the basis of the air quality assessment (CR #1 – Air Quality) and a screening level wildlife risk assessment (CR #12 – Human Health and Wildlife Screening).

**Table 3.2-8 Mortality Risk Ratings for Grizzly Bear in Relation to Road Density**

| Risk Rating | Road Density |
|---|---|
| High | >2.4 km/km$^2$ |
| Moderate | 0.6 – 2.4 km/km$^2$ |
| Low | <0.6 km/km$^2$ |

#### 3.2.5.4.4 Changes in Abundance

As with mortality risk and health, changes in wildlife abundance related to Project development are difficult to predict quantitatively at the WLSA, WRSA, and GBRSA scales. Wildlife abundance will most likely be influenced by the loss of suitable habitat, but might also be related to changes in movement, behaviour, habitat fragmentation, and mortality risk. Where possible, published species densities were used to determine potential loss of individuals from changes in habitat availability associated with the Project. Otherwise, changes in wildlife abundance related to other factors were evaluated qualitatively.

## 4.0 BASELINE CASE ASSESSMENT

The baseline case assessment includes existing environmental conditions and all existing projects and disturbances in the WLSA, WRSA, and GBRSA. Existing disturbances in the WLSA, WRSA, and the GBRSA were typically comprised of linear features (*i.e.* roads, pipeline ROWs, transmission lines, trails, and railways), well pads, agricultural lands (*e.g.* cultivated, pasture, *etc.*), rural residential areas, towns, and recreational areas (golf courses and ski hills).

### 4.1 Wildlife Health

Wildlife health was assessed on the basis of the air quality assessment (CR #1 – Air Quality) and a screening level wildlife risk assessment (CR #12 – Human Health and Wildlife Screening, Appendix H) conducted for the Project.

The air quality assessment modeled the contribution to key air quality concerns and parameters resulting from operation of the Project, including sulphur dioxide ($SO_2$), oxides of nitrogen ($NO_x$), carbon monoxide (CO), particulate matter ($PM_{2.5}$, $PM_{10}$, and TSP), volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), and metals and particulate deposition. The results indicated that for most air quality emissions, Project and cumulative effects were localized and decrease as distance from the Project increases. The effects are likely to be continuous and long-lasting but reversible with mitigation. The air emissions levels were considered low and, with the exception of particulate matter ($PM_{2.5}$, $PM_{10}$, and TSP), predicted concentrations were generally well below Alberta's ambient air quality objectives in both the air quality LSA and RSA. However, residual effects were high for fugitive dust ($PM_{10}$ and TSP, and to a lesser extent $PM_{2.5}$) even when the effects of road watering and winter snow were accounted for but not for any mitigation effects of vegetation or trapping by small terrain features. Project predictions were a result of the particular configuration of mining and haul roads during Year 14 and are not indicative of a long-term effect. Overall, residual air quality effects related to the Project were considered to be not significant.

The screening level wildlife risk assessment evaluated potential risks to wildlife associated with chemicals of potential concern emitted from the Project into the air and deposited on soil and surface water within the GBRSA. The wildlife risk assessment used the same models and air concentrations as was used the human health risk assessment. The results of the wildlife risk assessment indicated that wildlife health effects were likely to be highly localized, that Project-related contribution to emissions in the GBRSA would be negligible to small, and that the risk of adverse effects associated with Project emissions on the health of wildlife in the study areas would be minimal. The maximum predicted air concentrations associated with Project emissions do no exceed either the acute or chronic toxicity reference values protective of wildlife, with the exception of $PM_{2.5}$ in the mammalian acute assessment which was only slightly greater than 1.0. Similarly, maximum predicted long-term soil and surface water concentrations did not exceed the soil quality and surface water quality guidelines, respectively. Because of the highly conservative assumptions that were used during the wildlife risk assessment, the prediction confidence was considered high.

Based on the results of the air quality assessment and the screening level wildlife risk assessment, it was concluded that Project emissions will not pose a threat to wildlife health; therefore, health effects for the wildlife VCs in the WLSA, WRSA, and GBRSA were not considered further.

## 4.2 Wildlife Habitat

### 4.2.1 Wildlife Local Study Area

Moderate mixed coniferous forest (24.4%) was the predominant habitat type in the WLSA at baseline (Table 4.2-1, Figure 4.2-1). The second most abundant habitat type was closed mixedwood (17.6%), followed by open pine (9.2%), open mixed coniferous (7.8%), and closed mixed coniferous (7.4%). Anthropogenic disturbances associated with roads/highways, rail, clearcuts, pipelines, agricultural activity, and industrial and residential developments accounted for 18.2% of the WLSA. Two other habitats accounted for approximately 5% of the WLSA (open mixedwood, grassland), while the remaining types represented minor components (<1.5%) of the WLSA at baseline (Table 4.2-1, Figure 4.2-1).

**Table 4.2-1 Areal Extent of Baseline Wildlife Habitats in the Wildlife Local Study Area**

| Habitat Types | Ecosite Phases by Natural Subregion | | Area (ha)[1] | % of WLSA |
|---|---|---|---|---|
| | Montane | Subalpine | | |
| Open Pine | a1, b1 | a1, b1 | 516.7 | 9.2 |
| Open Deciduous | b2, c3 | - | 51.6 | 0.9 |
| Open Mixedwood | b3, c4 | - | 291.2 | 5.2 |
| Open Mixed Coniferous | c1, c2 | - | 440.5 | 7.8 |
| Moderate Mixed Coniferous | - | e1, e3, e4 | 1,375.8 | 24.4 |
| Closed Deciduous | f1 | - | 27.6 | 0.5 |
| Closed Mixedwood | d1, d2, e2, e3 | - | 991.2 | 17.6 |
| Closed Spruce | g1, g2 | h1 | 79.4 | 1.4 |
| Closed Mixed Coniferous | d3, e1 | f1, f2 | 419.5 | 7.4 |
| Grassland | HG | | 290.3 | 5.1 |
| Upland Shrub | SC | - | 0.2 | 0.0 |
| Shrubby Wetland | SO, FONS | - | 17.9 | 0.3 |
| Treed Wetland | STNN | - | 4.8 | 0.1 |
| Rock Barren | NMR | | 48.6 | 0.9 |
| Waterbody | NWF, NWL, NWR | | 63.9 | 1.1 |
| Anthropogenic Disturbance | AIF, AIH, AII, AIM, ASC, CC, CIP, CIW, CL, CO, CP | | 1,027.3 | 18.2 |
| **Totals[1]** | | | **5,646.4** | **100.0** |

[1] Due to rounding of values, totals may not equal the sum of the individual values presented in the table.

### 4.2.2 Regional Study Areas

At baseline, the WRSA was predominantly characterized by mature conifer forest habitat (52.2%) composed of four ELC categories: closed conifer mature (19.3%), moderate conifer mature (12.2), open conifer mature (12.2%), and dense conifer mature forest habitats (8.6%) (Table 4.2-2, Figure 4.2-1). Herbaceous habitats (14.4%) and barren land (6.0%) were also common habitat features at this landscape scale. Cutblocks and other regenerating clearings (open regenerating herb, open regenerating shrub, and closed regenerating treed) were the most common anthropogenic disturbances in the WRSA at baseline (13.3%). Other important anthropogenic disturbances at the WRSA scale included agricultural land (5.4%) and linear anthropogenic disturbances (3.4%).

Industry, including other mine operations, accounted for 0.6% of the WRSA (472.0 ha). Old-growth forest only accounted for 2.1% of the WRSA (1,560.5 ha).

Similarly, the GBRSA was predominantly characterized by mature conifer forest (34.3%) and herbaceous habitats (19.9%) under baseline conditions (Table 4.2-2, Figure 4.2-2). Cutblocks and other regenerating clearings (open regen herb, open regen shrub, and closed regen treed) were the most common anthropogenic disturbance in the GBRSA (13.3%; 17,991.2 ha). Agriculture accounted for an additional 9.5% of the landscape at the GBRSA scale and was relatively more abundant than in the WRSA. Linear anthropogenic disturbances accounted for 2.7% and industrial developments (including mines) accounted for 1.1% of the GBRSA. Old-growth forest accounted for 4.7% (13,460.7 ha) of the GBRSA at baseline.

**Table 4.2-2 Areal Extent of Baseline Wildlife Habitats in the Wildlife and Grizzly Bear Regional Study Areas**

| ELC Class | WRSA | | GBRSA Area | |
|---|---|---|---|---|
| | Area (ha) | % of WRSA | Area (ha) | % of GBRSA |
| Agriculture | 3,992.2 | 5.4 | 27,010.6 | 9.5 |
| Barren Land | 4,416.5 | 6.0 | 18,650.5 | 6.6 |
| Closed Broadleaf Mature Forest | 1,165.0 | 1.6 | 4,921.0 | 1.7 |
| Closed Broadleaf Old Forest | 23.6 | 0.03 | 287.3 | 0.1 |
| Closed Broadleaf Young Forest | 660.3 | 0.9 | 900.0 | 0.3 |
| Closed Conifer Mature Forest | 14,207.9 | 19.3 | 34,268.2 | 12.1 |
| Closed Conifer Old Forest | 228.9 | 0.3 | 2,774.2 | 1.0 |
| Closed Conifer Young Forest | 112.6 | 0.2 | 2,249.8 | 0.8 |
| Closed Mixed Mature Forest | 231.2 | 0.3 | 824.2 | 0.3 |
| Closed Mixed Old Forest | 8.7 | 0.01 | 79.6 | 0.03 |
| Closed Mixed Young Forest | 38.1 | 0.05 | 81.5 | 0.03 |
| Closed Regen Treed | 161.4 | 0.2 | 2,253.7 | 0.8 |
| Dense Broadleaf Mature Forest | 210.2 | 0.3 | 1,144.3 | 0.4 |
| Dense Broadleaf Old Forest | - | 0.0 | 6.9 | 0.002 |
| Dense Broadleaf Young Forest | 6.3 | 0.01 | 79.2 | 0.03 |

**Table 4.2-2 Areal Extent of Baseline Wildlife Habitats in the Wildlife and Grizzly Bear Regional Study Areas**

| ELC Class | WRSA | | GBRSA Area | |
|---|---|---|---|---|
| | Area (ha) | % of WRSA | Area (ha) | % of GBRSA |
| Dense Conifer Mature Forest | 6,308.4 | 8.6 | 14,883.8 | 5.2 |
| Dense Conifer Old Forest | 65.0 | 0.1 | 438.5 | 0.2 |
| Dense Conifer Young Forest | 23.0 | 0.03 | 528.5 | 0.2 |
| Dense Mixed Mature Forest | - | 0.0 | 101.4 | 0.04 |
| Dense Mixed Young Forest | - | 0.0 | 3.7 | 0.001 |
| Industrial (*e.g.* Mining) | 472.0 | 0.6 | 3183.6 | 1.1 |
| Linear Anthropogenic Disturbance | 2,506.6 | 3.4 | 7,626.0 | 2.7 |
| Lush Herb | - | 0.0 | 352.0 | 0.1 |
| Moderate Broadleaf Mature Forest | 707.1 | 1.0 | 3,167.4 | 1.1 |
| Moderate Broadleaf Old Forest | 26.6 | 0.04 | 437.3 | 0.2 |
| Moderate Broadleaf Young Forest | 269.7 | 0.4 | 465.6 | 0.2 |
| Moderate Conifer Mature Forest | 8,938.0 | 12.2 | 21,595.9 | 7.6 |
| Moderate Conifer Old Forest | 448.0 | 0.6 | 4,223.7 | 1.5 |
| Moderate Conifer Young Forest | 240.4 | 0.3 | 2,940.1 | 1.0 |
| Moderate Mixed Mature Forest | 247.9 | 0.3 | 3,496.6 | 1.2 |
| Moderate Mixed Old Forest | 78.9 | 0.1 | 297.9 | 0.1 |
| Moderate Mixed Young Forest | 62.9 | 0.1 | 172.1 | 0.06 |
| Natural Graminoid Wetland | 18.8 | 0.03 | 158.5 | 0.06 |
| Natural Shrubby | 825.6 | 1.1 | 7,555.5 | 2.7 |
| Natural Shrubby Wetland | 331.1 | 0. | 762.7 | 0.3 |
| Natural Upland Herb | 4,789.4 | 6.5 | 38,513.7 | 13.6 |
| Open Water | 135.8 | 0.2 | 1,544.0 | 0.5 |
| Open Broadleaf Mature Forest | 611.6 | 0.8 | 1,546.4 | 0.5 |
| Open Broadleaf Old Forest | 73.2 | 0.1 | 378.8 | 0.1 |
| Open Broadleaf Young Forest | 152.1 | 0.2 | 421.5 | 0.1 |

**Table 4.2-2 Areal Extent of Baseline Wildlife Habitats in the Wildlife and Grizzly Bear Regional Study Areas**

| ELC Class | WRSA | | GBRSA Area | |
|---|---|---|---|---|
| | Area (ha) | % of WRSA | Area (ha) | % of GBRSA |
| Open Conifer Mature Forest | 8,936.8 | 12.2 | 26,698.2 | 9.4 |
| Open Conifer Old Forest | 590.5 | 0.8 | 4403.4 | 1.6 |
| Open Conifer Young Forest | 429.7 | 0.6 | 4,066.2 | 1.4 |
| Open Mixed Mature Forest | 318.7 | 0.4 | 1,581.4 | 0.6 |
| Open Mixed Old Forest | 17.1 | 0.02 | 133.1 | 0.05 |
| Open Mixed Young Forest | 387.6 | 0.5 | 471.0 | 0.2 |
| Open Regen Herb | 5,798.0 | 7.9 | 17,991.2 | 6.3 |
| Open Regen Shrub | 3,789.1 | 5.2 | 17,631.8 | 6.2 |
| Settlement | 426.9 | 0.6 | 595.5 | 0.2 |
| Treed Wetland | 57.5 | 0.1 | 126.5 | 0.05 |
| **Totals** | **73,547.0** | **100.0** | **284,024.7** | **100.0** |

### 4.2.3 Critical Habitat for Species at Risk

Critical habitat has not yet been identified for three of the four SARA-listed species known to be present in the WLSA: olive-sided flycatcher, common nighthawk, and short-eared owl. Therefore, it is not possible to determine the amount of critical habitat available to these species in the WLSA or GBRSA. Critical habitat was not considered further in the assessment of these species.

