APPENDIX H
WILDLIFE AND BIODIVERSITY

Attachment 11A HABITAT SUITABILITY MODELS

11A.1 INTRODUCTION

This appendix includes species accounts for five key indicator species as well as a description of the methods used to develop the habitat suitability models to support the assessment (see Section 11.2.2.4).

Habitat suitability models are used to assess potential direct (i.e., habitat loss) and indirect (i.e., sensory disturbance) effects on changes in habitat availability for five key indicators. Key indicators represent terrestrial (upland and lowland) and aquatic habitat types including two migratory birds, the olive-sided flycatcher (*Contopus cooperi*) and Sprague's pipit (*Anthus spragueii*), which are species dependent on forest and grassland habitat, respectively. Grizzly bear (*Ursus arctos*), and elk (*Cervus canadensis*) are representative large mammal species that occur in the local assessment area (LAA). The northern leopard frog (*Lithobates pipiens*) represents amphibians and wetland dependent species. A list of key indicator wildlife species and the rationale for their selection is provided in Section 11.1.2.

11A.1.1 Model Development

Habitat suitability models for key indicators are based on assessing the suitability of each habitat type (ecosite phase) to provide the necessary life requisites (e.g., food, cover) to meet seasonal habitat requirements. Vegetation and wetland mapping was completed for the LAA using grassland vegetation inventory (GVI) database and the Alberta Wetland Classification System (ESRD 2015). The map was refined using pre-field and field data collection. Ecosite phases were based on the Foothills Parkland Range Plant Community Guide (ESRD 2012a). For more information on the methods, see Volume 4 Vegetation and Wetlands Technical Data Report.

A four-class rating scheme rates habitat suitability for each habitat type and structural stage and reflects the expected use of each habitat type for each species: Class 1 = high habitat value; Class 2 = moderate habitat value; Class 3 = low habitat value; and Class 4 = very low to nil habitat value.

Habitat Effectiveness

Wildlife species might avoid or reduce their use of habitats adjacent to human development or activities. These potential indirect effects on habitat availability are estimated using species- and disturbance specific zones of influence (ZOI). Zones of influence are incorporated into habitat suitability models to account for indirect loss of habitat associated with sensory disturbance for specific types of anthropogenic development (e.g., roads, seismic lines and industrial footprints). Sensory disturbance includes changes in noise, temperature, light, and other visual stimuli that are perceived by the species. Typically, habitats closer to these disturbances have lower habitat effectiveness than comparable habitats located farther away. For example, chronic noise levels can lead to lower songbird density adjacent to the noise source (Habib et al. 2007; Bayne et al. 2008) and unexpected noises above 90 dB can elicit a flight response in mammals (Manci et al. 1988). For most ZOI, a disturbance modifier is applied to the habitat rating to reduce the overall suitability of habitat values. The magnitude of reduction (if any) and size of the ZOI depends on the type of anthropogenic development and the sensitivity of the key indicator to human disturbance, which are described in the species accounts discussed below.

Habitat Suitability Model Verification

Habitat suitability models are based on peer-reviewed and technical literature, as well as the professional judgement of wildlife biologists familiar with each species' ecology. Three of four steps recommended for model verification were completed including document review, internal calibration, and external review (Muir et al. 2011). Observational data collected during wildlife surveys are often not of sufficient quantity or spatial dispersion to meet the requirements of model validation (i.e., statistical comparison), especially for species at risk which occur at lower densities on the landscape. Depending on the species and survey methods, observations of species can also occur in habitat that is not preferred (i.e., animal is travelling from one suitable area to another).

Although there was very little species occurrence data available in the LAA to externally verify the habitat suitability models, the models provide a reasonable prediction of habitat suitability, based on current knowledge and peer-reviewed literature of each key indicator's ecology and seasonal habitat requirements. Overall, the habitat suitability maps provide a reasonable assessment of potential project effects in the LAA.

11A.2 SPECIES ACCOUNTS

Species accounts were prepared to support the habitat suitability models developed for key indicator species. The species account provides a summary of each key indicator's life requisites, ecology and key habitat requirements as well as limiting factors and rating assumptions used to produce the habitat suitability map. The species accounts were developed using the scientific literature and, where possible, included regional information related to wildlife use in prairie and foothill ecosystems including the eastern slopes of the Rocky Mountains.

11A.2.1 Olive-sided Flycatcher

Status

In Canada, olive-sided flycatcher is listed as *threatened* on Schedule 1 of the *Species at Risk Act* (SARA) (Environment Canada 2016) because of a widespread and consistent population decline over the past 30 years (COSEWIC 2007, Environment Canada 2016). Olive-sided flycatcher is not listed under the *Alberta Wildlife Act* (AWA) (Government of Alberta 2015) but has a general status of *may be at risk* in Alberta (Government of Alberta 2017).

Distribution

As a migrant songbird, olive-sided flycatcher occurs in Alberta only during the breeding season (late May to early September) (FAN 2007). The species has a widespread distribution in Alberta, with breeding occurring in the Boreal Forest, Foothills, Grassland, Parkland and Rocky Mountain Natural Regions (Semenchuk 1992; FAN 2007). The olive-sided flycatcher breeds throughout much of the forested regions of Canada and the western and northeastern United States (COSEWIC 2007).

Ecology and Key Habitat Requirements

Across its range, olive-sided flycatcher typically occurs in coniferous and mixed-coniferous forest (COSEWIC 2007; Kotliar 2007; Altman and Sallabanks 2012). Nests are generally found in coniferous trees, predominantly spruce. Deciduous forests are generally avoided, although nests have been observed in trembling aspen and willow (Tufts 1986; Campbell et al. 1997; Wright 1997). Primary nesting habitat includes late successional open and semi-open coniferous forests, as well as forest edges near natural openings (e.g., ponds, lakes, rivers and meadows) and near anthropogenic openings such as clear-cuts (COSEWIC 2007; Kotliar 2007; Altman and Sallabanks 2012). Clear-cuts and other young (0 to 10 years old) forests are used if they contain snags or residual live trees for singing and foraging perches (COSEWIC 2007; Altman and Sallabanks 2012). Similarly, recent (0 to 30 years old) burns are considered important habitat (Morissette et al. 2002; Meehan and George 2003; BAMP 2011), likely because of the creation of forest openings and edge habitat, as well as availability of snags and live trees (COSEWIC 2007; Kotliar 2007; Altman and Sallabanks 2012).

Vegetation structure with adjacent open or riparian areas appears to be more important than tree species composition (Wells et al. 2009). Gaps in coniferous forests provide suitable breeding habitat, whereas closed canopy coniferous forests, including young (pole-sapling) and mature forests that lack gaps or edges, are considered poor habitat (COSEWIC 2007; Kotliar 2007).

Birds nesting in disturbed habitats might experience higher nesting mortality and lower nest success than those in natural forest openings through increased predation, suggesting that these habitats might be ecological traps (Robertson and Hutto 2007).

Habitat Use and Life Requisites

Breeding (nesting) habitat is the life requisite rated for the olive-sided flycatcher. Breeding habitats provide suitable nest sites as well as resources for other life requisites such as foraging, shelter and security. Therefore, although the habitat suitability model represents nesting (reproduction) habitat, the ratings inherently include a portion of other living requirements. Suitable areas for nesting include open early to mid-successional stands as well as mature and old stands with edge habitat, sparse canopy cover and tall trees or snags (Environment Canada 2016). Nesting generally occurs in live coniferous trees that are slightly shorter than the surrounding canopy (COSEWIC 2007). Breeding territories for olive-sided flycatcher typically range from 10-20 ha (Altman and Sallabanks 2012).

Ratings Assumptions

Habitat suitability model ratings for olive-sided flycatcher breeding habitat use the following assumptions:

- Mature coniferous and mixedwood forests provide high and moderate suitability breeding habitat, respectively. Coniferous dominated – pine leading vegetation cover classes are given a lower rating because they typically do not provide gaps or edges preferred by olive-sided flycatchers (Kotliar 2007).
- Deciduous dominated vegetation cover classes are considered low suitability breeding habitat. Non-treed vegetation cover classes are assumed to have no value for nesting and were given a very low to nil rating.
- Older forests are assumed to have more forest gaps; and therefore, structural stage 6 (mature) and 7 (old) are given the highest ratings in each vegetation cover class. Structural stages 4 (pole sapling) and 5 (young forest) are less preferred for nesting and are given lower ratings, and structural stage 1 (non-vegetated), 2 (herb) and 3 (shrub) stands are given a very low to nil rating.
- Olive-sided flycatcher use edge habitats. Edge habitat is assumed to extend 50 m into the forest interior. Model assumptions include rating for habitat within 50 m of an edge. Distance from the natural edge is used to modify ratings of structural stage 6 and 7 habitat. Habitat suitability ratings are decreased by 1 class if any habitat occurs greater than 50 m from natural edge in patches of structural stage 6 or 7 coniferous or mixedwood (non-lodgepole pine) forests.

Ratings Adjustments for Disturbances

Olive-sided flycatcher vocalizations are presumably used to attract mates and defend territories (Altman and Sallabanks 2012). Therefore, it is assumed that noise disturbance might affect otherwise suitable breeding habitat as has been shown for other songbirds (Habib 2006; Habib et al. 2007, Sutter et al. 2016). Environment Canada (2009), through further consultation with P. Gregoire (2014, pers. comm.), recommends setback buffers for petroleum industry activities for bird species at risk in Alberta. These setback buffers are used as ZOI for this Project, and assigned to varying levels of sensory disturbance based on factors such as noise level or perceived visual impediments. The following rating adjustments are applied to estimate the ZOI associated with each disturbance type:

- Industrial development and primary roads are considered high disturbance and buffered by 300 m. Suitability ratings are reduced by two classes for the first 150 m and one class if disturbance is greater than 150 m.
- Secondary roads are considered high disturbance and buffered by 300 m and suitability ratings are reduced by one class.
- Rural residential, tertiary roads and transmission lines are considered moderate disturbance and buffered by 150 m and suitability ratings are reduced by one class.
- Agricultural lands (e.g., cropland, hayland) are considered a low disturbance and buffered by 50 m and suitability ratings are reduced by one class.

11A.2.2 Sprague's Pipit

Status

Sprague's pipit is listed as *threatened* on Schedule 1 of the SARA due to a significant decline in numbers and a possible contraction of its range (COSEWIC 2010a). In Alberta, Sprague's pipit is listed as *special concern* under the AWA (Government of Alberta 2015).

Distribution

Sprague's pipit is a migratory species and is found in southern Alberta only during the breeding season (Environment Canada 2012). In Canada, it breeds in native prairie habitat, and is found in the Prairie Provinces, from the foothills of southern and central Alberta to southwest Manitoba (Environment Canada 2012, Davis et al. 2014).

General Ecology and Key Habitat Requirements

Sprague's pipit breeds in native mixed-grass prairie with vegetation of intermediate height (10 cm – 30 cm) with few shrubs and woody vegetation, and flat, gently-rolling topography (Davis et al. 1999; COSEWIC 2010a; Davis et al. 2014). Moderately-grazed habitat is preferred (Davis et al. 1999; Environment Canada 2012). Although Sprague's pipit is considered a native grassland specialist, breeding in tame pasture and hayfield can occur in some parts of its range (Fisher and Davis 2011; Davis et al. 2013). Minimum grassland patch size requirements have been reported (Davis 2004; Davis et al. 2006; Environment Canada 2012); however, there is considerable variability based on landscape conditions (Davis et al. 2013). Davis (2004) reported minimum patch sizes that ranged from 69 ha to 314 ha and found Sprague's pipit did not use areas that were less than 29 ha. Overall, there is uncertainty in patch size requirements as interior area-to-edge ratios might drive habitat selection as opposed to overall patch size (Davis 2004; Koper et al. 2009; Jones and White 2012).

Habitat Use and Life Requisites

Breeding (nesting) habitat is the life requisite rated for the Sprague's pipit model. Breeding habitats provide suitable nest sites as well as resources for other life requisites such as foraging, shelter and security. Although the habitat suitability model primarily rates breeding habitat, the ratings inherently include a portion of other life requisites. Sprague's pipit has been documented nesting in tame pasture and hayland, but in lower numbers compared to native grassland (COSEWIC 2010a; Davis et al. 2014). Sprague's pipit is rarely recorded in cropland (Davis et al. 2014).

Ratings Assumptions

Habitat suitability model ratings for Sprague's pipit breeding habitat use the following assumptions:

- Native grasslands that occur on moderately well-drained sites (xeric to mesic) with limited presence of non-native plant species provide high suitability habitat. Grasslands with imperfectly and poorly drained soils (subhygric to hydric) are rated as low suitability.
- Tame pasture and cultivated hayfields are rated as low suitability.
- Forested areas, riparian and shrub habitat are rated as very low to nil.
- Cropland is rated very low to nil.
- Sprague's pipit has been reported as an area sensitive species (Davis 2004), despite the uncertainty associated with minimum patch size requirements. As such, a patch size that considers the existing landscape condition as well as previously reported values is used. Specifically, grassland habitats smaller than 69 ha are rated as low and patch sizes greater than 69 ha have a rating of moderate or high depending on the results of the ZOI.

Ratings Adjustments for Disturbances

Sprague's pipit vocalizations are presumably used to attract mates and defend territories (Davis et al. 2014). Therefore, it is assumed that noise disturbance might affect otherwise suitable breeding habitat as has been shown for other songbirds (Habib 2006; Habib et al. 2007). Sutter et al. (2016) found that Sprague's pipit daily nest survival rate increased with increasing distance from a pipeline construction right-of-way. Environment Canada (2009) recommends setback buffers for petroleum industry activities for bird species at risk in Alberta. These setback buffers are used as the ZOI for this Project and assigned to varying levels of sensory disturbance based on factors such as noise level or perceived visual impediments. In addition, habitat edge effects have been shown to be strongly influenced by distance to cropland for Sprague's pipit in southern Alberta (Koper et al. 2009). Specifically, a 50% decline from the predicted maximum relative abundance was observed 480 m from cropland (Koper et al. 2009).

The following rating adjustments are applied to estimate the ZOI associated with each disturbance type:

- Agricultural cropland is buffered by 500 m and suitability ratings are reduced by one class.
- Industrial development, and primary and secondary roads are considered high disturbance and buffered by 350 m and suitability ratings are reduced by two classes.
- Rural residential, tertiary roads and transmission lines are considered moderate disturbance and buffered by 150 m and suitability ratings are reduced by one class.

11A.2.3 Northern Leopard Frog

Status

In Canada, the Prairie population of northern leopard frog is listed as *special concern* under Schedule 1 of SARA due to a contraction in the species' range, a decline in numbers, an increase in isolation between populations, habitat loss, and disease (COSEWIC 2010b). Northern leopard frog is listed as *threatened* under the AWA (Government of Alberta 2015).

Distribution

In Alberta, northern leopard frog is found primarily in the central and southern portion of the province and in an area in the northeast corner (Environment Canada 2013). Northern leopard frog is found in all Canadian provinces and the Northwest Territories (Environment Canada 2013).

General Ecology and Key Habitat Requirements

Northern leopard frog requires three distinct habitat types to meet their breeding, foraging and overwintering habitat requirements (ESRD 2012b). Shallow, warm waters of a variety of wetlands, including marshes, sloughs and slow-moving sections of streams and rivers are used for breeding (SRD 2003, Environment Canada 2013). Saline and acidic waters do not provide suitable breeding habitat (Karns 1992; Stevens et al. 2010). Optimal breeding wetlands have emergent vegetation for cover and as a substrate for egg mass attachment (Kendell 2002) and contain no predatory fish (Merrell and Rodell 1968; SRD 2003). Water must be present in the wetland until the tadpoles metamorphose and can move around in upland areas. Young-of-the-year, sub-adult and adult northern leopard frogs might forage up to 2 km from breeding sites (Russell and Bauer 2000, ESRD 2012b) and prefer meadows, pastures, riparian areas and ditches, and tend to avoid heavily treed areas and tall grass (COSEWIC 2009). Northern leopard frogs overwinter in water that does not completely freeze, which are typically permanent ponds, lakes, rivers and streams (ESRD 2012b), and are usually within 1.6 km of breeding habitat (Kendell 2002). Northern leopard frogs have been observed to successfully overwinter in waters containing predatory fish (Emery et al. 1972).

Habitat Use and Life Requisites

Breeding habitat is the life requisite rated for northern leopard frog. Waterbodies with shallow water and emergent vegetation that are relatively free of predatory fish are required for breeding. In addition, the suitability of breeding habitat is dependent on the proximity of potential foraging and overwintering sites.

Ratings Assumptions

Habitat suitability model ratings for northern leopard frog breeding habitat use the following assumptions:

- Northern leopard frog prefers warm, shallow water for breeding. All waterbodies with emergent vegetation are rated high. Any waterbodies with no emergent vegetation are rated very low to nil.
- Northern leopard frog reproduction occurs successfully in waters with neutral pH. Areas with high salinity are avoided. Saline or acidic waters, as found in bogs, are rated low for breeding suitability.
- Permanency of water is an important criterion for successful reproduction. Waterbodies that dry up before complete metamorphosis of tadpoles (i.e., dry before end of June) are not ideal. Waterbodies classified as ephemeral (Class I) are rated very low to nil, and those classified as temporary (Class II) are rated low.

- Fish are observed as predators of northern leopard frogs. Even small fish, such as brook stickleback (*Culaea inconstans*), can feed on northern leopard frog eggs. Waterbodies with known information on fish presence have their rating decreased by one class.
- Breeding wetlands typically occur within 2 km of overwintering sites. The probability of breeding wetland occurrence decreases the farther the frogs must travel from their overwintering sites. Therefore, breeding habitat suitability is decreased by one class if a potential overwintering site is greater than 2 km from a potential breeding site.

Ratings Adjustments for Disturbances

Amphibians, such as northern leopard frog, vocalize to attract mates in the spring, and anthropogenic noise has been shown to alter call rates in males (Sun and Narins 2005; Cunnington and Fahrig 2010). Environment Canada (2009) recommends setback buffers for petroleum industry activities for amphibian species at risk in the prairies. These setback buffers are used as ZOI, and assigned to varying levels of sensory disturbance based on factors such as noise level or perceived visual impediments. No ZOIs are applied to agricultural areas. The following rating adjustments are applied to estimate the ZOI associated with each disturbance type:

- Industrial development, and primary and secondary roads are considered high disturbance and buffered by 400 m. Suitability ratings are reduced by two classes for the first 200 m and one class if disturbance is greater than 200 m away.
- Tertiary roads and rural residential are considered a moderate disturbance and buffered by 200 m and suitability ratings are reduced by one class.

11A.2.4 Elk

Status

Elk is not listed under the SARA or the AWA and is considered secure in Alberta (Government of Alberta 2017).

Distribution

In Alberta, elk are primarily found in the mountains and foothills regions, however, elk populations also exist in Elk Island National Park, Cypress Hills Provincial Park, and Canadian Forces Base (CFB) Suffield (Naughton 2012). The RAA occurs in Wildlife Management Units (WMU) 212 and WMU 312 west of Calgary. Overall, wintering elk occur throughout these WMUs including the LAA, but typically occur in larger numbers south of Highway 22X and west of Highway 552 (Ranger and Rasmussen 2013). The most recent aerial survey indicate elk are relatively more abundant in WMU 312 (total count = 1,667) than WMU 212 (total count = 514) (Ranger and

Rasmussen 2013). Regional populations of elk herds also occur in surrounding areas including the Bow Valley, Banff National Park, and Kananaskis Country.

Ecology and Key Habitat Requirements

Elk occur in areas that provide a mosaic of open grasslands and forest cover. Elk are primarily grazers but will also browse shrubs during winter if snow conditions prevent access to preferred grasses. Overall, elk select habitats with high herbaceous forage biomass, especially grasslands where graminoids (e.g., rough fescue) make up most of their diet (Morgantini 1995; Christianson and Creel 2007; Seidel and Boyce 2016). Elk also use other habitats during summer and winter such as shrubland, riparian, and deciduous forests where preferred forage plants are available (Nietfeld et al. 1985; Benz et al. 2016, Hauer et al. 2016). In addition, elk also use cattle pastures where elk home ranges and cattle ranches overlap (Pruvot et al. 2014). In these agricultural areas, terrain ruggedness, and the proportion of hayland on pastures have been positively related to pasture use by elk in southwestern Alberta.

