Act*

Bird species density, species richness, and diversity for each major habitat type are summarized in Table 2.4-10. The shrubby wetland habitat type had the highest number of birds detected/ha surveyed (8.5 birds/ha). The closed spruce habitat type (6.3 birds/ha) also had high numbers of birds/ha surveyed.

The Shannon's diversity index (H) was highest for closed mixedwood (H = 3.0), moderate mixed coniferous (H = 3.0), and anthropogenic disturbance habitat types (H = 3.0), followed by the open mixedwood habitat type (H = 2.8) and the closed mixedwood habitat type (H = 2.8) (Table 2.4-11). The closed deciduous habitat type had the lowest diversity index (H = 1.2, four species).

Table 2.4-10 Songbird and Woodpecker Species Richness (SR) and Diversity (H) in the Wildlife Local Study Area

Habitat Type	Area (ha) Surveyed	No. of Birds	No. of Birds/ha	SR	SR/ha Surveyed	H	Songbird/Woodpecker Species Detected
Open Pine	5.3	23	4.3	10	1.9	2.1	American pipit, American robin, Cassin's vireo, chipping sparrow, dark-eyed junco, ruby-crowned kinglet, Townsend's solitaire, western bluebird, yellow warbler, yellow-rumped warbler
Open Deciduous	0.9	4	4.4	4	4.4	1.4	MacGillivray's warbler, red-naped sapsucker, warbling vireo, yellow-rumped warbler
Open Mixedwood	8.9	33	3.7	20	2.2	2.8	Alder flycatcher, American pipit, American robin, black-backed woodpecker, black-capped chickadee, chipping sparrow, dark-eyed junco, eastern kingbird, golden-crowned sparrow, grasshopper sparrow, hermit thrush, least flycatcher, red-breasted nuthatch, ruby-crowned kinglet, Swainson's thrush, Townsend's solitaire, veery, white-breasted nuthatch, white-crowned sparrow, yellow warbler
Open Mixed Coniferous	7.0	23	3.3	14	2.0	2.5	American pipit, cedar waxwing, chipping sparrow, dark-eyed junco, hermit thrush, house wren, MacGillivray's warbler, olive-sided flycatcher, Pacific-slope flycatcher, purple finch, red-breasted nuthatch, ruby-crowned kinglet, warbling vireo
Moderate Mixed Coniferous	53.4	154	2.9	35	0.7	3.0	American pipit, American robin, black-capped chickadee, brown-headed cowbird, chipping sparrow, Clark's nutcracker, common raven, common yellowthroat, dark-eyed junco, dusky flycatcher, fox sparrow, golden-crowned kinglet, hermit thrush, house wren, Lincoln's sparrow, magnolia warbler, northern waterthrush, olive-sided flycatcher, pine grosbeak, Pacific-slope flycatcher, purple finch, ruby-crowned kinglet, Steller's jay, Swainson's thrush, Townsend's solitaire, Townsend's warbler, tree swallow, American three-toed woodpecker, varied thrush, warbling vireo, western bluebird, western kingbird, Wilson's warbler, yellow warbler, yellow-rumped warbler.

Table 2.4-10 Songbird and Woodpecker Species Richness (SR) and Diversity (H) in the Wildlife Local Study Area

Habitat Type	Area (ha) Surveyed	No. of Birds	No. of Birds/ha	SR	SR/ha Surveyed	H	Songbird/Woodpecker Species Detected
Closed Deciduous	2.0	6	3	4	2.0	1.2	American pipit, common yellowthroat, ruby-crowned kinglet, yellow warbler
Closed Mixedwood	44.7	133	3.0	33	0.7	3.0	American pipit, American robin, American tree sparrow, Baird's sparrow, black-capped chickadee, brown-headed cowbird, bohemian waxwing, Cassin's vireo, clay-coloured sparrow, cedar waxwing, chipping sparrow, common yellowthroat, dark-eyed junco, golden-crowned kinglet, golden-crowned sparrow, grasshopper sparrow, hermit thrush, house sparrow, least flycatcher, Lincoln's sparrow, Nashville warbler, Pacific-slope flycatcher, red-breasted nuthatch, ruby-crowned kinglet, ruffed grouse, Swainson's thrush, Townsend's solitaire, Townsend's warbler, warbling vireo, western kingbird, yellow warbler, yellow-rumped warbler.
Closed Spruce	4.9	31	6.3	14	2.9	2.4	American pipit, American robin, chipping sparrow, common yellowthroat, dark-eyed junco, golden-crowned kinglet, least flycatcher, ruby-crowned kinglet, Townsend's solitaire, Townsend's warbler, warbling vireo, Wilson's warbler, yellow warbler, yellow-rumped warbler
Closed Mixed Coniferous	3.7	12	3.2	10	2.7	2.3	Brown-headed cowbird, house finch, magnolia warbler, northern waterthrush, olive-sided flycatcher, Pacific wren, ruby-crowned kinglet, red-winged blackbird, Townsend's solitaire, Wilson's warbler, yellow warbler
Grassland	9.4	33	3.5	14	1.5	2.3	American pipit, American robin, black-capped chickadee, chipping sparrow, common yellowthroat, dark-eyed junco, hermit thrush, olive-sided flycatcher, Pacific-slope flycatcher, ruby-crowned kinglet, Townsend's solitaire, white-throated sparrow, yellow warbler, yellow-rumped warbler
Upland Shrub	0	0	0	0	0	0	-

Table 2.4-10 Songbird and Woodpecker Species Richness (SR) and Diversity (H) in the Wildlife Local Study Area

Habitat Type	Area (ha) Surveyed	No. of Birds	No. of Birds/ha	SR	SR/ha Surveyed	H	Songbird/Woodpecker Species Detected
Shrubby Wetland	1.3	11	8.5	8	6.2	2.0	Dark-eyed junco, dusky flycatcher, least flycatcher, Nashville warbler, red-breasted nuthatch, ruby-crowned kinglet, Townsend's solitaire, Townsend's warbler
Treed Wetland	0	0	0	0	0	0	-
Rock/Barren	5.7	7	1.2	5	0.9	1.5	Barn swallow, dark-eyed junco, hermit thrush, ruby-crowned kinglet, warbling vireo
Waterbody	0	0	0	0	0	0	-
Anthropogenic Disturbance	35.0	161	4.6	36	1.0	3.0	American pipit, American robin, black-capped chickadee, brown-headed cowbird, blue jay, Cassin's vireo, chipping sparrow, common raven, common yellowthroat, dark-eyed junco, dusky flycatcher, golden-crowned kinglet, hermit thrush, least flycatcher, Nashville warbler, northern flicker, orange-crowned warbler, olive-sided flycatcher, pine grosbeak, Pacific-slope flycatcher, purple finch, red-breasted nuthatch, ruby-crowned kinglet, red-naped sapsucker, Steller's jay, Swainson's thrush, Townsend's solitaire, Townsend's warbler, varied thrush, veery, vesper sparrow, warbling vireo, white-crowned sparrow, Wilson's warbler, yellow warbler, yellow-rumped warbler

2.4.3.2.2 Grouse and Turkeys

2.4.3.2.2.1 2014 Results

Ruffed grouse have been reported along BBS Route 04-205, and the FWMIS database indicates that sharp-tailed grouse have occurred in the WLSA. Additionally, several wild turkeys (Photo 2.4-8, 0.75/birds/100 camera days) and one blue grouse (0.01 birds/100 camera days) were detected by the wildlife cameras, and ruffed grouse were heard drumming in the area during the owl survey.

Sharp-tailed grouse are unlikely to be common in the WLSA, although they may use some of the cutblock and open habitat types in the area. They are generally associated with areas dominated by grasslands and shrubs (Connelly *et al.*, 1998) and are most common in the Boreal Forest, Grassland, and Parkland Natural Regions of Alberta (FAN, 2007).

Photo 2.4-8 Nine wild turkeys walking along a trail at Camera GM11 in the WLSA, September 26, 2015.

2.4.3.2.2.2 2015-2016 Results

Grouse pellets were detected in seven of the nine habitats surveyed during the pellet survey, and were found most frequently in moderate mixed coniferous forest habitat (Table 2.4-11). Grouse were also found in all other surveyed forested habitats except closed deciduous. Grouse were also not

detected in open grassland habitat. Turkey pellets were detected in closed mixedwood, open mixed coniferous, and open pine habitats, with similar densities in all habitats (Table 2.4-11).

Table 2.4-11 Grouse and Turkey Pellet Densities in the Wildlife Study Area

Habitat Type	Area Sampled (ha)	Pellet Density (pellets/ha)	
		Grouse spp.	Wild Turkey
Closed Deciduous	0.11	0.0	0.0
Closed Mixed Coniferous	0.34	5.9	0.0
Closed Mixedwood	0.57	8.8	7.1
Closed Spruce	0.23	4.4	0.0
Grassland	0.34	0.0	0.0
Moderate Mixed Coniferous	0.91	64.0	0.0
Open Mixed Coniferous	0.23	8.8	8.8
Open Mixedwood	0.34	5.9	0.0
Open Pine	0.34	2.9	8.8
Total	**3.40**	**20.9**	**2.7**

Several wild turkeys (1.45 birds/100 camera days) were detected by the wildlife cameras during the 2015-2016 monitoring period. Wild turkeys were most frequently detected at Camera GM19 in open mixedwood forest, but were also commonly detected at GM13 and GM14 in grassland and anthropogenic disturbance habitats, respectively. Wild turkeys were the only bird species detected by the wildlife cameras in the golf course relocation area.

Five male ruffed grouse were incidentally heard drumming during various baseline surveys in 2016 (Figure 2.4-4), two spruce grouse were observed incidentally (Figure 2.4-4), and two groups of wild turkeys were observed incidentally in open areas along an access road during the pellet/scat surveys (Figure 2.4-4).

2.4.3.2.3 Waterbirds

2.4.3.2.3.1 2013 – 2015 Results

Aquatic birds are relatively uncommon in the WLSA as there are no large lakes, although some limited wetland areas and flowing water associated with Blairmore Creek, Gold Creek, and their associated headwater tributaries were present. Creeks and wetlands were assessed during the spring

breeding bird survey to detect any waterbirds that may be present. During this survey, two female Barrow's goldeneyes were observed in a wetland, one spotted sandpiper was seen near a creek, and a sora was heard by a wetland located close to Highway 3. Soras forage and breed in shallow or intermediate-depth freshwater wetlands (Melvin and Gibbs, 2012). Soras are rated "Sensitive" in Alberta (not federally listed) because of declining populations since 1994 associated with wetland habitat loss. Two ring-necked ducks were also seen in one of the existing pit lakes in the WLSA.

Harlequin ducks generally live on or near fast-flowing, clear rivers (Robertson and Goudie, 1999). Harlequin ducks were not observed during any of the field surveys conducted in the WLSA and are unlikely to occur because of absence of large rivers. Within the GBRSA, Harlequin ducks have been documented in Racehorse Creek, which is located approximately 14 km northwest of the WLSA and in the nearby Livingstone and the Oldman Rivers (Paton, 2000).

Due to the scarcity of available open water habitat and corresponding low waterbird abundance and diversity in the WLSA, Project effects on waterbirds were not assessed any further.

2.4.3.2.3.2 2016 Results

Creeks and wetlands were assessed during the spring breeding bird surveys and amphibian surveys to detect any waterbirds that may be present. During these surveys, two Barrow's goldeneyes (male/female pair) and two buffleheads (male/female pair) were observed in one of the existing end pit lakes in the WLSA (Figure 2.4-4). Harlequin ducks were not observed during any of the field surveys conducted in the WLSA in 2016.

2.4.3.2.4 Raptors

A summary of the raptor species identified in the WLSA is provided in Table 2.4-12.

Table 2.4-12 Raptor Species Identified in the Wildlife Local Study Area and the Applicable Conservation Status

Species	Provincial Status		COSEWIC Designation	2014/ 2015	2016	FWMIS
	General	Legislated				
American Kestrel	Sensitive	-	-	X	-	-
Bald Eagle	Sensitive	-	Not At Risk	X		-
Barred Owl	Sensitive	Special Concern	-	-	X	-
Great Horned Owl	Secure	-	-	X	X	-
Great Gray Owl	Sensitive	-	Not At Risk	X	-	-
Golden Eagle	Sensitive	-	Not At Risk	X	X	X

Table 2.4-12 Raptor Species Identified in the Wildlife Local Study Area and the Applicable Conservation Status

Species	Provincial Status		COSEWIC Designation	2014/ 2015	2016	FWMIS
	General	Legislated				
Red-tailed Hawk	Secure	-	Not At Risk	-	X	-
Short-eared Owl	May Be At Risk	-	Special Concern	-	-	X
Osprey	Sensitive	-	-	-	-	X

2.4.3.2.4.1 Raptors

2.4.3.2.4.1.1 2013-2015 Results

2.4.3.2.4.1.1.1 Owls

Overall, 34.3% (1,937.6 ha) of the WLSA was sampled during the 2015 owl survey (Table 2.4-13). The survey coverage provided a range of percentage of available habitat types from a low of 0.0% for upland shrub and treed wetland habitat types to a high of 55.1% coverage for the rock/barren type. Weather conditions during the nocturnal owl survey were considered to be good with no precipitation, winds varying 0 to 2 on the Beaufort scale (*i.e.* from 0 to 12 km/hr), and temperatures between 5°C to 8°C.

Table 2.4-13 Major Habitat Types Sampled During the Spring Nocturnal Owl Call Survey in the Wildlife Local Study Area - 2015

Habitat Type	Area Surveyed (ha)	Available Habitat (ha)	Percentage (%) of Available Habitat
Open Pine	194.2	516.7	37.6
Open Deciduous	20.1	51.6	39.0
Open Mixedwood	102.6	291.2	35.2
Open Mixed Coniferous	136.8	440.5	31.1
Moderate Mixed Coniferous	368.1	1,375.8	26.8
Closed Deciduous	2.2	27.6	8.0
Closed Mixedwood	434.4	991.2	43.8
Closed Spruce	41.3	79.4	52.0
Closed Mixed Coniferous	125.4	419.5	29.9

Table 2.4-13 Major Habitat Types Sampled During the Spring Nocturnal Owl Call Survey in the Wildlife Local Study Area - 2015

Habitat Type	Area Surveyed (ha)	Available Habitat (ha)	Percentage (%) of Available Habitat
Grassland	67.9	290.3	23.4
Upland Shrub	0.0	0.2	0.0
Shrubby Wetland	2.7	17,9	15.1
Treed Wetland	0.0	4.8	0.0
Rock/Barren	26.8	48.6	55.1
Waterbody	1.0	63.9	1.6
Anthropogenic Disturbance	414.1	1,027.3	40.3
Total	**1,937.6**	**5,646.4**	**34.3**

A pair of great horned owls was heard on March 30, 2015 calling in the southern portion of the WLSA (Figure 2.4-5) in response to both heterospecific (northern pygmy owl) and conspecific calls. This area is dominated by open coniferous and mixedwood forests. Another great horned owl was heard on March 31, 2015 in the central portion of the WLSA where it responded to a broadcast of a conspecific call. This owl was located in an area dominated by closed mixedwood forests and clearings (Figure 2.4-5). Based on this data, a density of 0.12 great horned owls/km^2 was calculated for the WLSA. No other owls were heard during the survey; however, great gray owls have been detected incidentally in the WLSA. One great gray owl was recorded on June 3, 2014, during the amphibian survey (Figure 2.4-5), while a landowner in the WLSA reported seeing great gray owls on their property.

A query of the FWMIS database indicates that short-eared owls have occurred within 1 km of the WLSA. Short-eared owls prefer to nest in open areas such as tundra, grasslands, fallow pastures, bogs, marshes, and sand-sage habitats (COSEWIC, 2008). The choice of nesting site also appears to be strongly influenced by the abundance of rodents (COSEWIC, 2008). In Alberta, they are most common in the Grassland Natural Region, followed by the Boreal Forest and Parkland Natural Regions (FAN, 2007) and Clayton (2000) notes that they are found in non-mountainous areas of the province. Suitable habitat for them in the WLSA is generally limited, although they could nest in some of the patches of grassland present.

2.4.3.2.4.1.1.2 Hawks and Eagles

One American kestrel (provincially "Sensitive") was seen within the WLSA on April 29, 2015 (Figure 2.4-4). Kestrels will hunt in a wide variety of open or semi-open habitats, including forests, grasslands, and agricultural areas (Smallwood and Bird, 2002). They are secondary cavity nesters and nest in tree cavities formed from rot or woodpecker activity, or in artificial nest boxes (Smallwood and Bird, 2002).

One red-tailed hawk was sighted by Kainai Elders during a sight visit conducted in July 2014 (Kainai Nation 2015). Red-tailed hawks are common throughout Alberta and occupy a wide variety of open and semi-open habitats.

Bald and golden eagles occur in the WLSA. One bald eagle was seen during the songbird survey, one mature golden eagle was seen flying over the WLSA on October 8 2014, and another was seen on June 25, 2015 (Figure 2.4-4). Golden eagles were spotted by Piikani, Kainai, and Tsuut'ina technicians during site visits conducted during 2014 (Piikani Nation 2015, Kainai Nation 2015, and Tsuut'ina Nation 2015). Bald and golden eagles are listed as "Not at Risk" by COSEWIC (COSEWIC 2014) although both are listed as "Sensitive" in Alberta. The bald eagle is listed as "Sensitive" because it was at risk during the past (particularly before DDT was banned in North America) and because it is vulnerable to disturbance of its nest sites. Golden eagles are considered "Sensitive" in Alberta because there are only 100-250 breeding pairs in the province, and are vulnerable human-related disturbances.