In December 2015, critical habitat for little brown myotis was partially identified for hibernacula (Environment Canada, 2015). Potential hibernacula in the WLSA include abandoned mines, which are too unsafe to enter to verify suitability based on temperature (2°C - 10°C) and relative humidity (>80%). Where access to (not in) abandoned mines was safe, Benga surveyed the immediate area for bat guano and found none. Critical habitat was not considered further in the assessment of little brown myotis. This will be further validated by the 2016 Bat Survey.

## 4.3 Wildlife Diversity

Wildlife diversity under baseline conditions was assessed for the WLSA and GBRSA using field data and a review of range distribution maps. Based on this information, 219 wildlife species comprised of

10 herptiles, 156 birds, and 53 mammals could potentially occur in the WLSA (Appendix D). This compares to 268 wildlife species comprised of 11 herptiles, 196 birds, and 61 mammals that could potentially occur in the GBRSA (Appendix D). Both study areas were dominated by moderate-high and high diversity habitats based on the total number of species that could occur within each ecosite phase (WLSA) and ELC class (GBRSA) (Table 4.3-1, Figures 4.3-1 and 4.3-2). Each species was given a binary ranking (0 or 1) based on the probability of occurrence in the ecosite or ELC class.

**Table 4.3-1 Baseline Wildlife Diversity in the Wildlife Local Study Area and Grizzly Bear Regional Study Area**

| Diversity Rating | No. of Species | Wildlife LSA | | Grizzly Bear RSA | |
|---|---|---|---|---|---|
| | | Area (ha) | % of WLSA | Area (ha) | % of GBRSA |
| Low | 0 - 19 | 165.4 | 2.9 | 3,183.6 | 1.1 |
| Moderate-Low | 20 - 44 | 238.6 | 4.2 | 26,276.5 | 9.3 |
| Moderate | 45 - 70 | 340.9 | 6.0 | 3,232.9 | 1.1 |
| Moderate-High | 71 - 90 | 3,069.8 | 54.4 | 112,817.4 | 39.7 |
| High | ≥ 91 | 1,831.7 | 32.4 | 138,514.2 | 48.8 |
| **Total[1]** | | **5,646.4** | **100.00** | **284,024.7** | **100.0** |

[1]Due to rounding of values, totals may not equal the sum of the individual values presented in the table.

High wildlife diversity habitat was composed of primarily open mixedwood, open deciduous, open mixed coniferous, closed mixedwood, shrubby wetland, and treed wetland habitats in the WLSA (Table 4.3-2). Mature forest, old growth forest, shrub lands, wetlands, and herbaceous habitats had high potential for wildlife diversity in the GBRSA (Table 4.3-3). A total of 123 and 165 species were considered to use some disturbance features present in the WLSA and GBRSA, respectively. Disturbances represent the largest portion of the low and moderate-low wildlife biodiversity habitat rankings, although residential areas were expected to support moderate-high numbers of wildlife species.

**Table 4.3-2 Baseline Wildlife Diversity for Habitat Types and Ecosite Phases in the Wildlife Local Study Area**

| Habitat Type | Ecosite Phase | Natural Subregion | No. of Species | Diversity Rating | Total Area (ha) | % of WLSA |
|---|---|---|---|---|---|---|
| Open Pine | a1 | MN | 95 | High | 57.1 | 1.0 |

**Table 4.3-2 Baseline Wildlife Diversity for Habitat Types and Ecosite Phases in the Wildlife Local Study Area**

| Habitat Type | Ecosite Phase | Natural Subregion | No. of Species | Diversity Rating | Total Area (ha) | % of WLSA |
|---|---|---|---|---|---|---|
| | a1 | SA | 83 | Moderate-High | 20.3 | 0.4 |
| | b1 | MN | 94 | Moderate-High | 313.2 | 5.5 |
| | b1 | SA | 83 | Moderate-High | 126.0 | 2.2 |
| Open Deciduous | b2 | MN | 88 | Moderate-High | 22.5 | 0.4 |
| | c3 | MN | 99 | High | 29.1 | 0.5 |
| Open Mixedwood | b3 | MN | 110 | High | 34.8 | 0.6 |
| | c4 | MN | 111 | High | 256.4 | 4.5 |
| Open Mixed Coniferous | c1 | MN | 99 | High | 228.2 | 4.0 |
| | c2 | MN | 97 | High | 212.3 | 3.8 |
| Moderate Mixed Coniferous | e1 | SA | 94 | Moderate-High | 1,127.9 | 20.0 |
| | e3 | SA | 94 | Moderate-High | 220.2 | 3.9 |
| | e4 | SA | 94 | Moderate-High | 27.7 | 0.5 |
| Closed Deciduous | f1 | MN | 87 | Moderate-High | 27.6 | 0.5 |
| Closed Mixedwood | d1 | MN | 102 | High | 121.0 | 2.1 |
| | d2 | MN | 102 | High | 659.0 | 11.7 |
| | e2 | MN | 100 | High | 95.2 | 1.7 |
| | e3 | MN | 102 | High | 115.9 | 2.1 |
| Closed Mixed Coniferous | d3 | MN | 87 | Moderate-High | 11.6 | 0.2 |
| | e1 | MN | 87 | Moderate-High | 319.8 | 5.7 |
| | f1 | SA | 82 | Moderate-High | 56.8 | 1.0 |
| | f2 | SA | 82 | Moderate-High | 31.4 | 0.6 |
| Closed Spruce | g1 | MN | 91 | Moderate-High | 49.4 | 0.9 |
| | g2 | MN | 91 | Moderate-High | 20.6 | 0.4 |
| | h1 | SA | 86 | Moderate-High | 9.3 | 0.2 |
| Shrubby Wetland | FONS | MN | 111 | High | 17.6 | 0.3 |
| | SO | MN | 111 | High | 0.3 | 0.0 |

**Table 4.3-2 Baseline Wildlife Diversity for Habitat Types and Ecosite Phases in the Wildlife Local Study Area**

| Habitat Type | Ecosite Phase | Natural Subregion | No. of Species | Diversity Rating | Total Area (ha) | % of WLSA |
|---|---|---|---|---|---|---|
| Treed Wetland | STNN | MN | 105 | High | 4.8 | 0.1 |
| Grassland | HG | - | 74 | Moderate-High | 290.3 | 5.1 |
| Upland Shrub | SC | - | 80 | Moderate-High | 0.2 | 0.0 |
| Rock Barren | NMR | - | 29 | Moderate-Low | 48.6 | 0.9 |
| Waterbody | NWF | - | 65 | Moderate | 53.5 | 0.9 |
| | NWL | - | 66 | Moderate | 0.6 | 0.0 |
| | NWR | - | 57 | Moderate | 9.8 | 0.2 |
| Anthropogenic Disturbance | AIF | - | 92 | Moderate-High | 2.2 | 0.0 |
| | AIH | - | 27 | Moderate-Low | 124.8 | 2.2 |
| | AII | - | 0 | Low | 0.2 | 0.0 |
| | AIM | - | 8 | Low | 165.2 | 2.9 |
| | ASC | - | 78 | Moderate-High | 180.4 | 3.2 |
| | CC | - | 56 | Moderate | 239.7 | 4.2 |
| | CIP | - | 33 | Moderate-Low | 47.9 | 0.8 |
| | CIW | - | 26 | Moderate-Low | 17.3 | 0.3 |
| | CL, CO | - | 74 | Moderate-High | 212.4 | 3.8 |
| | CP | - | 60 | Moderate | 37.3 | 0.7 |
| **Total** | | | | | **5,646.4** | **100.0** |

**Table 4.3-3 Baseline Wildlife Diversity for Ecological Land Cover Classes in the Grizzly Bear Regional Study Area**

| ELC Class | No. of Species | Diversity Rating | Total Area (ha) | % of GBRSA |
|---|---|---|---|---|
| Agriculture | 85 | Moderate-High | 27,010.6 | 9.5 |
| Barren Land | 21 | Moderate-Low | 18,650.5 | 6.6 |

**Table 4.3-3 Baseline Wildlife Diversity for Ecological Land Cover Classes in the Grizzly Bear Regional Study Area**

| ELC Class | No. of Species | Diversity Rating | Total Area (ha) | % of GBRSA |
|---|---|---|---|---|
| Closed Conifer Mature Forest | 93 | Moderate-High | 34,268.2 | 12.1 |
| Closed Conifer Old Forest | 93 | Moderate-High | 2,774.2 | 1.0 |
| Closed Conifer Young Forest | 73 | Moderate-High | 2,249.8 | 0.8 |
| Closed Broadleaf Mature Forest | 84 | Moderate-High | 4,921.0 | 1.7 |
| Closed Broadleaf Old Forest | 84 | Moderate-High | 287.3 | 0.1 |
| Closed Broadleaf Young Forest | 68 | Moderate | 900.0 | 0.3 |
| Closed Mixed Mature Forest | 101 | High | 824.2 | 0.3 |
| Closed Mixed Old Forest | 101 | High | 79.6 | 0.0 |
| Closed Mixed Young Forest | 80 | Moderate-High | 81.5 | 0.0 |
| Closed Regeneration - Treed | 66 | Moderate | 2,253.7 | 0.8 |
| Dense Conifer Mature Forest | 92 | Moderate-High | 14,883.8 | 5.2 |
| Dense Conifer Old Forest | 92 | Moderate-High | 438.5 | 0.2 |
| Dense Conifer Young Forest | 72 | Moderate-High | 528.5 | 0.2 |
| Dense Broadleaf Mature Forest | 83 | Moderate-High | 1,144.3 | 0.4 |
| Dense Broadleaf Old Forest | 83 | Moderate-High | 6.9 | 0.0 |
| Dense Broadleaf Young Forest | 64 | Moderate | 79.2 | 0.0 |
| Dense Mixed Mature Forest | 100 | High | 101.4 | 0.0 |
| Dense Mixed Young Forest | 79 | Moderate-High | 3.7 | 0.0 |
| Industrial Disturbance | 13 | Low | 3,183.6 | 1.1 |
| Linear Disturbance | 40 | Moderate-Low | 7,626.0 | 2.7 |
| Lush Herb | 77 | Moderate-High | 352.0 | 0.1 |
| Moderate Conifer Mature Forest | 105 | High | 21,595.9 | 7.6 |
| Moderate Conifer Old Forest | 105 | High | 4,223.7 | 1.5 |
| Moderate Conifer Young Forest | 86 | Moderate-High | 2,940.1 | 1.0 |
| Moderate Broadleaf Mature Forest | 97 | High | 3,167.4 | 1.1 |
| Moderate Broadleaf Old Forest | 97 | High | 437.3 | 0.2 |

**Table 4.3-3 Baseline Wildlife Diversity for Ecological Land Cover Classes in the Grizzly Bear Regional Study Area**

| ELC Class | No. of Species | Diversity Rating | Total Area (ha) | % of GBRSA |
|---|---|---|---|---|
| Moderate Broadleaf Young Forest | 79 | Moderate-High | 465.6 | 0.2 |
| Moderate Mixed Mature Forest | 113 | High | 3,496.6 | 1.2 |
| Moderate Mixed Old Forest | 113 | High | 297.9 | 0.1 |
| Moderate Mixed Young Forest | 92 | Moderate-High | 172.1 | 0.1 |
| Natural Graminoid Wetland | 88 | Moderate-High | 158.5 | 0.1 |
| Natural Upland Shrub | 106 | High | 7,555.5 | 2.7 |
| Natural Shrub Wetland | 119 | High | 762.7 | 0.3 |
| Natural Upland Herbaceous | 98 | High | 38,513.7 | 13.6 |
| Open Conifer Mature Forest | 113 | High | 26,698.2 | 9.4 |
| Open Conifer Old Forest | 113 | High | 4,403.4 | 1.6 |
| Open Conifer Young Forest | 98 | High | 4,066.2 | 1.4 |
| Open Broadleaf Mature Forest | 109 | High | 1,546.4 | 0.5 |
| Open Broadleaf Old Forest | 109 | High | 378.8 | 0.1 |
| Open Broadleaf Young Forest | 95 | High | 421.5 | 0.1 |
| Open Mixed Mature Forest | 121 | High | 1,581.4 | 0.6 |
| Open Mixed Old Forest | 121 | High | 133.1 | 0.0 |
| Open Mixed Young Forest | 104 | High | 471.0 | 0.2 |
| Open Regeneration - Herbaceous | 82 | Moderate-High | 17,991.2 | 6.3 |
| Open Regeneration - Shrub | 98 | High | 17,631.8 | 6.2 |
| Open Water | 78 | Moderate-High | 1,544.0 | 0.5 |
| Settlements | 81 | Moderate-High | 595.5 | 0.2 |
| Treed Wetlands | 115 | High | 126.5 | 0.0 |
| **Total** | | | **284,024.7** | **100.0** |

## 4.4 Valued Components

Ten VCs were selected for the wildlife assessment (Section 3.2.3). The species status and habitat requirements, habitat availability, habitat connectivity and movement, mortality risk, and abundance of each VC at baseline are described in Sections 4.4.1 to 4.4.10. Project effects are assessed at the local scale (WLSA) for all VCs. Only those VCs with home ranges greater in areal extent than the WLSA or those that were deemed to be affected by the Project at the regional scale were considered for assessment at the WRSA or GBRSA level. VCs with small home range sizes that were not expected to be affected by Project development at the local scale will not be affected by Project development at broader regional scales. As such, an effects assessment at the WRSA and GBRSA levels was only considered for selected VCs.