Forested habitats are also important to elk for security and thermal protection, which influences the suitability of feeding habitats and vigilance behaviour (Grover and Thompson 1986; Hernandez and Laundre 2005; Liley and Creel 2007; Robinson et al. 2010). As such, elk prefer areas that provide both open feeding areas as well as adjacent forest cover and typically use feeding areas that are within 200 m of forest cover (Grover and Thompson 1986; Liley and Creel 2007; Robinson et al. 2010).

In summer, elk feed primarily on grasses and forbs, such as fescue (*Festuca* spp.), bluegrass (*Poa* spp.), brome (*Bromus* spp.) and common yarrow (*Achillea millefolium*) (Nietfeld et al. 1985; Morgantini 1995). In winter, elk feed on grasses (e.g., rough fescue) when not limited by snow depths, but also browse on deciduous trees and shrubs including trembling aspen (*Populus tremuloides*) and saskatoon (*Amelanchier alnifolia*) (Nietfeld et al. 1985; Christianson and Creel 2007; Morgantini 1995; Frisina et al. 2008; Benz et al. 2016). During winter, open areas that receive increased solar radiation (i.e., southerly aspects) provide access to preferred grasses and other herbaceous forage (Alexander et al. 2006; Webb and Anderson 2009).

Overall, several factors influence seasonal habitat use by elk including forage quality and availability, terrain, weather conditions as well as predators and human activities (Ciuti et al. 2012, Seidel and Boyce 2016). Although elk are often migratory, spending winters at lower elevations and ascending to higher elevations during summer (Paton 2012; Prokopenko 2016), some elk are resident where they remain in the same area year-round (Nietfeld et al. 1985; Robinson et al. 2010; Hebblewhite and Merrill 2011).

Habitat Use and Life Requisites

The life requisites rated for elk are summer and winter feeding habitat. The summer season is broadly defined to include the growing season (April-October) and winter defined as the most limiting season for forage availability, which extends from November to March. Other key life requisites considered in the model include the proximity of security and thermal cover to feeding habitat.

Ratings Assumptions

Habitat suitability model ratings for summer and winter elk feeding habitat use the following assumptions:

- Elk are primarily grazers and prefer grassland habitat for feeding during winter; therefore, native grassland habitats (e.g., rough fescue) are rated high including ecosites that occur on south or southwest aspects, which can provide snow-free areas for winter and spring feeding. Native grasslands are also rated high during summer.
- Tame pasture is rated moderate in both winter and summer. Hayland is also rated moderate during the winter, but low during the summer.
- Deciduous and mixedwood forests containing a high diversity of preferred forb and grass species in the understorey are rated moderate during summer. During the winter, shrub and aspen browsing becomes more prominent; therefore, shrub and tree dominated habitats with suitable browse species are also rated moderate. Coniferous forests are rated low due to a sparse understorey of preferred forage.
- Mature and old forests are assumed to have more gaps and potential foraging opportunities, therefore, structural stage 6 and 7 are rated higher than closed canopy pole-sapling (structural stage 4) or young forests (structural stage 5). Structural stage 4 and 5 stands are given a very low to nil rating. Structural stage 3 is rated the same as structural stage 6 and 7.
- Riparian habitats are very productive and provide a variety of preferred grasses, sedges, and browse. Ecosite phases along the Elbow River floodplain are rated moderate to high, depending on overstorey and understorey plant species composition for both summer and winter.
- Ecosite phases that contain some preferred forage plants but with a predominantly north aspect have their ratings reduced by one class. Those with a predominantly south or southwesterly aspect retain their initial ratings.
- Distance from cover is used to modify feeding habitat ratings for grassland (open) habitat, structural stage 2. If feeding habitat is greater than 200 m from cover (structural stage 3, 6, and 7), ratings are reduced by one class.

Ratings Adjustments for Disturbances

Elk have been shown to avoid roads, which can affect habitat use and distribution. However, the extent to which elk reduce their use near roads varies with time of day, sex, road type and traffic volume (McCorquodale 2013; Buchanan et al. 2014; Prokopenko 2016). Some studies have reported elk reduce their use near roads at distances that vary from 250 m up to 1 km or more (McCorquodale 2013). Prokopenko (2016) studied elk in southern Alberta and reported elk selected areas farther from roads during all times of the day; however, elk were farthest (345 m) from the nearest road during the twilight hours. Considering the variability associated with road avoidance behaviour exhibited by elk, a 500 m and 250 m buffer is used as a ZOI for high traffic volume and medium to low traffic volume roads, respectively. The Trans-Canada Highway, Highway 8 and Highway 22, and Springbank Road are categorized as high traffic volume roads (Alberta Transportation 2016). Public township and range roads are categorized as moderate traffic volume, and private roads and driveways are categorized as low traffic volume.

Elk might avoid other linear developments and human settlements to some degree, but in some circumstances select these features for forage. Early successional stage vegetation used as forage by ungulates can be found under, or on, linear developments such as transmission line and pipeline rights-of-ways (Frair et al. 2005; Bartzke et al. 2014). Because elk are likely to forage on rights-of-ways, no ZOI is applied to these disturbances. Similarly, elk might select agricultural areas including tame pastures and hayland (Pruvot et al. 2014); therefore, no ZOI is applied. Elk might also select for habitats closer to human settlements as a predator avoidance strategy (Robinson et al. 2010; Rogala et al. 2011), but are still likely to avoid them up to a certain distance when human activity is high. The following rating adjustments are applied to estimate the ZOI associated with each disturbance type:

- Industrial development and primary roads are considered high disturbance and buffered by 500 m and suitability ratings are reduced by two classes.
- Rural residential and secondary roads are considered moderate disturbance and buffered by 250 m and suitability ratings are reduced by two classes.
- Tertiary roads are considered a low disturbance and buffered by 250 m and suitability ratings are reduced by one class.

11A.2.5 Grizzly Bear

Status

Grizzly bear is listed as *threatened* under the AWA (Government of Alberta 2015). It is currently not listed under the SARA, but is listed as *special concern* by Committee on the Status of Endangered Wildlife in Canada (COSEWIC), due to a decline in numbers, sensitivity to anthropogenic activity and increased isolation between populations (COSEWIC 2012).

Distribution

In Alberta, grizzly bears are found primarily in the Rocky Mountains, foothills and west-central northwestern boreal forest (Festa-Bianchet and Kansas 2010). In Canada, grizzly bear is found in Alberta, British Columbia, Yukon Territory, Northwest Territories and Nunavut.

General Ecology and Key Habitat Requirements

Grizzly bears have large home ranges ([e.g., female, 500 km^2; male, 1500 km^2] Stevens and Gibeau 2005; AEP 2016) as they typically travel over large areas in search of food and mates (SRD 2008). Grizzly bears are omnivorous and opportunistic feeders that select various habitats to meet seasonal food requirements in both mountain and foothill environments (Munro et al. 2006; Cristescu et al. 2015). Overall, grizzly bears select seasonal habitats based on plant phenology and availability of preferred forage resources (Nielsen et al. 2003). Floodplains, forest openings, graminoid meadows, and wetlands typically provide preferred forage plants during spring and early summer (SRD 2008; SRD and ACA 2010). In the Bow Valley near Canmore, Alberta, grizzly bears select areas with abundant herbaceous vegetation (i.e., greenness) and low to intermediate road densities during spring and summer (Chetkiewicz and Boyce 2009). During late summer and fall, feeding habitats include areas that provide berry-producing shrubs such as semi-open mesic forests as well as cutblocks and burns (Nielsen et al. 2004; Munro et al. 2006).

Habitat Use and Life Requisites

The key life requisite rated for grizzly bear includes spring/early summer and late summer/fall feeding habitat. These seasons represent pre-berry and berry seasons, respectively, following previous research conducted in the Bow River watershed (Mueller et al. 2004; Theberge et al. 2005). A summary of seasonal feeding habitat and attributes are summarized below.

Spring/Early Summer (late April – mid July)

After hibernation, grizzly bears feed primarily in open areas that are snow free, typically grasslands. wet meadows and riparian habitats (Hamer and Herrero 1983; SRD and ACA 2010). Forage consists of a variety of plants including graminoids, sedges (*Carex* spp.), horsetail (*Equisetum* spp.) and forbs such as hedysarum (*Hedysarum* spp.), cow parsnip (*Heracleum lanatum*), peavine (*Lathyrus ochroleucus*), and clover (*Trifolium* spp.) (Hamer and Herrero 1987; Nielson et al. 2003. Munro et al. 2006; SRD and ACA 2010). Introduced species such as dandelion (*Taraxacum* spp.) are also consumed. Opportunistic feeding on winter-killed ungulates or calves can also be an important source of food during the spring (Munro et al. 2006; SRD and ACA 2010).

Late Summer/Fall (late July–October)

Berries are the primary source of energy and fat deposition during summer and fall (Munro et al. 2006). In the central Rocky Mountains, buffaloberry (*Shepherdia* spp.) is the most common berry consumed by grizzly bears. Other important berry-producing shrubs include bearberry (*Arctostaphylos* spp.), velvet-leaved blueberry (*Vaccinium myrtilloides*) and lingonberry (*Vaccinium* vitis-idaea) (Hamer and Herrero 1987; Munro et al. 2006; SRD and ACA 2010).

Ratings Assumptions

Habitat suitability model ratings for grizzly bear feeding habitat use the following assumptions:

Spring/Early Summer Feeding

- Ecosites that contain preferred herbaceous plants (e.g., grass, sedge, horsetail, hedysarum, cow parsnip) are rated high including grasslands (structural stage 2) and mature open forests (structural stage 6) that occur along riparian areas.
- Winter-killed ungulates and calves can provide opportunistic feeding opportunities during spring. Therefore, riparian and shrublands that might provide security cover for ungulates are rated high.
- All non-native vegetation units (e.g., crop fields, hayfield) are rated low or very low to nil.

Late Summer/Fall Feeding

- Ecosites that support buffaloberry are rated high for late summer/fall feeding, which include shrub-dominated habitats (structural stage 3) as well as mature forests (structural stage 6) with an open canopy. Habitats that do not contain buffaloberry but support other berry-producing shrubs (e.g., saskatoon and bearberry) are rated as moderate.

- Overall, structural stage 3 and 6 are rated higher than closed canopy and younger forests (structural stage 4 and 5). Structural stage 2, 4, and 5 are rated very low to nil because of lack of berry-producing shrubs.
- All non-native vegetation units (e.g., crop fields, hayfield) are rated very low to nil.

Ratings Adjustments for Disturbances

Grizzly bears might avoid habitats adjacent to roads, which results in reduced habitat effectiveness. However, the extent to which grizzly bears avoid roads depends on several factors including the type of road, time of day, frequency of human use, habitat quality as well as age and sex of bear (Benn and Herrero 2002; Gibeau et al. 2002; Mueller et al. 2004; Roever et al. 2008; Northrup et al. 2012a). Grizzly bears have been reported to avoid habitat near high traffic volume roads where avoidance can extend from 1 km to 2 km (Gibeau et al. 2002; Northrup et al. 2012a). Northrup et al. (2012a) also studied moderate (20 to 100 vehicles per day) and low traffic volume roads (less than 20 vehicles per day) and found grizzly bears avoided moderate and low traffic volume roads within approximately 500 m and 250 m, respectively. Overall, this study found grizzly bears used low-volume roads when available and crossed these roads more frequently, particularly at night.

With consideration of the potential avoidance of roads by grizzly bears described above, the Trans-Canada Highway, Highway 8 and 22, and Springbank Road are considered as high traffic volume roads for this model (Alberta Transportation 2016). Public township and range roads are categorized as moderate traffic volume, and private roads and driveways are categorized as low traffic volume.

Avoidance of low-impact linear features, such as transmission line rights-of-way, appears to be variable among individual grizzly bears, but generally continue to move and forage under these features (Nielsen et al. 2002). As such, no ZOI is applied to transmission and pipeline rights-of-way. Indeed, grizzly bears have been shown to use habitats near human settlements and agricultural lands where the risk of human-caused mortality is high but are attracted to these areas presumably for the forage resources they provide (Gibeau et al. 2002; Northrup et al. 2012b); therefore, no ZOIs are applied to agricultural areas. The following rating adjustments are applied to estimate the ZOI associated with each disturbance type:

- Primary roads are considered high disturbance and buffered by 1,000 m. Suitability ratings are reduced by two classes for the first 500 m and one class if disturbance is greater than 500 m.
- Industrial development and secondary roads are considered high disturbance and buffered by 500 m and suitability ratings are reduced by two classes.

- Rural residential is considered moderate disturbance and buffered by 250 m and suitability ratings are reduced by two classes.
- Tertiary roads are considered a low disturbance and buffered by 250 m and suitability ratings are reduced by one class.

11A.3 REFERENCES

11A.3.1 Literature Cited

Alberta Transportation. 2016. Alberta Highways 1 to 986 Traffic Volume History 2006-2015. Strategy and Policy Branch, Alberta Transportation. Available at: https://www.transportation.alberta.ca/2639.htm. Accessed: January 2017.

Alexander, S.M., T.B. Logan and P.C. Paquet. 2006. Spatio-temporal co-occurrence of cougars (*Felis concolor*), wolves (*Canis lupus)* and their prey during winter: a comparison of two analytical methods. *Journal of Biogeography*. 33: 2001 – 2012.

Altman, B. and R. Sallabanks. 2012. Olive-sided Flycatcher (Contopus cooperi). In: A. Poole [ed.]. The Birds of North America Online. Cornell Lab of Ornithology. Ithaca, New York. Available at: http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/502. Accessed January 2017.

AEP (Alberta Environment and Parks). 2016. Alberta Grizzly Bear (*Ursus arctos*) Recovery Plan. Alberta Environment and Parks, Alberta Species at Risk Recovery Plan No. 38. Edmonton, AB. 85 pp.

BAMP (Boreal Avian Modelling Project). 2011. Species list. Available at: http://www.borealbirds.ca/avian_db/accounts.php. Accessed: January 2017.

Bartzke, G.S., R. May, K. Bevanger, S. Stokke, and E. Roskaft. 2014. The effects of power lines on unuglates and implications for power line routing and rights-of-way management. *International Journal of Biodiversity and Conservation* 6: 647-662.

Bayne, E.M., L. Habib and S. Boutin. 2008. Impacts of chronic anthropogenic noise from energy-sector activity on abundance of songbirds in the boreal forest. Conservation Biology 22: 1186–1193.

Benn, B. and S. Herrero. 2002. Grizzly Bear Mortality and Human Access in Banff and Yoho National Parks, 1971-98. *International Association for Bear Research and Management* 13: 213 – 221.

Benz, R.A., M.S. Boyce, H. Thurfjell, D.G. Paton, M. Musiani, C.F. Dormann, and S. Ciuti. 2016. Dispersal ecology informs design of large-scale wildlife corridors. PLoS ONE 11: e0162989. doi:10.1371/journal.pone.0162989

Buchanan, C.B., J.L. Beck. T.E. Bills and S.N. Miller. 2014. Seasonal Resource Selection and Distributional Response by Elk to Development of a Natural Gas Field. *Rangeland Ecology and Management* 67: 369 – 379.

Campbell, R.W., N.K. Dawe, I. McTaggart-Cowan, J.M. Cooper and G.W. Kaiser. 1997. The birds of British Columbia. Volume 3 – passerines (flycatchers through vireos). Royal British Columbia Museum, Victoria, BC.

Chetkiewicz, C.L.B and M.S. Boyce. 2009. Use of resource selection functions to identify conservation corridors. *Journal of Applied Ecology* 46: 1036-1047.

Christianson, D.A. and S. Creel. 2007. A review of environmental factors affecting elk winter diets. *Journal of Wildlife Management* 71: 164 – 176.

Ciuti, S., J.M. Northrup, T.B. Muhly, S. Simi, M. Musiani, and J. A. Pitt. 2012. Effects of humans on behaviour of wildlife exceed those of natural predators in a landscape of fear. PLoS ONE 7(11): e50611.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2007. COSEWIC assessment and status report on the Olive-sided Flycatcher *Contopus cooperi* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa.

COSEWIC. 2009. COSEWIC assessment and update status report on the northern leopard frog, *Lithobates pipiens*, Rocky Mountain population, Western Boreal/Prairie populations and Eastern populations, in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa vii +69 pp.

COSEWIC. 2010a. COSEWIC Assessment and Status Report on the Sprague's Pipit *Anthus spragueii* in Canada. Ottawa, ON. ix + 34 pp. Available at: https://www.registrelep-sararegistry.gc.ca/virtual_sara/files/cosewic/sr_Sprague's%20Pipit_0810_e.pdf. Accessed January 2017.

COSEWIC. 2010b. COSEWIC Assessment and Update Status Report on the Northern Leopard Frog *Lithobates pipiens*, Rocky Mountain Population, Western Boreal/Prairie Populations and Eastern Populations in Canada. Ottawa, ON. vii + 69 pp. Available at: http://www.sararegistry.gc.ca/virtual_sara/files/cosewic/sr_northern_leopard_frog_0809i_e.pdf. Accessed January 2016.

COSEWIC. 2012. COSEWIC assessment and status report on the Grizzly Bear *Ursus arctos* in Canada. Ottawa, ON. xiv + 84 pp. Available at: http://www.registrelep-sararegistry.gc.ca/virtual_sara/files/cosewic/sr_ours_grizz_bear_1012_e.pdf. Accessed January 2017.

Cristescu, B., G.B. Stenhouse and M.S. Boyce. 2015. Grizzly bear diet shifting on reclaimed mines. Global Ecology and Conservation 4: 207 – 220.

Cunnington, G.M. and L. Fahrig. 2010. Plasticity in the vocalization of anurans in response to traffic noise. *Acta Oecologica* 36(2010): 463-470.

Davis, S.K., D.C. Duncan and M.A. Skeel. 1999. Distribution and habitat associations of three endemic grassland songbirds in southern Saskatchewan. *Wilson Bulletin* 111: 389 – 396.

Davis, S. K. 2004. Area sensitivity in grassland passerines: Effects of patch size, patch shape, and vegetation structure on bird abundance and occurrence in southern Saskatchewan. The *Auk* 121: 1130 – 1145

Davis, S.K., R.M. Brigham, T.L. Shaffer and P.C. James. 2006. Mixed-grass prairie passerines exhibit weak and variable responses to patch size. *The Auk* 12: 807 – 821.

Davis, S.K., R.J. Fisher, S.L. Skinner, T.L. Shaffer, R.M. Brigham. 2013. Songbird abundance in native and planted grassland varies with type and amount of grassland in the surrounding landscape. The Journal of Wildlife Management 77: 908-919.

Davis, S.K., M.B. Robbins and B.C. Dale. 2014. Sprague's Pipit (Anthus spragueii). The Birds of North America (P. G. Rodewald, Ed.). Cornell Lab of Ornithology, Ithaca, NY. Available at: https://birdsna.org/Species-Account/bna/species/sprpip. Accessed January 2016.

Emery, A.R., A.H. Berst and K. Kodaira. 1972. Under-ice observations of wintering sites of leopard frogs. Copeia 1972: 123 – 126.

Environment Canada. 2009. Petroleum Industry Activity Guidelines for Wildlife Species at Risk in the Prairie and Northern Region. Canadian Wildlife Service, Prairie and Northern Region, Edmonton, AB. 64 pp.

Environment Canada. 2012. Amended Recovery Strategy for the Sprague's Pipit (*Anthus spragueii*) in Canada. Species at Risk Act Recovery Strategy Series. Ottawa, ON. vi + 46 pp.

Environment Canada. 2013. Management Plan for the Northern Leopard Frog (*Lithobates pipiens*), Western Boreal/Prairie Populations, in Canada. *Species at Risk Act* Management Plan Series. Ottawa, ON. iii + 28 pp.

Environment Canada. 2016. Recovery Strategy for the Olive-sided Flycatcher (*Contopus cooperi*) in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. vii + 52 pp.

ESRD (Alberta Environment and Sustainable Resource Development). 2012a. Range Plant Communities and Range Health Assessment Guidelines for the Foothills Parkland Natural Subregion of Alberta. Prepared by Craig DeMaere, Michael Alexander, and Michael Willoughby. Lands Division, Pincher Creek, Alberta.

ESRD. 2012b. Alberta Northern Leopard Frog Recovery Plan, 2010 – 2015. Alberta Species at Risk Recovery Plan No. 20. Edmonton, AB. 34 pp.

ESRD. 2015. Alberta Wetland Classification System – June 1, 2015. Water Policy Branch, Policy and Planning Division, Edmonton, AB.