Bald eagles generally nest in forests located near large bodies of water (FAN 2007) where they feed on fish, waterfowl, and other aquatic animals and carrion. Given the lack of large waterbodies in northern section WLSA, Bald eagles are unlikely to breed in the WLSA due the absence of any large waterbodies although may breed along the Crowsnest River. Golden eagles will nest on a variety of structures, but prefer cliff edges and are thus most common in Alberta in the Rocky Mountain Natural Region, where cliffs are most abundant (FAN, 2007). They typically prey on mammals and will hunt in a wide variety of habitats, although they prefer to hunt in open areas (Kochert *et al.*, 2002).

Flyways for various species of eagles and hawks in Alberta typically follow mountain ridges (including the Grassy Mountain area) where updrafts are common during the spring and fall migration periods. Piistaistakis Ridge, which is located approximately 6 km southeast of the WLSA (Figure 2.4-6), is used by birdwatchers to observe and count migrating golden eagles. The ridge was named by the ancestors of the Blackfoot people for the eagles ("Piistaistakis" means "Place of the Eagles").

Ospreys also generally breed near large water bodies such as lakes and rivers and are therefore unlikely to breed in WLSA. However, they may breed along the Crowsnest River in the GBRSA.

2.4.3.2.4.1.2 Spring 2016 Results

2.4.3.2.4.1.2.1 Short-eared Owls

Short-eared owls have a general provincial status of "May be at Risk," and are a federal species of "Special Concern" (SARA Schedule 1) (Environment Canada, 2016c). Short-eared owls occur throughout all natural subregions in Alberta, although they are most common in the Grasslands Natural Region (FAN 2007). They prefer non-forested habitats with medium to tall vegetation on flat to rolling terrain (*e.g.* native grass prairie, pasture) where prey populations, particularly small microtine rodents, are generally high (GoA, 2013b). Short-eared owls will nest and forage in these habitats during the summer and may also overwinter in some regions of Alberta (GoA, 2013b).

Overall, 20% (1,127.4 ha) of the WLSA was sampled during the 2016 short-eared owl survey (Table 2.4-14). The survey coverage provided a range of available habitat types in the WLSA from a low of 0% for upland shrub habitat types to a high of 34.4% coverage for anthropogenic disturbance habitat types. Most of the anthropogenic disturbances sampled were regenerating cutblocks (45%, 159.2 ha), abandoned mine sites (10%, 35.5 ha) and perennial forage crops (*i.e.* pasture; 9.5%, 33.4 ha). All suitable (flat, rolling terrain) grassland habitats in the WLSA were surveyed.

No short-eared owls were observed during the three short-eared owl surveys in 2016.

Table 2.4-14 Major Habitat Types Sampled During the Short-eared Owl Point Count Surveys in the Wildlife Local Study Area - 2016

Habitat Type	Area Surveyed (ha)	Available Habitat (ha)	% of Available Habitat
Anthropogenic Disturbance	353.3	1,027.3	34.4
Closed Deciduous	0.03	27.6	0.1
Closed Mixed Coniferous	88.1	419.5	21.0
Closed Mixedwood	253.9	991.2	25.6
Closed Spruce	16.8	79.4	21.2
Grassland	69.0	290.3	23.8
Moderate Mixed Coniferous	120.5	1,375.8	8.8
Open Deciduous	14.7	51.6	28.6

Table 2.4-14 Major Habitat Types Sampled During the Short-eared Owl Point Count Surveys in the Wildlife Local Study Area - 2016

Habitat Type	Area Surveyed (ha)	Available Habitat (ha)	% of Available Habitat
Open Mixed Coniferous	28.4	440.5	6.4
Open Mixedwood	91.2	291.2	31.3
Open Pine	90.1	516.7	17.4
Rock Barren	-	48.6	-
Shrubby Wetland	1.3	17.9	7.1
Treed Wetland	-	4.8	-
Upland Shrub	-	0.2	-
Waterbody	-	63.9	-
Total	**1,127.4**	**5,646.4**	**20.0**

2.4.3.2.4.1.2.2 Aerial Raptor Nest Survey

The most common habitat types traversed during the aerial raptor nest survey were closed mixedwood, moderate mixed coniferous, and anthropogenic disturbances (Table 2.4-15).

Table 2.4-15 Major Habitat Types Sampled During the Aerial Raptor Nest Survey in the Wildlife Local Study Area - 2016

Habitat Type	Length Surveyed (km)	% of Total Survey Length	Available Habitat in WLSA (ha)	% of Available Habitat in WLSA
Anthropogenic Disturbance	9.0	16.8	1,027.3	18.2
Closed Deciduous	1.4	2.5	27.6	0.5
Closed Mixed Coniferous	1.8	3.4	419.5	7.4
Closed Mixedwood	13.8	25.5	991.2	17.6
Closed Spruce	0.8	1.5	79.4	1.4
Grassland	3.2	6.0	290.3	5.1
Moderate Mixed Coniferous	14.1	26.1	1,375.8	24.4
Open Deciduous	0.1	0.1	51.6	0.9

Table 2.4-15 Major Habitat Types Sampled During the Aerial Raptor Nest Survey in the Wildlife Local Study Area - 2016

Habitat Type	Length Surveyed (km)	% of Total Survey Length	Available Habitat in WLSA (ha)	% of Available Habitat in WLSA
Open Mixed Coniferous	1.1	2.1	440.5	7.8
Open Mixedwood	2.5	4.7	291.2	5.2
Open Pine	4.1	7.6	516.7	9.2
Rock Barren	1.8	3.4	48.6	0.9
Shrubby Wetland	0.1	0.1	17.9	0.3
Treed Wetland	-	-	4.8	0.1
Upland Shrub	-	-	0.2	0.0
Waterbody	-	-	63.9	1.1
Total	**54.0**	**100.0**	**5,646.4**	**100.0**

A total of 14 potential raptor nests (2 active, 12 inactive) were recorded during the aerial survey and confirmed during the essential raptor nest habitat survey. An additional active red-tailed hawk nest was detected during the songbird survey (Table 2.4-16). The three active nests were identified to species based on the presence of adult raptors.

Table 2.4-16 Raptor Nests Detected During the Aerial Raptor Nest and Songbird Survey in the Wildlife Local Study Area - 2016

Species	Nest Type	Nest Status	Habitat Type
Great Horned Owl	Stick	Active	Moderate mixed coniferous
Red-tailed hawk	Stick	Active	Closed Spruce
Red-tailed hawk	Stick	Active	Open Mixedwood
-	Stick	Inactive	Closed Mixedwood
-	Stick	Inactive	Open Pine
-	Stick	Inactive	Closed Mixedwood
-	Stick	Inactive	Closed Mixedwood
-	Stick	Inactive	Closed Mixedwood

Table 2.4-16 Raptor Nests Detected During the Aerial Raptor Nest and Songbird Survey in the Wildlife Local Study Area - 2016

Species	Nest Type	Nest Status	Habitat Type
-	Stick	Inactive	Closed Mixedwood
-	Stick	Inactive	Moderate Mixed Coniferous
-	Stick	Inactive	Closed Mixedwood
-	Stick	Inactive	Closed Mixed Coniferous
-	Stick	Inactive	Moderate Mixed Coniferous
-	Stick	Inactive	Moderate Mixed Coniferous
-	Stick	Inactive	Moderate Mixed Coniferous

One active red-tailed hawk nest was observed in the WLSA during the aerial survey, for an estimated nest density of 0.019 nests/km. A second active red-tailed hawk nest was detected during the songbird survey. Red-tailed hawks are provincially-listed as "Secure" in Alberta and are widespread throughout southern Alberta (GoA, 2013b). Red-tailed hawks use stick nests built close to the tops of prominent trees with good visibility, often near forest edges (GoA, 2013b). Nests were found in closed spruce habitat (n = 1 nest) and open mixedwood habitat (n = 1 nest) (Figure 2.4-7). Red-tailed hawk nests, all of which were outside of the Project footprint, were buffered by 100 m setback distance in accordance with the *Integrated Standards and Guidelines Best Practices* (GoA, 2013a).

A single great horned owl nest was observed during the aerial survey and confirmed during the essential habitat survey (nest density of 0.019 nests/km). Great horned owls are provincially-listed as "Secure" and are widespread but thinly distributed in forested areas of Alberta (GoA, 2013b). Great horned owls have highly variable nest sites and nest characteristics, usually occupying stick nests of other species, but also tree cavities, snags, cliffs, artificial platforms, and abandoned buildings (GoA, 2013b). The great horned owl detected during the aerial survey in the WLSA occupied a stick nest in moderate mixed coniferous habitat (Figure 2.4-7). Great horned owl nests were buffered by 100 m setback distance in accordance with the *Integrated Standards and Guidelines Best Practices* (GoA 2013a).

The two red-tailed hawk nests and one great horned owl nest were all located within 250 m of Blairmore Creek, suggesting that Blairmore Creek provides high suitability nesting habitat for raptors in the WLSA. These nests are all located outside of the Project footprint.

2.4.3.2.4.1.2.3 Essential Raptor Nest Habitat Survey

Overall, 42.5 km of the WLSA was sampled during the 2016 essential raptor nest habitat survey (Table 2.4-17). The survey coverage provided a range of available habitat types in proportion to their availability from a low of 0.1 km for open deciduous forest to 13.9 km for the closed mixedwood habitat type (Table 2.4-17). Several habitat types were not sampled, such as rock barren, shrubby wetland, upland shrub and waterbodies, because they do not generally offer suitable habitat for raptor nesting. Anthropogenic disturbances were avoided to the extent possible; however, cutblocks and perennial forage crop habitats, which provide habitat for ground-nesting raptors, and edge habitats and tall remnant trees, which could be utilized by some species, were sampled.

Table 2.4-17 Major Habitat Types Sampled During the Raptor Essential Habitat Survey in the Wildlife Local Study Area - 2016

Habitat Type	Length Surveyed (km)	% of Total Survey Length	Available Habitat (ha)	% of Available Habitat in WLSA
Anthropogenic Disturbance	3.1	7.3	1,027.3	18.2
Closed Deciduous	-	-	27.6	0.5
Closed Mixed Coniferous	3.9	9.2	419.5	7.4
Closed Mixedwood	13.9	32.8	991.2	17.6
Closed Spruce	2	4.6	79.4	1.4
Grassland	1.3	3.1	290.3	5.1
Moderate Mixed Coniferous	10.8	25.5	1,375.8	24.4
Open Deciduous	0.1	0.2	51.6	0.9
Open Mixed Coniferous	2.5	5.8	440.5	7.8
Open Mixedwood	2.8	6.6	291.2	5.2
Open Pine	2	4.8	516.7	9.2
Rock/Barren	-	-	48.6	0.9
Shrubby Wetland	-	-	17.9	0.3
Treed Wetland	-	-	4.8	0.1
Upland Shrub	-	-	0.2	0.0
Waterbody	-	-	63.9	1.1
Total	**42.5**	**100.0**	**5,646.4**	**100.0**

A total of 80 essential raptor nest habitat features were located in the WLSA (Table 2.4-18, Figure 2.4-8). The majority of those essential features were mature dead or dying balsam poplars adjacent to spruce stands (n = 31, 38.8% of all features) and large conifer trees in stands where conifer is rare (n = 26, 32.5% of all features). Other common essential nest habitat features included inactive stick nests (n = 12, 15.0% of all features) and cavity holes (n = 9, 11.3% of all features). Cavity holes were typically located in mature balsam poplar or aspen trees. Raptor sign (n = 1, 1.3% of all features) was rare during the survey, and was limited to one calling great horned owl.

Essential raptor nest features were most predominant (n = 36, 45% of identified features) and occurred at a relatively high density (2.6 features/km) in closed mixedwood forest. The highest density of features per surveyed length (10.0 features/km) was in open deciduous forest where one feature - a tall spruce in a stand without any other conifers - was located during a survey of 0.1 km of open deciduous forest. Densities of essential habitat features were also high in closed mixed coniferous (3.3 features/km) and anthropogenic disturbance (2.9 features/km) habitat types. No essential raptor habitat features were found in the grassland habitat type. Overall, essential nest habitat features occurred at a density of 1.9 features/km in the WLSA.

Table 2.4-18 Habitat Associations of Essential Raptor Nest Habitat Features in the Wildlife Local Study Area - 2016

Habitat Type	Number of Features	Density of Habitat Features (#/km)	% of Identified Features
Anthropogenic Disturbance	9	2.9	11.3
Closed Mixed Coniferous	13	3.3	16.3
Closed Mixedwood	36	2.6	45.0
Closed Spruce	3	1.5	3.8
Moderate Mixed Coniferous	11	1.0	13.8
Open Deciduous	1	10.0	1.3
Open Mixed Coniferous	1	0.4	1.3
Open Mixedwood	3	1.1	3.8
Open Pine	3	1.5	3.8
Total	**80**	**1.9**	**100.0**

Of the 80 essential habitat features detected during the survey, 64 (80%) were located within 300 m of a surface water feature, including Blairmore and Gold Creeks and their tributaries (Figure 2.4-8). The

areas within 300 m of Blairmore Creek and Gold Creek contained 27 (33.8%) and 14 (17.5%) essential raptor nest features, respectively, highlighting the importance of these water features for raptors.

2.4.3.2.4.1.2.4 Incidental Sightings

Great horned owls were heard calling during the short-eared owl and essential raptor nest habitat surveys (Figure 2.4-4). A lone barred owl ("Sensitive" in Alberta) was detected twice near the same location along an access road in the WLSA (Figure 2.4-4, Photo 2.4-9). Barred owls are year-round residents of Alberta, typically inhabiting swamps and dense forest in the Boreal, Foothills, and Rocky Mountain Natural Regions (GoA, 2013b). An adult golden eagle was detected incidentally in the WLSA during the pellet/scat survey (Figure 2.4-4). The eagle was perched in a spruce tree and no nest was visible nearby. The only other raptor species detected incidentally in 2016 were red-tailed hawks (Figure 2.4-4).

Photo 2.4-9 Barred owl detected incidentally along an access road in the WLSA on April 28, 2016.

2.4.3.2.5 Other Birds

Three common nighthawks ("Threatened" under SARA Schedule 1, provincially "Sensitive") were detected during the songbird surveys in 2014 (Figure 2.4-3). This species will forage in a wide variety of habitats, including meadows, wetlands, forest edges, pastures, and over bodies of water (Brigham *et al.*, 2011). They lay their eggs on bare patches of ground, including in burned or clear-cut forests (Fowle, 1946; Brigham *et al.*, 2011). There is suitable habitat for nesting nighthawks in the WLSA, particularly in the patches of recently-harvested forest in the northern section.

There were no sightings of common nighthawk in 2016.

2.4.3.3 Mammals

2.4.3.3.1 Bats

Based on range distribution maps, six bat species are likely to occur in the WLSA: big brown bat, silver-haired bat, hoary bat, little brown myotis, long-legged myotis, and long-eared myotis. Silver-haired and hoary bats are "Sensitive" in Alberta (AEP, 2013) while the little brown myotis is federally designated as "Endangered" under SARA Schedule 1.

2.4.3.3.1.1 2014 Results

2.4.3.3.1.1.1 Mistnetting

Three little brown myotis were captured in the mist nets and an additional bat (long-eared myotis) escaped just as it was disentangled from the net. Another individual released itself from the net before handlers could identify it. The three captured little brown myotis were all males; two were adults and one was a juvenile. All were in good condition with no obvious signs of white nose syndrome.

2.4.3.3.1.1.2 Acoustic Monitoring

Acoustic recorders were placed near marshes surrounded by coniferous or mixedwood forests, a mixed conifer forest near a creek, and a mixedwood forest adjacent to a clearing with abandoned buildings nearby (Figure 2.3-7). These locations were considered to be the highest quality foraging or roosting habitats in the WLSA. At four of the five monitoring stations, the temperature remained warmer than 10°C for the entire night with no notable precipitation. At one station, the temperature dropped below 10°C from 01:43 through to past sunrise. As bat activity often declines at temperatures below 10°C, this was considered when the results from this station were interpreted.

The acoustic detectors operated for 46.5 hrs (41.2 hr >10°C), during which time 8,415 (8,407) bat passes representing four species or groups were recorded (Tables 2.4-19 and 2.4-20) for an overall detection rate of 180.9 (200.7) bat passes/detector hr. All of the species or species groups expected to be in the WLSA were detected during the acoustic surveys. Overall, the little brown myotis/long-legged myotis group (n = 6,676 passes) was the most abundant species or species group detected, followed by big brown bat/silver-haired bat (n = 638 passes), hoary bat (n=621 passes), and long-eared myotis (n = 480 passes).

Table 2.4-19 Bat Species and Species Groups Detected During the Acoustic Survey (46.5 Detector Hours) in the Wildlife Local Study Area - 2014

Station	Total	EPFU/LANO[1]	LACI[1]	MYLU/MYVO[1]	MYEV[1]
No. of Passes					
A1	641	98	480	52	11
A7[2]	131	28	23	64	16
A8	701	206	53	392	50
A10	6,183	261	27	5,529	366
A12	759	45	38	639	37
Total	**8,415**	**638**	**621**	**6,676**	**480**
Passes/Detector Hour					
A1	69.5	10.6	52.1	5.6	1.2
A7[2]	14.1	3.0	2.5	6.9	1.7
A8	75.5	22.2	5.7	42.2	5.4
A10	660.1	27.9	2.9	590.3	39.1
A12	81.0	4.8	4.1	68.2	4.0
Total	**180.9**	**13.7**	**13.4**	**143.5**	**10.3**

[1] EPFU/LANO - Big brown or silver-haired bat; LACI - Hoary bat; MYLU/MYVO - Little brown myotis or long-legged myotis; MYEV – Long-eared myotis.