### 4.4.1 Columbia Spotted Frog

#### 4.4.1.1 Species Status and Habitat Requirements

The Columbia spotted frog is a provincially "Sensitive" species in Alberta that breeds in slow streams, slow rivers, marshes, beaver ponds, springs, pools, the margins of small lakes, and alluvial fans (James, 1998). They tend to select water bodies with emergent vegetation, which can provide attachment points and cover for their egg masses (Davis and Verrell, 2005; Welch and MacMahon, 2005; Pearl *et al.*, 2007; Bartelt *et al.*, 2011).

After breeding, Columbia spotted frogs may remain at their breeding pond for the remainder of the spring and summer or they may disperse to a more favorable location. Adults will often disperse from their small breeding ponds to spend the summer near larger water bodies, creeks, or rivers (Bull and Hayes, 2001). Newly metamorphosed juveniles may also disperse from their natal water bodies, moving distances up to 5.7 km (Funk *et al.*, 2005). Riparian habitats are important dispersal corridors for the species, although dispersing Columbia spotted frogs may also move through upland sites (Pilliod *et al.*, 2002).

Columbia spotted frogs often use different waterbodies for breeding and for hibernation because good breeding ponds (which are typically small, organically rich ponds) are likely to become anoxic in winter (Pilliod *et al.*, 2002). Ponds used for hibernation are generally deeper and larger than ponds used for breeding (Pilliod *et al.*, 2002).

Columbia spotted frogs occur throughout the WRSA. Pearson (2005) found Columbia spotted frogs in montane and subalpine ecosystems throughout the Crowsnest Pass region and along the Forestry Trunk Road just west of the WLSA. They are also the most commonly detected amphibian in the Castle-River drainage (Arc Wildlife Services Ltd. 2005), which lies in the southern portion of the WRSA.

#### 4.4.1.2 Habitat Availability

At baseline, the WLSA contains only 172.9 ha (3.1%) of effective breeding habitat for Columbia spotted frogs, most of which is comprised of ponds and wetlands (Table 4.4-1 Figure 4.4-1). They breed in a pond located in the centre of the WLSA, as adult frogs and an egg mass were observed and adults were heard calling there during the 2014 and 2016 amphibian surveys. There are also three other ponds in the WLSA that may serve as breeding habitat for Columbia spotted frogs where groups of adults were observed during the 2016 surveys (Figure 4.4-1). Other potentially suitable breeding habitat includes a shrubby wetland in the centre of the WLSA and a waterbody along the Crowsnest River in the southern portion of the WLSA (Figure 4.4-1).

Columbia spotted frogs may breed in slow-moving streams or in pools associated with streams (Licht, 1969). However, such streams were rated as moderate-quality habitat as streams in the WLSA may contain fish and most amphibians prefer to breed in still water. Habitat rated as low quality consists of wet ecosite phases that may provide summering habitat or dispersal routes for Columbia spotted frogs. Low quality habitat is unlikely to provide breeding habitat unless small pools are present.

**Table 4.4-1 Baseline Habitat Availability for Columbia Spotted Frogs in the Wildlife Local Study Area**

| Habitat Suitability Class | Area (ha) | % of WLSA |
|---|---|---|
| High | 49.6 | 0.9 |
| Moderate | 123.3 | 2.2 |
| Low | 194.0 | 3.4 |
| Nil | 5,279.5 | 93.5 |
| **Total** | **5,646.4** | **100.0** |
| **Effective Habitat[1]** | **172.9** | **3.1** |

[1] Effective Habitat = High plus Moderate habitat suitability classes.

#### 4.4.1.3 Habitat Connectivity and Movement

With the exception of very isolated ponds, most populations of Columbia spotted frogs consist of frogs from multiple breeding ponds. Dispersal among breeding ponds appears to be important for the viability of Columbia spotted frog populations (Funk *et al.*, 2005a, b). Adults may undergo up to three movements each year. First, they may move from a hibernation site to a breeding pond. Once breeding has occurred, some adults then move to separate summer habitat. In fall, there may be another movement back to a suitable hibernation site.

Columbia spotted frogs will travel along streams or upland areas (Pilliod *et al.*, 2002). Bill and Hayes (2001) found that Columbia spotted frogs tended to travel along riparian corridors, but may also travel on relatively dry land. There are a number of streams located within the WLSA that would serve as dispersal corridors and/or summer habitat for Columbia spotted frogs (Figure 4.4-1). Rocky, barren areas within the WLSA, as well as Highway 3 and the Town of Blairmore would function as barriers to dispersal within the WLSA.

#### 4.4.1.4 Mortality Risk

The risk of Columbia spotted frog mortality from anthropogenic disturbances is low in the WLSA under baseline conditions; however, vehicles (including off-road vehicles) may cause some mortality. During a survey conducted in southwest Alberta, Paton (2002) noted that people had driven ATVs through amphibian breeding ponds, which often destroyed eggs. One pond with amphibian eggs was found later to have no amphibians after it had been extensively driven through with ATVs (Paton, 2002). Grazing cattle can also have a negative effect on Columbia spotted frog populations, particularly if breeding ponds are trampled (Reaser, 2000).

The stocking of fishless ponds can also cause declines in amphibian populations (Reaser, 2000). In addition, amphibians are generally sensitive to declines in water quality and populations can be negatively affected by heavy metals in the runoff from mine tailings (Lefcort *et al.*, 1998), and road salt runoff (Karakker *et al.*, 2008).

The primary natural source of mortality for Columbia spotted frogs is predation. Predatory fish and garter snakes may eat eggs and tadpoles, and garter snakes and a variety of birds and mammals may eat adults. They are also prone to desiccation while dispersing overland, and eggs and tadpoles will die if their waterbody dries up. The role of disease in limiting amphibian populations in Alberta is unclear.

#### 4.4.1.5 Abundance

Columbia spotted frogs and a single egg mass were observed at a total of six locations in the WLSA during the amphibian surveys conducted during 2014 and 2016. It is possible that this species occurs, but was not detected, in other areas of the WLSA because they have quiet calls that can generally be detected only within a 30-m radius (James, 1998). Many Columbia spotted frogs will also call while underwater, and if they are under a few feet of water their calls will be inaudible from the air (Licht, 1969), making detection difficult. The relative abundance of this species under baseline conditions in the WLSA is unknown.

### 4.4.2 Western Toad

#### 4.4.2.1 Species Status and Habitat Requirements

The western toad is provincially listed as "Sensitive" and federally listed as a species of "Special Concern" by COSEWIC. Like other amphibians, western toads require water to breed in. They will breed in a variety of natural and artificial habitats with or without tree cover, coarse woody debris, or emergent vegetation (COSEWIC, 2002). These can be ponds, stream edges, or the shallow margins of lakes, ditches, or ruts (COSEWIC, 2002). They rarely lay eggs in water more than 1 m deep (COSEWIC, 2002). However, ditches and ruts may act as sinks for the species, as amphibian larvae in them rarely complete metamorphosis into adults (Andrews *et al.*, 2008).

After breeding, western toads often move to a summer foraging range. Browne *et al.* (2009) found that western toad abundance at terrestrial sites was positively associated with closed deciduous forest cover, likely because the understory was better developed in deciduous than coniferous forests in their study area. A well-developed understory would provide protection from predators and desiccation.

While not foraging, western toads spend their time in concealed refugia, which may be rodent burrows, underneath logs or other vegetation, inside decayed tree stumps, or exposed muddy areas (Davis, 2000; Long and Prepas, 2012).

Western toads do not hibernate in waterbodies, but they may hibernate in rodent burrows, peat hummocks, decayed root tunnels, red squirrel middens, natural crevice systems, and cavities under trees (Browne and Paszkowski, 2010). Some western toads may dig hibernation burrows up to 1.3 m deep (Russell and Bauer, 2000).

#### 4.4.2.2 Habitat Availability

Effective breeding habitat for western toads, which consists of ponds and wetlands and to some extent slow-moving reaches and pools associated with streams, is limited in the WLSA (269.7 ha, 4.8%) (Table 4.4-2; Figure 4.4-2). Low-quality habitat is present in the WLSA and is associated with wet ecosite phases that are unlikely to be used for breeding (unless small pools are present) but are more likely to be used as summer foraging habitat. After breeding, western toads spend time in wet, terrestrial habitats.

**Table 4.4-2 Baseline Habitat Availability for Western Toads in the Wildlife Local Study Area**

| Habitat Suitability Class | Area (ha) | % of WLSA |
|---|---|---|
| High | 50.4 | 0.9 |

**Table 4.4-2 Baseline Habitat Availability for Western Toads in the Wildlife Local Study Area**

| Habitat Suitability Class | Area (ha) | % of WLSA |
|---|---|---|
| Moderate | 219.3 | 3.9 |
| Low | 1,645.4 | 29.1 |
| Nil | 3,731.4 | 66.1 |
| **Total** | **5,646.4** | **100.0** |
| **Effective Habitat[1]** | **269.7** | **4.8** |

[1] Effective Habitat = High plus Moderate habitat suitability classes.

#### 4.4.2.3 Habitat Connectivity and Movement

Western toads may undergo several periods of movement during the seasons they are active. Mature adults first move to a breeding pond, which will be followed by a move to summer foraging habitat. Some toads will use more than one foraging habitat throughout the summer. In fall, toads then move to a suitable hibernation site. Like Columbia spotted frogs, western toads will use streams and riparian areas as movement corridors (Adams *et al.*, 2005, Schmetterling and Young, 2008), moving up to 12 km in summer (Schmetterling and Young, 2008).

There are several creeks in the WLSA that would allow western toads to disperse among breeding ponds and summer foraging habitats (Figure 4.4-2). The primary natural barrier to dispersal would be rocky, exposed mountain tops. There are few anthropogenic disturbances in the WLSA that would impede dispersal, as toads will cross roads and trails, particularly during rainy nights. However, dispersing toads have an increased risk of mortality along roads/highways (*e.g.* Highway 3) and trails (off-road vehicles), which may affect gene flow among populations.

#### 4.4.2.4 Mortality Risk

The risk of western toad mortality resulting from anthropogenic disturbances is low in the WLSA under baseline conditions; however, vehicles (including off-road vehicles) may cause some mortality (Paton, 2002). In the WRSA, vehicles are likely to be the primary anthropogenic cause of mortality and road salt runoff may also negatively affect amphibian populations near roads (Karakker *et al.*, 2008). Accidental spills of deleterious substances associated with existing oil, gas, and agricultural activities may pose a mortality risk to western toads, particularly if these spills occur in the vicinity of watercourses. Amphibians in general are sensitive to many types of chemical contaminants, including pesticides, heavy metals, and fertilizers (COSEWIC, 2002), but their effects on western toad populations in southwestern Alberta are unknown.

Natural sources of mortality include predation, as numerous species will prey on western toad tadpoles, including garter snakes, sandpipers, American robins, and mallards (Russell and Bauer, 2000). Tadpoles are also susceptible to desiccation if their waterbody dries up. The role of disease in limiting western toad populations in Alberta is unknown.

#### 4.4.2.5 Abundance

Western toads were observed in six locations in the WLSA during the 2014 and 2016 amphibian surveys and at additional locations of incidental sightings. As some populations of western toads lack vocal sacks (Pauly, 2008), some toads may have been overlooked during the survey. Some toads seen in June 2015 were juveniles, indicating that breeding occurs in the WLSA. However, the relative abundance of this species under baseline conditions in the WLSA is unknown.