FAN (Federation of Alberta Naturalists). 2007. The Atlas of Breeding Birds of Alberta: A Second Look. Federation of Alberta Naturalists. Edmonton, Alberta.

Festa-Bianchet, M. and J.L. Kansas. 2010. Status of the Grizzly Bear (*Ursus arctos*) in Alberta. Update 2010. Alberta Sustainable Resource Development. Wildlife Status Report No. 37 (Update 2010). Edmonton.

Fisher, R.J. and S.K. Davis. 2011. Habitat use by Sprague's Pipit (*Anthus spragueii*) in native pastures and planted, non-native hay fields. The Auk 128: 273 – 282.

Frair J. L., E. H Merrill., D. R. Visscher, D. Fortin, H. L. Beyer, J.M. Morales. 2005. Scales of movement by elk in response to heterogeneity in forage resources and predation risk. Landscape Ecology 20, 273–287.

Frisina, M.R., C.L. Wambolt, W.W Fraas, and G. Guenther. 2008. Mule deer and elk winter diet as an indicator of habitat competition. Pp 123-126 in S.G. Kitchen, R.L. Pendleton, T.A. Monaco, and J.C. Vernon (ed.), Proceedings-Shrublands under fire: disturbance and recovery in a changing world; 2006 June 6-8; Cedar City, UT. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Gibeau, M.L., A.P. Clevenger, S. Herrero and J. Wierzchowski. 2002. Grizzly bear response to human development and activities in the Bow River Watershed, Alberta, Canada. Biological Conservation 103: 227 – 236.

Grover, K.E and M.J. Thompson. 1986. Factors Influencing Spring Feeding Site Selection by Elk in the Elkhorn Mountains, Montana. The Journal of Wildlife Management 50: 466 – 470.

Government of Alberta. 2015. Species Assessed by the Conservation Committee. Alberta Environment and Parks, Fish and Wildlife Division, Edmonton, Alberta. Available at: http://open.alberta.ca/publications/species-assessed-by-alberta-s-endangered-species-conservation-committee-alberta-species-at-risk. Accessed February 2017.

Government of Alberta. 2017. Alberta Wild Species General Status Listing – 2015. Alberta Environment and Parks. Accessed June 2017 from: http://aep.alberta.ca/fish-wildlife/species-at-risk/wild-species-status-search.aspxHabib, L.D. 2006. Effects of chronic industrial noise disturbance on boreal forest songbirds. M.Sc. Thesis. University of Alberta, Edmonton, AB.

Habib, L.D., E.M. Bayne and S. Boutin. 2007. Chronic industrial noise affects pairing success and age structure of Ovenbirds *Seiurus aurocapilla*. Journal of Applied Ecology 44:176–184.

Hamer, D. and S. Herrero. 1983. Ecological studies of the grizzly bear in Banff National Park: final report. Parks Canada, Calgary, AB.

Hamer, D. and S. Herrero. 1987. Grizzly bear food and habitat in the front ranges of Banff National Park, Alberta. International Association for Bear Research and Management 7: 199-213.

Hauer, F.R., H. Locke, V.J. Dreitz, M. Hebblewhite, W.H. Lowe, C.C. Muhlfeld, C.R. Nelson, M.F. Proctor, S.B. Rood. 2016. Gravel-bed river floodplains are the ecological nexus of glaciated mountain landscapes. Science Advances DOI: 10.1126/sciadv.1600026

Hebblewhite, M. and E.H. Merrill. 2011. Demographic balancing of migrant and resident elk in a partially migratory population through forage – predation tradeoffs. Oikos 120: 1860 - 1870

Hernandez, L. and J.W. Laundre. 2005. Foraging in the 'landscape of fear' and its implications for habitat use and diet quality of elk (Cervus elaphus) and bison (Bison bison). Wildlife Biology 11: 215 – 220.

Jones, S.L. and G.C. White. 2012. The effect of habitat edges on nest survival of Sprague's pipit. The Wilson Journal of Ornithology 124: 310-315.

Karns, D.R. 1992. Effects of acidic bog habitats on amphibian reproduction in a northern Minnesota peatland. Journal of Herpetology 26: 401-412.

Kendell, K. 2002. Survey protocol for the northern leopard frog. Alberta Species at Risk Report No. 43. Fish and Wildlife Division, Edmonton, AB. 30 pp.

Koper, N., D.J. Walker, and J. Champagne. 2009. Nonlinear effects of distance to habitat edge on Sprague's pipits in southern Alberta, Canada. Landscape Ecology 24: 1287-1297.

Kotliar, N.B. 2007. Olive-sided Flycatcher (Contopus cooperi): A Technical Conservation Assessment. U.S. Forest Service, Rocky Mountain Region.

Liley, S. and S. Creel. 2007. What best explains vigilance in elk characteristics of prey, predators, or the environment? Behavioral Ecology 19: 245 – 254.

Manci, K.M., D.N. Gladwin, R. Villella and M.G. Cavendish. 1988. Effects of aircraft noise and sonic booms on domestic animals and wildlife: a literature synthesis. U.S. Department of the Interior, Fish and Wildlife Service, National Ecology Research Center. Fort Collins, Colorado.

McCorquodale, S.M. 2013. A brief review of the scientific literature on elk, roads, & traffic. Available at: http://wdfw.wa.gov/publications/01491/wdfw01491.pdf. Accessed January 2017.

Meehan, T.D. and T.L. George. 2003. Short-term effects of moderate- to high-severity wildfire on a disturbance-dependent flycatcher in northwest California. Auk 120:1102-1113. Morissette, J.L., T.P. Cobb, R.M. Brigham and P.C. James. 2002. The response of boreal forest songbird communities to fire and post-fire harvesting. Canadian Journal of Forest Research 32:2169-2183.

Merrell, D.J. and C.F Rodell. 1968. Seasonal selection in the leopard frog, Rana pipiens. Evolution 22: 284-288.

Morgantini, L.E. 1995. The Ya Ha Tinda: an ecological overview. Canadian Heritage, Parks Canada, Calgary, Alberta, Canada.

Morissette, J.L., Cobb, T.P., Brigham, R.M., James, P.C., 2002. The response of boreal forest songbird communities to fire and post-fire harvesting. Canadian Journal of Forest Research. 32, 2169–2183.

Mueller, C., S. Herrero, and M. L. Paquet. 2004. Distribution of subadult grizzly bears in relation to human development in the Bow River Watershed, Alberta. *Ursus* 15: 35-47.

Muir, J.E., V.C. Hawkes, K.N. Tuttle, and T. Mochizuki. 2011. Synthesis of habitat models used in the oil sands region. LGL Report EA3259. Unpublished report prepared for the Cumulative Environmental Management Association (CEMA) – The Reclamation Working Group (RWG), Fort McMurray, Alta., by LGL Limited, Sidney, B.C. 30 pp. + Appendices. Available at: http://library.cemaonline.ca/

Munro, R.H.M., S.E. Nielsen, M.H. Price, G.B. Stenhouse and M.S. Boyce. 2006. Seasonal and diel patterns of grizzly bear diet and activity in west-central Alberta. Journal of Mammalogy 87: 1112 – 1121.

Naughton, D. 2012. The Natural History of Canadian Mammals. University of Toronto Press, Toronto, ON.

Nielsen, S.E., M.S. Boyce, G.B. Stenhouse and R.H.M. Munro. 2002. Modeling grizzly bear habitats in the Yellowhead ecosystem of Alberta: taking autocorrelation seriously. Ursus 13: 45-56.

Nielsen, S.E., M.S. Boyce, G.B. Stenhouse, and R.H.M. Munro. 2003. Development and testing of phenologically driven grizzly bear habitat models. *Ecoscience* 10: 1-10.

Nielsen, S.E., R.H.M. Munro, E.L. Bainbridge, G.B. Stenhouse and M.S. Boyce. 2004. Grizzly bears and forestry - Distribution of grizzly bear foods in clearcuts of west-central Alberta, Canada. Forest Ecology and Management 199: 67-82.

Nietfeld, M., J. Wilk, K. Woolnough and B. Hoskin. 1985. Wildlife Habitat Requirement Summaries for Selected Wildlife Species in Alberta. Wildlife Resource Inventory Unit, Alberta Energy and Natural Resources. ENR Technical Report Number T/73.

Northrup, J.M., J. Pitt, T.B. Muhly, G.B. Stenhouse, M. Musiani and M.S. Boyce. 2012a. Vehicle traffic shapes grizzly bear behaviour on a multiple-use landscape. *Journal of Applied Ecology* 49: 1159 – 1167.

Northrup, J.M., G.B. Stenhouse, and M.S. Boyce. 2012b. Agricultural lands as ecological traps for grizzly bears. *Animal Conservation* 15: 369–377.

Paton, D. 2012. Connectivity of Elk Migration in Southwestern Alberta. Master's Thesis – University of Calgary, Calgary Alberta

Prokopenko, C.M. 2016. Multiscale Habitat Selection and Road Avoidance of Elk on their Winter Range. M.Sc. Thesis. University of Alberta, Edmonton, AB.

Pruvot, M., D. Seidel, M.S. Boyce, M. Musiani, A. Massolo, S. Kutz, and K. Orsel. 2014. What attracts elk onto cattle pasture? Implications for inter-species disease transmission. P*reventative Medicine* 117: 326-339.

Ranger, M., and C. Rasmussen, Editors. 2013. Delegated big game surveys, 2012/2013 survey season. Data Report, D-2013-006, produced by the Alberta Conservation Association, Sherwood Park, Alberta, Canada. 63 pp.

Robertson, B.A. and R.L. Hutto. 2007. Is selectively harvested forest an ecological trap for Olive-sided Flycatchers? Condor 109:109-–121.

Robinson, B., M. Hebblewhite and E. Merrill. 2010. Are migrant and resident elk (Cervus elaphus) exposed to similar forage and predation risk on their sympatric winter range? Ecosystem Ecology 164: 265 – 275.

Roever. C.L., M. S. Boyce and G. B. Stenhouse. 2008. Grizzly bears and forestry II: Grizzly bear habitat selection and conflicts with road placement. *Forest Ecology and Management* 256: 1262–1269.

Rogala, J.K., M. Hebblewhite, J. Whittington, C.A. White and J. Coleshill. 2011. Human Activity Differentially Redistributes Large Mammals in the Canadian Rockies National Parks. University of Montana wildlife Biology Faculty Publications. Paper 7.

Russell, A.P. and A.M. Bauer. 2000. The Amphibians and Reptiles of Alberta: A Field Guide and primer of Boreal Herpetology. Second Edition. University of Calgary Press.

Seidel, D.P. and M.S. Boyce. 2016. Varied tastes: home range implications of foraging-patch selection. *Oikos* 125: 39–49.

Semenchuk, G.P. 1992. The Atlas of Breeding Birds of Alberta. Published by the Federation of Alberta Naturalists, Edmonton, Alberta.

SRD (Alberta Sustainable Resource Development). 2003. Status of the Northern Leopard Frog (*Rana pipiens*) in Alberta: Update 2003. Alberta Sustainable Resource Development, Fish and Wildlife Division, and Alberta Conservation Association, Wildlife Status Report No. 9 (Update 2003), Edmonton, AB. 61 pp.

SRD. 2008. Alberta Grizzly Bear Recovery Plan 2008-2013. Alberta Species at Risk Recovery Plan No. 15. Fish and Wildlife Division, Edmonton, AB. 68 pp.

SRD and ACA (Alberta Sustainable Resource Development and Alberta Conservation Association). 2010. Status of the grizzly bear (*Ursus arctos*) in Alberta. Update 2010. Sustainable Resource Development. Wildlife Status Report No. 37. (Update 2010). 44 pp.

Stevens, S. and M. Gibeau. 2005. Home range analysis. Pp 144-152 in S. Herrero, (ed). Biology, demography, ecology and management of grizzly bears in and around Banff National Park and Kananaskis Country: The final report of the Eastern Slopes Grizzly Bear Project. Faculty of Environmental Design, University of Calgary, Alberta, Canada.

Stevens, S.D., D. Page and D.R.C. Prescott. 2010. Habitat suitability index for the northern leopard frog in Alberta: model derivation and validation. Alberta Species at Risk Report No. 132. Fish and Wildlife Division, Edmonton, AB. 16 pp.

Sun, J.W.C. and P.M. Narins. 2005. Anthropogenic sounds differentially affect amphibian call rate. *Biological Conservation* 121 (2005): 419-427.

Sutter, G.C., S.K. Davis, J.C. Skiffington, L.M. Keating, and L.A. Pittaway. 2016. Nesting Behaviour and Reproductive Success of Sprague's Pipit (*Anthus spragueii*) and Vesper Sparrow (*Pooecetes gramineus*) during Pipeline Construction. *Canadian Field-Naturalist* 130(2): 99-109.

Theberge, J., S. Herrero, and S. Jevons. 2005. Resource selection by female grizzly bears with consideration to heterogeneous landscape pattern and scale. Pp 161-180 in S. Herrero, (ed). Biology, demography, ecology and management of grizzly bears in and around Banff National Park and Kananaskis Country: The final report of the Eastern Slopes Grizzly Bear Project. Faculty of Environmental Design, University of Calgary, Alberta, Canada.

Tufts, R. W. 1986. Birds of Nova Scotia. 3rd ed. Nimbus Publ. Co. Ltd. Halifax, Nova Scotia.

Webb, S.M., and R.B. Anderson. 2009. Predicting habitat value for elk in the Central East Slopes of Alberta. Technical report, T-2009-002, produced by the Alberta Conservation Association, Rocky Mountain House, Alberta, Canada. 32 pp.

Wells, R, Stuart-Smith, K., Mahony, N., Norris, A. and De Groot. 2009. Incidental Take and Protecting Habitat for Migratory Birds in the East Kootenay Region, British Columbia. Prepared for Tembec, Western Canada Division, Cranbrook, BC and Canadian Wildlife Service, Delta, BC.

Wright, J. M. 1997. Olive-sided Flycatchers in central Alaska, 1994-1996. Final Rep. Proj. SE-3-4. Alska Dept. Fish and Game. Federal Aid in Wildlife Restoration, Juneau, AK

11A.3.2 Personal Communication

Gregoire, P. 2014. Environment and Climate Change Canada. Edmonton, AB.

SPRINGBANK OFF-STREAM RESERVOIR PROJECT Environmental Impact Assessment

Volume 4: Appendices
Appendix H

Wildlife and Biodiversity Technical Data Report

Prepared for:
Alberta Transportation

Prepared by:
Stantec Consulting Ltd.

March 2017

Table of Contents

LIST OF TABLES

LIST OF FIGURES

Abbreviations

AEP	Alberta Environment and Parks
ATV	all-terrain vehicle
AWA	*Alberta Wildlife Act*
COSEWIC	Committee on the Status of Endangered Wildlife
EIA	environmental impact assessment
ESRD	Environment and Sustainable Resource Development
LAA	local assessment area
SARA	*Species at Risk Act*
SOMC	Species of Management Concern
the Project	Springbank Off-stream Reservoir Project
UTM	Universal Transverse Mercator

1.0 INTRODUCTION

This Technical Data Report provides information on wildlife and biodiversity collected to support the environmental impact assessment (EIA) for the Springbank Off-stream Reservoir Project (the Project). Specifically, this appendix includes a description of the wildlife survey methods and results for bird, amphibian and mammal surveys conducted in the local assessment area (LAA).

2.0 METHODS

2.1 BREEDING BIRD SURVEY

Breeding bird surveys were conducted to provide an overview of the presence of songbird and woodpecker species in the LAA and to compare species density and richness among habitat types.

2.1.1 Site Selection and Survey Methods

Point count locations were chosen to capture representative breeding bird habitats in the LAA. Where possible, stations were located greater than or equal to 300 m apart and greater than or equal to150 m from existing anthropogenic disturbances. Survey station radii (100 m) were generated and georeferenced in the field using a datalogger.

The LAA is in the Foothills Parkland natural subregion and contains both grassland and forested habitat; therefore, both the Grassland and Boreal/ Foothills guidelines within the *Sensitive Species Inventory Guidelines* (Environment and Sustainable Resource Development [ESRD] 2013) were followed. Stations were surveyed twice, ten days apart in June 2016. This is in accordance with the recommended survey period for both grassland [May 15 to June 1] and foothills [June 1 to July 7] songbirds [ESRD 2013]).

Surveys started at sunrise and continued until 10:00 am. At each station, the observer waited two minutes to let effects of arrival disturbance subside, followed by a 10-minute listening and observation period. Birds within a 100 m radius were identified audibly or visually at each point count station; those identified beyond 100 m and those observed flying over the survey area (fly-bys) were recorded as incidental occurrences. Surveys were delayed or cancelled during unfavourable weather conditions (i.e., rain more than an intermittent drizzle or wind speeds greater than 20 km/h).

2.1.2 Data Analysis

Systematic and incidental observations collected during the survey were used to describe songbird and woodpecker species richness for the LAA. Data recorded within the 100 m survey radii were used to estimate density of breeding territories (per 100 ha) in the LAA for each habitat type surveyed. Territorial density was calculated using the maximum number of detections recorded during the two survey visits, based on the assumption that bird detections are typically underestimated (Bibby et al. 2000). To generate valid estimates of territorial density and habitat associations, the analysis excluded:

- incidental records (e.g., fly-bys, after Ralph et al. 1993)

- call note records with no evidence of nesting or territorial display (e.g., a breeding pair exhibiting display behaviour, an adult with nesting material, fecal sac or food, or an active nest)
- records with no evidence of nesting or territorial display for species that tend to breed outside the primary breeding period for migratory birds (i.e., corvids, crossbills and pine siskin [*Carduelis pinus*]).
- colonial nesting species, including all swallows except for tree swallow (*Tachycineta bicolor*), which are not colonial. Breeding colonies can skew density estimates of small areas and therefore swallow colonies were recorded as incidental observations.
- nest parasites (i.e., brown-headed cowbird [*Molothrus ater*]) because their density is reliant on the availability of host territories and, therefore, density is less associated with habitat

If multiple individuals of a species were recorded at a station, territories were calculated as the number of territorial males. If sex was unknown, territories were calculated as half of the number of adults observed, rounding up for odd numbers (Bibby et al. 2000).

2.2 AMPHIBIAN SURVEYS

Amphibian surveys were conducted to target northern leopard frog (*Lithobates pipiens*) and western toad (*Anaxyrus boreas*), as well as to estimate density of all amphibian species potentially occurring in the LAA.

2.2.1 Site Selection and Survey Methods

Nocturnal amphibian survey targets were selected to provide even and representative coverage of wetlands across the LAA. Visual surveys were selected to survey wetlands for high potential of targeted species (northern leopard frog and western toad), as well as those that were not surveyed during nocturnal amphibian surveys.

Two rounds of nocturnal acoustic amphibian surveys (nocturnal amphibian) and one round of diurnal visual encounter surveys (visual amphibian) were conducted in the LAA. The nocturnal and visual amphibian survey methods followed the Alberta Environment and Parks (AEP) *Sensitive Species Inventory Guidelines* (ESRD 2013) (Research Permit #57013, Collection License #57014). The nocturnal amphibian survey methods apply to species that can be detected by call, including boreal chorus frog (*Pseudacris maculata*), wood frog (*Lithobates sylvaticus*), northern leopard frog and western toad. The visual amphibian survey methods apply particularly to species not easily detected by call (i.e., northern leopard frog), and non-calling species (i.e., western tiger salamander [*Ambystoma mavortium*]), as well as all other amphibians potentially occurring in the LAA.

2.2.2 Nocturnal Amphibian Surveys

Stations were surveyed at night between 30 minutes after sunset and 01:00 hours (ESRD 2013). Each visit to a station consisted of a two-minute silent period to allow any disturbance made accessing the site to subside, followed by a 5-minute listening period, consistent with the protocol of the North American Amphibian Monitoring Program (USGS 2010).

Nocturnal amphibian stations were surveyed twice, six days apart, between April 15 and May 25, within the recommended survey period for northern leopard frog. The recommended survey period for western toad in the *Sensitive Species Inventory Guidelines* (ESRD 2013) is May 15 to June 14; however, due to an early spring and calling activity observed incidentally by Stantec biologists approximately 25 km due west of the LAA (Sibbald Flats) on April 16, 2016, surveys conducted in early May were considered acceptable for western toad.