[2] At Station A7, ambient temperature was <10°C from 01:43 until after sunrise

Little brown myotis is ranked "Endangered" under SARA Schedule 1 because populations in eastern North America have been decimated by white-nose syndrome, a disease caused by the fungus *Pseudogymnoascus destructans*. In Canada, white nose syndrome has yet to spread east of Ontario (NWHC 2014). The disease was first detected in 2006 in New York State and it has now spread southward and eastward to Georgia, Michigan and Wisconsin, and northward to Quebec and eastern Ontario (NWHC, 2014). It is spreading west at a rate of 200 – 400 km/year, and Forbes (2012) estimates that it will affect the entire Canadian population of little myotis within 11 - 22 years.

Silver-haired and hoary bats are considered "Sensitive" in Alberta (not federally listed) because of mortality associated with wind energy projects; however, more research is needed to accurately the sizes of these populations.

Table 2.4-20 Bat Species and Species Groups Detected During the Acoustic Survey When Ambient Temperature >10°C (41.2 Detector Hours) - 2014

Station	Total	EPFU/LANO[1]	LACI[1]	MYLU/MYVO[1]	MYEV[1]
No. of Passes					
A1	641	98	480	52	11
A7[2]	123	26	19	62	16
A8	701	206	53	392	50
A10	6,183	261	27	5,529	366
A12	759	45	38	639	37
Total	**8,407**	**636**	**617**	**6,674**	**480**
Passes/Detector Hour					
A1	69.5	10.6	52.1	5.6	1.2
A7[2]	26.5	5.6	4.1	13.3	3.4
A8	75.5	22.2	5.7	42.2	5.4
A10	660.1	27.9	2.9	590.3	39.1
A12	81.0	4.8	4.1	68.2	4.0
Total	**200.7**	**15.2**	**14.7**	**159.3**	**11.5**

[1] EPFU/LANO - Big brown or silver-haired bat; LACI - Hoary bat; MYLU/MYVO - Little brown myotis or long-legged myotis; MYEV – Long-eared myotis.

2.4.3.3.1.2 2016 Results

Additional mistnetting and acoustic monitoring surveys are planned for July 2016. These results will be submitted under separate cover.

2.4.3.3.2 Rodents and Lagomorphs

2.4.3.3.2.1 2013 – 2015 Results

Three rodent species (Columbian ground squirrel, golden-mantled ground squirrel, and red squirrel) and two lagomorph species (American pika, snowshoe hare) were identified during baseline studies conducted in the WLSA. Red squirrels, Columbian ground squirrels, and snowshoe hare were all identified during the wildlife camera program, while American pikas and golden-mantled ground

squirrels were observed incidentally during the songbird survey. All of these species are considered "Secure" in Alberta.

The snowshoe hare is a species of management concern based on its importance as a prey species for Canada lynx and other predators (Hoover *et al.*, 1999) and because of its economic and social value. Snowshoe hare typically follow a 10-year population cycle (Boutin *et al.*, 1995), so population numbers can vary greatly among years. Snowshoe hare prefer densely forested stands where the understory provides forage and protection from predators, especially during the winter (Griffin and Mills, 2009). In the WLSA, snowshoe hares were detected in moderate mixed coniferous, open mixedwood, and disturbed habitats during the wildlife camera program (Table 2.4-21). They were most frequently recorded in moderate mixed coniferous habitat at cameras GM04, GM21, and GM02 (Table 2.4-21). Snowshoe hares were detected throughout the year in WLSA but were recorded the least in summer and most detected in spring (Table 2.4-22).

Table 2.4-21 Detection Frequencies (No./100 Camera Days) of Rodents and Lagomorphs by Camera and Habitat in the Wildlife Local Study Area – 2013-2015

Camera No.	Habitat Type	Camera Days	Columbian Ground Squirrel	Red Squirrel	Snowshoe Hare	Total
GM01	Outside the WLSA	583	-	-	-	**0.00**
GM02	Moderate Mixed Coniferous	583	-	0.17	0.34	**0.51**
GM03	Moderate Mixed Coniferous	639	-	-	-	**0.00**
GM04	Moderate Mixed Coniferous	506	-	0.20	2.17	**2.37**
GM05	Outside the WLSA	583	-	0.17	1.72	**1.89**
GM06	Closed Mixedwood	581	-	0.17	-	**0.17**
GM07	Outside the WLSA	582	-	-	-	**0.00**
GM08	Moderate Mixed Coniferous	221	-	-	-	**0.00**
GM09	Moderate Mixed Coniferous	173	-	-	-	**0.00**
GM10	Closed Mixedwood	581	-	1.20	-	**1.20**
GM11	Closed Mixedwood	548	-	0.18	-	**0.18**
GM12	Closed Spruce	581	-	-	-	**0.00**

Table 2.4-21 Detection Frequencies (No./100 Camera Days) of Rodents and Lagomorphs by Camera and Habitat in the Wildlife Local Study Area – 2013-2015

Camera No.	Habitat Type	Camera Days	Columbian Ground Squirrel	Red Squirrel	Snowshoe Hare	Total
GM13	Grassland	581	0.17	0.69	-	**0.86**
GM14	Anthropogenic Disturbance	583	0.34	-	-	**0.34**
GM15	Closed Mixedwood	493	-	-	-	**0.00**
GM16	Outside the WLSA	177	-	-	0.56	**0.56**
GM17	Open Mixedwood	177	-	-	0.56	**0.56**
GM18	Closed Mixedwood	177	-	-	-	**0.00**
GM19	Open Mixedwood	175	-	-	-	**0.00**
GM20	Grassland	232	-	-	-	**0.00**
GM21	Moderate Mixed Coniferous	175	-	-	0.57	**0.57**
GM22	Anthropogenic Disturbance	232	-	-	0.43	**0.43**
GM23	Anthropogenic Disturbance	175	-	-	-	**0.00**
GM24	Rock/Barren	173	-	-	-	**0.00**
GM25	Anthropogenic Disturbance	173	-	-	-	**0.00**
Total		**9,684**	**0.03**	**0.17**	**0.28**	**0.48**

Table 2.4-22 Detection Frequencies (No./100 Camera Days) of Rodents and Lagomorphs by Season in the Wildlife Local Study Area – 2013 - 2015

Species	Season				Total
	Winter	Spring	Summer	Fall	
Camera Days	5,553	994	1,352	1,785	**9,684**
Columbian Ground Squirrel	-	0.3	-	-	**0.03**
Red Squirrel	0.05	0.4	0.15	0.39	**0.17**
Snowshoe Hare	0.31	0.4	0.07	0.28	**0.28**

Red squirrel is also an important prey animal for several species including northern goshawk (Selonen *et al.* 2010), American marten (Gosse and Hearn, 2005), and fisher (Powell, 1981). Red squirrels are relatively common across their range in habitats with a coniferous component. Red squirrels were recorded at 7 (28%) of the 25 cameras (Table 2.4-21). These cameras were all located in habitats with a coniferous component (closed mixedwood, moderate mixed coniferous), except for camera GM13 which was located on the edge of a grassland-forest transition zone. Red squirrels can move long distances during foraging, mating and natal dispersal, and may cross non-forested habitats in search of food, mates or new territories. Red squirrels were detected at cameras in the WLSA throughout the year, but were most frequently recorded in spring and fall and least frequently in winter (Table 2.4-22). Red squirrels are generally less active during the winter months, a behavioural strategy to reduce heat loss, and most active in the spring and fall during mating season and winter food caching activities, respectively.

Red squirrels or their middens (food caches) were also recorded at 16 of the songbird survey stations in June 2014. Members of the Kainai Nation also noted the presence of numerous red squirrel middens and snowshoe hare tracks during a site visit conducted in fall 2014 (Kainai Nation, 2015). Both species appear to be common throughout the WLSA.

Columbian ground squirrels are hibernating colonial rodents commonly found throughout the Rocky Mountain Natural Region in Alberta. They occupy open meadows, grasslands, and disturbed habitats such as cutblocks and vegetated clearings. In the WLSA, Columbian ground squirrels were detected at cameras GM13 and GM14, which are located in grassland (Photo 2.4-10) and vegetated anthropogenic disturbance (transmission line) habitats, respectively (Table 2.4-21). Columbian ground squirrels were detected in only spring following emergence from hibernation (Table 2.4-22).

Photo 2.4-10 Columbian ground squirrel in grassland habitat at camera GM13 in the WLSA, May 1, 2014.

American pikas typically occupy habitats consisting of rock slides and talus slopes along the interface with open meadows. In Alberta, American pikas are distributed throughout the Rocky Mountain Natural Region. Similarly, golden-mantled ground squirrels inhabit rocky talus and meadows in the Rocky Mountain natural region, but may also be found in open coniferous forest habitat. Both species are susceptible to predation by weasels and birds of prey. The locations of American pika and golden-mantled ground squirrel sightings within the WLSA are shown on Figure 2.4-4.

2.4.3.3.2.2 2015 – 2016 Results

Three rodent species (Columbian ground squirrel, red squirrel, and yellow pine chipmunk) and one lagomorph species (snowshoe hare) were identified during the baseline studies conducted in the WLSA in 2015 – 2016.

Snowshoe hares were detected frequently during the late winter track survey in the WLSA, occurring most frequently in moderate mixed coniferous and closed mixed coniferous forest (Table 2.4-23). Snowshoe hares were also detected along anthropogenic disturbances and in closed mixedwood forest (Table 2.4-23). Similarly, snowshoe hare pellet densities were greatest in moderate mixed coniferous and closed mixedwood forest habitats (Table 2.4-24). Hares were also detected in closed mixed coniferous, closed spruce, open mixed coniferous and open pine habitats during the pellet/scat survey, but pellet densities were an order of magnitude lower in these habitats than in moderate

mixed coniferous and closed mixedwood forests indicating a strong preference by hares for the latter two habitat types (Table 2.4-24).

Snowshoe hares were also detected at four of the 27 cameras in the WLSA during the 2015-2016 monitoring period (Table 2.4-25) and where most frequently detected at Camera GM04 (4.04 detections/100 camera days). All camera trap detections of snowshoe hares in the WLSA were in moderate mixed coniferous forest. Snowshoe hares were most frequently detected during the 2015-2016 camera monitoring program in winter, but they were also detected in summer and fall (Table 2.4-26).

Table 2.4-23 Late Winter Track Frequencies of Snowshoe Hares and Red Squirrels in the Wildlife Local Study Area - 2016

Habitat Type	Total Survey Length (km)	Track Frequency (tracks/km-day)	
		Red squirrel	Snowshoe hare
Anthropogenic Disturbance	3.61	0.28	0.28
Closed Mixed Coniferous	1.19	0.0	0.70
Closed Mixedwood	6.43	0.16	0.08
Closed Spruce	0.78	0.0	0.0
Grassland	2.97	0.0	0.0
Moderate Mixed Coniferous	10.72	0.14	0.73
Open Mixedwood	0.63	0.0	0.0
Open Pine	0.18	0.0	0.0
Rock Barren	0.16	0.0	0.0
Treed Wetland	0.28	0.0	0.0
Total/Average	**26.95**	**0.19**	**0.45**

Table 2.4-24 Pellet Densities for Snowshoe Hares, Red Squirrels and Columbian Ground Squirrels in the Wildlife Study Area - 2016

Habitat Type	Area Sampled (ha)	Pellet Density (pellets/ha)		
		Snowshoe Hare	Red Squirrel	Columbian Ground Squirrel
Closed Deciduous	0.11	0.0	0.0	0.0
Closed Mixed Coniferous	0.34	23.6	67.7	0.0
Closed Mixedwood	0.57	303.9	17.7	0.0
Closed Spruce	0.23	57.4	30.9	0.0
Grassland	0.34	2.9	0.0	8.8
Moderate Mixed Coniferous	0.91	861.3	28.7	0.0
Open Mixed Coniferous	0.23	70.7	39.8	0.0
Open Mixedwood	0.34	0.0	14.7	0.0
Open Pine	0.34	35.3	20.6	5.9
Total	3.40	295.1	25.6	1.5

Table 2.4-25 Detection Frequencies (No./100 Camera Days) of Rodents and Lagomorphs by Camera and Habitat in the Wildlife Local Study Area - 2015-2016

Camera No.	Habitat Type	Camera Days	Columbian Ground Squirrel	Snowshoe Hare	Total
GM01	Outside the WLSA	337	-	-	**-**
GM02	Moderate Mixed Coniferous	395	-	-	**-**
GM03	Moderate Mixed Coniferous	297	-	0.34	**0.34**
GM04	Moderate Mixed Coniferous	223	-	4.04	**4.04**
GM05	Outside the WLSA	217	-	-	**-**
GM06	Closed Mixedwood	338	-	-	**-**
GM07	Outside the WLSA	338	-	-	**-**
GM08	Moderate Mixed Coniferous	388	-	-	**-**
GM09	Moderate Mixed Coniferous	295	-	-	**-**

Table 2.4-25 Detection Frequencies (No./100 Camera Days) of Rodents and Lagomorphs by Camera and Habitat in the Wildlife Local Study Area - 2015-2016

Camera No.	Habitat Type	Camera Days	Columbian Ground Squirrel	Snowshoe Hare	Total
GM10	Closed Mixedwood	339	-	-	**-**
GM11	Closed Mixedwood	84	-	-	**-**
GM12	Closed Spruce	339	-	-	**-**
GM13	Grassland	354	-	-	**-**
GM14	Anthropogenic Disturbance	352	-	-	**-**
GM15	Closed Mixedwood	123	-	-	**-**
GM16	Outside the WLSA	262	-	0.76	**0.76**
GM17	Open Mixedwood	287	-	-	**-**
GM18	Closed Mixedwood	352	-	-	**-**
GM19	Open Mixedwood	353	-	-	**-**
GM20	Grassland	296	-	-	**-**
GM21	Moderate Mixed Coniferous	337	-	0.30	**0.30**
GM22	Anthropogenic Disturbance	281	-	-	**-**
GM23	Anthropogenic Disturbance	338	-	-	**-**
GM24	Rock/Barren	338	-	-	**-**
GM25	Anthropogenic Disturbance	354	-	-	**-**
GC01	Open Pine	51	-	-	**-**
GC02	Open Deciduous	51	1.96	-	**1.96**
Total		**7,719**	**0.01**	**0.17**	**0.18**

Table 2.4-26 Detection Frequencies (No./100 Camera Days) of Rodents and Lagomorphs by Season in the Wildlife Local Study Area - 2015-2016

Species	Season				Total
	Winter	Spring	Summer	Fall	
Camera Days	2,970	852	2,164	1,733	**7,719**
Columbian Ground Squirrel	-	0.12	-	-	**0.01**
Snowshoe Hare	0.27	-	0.14	0.12	**0.17**

Red squirrels were detected during the winter track survey (Table 2.4-23) and the pellet/scat survey (Table 2.4-24). During the winter track survey, red squirrels were detected in closed mixedwood and moderate mixed coniferous forest habitat types, as well as along anthropogenic disturbances. Similarly, red squirrels were also detected in closed mixedwood and moderate mixed coniferous forest habitats during the pellet/scat survey; however, their pellets were more frequently detected in other habitats, such as closed mixed coniferous, closed spruce, and open mixed coniferous forests. The only habitats red squirrels were not detected in during the pellet/scat survey were grassland and closed deciduous. Red squirrels are conifer seed dietary specialists and require a coniferous tree component within their home range, as such, they are not expected to be found in grassland and deciduous forest.

Columbian ground squirrels were detected during the pellet/scat survey and camera trapping program in grassland and open habitat types (Tables 2.4-24 and 2.4-25). Columbian ground squirrels had the greatest density of pellets in grassland habitat compared to the other rodent and lagomorph species surveyed, but had the lowest overall total pellet density amongst rodents and lagomorphs in the WLSA.

A yellow pine chipmunk was detected incidentally during the pellet/scat survey (Figure 2.4-4).

2.4.3.3.3 Carnivores

2.4.3.3.3.1 2013 –2015 Results

Seven species of carnivores were detected in the WLSA during the wildlife camera program conducted between September 2013 and June 2015 (Table 2.4-27). Coyote was the most frequently recorded carnivore (1.58/100 camera days), followed by black bear (0.26/100 camera days), red fox (0.22/100 camera days), and gray wolf (0.19/100 camera days). The highest carnivore detection frequency was recorded at camera GM11, which is located in a closed mixed wood forest while no carnivores were recorded at four of the cameras (Table 2.4-27). In general, carnivores were most

frequently detected during summer (4.51/100 camera days) and least frequently during winter (1.89/100 camera days) (Table 2.4-28).