### 4.4.3 Olive-sided Flycatcher

#### 4.4.3.1 Species Status and Habitat Requirements

The olive-sided flycatcher, which is provincially listed as "May Be At Risk" and federally listed as "Threatened" and a Schedule 1 species under SARA, is a migratory suboscine songbird that overwinters in South and Central America and breeds in coniferous forests in Canada and the northern United States. Olive-sided flycatcher density is highest in mature conifer stands within landscapes that are patchy because of natural disturbances (*e.g.* burns) (Environment Canada, 2015a). During the breeding season, olive-sided flycatchers prefer coniferous over deciduous forests (Kirk *et al.*, 1996), and are frequently associated with forest openings and edges, especially those created by wetlands (FAN 2007). This species may also be associated with open forests interspersed with patches of meadow or shrub (Wright, 1997). Even in young forests, they require the presence of some tall trees or snags to use as foraging and singing perches (Wright, 1997). They also require conifers for nesting, preferring to nest in live over dead conifers (Wright, 1997).

Breeding Bird Survey data indicate that olive-sided flycatcher populations are declining across their range (COSEWIC, 2007a). Olive-sided flycatchers are often attracted to partially harvested landscapes, which are common in much of their breeding range (COSEWIC, 2007a). There is also evidence that such landscapes act as sinks for the species, because predation rates on chicks are higher in human-altered landscapes (COSEWIC, 2007a).

#### 4.4.3.2 Habitat Availability

Under baseline conditions, 53.2% (3,001.2) of the WLSA contains effective habitat for olive-sided flycatcher (Table 4.4-3; Figure 4.4-3). This effective habitat is characterized by open coniferous and mixedwood forests with or near habitat edges. Low-quality habitat consists of habitat that would provide only foraging opportunities (such as regenerating clear cuts and shrubby wetlands), and low-quality potential breeding habitat such as the interior of mixedwood or closed coniferous forests. Nil-quality habitat includes deciduous forests and most anthropogenic disturbances (except for clear cuts).

**Table 4.4-3 Baseline Habitat Availability for Olive-sided Flycatchers in the Wildlife Local Study Area**

| Habitat Suitability Class | Area (ha) | % of WLSA |
|---|---|---|
| High | 1,066.4 | 18.9 |
| Moderate | 1,934.8 | 34.3 |
| Low | 1,386.3 | 24.6 |
| Nil | 1,258.8 | 22.3 |
| **Total** | **5,646.4** | **100.0** |
| **Effective Habitat[1]** | **3,001.2** | **53.2** |

[1] Effective Habitat = High plus Moderate habitat suitability classes.

#### 4.4.3.3 Habitat Connectivity and Movement

Forest fragmentation can constrain or impede the movements of some forest birds such as black-capped chickadees (Belisle and Desrochers, 2002). Although the WLSA is fragmented at baseline by existing anthropogenic activity associated with forestry, rural residential, recreational trails, previous coal mining, and oil and gas developments, there are likely no major barriers to olive-sided flycatcher movements because of their habitat preferences for forest edge habitats.

#### 4.4.3.4 Mortality Risk

Aside from predation (particularly eggs and chicks), the risk of bird mortality resulting from anthropogenic disturbances is likely low in the WLSA under baseline conditions. However, mortality risks from bird collisions with transmission lines and towers and other structures (Taylor, 1973; James, 1998; Ghalambor *et al.,* 1999; Hejl *et al.,* 2002; Walters *et al.,* 2002; Wyatt and Francis, 2002; Erickson *et al.,* 2005) and road salting (Martell, 2015) would be expected to be higher in the southern portion of the WRSA because of the higher level of anthropogenic activities.

#### 4.4.3.5 Abundance

Fifteen olive-sided flycatchers were detected in the WLSA during the songbird surveys in 2014 (n=5) and 2016 (n=10). Olive-sided flycatchers were also observed incidentally to the west of the WLSA in

2014 and were periodically recorded on BBS Route 04-205, which passes through the WRSA. The relative abundance of this species under baseline conditions in the WLSA is unknown.

### 4.4.4 Great Grey Owl

#### 4.4.4.1 Species Status and Habitat Requirements

Great grey owls, which are a provincially "Sensitive" species, require mature to old-growth forests for breeding. They do not build their own nests but will breed in large stick/platform nests built by other species (particularly northern goshawks, red-tailed hawks, and ravens), or on the tops of tall, partially decayed conifer snags (Bull and Duncan, 1993). Great gray owls prefer nest sites in forests with two or more canopy layers and with closure of >60% (Bull and Henjum, 1990). They will nest in coniferous forests (Franklin, 1988), mixedwood forests (Bull and Duncan, 1993), and deciduous forests (Oeming, 1955). They may use nests located in conifers or deciduous trees (Bull and Duncan, 1993, Stepinsky, 1997). Nests located in forests containing cover for nestlings and some broken, leaning trees provide the best environment for great gray owl fledglings.

High-quality nesting sites for great grey owls should also be near good foraging areas. Grey great owls tend to hunt in areas that provide good habitat for their prey, which are generally voles or northern pocket gophers although they will supplement their diets with other prey items. Great gray owls tend to hunt in moist meadows with understory vegetation between 10 and 65 cm tall (Sears, 2006). Voles typically prefer relatively wet areas with a thick covering of grass, forbs, or sedge (Sears, 2006).

#### 4.4.4.2 Habitat Availability

Effective foraging and nesting habitats for great gray owls is abundant, accounting for 58.7% (3,312.7 ha) of the WLSA although most of the effective habitat falls within the moderate suitability class (Table 4.4-4; Figure 4.4-4). Since nesting habitat is more likely to be limiting, high-quality nesting habitat was given the highest habitat suitability rating. High-quality breeding habitat for great grey owls generally consists of patches of old, closed forests at least 6 ha in area. This habitat was limited in the WLSA (26.0 ha, 0.5%), occurring primarily in two habitat patches located in the south central portion of the WLSA (Figure 4.4-4). Moderate-quality habitat was more abundant (3,286.7 ha) and is comprised of good foraging habitat, and moderate-quality nesting habitat (such as mature, mesic closed forests, and old-growth mesic open forests). Low-quality habitat, of which there were 1,188.1 ha in the WLSA, consists of mature, dry, open forests that may provide foraging or breeding habitat. Twenty percent of the WLSA (or 1,145.6 ha) consists of habitat that is unlikely to provide either nesting or foraging opportunities for great grey owls.

**Table 4.4-4 Baseline Habitat Availability for Great Grey Owls in the Wildlife Local Study Area**

| Habitat Suitability Class | Area (ha) | % of WLSA |
|---|---|---|
| High | 26.0 | 0.5 |
| Moderate | 3,286.7 | 58.2 |
| Low | 1,188.1 | 21.0 |
| Nil | 1,145.6 | 20.3 |
| **Totals** | **5,646.4** | **100.0** |
| **Effective Habitat[1]** | **3,312.7** | **58.7** |

[1] Effective Habitat = High plus Moderate habitat suitability classes.

#### 4.4.4.3 Habitat Connectivity and Movement

Under baseline conditions, there are no major barriers to great grey owl movement in the WLSA, although movements in the vicinity of Blairmore and Highway 3 may be affected. However, when vole populations are low, great gray owls may forage in towns or cities (Nero, 1981).

#### 4.1.3.4 Mortality Risk

There are few anthropogenic sources of direct mortality for great grey owls. They are occasionally killed by collisions with vehicles or power lines, or being shot illegally (Bull and Henjum, 1990). Natural sources of mortality include starvation and predation (particularly of chicks).

#### 4.4.4.4 Abundance

Great gray owls are known to occur in the WLSA, as at least one bird was incidentally observed during the amphibian survey conducted during June 2014. The relative abundance of this species under baseline conditions in the WLSA is unknown.

### 4.4.5 Little Brown Myotis

#### 4.4.5.1 Species Status and Habitat Requirements

Little brown myotis is common in Alberta, and likely the most abundant bat species. This species is federally listed as “Endangered” and is a Schedule 1 species under SARA but is listed as “Secure” in Alberta. Historically, they have been common throughout their range, but white-nose syndrome, a disease caused by the fungus *Pseudogymnoascus destructans*, has decimated many populations in eastern North America. The disease has caused a 94% decline in the known number of bats hibernating in colonies in Nova Scotia, New Brunswick, Ontario, and Quebec (COSEWIC, 2013). The disease has not reached Alberta, but it is estimated that the entire population of little brown myotis will be affected within 12 to 18 years (COSEWIC, 2013).

Little brown myotis is more abundant in old-growth deciduous and mixedwood forests than in younger forests. This species may preferentially select roosts near surface water and in mature forests because of the abundance of prey (Pattie and Fisher, 1999) and the presence of snags and hollow trees.

Little brown myotis are nocturnal aerial insectivores that become active at dusk and do most of their foraging around and over water (Lunde and Harestad, 1986), although they will also forage in tree canopies. They feed heavily on aquatic insects and often feed along the margins of lakes and streams early in the evening and then over water later in the night (Belwood and Fenton, 1976; Fenton and Barclay, 1980; Barclay, 1991; Clare *et al.*, 2011). They generally prefer to forage over calm ponds than over more turbulent waterbodies (such as rivers) (Mackey and Barclay, 1989). They may also forage along the edges of cutblocks, along trails, or in forest gaps (Patriquin and Barclay 2003, COSEWIC, 2013) but avoid large, open areas (COSEWIC, 2013).

Little brown myotis roosts are typically in large trees, including living, partially alive, and dead trees (Olson, 2011). Little brown myotis will also roost under exfoliating tree bark, in cavities excavated by animals, and in knot holes (Olson, 2011). Night roosts are usually located in a cavity where large numbers of bats can cluster (Fenton and Barclay, 1980). During the day, little brown myotis use day roosts, which are usually different from their night roosts.

Lactating females will use maternity roosts that are separate from the night roosts used by non-lactating females and males (Anthony *et al.*, 1981). Reproductive females use roosts with varying characteristics throughout their reproductive cycle. Once little brown myotis pups are able to fly, both they and their mothers may return to using common night roosts (Anthony *et al.*, 1981). Little brown myotis rely extensively on tree cavities for roosting and raising young, and the availability of roosts may be limiting to some bat populations (Olson, 2011). Females have high fidelity to nursery roosts and return to the same roosts each spring.

#### 4.4.5.2 Habitat Availability

Roosting habitat was assumed to be the most limiting factor for this species, so habitats were rated based on their ability to provide suitable roosting trees. In the WLSA, mature and old-growth deciduous forests were given a habitat suitability rating of high and mature and old-growth mixedwood forests were assigned a habitat suitability rating of moderate. Mature and old-growth coniferous forests were given a habitat suitability rating of low, based on male little brown myotis occasionally roosting in conifer snags. Young deciduous and mixedwood forests were rated as low.

Young, sapling, and shrubby coniferous forests, and sapling/shrubby deciduous or mixedwood forests, and other non-treed habitats, were given a habitat suitability rating of nil.

Based on this approach, approximately 20.7% of the WLSA was comprised of highly- (0.7%) or moderately- (20.0%) suitable roosting habitat for little brown myotis under baseline conditions (Table 4.4-5, Figure 4.4-5).

**Table 4.4-5 Baseline Habitat Availability for Little Brown Myotis in the Wildlife Local Study Area**

| Habitat Suitability Class | Area (ha) | %WLSA |
|---|---|---|
| High | 37.8 | 0.7 |
| Moderate | 1,128.7 | 20.0 |
| Low | 2,638.7 | 46.7 |
| Nil | 1,841.3 | 32.6 |
| **Total** | **5,646.4** | **100.0** |
| **Effective Habitat[1]** | **1,166.5** | **20.7** |

[1] Effective Habitat = High + Moderate suitability classes.

#### 4.4.5.3 Habitat Connectivity and Movement

Little brown myotis, as well as the other bat species in the region, are likely to move freely through most of the WLSA at baseline as many of the existing disturbance features do not appear to be barriers to movement. Stray artificial light (sky glow) associated with existing urban/rural residential areas and industrial facilities may reduce the overall effectiveness of habitats for bats through disruption of migratory patterns, breeding and reproduction, and predator-prey dynamics (Longcore and Rich, 2004; Navara and Nelson, 2007; Bat Conservation Trust 2008 and 2011, RCEP, 2009). Additionally, commuting bats may avoid higher traffic volume roads such as Highway 3 (Bennett and Zurcher, 2012).

#### 4.4.5.4 Mortality Risk

The most significant mortality risk to little brown myotis in Canada is white-nose syndrome, which has not yet reached Alberta but may do so within the next two decades. The most likely anthropogenic source of mortality for little brown myotis in the WLSA at baseline is collisions with tall infrastructure and vehicles. Additionally, bat colonies are frequently eradicated from buildings because of potential concerns about disease transmission. Natural sources of bat mortality are likely to include predation and starvation.

#### 4.4.5.5 Abundance

Little brown myotis are present and appear to be relatively abundant in the WLSA under baseline conditions. Three of the four bats captured with mistnets in 2014 were little brown myotis, and 79% of the 8,415 passes identified using acoustic recordings were attributed to little brown myotis or another small-bodied myotis, long-legged myotis.

### 4.4.6 American Marten

#### 4.4.6.1 Species Status and Habitat Requirements

This species has a general provincial status of "Secure" (AEP, 2015) and populations outside of Newfoundland have not been assessed by COSEWIC or SARA.