Station number, UTM, and weather conditions (including moon phase, wind, temperature, and precipitation) were recorded on data loggers for each station. Amphibian species were detected by their auditory calls within 500 m of the station and their location was projected using a map feature. The following index of abundance was used to record the occurrence of amphibian species (Mossman et al. 1998):

0 = no amphibians heard calling

1 = individuals can be counted (no overlapping calls) – estimate of 1-5 individuals calling at site

2 = calls of individuals are distinguishable, but some calls overlap – estimate of 6-10 individuals calling at site

3 = full chorus, or continuous calls, where individuals cannot be distinguished – estimate of more than 10 individuals calling at site.

For calling indices 1 and 2, the number of individuals calling was estimated.

Surveys were postponed if wind speed was greater than Beaufort 3 (greater than 20 km/h), temperature was consistently below 5°C, or if precipitation impeded detectability of amphibians. All nocturnal survey stations were visited twice. Although wetlands were targeted at survey stations, most surveys sampled more than one habitat type within the 500 m amphibian detection radius. This included upland terrestrial habitat and other lowland wetland areas. Survey stations were accessed by vehicle for roadside surveys and on foot for off-road surveys.

2.2.3 Visual Amphibian Surveys

The diurnal visual survey consisted of two biologists walking the margin of a wetland, searching for tadpoles, juveniles, and/or basking adults within 1 m of the shoreline (RIC 1998; ESRD 2013). Surveys were delayed or suspended in winds greater than 20 km/h, any precipitation, or cloud conditions that prevented visibility into the water.

2.2.4 Data Analysis

Detected occupancy rate, defined as the number of survey stations occupied by a species divided by the number of stations surveyed, was calculated. Although there were repeated visits to each survey station, the probability of detection was not accounted for; therefore, the detected occupancy rate represents a simple occupancy estimate (Mackenzie et al. 2002, Mackenzie et al. 2006).

Relative abundance (calling index) was summarized by station for nocturnal and visual amphibian surveys. Maximum calling index and associated estimated count over the repeated nocturnal amphibian visits at each station was used to determine relative abundance because this number ultimately represents the largest abundance value detected at each station and prevents double-counting the same individuals (Royle 2004).

2.3 RAIL SURVEYS

Nocturnal rail surveys were conducted to determine rail distribution, identify potential breeding sites and describe species richness in the LAA. The primary target of this survey was yellow rail (*Coturnicops noveboracensis*), which is listed as *special concern* under the *Species at Risk Act* (SARA) and thought to be declining in Alberta and elsewhere in Canada (Environment Canada 2013). Sora (*Porzana carolina*) and Virginia rail (*Rallus limicola*) were secondary targets for this survey.

2.3.1 Site Selection and Survey Methods

Survey stations were identified in advanced, based on access and using wetland mapping and aerial imagery to target areas of suitable breeding habitat for yellow rail. These habitat areas included wet meadows, fens, and vegetated riparian margins. Survey protocols followed Alberta's *Sensitive Species Inventory Guidelines* for yellow rail (ESRD 2013). Call–playback surveys are recommended as they enhance detection of yellow rail (ESRD 2013) (Research Permit #56414, Collection License #56415). Surveys were conducted during the rail breeding season between the last week of May and the first week of July (Bazin and Baldwin 2007). To avoid counting the same individual twice, survey stations were spaced at least 500 m apart. Survey stations were accessed by truck for roadside surveys and on foot for off-road surveys. Because the detection of yellow rail is contingent on numerous factors such as time of year, weather, and peak calling period, two surveys were completed nine days apart in accordance with ESRD (2013) to increase the chance of detections.

Surveys began 30 minutes after sunset and ended one hour before sunrise. Rail surveys were delayed or suspended when wind speed was greater than 20 km/h, temperatures were below freezing, or if precipitation exceeded a light intermittent drizzle (after Boyce and Conway 2009 and Bird Studies Canada 2010). After arrival at the survey station, observers waited for two minutes to let the effects of arrival disturbance subside, and to listen for rails calling during this period. If a rail was heard vocalizing during the initial two-minute period, the detection was recorded. If no rails were detected, a broadcast survey was initiated. The broadcast sequence consisted of a series of calls with the following pattern: 20 seconds of yellow rail calls, 30 seconds of silence; 20 seconds of Virginia rail calls, 30 seconds of silence; and 20 seconds of sora calls followed by a five-minute silent listening period to detect any vocalizations that were delayed due to potential stress associated with the broadcasts. Rail detected outside the detection period, and observations beyond the 500 m plot radius, were recorded as incidental observations.

Rail observations were recorded and georeferenced using a datalogger. At each station, observers recorded the date and time, a GPS waypoint, basic weather data (e.g., temperature, wind speed, percent cloud cover and precipitation), moon phase and visibility, presence of aurora borealis, and the noise level. Surveys were completed under Stantec's nocturnal rail call-playback permit with AEP.

2.3.2 Data Analysis

Detected occupancy rate, defined as the number of survey stations occupied by a species divided by the number of stations surveyed, was calculated. Nocturnal call-playback survey data is presented as a summary of species richness and distribution for the LAA. The total count of rails observed is presented as the maximum number of rails recorded at each station during either of the two site visits. Habitat associations are also recorded for each observation.

2.4 RAPTOR NEST

Stick nest surveys were conducted to identify locations of active and potential nest sites of raptors and heron rookeries in the LAA. Raptor nest surveys were conducted during May and June of 2016 in conjunction with other wildlife surveys (nocturnal amphibian and breeding bird surveys).

Aerial imagery and habitat reconnaissance information was used to identify areas with potential for nesting raptors (forested areas, trees in grasslands, nest platforms and other structures). All raptor nest surveys were conducted between May 1 and June 30, following the *Sensitive Species Inventory Guidelines* (ESRD 2013).

In open habitats, surveys were conducted roadside by truck, or accessing land on foot, scanning any available habitats for nesting sites or raptors using binoculars and spotting scopes. In more closed habitats, such as forest, a more systematic grid search was conducted to cover areas of potential habitat. Once a raptor nest was detected, the location was recorded with GPS and the personnel left the area to avoid disturbance to nesting raptors. Surveys were conducted between 30-minutes after sunrise and 30-minutes before sunset. Raptor nests detected incidentally during other site visits were also recorded.

Raptor and heron nest data were summarized using the number of active nests identified by species. If nests were occupied by a non-raptor or heron species (i.e. waterfowl or corvid), the species was recorded; however, these nests were considered inactive.

2.5 WATERBIRD

Waterbird surveys were conducted to assess the occurrence and abundance of waterfowl and other waterbirds in the LAA to identify any important staging or breeding wetlands for waterbird species of management concern (SOMC). Waterbird surveys were conducted during June in conjunction with breeding bird surveys.

Aerial imagery and habitat reconnaissance information was used to identify all wetlands in the LAA. Surveys were conducted between mid-May and mid-June to coincide with peak waterfowl breeding and between 30-minutes after sunrise to 30-minutes before sunset. Each wetland was visited twice, at least ten days apart. The count, number of adults and juveniles, and species of all waterbirds was recorded. Waterbirds observed incidentally during other surveys were also recorded.

Waterbird data were summarized by species using the maximum number of adults observed at each location (i.e. wetland, portion of watercourse) over the duration of field surveys. Broods were summarized using the maximum count of brood observation by species at a given location.

2.6 REMOTE CAMERA SURVEY

A remote camera survey was conducted to collect data on year-round activity, relative abundance, distribution, and habitat by medium and large mammals (i.e., felines, canines, bears, and ungulates) in the LAA.

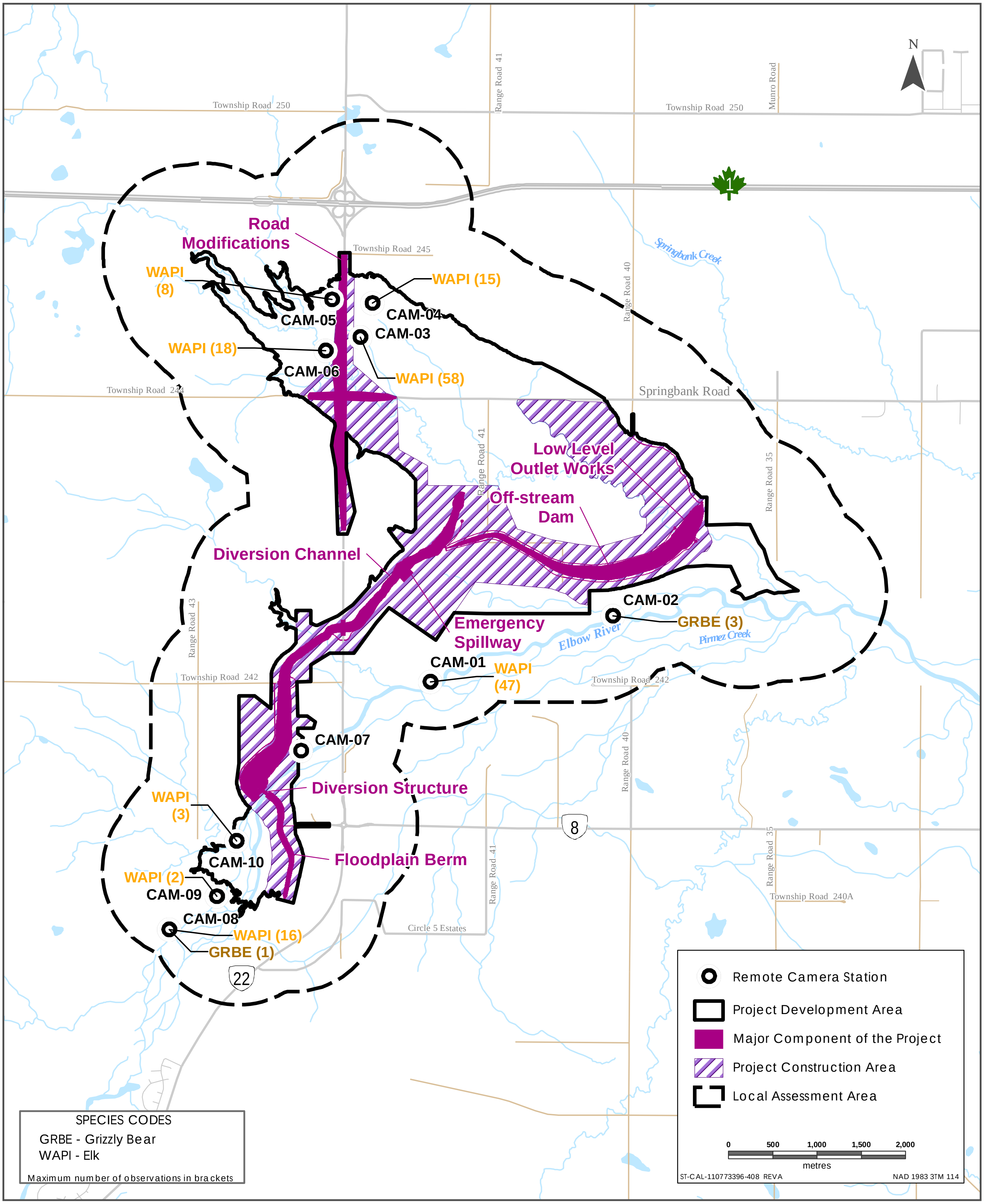
2.6.1 Site Selection and Survey Methods

Ten remote cameras were placed in the LAA at sites where there was potential for wildlife movement such as wildlife trails, human made trails, riparian areas and wetlands. Six remote cameras were deployed along the Elbow River, including two cameras located upstream of the proposed diversion structure, one camera near the proposed floodplain berm and the remaining three cameras located downstream of the diversion inlet between the diversion and low-level outlet channels (see Figure 2-1). Two remote cameras were deployed in wetland and shrubland habitat on either side of the proposed raising of Highway 22 (Figure 2-1). Cameras were mounted at approximately 1.5 m above the ground. The cameras operated 24 hours per day, and functioned in low light conditions without using a flash. Cameras were set at the highest trigger sensitivity (i.e., RapidFire) with 5 image captures per trigger to increase potential captures of rare and elusive species.

Maintenance visits to clear vegetation around the camera, collect data, and assess functionality of the cameras (e.g., battery performance and trigger function) were conducted approximately every four months during monitoring.

2.6.2 Data Analysis

All images were reviewed using MapView Professional software to determine wildlife presence. Individuals detected by remote cameras were identified to species as well as age and sex class, when possible. Wildlife observations were recorded by identifying independent events, which were defined as any image or series of images of the same animal or group of animals. The event ends after the animal or group of animals has left the image for greater than two minutes. Species richness (total number of species recorded) was compared among camera stations. To estimate relative abundance (i.e., photographic rate), data were standardized by summing the count for each species over all independent events and dividing by the number of days the camera was active and calculated as the number of detections per 100 camera-days. Although there are challenges associated with defining seasons for multi-species remote camera surveys, photographic rates were calculated for four seasons including spring (April and May), summer (June to August), fall (October and November) and winter (December to March). Only medium to large terrestrial mammals were included in the relative abundance analysis. All other wildlife observations observed by remote cameras were recorded as incidentals.



Sources: Base Data - Government of Alberta, Government of Canada, Thematic Data - Stantec Ltd.

Remote Camera Survey Locations and Grizzly Bear and Elk Observations in the LAA

Stantec

Figure 2-1

2.7 WINTER TRACKING SURVEYS

Winter track surveys were conducted to provide data on species occurrence and movement throughout the LAA.

2.7.1 Site Selection and Survey Methods

In February 2015, a winter track survey was conducted along secondary roads in the LAA. Due to access restrictions, track surveys were conducted roadside only through representative portions of the LAA. In January 2017, a winter track survey was conducted to provide data on species movement in areas that could be influenced by construction of the diversion channel and diversion structure, including the diversion inlet and floodplain berm and modifications to Highway 22. Any potential crossing points of Highway 22, including the Elbow River bridge, were observed incidentally for evidence of wildlife crossing. Surrounding secondary roads were also surveyed.

The survey protocol followed winter track survey methods, based on those described in the *Sensitive Species Inventory Guidelines* (ESRD 2013). Tracks of mule and white-tailed deer (*Odocoileus* spp.) were identified to species group (unidentified deer) because of difficulty differentiating tracks to the species level. Tracks of small mammals including mice, voles, and shrews were grouped as unknown microtine. Tracks of small mustelids (long-tailed, short-tailed and least weasel [*Mustela* spp.]), where not identified to species, were grouped as unknown weasel. Where necessary, tracks were back-tracked to obtain more visible tracks and aid identification.

2.7.2 Data Analysis

Track counts are calculated as a standardized index of relative abundance (km-days) calculated following Thompson et al. (1989) where track period refers to the track accumulation period (i.e., number of days elapsed since last snowfall):

$$\text{Track Counts} = \frac{\sum \text{Tracks Observed}}{\sum \text{Transect length surveyed (km)} \times \text{Track Period (days)}}$$

Standardized track counts were calculated for each species within each surveyed transect. Mean track counts for each species or species group were also calculated for the total distance surveyed in the LAA.

3.0 RESULTS

3.1 BREEDING BIRD SURVEY

Breeding bird surveys were completed at 54 stations in the LAA. Each station was visited twice; once from June 9 to 11, 2016 and again from June 21 to 23, 2016. Survey stations were selected to cover a representative sample of habitat types in the LAA (Table 3-1). Weather conditions were suitable for breeding bird surveys during both visits. Average temperature during the morning periods was 13°C and ranged between 5°C and 22°C.

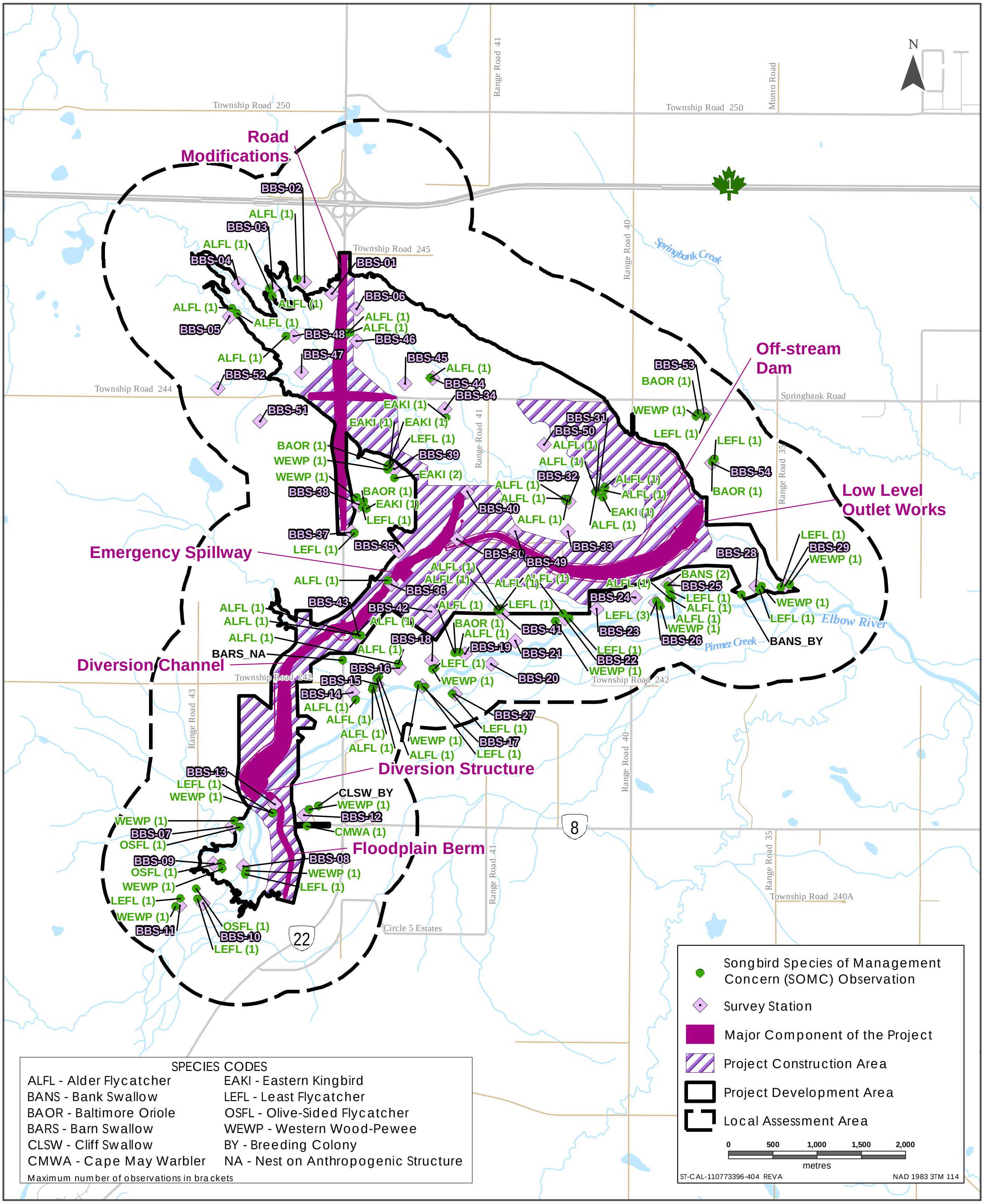
3.1.1 Breeding Bird Density

During the 2016 breeding bird survey, 632 territories of 52 species of songbird and woodpeckers were recorded within the survey radius (Table 3-2). Of these, six species are SOMC: olive-sided flycatcher (*Contopus cooperi*), western wood-pewee (*Contopus sordidulus*), alder flycatcher (*Empidonax alnorum*), least flycatcher (*Empidonax minimus*), eastern kingbird (*Tyrannus tyrannus*), and Baltimore oriole (*Icterus galbula*) (Figure 3-1).

Species richness was highest in mixed forest (45 species), followed by shrubland (26 species) and broadleaf forest (21 species) (Table 3-1). Of the natural vegetation communities, grassland and wetland habitat recorded the lowest species richness (10 and 11 species) (Table 3-1). Overall, breeding bird density was highest in two vegetation communities including mixed forest (587 territories/100 ha) and broadleaf (deciduous) forest (441 territories/100 ha) (Table 3-1). Coniferous forest, shrubland, and wetland habitat types had similar breeding bird densities, whereas grasslands had lower densities (Table 3-1).

Clay-colored sparrow (*Spizella pallida*), house wren (*Troglodytes aedon*) and savannah sparrow (*Passerculus sandwichensis*) had the highest breeding bird densities in the LAA followed by yellow warbler (*Setophaga petechia*), least flycatcher and Lincoln's sparrow (*Melospiza lincolnii*) (Table 3-2).