Table 2.4-27 Detection Frequencies (No./100 Camera Days) of Carnivores by Camera and Habitat Type in the Wildlife Local Study Area – 2013 – 2015

Camera No.	Habitat Type	Camera Days	American Marten	Black Bear	Canada Lynx	Cougar	Coyote	Gray Wolf	Grizzly Bear	Red Fox	Total
GM01	Outside the WLSA	583	-	0.17	0.17	-	0.86	0.34	0.34	-	**1.89**
GM02	Moderate Mixed Coniferous	583	-	0.34	-	-	-	-	-	-	**0.34**
GM03	Moderate Mixed Coniferous	639	-	-	-	-	0.16	-	-	-	**0.16**
GM04	Moderate Mixed Coniferous	506	-	0.40	-	-	0.20	-	-	-	**0.59**
GM05	Outside the WLSA	583	-	0.17	0.34	-	3.26	-	0.17	-	**3.95**
GM06	Closed Mixedwood	581	-	0.17	-	-	0.52	0.17	0.17	-	**1.03**
GM07	Outside the WLSA	582	-	0.34	0.52	-	3.78	0.69	-	-	**5.33**
GM08	Moderate Mixed Coniferous	221	-	-	-	0.90	1.36	-	-	-	**2.26**
GM09	Moderate Mixed Coniferous	173	-	-	0.58	-	0.58	-	-	-	**1.16**
GM10	Closed Mixedwood	581	0.17	0.34	-	-	0.52	0.52	-	-	**1.55**
GM11	Closed Mixedwood	548	-	1.09	-	0.36	7.12	0.18	-	2.74	**11.50**
GM12	Closed Spruce	581	-	-	-	-	-	-	-	-	**0.00**
GM13	Grassland	581	-	0.86	-	0.17	3.44	0.17	-	0.17	**4.82**
GM14	Anthropogenic Disturbance	583	-	0.17	-	0.17	2.92	0.17	-	0.34	**3.77**
GM15	Closed Mixedwood	493	-	0.41	-	0.41	0.81	-	-	-	**1.62**
GM16	Outside the WLSA	177	-	-	-	-	0.56	1.69	-	-	**2.26**
GM17	Open Mixedwood	177	-	-	-	-	1.13	0.56	-	0.56	**2.26**
GM18	Closed Mixedwood	177	-	-	-	-	-	-	-	-	**0.00**

Table 2.4-27 Detection Frequencies (No./100 Camera Days) of Carnivores by Camera and Habitat Type in the Wildlife Local Study Area – 2013 – 2015

Camera No.	Habitat Type	Camera Days	American Marten	Black Bear	Canada Lynx	Cougar	Coyote	Gray Wolf	Grizzly Bear	Red Fox	Total
GM19	Open Mixedwood	175	-	-	-	-	0.57	0.57	-	1.14	**2.29**
GM20	Grassland	232	-	-	-	-	-	-	-	-	**0.00**
GM21	Moderate Mixed Coniferous	175	-	-	1.14	-	-	-	-	-	**1.14**
GM22	Anthropogenic Disturbance	232	-	-	-	-	3.02	-	-	-	**3.02**
GM23	Anthropogenic Disturbance	175	-	-	-	-	0.57	-	-	-	**0.57**
GM24	Rock Barren	173	-	-	-	-	-	-	-	-	**0.00**
GM25	Anthropogenic Disturbance	173	-	-	-	-	1.73	-	-	-	**1.73**
Total		**9,684**	**0.01**	**0.26**	**0.08**	**0.08**	**1.58**	**0.19**	**0.04**	**0.22**	**2.47**

Table 2.4-28 Seasonal Habitat Detection Frequencies (No./100 Camera Days) of Carnivores in the Wildlife Local Study Area – 2013 – 2015

Species	Season				Total
	Winter	Spring	Summer	Fall	
Camera Days	5,553	994	1,352	1,785	**9,684**
American Marten	0.02	-	-	-	**0.01**
Black Bear	-	0.4	1.33	0.17	**0.26**
Canada Lynx	0.13	-	0.15	-	**0.08**
Cougar	0.02	0.2	0.15	0.17	**0.08**
Coyote	1.33	1.11	2.29	2.07	**1.58**
Gray Wolf	0.22	0.1	0.07	0.22	**0.19**
Grizzly Bear	0.02	0.1	0.07	0.06	**0.04**

Table 2.4-28 Seasonal Habitat Detection Frequencies (No./100 Camera Days) of Carnivores in the Wildlife Local Study Area – 2013 – 2015

Species	Season				Total
	Winter	Spring	Summer	Fall	
Camera Days	5,553	994	1,352	1,785	**9,684**
Red Fox	0.16	0.5	0.44	0.06	**0.22**
Total	**1.89**	**2.41**	**4.51**	**2.75**	**2.47**

2.4.3.3.3.1.1 Mustelids

American marten is a "Secure" species in Alberta. They preferentially select mature coniferous forests with abundant coarse woody debris and snags. Such habitats provide protection from predators, habitat for their rodent prey, denning sites, and subnivian access for hunting and thermoregulation during winter (Thompson and Curran, 1995; Payer and Harrison, 2003). Marten were detected only once at camera GM10 (Table 2.4-27), which was located in closed mixedwood forest habitat in winter.

No other mustelids were detected by the wildlife cameras; however, a FWMIS database query indicates that wolverines have been reported to occur in the region. Wolverines occur in the western mountains and northern boreal forest of Alberta but generally occur at low densities. They are a species of "Special Concern" in Canada (COSEWIC, 2003) and have a general provincial status of "May Be At Risk." The wolverine was assessed by Alberta Endangered Species Conservation Committee but it was given a status of "Data Deficient." Wolverines are difficult to study because of their large home ranges and low densities (Naughton, 2012), often with just a few animals/1,000 km^2.

2.4.3.3.3.1.2 Canada Lynx

Canada lynx, are a "Sensitive" species in Alberta, were recorded at cameras GM09 and GM21 in the WLSA as well as at cameras located just outside of the WLSA (GM01, GM05, and GM07; WLSA (Figure 2.4-9). Overall, Canada lynx were more commonly detected just outside the WLSA than they inside of the WLSA. Within the WLSA, they were most frequently detected at cameras GM21 and GM09, which were both located in moderate mixed coniferous habitat (Table 2.4-27, Figure 2.4-9), although camera GM09 was located along the transition zone between the moderate mixed coniferous habitat and an anthropogenic disturbance (Photo 2.4-11).

Lynx are highly dependent upon snowshoe hares for their diet, and therefore, often select habitats with a high density of hares (Bayne *et al.*, 2008). Lynx prefer to hunt in regenerating forest stands, but also use mature stands (Murray *et al.* 1994; O'Donoghue *et al.* 1997). Canada lynx were most

frequently detected in the summer and winter seasons, and were not detected in spring and fall (Table 2.4-28).

Photo 2.4-11 Canada lynx at the top of Grassy Mountain at the existing coal mine disturbance at camera GM09 in the WLSA, January 15, 2015.

2.4.3.3.3.1.3 Cougar

Cougars were detected at five cameras in the wildlife camera program (Figure 2.4-10, Photo 2.4-12). Cougars were detected most frequently in moderate mixedwood and closed mixedwood forest habitat, but were also detected in grassland habitat and along an anthropogenic linear feature (transmission line) (Table 2.4-27). Cougars were most frequently detected at camera GM08. Lone individual cougars were most often photographed by the wildlife cameras; however, a family group of four individuals (one female and three juveniles) was recorded on May 12, 2014. The presence of this family group in the WLSA suggests that cougars may be breeding and denning in the area. Maternity dens are typically located in dense thickets, brush piles, rock crevices, or under large fallen trees (Anderson 1983). Cougars are year-round residents in the WLSA, having been recorded in all of the seasons (Table 2.4-28). They were least frequent in but had relatively similar detection frequencies in spring, summer, and fall.

Cougars are "Secure" in Alberta and populations are considered to be stable or increasing throughout most of their range in the province (AESRD, 2012). In southwestern Alberta, cougar population densities varied from 2.7 to 4.7 cougars/100 km^2 in 1992 (Ross and Jalkotzy, 1992) and, more recently,

35 cougars/1,000 km² in 2011 for the region around the WLSA (AESRD 2012). In general, cougars are highly territorial and asocial animals, except for mother-juvenile associations and during mating periods. Territories are well scent-marked and are defended against conspecifics. In southwestern Alberta, the mean annual home ranges for female cougars were 140 km² (range from 62 to 318 km²), while males had larger ranges of 334 km² (range from 221 to 438 km²; Ross and Jalkotzy, 1992). Adult females with juveniles typically have the smallest home ranges. Juveniles disperse from the maternal home range by 21 months of age and dispersal distances range from 30 to 155 km in southwestern Alberta (Ross and Jalkotzy, 1992). Cougars prey primarily on smaller ungulate species, such as deer, and on juveniles of larger ungulate species, such as moose (Ross and Jalkotzy, 1992, Ross and Jalkotzky, 1996; Knopff *et al.*, 2010). Snowshoe hares, porcupines, and domestic stock are also preyed upon. In Alberta, cougars favour forested habitats that support populations of ungulates and other prey species. Areas with rock ledges and outcrops may be preferable since these features are often used as vantage points for hunting, resting, and to escape wolves.

Photo 2.4-12 A family of four cougars at camera GM11 in the WLSA, May 12, 2014.

2.4.3.3.3.1.4 Red Fox

Red foxes were detected at five of the cameras in the WLSA (Table 2.4-27). Observations of red fox were most frequent in open mixedwood and closed mixedwood forest habitat (Table 2.4-28, Photo 2.4-13). They were also detected in grassland and along an anthropogenic disturbance (transmission line). Red foxes were recorded in all four seasons, but were most frequently recorded during the spring and summer periods and least frequently in fall (Table 2.4-28). The red fox is the smallest canid species that occurs in the WLSA, and are fairly common residents of the foothills

natural region. Red fox prey upon small rodents (mice and voles) and birds in forested and open habitats throughout their range in Alberta. The red fox is classified as "Secure" in Alberta.

Photo 2.4-13 A red fox in closed mixedwood habitat at Camera GM11 in the WLSA, March 16, 2014.

2.4.3.3.3.1.5 Coyote

Coyotes were detected by wildlife cameras throughout the WLSA in moderate mixed coniferous, closed mixedwood (Photo 2.4-14), open mixedwood, grassland, and disturbed habitats. They were also detected at the four cameras outside of the WLSA (Figure 2.4-11). Coyotes were detected at 19 of the 25 cameras in the WLSA, and were most frequently photographed at cameras GM11 (closed mixedwood), GM07 (outside WLSA), GM13 (grassland), GM05 (outside WLSA) and GM22 (anthropogenic disturbance; Table 2.4-26). Coyotes often exploit open and edge habitats where prey species such as voles, mice and snowshoe hare are generally most abundant (Theberge and Wedeles, 1989). However, coyotes are habitat generalists that use a broad range of habitats depending on prey availability and accessibility (Turner *et al.*, 2011).

Coyotes are a "Secure" species that occurs throughout the province. Historically, coyotes inhabited open habitat and grasslands (Gier, 1975), but have expanded their range following the extirpation of wolves from many areas (Pattie and Fisher, 1999). Coyotes were the most frequently detected carnivore in the WLSA during the wildlife camera program (Table 2.4-27), photographed most often in summer and fall and detected least frequently in spring (Table 2.4-28).

Photo 2.4-14 A coyote in closed mixedwood habitat at camera GM10 in the WLSA, December 29, 2013.

2.4.3.3.3.1.6 Gray Wolf

Gray wolves occur in a variety of habitats in North America (Mech, 1974). In Alberta, wolves are largely restricted to forested habitats in the mountain, foothills and boreal regions where they are important predators of moose, deer, and elk. Gray wolves are classified as "Secure" in in the province.

Wolves were detected at seven of the 21 cameras inside the WLSA and three of the four cameras outside of the WLSA over the course of the wildlife camera program (Table 2.4-27, Figure 2.4-12). They were most frequently detected at camera GM16 (Photo 2.4-15) and cameras GM10 (closed mixedwood), GM17 (open mixedwood), and GM19 (open mixedwood) (Table 2.4-27). Wolves were also recorded in grassland habitat (GM13) and along a pipeline right-of-way (GM14). Wolves often use linear disturbances, such as pipelines and roads, as movement corridors (Latham *et al.*, 2011).

Wolves occurred in the WLSA throughout the year (Table 2.4-28). They were most frequently detected in fall and winter, and were least frequent during the summer period. Grey wolf scat was also recorded incidentally in closed mixed coniferous forest in the WLSA (Figure 2.4-4).

Photo 2.4-15 Two gray wolves chasing a mule deer buck outside of the WLSA at camera GM16, November 8 2014.

2.4.3.3.3.1.7 Black Bear

Black bears are primarily a forest-dwelling species throughout their range (Pattie and Fisher 1999), but their overall habitat selection can shift seasonally with the availability of food (Larivière, 2001). Their diet is omnivorous, relying largely on buds in the spring and berries in summer and fall (Raine and Kansas, 1990). Black bears are a "Secure" species that occurs throughout most of the forested areas of Alberta.

Black bears were recorded at nine of the wildlife cameras in the WLSA and two of the cameras outside of the WLSA (Figure 2.4-13). They were most frequently detected at camera GM11 in closed mixedwood forest and GM13 in grassland habitats (Table 2.4-27). Black bears were also present in moderate mixed coniferous and closed mixedwood habitats (Table 2.4-27, Photo 2.4-16). Black bears were most frequently detected in summer, but were also present in spring and fall (Table 2.4-28).

Photo 2.4-16 Two black bears in grassland habitat at camera GM13 in the WLSA, May 13 2014.

2.4.3.3.3.1.8 Grizzly Bear

Grizzly bears are an "At Risk" species with a legislated status of "Threatened" in Alberta. They are also a species of "Special Concern" in Canada (COSEWIC, 2012). Grizzly bears currently occur throughout the Rocky Mountain and foothills regions of Alberta, as well as in some portions of the boreal forest. Grizzly bears are habitat generalists and omnivores, although their diet is largely plant-based in Alberta (Nielsen *et al.*, 2004); subsequently, their occurrence and distribution generally follows that of forage availability. During the spring and fall, grizzly bears are most likely to forage for roots in non-forested herbaceous and shrubby habitats (Munro *et al.*, 2006). In late summer, grizzly bears switch their primary diet to berries, which they forage for in open forests, wet forests and mixedwood forests (Munro *et al.*, 2006). Ungulates such as deer and elk may comprise a small component of the grizzly bear diet in the Rocky Mountain region of Alberta. Ungulates are more likely to be killed by grizzly bears in non-forested, open forest, and wet forest habitats (Munro *et al.*, 2006). While grizzly bears tend to avoid active human disturbances, they often forage in clear cuts, reclaimed well sites, and vegetated linear disturbances (such as transmission lines, pipelines, and road verges) since these habitats can provide diverse food sources such as roots, forbs and berries (Nielsen *et al.*, 2004).

In the WLSA, grizzly bears were detected at three of the 25 cameras (Figure 2.4-14), and only one of which was located within the WLSA (GM06). Camera GM06 was located along Blairmore Creek (Photo 2.4-17) in the central portion of the WLSA (Figure 2.4-14) in closed mixedwood forest. Grizzly

bears were also detected at cameras GM01 (Photo 2.4-18), which was located along a linear pipeline disturbance, and GM05, which was located along the edge of a regenerating cutblock.

Photo 2.4-17 A grizzly bear in closed mixedwood habitat along Blairmore Creek at camera GM06 in the WLSA, April 13, 2015.

Photo 2.4-18 A grizzly bear along a cutline at camera GM01 outside of the WLSA, May 25, 2014.

Grizzly bears were detected on April 13, May 25, June 4, and November 13 during the wildlife camera program (Table 2.4-27). In west-central Alberta, pregnant female grizzly bears generally hibernate between mid-November and mid-April (Graham and Stenhouse, 2014). Mean number of days in hibernation for grizzly bears in west-central Alberta ranged between 134 and 175 days depending on life-history stage of the individual, with sub-adult males and sub-adult females hibernating for the shortest period of time (Graham and Stenhouse, 2014). Overall, grizzly bears were detected during all four seasons (Table 2.4-28) in the WLSA during the wildlife camera program. Grizzly bears were most frequently detected during the spring season and least frequently during the winter season, but detected frequencies were generally low across all seasons. After American marten, grizzly bears were the least detected carnivore in the WLSA between September 2013 and June 2015.

Grizzly bears were also observed incidentally three times in the WLSA during the amphibian and bat baseline surveys on June 5, 2014 and August 9, 2014 (Figure 2.4-4). In all cases, a pair of juvenile grizzly bears, aged approximately two-years old, were observed moving through grassland and closed mixedwood habitats, as well as along a vegetated road edge.

2.4.3.3.3.2 2015 –2016 Results

Twelve species of carnivore were detected in the WLSA during the baseline data collection period (April 2015 – June 2016), from several survey methods, including wildlife camera trapping, winter tracking, and pellet/scat surveys.

Five carnivore species were detected during the winter track survey in March 2016: Canada lynx, coyote, gray wolf, red fox, and least weasel (Table 2.4-29). Gray wolf was the most frequently detected carnivore during the winter track surveys (0.51 tracks/km/day), followed by Canada lynx and coyote. Carnivore diversity was highest in moderate mixed coniferous forest during the winter track survey (n = 4 species).

Table 2.4-29 Late Winter Track Frequencies of Carnivores in the Wildlife Local Study Area - 2016

Habitat Type	Total Survey Length (km)	Track Frequency (tracks/km-day)				
		Canada Lynx	Coyote	Gray Wolf	Red Fox	Least Weasel
Anthropogenic Disturbance	3.61	-	0.14	-	-	-
Closed Mixed Coniferous	1.19	-	0.42	-	-	-
Closed Mixedwood	6.43	0.08	-	-	-	-
Closed Spruce	0.78	-	-	-	-	-

Table 2.4-29 Late Winter Track Frequencies of Carnivores in the Wildlife Local Study Area - 2016

Habitat Type	Total Survey Length (km)	Track Frequency (tracks/km-day)				
		Canada Lynx	Coyote	Gray Wolf	Red Fox	Least Weasel
Grassland	2.97	0.17	-	-	0.17	-
Moderate Mixed Coniferous	10.72	0.56	0.05	0.22	-	0.03
Open Mixedwood	0.63	-	-	0.80	-	-
Open Pine	0.18	-	-	-	-	-
Rock Barren	0.16	-	-	-	-	-
Treed Wetland	0.28	-	-	-	-	-
Total/Average	**26.95**	**0.27**	**0.20**	**0.51**	**0.17**	**0.03**

Scats were detected for five carnivores during the pellet/scat survey in the WLSA: Canada lynx, black bear, American marten, ermine and least weasel (Table 2.4-30). American marten had the highest scat density amongst carnivores in the WLSA during the scat survey.