American martens occur throughout the forested regions of Canada. In Alberta, the species occurs in all regions except the southeastern prairie region. Throughout their Alberta range and much of their Canada range, American martens are associated with coniferous forests (Koehler and Hornocker, 1977; Raine, 1983; Mowat, 2006; Kirk and Zielinski, 2009). In the Selkirk and Purcell Mountains of southern British Columbia, Mowat (2006) found evidence of marten use in a variety of habitats, including recently logged areas, regenerating stands, dry Douglas fir forests, and subalpine forests, with a preference for older stands with greater crown closure. Several other studies have also indicated that martens prefer mature to old-growth, closed canopy forests (Koehler and Hornocker, 1977; Wilbert *et al.*, 2000; Poole *et al.*, 2004; Mowat, 2006; Kirk and Zielinski, 2009). Martens avoid open habitats (Baldwin and Bender, 2008) and will not travel across frozen lakes and rivers (Raine, 1983).

Their preference for mature to old-growth forest is likely related to their use of structures associated with downed, dead woody material, which is likely to be more abundant in old forests. Wright (1999) and Baldwin and Bender (2008) found a positive association between marten use of a site and the volume of downed woody material.

American martens prefer mesic habitats over xeric ones (Mowat, 2006; Baldwin and Bender, 2008; Kirk and Zielinski, 2009), likely because wetter sites have higher primary productivity and a greater abundance of prey (Mowat, 2006). Voles, which are frequently a preferred prey for martens, are most abundant in mesic habitats (Koehler and Hornocker, 1972).

#### 4.4.6.2 Habitat Availability

Habitat suitability for American marten was based on ecosite phase, forest age, and disturbance under winter conditions, when individuals of this species are more likely to be under nutritional or physiological stress. Although previous (*e.g.* coal mining) and existing (*e.g.* forestry, oil and gas, *etc.*)

anthropogenic disturbances have reduced marten habitat suitability in the WLSA to some extent, approximately two-thirds of the WLSA was still rated as effective habitat for the marten at baseline (Table 4.4-6, Figure 4.4-6). Most of the effective habitat for marten was characterized as moderate-high to moderate and was distributed throughout the WLSA. Only 9.1% (511.4 ha) of the WLSA was rated as high-quality habitat, most of which was restricted to the northern and southeastern portions of the WLSA (Figure 4.4-6).

**Table 4.4-2 Baseline Habitat Availability for American Marten in the Wildlife Local Study Area**

| Habitat Suitability Class | Area (ha) | % of WLSA |
|---|---|---|
| High | 511.4 | 9.1 |
| Moderate-High | 1,658.8 | 29.4 |
| Moderate | 1,570.1 | 27.8 |
| Moderate-Low | 349.8 | 6.2 |
| Low | 365.2 | 6.5 |
| Nil | 1,191.1 | 21.1 |
| **Total** | **5,646.4** | **100.0** |
| **Effective Habitat[1]** | **3,740.3** | **66.2** |

[1] Effective Habitat = High plus Moderate-High plus Moderate habitat suitability classes

#### 4.4.6.3 Habitat Connectivity and Movement

American martens are typically associated with old or mature forests and they frequently avoid non-forested areas while foraging (Steventon and Major, 1982; Thompson and Harestad, 1994; Potvin *et al.*, 2000; Cushman *et al.*, 2011). They generally respond negatively to roads, wide (>3 m) linear disturbances, and forest clearings. As a result, the major barriers to marten movements in the WLSA are likely to be Highway 3 and the residential and industrial areas along it. American martens are also unlikely to move through open, grassy habitats and rocky, barren areas such as those areas located in the central portion of the WLSA.

#### 4.4.6.4 Mortality Risk

Because the American marten in Alberta is managed as a furbearing species, the major anthropogenic source of mortality in the WLSA and WRSA is likely to be trapping. Trapping of martens is regulated in the WLSA and WRSA and may occur from November 1 to January 31. During the 2010/2011 to the 2014/2015 trapping seasons, a seasonal average of 10,397 marten pelts were exported from Alberta.

The predominant natural source of mortality for martens is predation (Bull and Heater, 2001), with key predators being wolves, coyotes, fishers, great gray owls, and lynx all of which occur in and around the WLSA.

#### 4.4.6.5 Abundance

One American marten was detected by the wildlife cameras set up in the WLSA and scat was observed in three habitat types during the 2016 pellet/scat survey. There are no data available on marten density in southwest Alberta. Marten densities can vary depending on vole abundance and habitat type. During periods of high vole density, densities can reach 2.4 marten/km$^2$ (Naughton, 2012). However, the relative abundance of this species under baseline conditions in the WLSA is unknown.

### 4.4.7 Canada Lynx

#### 4.4.7.1 Species Status and Habitat Requirements

The Canada lynx occurs at low densities throughout its range in Alberta (Pattie and Fisher, 1999). This species is considered “Sensitive” in Alberta because of recent population declines and increasing concerns regarding habitat loss and fragmentation (AEP 2010). However, they are not considered to be at risk at the federal level.

Canada lynx populations can undergo dramatic nine to 11 year cycles, and Alberta is estimated to have approximately 8,000 lynx during the low point of the cycle (AEP, 2010). Lynx population cycles are closely linked to those of snowshoe hares (Mowat and Slough, 2003; Poole, 2003), their preferred prey. Lynx population cycles typically lag one to two years behind those of hares, and can be synchronous over large areas (Naughton, 2012). However, lynx populations in the southern part of their range (including the WLSA) do not appear to display the dramatic cycles seen in northern populations (Murray *et al.,* 2008). The ecology of southern lynx populations appears to resemble those of northern populations during the low phases of their cycles (Apps, 2000).

Lynx habitat use can be best predicted by snowshoe hare habitat use (Keim *et al.,* 2011). Hares tend to prefer early successional forests with well-developed understories (Koehler and Aubry, 1994, Westworth Associates Environmental Ltd., 2002). Such habitat supplies hares with abundant browse and provides them with both thermal cover and protection from predators (Buehler and Keith, 1982). However, at times lynx may use sub-optimal snowshoe hare habitats because predation success can be greater in more open habitats (Fuller *et al.,* 2006).

### 4.4.7.2 Habitat Availability

Almost half of the WLSA (2,569.6, ha, 45.5%) is comprised of effective lynx habitat, most of which is located in the northern half of the WLSA (Table 4.4-7, Figure 4.4-7). These results appear to be consistent with Weaver (2013) where potential habitat suitability for lynx was assessed at the regional landscape level (Figure 4.4-8). Effective lynx winter habitat consists of coniferous forests with dense, shrubby understories which provides browse and cover for the lynx's preferred prey as well as horizontal cover for the lynx. Moderate-low and low-quality habitats generally lack either horizontal cover or dense shrub layers. Nil-quality habitats include anthropogenic disturbances or non-vegetated land that lynx are likely to avoid.

Much of the southwest section of the WLSA is comprised of lower quality habitats because of the presence of Blairmore and other anthropogenic disturbances (Figure 4.4-7). Hair-snagging surveys for lynx conducted from 2001-2004 in the Crowsnest Pass area are consistent with this: no lynx were detected by hair snag stations set up within approximately 5 km of Highway 3 on the Alberta side of the Crowsnest Pass (Apps *et al.,* 2007). However, lynx were found in less disturbed areas both north and south of Highway 3 (Apps *et al.,* 2007). Additionally, wildlife camera data collected within the WLSA found Canada lynx in only the northern section of the WLSA (Figures 2.4-6 and 2.4-17).

**Table 4.4-7 Baseline Habitat Availability for Canada Lynx in the Wildlife Local Study Area and Wildlife Regional Study Area**

| Habitat Suitability Class | WLSA | | WRSA | |
|---|---|---|---|---|
| | Area (ha) | % of WLSA | Area (ha) | % of WRSA |
| High | 88.2 | 1.6 | 19,827.9 | 27.0 |
| Moderate-High | 1,640.3 | 29.1 | 10,115.6 | 13.8 |
| Moderate | 841.1 | 14.9 | 1,087.3 | 1.5 |
| Moderate-Low | 857.0 | 15.2 | 13,703.1 | 18.6 |
| Low | 678.5 | 12.0 | 5,511.1 | 7.5 |
| Nil | 1541.4 | 27.3 | 23,301.9 | 31.7 |
| **Total** | **5,646.4** | **100.0** | **73,547.0** | **100.0** |
| **Effective Habitat1** | **2,569.6** | **45.5** | **31,030.8** | **42.2** |

[1] Effective Habitat = High plus Moderate-High plus Moderate habitat suitability classes.

Approximately 42.2% of the WRSA (or 31,030.8 ha) is comprised of effective Canada lynx winter habitat (Table 4.4-7).

Most of the effective lynx habitat in the WRSA is located in the Montane and Subalpine Natural Subregions (Figure 4.4-8, Figure 4.4-9). The Foothills Fescue Natural Subregion contains very little effective lynx habitat as much of it is covered in open, agricultural land. The Alpine Natural Subregion also lacks effective lynx habitat as it is not forested. Additionally, much of the far southern portion of the WRSA is comprised of ineffective lynx habitat because it lacks tree cover because of a recent fire (Figure 4.4-8) and Canada lynx tend to avoid recently burned areas (Koehler *et al.*, 2008). However, the area is likely to provide effective habitat in the future as the forests regenerate. These results appear to be consistent with Weaver (2013), who assessed potential habitat suitability for lynx at the regional landscape level.

#### 4.4.7.3 Habitat Connectivity and Movement

Canada lynx from southern populations can have large home ranges and are capable of dispersing long distances. In the southern Canadian Rockies, the mean home range sizes for male and female lynx were 381 $km^2$ and 239 $km^2$, respectively (Apps, 2000). In Montana, the mean annual home range sizes for male and female lynx were 220 $km^2$ and 90 $km^2$, respectively (Squires and Laurion, 2000). These values are all larger than the size of the WLSA (56 $km^2$) but smaller than the area of the WRSA (735.5 $km^2$). The WLSA is therefore likely too small to compose an entire home range for an individual Canada lynx. However, female Canada lynx raising young kittens may represent an exception, as their movements tend to be more restrained (Burdett *et al.*, 2007).

Lynx often move several kilometers each day in search of prey. In the southern Canadian Rockies, the mean daily minimum movements for male and female lynx were 3.8 km and 3.0 km, respectively (Apps, 2000). However, the distance travelled daily by Canada lynx will vary with the density of snowshoe hares; where hares are scarce, lynx may move up to 9 km/day to find prey (Naughton, 2012).

Adults may move their home ranges when prey becomes scarce, and subadult lynx frequently disperse from their natal home ranges during spring (Naughton, 2012). Subadult females often remain close to their mother's home range, while males typically disperse longer distances (Naughton, 2012). The distance moved by a dispersing lynx before it establishes a new home range varies widely and is likely highly dependent on prey availability. Dispersal distances of up to 1,100 km have been reported (Poole, 1997, 2003). The low level of genetic differentiation documented among lynx populations in mainland North America suggests frequent gene flow occurs among populations in different regions (Row *et al.*, 2012).

Anthropogenic disturbances such as roads can affect lynx movements and space use. For example, radio-collared Canada lynx in the southern Canadian Rocky Mountains crossed highways less frequently than expected (Apps, 2000). Additionally, Squires *et al.* (2013) radio-collared 44 Canada lynx in Montana that had home ranges within 8 km of a two-lane highway. Only 12 (27%) of those lynx would cross the highway. As many lynx appear to avoid roads, Highway 3 is likely to influence lynx movements in the vicinity of the WRSA (Figure 4.4-8). Similar results were reported by Weaver (2013).

Canada lynx densities appear to be negatively affected by high road densities. Bayne *et al.* (2008) found that lynx occupancy was lower in areas with higher road densities, particularly where coyote activity was highest. Canada lynx densities are generally lower at the southern edge of their range, but this appears to be more related to higher road densities than to changes in prey densities (Bayne *et al.*, 2008). The decreased use of habitat by lynx in areas with high road densities may be related to lynx avoidance of roads, competition with coyotes (which are more common in the southern part of the lynx's range where road densities are higher), or increased lynx mortality because of increased human access to an area (*i.e.* trapping) (Bayne *et al.*, 2008).

Alpine regions are likely the major natural barriers to lynx movement in the WRSA, as Canada lynx often avoid high elevations and steep slopes (Apps, 2000; Koehler *et al.*, 2008). Lynx are also unlikely to travel through the Foothills Fescue region in the eastern section of the WRSA, as they generally avoid open grasslands (Squires *et al.*, 2013). However, lynx do occasionally travel into the prairie grassland region of Canada. This may occur when large numbers of lynx from the boreal forest must travel widely to find food following large declines in snowshoe hare numbers (Naughton, 2012).

#### 4.4.7.4 Mortality Risk

Lynx in Alberta are managed as a furbearing species and trapping is likely the only significant human-related mortality risk to this species in the WLSA and WRSA under baseline conditions. Canada lynx are rarely hit by vehicles in the Crowsnest Pass region (Miistakis Institute for the Rockies, 2005; Alberta Transportation, 2015).

The primary natural source of mortality in lynx is likely starvation (Apps, 2000) although they are also occasionally killed by fishers, cougars, wolves, coyotes, or wolverines (Murray *et al.*, 2008).