Fourteen additional songbird species were recorded incidentally during field surveys, including one additional songbird SOMC: Cape May warbler (*Setophaga tigrina*). Sprague's pipit (*Anthus spragueii*) was not detected in the LAA during the 2016 surveys; however, Sprague's pipit was reported approximately 1 km northwest of the LAA on May 16, 2016 (eBird 2016) in similar habitat found in the LAA.



Sources: Base Data - Government of Alberta, Government of Canada, Thematic Data - Stantec Ltd.

Breeding Bird Survey Locations and Songbird SOMC Observations in the LAA

Stantec

ALBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESERVOIR PROJECT ENVIRONMENTAL IMPACT ASSESSMENT

Figure 3-1

Table 3-1 Breeding Bird Survey Sampling Effort, Richness, and Density by Habitat Type in the LAA

Cover Type	Land Unit	Area in LAA (ha)	Area Surveyed (ha)	Number of Species Detected (richness)	Density of Territories (territories/ 100 ha)	Number of SOMC
Grassland	b5: Grassland – submesic/medium	37.9	0.4	0	0.0	0
	c1: Rough fescue	381.8	18.3	9	224.5	0
	f4: Grassland - subhygric/rich	5.4	0.4	1	243.3	0
Grassland Subtotal		**425.1**	**19.0**	**10**	**220.5**	0
Shrubland	e3: Shrubland - mesic/rich	99.0	2.9	10	699.6	0
	f3: Shrubland - subhygric/rich	309.5	40.3	23	332.7	0
Shrubland Subtotal		**408.5**	**43.2**	**26**	**357.0**	0
Broadleaf Forest	b2: Hairy wild rye Aw	0.2	<0.01	N/A	0.0	0
	d1: Pine grass-Aw	21.3	0.6	4	1,079.3	0
	e1: Snowberry-silverberry Aw-Pb	89.8	4.5	12	417.6	2
	f2: Red osier dogwood Pb-Aw	67.1	12.5	14	423.6	0
	g2: Horsetail Aw-Pb	73.4	6.2	11	435.4	0
Broadleaf Forest Subtotal		**251.8**	**23.8**	**21**	**440.8**	2

Table 3-1 Breeding Bird Survey Sampling Effort, Richness, and Density by Habitat Type in the LAA

Cover Type	Land Unit	Area in LAA (ha)	Area Surveyed (ha)	Number of Species Detected (richness)	Density of Territories (territories/ 100 ha)	Number of SOMC
Mixed Forest	b3: Hairy wild rye Aw-Sw-Pl	109.9	12.8	26	657.4	4
	d2: Pine grass-Sw-Pl-Aw	2.5	2.2	14	1,015.2	2
	e2: Snowberry-silverberry Sw	81.9	13.0	28	555.5	2
	e4: Snowberry-silverberry Sw-Aw	16.1	3.6	14	525.8	2
	f1: Red osier dogwood Sw	85.7	10.4	25	473.1	0
Mixed Forest Subtotal		**296.1**	**41.9**	**45**	**587.4**	4
Coniferous Forest	b4: Hairy wild rye Sw	59.1	2.7	5	185.9	0
	d3: Pine grass-Sw	6.8	0.0	N/A	N/A	N/A
	g1: Horsetail Sw	179.3	4.0	11	471.9	2
Coniferous Forest Subtotal		**245.2**	**6.7**	**15**	**357.4**	2
Upland Subtotal		**1,627.2**	**134.6**	**52**	**424.2**	4

Table 3-1 Breeding Bird Survey Sampling Effort, Richness, and Density by Habitat Type in the LAA

Cover Type	Land Unit	Area in LAA (ha)	Area Surveyed (ha)	Number of Species Detected (richness)	Density of Territories (territories/ 100 ha)	Number of SOMC
Wetland	FSmr: Moderate-rich shrubby fen	42.6	3.4	10	437.1	1
	I: Ephemeral waterbody	5.0	0.01	0	0.0	0
	MGII: Temporary graminoid marsh	92.9	0.8	0	0.0	0
	MGIII: Seasonal graminoid marsh	102.7	2.7	3	366.1	0
	MGIV: Semi-permanent graminoid marsh	34.7	0.2	0	0.0	1
	SSIII: Seasonal shrubby swamp	5.3	0.0	N/A	N/A	N/A
	SWmIII: Seasonal wooded mixedwood swamp	20.3	0.0	N/A	N/A	N/A
	WAV: Shallow open water with submersed and/or floating aquatic vegetation	7.2	0.0	N/A	N/A	N/A
	WAVIs: Saline shallow open water with submersed and/or floating aquatic vegetation	0.9	0.0	N/A	N/A	N/A
Wetland Subtotal		**311.6**	**7.2**	**11**	**345.9**	2
Water	Open Water	283.5	4.4	0	0.0	0
Water Subtotal		**283.5**	**4.4**	**0**	**0.0**	0
Agriculture	CR: Annual Crop	547.2	4.1	1	48.5	0
	DgRe: Dugout	2.0	0.0	N/A	N/A	N/A
	HY: Hayland	1,325.2	0.0	N/A	N/A	N/A
	TM: Tame Pasture	469.5	18.2	4	186.7	

Table 3-1 Breeding Bird Survey Sampling Effort, Richness, and Density by Habitat Type in the LAA

Cover Type	Land Unit	Area in LAA (ha)	Area Surveyed (ha)	Number of Species Detected (richness)	Density of Territories (territories/ 100 ha)	Number of SOMC
Agriculture Subtotal		**2,343.9**	**22.3**	**4**	**161.2**	0
Disturbed land [a]		294.5	1.1	0	0.0	0
Total		**4,860.0**	**169.6**	**52**	**372.5**	4

NOTES:
Aw – aspen (*Populus tremuloides*)
Pb – balsam poplar (*Populus balsamifera*)
Pl – lodgepole pine (*Pinus contorta*)
Sw – white spruce (*Picea glauca*)
[a] Disturbed land includes industrial facilities, disturbed land, transportation and rural residential land unit types.

Table 3-2 Breeding Bird Densities and Species Occurrence by Habitat Type

Name	Scientific Name	Number of Territories Detected	Density (territories/100 ha)	Habitat Type [a]
Yellow-bellied sapsucker	*Sphyrapicus varius*	3	1.8	b3, d2
Downy woodpecker	*Picoides pubescens*	2	1.2	b3, d2
Hairy woodpecker	*Leuconotopicus villosus*	2	1.2	e2, e4
Northern flicker	*Colaptes auratus*	1	0.6	e1
Olive-Sided flycatcher	*Contopus cooperi*	2	1.2	b3, e4
Western wood-pewee	*Contopus sordidulus*	19	11.2	b3, d2, e1, e2, e4, f1, f3, g1, g2
Alder flycatcher	*Empidonax alnorum*	17	10.0	e1, e3, e4, f1, f2, f3, FSmr
Least flycatcher	*Empidonax minimus*	35	20.6	b3, d2, e1, e2, f1, f3, g1, g2, FSmr
Hammond's flycatcher	*Empidonax hammondii*	2	1.2	b3, d2
Eastern kingbird	*Tyrannus tyrannus*	3	1.8	f3
Cassin's vireo	*Vireo cassinii*	1	0.6	e4
Warbling vireo	*Vireo gilvus*	8	4.7	b3, e3, f1, f2, g2
Red-eyed vireo	*Vireo olivaceus*	2	1.2	FPe3
Tree swallow	*Tachycineta bicolor*	1	0.6	b3
Black-capped chickadee	*Poecile atricapillus*	15	8.8	b3, d2, e2, e4, f1, f2, f3, g1, g2, FSmr
Boreal chickadee	*Poecile hudsonicus*	5	2.9	b4, e1, e2, f1
Red-breasted nuthatch	*Sitta canadensis*	2	1.2	e1, e2
White-breasted nuthatch	*Sitta carolinensis*	1	0.6	b3
House wren	*Troglodytes aedon*	55	32.4	b3, c1, d2, e2, e4, f1, f2, f3, g1, g2
Golden-crowned kinglet	*Regulus satrapa*	1	0.6	f1

Table 3-2 Breeding Bird Densities and Species Occurrence by Habitat Type

Name	Scientific Name	Number of Territories Detected	Density (territories/100 ha)	Habitat Type [a]
Ruby-crowned kinglet	*Regulus calendula*	17	10.0	e1, e2, e4, f1, g1
Mountain bluebird	*Sialia currucoides*	3	1.8	f3, TM
Swainson's thrush	*Catharus ustulatus*	3	1.8	e2, f1, g1
American robin	*Turdus migratorius*	28	16.5	b3, b4, d2, e2, e4, f1, f2, f3, g1, g2, FSmr
Gray catbird	*Dumetella carolinensis*	3	1.8	e2, f3, g1
European starling	*Sturnus vulgaris*	6	3.5	b3, d2, e2
Cedar waxwing	*Bombycilla cedrorum*	22	13.0	b3, c1, d1, d2, e1, e2, e3, e4, f1, f2, f3, g2
Ovenbird	*Seiurus aurocapilla*	1	0.6	f1
Northern waterthrush	*Parkesia noveboracensis*	4	2.4	e2, e4
Tennessee warbler	*Leiothlypis peregrina*	21	12.4	b3, b4, e2, e4, f1, f3, FSmr
MacGillivray's warbler	*Geothlypis tolmiei*	1	0.6	f1
Yellow warbler	*Setophaga petechia*	42	24.8	b3, d2, e1, e2, e3, e4, f1, f2, f3, g2, FSmr
Yellow-rumped warbler	*Setophaga coronata*	6	3.5	b3, e2, f1
Wilson's warbler	*Cardellina pusilla*	3	1.8	b3, e2, f2
Chipping sparrow	*Spizella passerina*	3	1.8	b3, c1
Clay-colored sparrow	*Spizella pallida*	116	68.4	b3, b4, c1, d1, d2, e1, e2, e3, e4, f1, f2, f3, g2, FSmr, MGIII, TM
Savannah sparrow	*Passerculus sandwichensis*	53	31.2	CR, c1, e1, e2, e3, f2, f3, MGIII, TM
Le Conte's sparrow	*Ammodramus leconteii*	3	1.8	c1, e2, f3
Nelson's sparrow	*Ammodramus nelsoni*	1	0.6	f3

Table 3-2 Breeding Bird Densities and Species Occurrence by Habitat Type

Name	Scientific Name	Number of Territories Detected	Density (territories/100 ha)	Habitat Type [a]
Song sparrow	*Melospiza melodia*	9	5.3	b4, d1, e1, e2, f1, f3, FSmr
Lincoln's sparrow	*Melospiza lincolnii*	31	18.3	b3, c1, e2, e3, f1, f2, f3, g2, FSmr, MGIII
White-throated sparrow	*Zonotrichia albicollis*	18	10.6	b3, e2, f1, f2, f3, g1, g2
Dark-eyed junco	*Junco hyemalis*	5	2.9	e2, f1, f3
Rose-breasted grosbeak	*Pheucticus ludovicianus*	9	5.3	b3, d2, e2, f1, f2
Red-winged blackbird	*Agelaius phoeniceus*	7	4.1	b3, e3, f3, f4
Western meadowlark	*Sturnella neglecta*	3	1.8	c1, TM
Brewer's blackbird	*Euphagus cyanocephalus*	2	1.2	f1, f3
Baltimore oriole	*Icterus galbula*	7	4.1	b3, d2, f3
House finch	*Haemorhous mexicanus*	2	1.2	e2, g1
Purple finch	*Haemorhous purpureus*	1	0.6	e2
Pine siskin	*Spinus pinus*	1	0.6	g1
American goldfinch	*Spinus tristis*	24	14.1	b3, c1, d1, e3, f1, f2, f3, FSmr
Total	**52**	**632**	**372.5**	**N/A**

NOTE:
[a] Habitat code definitions are provided in Table 3-1. For a full description of habitat types see Volume 3a (Section 11.2)

3.2 AMPHIBIAN SURVEYS

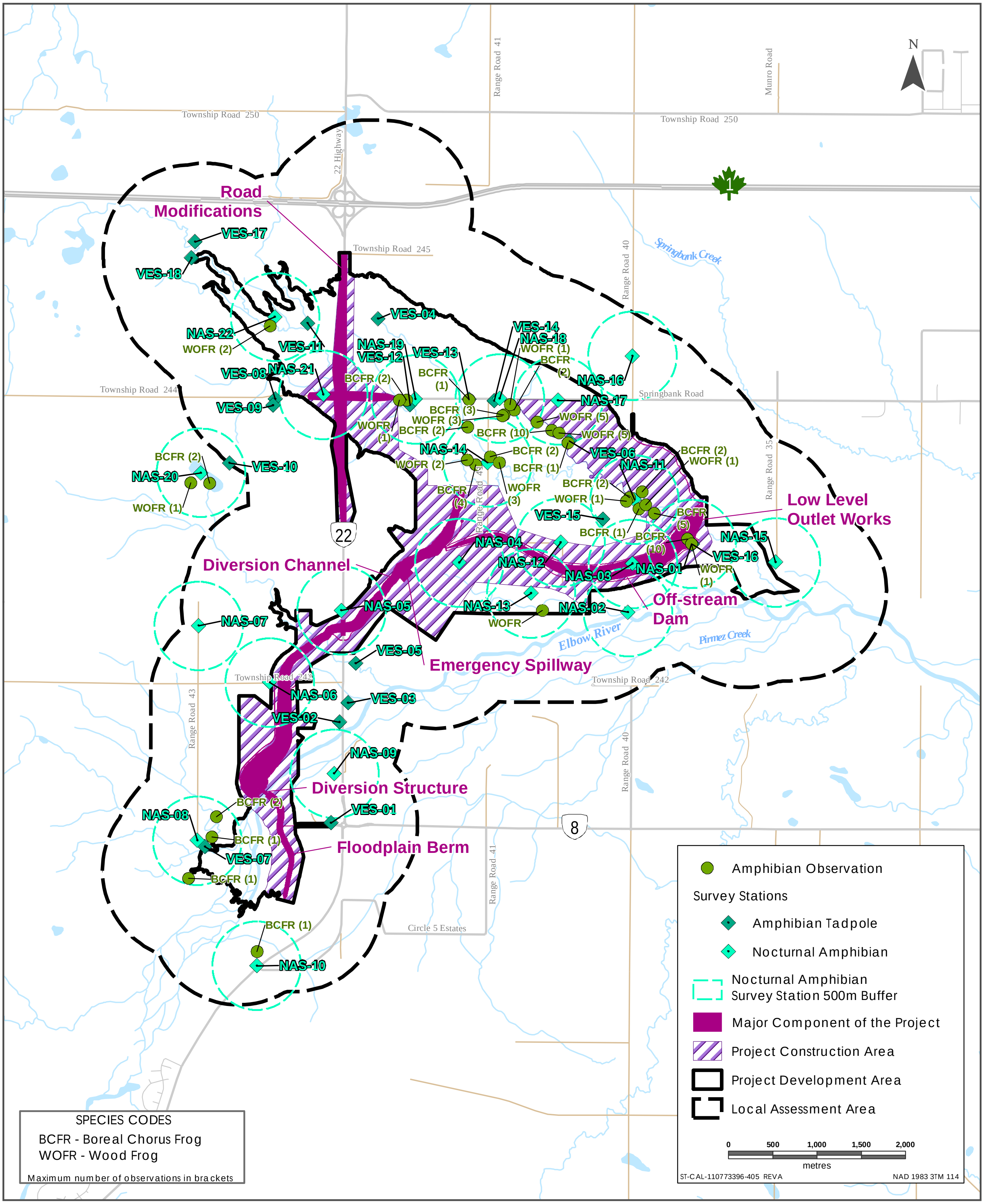
Two rounds of nocturnal amphibian surveys were conducted at 22 survey stations in the LAA (Figure 3-2; Table 3-3). Round one was conducted on May 5 and round two was conducted on May 11, 2016. A visual amphibian survey was conducted at 19 stations on July 14, 2016. Weather conditions were suitable for amphibian surveys during all three visits. Average temperature during the nocturnal amphibian survey period was 6°C and ranged between 5°C and 9°C. Due to the dry conditions during visual amphibians, wetlands that were dry were not surveyed.

3.2.1 Relative Abundance

Two amphibian species were observed during both the nocturnal and visual surveys including boreal chorus frog and wood frog (Figure 3-2). During the nocturnal amphibian survey, amphibians were recorded at 45.4% of the survey stations (10 of 22) (Table 3-3) and at 17% (3 of 18) of visual survey stations (Table 3-4). Detected occupancy rate during nocturnal surveys was 41% for boreal chorus frog and 36% for wood frog (Table 3-3). Detected occupancy rate for all 18 visual amphibian stations was 6% for boreal chorus frog and 11% for wood frog (Table 3-4). Both wood frog and boreal chorus frog were also incidentally observed on other wildlife surveys.

A calling index of 1 was most frequently observed when amphibians were detected (Table 3-3). During the nocturnal amphibian survey, boreal chorus frog was detected more frequently compared to wood frog. An estimated total of 52 boreal chorus frogs and 26 wood frogs were detected during the survey. No other amphibian species were observed.

During nocturnal amphibian surveys, amphibians were observed in stations covering a variety of wetland types including Class C and Class D waterbodies (defined in Table 3-1), and Class I, II, III, IV and V wetlands (Table 3-3). During visual amphibian surveys, amphibians were observed at stations containing Class III wetlands as well as dugout and Class D waterbodies (Table 3-4).



Sources: Base Data - Government of Alberta, Government of Canada, Thematic Data - Stantec Ltd.

Amphibian Survey Locations and Observations in the LAA

Stantec

ALBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESERVOIR PROJECT ENVIRONMENTAL IMPACT ASSESSMENT

Figure 3-2

Table 3-3 Maximum Calling Index and Estimated Count of Amphibians Detected during Nocturnal Amphibian Surveys

Nocturnal Amphibian Survey Station	Habitat Surveyed [a]	Species Observed				
		Boreal Chorus Frog		Wood Frog		Total Amphibians
		Maximum Calling Index	Maximum Count	Maximum Calling Index	Maximum Count	Maximum Count
NAS- 01	Open Water, MGI, MG II, MG III, MG IV	3	10	1	1	11
NAS- 02	Open Water, MGI, MG II, MG III	0	0	0	0	0
NAS- 03	Open Water, MGI, MG II, MG III, MG IV	0	0	0	0	0
NAS- 04	MG II, MG III, FSmr	0	0	0	0	0
NAS- 05	Open Water, MGI, MG II, MG III, DgRe	0	0	0	0	0
NAS- 06	MGI, MG II, MG III	0	0	0	0	0
NAS- 07	MG III, WAVIs, WAV	0	0	0	0	0
NAS- 08	Open Water, MG II	1	3	0	0	3
NAS- 09	Open Water, SSIII, MGIV, DgRe	0	0	0	0	0
NAS- 10	MGIII, MGIV	1	1	0	0	1
NAS- 11	Open Water, MG II, MG III, MG IV	2	8	1	2	10
NAS- 12	MG II, MG III, MG IV	0	0	0	0	0
NAS- 13	Open Water, MGIII, FSmr	0	0	0	0	0
NAS- 14	Open Water, MGII, MGIII	1	8	1	5	13
NAS- 15	Open Water, MGIII	0	0	0	0	0
NAS- 16	I, MGIII	0	0	0	0	0

Table 3-3 Maximum Calling Index and Estimated Count of Amphibians Detected during Nocturnal Amphibian Surveys

Nocturnal Amphibian Survey Station	Habitat Surveyed [a]	Species Observed				
		Boreal Chorus Frog		Wood Frog		Total Amphibians
		Maximum Calling Index	Maximum Count	Maximum Calling Index	Maximum Count	Maximum Count
NAS- 17	MGII, MGIII, MGIV, Open Water	2	11	2	10	21
NAS- 18	Open Water, SSIII, MGII, MGIII, MGIV, DgRe	2	7	1	4	11
NAS- 19	Open Water, MGII, MGIII, MGIV	1	2	1	1	3
NAS- 20	MGII, MGIII, WAV	1	2	1	1	3
NAS- 21	MGII, MGIII, MGIV, DgRe	0	0	0	0	0
NAS- 22	MGII, MGIII, WAV	0	0	1	2	2
Count / Total	**N/A**	**N/A**	**52**	**N/A**	**26**	**78**

NOTE:
[a] Habitat types are defined in Table 3-1.