Table 2-4.30 Carnivore Scat Densities in the Wildlife Local Study Area - 2016

Habitat Type	Area Sampled (ha)	Scat Density (scats/ha)				
		Canada Lynx	Black Bear	American Marten	Ermine	Least Weasel
Closed Deciduous	0.11	-	-	-	-	-
Closed Mixed Coniferous	0.34	-	-	-	-	2.9
Closed Mixedwood	0.57	-	3.5	5.3	-	-
Closed Spruce	0.23	-	-	-	-	8.8
Grassland	0.34	-	-	-	-	-
Moderate Mixed Coniferous	0.91	1.1	-	2.2	1.1	1.1
Open Mixed Coniferous	0.23	4.4	-	4.4	-	-
Open Mixedwood	0.34	-	2.9	-	-	-
Open Pine	0.34	-	-	-	-	-
Total	3.40	0.6	0.9	1.8	0.3	1.2

Nine species of carnivores were detected in the WLSA during the wildlife camera program conducted between spring 2015 and spring 2016 (Table 2.4-31). Coyote was the most frequently recorded carnivore (0.57 detections/100 camera days), followed by gray wolf (0.29 detections/100 camera days), black bear (0.27 detections/100 camera days), and red fox (0.18 detections/100 camera days). American badger and bobcat were detected for the first time during the 2015-2016 monitoring period. The highest carnivore detection frequencies were recorded at cameras GM22 and GM11, which were located in an anthropogenic disturbance and closed mixedwood forest, respectively. No carnivores were recorded at five of the 27 cameras (Table 2.4-31). In general, carnivores were most frequently detected during summer (2.08/100 camera days) and least frequently during winter (1.14/100 camera days) (Table 2.4-32).

Table 2.4-31 Detection Frequencies (No./100 Camera Days) of Carnivores by Camera and Habitat Type in the Wildlife Local Study Area – 2015 – 2016

Camera No.	Habitat Type	Camera Days	American Badger	Black Bear	Bobcat	Canada Lynx	Cougar	Coyote	Gray Wolf	Grizzly Bear	Red Fox	Total
GM01	Outside the WLSA	*337*	-	-	-	-	-	-	0.30	0.30	-	**0.59**
GM02	Moderate Mixed Coniferous	*395*	-	-	-	-	-	0.25	-	-	-	**0.25**
GM03	Moderate Mixed Coniferous	*297*	-	-	-	-	-	-	-	-	-	**0.00**
GM04	Moderate Mixed Coniferous	*223*	-	-	-	-	-	0.45	-	-	-	**0.45**
GM05	Outside the WLSA	*217*	-	-	0.92	-	-	1.38	-	-	-	**2.30**
GM06	Closed Mixedwood	*338*	-	1.78	-	-	0.30	0.89	0.30	0.30	-	**3.55**
GM07	Outside the WLSA	*338*	-	-	-	-	-	1.18	1.78	-	-	**2.96**
GM08	Moderate Mixed Coniferous	*388*	-	-	-	-	0.52	0.26	-	-	-	**0.77**
GM09	Moderate Mixed Coniferous	*295*	0.68	-	-	0.68	-	-	-	0.34	-	**1.69**
GM10	Closed Mixedwood	*339*	-	-	-	0.29	-	0.59	1.18	-	-	**2.06**
GM11	Closed Mixedwood	*84*	-	3.57	-	-	1.19	1.19	-	-	-	**5.95**
GM12	Closed Spruce	*339*	-	-	-	-	-	-	0.29	-	-	**0.29**
GM13	Grassland	*354*	-	1.13	-	-	-	1.69	-	-	1.41	**4.24**
GM14	Anthropogenic Disturbance	*352*	-	0.28	-	-	-	1.14	-	-	-	**1.42**
GM15	Closed Mixedwood	*123*	-	-	-	-	0.81	-	-	0.81	-	**1.63**

Table 2.4-31 Detection Frequencies (No./100 Camera Days) of Carnivores by Camera and Habitat Type in the Wildlife Local Study Area – 2015 – 2016

Camera No.	Habitat Type	Camera Days	American Badger	Black Bear	Bobcat	Canada Lynx	Cougar	Coyote	Gray Wolf	Grizzly Bear	Red Fox	Total
GM16	Outside the WLSA	*262*	-	0.38	-	-	-	-	-	-	1.15	**1.53**
GM17	Open Mixedwood	*287*	-	0.35	-	-	-	-	-	-	0.35	**0.70**
GM18	Closed Mixedwood	*352*	-	-	-	-	-	1.14	-	-	-	**1.14**
GM19	Open Mixedwood	*353*	-	-	-	-	0.57	0.28	0.57	-	-	**1.42**
GM20	Grassland	*296*	-	0.68	-	-	0.34	-	-	0.34	-	**1.35**
GM21	Moderate Mixed Coniferous	*337*	-	-	-	-	-	-	-	-	-	**0.00**
GM22	Anthropogenic Disturbance	*281*	-	0.71	-	-	-	4.27	1.42	-	-	**6.41**
GM23	Anthropogenic Disturbance	*338*	-	-	-	-	-	-	-	-	-	**0.00**
GM24	Rock Barren	*338*	-	-	-	-	-	-	-	-	-	**0.00**
GM25	Anthropogenic Disturbance	*354*		-	-	-	-	-	0.85	-	1.41	**2.26**
GC01	Open Pine	*51*	-	1.96	-	-	-	1.96	-	-	-	**3.92**
GC02	Open Deciduous	*51*	-	-	-	-	-	-	-	-	-	**0.00**
Total		***7,719***	**0.03**	**0.27**	**0.03**	**0.04**	**0.10**	**0.57**	**0.29**	**0.06**	**0.18**	**1.57**

Table 2.4-32 Seasonal Habitat Detection Frequencies (No./100 Camera Days) of Carnivores in the Wildlife Local Study Area – 2015 – 2016

Species	Season				Total
	Winter	Spring	Summer	Fall	
Camera Days	2,970	852	2,164	1,733	**7,719**
American Badger	-	-	0.09	-	**0.03**
Black Bear	-	0.35	0.69	0.17	**0.27**
Bobcat	-	-	0.05	0.06	**0.03**
Canada Lynx	0.07	-	0.05	-	**0.04**
Cougar	0.07	-	0.14	0.17	**0.10**
Coyote	0.57	0.70	0.28	0.87	**0.57**
Gray Wolf	0.37	0.35	-	0.46	**0.29**
Grizzly Bear	-	0.35	0.05	0.06	**0.06**
Red Fox	0.07	0.23	0.23	0.29	**0.18**
Total	**1.14**	**2.00**	**1.57**	**2.08**	**1.57**

2.4.3.3.3.2.1 Mustelids

Five mustelid species were identified as occurring in the WLSA (Table 2.4-33). American marten, least weasel, and ermine were confirmed through the scat survey (Figure 2.4-15). Least weasel was also confirmed through the winter track survey. American marten and American badger were confirmed through the camera trapping program. Wolverine was confirmed through an FWMIS search, but was not detected in the WLSA during any of the baseline surveys.

Table 2.4-33 Mustelid Species Identified in the Wildlife Local Study Area and the Applicable Conservation Status – 2015 - 2016

Species	Provincial Status		COSEWIC Designation	WLSA	FWMIS
	General	Legislated			
American badger	Sensitive	Data Deficient	Special Concern	X	
American marten	Secure	-	--	X	
Ermine	Secure	-	-	X	
Least Weasel	Secure	-	-	X	

Table 2.4-33 Mustelid Species Identified in the Wildlife Local Study Area and the Applicable Conservation Status – 2015 - 2016					
Species	**Provincial Status**		**COSEWIC Designation**	**WLSA**	**FWMIS**
	General	**Legislated**			
Wolverine	May Be At Risk	Data Deficient	Species of Concern		X

American badger (*taxus* subspecies; "Sensitive" in Alberta, "Special Concern" COSEWIC) was detected at camera GM09 in moderate mixed coniferous along the edge of an existing coal mine disturbance in an alpine area in the WLSA (Figure 2.3-8, Photo 2.4-19). American badgers were detected in summer only (Table 2.4-32) and were detected on two separate occasions (likely the same individual) moving in a northward direction. American badgers were one of the least detected carnivores, but were the only mustelid species detected in the WLSA during the 2015-2016 camera monitoring period. American badgers are fossorial carnivores that occur throughout Alberta in non-forested grassland and shrubland biomes. According to COSEWIC (2012b), soil and prey availability are defining features of American badger habitat with soils that can be burrowed into without collapsing being preferred. Early seral stage habitats along forest corridors, agricultural areas with sufficient hedge/fence rows, alpine areas, and wetlands have been found to support sufficient prey populations to attract badgers into those habitats (COSEWIC, 2012b). Generally, badger habitat is declining across Canada. Persecution by landowners, trapping, incidental killing by rodenticides, and vehicle collisions are all contributing mortality risks (COSEWIC, 2012b).

Photo 2.4-19 American badger detected at Camera GM09 on August 6, 2015 in the WLSA.

American marten scats occurred at the highest density amongst carnivores during the scat survey in the WLSA (Table 2.4-30, Photo 2.4-20), followed by least weasel, black bear, Canada lynx, and ermine. American marten scats were detected in closed mixedwood (highest scat density), open mixed coniferous, and moderate mixed coniferous forest habitats (Table 2.4-30, Figure 2.4-15). Least weasel scat had the highest density in closed spruce habitat, but their scat was also detected in closed mixed coniferous forest and moderate mixed coniferous forest (Table 2.4-30, Figure 2.4-15). Ermine scat was detected in moderate mixed coniferous (Table 2.4-30, Figure 2.4-15). Red squirrels are an important prey species for American marten, least weasel, and, to a lesser extent, ermine. American marten, least weasel, and ermine scat density and habitat occupancy followed those of red squirrels (Tables 2.4-24 and 2.4-30). Least weasels were the only mustelid species detected during the winter track survey (Table 2.4-29, Figure 2.4-16).

American marten scat was also detected incidentally in the WLSA during the pellet/scat survey outside of the surveyed transect and during the raptor essential habitat survey (Figure 2.4-4).

Photo 2.4-20 American marten scat at red squirrel kill site in the WLSA on May 5, 2016.

2.4.3.3.3.2.2 Bobcat

Bobcats ("Sensitive" in Alberta) were only recorded on two occasions along the edge of cutblock at camera GM05 (Photo 2.4-21) outside of the WLSA (Figure 2.3-8). Bobcats have not been detected inside the WLSA. Bobcats were one of the least detected carnivores during the 2015-2016 camera monitoring program.

Photo 2.4-21 Bobcat detected at Camera GM05 outside of the WLSA on June 9, 2015.

2.4.3.3.3.2.3 Canada Lynx

Canada lynx were recorded at cameras GM09 and GM10 during the 2015-2016 wildlife camera monitoring period and were one of the least frequently detected carnivores in the WLSA (Table 2.4-31, Figure 2.4-17). Generally, Canada lynx detection frequencies and spatial distribution were lower than in the 2013-2015 monitoring period, possibly due to decreased snowshoe hare populations as exemplified by lower snowshoe hare detection frequencies. Canada lynx habitat preferences track those of their main prey species: snowshoe hare. During the winter track and pellet/scat surveys snowshoe hares were most commonly detected in closed mixedwood, moderate mixed coniferous, open mixed coniferous, and closed mixed coniferous habitats (Tables 2.4-22 and 2.4-24). Likewise, Canada lynx were most frequently detected in closed mixedwood, moderate mixed coniferous and open mixed coniferous habitats during the winter track and pellet/scat surveys (Tables 2.4-29 and 2.4-30; Figures 2.4-15 and 2.4-16).

2.4.3.3.3.2.4 Cougar

Cougars were detected at six cameras during the 2015-2016 camera monitoring period (Figure 2.4-18). Cougars were detected in closed mixedwood, moderate mixed coniferous, open mixedwood, and grassland habitats (Table 2.4-31). Cougars were most frequently detected at camera GM11. Cougars were detected at three new cameras in the current monitoring period: GM06, GM19 and GM20. Lone individual cougars were most often photographed by the wildlife cameras. Cougars were not detected during the spring, but were detected in all other seasons (Table 2.4-32).

2.4.3.3.3.2.5 Red Fox

Red foxes were detected at four of the cameras in the WLSA during the 2015-2016 monitoring period (Table 2.4-29). Observations of red fox were most frequent in grassland and along an anthropogenic disturbance. Red foxes were recorded in all four seasons, but were most frequently recorded during the fall and least frequently in winter (Table 2.4-32).

2.4.3.3.3.2.6 Coyote

Coyotes were detected by wildlife cameras throughout the WLSA in moderate mixed coniferous, closed mixedwood, open mixedwood, grassland, open pine, and disturbed habitats (Table 2.4-31). They were also detected at three cameras outside of the WLSA (Figure 2.4-19). Coyotes were detected at 14 of the 27 cameras, and were most frequently photographed at cameras GM22 (anthropogenic disturbance), GM22 (anthropogenic disturbance), GC01 (open pine), GM13 (grassland), and GM05 (outside WLSA).

Coyotes were the most frequently detected carnivore in the WLSA during the 2015-2016 wildlife camera program (Table 2.4-30), photographed most often in fall and detected least frequently in summer (Table 2.4-32).

One coyote scat was also detected incidentally in the WLSA during the pellet/scat survey outside of the transect (Figure 2.4-4).

2.4.3.3.3.2.7 Gray Wolf

Wolves were detected at eight of the 27 cameras over the course of the 2015-2016 wildlife camera program (Table 2.4-31, Figure 2.4-20). They were most frequently detected at cameras GM07 (outside of WLSA), GM10 (closed mixedwood), and GM22 (anthropogenic disturbance). Overall, gray wolf detection frequencies were higher in the 2015-2016 monitoring period than in the 2013-2015 monitoring period. Wolves occurred in the WLSA in all seasons except summer during the 2015-2016 camera monitoring period and were most frequently detected in fall (Table 2.4-32).

Gray wolf tracks were also recorded incidentally in the WLSA (Figure 2.4-4).

2.4.3.3.3.2.8 Black Bear

Black bears were recorded at nine of the wildlife cameras in the during the 2015-2016 monitoring program (Figure 2.4-21). They were most frequently detected at camera GM11 in closed mixedwood forest (Table 2.4-31). Black bears were also present in grassland, open mixedwood, open pine and in anthropogenic disturbances. Black bears were most frequently detected during summer, but were

also present in spring and fall (Table 2.4-32). Detection frequencies of black bears were similar during the two camera monitoring periods (Tables 2.4-27 and 2.4-31).

Black bear scat and tracks were also detected incidentally at four locations and one black bear was visually observed in the WLSA during the spring 2016 surveys (Figure 2.4-4).

2.4.3.3.3.2.9 Grizzly Bear

In the WLSA, grizzly bears were detected at five of the 27 cameras (Table 2.4-31, Figure 2.4-22), four of which were located (GM06, GM09, GM15, GM20). Grizzly bears were previously recorded on GM06, but not the other three cameras. Grizzly bears were detected during spring, summer and fall (Table 2.4-32). Grizzly bears were most frequently detected during the spring season and least frequently during the summer and fall.

2.4.3.3.4 Ungulates

2.4.3.3.4.1 2013 –2015 Results

Four ungulate species were during the wildlife camera program from September 2013 to June 2015 (Table 2.4-34) and incidentally during other wildlife surveys conducted in the WLSA (Figure 2.4-4). Mule deer were the most frequently detected species, followed by white-tailed deer, moose, and elk (Table 2.4-34). A number of other deer were recorded at some of the cameras locations; however, due to picture quality, these specific observations did not allow accurate species identification.

Table 2.4-34 Detection Frequencies of Ungulates by Camera and Habitat in the Wildlife Local Study Area – 2013 - 2015

Camera No.	Habitat Type	Camera Days	Deer spp.	Elk	Moose	Mule Deer	White-tailed Deer	Total
GM01	Outside WLSA	583	-	1.89	3.6	0.86	4.12	10.46
GM02	Moderate Mixed Coniferous	583	-	-	-	3.43	-	3.43
GM03	Moderate Mixed Coniferous	639	-	3.13	2.82	4.85	0.31	11.11
GM04	Moderate Mixed Coniferous	506	-	-	0.59	1.78	0.2	2.57
GM05	Outside WLSA	583	-	1.37	2.06	1.03	2.06	6.52
GM06	Closed Mixedwood	581	0.17	0.34	4.48	7.23	1.03	13.25

Table 2.4-34 Detection Frequencies of Ungulates by Camera and Habitat in the Wildlife Local Study Area – 2013 - 2015

Camera No.	Habitat Type	Camera Days	Deer spp.	Elk	Moose	Mule Deer	White-tailed Deer	Total
GM07	Outside WLSA	582	-	0.86	2.23	2.41	9.45	14.95
GM08	Moderate Mixed Coniferous	221	-	12.67	1.36	14.93	-	28.96
GM09	Moderate Mixed Coniferous	173	-	-	-	1.16	-	1.16
GM10	Closed Mixedwood	581	0.17	0.17	0.17	3.61	0.34	4.48
GM11	Closed Mixedwood	548	0.55	0.73	1.64	6.93	3.83	13.69
GM12	Closed Spruce	581	-	0.52	0.52	2.41	2.58	6.02
GM13	Grassland	581	-	2.93	0.69	8.61	0.17	12.39
GM14	Anthropogenic Disturbance	583	-	-	1.72	-	0.51	2.23
GM15	Closed Mixedwood	493	0.41	3.25	0.41	4.06	10.34	18.46
GM16	Outside WLSA	177	-	1.69	1.13	3.95	0.56	7.34
GM17	Open Mixedwood	177	-	-	-	-	1.69	1.69
GM18	Closed Mixedwood	177	-	-	0.56	0.56	-	1.13
GM19	Open Mixedwood	175	-	0.57	-	1.14	2.29	4
GM20	Grassland	232	-	0.86	1.72	3.02	0.43	6.03
GM21	Moderate Mixed Coniferous	175	-	-	1.14	-	-	1.14
GM22	Anthropogenic Disturbance	232	-	0.86	7.33	9.05	1.29	18.53
GM23	Anthropogenic Disturbance	175	-	-	-	-	-	0
GM24	Rock Barren	173	-	-	-	-	-	0
GM25	Anthropogenic Disturbance	173	-	-	-	4.62	-	4.62
Total		**9,684**	**0.07**	**1.27**	**1.56**	**3.62**	**2.12**	**8.64**

2.4.3.3.4.1.1 Mule deer

Mule deer are a "Secure" species that occurs throughout Alberta; however, they are most abundant in southern and western Alberta (Pattie and Fisher, 1999). They generally prefer coniferous forest edges, mixedwood forests, shrublands, early-successional forests, and disturbed habitats, such as clearcuts and burns (Pattie and Fisher, 1999). Mule deer are an important species because of their recreational

value to sport hunters. They also identified by some of the Treaty 7 First Nations to have traditional value (Kainai Nation 2015, Piikani Nation 2015, Tsuut'ina Nation 2015).