#### 4.4.7.5 Abundance

Although Canada lynx are known to occur in the WLSA, they were one of the least common carnivores detected based on the wildlife camera trapping program under baseline conditions. There is little data on lynx density in the Crowsnest Pass region, although lynx densities in the southern part of their range (2-3 lynx/100 km$^2$) are generally similar to those in the northern boreal forest during periods of low hare density (Aubry *et al.*, 2000). Lynx populations in the Castle-Carbondale region (which overlaps the south section of the WRSA) are generally patchy and of low density (Arc Wildlife

Services, 2004). Lynx are expected to occur in the WRSA under baseline conditions but likely at low densities.

### 4.4.8 Grizzly Bear

#### 4.4.8.1 Species Status and Habitat Requirements

Grizzly bears are a "Threatened" species in Alberta. In British Columbia, they are listed as "Vulnerable" (S3; Conservation Data Centre, 2015), but the Flathead and South Rockies populations are listed as "Viable" (Hamilton and Austin, 2001; MFLNRO, 2012). At the federal level, grizzly bears are classified as a species of "Special Concern".

Grizzly bear range in the province of Alberta is divided into seven distinct Grizzly Bear Population Units (GBPU) or Bear Management Areas (BMA) based on known population structure and anthropogenic or natural barriers to movement (AESRD and ACA 2010; AESRD, 2013; AEP, 2016a). The WLSA and GBRSA fall within the boundaries of the Livingstone GBPU (BMA 5) and the Castle GBPU (BMA 6). The Castle GBPU lies between the Alberta-Montana border and Highway 3, while the Livingstone GBPU lies between Highway 3 and Highway 1. The western section of the GBRSA also covers a small portion of southeastern British Columbia. The current range of grizzly bears in British Columbia has been delineated into 56 GBPUs for conservation and management purposes. In the south, GBPU boundaries follow natural (*e.g.* large rivers) and human-caused (*e.g.* settled valleys) geographical divisions, which also reflect a degree of genetic isolation (Proctor *et al.*, 2012). The GBRSA includes portions of the Flathead and South Rockies GBPUs in WMUs 4-1 and 4-23 in British Columbia.

Grizzly bear distribution and habitat use correspond with the availability and location of food (Chetkiewicz and Boyce, 2009; AESRD and ACA, 2010). The largely plant-based diet of grizzly bears varies seasonally (Hamer and Herrero, 1987). During early spring (pre-green-up), grizzly bears will feed heavily on roots (Hamer and Herrero, 1987; McLellan and Hovey, 1995; Munro *et al.*, 2006), and during late spring, green vegetation starts to make up a larger part of the diet. During late summer and early fall, berries (particularly *Vaccinium* spp. and Canada buffaloberry) comprise a large part of the diet and once they become unavailable, roots will again become a dominant part of the diet (Munro *et al.*, 2006). Ungulates can also make up a significant portion of the diet, depending on the season. In west-central Alberta, newborn ungulates make up the largest part of the diet during May and June (Munro *et al.*, 2006), while in southern British Columbia and Montana, they compose the greatest part of the diet during April, May, September, and October (McLellan and Hovey, 1995). In the Rocky Mountains, ground squirrels are an important component of the grizzly bear diet, while in British Columbia, grizzly bears incorporate a greater amount of fish into their diet than they do in Alberta (AESRD and ACA, 2010).

Habitat availability and habitat state mapping for grizzly bears was obtained from the Foothills Research Institute Grizzly Bear Program (FRIGBP, 2012). The FRIGBP RSF combines remote-sensing imagery, digital elevation models, linear access features, hydrologic features, and administrative areas with known GPS locations of radio-collared grizzly bears to predict the seasonal probability of grizzly bear occurrence in an area of interest (FRIGBP, 2012). The FRIGBP RSF is scaled from 1 to 10, with 1 being the lowest value and 10 being the highest. RSFs are statistical estimates of the probability that a resource unit is used or occupied by the species of interest; in the case of grizzly bear RSFs, the values depict the probability of grizzly bear occurrence in a spatial unit. Grizzly bear occurrence in this RSF model is based on the abundance and distribution of various habitat resources including food, water, denning sites, and thermal cover.

Figures 4.4-10, 4.4-11, and 4.4-12 illustrate grizzly bear RSFs for the spring, summer and fall seasons, respectively, in the WLSA, and Figures 4.4-13, 4.4-14 and 4.4-15 illustrate grizzly bear RSFs for the spring, summer and fall seasons, respectively, in the GBRSA. Average RSF values were calculated for the WLSA and the GBRSA for each season (Table 4.4-8), which places seasonal grizzly bear habitat values in the WLSA in a regional context.

**Table 4.4-8 Baseline Resource Selection Function for Grizzly Bears in the Wildlife Local Study Area and Grizzly Bear Regional Study Area**

| Season | WLSA | GBRSA |
|---|---|---|
| Spring | 6.50 | 5.72 |
| Summer | 6.04 | 5.09 |
| Fall | 5.93 | 5.19 |
| **Average RSF Value** | **6.16** | **5.33** |

[1] RSF is measured on a scale of 1 (lowest) to 10 (highest), with values proportional to the probability of resource use.

Based on the RSF model results, grizzly bear occurrence probability was highest in the higher elevation eastern portion and lower elevation southern portion of the WLSA in spring (Figure 4.4-10). The higher elevation eastern portion of the WLSA retains high habitat value throughout summer and fall, while the southern portion of the WLSA undergoes a reduction in probability of occurrence through the summer and fall seasons (Figures 4.4-11 and 4.4-12). The montane central portions and subalpine habitats in the northern portion of the WLSA generally supported low RSF values in spring, summer, and fall. The mean RSF value for the WLSA was highest in spring and lowest in fall (Table 4.4-8). The portion of the GBRSA that was modelled has consistently lower average RSF values than the WLSA for all seasons (Table 4.4-8; compare Figures 4.4-10 to 4.4-12 with Figures 4.4-13 to

4.4-15), indicating that, on average, grizzly bears are more likely to occur in and use habitat in the WLSA than in the surrounding GBRSA .

The FRIGBP 2012 Deliverables also included mapping of grizzly bear population sources and sinks (habitat states) in the WLSA and GBRSA (Figures 4.4-16 and 4.4-17). The FRIGBP calculated five grizzly bear habitat states by combining the RSF values with the human-caused mortality risk estimates (see below). Primary and secondary population sources are defined as areas with high-quality and moderate-quality resource availability, respectively, where the mortality risk is low (Nielsen *et al.,* 2009). Primary and secondary population sinks are defined as areas of high-quality and moderate-quality habitat, respectively, which incur a very high risk of mortality. Non-critical habitat includes areas of low quality habitat where grizzly bears are not expected to occur regardless of mortality risk.

The WLSA supported approximately equivalent amounts of source habitat (2720.9 ha, 48.2%) and sink habitat (2645.7 ha, 46.9%) at Baseline (Table 4.4-9), indicating approximately half of the WLSA provides effective habitat with high grizzly bear survival. The WLSA contained only 826.0 ha (14.6%) of primary source habitats at Baseline. At Baseline, primary source habitats for grizzly bears occurred mostly in the central portion of the WLSA and secondary source habitats occurred throughout the WLSA where road densities were relatively low (Figure 4.4-16). Primary sink habitats occurred mainly in the southern and eastern portions of the WLSA and adjacent to linear anthropogenic features where mortality risk was expected to be greater (Figure 4.4-16). Small areas of non-critical habitat occurred throughout the WLSA at Baseline and consisted of mostly existing cutblocks and other clearings.

In the GBRSA, 50% of the modelled RSF area was composed of effective (source) habitat, 27.8% was sink habitat, and 22.3% was considered non-critical at Baseline (Table 4.4-9, Figure 4.4-17). The region east of the modelled RSF area was assumed to be non-critical habitat (*i.e*. an area where grizzly bears were not expected to occur) because of the predominant agricultural landscape (Northrup *et al.,* 2012). In contrast, the region of the GBRSA located west of the RSF model are in British Columbia and provides source and sink habitats for grizzly bears based on existing information available for the region. In that area, high-quality grizzly bear habitat, high population densities, and stable populations are present although the presence of roads/highways and urban areas indicates that sink habitat is also present (Apps *et al.,* 2007; Mowat *et al.,* 2013). There appear to be similar proportions of source and sink habitats at both the local and regional scales within the modelled RSF area and in the western portion of the GBRSA.

The WLSA was not located within any of the Carnivore Core Security Areas identified by Apps *et al.* (2007); however, the GBRSA contains core security areas 5, 6, 7, and 15. These areas were identified based on landscape suitability, vulnerability, and movements of grizzly bears, Canada lynx, and wolverine (Apps *et al.,* 2007). It is unlikely that grizzly bears would maintain home ranges east of the Castle and Livingstone GBPUs in the GBRSA since those areas are dominated by agricultural lands with a high human density and low grizzly bear population viability (Apps *et al.,* 2007; AESRD and ACA, 2010; FRIGBP, 2012).

**Table 4.4-9 Baseline Habitat States for Grizzly Bear in the Wildlife Local Study Area and Grizzly Bear Regional Study Area**

| Habitat State | WLSA | | GBRSA | |
|---|---|---|---|---|
| | Area (ha) | % of WLSA | Area (ha) | % of WRSA |
| Primary Sink | 1,348.6 | 23.9 | 22,883.04 | 15.3 |
| Secondary Sink | 1,297.1 | 23.0 | 18,683.91 | 12.5 |
| Non-critical Habitat | 279.8 | 5.0 | 33,486.03 | 22.3 |
| Secondary Source | 1,895.0 | 33.6 | 39,908.34 | 26.6 |
| Primary Source | 826.0 | 14.6 | 35,078.58 | 23.4 |
| **Total** | **5,646.4** | **100.0** | **150,039.9** | **100.0** |

#### 4.4.8.2 Habitat Connectivity and Movement

Grizzly bears are a very wide ranging species, with documented home ranges of up to 4,700 $km^2$ in Alberta (AESRD, 2008), although home range sizes and movements are generally much smaller and vary depending on habitat quality (AESRD, 2008). Bears from the Crowsnest Pass region have been detected as far away as Banff National Park (Mowat *et al.,* 2013). Despite their wide-ranging behaviour, grizzly bear natal dispersal capabilities are low. For instance, young females typically establish home ranges adjacent to or within 20 km their maternal home range, while young males may move up to 60 km from their paternal home range (AESRD and ACA, 2010, and references therein). Grizzly bear movements vary depending on the season as well. Daily movements are lowest in early summer, but by late summer bears may make large movements in search of berry-rich habitats (AESRD and ACA, 2010). During the berry season, grizzly bear movement activity becomes more restricted, but they are known to roam widely again in search of other dietary resources following the berry season (AESRD and ACA, 2010).

There appear to be very few barriers to grizzly bear movement within the WLSA at Baseline, although they may avoid the unimproved access roads in the south and northwest sections. During baseline wildlife surveys (camera trapping, incidental observations) conducted in the WLSA, grizzly bears were observed using linear anthropogenic features and forested habitats within 100 m of and on both sides of the unimproved access roads, indicating that these features are likely permeable for grizzly bears. In the GBRSA, Highway 3 appears to restrict grizzly bear movement and gene flow (Proctor *et al.*, 2005). A recent study of grizzly bear movement in the Crowsnest Pass region of British Columbia detected only 12 crossings (all by males) of Highway 3 by grizzly bears between 2006 and 2011 (Mowat *et al.*, 2013) and a 1997 study reported only one male crossing of Highway 3 in British Columbia (Mowat and Strobeck, 2000). Furthermore, a study specifically designed to assess movement across Highway 3 in the Crowsnest Pass region only detected crossings of two males and one female (Apps *et al.*, 2007).

Grizzly bears have been documented moving across the Continental Divide both north and south of Highway 3 (Proctor *et al.*, 2012; Apps *et al.*, 2007), although this movement is rare. In 1997 and 2007, two male bears (Mowat and Strobeck, 2000) and six male bears (Boulanger *et al.*, 2008) were detected on both sides of the Continental Divide. Apps *et al.* (2007) reported eight individual grizzly bears crossing the Continental Divide between Alberta and British Columbia. Grizzly bears most frequently crossed the Continental Divide south of Highway 3 using Tent Mountain Pass and Ptolemy Pass, as well as an unnamed pass immediately south of Highway 3 (Apps *et al.*, 2007). None of these bears were detected further east of Ptolemy Massif, which was considered by Apps *et al.* (2007) to be a barrier to the west-east movement of grizzly bears. Apps *et al.* (2007) also reported a single crossing of the Continental Divide north of Highway 3 by a lone male grizzly bear, possibly utilizing Racehorse Pass (Apps *et al.*, 2007). Since grizzly bears generally avoid areas with high levels of human activity, any urban and industrial areas in the GBRSA likely function as barriers to grizzly bear movement.

#### 4.4.8.3 Mortality Risk

Human-caused mortality has been implicated as the largest source of grizzly bear mortality and the most important contributing factor to grizzly bear population declines in Alberta and British Columbia (AESRD and ACA, 2010; McLellan *et al.*, 1999). McLellan *et al.* (1999) estimated that between 77% and 85% of all grizzly bear mortalities in Alberta, British Columbia, and nearby jurisdictions were human-caused.

Legal hunting of grizzly bears has been suspended in Alberta since 2006. However, grizzly bears may still be killed by humans defending themselves or their property, by being hit by vehicles, by hunters mistaking them for black bears, by hunters acting illegally, or by aboriginal hunters. Problem bears may also be euthanized by Alberta Fish and Wildlife officers. Illegal hunting is currently the factor most responsible for grizzly bear mortality in Alberta (GoA, 2013c).