Table 3-4 Amphibian Species Observed during Visual Amphibian Surveys

Visual Amphibian Survey Station	Habitat Type [a]	Boreal Chorus Frog	Wood Frog	Total
VES-01	DgRe	0	0	0
VES-02	MGIV	0	0	0
VES-03	MGIII	0	0	0
VES-04	MGII	0	0	0
VES-05	DgRe	0	0	0
VES-06	Open Water, MGIV	0	0	0
VES-07	Open Water	0	0	0
VES-08	WAV	0	0	0
VES-09	MGIV	0	0	0
VES-10	WAV	0	0	0
VES-11	MGIII	0	0	0
VES-12	MGIV, Open Water	0	0	0
VES-13	MGIII, SSIII	1	0	1
VES-14	MGIII, DgRe, Open Water	0	2	2
VES-15	MGIV	0	0	0
VES-16	Open Water	0	0	0
VES-17	MGIII	0	0	0
VES-18	MGIII	0	1	1
Total	**N/A**	**1**	**3**	**4**

NOTE:
[a] Habitat types are defined s in Table 3-1

3.3 RAIL SURVEYS

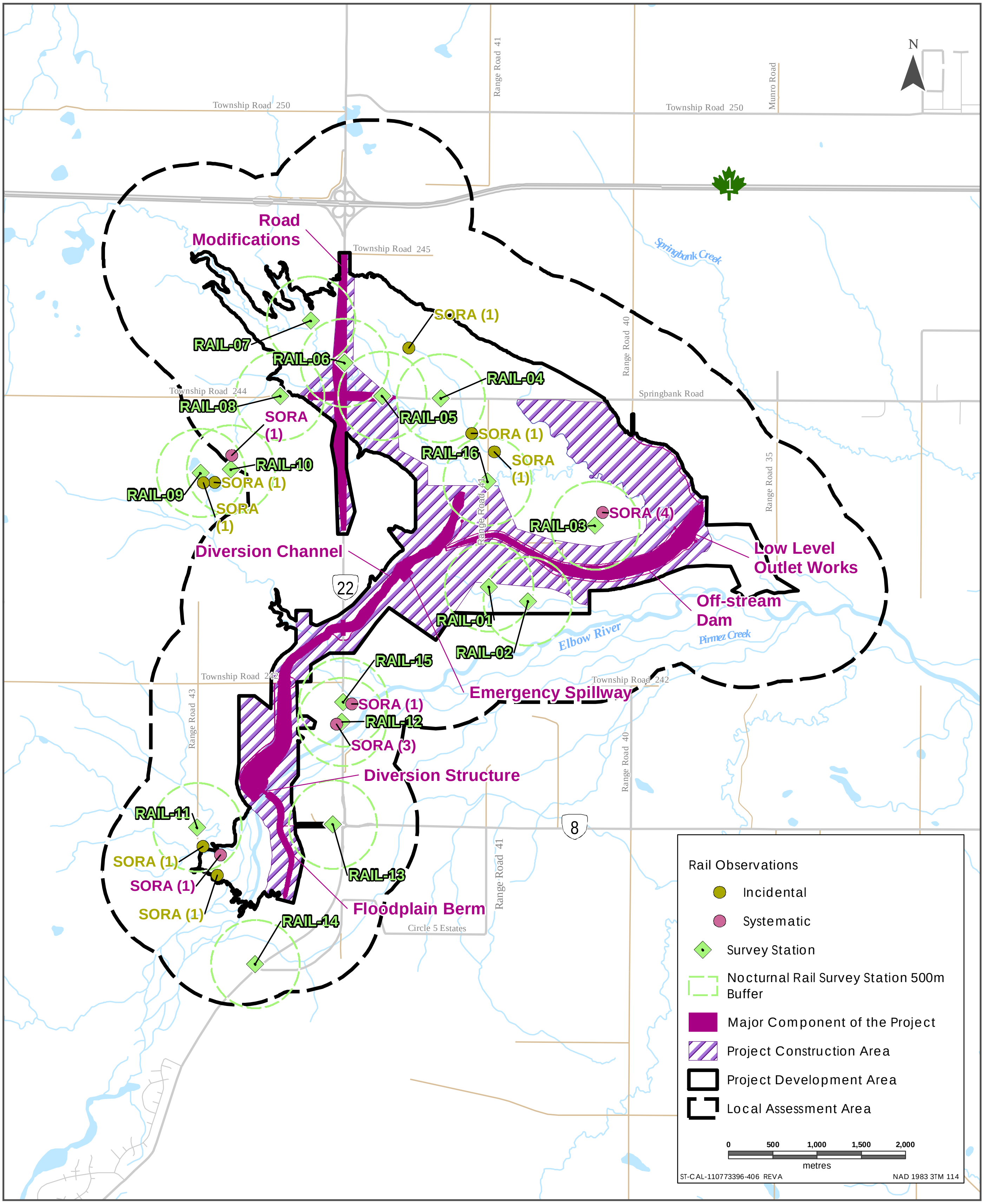
Two rounds of nocturnal rail call-playback surveys were conducted at 16 stations in the LAA. The first round was conducted on July 15, 2016. The second round was conducted on July 24 and July 27, 2016 due to unsuitable weather conditions half way through the July 24 visit. Otherwise, weather conditions were suitable during the survey periods. The average temperature during the rail survey period was 8°C and ranged between 2°C and 15°C.

One species of rail, sora, was observed during the surveys. Sora were observed at 5 of the 16 stations (a detected occupancy rate of 31%), with a total maximum count of 10 sora observed over all 16 stations (Table 3-5). Five sora were incidentally observed within the LAA during nocturnal rail surveys, and two sora were incidentally observed on breeding bird and visual amphibian surveys (Figure 3-3).

Table 3-5 The Number of Sora Observed during Nocturnal Rail Surveys

Nocturnal Rail Survey Station	Habitat Type [a]	Maximum Number of Sora Observed
RAIL-01	MGII, MGIII, FSmr	0
RAIL-02	FSmr, MGIII, Open Water	0
RAIL-03	MGII, MGIII, MGIV	4
RAIL-04	Open Water, MGII, MGIII, MGIV, SSIII	0
RAIL-05	MGII, MGIII, MGIV, Open Water	0
RAIL-06	MGII, MGIII, MGIV	0
RAIL-07	MGII, MGIII, WAV	0
RAIL-08	MGII, MGIII, MGIV, WAV, DgRe	0
RAIL-09	MGIII, WAV	0
RAIL-10	MGIII, MGIV, WAV	1
RAIL-11	Open Water, MGII	1
RAIL-12	Open Water, MGIII, MGIV, DgRe	3
RAIL-13	DgRe	0
RAIL-14	MGIII, MGIV	0
RAIL-15	Open Water, MGII, MGIII, MGIV, DgRe	1
RAIL-16	MGII, MGIII, Open Water	0
Grand Total	**N/A**	**10**

NOTE:
[a] Habitat types are defined in Table 3-1.



Sources: Base Data - Government of Alberta, Government of Canada, Thematic Data - Stantec Ltd.

Nocturnal Rail Survey Locations and Observations in the LAA

Stantec

Figure 3-3

During rail surveys, rails were most often observed in Class IV wetlands (n=7 observations) and were also observed in Class D waterbody (n=1), and Class III (n=1) and Class V wetlands (n=1) (Table 3-6).

Table 3-6 Habitat Types Occupied by Sora During 2016 Nocturnal Rail Surveys

Habitat Type [a]	Maximum Count of Sora
Open Water	1
MGIII	1
MGIV	7
WAV	1
Total	**10**
NOTE: [a] Habitat types are defined in Table 3-1	

3.4 RAPTOR NEST SURVEYS

Seven species of raptor, including three SOMC—bald eagle (*Haliaeetus leucocephalus*), osprey (*Pandion haliaetus*), and American kestrel (*Falco sparverius*)—were observed in the LAA (Figure 3-4).

Fifteen active and potential raptor nests were identified during raptor nest surveys and incidentally on other surveys (Figure 3-4). No heron rookeries were found in the LAA. Ten active raptor nests of five species were observed including osprey, red-tailed hawk (*Buteo jamaicensis*), Swainson's hawk (*Buteo swainsoni*), bald eagle, and long-eared owl (*Asio otus*). Five potential raptor nests were either inactive or were occupied by a non-raptor species including mallard (*Anas platyrhynchos*), American crow (*Corvus brachyrhynchos*) and common raven (*Corvus corax*) (Table 3-7).

3.5 WATERBIRD SURVEYS

Waterbird surveys were completed in conjunction with breeding bird surveys with one visit conducted between June 9 and June 11, 2016 and a second visit between June 21 and June 23, 2016. Waterbirds were also recorded as incidental observations during other wildlife surveys.

A total of 160 adults of 16 species were observed including two SOMC: great blue heron (*Ardea herodias*) and sora, which are considered *sensitive* under the *General Status of Alberta Wild Species* (Government of Alberta 2017) (Table 3-8; Figure 3-4). The most common waterbird species observed was mallard, followed by Canada goose (*Branta canadensis* [Table 3-8]).

Table 3-7 Active and Potential Raptor Nests Observed in the LAA

Nest ID	Nest Type	Nest Status	Species	Scientific Name	Recommended Setback (m)	SARA [a]	COSEWIC [b]	AWA [c]	AEP [d]
NP001	Platform nest	Active	Osprey	*Pandion haliaetus*	750[e]	N/A	N/A	N/A	Sensitive
NP002	Platform nest	Inactive	N/A	N/A	N/A	N/A	N/A	N/A	N/A
NT001	Tree stick nest	Active	Red-tailed hawk	*Buteo jamaicensis*	100[f]	N/A	N/A	N/A	N/A
NT002	Tree stick nest	Active	Bald eagle	*Haliaeetus leucocephalus*	1000[e]	N/A	N/A	N/A	Sensitive
NT003	Tree stick nest	Active	Red-tailed hawk	*Buteo jamaicensis*	100[f]	N/A	N/A	N/A	N/A
NT004	Tree stick nest	Active	Red-tailed hawk	*Buteo jamaicensis*	100[f]	N/A	N/A	N/A	N/A
NT005	Tree stick nest	Active	Red-tailed hawk	*Buteo jamaicensis*	100[f]	N/A	N/A	N/A	N/A
NT006	Tree stick nest	Active	Red-tailed hawk	*Buteo jamaicensis*	100[f]	N/A	N/A	N/A	N/A
NT007	Tree stick nest	Active	Long-eared owl	*Asio otus*	100[f]	N/A	N/A	N/A	N/A
NT008	Tree stick nest	Active (Non-raptor)	Mallard	*Anas platyrhynchos*	N/A	N/A	N/A	N/A	N/A
NT009	Tree stick nest	Active (Non-raptor)	American crow	*Corvus brachyrhynchos*	N/A	N/A	N/A	N/A	N/A
NT010	Tree stick nest	Inactive	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 3-7 Active and Potential Raptor Nests Observed in the LAA

Nest ID	Nest Type	Nest Status	Species	Scientific Name	Recommended Setback (m)	SARA [a]	COSEWIC [b]	AWA [c]	AEP [d]
NT011	Tree stick nest	Active	Red-tailed hawk	*Buteo jamaicensis*	100[f]	N/A	N/A	N/A	N/A
NT012	Tree stick nest	Active	Swainson's hawk	*Buteo swainsoni*	100[f]	N/A	N/A	N/A	N/A
NT013	Tree stick nest	Active (Non-raptor)	Common raven	*Corvus corax*	N/A	N/A	N/A	N/A	N/A

NOTES:

[a] Government of Canada 2017
EN (endangered), TH (threatened), SC (special concern), IR (in review – year of assessment by COSEWIC)

[b] COSEWIC 2016
EN (endangered), TH (threatened), SC (special concern), IR (in review – year of assessment by COSEWIC)

[c] Government of Alberta 2015
EN (endangered), TH (threatened), SC (special concern), DD (data deficient), -R (status recommended but not yet approved)

[d] Government of Alberta 2017
AR (at risk), MAR (may be at risk), S (sensitive), UD (undetermined)

[e] SRD 2011

[f] Stantec Recommended Setback; requires consultation with AEP

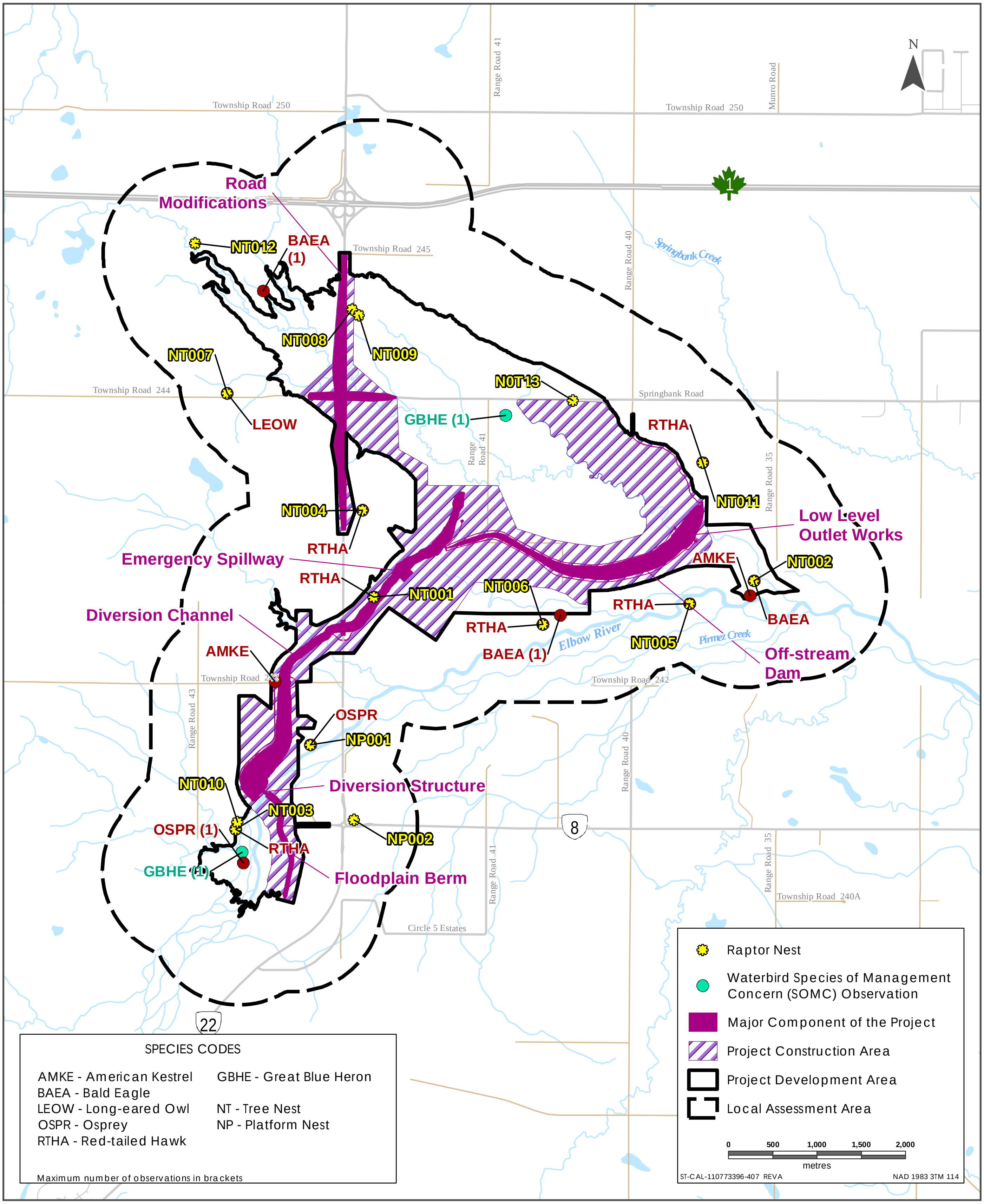
Table 3-8 Waterbird Species Observed in the LAA

Species Name	Scientific Name	Species Status				Count of Adults	Count of Broods
		SARA [a]	COSEWIC [b]	AWA [c]	AEP [d]		
Canada goose	*Branta canadensis*	-	-	-	-	16	5
Gadwall	*Anas strepera*	-	-	-	-	10	0
Mallard	*Anas platyrhynchos*	-	-	-	-	53	1
Blue-winged teal	*Anas discors*	-	-	-	-	12	0
Northern shoveler	*Anas clypeata*	-	-	-	-	1	0
Northern pintail	*Anas acuta*	-	-	-	-	1	1
Green-winged teal	*Anas crecca*	-	-	-	-	14	0
Lesser scaup	*Aythya affinis*	-	-	-	-	4	0
Common merganser	*Mergus merganser*	-	-	-	-	1	0
Common loon	*Gavia immer*	-	-	-	-	1	0
Great blue heron	*Ardea herodias*	-	-	-	*sensitive*	2	0
Sora [f]	*Porzana carolina*	-	-	-	*sensitive*	12	0
Killdeer	*Charadrius vociferus*	-	-	-	-	10	0

Table 3-8 Waterbird Species Observed in the LAA

Species Name	Scientific Name	Species Status				Count of Adults	Count of Broods
		SARA [a]	COSEWIC [b]	AWA [c]	AEP [d]		
Spotted sandpiper	*Actitis macularius*	-	-	-	-	10	0
Wilson's snipe	*Gallinago delicata*	-	-	-	-	12	0
Franklin's gull	*Leucophaeus pipixcan*	-	-	-	-	1	0
Total		**n/a**	**n/a**	**n/a**	**5**	**160**	**7**

NOTES:
[a] Government of Canada 2017
EN (endangered), TH (threatened), SC (special concern), IR (in review – year of assessment by COSEWIC)
[b] COSEWIC 2016
EN (endangered), TH (threatened), SC (special concern), IR (in review – year of assessment by COSEWIC)
[c] Government of Alberta 2015
EN (endangered), TH (threatened), SC (special concern), DD (data deficient), -R (status recommended but not yet approved)
[d] Government of Alberta 2017
AR (at risk), MAR (may be at risk), S (sensitive), UD (undetermined)
[f] Unique observations from nocturnal rail surveys and incidental observations.



Sources: Base Data - Government of Alberta, Government of Canada, Thematic Data - Stantec Ltd.

Waterbird and Raptor SOMC Observations and Raptor Nests in the LAA

Stantec

Figure 3-4

3.6 REMOTE CAMERA SURVEY

Ten cameras were deployed on April 26, 2016 (Figure 2-1). Cameras were checked and cards replaced on September 7, 2016 and January 5, 2017. Remote camera surveys were completed and cameras collected on March 21, 2017. Remote camera observations from April 26, 2016 to March 21, 2017 are summarized in this report by season.

Nine cameras (all cameras except CAM-05) were operational for the entire period between April 26, 2016 and March 21, 2017 (329 days). CAM-05 was dislodged from its housing by a moose on October 19, 2016 was not operational until it was replaced on January 13, 2017 as it and required replacing. A total of 3,207 camera days collected 116,186 images from all stations.

3.6.1 Relative Abundance

Nine medium to large species of mammal were recorded during the sampling period (Table 3-9; see Section 5.0 for example photos). CAM-08 deployed along a human trail near the Elbow River recorded the highest number of species (n = 8) (Table 3-9). Two species of small mammal (striped skunk [*Mephitis mephitis*] and snowshoe hare [*Lepus americanus*]) and five species of bird (Canada goose, mallard, red-tailed hawk, black-billed magpie [*Pica hudsonia*], and American crow) were recorded and included as incidental observations during the remote camera survey.

CAM-01, deployed along a wildlife trail near the Elbow River, recorded the highest overall activity with 229.2 detections per 100 camera-days (n=754), followed by CAM-04 with 191.8 detections per 100 camera-days(n=631). CAM-02 recorded the lowest activity with 13.4 observations per 100 days (n=44) (Table 3-9).

White-tailed deer (*Odocoileus virginianus*) were the most commonly detected species (n=2654), followed by elk (*Cervus canadensis*) (n=856). White-tailed deer were observed at all stations, and above average activity was recorded at CAM-03 (n=349), CAM-04 (n=548), CAM-08 (n=365) and CAM-09 (n=295). Elk were recorded at eight stations, with above average activity at CAM-01 (n=492), CAM-03 (n=185) and CAM-08 (n=78); these three stations comprised 88%of all elk observations.

Some species and stations observed seasonal change in activity, while others remained relatively constant (Table 3-9). Mule deer and white-tailed deer observed seasonal variation in activity levels between stations. Overall, highest activity levels of deer were observed during winter. Seasonal variation was observed in elk activity, with the majority of spring and summer activity recorded at CAM-01 and CAM-08, higher levels of fall activity at CAM-01 and CAM-03, and the majority of winter activity at CAM-03, CAM-04, CAM-05 and CAM-06. Across the LAA, elk activity was relatively consistently reported over the survey period. Moose were frequently observed across the LAA with similar activity across seasons.