In the WLSA, mule deer were frequently detected at cameras GM08 in moderate mixed coniferous forest), GM22 (along an anthropogenic disturbance [Photo 2.4-22]), and GM13 (in grassland habitat) (Table 2.4-34, Figure 2.4-23). They were predominantly detected in summer and were least frequently detected in spring (Table 2.4-35). The detection frequency in summer was approximately 100% greater than in fall and 135% greater than in winter. Mule deer were primarily detected in grassland habitat, followed by closed mixedwood and moderate mixed coniferous habitats. During summer, mule deer were detected equally in grassland and closed mixedwood habitats, but they shifted their habitat use away from closed mixedwood to moderate mixed coniferous in fall and, subsequently, back to closed mixedwood in winter. They occurred in grassland habitat relatively consistently across all seasons.

Photo 2.4-22 A mule deer doe with two fawns at camera GM22 in the WLSA, June 8, 2015.

Mule deer are generalist feeders with diets that vary seasonally. Grasses and forbs are included in their winter diet but are more important during the spring and summer (Waterhouse *et al.*, 1994; AFLW, 1989). Willows, shrubs, conifers (particularly Douglas fir), and aspen browse predominant their diet through fall and winter (Geist 1981, Waterhouse *et al.*, 1994). Mule deer will also forage on agricultural crops.

Table 2.4-35 Seasonal Habitat Detection Frequencies of Mule Deer in the Wildlife Local Study Area – 2013 - 2015

Habitat Type	No. of Cameras	Camera Days	Season				Total
			Winter	Spring	Summer	Fall	
Open Mixedwood	2	352	0.28	0.28	-	-	**0.57**
Moderate Mixed Coniferous	6	2,297	0.57	-	1.70	1.87	**4.14**
Closed Mixedwood	5	2,380	1.05	0.71	2.73	0.63	**5.13**
Closed Spruce	1	581	0.17	-	1.55	0.69	**2.41**
Grassland	2	813	1.97	1.11	2.83	1.11	**7.01**
Rock/Barren	1	173	-	-	-	-	**-**
Anthropogenic Disturbance	4	1,163	0.60	-	1.81	0.09	**2.49**
Outside WLSA	4	1,925	0.42	0.10	0.52	0.62	**1.66**
Total	**25**	**9,684**	**0.73**	**0.30**	**1.72**	**0.87**	**3.62**

Mule deer often move into lower elevation habitats with better thermal cover in winter in response to both colder temperatures and increasing snow depth. For example, in southwestern Alberta and southeastern British Columbia, coniferous and Douglas fir forests and warm aspects on gentle slopes provide adequate thermal cover and minimal snow depth in winter (Berg, 1983, Bunnell, 1990, Geist 1981). In spring, mule deer move away from coniferous-dominated forests into treeless habitats and south-facing slopes where snowpack has been reduced and food is more accessible (AFLW, 1989). Mule deer in the WLSA appeared to favour grassland habitat in the winter; however, were also frequently detected in closed mixedwood forest habitat in the WLSA in winter. Closed mixedwood forest is expected to provide adequate thermal cover and forage for mule deer in the WLSA.

Where mule deer and white-tailed deer are sympatric in southwestern Alberta, mule deer are more likely to be found in subalpine and alpine habitats during the snow-free period, while white-tailed deer rarely use these natural subregions in favour of lower elevation montane habitats (AFLW, 1989). Mule deer migrate an average of 2 to 5 km in fall and early winter downslope from high elevation habitats to lower elevation habitats, particularly in mountainous areas with high snowfall (McNay and Doyle, 1987; AFLW 1989). Typical predators of mule deer include coyotes, wolves, cougars, lynx and golden eagles.

2.4.3.3.4.1.2 White-tailed Deer

White-tailed deer are a "Secure" species that occurs throughout most of Alberta. They appear to be expanding their range in the province west into the foothills and mountains, and north into the boreal region.

White-tailed deer were recorded at 17 of the 25 cameras in the WLSA, but were most frequently detected at cameras GM15 and GM07 (Table 2.4-34, Figure 2.4-24). Camera GM07 is located just outside of the defined WLSA, while GM15 is located within the WLSA in closed mixedwood forest. White-tailed deer were also detected in moderate mixed coniferous, closed spruce, open mixedwood, and grassland habitats throughout the WLSA.

White-tailed deer were detected in the WLSA during all four seasons (Table 2.4-36). During winter, white-tailed deer were most frequently detected in the WLSA in closed and open mixedwood forests. During the summer and fall, they were most frequently detected in closed mixedwood and closed spruce forests. Detection frequencies were lowest across the entire WLSA during spring.

Table 2.4-36 Seasonal Habitat Detection Frequencies of White-tailed Deer in the Wildlife Local Study Area – 2013 - 2015

Habitat Type	No of Cameras	Camera Days	Season				Total
			Winter	Spring	Summer	Fall	
Open Mixedwood	2	352	1.42	0.57	-	-	**1.99**
Moderate Mixed Coniferous	6	2,297	-	-	0.13	-	**0.13**
Closed Mixedwood	5	2,380	1.47	0.13	0.63	1.13	**3.36**
Closed Spruce	1	581	0.86	-	1.20	0.52	**2.58**
Grassland	2	813	-	0.12	0.12	-	**0.25**
Rock/Barren	1	173	-	-	-	-	**-**
Anthropogenic Disturbance	4	1,163	0.09	0.09	0.17	0.17	**0.52**
Outside WLSA	4	1,925	0.10	-	2.81	1.87	**4.78**
Total	**25**	***9,684***	**0.50**	**0.07**	**0.85**	**0.70**	**2.12**

White-tailed deer appear to prefer open and closed mixedwood habitats for overwintering in the WLSA (Table 2.4-36, Photo 2.4-23). During mild winters, white-tailed deer generally prefer open shrubland or aspen-dominated deciduous stands, but they move into denser forests with more thermal cover in winters with deeper snowpack (Wishart, 1984). White-tailed deer will migrate to separate summer-fall and winter ranges, particularly at northern latitudes and in mountainous areas

(Sabine *et al.*, 2002; Stewart *et al.*, 2011 and references therein). Migratory individuals often use transitional ranges in spring and fall as they move between summer and winter ranges. In northern areas, white-tailed deer move to overwintering ranges in response to cold temperatures and snowfall, and return to summer ranges as forage becomes available (Sabine *et al.*, 2002; Stewart *et al.*, 2011). Average migration distance has been reported at approximately 16 to 20 km, but can be regionally dependent (Stewart *et al.*, 2011; Sabine *et al.*, 2002; Grovenburg *et al.*, 2009).

Photo 2.4-23 White-tailed deer doe and fawn in a cutblock at camera GM05 outside of the WLSA, September 9, 2014.

2.4.3.3.4.1.3 Moose

Moose are a "Secure" species that is distributed throughout the forested regions of Alberta (Pattie and Fisher, 1999). Moose use a variety of habitats, but are most closely associated with shrubby wetlands, riparian areas, open conifer wetlands, and deciduous forest stands that provide ample browse during various times of the year (Hauge and Keith, 1981; Osko *et al.*, 2004). Moose are a species of management concern because of their recreational hunting value and were identified to be traditionally used by the Treaty 7 First Nations (Kainai Nation 2015, Piikani Nation 2015, Tsuut'ina Nation 2015).

During the wildlife camera program, moose were detected at 18 of the 25 cameras (Table 2.4-34; Figure 2.4-25). Moose were most frequently detected at cameras GM22 and GM06 that were located along an anthropogenic disturbance and in closed mixedwood forest, respectively. Incidental

observations of moose were also recorded in moderate mixed coniferous forest and along an anthropogenic disturbance in the WLSA (Figure 2.4-4).

Moose are present in the WLSA throughout the year, but were most frequently detected in summer and least frequently detected in spring (Table 2.4-37). Moose were most frequently detected within anthropogenic disturbances, such as transmission lines and pipelines, which they appear to be using as movement corridors through the WLSA (Photo 2.4-24).

Table 2.4-37 Seasonal Habitat Detection Frequencies of Moose in the Wildlife Local Study Area – 2013 - 2015

Habitat Type	No. of Cameras	Camera Days	Season				Total
			Winter	Spring	Summer	Fall	
Open Mixedwood	2	352	-	-	-	-	**-**
Moderate Mixed Coniferous	6	2,297	0.13	-	0.48	0.52	**1.13**
Closed Mixedwood	5	2,380	0.38	0.17	0.88	0.21	**1.64**
Closed Spruce	1	581	-	0.34	-	0.17	**0.52**
Grassland	2	813	0.12	0.49	0.37	-	**0.98**
Rock/Barren	1	173	-	-	-	-	**-**
Anthropogenic Disturbance	4	1,163	1.29	0.26	0.60	0.17	**2.32**
Outside WLSA	4	1,925	0.73	0.36	0.62	0.78	**2.49**
Total	**25**	**9,684**	**0.43**	**0.21**	**0.56**	**0.36**	**1.56**

In winter, moose generally prefer mixedwood stands (Visscher *et al.* 2006), which is consistent with data collected during the wildlife camera program. Moose were more frequently detected in closed mixedwood forest than in any other undisturbed habitat (Table 2.4-37). The energetic benefits of foraging in different habitats may change throughout the year for moose; however, mixedwood and shrubland habitats on average consistently contain the most forage (Visscher *et al.*, 2006). Under some circumstances (*i.e.* high predation stress), moose may preferentially select habitats that provide suitable cover over habitats with abundant forage (Dussault *et al.*, 2005).

Photo 2.4-24 A moose walking along a transmission line at camera GM14 in the WLSA, February 3, 2014.

2.4.3.3.4.1.4 Elk

Elk is a "Secure" species in Alberta, occurring throughout the mountain and foothills regions, as well as the western boreal forest and several isolated pockets in the parkland and prairie regions (Pattie and Fisher, 1999). Based on the wildlife camera program, elk was the least frequently detected ungulate species in the WLSA (Table 2.4-34, Figure 2.4-26). They were also the least common detected ungulate species in the WLSA during the winter period (Table 2.4-38). Like mule deer and white-tailed deer, elk migrate from higher elevation summer ranges to lower elevation winter ranges as a behavioural strategy to avoid deep snow. Deep snow can impede both movement and access to forage. While there appears to be some suitable higher elevation habitats for elk in the WLSA, it is unclear where elk are wintering in the general region.

Elk prefer to graze on graminoids and forbs and display a strong selection for graminoid-dominated habitats throughout the year (Christianson and Creel, 2007); however, their diet appears to be closely related to the relative abundance of available foods, particularly in winter (Christianson and Creel, 2007). While not preferred, elk will also browse on woody plants such as shrubs and aspen in fall and winter when graminoids are less readily available (Hebblewhite *et al.* 2008). Unlike elk, mule deer, white-tailed deer, and moose all incorporate higher proportions of browse into their diets (Claar, 1973; Kufeld, 1973; Kasworm *et al.*, 1984), which likely allows them to utilize browse-

producing habitats in the WLSA during winter. In spring, summer, and fall, elk were most frequently detected in grassland and moderate mixed coniferous forest habitats in the WLSA (Photo 2.4-25). Overall, elk were most frequently detected in grassland habitat that is consistent with their reported preference for graminoid-dominant habitats.

Table 2.4-38 Seasonal Habitat Detection Frequencies of Elk in the Wildlife Local Study Area – 2013 - 2015

Species	No. of Cameras	Camera Days	Season				Total
			Winter	Spring	Summer	Fall	
Open Mixedwood	2	352	-	0.28	-	-	**0.28**
Moderate Mixed Coniferous	6	2,297	-	-	1.74	0.35	**2.09**
Closed Mixedwood	5	2,380	0.04	0.25	0.63	0.04	**0.97**
Closed Spruce	1	581	-	0.17	0.34	-	**0.52**
Grassland	2	813	-	0.49	1.60	0.25	**2.34**
Rock/Barren	1	173	-	-	-	-	**-**
Anthropogenic Disturbance	4	1,163	-	0.09	0.09	-	**0.17**
Outside WLSA	4	1,925	0.05	-	1.04	0.31	**1.40**
Total	**25**	**9,684**	**0.02**	**0.13**	**0.94**	**0.18**	**1.27**

Photo 2.4-25 A female elk and calf at Camera GM08 in the WLSA, July 14, 2014.

2.4.3.3.4.1.5 Bighorn Sheep and Mountain Goats

Neither bighorn sheep nor mountain goats were detected in the WLSA during the wildlife camera program; however, both species are reported to occur in southwestern Alberta. Bighorn sheep are frequently seen (close to the WLSA) near Highway 3 in Blairmore (Lee, 2007).

A mountain goat survey was conducted in WMU 402 (Figure 2.2-2) during 2010 when 120 adults, 15 kids, and 13 yearlings were located (Jokinen and Hale, 2012). Of these 148 goat locations, 58 (39.2%; 45 adults, four yearlings, and nine kids) were observed on Crowsnest Mountain, which is located approximately 10 km northwest of the WLSA. The Livingstone Range, which is located about 6 east of the WLSA, was not included in the 2010 survey, but the area typically contains about 12 goats (Jokinen and Hale, 2012).

2.4.3.3.4.2 2015 – 2016 Results

The same four ungulate species (mule deer, white-tailed deer, elk, moose) detected in the 2013-2015 survey period were also observed during the 2015 – 2016 period. These four species have been confirmed to occur in the WLSA through various field surveys, including the wildlife camera trap program (Tables 2.4-39), winter track survey (Table 2.4-40), and pellet survey (Table 2.4-41).

All four ungulate species were observed during the wildlife camera program from April 2015 to June 2016 (Table 2.4-39). Moose and deer were detected during the winter track surveys in March 2016, and moose, deer and elk were detected during the pellet group surveys in May 2016. Moose and elk were also detected incidentally during other wildlife surveys conducted in the WLSA (Figure 2.4-4).

Detection frequencies of all four ungulate species at the wildlife cameras were higher in the 2015-2016 camera monitoring period than they were in the 2013-2015 period. A number of other deer were recorded at some of the camera locations; however, due to picture quality, these specific observations did not allow accurate identification to the species level and these detections were grouped (deer spp.) for the analysis. Similarly, mule deer and white-tailed deer tracks and pellets are difficult to distinguish in the field and these samples were grouped (deer spp.) for the analysis.

Table 2.4-39 Detection Frequencies of Ungulates by Camera and Habitat in the Wildlife Local Study Area – 2015 – 2016

Camera No.	Habitat Type	Camera Days	Deer spp.	Elk	Moose	Mule Deer	White-tailed Deer	Total
GM01	Outside WLSA	337	-	1.19	3.26	4.75	9.79	**18.99**
GM02	Moderate Mixed Coniferous	395	-	-	0.51	5.82	-	**6.33**
GM03	Moderate Mixed Coniferous	297	-	2.02	4.04	6.73	-	**12.79**
GM04	Moderate Mixed Coniferous	223	-	-	0.45	6.28	0.45	**7.17**
GM05	Outside WLSA	217	-	8.29	5.07	0.92	8.29	**22.58**
GM06	Closed Mixedwood	338	-	-	2.37	8.88	2.96	**14.20**
GM07	Outside WLSA	338	-	1.78	1.78	0.89	17.46	**21.89**
GM08	Moderate Mixed Coniferous	388	-	1.29	0.52	4.90	0.26	**6.96**
GM09	Moderate Mixed Coniferous	295	-	2.71	-	20.68	-	**23.39**
GM10	Closed Mixedwood	339	-	-	1.18	2.36	2.95	**6.49**
GM11	Closed Mixedwood	84	-	1.19	13.10	44.05	22.62	**80.95**
GM12	Closed Spruce	339	0.59	-	-	7.96	8.55	**17.11**
GM13	Grassland	354	0.28	6.78	1.98	14.97	2.26	**26.27**
GM14	Anthropogenic Disturbance	352	-	-	0.57	-	0.85	**1.42**
GM15	Closed Mixedwood	123	0.81	21.95	2.44	13.01	18.70	**56.91**
GM16	Outside WLSA	262	0.38	12.60	0.38	6.87	6.11	**26.34**
GM17	Open Mixedwood	287	-	5.57	0.70	2.09	14.98	**23.34**
GM18	Closed Mixedwood	352	-	-	2.27	0.57	0.57	**3.41**
GM19	Open Mixedwood	353	-	1.42	2.27	7.65	7.93	**19.26**
GM20	Grassland	296	-	7.43	0.68	2.36	0.68	**11.15**
GM21	Moderate Mixed Coniferous	337	-	4.15	3.56	1.48	1.48	**10.68**
GM22	Anthropogenic Disturbance	281	-	1.78	5.69	17.08	1.07	**25.62**

Table 2.4-39 Detection Frequencies of Ungulates by Camera and Habitat in the Wildlife Local Study Area – 2015 – 2016

Camera No.	Habitat Type	Camera Days	Deer spp.	Elk	Moose	Mule Deer	White-tailed Deer	Total
GM23	Anthropogenic Disturbance	338	-	2.37	8.58	11.54	0.89	**23.37**
GM24	Rock Barren	338	-	-	-	-	-	**0.00**
GM25	Anthropogenic Disturbance	354	-	7.06	-	25.71	0.28	**33.05**
GC01	Open Pine	51	-	7.84	-	-	7.84	**15.69**
GC02	Open Deciduous	51	-	3.92	-	-	5.88	**9.80**
Total		**7,719**	0.06	3.02	2.05	7.41	4.20	**16.74**

Table 2.4-40 Late Winter Track Frequencies of Ungulates in the Wildlife Local Study Area – 2015 – 2016

Habitat Type	Total Survey Length (km)	Track Frequency (tracks/km-day)	
		Moose	Deer spp.
Anthropogenic Disturbance	3.61		
Closed Mixed Coniferous	1.19		
Closed Mixedwood	6.43		0.08
Closed Spruce	0.78		
Grassland	2.97		
Moderate Mixed Coniferous	10.72	0.09	
Open Mixedwood	0.63		
Open Pine	0.18		
Rock Barren	0.16		

Table 2.4-40 Late Winter Track Frequencies of Ungulates in the Wildlife Local Study Area – 2015 – 2016			
Habitat Type	**Total Survey Length (km)**	**Track Frequency (tracks/km-day)**	
		Moose	**Deer spp.**
Treed Wetland	0.28		
Total/Average	**26.95**	**0.09**	**0.08**

Table 2.4-41 Ungulate Pellet Densities in the Wildlife Study Area – 2015 – 2016				
Habitat Type	**Area Sampled (ha)**	**Pellet Density (pellets/ha)**		
		Moose	**Deer spp.**	**Elk**
Closed Deciduous	0.11	44.2	44.2	17.7
Closed Mixed Coniferous	0.34	8.8	167.8	8.8
Closed Mixedwood	0.57	5.3	183.7	17.7
Closed Spruce	0.23	4.4	35.3	0.0
Grassland	0.34	23.6	58.9	5.9
Moderate Mixed Coniferous	0.91	43.1	25.4	23.2
Open Mixed Coniferous	0.23	13.3	220.8	0.0
Open Mixedwood	0.34	0.0	182.6	11.8
Open Pine	0.34	2.9	188.5	0.0
Total	**3.40**	**18.6**	**115.7**	**12.4**

2.4.3.3.4.2.1 Mule deer

Mule deer were detected at 23 of the 27 cameras during the 2015-2016 monitoring period. In the WLSA, mule deer were frequently detected at cameras GM25 and GM22 (along an anthropogenic disturbance), GM11 and GM15 (closed mixedwood), GM13 (grassland), and GM09 (moderate mixedwood) (Table 2.4-42, Figure 2.4-27).