In the Livingstone and Castle GBPUs, 30 and 28 grizzly bear mortalities (approximately 3 bears/year) were documented 1999 and 2009, respectively (Boulanger and Stenhouse, 2009). In 2013, eight grizzly bears were killed in the Livingstone GBPU and five were killed in the Castle GBPU (GoA, 2013c). According to the Government of Alberta (2013), those 13 known mortalities were attributed to illegal hunting (5), unknown causes (2), mistaken for black bear (2), self-defence (2), control kill (1), and aboriginal harvest (1). Vehicle and train collisions are also a known mortality source for grizzly bears in Alberta, accounting for approximately 5% of mortalities in most years (Alberta Grizzly Bear Recovery Team 2005). The Alberta Grizzly Bear Recovery Team (2005) reported that total human-caused mortality of less than 2.9% to 4.9% is required to maintain grizzly bear populations in moderate and optimal habitat. The mortality rate in the Castle and Livingstone GBPUs was estimated to be approximately 8% in 2013 (GoA, 2013c).

Similarly, the annual grizzly bear mortality rate in the South Rockies GBPU in BC has exceeded 5% of the estimated population in most years over the past two decades (Hamilton and Austin, 2001; Mowat *et al.*, 2013). The majority of the human-caused grizzly bear mortality has been attributed to hunting, control kills, and illegal harvesting (Hamilton and Austin, 2001). In the Flathead and South Rockies GBPUs, known human-caused grizzly bear mortalities have averaged 19.2 bears annually since 1978 (Mowat *et al.*, 2013), with females representing close to 40% of the grizzly bear kill (Mowat *et al.*, 2013). Control kills of problem bears in the Flathead and South Rockies GBPUs have mostly been located near the Highway 3 corridor between Jaffray and the Alberta border where human population densities are high (Mowat *et al.*, 2013). Road and rail mortalities have also been an important source of human-caused grizzly bear mortality in the Flathead and South Rockies GBPUs, making up 30% of the total non-hunting mortality between 2004 and 2011 (Mowat *et al.*, 2013). Road and rail mortalities have predominantly occurred in the Highway 3 corridor. In the past, hunting restrictions and complete closures have been implemented several times in the South Rockies and Flathead GBPUs because either female or total kill has exceeded maximum allowable mortality levels (Mowat *et al.*, 2013). In 2011, the South Rockies GBPU was again closed to hunting and the Flathead GBPU was partially closed to only allow for limited entry by draw for residents and guide outfitter hunting for non-residents (MFLNRO 2012).

Grizzly bear mortality risk has been correlated with the density of anthropogenic linear features, which act to improve human access and increase the likelihood of grizzly bear encounters with humans (Boulanger and Stenhouse, 2014). Grizzly bear habitat security has been found to decline when road density approaches a critical threshold of 2.4 $km/km^2$ (Salmo and Diversified, 2003; Hamilton and Austin, 2004; Nielsen *et al.*, 2009). Boulanger and Stenhouse (2014) suggest that maintaining a 0.75 $km/km^2$ road density threshold will be required to ensure viable grizzly bear populations in Alberta. Under baseline conditions, the density of roads in the WLSA is 0.88 $km/km^2$, which exceeds the threshold defined by Boulanger and Stenhouse (2014). This suggests that the grizzly bear population in the WLSA may not be capable of supporting a viable grizzly bear population under baseline conditions. The density of roads in the GBRSA was below any of the key established thresholds for road density outlined above (0.53 km/km$^2$) at baseline, suggesting that the GBRSA provides adequate habitat security and has the potential to support a viable grizzly bear population.

The FRIGBP (2012) Deliverables included a mortality risk model that predicted the relative probability of human-caused grizzly bear mortality based on various landscape variables. Distance to both roads and trails were the most important variable influencing mortality risk in the model. Map grid cells in the model output were rated between 1 (lowest mortality risk) and 10 (highest mortality risk) in terms of probability of grizzly bear mortality. Mortality risk for grizzly bears in the WLSA was greatest along the access roads and trails, near human settlements and farmsteads, along hydrological features, and in the Highway 3/railway corridor (Figure 4.4-18). The WLSA occurs in an area of relatively high grizzly bear mortality risk in a regional context. The average mortality risk value was 5.48 for the WLSA at baseline, which was considerably higher than the GBRSA at baseline (4.61). Areas west of the FRIGBP mortality model in British Columbia likely have greater mortality risk because of the legal harvest of grizzly bears in those WMUs, while the area to the east is also likely to have greater mortality risk because of high human presence and the greater likelihood of human conflict.

#### 4.4.8.4 Abundance

Grizzly bears have been detected in the WLSA. They were detected by four cameras located in the WLSA and by two other cameras located in the vicinity of the WLSA. A pair of juvenile grizzly bears was also observed incidentally in the WLSA in 2014. The relative abundance of this species under baseline conditions in the WLSA is unknown.

Based on existing information for Alberta, the Livingstone GBPU had an estimated population of 90 bears in 2006 and the Castle GBPU had an estimated population of 51 bears in 2007 (AESRD and ACA, 2010). These population estimates have not been updated since their initial reporting and were still deemed applicable in 2013 (GoA, 2013c). Apps *et al.* (2007) estimated the grizzly bear population in the Crowsnest region of Alberta to be 38 bears in 2002. The density of grizzly bears south of Highway 1 (Castle and Livingstone GBPUs combined) has been estimated at between 12 and 18 bears/1,000 km$^2$ (AESRD and ACA, 2010; Grizzly Bear Inventory Team, 2007). This density of grizzly bears is greater than in the Yellowhead and Clearwater GBPUs, which are considered population sinks, but less than the Grande Cache GBPU, which has the largest population of grizzly bears in Alberta (AESRD and ACA, 2010). There are an estimated 700 grizzly bears occurring throughout the province of Alberta (AESRD and ACA, 2010).

In British Columbia, the most recent grizzly bear population estimate for the Flathead population was 175 individuals (50-60 bears/1,000 km$^2$) and 305 individuals (30-40 bears/1,000 km$^2$) for the South

Rockies population (MFLNRO, 2012). In 2008, a population estimate of 178 bears (55 bears/1,000 km$^2$) was derived for the Flathead GBPU (Boulanger *et al.,* 2008). Previously, Boulanger *et al.* (2001) estimated the Flathead population to be 156 individuals (density of 48 bears/1000 km$^2$) in 2001, and in 1989 the Flathead population density was estimated at 80 bears/1,000 km$^2$ (McLellan 1989). The mean density of grizzly bears in the South Rockies GBPU was estimated to be 35.2 bears/1,000 km$^2$ between 2006 and 2011, 41.4 bears/1,000 km$^2$ between 2007 and 2008, and 37.7 bears/1,000 km$^2$ between 2006 and 2009 (Mowat *et al.,* 2013). Both of these GBPUs appear to have stable grizzly bear populations (Mowat *et al.,* 2013). There are an estimated 15,000 grizzly bears in British Columbia (MFLNRO, 2012).

### 4.4.9 Moose

#### 4.4.9.1 Species Status and Habitat Requirements

Moose are provincially listed as "Secure" and are considered to be "Not at Risk" in Canada. Moose are an important species for recreational hunters and traditional users and occur throughout the forested regions of Alberta. They occupy a variety of habitats, but are most closely associated with deciduous, shrubby, riparian, and lowland treed habitats that provide ample browse. Moose may have their summer and winter needs met in the same home range because deciduous shrubs can provide forage during both seasons and dense coniferous forests can provide shelter from the sun during summer and from deep snow during the winter (Dussault *et al.,* 2006). However, moose in mountainous areas often shift their ranges to lower elevations during winter to avoid deep snow (Maier *et al.,* 2005). Energetic benefits of foraging in different habitats may change with increased snow depth although mixedwood and shrublands on average consistently contain the most forage (Visscher *et al.,* 2006). Shrublands contain the highest biomass of preferred forage, but availability decreases rapidly as snow depths approach 70 cm, at which point moose tend to prefer mixedwood stands (Visscher *et al*., 2006).

Moose require large amounts of woody browse, preferring deciduous species like willow, aspen, balsam poplar, dwarf birch, Saskatoon, red-osier dogwood, chokecherry, hazelnut, and low and high bush cranberry (Timmermann and McNicol, 1988; Westworth *et al.,* 1989; Renecker and Hudson, 1993). These species occur in shrubby habitats, early seral stage forests, and deciduous-dominated stands. Moose prefer early successional habitats 11-30 years following disturbance (Kelsall *et al.,* 1977). Riparian and wetland habitats may have a disproportionate value to moose, as they are an important source of summer forage, are used during the summer to regulate their body temperature, and also to escape predators (Courtois *et al.,* 2002). Moose may preferentially select habitats that provide suitable cover over habitats with abundant forage in instances where predation stress is high (Dussault *et al.,* 2005).

#### 4.4.9.2 Habitat Availability

Forty-nine percent of the WLSA and 46.7% of the WRSA were considered effective moose winter habitat under Baseline conditions (Table 4.4-10). Effective winter habitat for moose was widely distributed in the WLSA (Figure 4.4-20) and WRSA (Figure 4.4-21), although larger contiguous areas of effective winter habitat were located in the southern and eastern portions of the WRSA.

**Table 4.4-10 Baseline Winter Habitat Availability for Moose in the Wildlife Local Study Area and Wildlife Regional Study Area**

| Habitat Suitability Class | WLSA | | WRSA | |
|---|---|---|---|---|
| | Area (ha) | % of WLSA | Area (ha) | % of WRSA |
| High | 35.1 | 0.6 | 4,228.7 | 5.7 |
| Moderate-High | 1,928.2 | 34.1 | 11,779.2 | 16.0 |
| Moderate | 805.7 | 14.3 | 18,329.9 | 24.9 |
| Moderate-Low | 663.7 | 11.8 | 22,136.9 | 30.1 |
| Low | 1,464.1 | 25.9 | 6,877.2 | 9.4 |
| Nil | 749.7 | 13.3 | 10,195.1 | 13.9 |
| **Total** | **5,646.4** | **100.0** | **73,547.0** | **100.0** |
| **Effective Habitat[1]** | **2,769.0** | **49.0** | **34,337.8** | **46.7** |

[1] Effective Habitat = High plus Moderate-High plus Moderate habitat suitability classes.

All effective winter habitat (high, moderate-high, and moderate quality) was considered to be core security habitat. This core habitat is of high value for moose because it provides adequate forage in areas safe from human disturbance and potentially predation. Core security habitat was mapped for the winter period only, when forage availability is most limiting.

Core security winter habitat was distributed throughout the WLSA in 23 patches (Table 4.4-11, Figure 4.4-22), and distributed in 214 patches throughout the WRSA (Table 4.4-11, Figure 4.4-23). Patches >100 ha, the largest blocks of undisturbed habitat, accounted for 42.3% (2,386.8 ha) and 40.4% (29,688.4 ha) of effective core moose winter habitat in the WLSA and WRSA, respectively (Table 4.4-11). Smaller patches ranging from 5 – 20 ha comprised the largest proportion of moose core winter habitat in terms of number of patches in both the WLSA and WRSA (Table 4.4-11). Approximately 48.6% (2,738.3 ha) of the WLSA is characterized as effective core winter habitat. Similarly, effective core moose winter habitat accounted for 45.8% of the WRSA. These results indicate that a relatively large proportion of the WLSA and WRSA provides suitable core winter habitat for moose at Baseline.

**Table 4.4-11 Baseline Availability of Core Winter Habitat Patches for Moose in the Wildlife Local Study Area and Wildlife Regional Study Area**

| Patch Size Range (ha) | WLSA | | | WRSA | | |
|---|---|---|---|---|---|---|
| | No. Patches | Area (ha) | % of WLSA | No. Patches | Area (ha) | % of WRSA |
| 5-20 | 10 | 144.2 | 2.6 | 122 | 1,301.0 | 1.8 |
| 21-40 | 6 | 151.8 | 2.7 | 31 | 893.7 | 1.2 |
| 41-60 | 1 | 55.5 | 1.0 | 13 | 686.6 | 0.9 |
| 61-80 | 0 | - | - | 5 | 340.2 | 0.5 |
| 81-100 | 0 | - | - | 8 | 704.3 | 1 |
| >100 | 6 | 2,386.8 | 42.3 | 35 | 29,688.4 | 40.4 |
| **Totals** | **23** | **2,738.3** | **48.6** | **214** | **33,614.2** | **45.8** |

#### 4.4.9.3 Habitat Connectivity and Movement

Many existing disturbance features that could potentially affect moose movements are present in the WLSA and WRSA at Baseline. Moose generally avoid busy roads (Dussault *et al.*, 2007; Laurian *et al.*, 2008), although they will cross them when moving from one location to another (Beyer *et al.*, 2013). In some instances, moose may even favour areas of moderate road density because roads are associated with the conversion of conifer forest to deciduous forest, which provides access to better forage and browse (Rempel *et al.*, 1997; Bowman *et al.*, 2010), although these features may act as population sinks (Arc Wildlife Services Ltd., 2004).