Table 3-9 Summary of Remote Camera Observations by Season from April 26 to March 21, 2016

Remote Camera Station	Season [a]	Detections per 100 Camera Days										
		Cougar	Coyote	Red Fox	Black Bear	Grizzly Bear	Moose	Elk	Mule Deer	White-tailed Deer	Unidentified Deer	All Species
CAM-01	Spring	0.0	0.0	2.9	0.0	0.0	37.1	54.3	0.0	85.7	0.0	18.0
	Summer	1.1	0.0	0.0	0.0	0.0	22.8	390.2	69.6	46.7	5.4	53.6
	Fall	3.3	0.0	0.0	0.0	0.0	7.7	120.9	15.4	35.2	0.0	19.1
	Winter	0.0	0.9	2.7	0.0	0.0	0.9	3.6	12.7	8.2	0.0	29.1
CAM-02	Spring	2.9	11.4	0.0	0.0	0.0	0.0	0.0	0.0	2.9	0.0	1.7
	Summer	0.0	3.3	0.0	0.0	0.0	0.0	0.0	1.1	9.8	0.0	1.4
	Fall	5.5	1.1	1.1	0.0	3.3	0.0	0.0	0.0	13.2	0.0	2.5
	Winter	0.0	0.0	1.8	0.0	0.0	0.9	0.0	0.0	0.0	0.0	2.7
CAM-03	Spring	0.0	22.9	0.0	0.0	0.0	17.1	2.9	0.0	157.1	0.0	20.0
	Summer	0.0	9.8	0.0	0.0	0.0	25.0	7.6	0.0	187.0	0.0	22.9
	Fall	0.0	1.1	0.0	0.0	0.0	6.6	128.6	0.0	64.8	0.0	21.1
	Winter	0.0	10.0	0.0	0.0	0.0	8.2	54.5	0.0	57.3	0.0	130.0
CAM-04	Spring	0.0	8.6	0.0	0.0	0.0	8.6	5.7	0.0	154.3	0.0	17.7
	Summer	0.0	18.5	0.0	0.0	0.0	6.5	2.2	0.0	270.7	5.4	30.3
	Fall	0.0	4.4	0.0	0.0	0.0	2.2	2.2	0.0	214.3	2.2	23.6
	Winter	0.0	9.1	0.0	0.0	0.0	2.7	20.0	0.0	45.5	0.0	77.3

Table 3-9 Summary of Remote Camera Observations by Season from April 26 to March 21, 2016

Remote Camera Station	Season [a]	Detections per 100 Camera Days										
		Cougar	Coyote	Red Fox	Black Bear	Grizzly Bear	Moose	Elk	Mule Deer	White-tailed Deer	Unidentified Deer	All Species
CAM-05	Spring	0.0	11.4	0.0	0.0	0.0	5.7	0.0	0.0	120.0	2.9	14.0
	Summer	0.0	0.0	0.0	0.0	0.0	7.6	0.0	2.2	73.9	0.0	8.4
	Fall [b]	0.0	2.1	0.0	0.0	0.0	16.7	0.0	0.0	10.4	0.0	1.6
	Winter [b]	0.0	0.0	0.0	0.0	0.0	1.5	49.3	0.0	1.5	0.0	52.2
CAM-06	Spring	0.0	0.0	0.0	0.0	0.0	5.7	11.4	0.0	65.7	5.7	8.9
	Summer	0.0	6.5	0.0	0.0	0.0	0.0	2.2	0.0	57.6	1.1	6.7
	Fall	0.0	5.5	0.0	0.0	0.0	0.0	0.0	0.0	24.2	0.0	3.1
	Winter	0.0	10.0	0.0	0.0	0.0	3.6	20.0	0.0	7.3	0.0	40.9
CAM-07	Spring	0.0	0.0	2.9	0.0	0.0	0.0	0.0	0.0	71.4	0.0	7.4
	Summer	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	77.2	1.1	7.9
	Fall	2.2	0.0	0.0	0.0	0.0	0.0	0.0	3.3	57.1	0.0	6.6
	Winter	0.0	3.6	0.0	0.0	0.0	0.0	0.0	0.0	89.1	0.0	92.7
CAM-08	Spring	0.0	2.9	2.9	0.0	0.0	2.9	151.4	2.9	225.7	0.0	38.9
	Summer	4.3	1.1	2.2	0.0	0.0	2.2	20.7	32.6	97.8	0.0	16.1
	Fall	6.6	23.1	1.1	0.0	1.1	3.3	6.6	4.4	116.5	0.0	17.1
	Winter	0.0	0.9	0.9	0.0	0.0	3.6	0.0	0.0	81.8	0.0	87.3

Table 3-9 Summary of Remote Camera Observations by Season from April 26 to March 21, 2016

Remote Camera Station	Season [a]	Detections per 100 Camera Days										
		Cougar	Coyote	Red Fox	Black Bear	Grizzly Bear	Moose	Elk	Mule Deer	White-tailed Deer	Unidentified Deer	All Species
CAM-09	Spring	0.0	0.0	2.9	0.0	0.0	5.7	8.6	0.0	151.4	0.0	16.9
	Summer	0.0	0.0	1.1	2.2	0.0	2.2	2.2	30.4	92.4	1.1	13.2
	Fall	0.0	0.0	1.1	0.0	0.0	11.0	0.0	13.2	100.0	0.0	13.1
	Winter	0.0	6.4	1.8	0.0	0.0	7.3	0.0	0.0	60.0	0.0	75.5
CAM-10	Spring	0.0	0.0	2.9	0.0	0.0	5.7	5.7	5.7	120.0	0.0	14.0
	Summer	0.0	3.3	1.1	0.0	0.0	0.0	2.2	45.7	80.4	5.4	13.8
	Fall	5.5	7.7	0.0	0.0	0.0	6.6	3.3	15.4	131.9	0.0	17.9
	Winter	4.5	8.2	0.0	0.0	0.0	1.8	0.0	0.0	233.6	0.0	248.2
All Stations	Spring	0.3	5.7	1.4	0.0	0.0	8.9	24.0	0.9	115.4	0.9	157.4
	Summer	0.5	4.2	0.4	0.3	0.0	6.6	42.7	18.2	99.3	2.0	174.3
	Fall	2.4	4.6	0.3	0.0	0.5	4.8	27.5	5.4	80.0	0.2	125.8
	Winter	0.5	5.1	13.3	3.1	1.3	0.8	60.7	84.9	0.5	5.1	13.3

NOTES:
[a] Spring: April to May; Summer: June to August; Fall: September to November; Winter: December to March
[b] Camera was not operational between October 19, 2016 and January 13, 2017

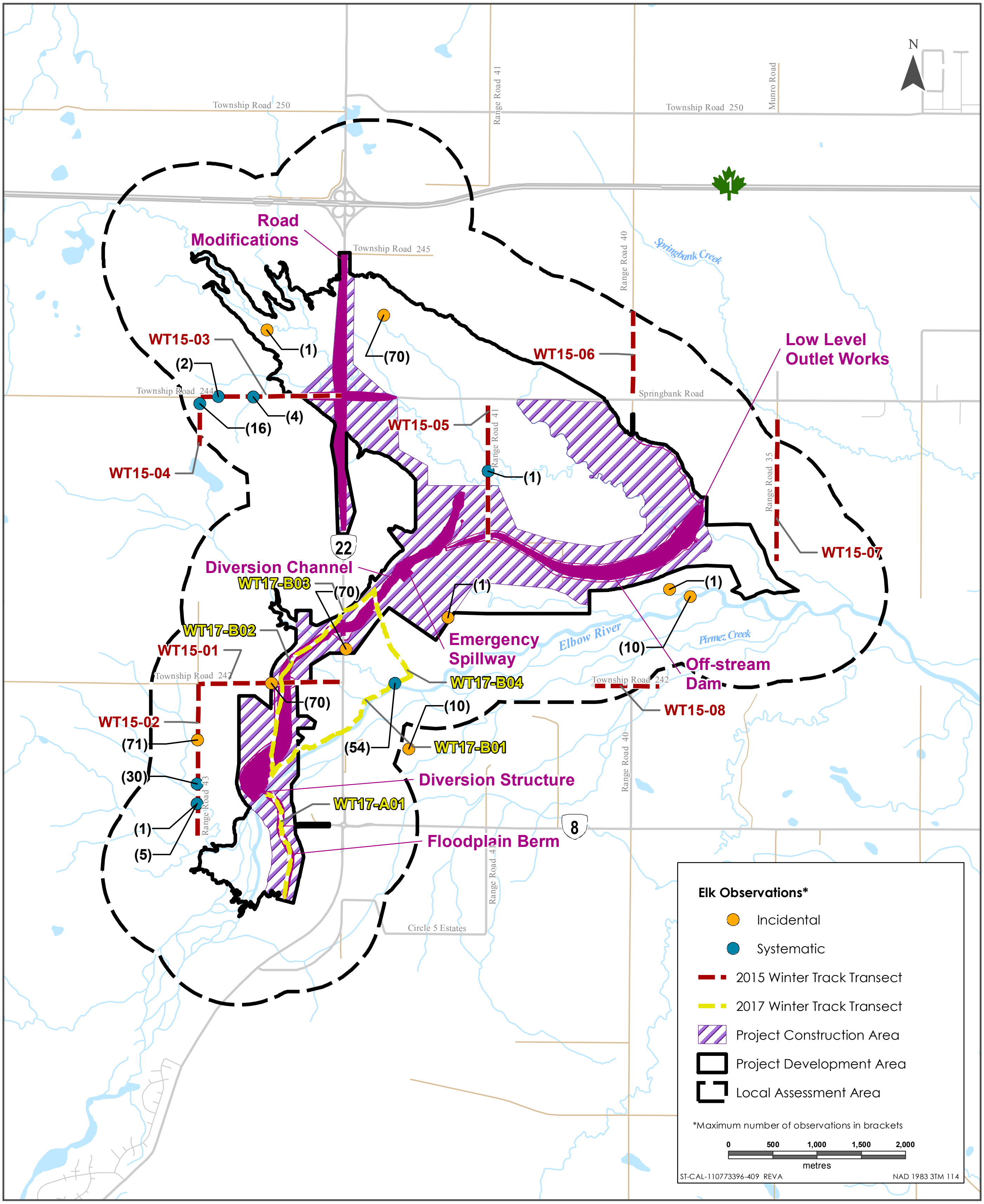
Carnivores were less frequently observed and seasonal variation was less pronounced than in ungulates. Cougar (*Puma concolor*) was sparsely reported at stations along the Elbow River; the majority of cougar observations were during fall. Coyote (*Canis latrans*) and red fox (*Canis vulpes*) were infrequently recorded across the LAA with consistent activity across seasons. Black bear (*Ursus americanus*) and grizzly bear (*Ursus arctos*) were both infrequently observed. Both black and grizzly bear were only observed at stations along the Elbow River. All black bear observations were during the summer, and all grizzly bear observations were during the fall.

3.7 WINTER TRACKING SURVEY

3.7.1 2015 Survey

A winter track survey was completed on February 4, 2015 in the LAA under fresh snow conditions. Snow coverage was 100 % throughout the survey area. Average snow depth was 7 cm and varied from 6 cm to11 cm. Temperatures ranged from 0°C to 2°C. Eight transects comprising a total of 10.5 km were surveyed in the LAA. Days since last snowfall was approximately 1.7 days. Due to access restrictions, track surveys were conducted along roadsides through representative portions of the LAA (see Figure 3-5).

Six wildlife species were identified during the winter track survey (Table 3-10). Track counts were highest for coyote and deer followed by elk. Elk tracks were observed most frequently west of Highway 22 adjacent to Township Road 244 and Range Road 43, where agricultural and shrublands occur (Table 3-10; Figure 3-5).



Sources: Base Data - Government of Alberta, Government of Canada, Thematic Data - Stantec Ltd.

Winter Track Survey Transects and Elk Observations in the LAA

Table 3-10 Wildlife Track Abundance for each Species Observed during the 2015 Winter Track Survey

Survey Transect	Track Count (number of tracks/km-day)						Number of Species Observed	Habitat Type adjacent to road transect
	Coyote	Elk	Red fox	Snowshoe hare	Unidentified deer	Unidentified microtine		
WT15-01	1.9	0.0	0.0	0.0	3.7	1.9	3	crop, hayland, tame pasture
WT15-02	8.4	21.9	0.0	0.0	0.0	0.0	2	crop, tame pasture
WT15-03	5.8	2.9	0.0	3.3	10.6	1.1	5	shrubland, crop, deciduous forest
WT15-04	2.1	14.6	0.0	0.0	10.5	0.0	3	crop, hayland
WT15-05	16.0	0.4	0.0	0.0	3.2	0.0	3	tame pasture, shrubland
WT15-06	2.3	0.0	0.0	2.8	3.4	0.0	3	tame pasture, aspen forest, hayland
WT15-07	13.5	0.0	0.0	0.0	17.0	2.1	3	crop, hayland tame pasture, native prairie
WT15-08	0.0	0.0	1.7	5.9	0.8	0.8	4	tame pasture, conifer forest
Mean	**7.6**	**4.9**	**0.1**	**1.2**	**6.4**	**0.8**	**6**	

3.7.2 2017 Survey

A winter track survey was completed on January 13 and 14, 2017. Average snow depth during the survey was 22 cm and varied from 15 cm to 32 cm. Snow coverage was 100 % throughout the survey area. Temperatures ranged from -14° C to -7°C. Five transects comprising a total of 7.1 km were surveyed in the LAA (Figure 3-5). Days since last snowfall ranged from 3.3 days to 4.3 days.

Seven species were identified during the 2017 winter track survey (Table 3-11). Deer tracks were the most frequently observed followed by elk and moose. Although deer tracks were encountered on all transects, track counts were highest near the proposed floodplain berm (Table 3-11). Elk tracks were only observed along the Elbow River, and counts of moose track were highest in the area between the diversion channel and the Elbow River. Except for deer, relatively few wildlife tracks were observed near the diversion channel (Table 3-11).

Although elk tracks were observed along the Elbow River near Highway 22, no elk tracks were observed crossing under the Highway 22 bridge (Figure 3-5). Elk appear to be deflected at the bridge, which is likely related to the large rip-rap present under the bridge. On one occasion, an estimated 70 elk (tracks) were incidentally observed crossing Highway 22, north of the Elbow River bridge, near Pirmez Creek (Figure 3-5).

North of the Highway 22 and Springbank Road intersection there are two culverts that cross under Highway 22, one with a height of 167 cm and a larger one with a height of 300 cm, measured from the ground. These culverts were visited to assess potential wildlife use during the winter track survey. Two sets of unidentified deer tracks were observed in the smaller culvert and no wildlife tracks observed in the larger culvert. A crossing location of approximately 70 elk was observed 150 m north of the two culverts over Highway 22, indicating these culverts are not selected by elk.

Table 3-11 Wildlife Track Abundance for each Species Observed during the 2017 Winter Track Survey

Survey Transect	Track Count (tracks/km-day)							Overall Species Richness	Rationale for Transect Placement
	Coyote	Elk	Ermine	Moose	Unidentified Deer	Unidentified microtine	Unidentified weasel		
WT17-A01	0.4	0.0	0.0	0.0	19.5	0.9	0.0	3	To determine wildlife movement across the proposed floodplain berm
WT17-B01	1.2	6.0	0.0	0.6	8.2	1.0	0.0	5	To determine wildlife movement along the Elbow River and under the Highway 22 bridge
WT17-B02	0.9	0.0	0.0	0.0	4.7	0.2	0.0	3	To determine wildlife movement across the proposed diversion channel
WT17-B03	0.0	0.0	0.0	0.0	1.7	0.0	0.5	2	To determine wildlife movement across the proposed diversion channel
WT17-B04	0.3	0.0	0.3	6.4	2.8	0.8	0.0	5	To determine wildlife movement between the proposed diversion channel and Elbow River
Mean	**0.6**	**1.8**	**0.04**	**1.2**	**7.7**	**0.6**	**0.1**	**6** [a]	

NOTE:
[a] Does not include unidentified weasel (ermine is included in this species grouping)

Stantec

3.7.3 Elk Movement Observations

Elk was frequently recorded in all seasons from remote camera surveys, winter track surveys, and incidental observations. While elk records were wide ranging over the LAA, the largest concentrations (~70 individuals) were recorded north of the Elbow River near Township Road 242 approximately 1 km west of Highway 22, crossing Highway 22 approximately 1 km north of the Elbow River bridge (this herd kept travelling west across pasture and cultivation north of the Elbow River towards the western edge of the LAA), as well as an area of pasture and wet shrub habitat east of Highway 22 between Springbank Road and the Trans-Canada Highway (Figure 3-5). Movements of elk were relatively consistent between 2015, 2016 and 2017 surveys.

3.8 SPECIES OF MANAGEMENT CONCERN

Twenty-six SOMC, including 15 birds and 11 mammals were observed during field surveys between 2015 and 2017 (Table 3-12; Figure 2-1; Figure 3-1). Three of the five key indicators were also observed. Olive-sided flycatcher was recorded during breeding bird surveys in mature conifer habitat along the Elbow River floodplain west of Highway 22 (Figure 3-1). Grizzly bear was infrequently recorded in summer and fall from remote camera surveys and incidental observations of sign (tracks and kill site). All grizzly bear observations were restricted to the banks of the Elbow River (Figure 2-1). Elk were observed in several locations within the LAA (see section 3.6 and 3.7).

Two species of swallow SOMC, bank swallow (*Riparia riparia*) and barn swallow (*Hirundo rustica*), were observed during field surveys. Swallows often nest colonially and were therefore not included in the breeding bird survey analysis; however, swallow colonies are typically used annually and are therefore considered important wildlife features. Three swallow colonies were observed in the LAA belonging to bank swallow, barn swallow, and cliff swallow (*Petrochelidon pyrrhonota*) (Figure 3-1). The barn swallow and cliff swallow colonies were observed on anthropogenic structures in the LAA. Barn swallow nests were observed at a culvert running under Highway 22, and cliff swallow nests were observed at Kamp Kiwanis (Figure 3-1). The bank swallow colony was observed in riparian habitat along the Elbow River (Figure 3-1).