Mule deer were predominantly detected in summer and were least frequently detected in winter (Table 2.4-42). During spring, mule deer were most frequently detected in grasslands, but they

shifted to closed spruce, moderate mixed coniferous and anthropogenic disturbances in summer and fall, and subsequently to grasslands in winter.

Table 2.4-42 Seasonal Habitat Detection Frequencies of Mule Deer in the Wildlife Local - 2015-2016

Habitat Type	No. of Cameras	Camera Days	Season				Total
			Winter	Spring	Summer	Fall	
Anthropogenic Disturbance	4	1,325	2.58	22.22	27.33	15.67	13.43
Closed Mixedwood	5	1,236	1.17	17.68	12.89	2.22	7.52
Closed Spruce	1	339	-	-	29.35	-	7.96
Grassland	2	650	4.58	79.41	6.88	5.33	9.23
Moderate Mixed Coniferous	6	1,935	0.77	2.13	16.24	10.92	7.34
Open Deciduous	1	51	-	-	-	-	-
Open Mixedwood	2	640	1.24	18.46	9.24	0.67	5.16
Open Pine	1	51	-	-	-	-	-
Outside WLSA	4	1,154	2.26	3.79	5.71	1.67	3.38
Rock Barren	1	338	-	-	-	-	-
Total	**27**	**7,719**	**1.72**	**11.62**	**14.14**	**6.69**	**7.41**

2.4.3.3.4.2.2 White-tailed Deer

White-tailed deer were recorded at 23 of the 27 cameras in the WLSA, but were most frequently detected at cameras GM11, GM15 and GM07 (Table 2.4-39, Figure 2.4-28). Cameras GM11 and GM15 are located in closed mixedwood forest, while GM07 is located just outside of the WLSA. White-tailed deer were also detected in moderate mixed coniferous, closed spruce, open mixedwood, grassland, open pine, open deciduous, and disturbed habitats throughout the WLSA.

White-tailed deer were detected in the WLSA during all four seasons, but were most frequently detected in spring (Table 2.4-43). White-tailed were most frequently detected in open mixedwood forest habitat in all seasons, except summer where they were most frequently detected in closed spruce. White-tailed deer were frequently detected outside the WLSA in summer and fall. Detection frequencies were comparatively low across all cameras during the winter (Table 2.4-43).

Table 2.4-43 Seasonal Habitat Detection Frequencies of White-tailed Deer in the Wildlife Local Study Area – 2015 – 2016

Habitat Type	No. of Cameras	Camera Days	Season				Total
			Winter	Spring	Summer	Fall	
Anthropogenic Disturbance	4	1,325	0.52	-	1.16	1.00	0.75
Closed Mixedwood	5	1,236	1.40	7.32	10.26	1.33	5.18
Closed Spruce	1	339	2.17	-	22.83	6.67	8.55
Grassland	2	650	-	11.76	3.13	0.67	1.54
Moderate Mixed Coniferous	6	1,935	-	-	1.39	-	0.36
Open Deciduous	1	51	-	5.88	-	-	5.88
Open Mixedwood	2	640	5.81	15.38	18.48	8.67	11.09
Open Pine	1	51	-	7.84	-	-	7.84
Outside WLSA	4	1,154	0.56	1.52	17.66	19.00	10.92
Rock Barren	1	338	-	-	-	-	-
Total	**27**	**7,719**	**0.94**	**4.11**	**8.27**	**4.73**	**4.20**

2.4.3.3.4.2.3 Deer spp.

Deer pellets could not be identified to species in the field during the pellet survey. Mule and white-tailed deer (deer spp.) pellet groups had the highest density in the WLSA amongst all ungulates. Deer spp. pellet groups were detected in all of the nine habitats sampled during the pellet count survey, with the highest densities occurring in open mixed coniferous habitat, open pine, open mixedwood, and closed mixed coniferous and the lowest density occurring in moderate mixed coniferous habitat (Table 2.4-41, Figure 2.4-29).

Deer spp. were detected in closed mixedwood forest habitat only during the winter track survey (Table 2.4-40, Figure 2.4-16).

2.4.3.3.4.2.4 Moose

During the wildlife camera program, moose were detected at 21 of the 27 cameras (Table 2.4-39; Figure 2.4-30). Moose were the least frequently detected ungulate species in the WLSA during the

2016-2016 monitoring period. Moose were most frequently detected at cameras GM11 and GM23 that were located, respectively, in closed mixedwood habitat and along an anthropogenic disturbance.

Moose were present in the WLSA throughout the year, but were most frequently detected in summer and least frequently detected in winter (Table 2.4-44). Moose were most frequently detected within anthropogenic disturbances, such as transmission lines and pipelines, which they appear to be using as movement corridors through the WLSA. They were also frequently detected in closed mixedwood forest. During the winter, moose were detected most frequently outside of the WLSA, and in summer and fall they were most frequent in disturbed habitat.

Table 2.4-44 Seasonal Habitat Detection Frequencies of Moose in the Wildlife Local Study Area - 2015-2016

Habitat Type	No. of Cameras	Camera Days	Season				Total
			Winter	Spring	Summer	Fall	
Anthropogenic Disturbance	4	1,325	1.03	-	6.98	5.67	3.55
Closed Mixedwood	5	1,236	1.17	3.66	4.77	1.33	2.75
Closed Spruce	1	339	-	-	-	-	-
Grassland	2	650	-	20.59	0.63	0.67	1.38
Moderate Mixed Coniferous	6	1,935	0.38	0.53	2.38	2.84	1.50
Open Deciduous	1	51	-	-	-	-	-
Open Mixedwood	2	640	0.41	4.62	2.72	0.67	1.56
Open Pine	1	51	-	-	-	-	-
Outside WLSA	4	1,154	1.98	1.52	3.80	2.00	2.51
Rock Barren	1	338	-	-	-	-	-
Total	**27**	**7,719**	**0.74**	**2.23**	**3.51**	**2.37**	**2.05**

Moose were detected in eight of the nine habitats sampled in the WLSA during the pellet survey (Table 2.4-41, Figure 2.4-31). The only habitat moose were not found in was open mixedwood. Moose pellet groups occurred at the highest density in closed deciduous and moderate mixed coniferous habitats, followed by grassland and open mixed coniferous forest. Moose pellet groups had the second highest density amongst the ungulate species found in the WLSA during the pellet

count survey. Moose were also detected in moderate mixed coniferous forest habitat during the winter track survey (Table 2.4-40, Figure 2.4-16).

Moose pellets were detected incidentally at two locations and a female moose was seen crossing a road in the WLSA (Figure 2.4-4).

2.4.3.3.4.2.5 Elk

Elk were detected at 19 of the 27 (70%) cameras and seven of the nine sampled habitats in the WLSA during the 2015-2016 camera monitoring period (Tables 2.4-39 and 2.4-45, Figure 2.4-32). Elk were most frequently detected in grassland habitats throughout all seasons in the WLSA, and were never detected in closed spruce and rock barren habitats. Elk were also common in other open habitats, such as open pine and open mixedwood. Elk were the least frequently detected ungulate species in the WLSA during the winter period in both camera monitoring periods (Tables 2.4-38 and 2.4-45). During the 2015-2016 monitoring period, no elk were detected during the winter months. Elk do not appear to overwinter in the WLSA and likely migrate out of the WLSA to their overwintering grounds; however, it is unclear where elk are overwintering in the region.

Table 2.4-45 Seasonal Habitat Detection Frequencies of Elk in the Wildlife Local Study Area – 2015 – 2016

Species	No. of Cameras	Camera Days	Season				Total
			Winter	Spring	Summer	Fall	
Anthropogenic Disturbance	4	1,325	-	5.05	7.56	2.33	2.87
Closed Mixedwood	5	1,236	-	1.83	5.97	-	2.27
Closed Spruce	1	339	-	-	-	-	-
Grassland	2	650	-	44.12	13.75	6.00	7.08
Moderate Mixed Coniferous	6	1,935	-	0.53	4.75	1.75	1.71
Open Deciduous	1	51	-	3.92	-	-	3.92
Open Mixedwood	2	640	-	9.23	8.15	-	3.28
Open Pine	1	51	-	7.84	-	-	7.84
Outside WLSA	4	1,154	-	13.64	11.68	-	5.29
Rock Barren	1	338	-	-	-	-	-
Total	**27**	**7,719**	**-**	**6.34**	**7.16**	**1.38**	**3.02**

The pellet count data and winter track data corroborated the wildlife camera findings that indicated elk were the least frequent ungulate species occurring in the WLSA. Elk pellet groups were detected

at a density of 12.4 pellet groups/ha versus 115.7 pellet groups/ha for deer spp. and 18.6 pellet groups/ha for moose (Table 2.4-41, Figure 2.4-33). Elk were not detected during the winter track survey. Elk pellet groups were densest in moderate mixed coniferous forest, as well as closed deciduous and closed mixedwood forest habitats. Elk pellets were not detected in open mixed coniferous and open pine habitats. Four elk were incidentally observed foraging along a transmission line, and elk pellets and tracks were incidentally detected at two locations in the WLSA.

2.4.3.3.4.2.6 Bighorn Sheep and Mountain Goats

No bighorn sheep or mountain goats were detected in the WLSA during the wildlife camera program, pellet survey, and winter track survey, or incidentally, between April 2015 and June 2016.

2.4.3.4 Human Activity

2.4.3.4.1 2013 – 2015 Results

Human activity was detected throughout the WLSA during the wildlife camera program (Table 2.4-46, Figure 2.4-34). Human activity in the WLSA was mostly associated with all-terrain vehicles (ATVs) and foot traffic (*e.g.* walking, hiking). Foot traffic was most frequent at camera GM15, followed by GM12 and GM08. Camera GM15 was deployed along a well-used wildlife/cattle trail in closed mixedwood forest habitat that also appeared to be used as a popular hiking route, particularly for individuals walking their dogs. Camera GM12 was situated near Gold Creek in the southeast corner of the WLSA and likely received a lot of foot traffic because of its proximity to local landowners in this portion the WLSA. GM08 was located at the intersection of two narrow ATV trails at the top of Grassy Mountain and was also well used by hikers.

Table 2.4-46 Detection Frequencies of Human Use and Activity Type by Camera in the Wildlife Local Study Area – 2013 - 2015

Camera No.	Camera Days	Foot Traffic	Horse	ATV	Snowmobile	Truck	Heavy Machinery	Total
GM01	583	0.69	0.34	0.69	10.98	-	-	**12.69**
GM02	583	-	-	-	-	-	-	**-**
GM03	639	-	-	-	0.31	-	-	**0.31**
GM04	506	-	-	-	-	-	-	**-**
GM05	583	-	-	-	-	-	-	**-**
GM06	581	1.55	1.89	41.31	1.72	0.86	-	**47.33**

Table 2.4-46 Detection Frequencies of Human Use and Activity Type by Camera in the Wildlife Local Study Area – 2013 - 2015

Camera No.	Camera Days	Foot Traffic	Horse	ATV	Snowmobile	Truck	Heavy Machinery	Total
GM07	582	0.52	-	-	-	-	-	**0.52**
GM08	221	2.26	-	56.11	-	0.45	-	**58.82**
GM09	173	-	-	0.58	-	-	-	**0.58**
GM10	581	-	-	-	-	-	-	**-**
GM11	548	0.36	3.83	4.01	-	-	-	**8.21**
GM12	581	4.48	-	0.34	-	-	-	**4.82**
GM13	581	-	-	-	-	-	-	**-**
GM14	583	0.17	-	0.34	-	0.17	0.34	**1.03**
GM15	493	16.84	0.2	0.81	-	-	-	**17.85**
GM16	177	-	-	-	-	-	-	**-**
GM17	177	1.69	-	-	-	-	-	**1.69**
GM18	177	-	-	-	-	-	-	**-**
GM19	175	0.57	-	0.57	-	-	-	**1.14**
GM20	232	1.72	-	-	-	-	-	**1.72**
GM21	175	1.71	-	-	1.71	-	-	**3.43**
GM22	232	-	-	3.88	0.43	0.86	-	**5.17**
GM23	175	-	-	-	-	-	-	**-**
GM24	173	-	-	-	-	-	-	**-**
GM25	173	-	-	-	-	-	-	**-**
Total	**9,684**	**1.49**	**0.36**	**4.22**	**0.83**	**0.09**	**0.02**	**7.01**

In addition to foot traffic, the WLSA was accessed by horseback, ATV, and snowmobile. Horseback riding activity was most frequently detected at cameras GM11 and GM06 (Table 2.4-46, Figure 2.4-34). Camera GM11 was located along a wildlife/cattle trail in closed mixedwood forest, while camera GM06 was located near Blairmore Creek. ATVs and snowmobiles are popular recreational vehicles that are used extensively to access the Crowsnest Pass region. The WLSA contains many ATV trails and linear disturbances that facilitate access to a broader network of trails in the region. One of the

more popular ATV trails in the WLSA (the 'Grassy Mountain Loop') follows Blairmore Creek, crossing it at several points. High detection frequencies at camera GM06 captured the use of this trail by quads, side-by-sides, and dirt bikes. The 'Grassy Mountain Loop' continues up the west side of Grassy Mountain from Blairmore Creek to the top of the mountain where camera GM08 is located. Camera GM08 had the highest detection frequency of ATVs during the wildlife camera program. The popular ATV trails in the WLSA were most frequently accessed in summer and fall (Table 2.4-47). During the winter, snowmobiles were frequently used to access portions of the WLSA, particularly, the pipeline ROW where camera GM01 was located (Figure 2.4-34). Areas around cameras GM06 and GM21 also incurred some snowmobile use during the winter season. Overall, human activity in the WLSA was highest in summer season and lowest in winter (Table 2.4-47). Hunting in the WLSA was also observed in the fall.

Despite Riversdale's ongoing Coal Exploration and Coal Quality programs from fall 2013 to summer 2015, the detection of heavy machinery and truck traffic in the WLSA was relatively low and is likely related to the low number of cameras (two) associated with roads and truck-accessible trails. The majority of activities associated with the geotechnical exploration investigations and coal quality programs occurred on existing trails and disturbed land, and did not involve coal mining activities, road building, or land clearing.

Table 2.4-47 Seasonal Detection Frequencies of Human Activity in the Wildlife Local Study Area – 2013 - 2015

Human Activity	Season				Total
	Winter	Spring	Summer	Fall	
Camera Days	*5,553*	*994*	*1,352*	*1,785*	***9,684***
Foot Traffic	1.19	0.70	1.63	2.75	**1.49**
Horseback	-	0.50	0.67	1.18	**0.36**
ATV	0.07	1.01	16.64	9.52	**4.22**
Snowmobile	1.44	-	-	-	**0.83**
Truck	-	0.10	0.44	0.11	**0.09**
Heavy Machinery	-	-	0.15	-	**0.02**
Total	**2.70**	**2.31**	**19.53**	**13.56**	**7.01**

2.4.3.4.2 June 2015 – June 2016

Human activity data were not included in the period of April 2015 – June 2016. Human presence was not anticipated to have changed from the 2013-2015 monitoring period and additional human use data would not have supplemented the wildlife baseline inventory.