Table 3-12 Potential, Historical and Observed Wildlife SOMC in the RAA

Common Name	Scientific Name	SARA [a]	COSEWIC [b]	AWA [c]	AEP [d]	Habitat Association	FWMIS [e]	Observed [f]
Birds								
trumpeter swan [g]	*Cygnus buccinators*		NAR	SC	S	Shallow lakes, marshes and ponds, wooded swamps	✓	
harlequin duck [g]	*Histrionicus histrionicus*			SC	S	Fast flowing streams and rivers		
ruffed grouse [g]	*Bonasa umbellus*					Mixed and broadleaf forest		
spruce grouse [g]	*Falcipennis canadensis*					Coniferous forest		
sharp-tailed grouse [g]	*Tympanuchus phasianellus*				S	Native grassland and tame pasture		
pied-billed grebe	*Podilymbus podiceps*				S	Seasonal or permanent wetlands with emergent vegetation	✓	
horned grebe	*Podiceps auritus*	SC	SC		S	Shallow, graminoid ponds and marshes	✓	
western grebe	*Aechmophorus occidentalis*	SC	SC	TH	AR	Lakes and marshes with large open area		
American white pelican	*Pelecanus erythrorhynchos*		NAR		S	Islands on lakes for breeding, forage in marshes, lakes, or rivers		
American bittern	*Botaurus lentiginosus*				S	Graminoid marsh		
great blue heron	*Ardea herodias*				S	Swamps or islands on lakes		✓

Table 3-12 Potential, Historical and Observed Wildlife SOMC in the RAA

Common Name	Scientific Name	SARA [a]	COSEWIC [b]	AWA [c]	AEP [d]	Habitat Association	FWMIS [e]	Observed [f]
black-crowned night-heron	*Nycticorax nycticorax*				S	Swamps, streams, rivers, marshes		
white-faced Ibis	*Plegadis chihi*				S	Marshes and swamps		
osprey	*Pandion haliaetus*				S	Large trees, typically broadleaf, and man-made structures near waterbodies with fish		✓
bald eagle [g]	*Haliaeetus leucocephalus*		NAR		S	Large trees, typically broadleaf, and man-made structures near waterbodies with fish		✓
northern goshawk	*Accipiter gentilis (atricapillus)*		NAR		S	Mature mixed and broadleaf forest		
broad-winged hawk	*Buteo platypterus*				S	Broadleaf or coniferous forest		
golden eagle [g]	*Aquila chrysaetos*		NAR		S	Grassland, shrubland, riparian and coniferous forest		
yellow rail	*Coturnicops noveboracensis*	SC	SC		UD	Sedge marsh		
sora	*Porzana carolina*				S	Seasonal or semi-permanent graminoid marsh or wet meadows	✓	✓
sandhill crane	*Grus canadensis*				S	Isolated bogs, marshes, swamps; cultivated fields		

Table 3-12 Potential, Historical and Observed Wildlife SOMC in the RAA

Common Name	Scientific Name	SARA [a]	COSEWIC [b]	AWA [c]	AEP [d]	Habitat Association	FWMIS [e]	Observed [f]
black-necked stilt	*Himantopus mexicanus*				S	Shallow graminoid marsh, saline shallow open water		
upland sandpiper	*Bartramia longicauda*				S	Native grassland		
long-billed curlew	*Numenius americanus*	SC	SC	SC	S	Native grassland		
red knot	*Calidris canutus (rufa)*	EN	EN		MAR	Saline, shallow marsh with open mudflats		
Caspian tern	*Hydroprogne caspia*		NAR		S	Islands on large marshes and lakes		
black tern	*Chlidonias niger*		NAR		S	Shallow marshes, semi-permanent ponds		
Forster's tern	*Sterna forsteri*				S	Islands or floating vegetation in marshes or streams		
northern pygmy-owl	*Glaucidium gnoma*				S	Mature coniferous forest; open forests		
barred owl	*Strix varia*			SC	S	Old growth broadleaf or mixed forest	✓	
great gray owl	*Strix nebulosa*		NAR		S	Coniferous forest		
short-eared owl	*Asio flammeus*	SC	SC		MAR	Open graminoid fens, bogs and grasslands		
common nighthawk	*Chordeiles minor*	TH	TH		S	Grassland, clear-cut areas of forest, gravel		

Table 3-12 Potential, Historical and Observed Wildlife SOMC in the RAA

Common Name	Scientific Name	SARA [a]	COSEWIC [b]	AWA [c]	AEP [d]	Habitat Association	FWMIS [e]	Observed [f]
pileated woodpecker	*Dryocopus pileatus*				S	Mixed and broadleaf forest		
American kestrel	*Falco sparverius*				S	Grassland, meadows, agricultural fields with broadleaf or mixedwood tree stands		✓
peregrine falcon	*Falco peregrinus*	SC	SC	TH	AR	Cliffs, grassland, shrubland	✓	
prairie falcon	*Falco mexicanus*		NAR	SC	S	Cliffs; grassland, shrubland	✓	
olive-sided flycatcher	*Contopus cooperi*	TH	TH		MAR	Old growth and mature coniferous and mixed forests, near open areas/edges; burns, with tall trees, dead standing trees	✓	✓
western wood-pewee	*Contopus sordidulus*				MAR	Broadleaf and mixed forest near riparian zones	✓	✓
alder flycatcher	*Empidonax alnorum*				S	Brush and shrubby wetlands		✓
least flycatcher	*Empidonax minimus*				S	Open broadleaf and mixed forest	✓	✓
eastern phoebe	*Sayornis phoebe*				S	Open broadleaf or mixed forest near water		
eastern kingbird	*Tyrannus tyrannus*				S	Open shrubland and woodlots, often near water		✓
loggerhead shrike	*Lanius ludovicianus excubitorides*	TH	TH	SC	S	Shrubland, agricultural land with hedgerows	✓	

Table 3-12 Potential, Historical and Observed Wildlife SOMC in the RAA

Common Name	Scientific Name	SARA [a]	COSEWIC [b]	AWA [c]	AEP [d]	Habitat Association	FWMIS [e]	Observed [f]
bank swallow	*Riparia riparia*	TH	TH		S	Banks of river, streams, and wetlands	✓	✓
barn swallow	*Hirundo rustica*	TH	TH		S	Near water in grassland, shrubland, open forest	✓	✓
Sprague's pipit [g]	*Anthus spragueii*	TH	TH	SC	S	Native grassland		
common yellowthroat	*Geothlypis trichas*				S	Graminoid marsh, shrubby and wooded swamp		
Cape May warbler	*Setophaga tigrina*			SC	S	Coniferous forest		✓
western tanager	*Piranga ludoviciana*				S	Coniferous and mixed forest		✓
Baird's sparrow	*Ammodramus bairdii*	SC	SC		S	Native grassland		
bobolink	*Dolichonyx oryzivorus*	TH	TH		S	Moist grassland, wet meadows		
rusty blackbird	*Euphagus carolinus*	SC	SC		S	Wet coniferous and mixed forest, fens, bogs, swamps		
Baltimore oriole	*Icterus galbula*				S	Mixed and broadleaf forest		✓

Table 3-12 Potential, Historical and Observed Wildlife SOMC in the RAA

Common Name	Scientific Name	SARA [a]	COSEWIC [b]	AWA [c]	AEP [d]	Habitat Association	FWMIS [e]	Observed [f]
Mammals								
red squirrel [g]	*Tamiasciurus hudsonicus*					Coniferous and mixed forests		✓
North American beaver [g]	*Castor canadensis*					Rivers, streams, lakes, marshes, swamps		
common muskrat [g]	*Ondatra zibethicus*					Rivers, streams, lakes, marshes, swamps		
North American porcupine [g]	*Erethizon dorsatum*					Mixed forests, shrubland, riparian areas with shrubs and trees		
snowshoe hare [g]	*Lepus americanus*					Forests with dense understory		✓
white-tailed jackrabbit [g]	*Lepus townsendii*					Grassland and shrubland		
silver-haired bat	*Lasionycteris noctivagans*				S	Old growth and mature forests		
eastern red bat	*Lasiurus borealis*				S	Broadleaf and mixed forest		
little brown myotis	*Myotis lucifugus*	EN	EN		MAR	Old growth forests with cavities, rock crevices, buildings	✓	
Canada Lynx [g]	*Lynx canadensis*		NAR		S	Coniferous and mixed forests	✓	
bobcat [g]	*Lynx rufus*				S	Forests, grassland, shrubland, coulees		

Table 3-12 Potential, Historical and Observed Wildlife SOMC in the RAA

Common Name	Scientific Name	SARA [a]	COSEWIC [b]	AWA [c]	AEP [d]	Habitat Association	FWMIS [e]	Observed [f]
cougar [g]	*Puma concolor*					Dense or open forests, shrubland, grassland, riparian areas		✓
coyote [g]	*Canis latrans*					Forests, shrubland, grassland, agricultural land		✓
grey wolf [g]	*Canis lupus*					Open forests, shrubland, grassland		
red fox [g]	*Vulpes vulpes*					Forests, shrubland, grassland, agricultural land		✓
black bear [g]	*Ursus americanus*					Open forests		✓
grizzly bear [g]	*Ursus artos*		SC	TH	AR	Grassland, shrubland, wet meadows, forest		✓
American marten [g]	*Martes americana*					Old growth coniferous or mixed forests		
short-tailed weasel [g]	*Mustela erminea*					Coniferous and broadleaf forests, meadows		
long-tailed weasel [g]	*Mustela frenata longicauda*		NAR		MAR	Grassland, shrubland, forests, agricultural land, marshes		
American mink [g]	*Neovison vison*					Forests, shrubland, grassland, riparian areas, urban areas; all near water		

Table 3-12 Potential, Historical and Observed Wildlife SOMC in the RAA

Common Name	Scientific Name	SARA [a]	COSEWIC [b]	AWA [c]	AEP [d]	Habitat Association	FWMIS [e]	Observed [f]
American badger [g]	*Taxidea taxus taxus*		SC	DD	S	Grassland, broadleaf forest, agricultural land		
moose [g]	*Alces americanus*					Mixed and broadleaf forest, marsh and swamps		✓
elk [g]	*Cervus elaphus*					Grassland, open shrubland, open forest		✓
mule deer [g]	*Odocoileus hemionus*					Coulees, grassland, open shrubland and forests		✓
white-tailed deer [g]	*Odocoileus virginianus*					Grassland, open shrubland and forest, riparian areas		✓
Amphibians								
western toad	*Anaxyrus boreas*	SC	SC		S	Graminoid marsh, swamps, shallow open water with emergent vegetation		
northern leopard frog	*Lithobates pipiens*	SC	SC	TH	AR	Graminoid marsh, swamps, shallow open water with emergent vegetation		
western tiger salamander	*Ambystoma mavortium*		SC			Semi-permanent and permanent wetlands	✓	

Table 3-12 Potential, Historical and Observed Wildlife SOMC in the RAA

Common Name	Scientific Name	SARA [a]	COSEWIC [b]	AWA [c]	AEP [d]	Habitat Association	FWMIS [e]	Observed [f]
Reptiles								
wandering (terrestrial) garter snake	*Thamnophis elegans vagrans*				S	Grassland, open forest, meadows, and riparian areas		
plains garter snake	*Thamnophis radix*				S	Grassland, open forest, agricultural areas, marshes, lakes		
red-sided garter snake	*Thamnophis sirtalis parietalis*				S	Grassland, open forest, agricultural areas, marshes, lakes		

NOTES:

[a] Government of Canada 2017
EN (endangered), TH (threatened), SC (special concern), IR (in review – year of assessment by COSEWIC)

[b] COSEWIC 2017
EN (endangered), TH (threatened), SC (special concern), IR (in review – year of assessment by COSEWIC)

[c] Government of Alberta 2015
EN (endangered), TH (threatened), SC (special concern), DD (data deficient), -R (status recommended but not yet approved)

[d] Government of Alberta 2017
AR (at risk), MAR (may be at risk), S (sensitive), UD (undetermined)

[e] Historical observations from the Fisheries and Wildlife Management Information System

[f] Stantec field observations Feb 2015-Jan 2017

[g] Species of traditional importance to Aboriginal communities

4.0 SUMMARY

Two rounds of breeding bird surveys were conducted at 54 stations. In total 67 songbird and woodpecker species were recorded during the survey (including incidental observations). Of these, 52 were included in the breeding bird density analysis. Six songbirds were SOMC, including one SARA-listed species: olive-sided flycatcher (see Figure 3-1). Other songbird SOMC observed incidentally included barn and bank swallow.

Two rounds of nocturnal amphibian surveys were conducted at 22 survey stations in the LAA. Two species of amphibian were detected: boreal chorus frog and wood frog. An estimated 52 boreal chorus frogs and 26 wood frogs were detected. No amphibian SOMC were observed in the LAA.

Two rounds of rail surveys were conducted at 16 stations. One species of rail, sora, an SOMC, was observed during rail surveys. Ten sora were observed within the LAA during rail surveys, and eight were observed incidentally.

Ten active and five potential raptor nests were observed in the LAA, including one active bald eagle nest and one active osprey nest.

Sixteen waterbird species, two of which are SOMC (great blue heron and sora) were identified in the LAA.

Nine medium to large species of mammal were recorded through remote cameras at 10 stations over 251 days, all of which are traditionally important species to Aboriginal communities, including elk and grizzly bear.

In 2015, the roadside winter tracking survey completed 10.5 km of transects, and in 2017, 7.1 km of winter tracking was completed. Between the 2015 and 2017 winter track surveys, nine species (or species groups) were observed, most of which are traditionally important species to Aboriginal communities.

5.0 EXAMPLES OF WILDLIFE SPECIES DETECTED IN THE LAA

Elk observed in shrubland habitat during summer – CAM01

Grizzly Bear observed in riparian habitat during fall – CAM02

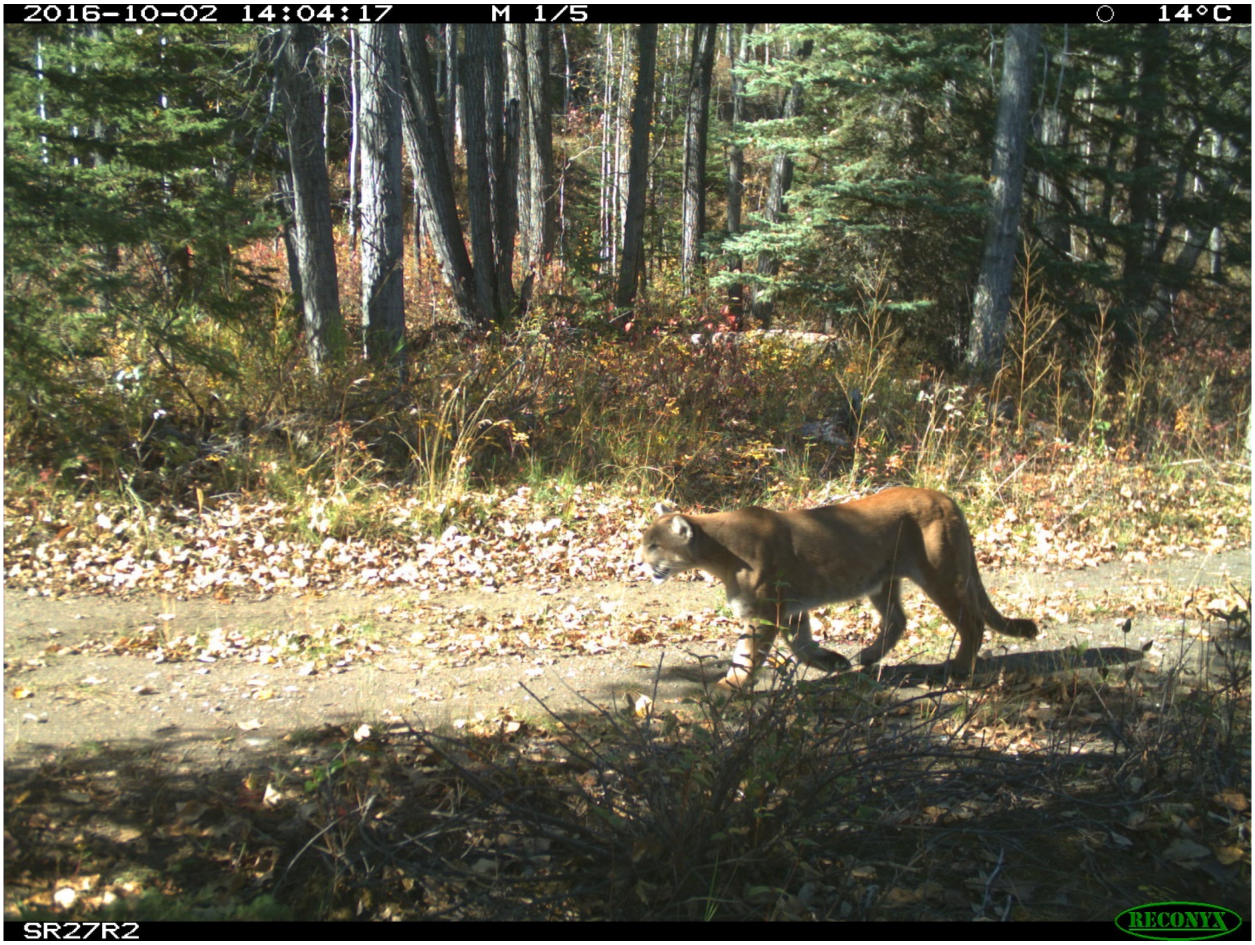
Elk observed in shrubland habitat during winter - CAM03

Coyote observed in grassland habitat during summer-CAM04

Moose observed in shrubland habitat during spring - CAM05

White-tailed deer observed in open shrubland habitat during summer-CAM06

Black bear observed along a wildlife trail in a mixedwood forest during summer- CAM07



Cougar observed along a human trail in a mixedwood forest during fall- CAM08

Red fox observed in a mixedwood forest during spring – CAM09

Mule deer observed along an ATV trail in a coniferous forest during summer – CAM 10

6.0 REFERENCES

Bazin, R. and F.B. Baldwin. 2007. Canadian Wildlife Service standardized protocol for the survey of Yellow Rails (*Coturnicops noveboracensis*) in prairie and northern region. Environment Canada, Winnipeg, MB.

Bibby, C.J., N.D. Burgess, D.A. Hill, and S. Mustoe. 2000. Bird Census Techniques. Second Edition. Academic Press, London.

COSEWIC (Committee on the Status of Endangered Wildlife). 2017. Committee on the Status of Endangered Wildlife in Canada. Accessed December 2017 from: https://www.canada.ca/en/environment-climate-change/services/committee-status-endangered-wildlife.html

eBird. 2016. eBird: An online database of bird distribution and abundance [web application]. eBird, Ithaca, New York. Accessed December 2016 from: http://www.ebird.org.

Environment Canada. 2013. Management Plan for the Yellow Rail (*Coturnicops noveboracensis*) in Canada. Species at Risk Act Management Plan Series. Environment Canada. Ottawa. iii + 24 pp.

ESRD. 2013. Sensitive Species Inventory Guidelines. Alberta Sustainable Resource Development, Fish and Wildlife Division, Edmonton, AB. Accessed December 2016 from: http://aep.alberta.ca/fish-wildlife/wildlife-management/documents/SensitiveSpeciesInventoryGuidelines-Apr18-2013.pdf.

Government of Alberta. 2015. Species Assessed by the Conservation Committee. Alberta Environment and Parks, Fish and Wildlife Division, Edmonton, Alberta. Accessed February 2017 from: http://open.alberta.ca/publications/species-assessed-by-alberta-s-endangered-species-conservation-committee-alberta-species-at-risk.

Government of Alberta. 2017. Alberta Wild Species General Status Listing – 2015. Alberta Environment and Parks. Accessed June 2017 from: http://aep.alberta.ca/fish-wildlife/species-at-risk/wild-species-status-search.aspx

Government of Canada. 2017. Species at Risk Public Registry. Accessed January 2017 from: http://www.registrelep-sararegistry.gc.ca/species/default_e.cfm.

MacKenzie, D.I, J.D. Nichols, G.B. Lachman, S. Droege, and J.A. Royle. 2002. Estimating site occupancy rates when detection probabilities are less than one. Ecology 83: 2248–2255.

MacKenzie, D. I., J.D. Nichols, J.A., Royle, K.H. Pollock, L.L. Bailey, and J.E. Hines. 2006. Occupancy estimation and modeling: inferring patterns and dynamics of species occurrence. Academic Press, 2006.

Mossman, M.J., L.M. Hartman, R.H. Hay, J.R. Sauer, and B.J. Dhuey. 1998. Monitoring long-term trends in Wisconsin frog and toad populations. Pp 169-198 In Lannoo, M.J. (ed). Status and Conservation of Midwestern Amphibians. University of Iowa Press, Iowa City, Iowa.

Ralph, C.J., G.R. Geupel, P. Pyle, T.E. Martin, D.F. DeSante. 1993. Handbook of field methods for monitoring landbirds. Gen. Tech. Rep. PSWGTR-144. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture; 41 p.

RIC (Resources Inventory Committee). 1998. Inventory Methods for Pond-breeding Amphibians and Painted Turtle. Standards for Components of British Columbia's Biodiversity No. 37. Prepared by Ministry of Environment, Lands and Parks Resources Inventory Branch for the Terrestrial Ecosystems Task Force Resources Inventory Committee. Available at: http://www.ilmb.gov.bc.ca/risc/pubs/tebiodiv/pond/assets/pond.pdf. Accessed January 2017.

Royle, J.A. 2004. Modelling abundance index data from anuran calling surveys. Conservation Biology 18: 1378-1385.

SRD (Alberta Sustainable Resource Development). 2011. Recommended Land Use Guidelines for Protection of Selected Wildlife Species and Habitat within Grassland and Parkland Natural Regions of Alberta. Fish and Wildlife Division, Sustainable Resource Development. Available at: http://aep.alberta.ca/fish-wildlife/wildlife-land-use-guidelines/documents/WildlifeLandUse-SpeciesHabitatGrasslandParkland-Apr28-2011.pdf. Accessed January 2017.

Thompson, I.D., I.J. Davidson, S. O'Donnell, and F. Brazeau. 1989. Use of track transects to measure the relative occurrence of some boreal mammals in uncut and regeneration stands. Canadian Journal of Zoology 67: 1816-1823.

USGS (United States Geological Survey). 2010. Northern American Amphibian Monitoring Program. Available at: http://www.pwrc.usgs.gov/naamp/.