2.4.3.5 Summary of Species Observed in WLSA

All wildlife species observed in the WLSA during the course of the field programs are listed in Table 2.4-48. Species include six amphibians, 87 birds, and 28 mammals.

Table 2.4-48 Wildlife Species Detected in the Wildlife Local Study Area with Applicable Conservation Status

Species	Provincial Status		Federal Designation	
	General	Legislated	COSEWIC	SARA
Amphibians (n=6)				
Boreal chorus frog	Secure	-	-	
Western toad	Sensitive	-	Special Concern	
Columbia spotted frog	Sensitive	-	Not at Risk	
Long-toed salamander	Sensitive	Special Concern	Not at Risk	
Western tiger salamander[1]	Secure	-	Special Concern	
Wood frog	Secure	-	-	
Birds (n=87)				
Songbirds, Corvids and Woodpeckers (n=71)				
Alder flycatcher	Secure	-	-	-
American crow[2]	Secure	-	-	-
American pipit	Secure	-	-	-
American robin	Secure	-	-	-
American three-toed woodpecker	Secure	-	-	-
American tree sparrow	Secure	-	-	-
Baird's sparrow	Sensitive	-	Special Concern	-
Barn swallow	Sensitive	-	Threatened	-
Black-backed woodpecker	Sensitive	-	-	-

Table 2.4-48 Wildlife Species Detected in the Wildlife Local Study Area with Applicable Conservation Status

Species	Provincial Status		Federal Designation	
	General	Legislated	COSEWIC	SARA
Black-billed magpie[2]	Secure	-	-	-
Black-capped chickadee	Secure	-	-	-
Blue jay[2]	Secure	-	-	-
Bohemian waxwing	Secure	-	-	-
Brown-headed cowbird[2]	Secure	-	-	-
Cassin's vireo	Undetermined	-	-	-
Cedar waxwing	Secure	-	-	-
Chipping sparrow	Secure	-	-	-
Clark's nutcracker[2]	Sensitive	-	-	-
Clay-coloured sparrow	Secure	-	-	-
Common nighthawk	Sensitive	-	Threatened	Schedule 1
Common raven[2]	Secure	-	-	-
Common yellowthroat	Sensitive	-	-	-
Dark-eyed junco	Secure	-	-	-
Dusky flycatcher	Secure	-	-	-
Eastern kingbird	Secure	-	-	-
Fox sparrow	Secure	-	-	-
Golden-crowned kinglet	Secure	-	-	-
Golden-crowned sparrow	Secure	-	-	-
Grasshopper sparrow	Sensitive	-	-	-
Hermit thrush	Secure	-	-	-
House finch	Secure	-	-	-
House sparrow[2]	Exotic	-	-	-
House wren	Secure	-	-	-
Least flycatcher	Sensitive	-	-	-

Table 2.4-48 Wildlife Species Detected in the Wildlife Local Study Area with Applicable Conservation Status

Species	Provincial Status		Federal Designation	
	General	Legislated	COSEWIC	SARA
Lincoln's sparrow	Secure	-	-	-
MacGillivray's warbler	Secure	-	-	-
Magnolia warbler	Secure	-	-	-
Marsh wren	Secure	-	-	-
Mountain bluebird	Secure	-	-	-
Mountain chickadee	Secure	-	-	-
Nashville warbler	Secure	-	-	-
Northern flicker	Secure	-	-	-
Northern waterthrush	Secure	-	-	-
Olive-sided flycatcher	May Be At Risk	-	Threatened	Schedule 1
Orange-crowned warbler	Secure	-	-	-
Pacific slope flycatcher	Undetermined	-	-	-
Pacific wren	Secure	-	-	-
Pine grosbeak	Secure	-	-	-
Purple finch	Secure	-	-	-
Red-breasted nuthatch	Secure	-	-	-
Red-naped sapsucker	Undetermined	-	-	-
Red-winged blackbird[2]	Secure	-	-	-
Ruby-crowned kinglet	Secure	-	-	-
Steller's jay[2]	Secure	-	-	-
Swainson's thrush	Secure	-	-	-
Townsend's solitaire	Secure	-	-	-
Townsend's warbler	Secure	-	-	-
Tree swallow	Secure	-	-	-
Varied thrush	Secure	-	-	-

Table 2.4-48 Wildlife Species Detected in the Wildlife Local Study Area with Applicable Conservation Status

Species	Provincial Status		Federal Designation	
	General	Legislated	COSEWIC	SARA
Veery	Secure	-	-	-
Vesper sparrow	Secure	-	-	-
Warbling vireo	Secure	-	-	-
Western bluebird	Secure	-	-	-
Western kingbird	Secure	-	-	-
Western wood-pewee	Sensitive	-	-	-
White-breasted nuthatch	Secure	-	-	-
White-crowned sparrow	Secure	-	-	-
White-throated sparrow	Secure	-	-	-
Wilson's warbler	Secure	-	-	-
Yellow warbler	Secure	-	-	-
Yellow-rumped warbler	Secure	-	-	-
Galliformes (Grouse, Turkey) (n=4)				
Blue grouse[2]	Secure	-	-	-
Ruffed grouse[2]	Secure	-	-	-
Spruce grouse[2]	Secure	-	-	-
Wild turkey[2]	Exotic	-	-	-
Waterbirds (n=5)				
Barrow's goldeneye	Secure	-	-	-
Bufflehead	Secure	-	-	-
Ring-necked duck	Secure	-	-	-
Sora	Sensitive	-	-	-
Spotted sandpiper	Secure	-	-	-
Raptors (n=7)				
American kestrel[2]	Sensitive	-	-	-

Table 2.4-48 Wildlife Species Detected in the Wildlife Local Study Area with Applicable Conservation Status

Species	Provincial Status		Federal Designation	
	General	Legislated	COSEWIC	SARA
Bald eagle[2]	Sensitive	-	Not At Risk	-
Barred owl[2]	Sensitive	Special Concern	-	-
Golden eagle[2]	Sensitive	-	Not At Risk	-
Great gray owl[2]	Sensitive	-	-	-
Great horned owl[2]	Secure	-	-	-
Red-tailed hawk[2]	Secure	-	-	-
Mammals (n=28)				
Rodents and Lagomorphs (n=6)				
American pika	**Secure**	**-**	**-**	**-**
Columbian ground squirrel	**Secure**	**-**	**-**	**-**
Golden-mantled ground squirrel	**Secure**	**-**	**-**	**-**
Red squirrel	**Secure**	**-**	**-**	**-**
Snowshoe hare	**Secure**	**-**	**-**	**-**
Yellow-pine chipmunk	**Secure**	**-**	**-**	**-**
Bats (n=6)				
Big brown bat	Secure	-	-	-
Hoary bat	Sensitive	-	-	-
Little brown myotis	Secure	-	Endangered	Schedule 1
Long-eared myotis	May Be At Risk	-	-	-
Long-legged bat	Undetermined	-	-	-
Silver-haired bat	Sensitive	-	-	-
Mustelids (n=4)				
American badger	Sensitive	Data Deficient	Special Concern	-
American marten	Secure	-	-	-
Least weasel	Secure	-	-	-

Table 2.4-48 Wildlife Species Detected in the Wildlife Local Study Area with Applicable Conservation Status

Species	Provincial Status		Federal Designation	
	General	Legislated	COSEWIC	SARA
Ermine	Secure	-	-	-
Carnivores (n=8)				
Black bear	Secure	-	-	-
Bobcat	Sensitive	-	-	-
Canada lynx	Sensitive	-	-	-
Cougar	Secure	-	-	-
Coyote	Secure	-	-	-
Grey wolf	Secure	-	-	-
Grizzly bear	At Risk	Threatened	Special Concern	-
Red fox	Secure	-	-	-
Ungulates (n=4)				
Elk	Secure	-	-	-
Moose	Secure	-	-	-
Mule deer	Secure	-	-	-
White-tailed deer	Secure	-	-	-

[1] Identification not confirmed

[2] Not protected under Migratory Birds Convention Act

2.4.4 Hunting and Trapping

As a part of the information review process, 6 years of harvest data were compiled from AEP's hunter harvest survey (AEP, 2015b). While harvest data cannot be used to determine species abundance because of the variability in annual harvest quotas, hunting effort, and variability in weather, the data can provide information on relative abundance of big game species in the WLSA and WRSA. Based on the data from AEP (2015a), white-tailed deer and elk had the highest harvest numbers of the five big game species (Table 2.4-49). Additionally, there are "general" seasons for elk and white-tailed deer in WMUs 303, 306, and 402 (AEP, 2015), indicating large and/or stable populations of these two species. Moose have been harvested at low numbers in these WMUs (10.9/year on average), suggesting that they occur in the WLSA and WRSA at a lower abundance than deer and elk. No

harvest data were available for bighorn sheep or mountain goats in these WMUs; however, for the 2015 hunting season, trophy sheep can be hunted by purchasing a general licence (AEP 2015).

Table 2.4-49 Summary of Big Game Harvest in Wildlife Management Units 303, 306 and 402

Species	2009	2010	2011	2012	2013	2014	Average
Moose	0	14	21	11	9	10	10.9
Elk	154	206	171	252	206	154	190.5
Black Bear	9	21	20	29	12	57	24.7
White-tailed Deer	205	200	224	284	255	286	242.3
Mule Deer	94	111	101	106	86	91	83.2
Total/Average	**462**	**552**	**537**	**682**	**568**	**598**	**566.5**

At the time of submission of this application, AEP had not provided requested trapping data that would allow for some assessment of fur-bearing species in the absence of winter tracking data. A winter tracking survey is planned for the Project during the winter of 2015/2016.

2.4.4.1 2016 Update

The harvest data were updated to include 2015 harvest information (Table 2.4-50). As planned, a winter tracking survey was completed in early 2016 (see Section 2.3.6).

Table 2.4-50 Summary of Big Game Harvest in Wildlife Management Units 303, 306 and 402

Species	2009	2010	2011	2012	2013	2014	2015	Average
Moose	0	14	21	11	9	10	17	11.7
Elk	154	206	171	252	206	154	129	181.7
Black Bear	9	21	20	29	12	57	27	25.0
White-tailed Deer	205	200	224	284	255	286	281	247.9
Mule Deer	94	111	101	106	86	91	102	98.7
Total/Average	**462**	**552**	**537**	**682**	**568**	**598**	**556**	**565**

2.4.5 Overland Conveyor Wildlife Use Survey

2.4.5.1 2013 – 2015 Results

The proposed alignment of the overland conveyor will create an approximately 5.4 km linear disturbance. This linear feature has the potential to affect local and regional movement patterns of large mammals (*e.g.* moose, deer, elk, black bear, grizzly bear, and cougar). Wildlife in the area will likely use the valley of Blairmore Creek as a north-south movement corridor; however, there is a need to ensure that wildlife can move across the landscape in an east-west direction as well.

On June 25, 2015, the entire length of the proposed overland conveyor was surveyed for signs of wildlife, particularly ungulate (deer, elk, and moose) trails, tracks, and areas of concentrated use. An additional objective of this survey was to identify east-west movement of wildlife along the conveyor route. In total, 28 areas of ungulate use were identified along the conveyor belt route (Figure 2.4-35). Determining species-specific use of any trails present along the conveyor route was not possible, except in cases where tracks were imprinted in the ground. Deer (both mule and white-tailed) were the only ungulate species for which tracks could be identified. Many of the ungulate trails on the west side of the coal conveyor commenced in the Blairmore Creek valley, moved east toward the proposed conveyor line and then fanned out in various directions upon crossing the current access road. Trails on the east side of the proposed coal conveyor tended to be north-south oriented.

Three wildlife cameras (GM11, GM15 and GM17) were also established within 100 m of the proposed overland conveyor route as part of the wildlife camera trapping program (Figure 2.3-8). These cameras captured seven large mammal species whose movements may be affected by the overland conveyor: black bear, cougar, gray wolf, elk, moose, mule deer, and white-tailed deer (Table 2.4-51). The majority (58%) of detections at these three cameras were of white-tailed deer and mule deer. Moose were the third most common ungulate species (4.4%) followed by elk (1.8%). Elk were only detected at camera GM15 moving in a north-south orientation, while white-tailed deer were detected at all three cameras. The large carnivores composed 13.7% of the total detections.

Table 2.4-51 Summary of Wildlife Camera Data Adjacent to the Proposed Overland Conveyor Route – 2013 – 2015

Species	CAMERA GM11		CAMERA GM15		CAMERA GM17		Total	
	Count	%	Count	%	Count	%	Count	%
Black Bear	6	4.8	2	2.1	0	-	8	3.5
Cougar	2	1.6	2	2.1	0	-	4	1.8

Table 2.4-51 Summary of Wildlife Camera Data Adjacent to the Proposed Overland Conveyor Route – 2013 – 2015

Species	CAMERA GM11		CAMERA GM15		CAMERA GM17		Total	
	Count	%	Count	%	Count	%	Count	%
Elk	0	-	4	4.2	0	-	4	1.8
Moose	7	5.6	3	3.2	0	-	10	4.4
Mule Deer	33	26.6	27	28.4	0	-	60	26.4
White-tailed Deer	20	16.1	50	52.6	3	37.5	73	32.2
Wolf	16	12.9	2	2.1	1	12.5	19	8.4
Total	**124**	**100.0**	**95**	**100.0**	**8**	**100.0**	**227**	100.0

2.4.5.2 2015 – 2016 Results

Twelve pellet/scat transects were established within 200 m of the proposed overland conveyor route as part of the broader pellet/scat count survey (Figure 2.3-10), resulting in a total sampled area of 0.68 ha over 1.8 km of transects. These twelve transects captured two large mammal species groups whose movements may be affected by the overland conveyor: deer spp. and moose (Table 2.4-52). Compared to deer spp. (123.6 pellet groups/ha), moose were relatively scarce (2.7 pellet groups/ha) in the area adjacent to the proposed conveyor.

Pellets of three small mammal species, whose movements are less likely to be affected by the overland conveyor due to their relatively small body size and home range size, were also detected on the pellet transects: snowshoe hare, red squirrel, and Columbian ground squirrel (Table 2.4-52). Pellets of grouse spp. and wild turkey were also detected, but movements of birds are not expected to be impeded by the conveyor.

Table 2.4-52 Pellet Densities Adjacent to the Proposed Overland Conveyor Route - 2016

Species	Density of Pellet Groups (pellet groups/ha)
Deer spp.	123.6
Moose	2.7
Snowshoe Hare	2.0

Table 2.4-52 Pellet Densities Adjacent to the Proposed Overland Conveyor Route - 2016	
Species	**Density of Pellet Groups (pellet groups/ha)**
Red Squirrel	14.3
Columbian Ground Squirrel	1.4
Grouse spp.	2.7
Wild Turkey	5.4

Wildlife detected by the three cameras (GM11, GM15 and GM17) near the conveyor location for the period of April 2015 to June 2016 are summarized in Table 2.4-53. These cameras captured eight large mammal species whose movements may be affected by the overland conveyor: black bear, cougar, coyote, elk, grizzly bear, moose, mule deer, and white-tailed deer. These cameras also detected red fox and wild turkey, whose movements are less likely to be affected by the overland conveyor due to their relatively small size, smaller home ranges and, in the case of turkeys, an ability to fly.

The majority (63.3%) of detections at these three cameras were of white-tailed deer and mule deer combined. Elk were the third most common ungulate (19.2%) followed by moose (7.0%). All four ungulate species were detected at all three cameras.

The large carnivores comprised 3.5% of the total detections. Black bears were the most common carnivore species (1.7%) at cameras adjacent to the proposed overland conveyor route.

Table 2.4-53 Summary of Wildlife Camera Data Adjacent to the Proposed Overland Conveyor Route – 2015 – 2016

Species	GM11		GM15		GM17		Total	
	Count	%	Count	%	Count	%	Count	%
Black Bear	3	3.8	-	-	1	1.3	4	1.7
Cougar	1	1.3	1	1.4	-	-	2	0.9
Coyote	1	1.3	-	-	-	-	1	0.4
Deer spp.	-	-	1	1.4	-	-	1	0.4
Elk	1	1.3	27	37.5	16	20.5	44	19.2
Grizzly Bear	-	-	1	1.4	-	-	1	0.4

Table 2.4-53 Summary of Wildlife Camera Data Adjacent to the Proposed Overland Conveyor Route – 2015 – 2016

Species	GM11		GM15		GM17		Total	
	Count	%	Count	%	Count	%	Count	%
Moose	11	13.9	3	4.2	2	2.6	16	7.0
Mule Deer	37	46.8	16	22.2	6	7.7	59	25.8
Red Fox	-	-	-	-	1	1.3	1	0.4
White-tailed Deer	19	24.1	23	31.9	43	55.1	85	37.1
Wild Turkey	6	7.6	-	-	9	11.5	15	6.6
Total	**79**	**100**	**72**	**100**	**78**	**100**	**229**	**100**

3.0 WILDLIFE ASSESSMENT

3.1 Key Wildlife Issues

Project development has the potential to interact with wildlife in different ways. The Project may alter wildlife habitat availability, habitat connectivity/movement, and wildlife mortality risk and health, all of which may affect the abundance of wildlife in the area (Table 3.1-1). Effects on habitat availability may be either direct (*e.g.* vegetation clearing) or indirect (*e.g.* avoidance of habitat because of sensory disturbance). Each of these issues will be examined for each VC chosen for the Project. Additionally, methods to mitigate any potential negative effects on wildlife will be discussed.

Table 3.1-1 Potential Interactions Between the Project and Wildlife

Project Activity or Component	Wildlife Issues			
	Habitat Availability	Habitat Fragmentation	Mortality Risk/Health	Abundance
Vegetation Clearing: • Loss of natural vegetation	✓	✓	✓	✓
Construction: • High levels of human activity • Sensory disturbance (noise/light)	✓	✓	✓	✓
Road and Utility Corridors: • Conveyor belt	✓	✓	✓	✓