Moose response to roads appears to vary relative to road density at the landscape scale. Moose have been reported to cross roads less frequently at road densities greater than 0.2 $km/km^2$ in summer and 0.4 $km/km^2$ in winter (Beyer *et al.*, 2013). Road density was estimated to be 0.88 $km/km^2$ in the WLSA and 0.47 $km/km^2$ in the WRSA under Baseline conditions. At these densities, roads would be expected to act as semi-permeable barriers to movement in both the WLSA and WRSA. Most of the roads are associated with the Highway 3 corridor and urbanized areas in the southern portion of the WLSA, which moose are more likely to avoid. However, unimproved access roads in the WLSA are unlikely to be avoided by moose because current levels of traffic are low (Hatch Mott MacDonald, 2015). The linear feature density, which includes vegetated trails, pipelines, and transmission lines, was 3.1 km/km$^2$ in the WLSA at Baseline. These types of linear features were considered to be highly permeable for moose, and unlikely to restrict moose movements in the WLSA at Baseline.

Although there were considerably more physical barriers to moose movement in the WRSA, the linear feature density (2.1 km/km$^2$) was lower than that in the WLSA. Highways, paved roads, and residential areas, and industrial/commercial developments were also considered to be the major anthropogenic barriers to moose movement in the WRSA. All-season access roads, highways and rail lines were expected to have moderate to low permeability for moose. Although no thorough studies on moose crossing attempts of Highway 3 have been conducted, a citizen science project noted at least 4 moose crossing observations (3.2% of all wildlife crossings) in the Crowsnest Pass region of Alberta between November 2004 and March 2006 (Lee, 2007). However, the greatest barriers to moose movement were areas with extensive urban and industrial development, which were considered impermeable. Moose were expected to move freely throughout the WLSA and WRSA, while avoiding areas of high human activity.

#### 4.4.9.4 Mortality

Moose were occasionally killed on Highway 3 in the Alberta section of the Crowsnest Pass. Between 1997 and 2004, at least 877 large mammals were killed by vehicles on this section of Highway 3, but fewer than 2% of those were moose (Miistakis Institute for the Rockies, 2005). Data from Alberta Transportation (2015) also indicated that moose were rarely killed by vehicles in the Crowsnest Pass area of Alberta between 2004 and 2012. During this timeframe, only two moose-vehicle collisions occurred on the section of Highway 3 between the Towns of Coleman and Bellevue (Alberta Transportation, 2015).

Moose hunting is regulated in Alberta. An estimated total of 7,748 moose were harvested by resident hunters throughout the province in 2014 (AEP, 2015a), but in the WMUs (303, 306, and 402) that overlap the WLSA and WRSA, only an estimated ten were harvested in 2014 and nine in 2013 (AEP, 2015a). Hunting for moose in WMUs 303, 306 and 402 is by limited entry draw and restricted to antlered males (AEP, 2015b).

The major natural source of mortality for moose in the Project area is predation, although moose may also die naturally from starvation, injuries, and parasites. The primary predators of moose in the area are wolves, cougars, black bears, and grizzly bears (Arc Wildlife Services, 2005), all of which occur in the WLSA. Annual cow moose survival rate in the Flathead region of northern Montana was estimated to be 0.88 (Kunkel and Pletcher, 1999). The most common cause of mortality in the Flathead region was predation (62% of mortality events); bears were the predators in 53% of those predation events (Kunkel and Pletcher, 1999).

#### 4.4.9.5 Abundance

Moose are known to occur in the WLSA based on wildlife camera trapping, winter tracking, and pellet count surveys. At Baseline, moose was the third most abundant ungulate species in the WLSA after mule deer and white-tailed deer.

In 1996, the estimated moose winter population in WMU 300 was 246 ± 55 individuals, which represented a density of 0.22 moose/km$^2$ (Shumaker, 1996). In January 2002, an estimated winter population of 271 ± 111 individuals (density of 1.04 moose/km$^2$) was reported for WMU 302 (Arc Wildlife Services Ltd., 2004). Both WMUs are located immediately south and west of the WLSA and the WRSA. In 2013, 460 ± 81 individuals were reported in WMU 300 (density of 0.41 moose/km$^2$) (Hermanutz and Jokinen, 2013). The moose population appears to have increased in WMU 300 between 1996 and 2013 (Hermanutz and Jokinen, 2013).

### 4.4.10 Elk

#### 4.4.10.1 Species Status and Habitat Requirements

Elk is a "Secure" species in Alberta, and is listed as "Not at Risk" in Canada. The habitat preferences of elk vary across seasons. During spring and summer, elk typically choose habitats with the highest available forage biomass and biodiversity (Boyce *et al.*, 2003; Hebblewhite *et al.*, 2008). Some elk migrate between summer and winter ranges, and a single population may contain migratory and non-migratory individuals. Both migratory and non-migratory elk occur in southwestern Alberta (Paton, 2012). During winter, elk in mountainous areas often move to lower elevations in response to the higher snow depths found at higher elevations. Overall, elk appear to select open, grassy habitats with high biomass for foraging during the winter. Jones and Hudson (2002) found that elk in west-central Alberta used open, grassy meadows more frequently during winter than expected based on their availability. They also found that feeding sites used by elk had more grass cover, lower canopy closure, a lower shrub percent, lower tree heights, and lower stem densities than unused areas (Jones and Hudson, 2002). However, if grass becomes unavailable during winter, elk may switch to browsing on shrubs or conifers (Singer, 1995). Elk may also choose home ranges with some forest cover during winter, as forested areas can provide thermal cover, and cover from predators. Elk will increase their selection of forested habitat types in the presence of predators (Muhly, 2010).

In Alberta, the Castle-Carbondale herd contains approximately 650 elk and ranges throughout the southern portion of the WRSA (Paton, 2012). This herd is one of seven subpopulations (herds) of elk in southwestern Alberta. The Castle-Carbondale subpopulation contains both migratory and resident individuals (Paton, 2012). The migratory elk may move distances up to 100 km, although one radio-collared male underwent a migration of 300 km for two consecutive seasons (Paton, 2012).

#### 4.4.10.2 Habitat Availability

Elk habitat suitability was based on availability of winter forage and thermal cover. Under baseline conditions, the WLSA contained approximately 28% (1,563.5 ha) effective winter habitat for elk (Table 4.4-12, Figure 4.4-24). Most of the effective winter habitat was comprised of moderately rated habitats (20.1%). Grassland habitats and shrubby habitats are preferred habitats for wintering elk as they provide ample forage opportunities. South-facing slopes with open forests and understories composed of pine grass and hairy wild rye are also important winter forage habitats for elk in winter. Since elk preferentially move into lower elevation habitats during the winter to avoid deep snow pack and improve access to forage, habitats in the montane natural subregion were assigned higher habitat suitability ratings than subalpine habitats. The WRSA contained an additional natural subregion (alpine) and corresponding ecosites relative to the WLSA. All habitats in the alpine subregion were considered unsuitable since elk do not generally use these high elevation habitats, particularly in the winter.

**Table 4.4-12 Baseline Winter Habitat Availability for Elk in the Wildlife Local Study Area and Wildlife Regional Study Area**

| Habitat Suitability Class | WLSA | | WRSA | |
|---|---|---|---|---|
| | Area (ha) | % of WLSA | Area (ha) | % of WRSA |
| High | 85.9 | 1.5 | 2,895.6 | 3.9 |
| Moderate-High | 341.3 | 6 | 9,887.0 | 13.4 |
| Moderate | 1,136.2 | 20.1 | 13,881.1 | 18.9 |
| Moderate-Low | 1,470.8 | 26 | 22,490.6 | 30.6 |
| Low | 1,700.2 | 30.1 | 13,873.1 | 18.9 |
| Nil | 911.9 | 16.1 | 10,519.6 | 14.3 |
| **Total** | **5,646.4** | **100** | **73,547.0** | **100** |
| **Effective Habitat[1]** | **1,563.5** | **27.7** | **26,663.7** | **36.3** |

[1] Effective Habitat = High + Moderate-High + Moderate suitability classes.

Continuous patches of effective winter habitat (high, moderate-high, and moderate quality) were considered to be core security winter habitat for elk. This core winter habitat is of high value for elk because it provides adequate forage in areas safe from human disturbance and, potentially, predation. Core security winter habitat was mapped for the winter period only, when forage availability is most limiting.

Core security winter habitat was distributed throughout the WLSA in 34 patches (Table 4.4-13, Figure 4.4-22) and in 301 patches throughout the WRSA (Table 4.4-13, Figure 4.4-23). Patches >100 ha, the largest blocks of undisturbed habitat, accounted for 16.5% (932.0 ha) and 26.2% (19,287.9 ha) of effective elk winter habitat in the WLSA and WRSA, respectively (Table 4.4-13). The most frequent patch size of core habitat was 5 to 20 ha in both the WLSA and WRSA (Table 4.4-13). Approximately 1,466.1 ha (26.0%) of the WLSA and 25,696.9 (34.9%) of the WRSA was characterized as effective core winter habitat for elk (Table 4.4-13). These results indicate that relatively large proportions of the WLSA and WRSA provide suitable core winter habitat for elk at under baseline conditions.

**Table 4.4-13 Baseline Availability of Core Winter Habitat Patches for Elk in the Wildlife Local Study Area and Wildlife Regional Study Area**

| Patch Size Ranges (ha) | WLSA | | | WRSA | | |
|---|---|---|---|---|---|---|
| | No. Patches | Area (ha) | % of WLSA | No. Patches | Area (ha) | % of WRSA |
| 5-20 | 23 | 271.6 | 4.8 | 176 | 1,886.9 | 2.5 |
| 21-40 | 3 | 94.3 | 1.7 | 51 | 1,521.6 | 2.2 |
| 41-60 | 2 | 101.1 | 1.8 | 22 | 1,072.1 | 1.4 |
| 61-80 | 1 | 67.0 | 1.2 | 14 | 1,004.5 | 1.4 |
| 81-100 | 0 | - | - | 13 | 923.9 | 1.2 |
| >100 | 5 | 932.0 | 16.5 | 25 | 19,287.9 | 26.2 |
| **Totals** | **34** | **1,466.1** | **26.0** | **301** | **25,696.9** | **34.9** |

### 4.4.10.3 Habitat Connectivity and Movement

Many existing disturbance features that could potentially affect elk movements occur in the WLSA and WRSA. Road density was estimated to be 0.88 km/km$^2$ in the WLSA and 0.47 km/km$^2$ in the WRSA at Baseline. Stewart *et al.* (2000) reported a road density of 0.91 km/km$^2$ in the nearby Castle-Carbondale region. In addition, Axys (1999) reported that more than half of the 10 drainages studied in the vicinity of the WRSA and the Castle-Carbondale region had road densities greater than 0.625 km/km$^2$. Lyon (1983) calculated that elk habitat effectiveness could be expected to decline by at least 25% with a road density of 0.62 km/km$^2$ and by at least 50% at 1.24 km/km$^2$. At these road densities, the WLSA is expected to have experienced a reduction in habitat effectiveness at Baseline because of pre-existing road infrastructure in the area (Lyon, 1983). Although there were considerably more physical barriers to elk movements in the WRSA, road density in the WRSA was below the 25% threshold described by Lyon (1983). Consequently, road density does not appear to have reduced habitat effectiveness for elk in the WRSA as much compared to the WLSA at Baseline.

There are several anthropogenic barriers to elk movement within the WLSA under Baseline conditions. Elk may avoid the unimproved access roads in the WLSA depending on traffic levels, but because current levels of traffic are low (Hatch Mott MacDonald, 2015), these unimproved roads are unlikely to represent a major barrier to elk movement. In the southern portion of the WLSA, however, Highway 3 likely functions as a major barrier to elk movement. Elk may cross busy highways, but overall, the presence of highways decreases the permeability of the landscape to elk (Dodd *et al.*, 2007). However, some elk do have home ranges that span the northern and southern sides of Highway 3 (Muhly, 2010). Areas with extensive urban/rural residential and industrial developments (*i.e.* towns) in the WLSA and WRSA were considered to be impermeable and also likely to be avoided by elk, thereby representing a major barrier to movement under Baseline conditions. Elk were generally expected to move freely throughout the WLSA and WRSA at Baseline while avoiding areas of high human activity.

#### 4.4.10.4 Mortality Risk

The two major anthropogenic sources of elk mortality in the WLSA and WRSA are vehicle collisions and hunting. Elk are rarely killed on Highway 3 in the Alberta section of the Crowsnest Pass that includes the Towns of Coleman, Blairmore, Frank, and Hillcrest. Between 1997 and 2004, at least 877 large mammals were killed by vehicles on this section of Highway 3, only 5% of which were elk (Miistakis Institute for the Rockies, 2005). An additional three elk were killed by vehicles between 2004 and 2012 on this section of Highway 3 (Alberta Transportation, 2015). According to Alberta Transportation (2015), the majority (95%) of animals killed between 2004 and 2012 on this section of Highway 3 were mule deer and white-tailed deer.

Elk hunting is provincially regulated in the WLSA and WRSA, and represents the largest source of mortality for the nearby Castle-Carbondale herd (Paton, 2012). In 2013, resident hunters in Alberta legally harvested 7,132 elk (AESRD, 2013c) with 94 (1.3%) of those animals harvested in WMUs 303 and 402 (AESRD 2013c).

The major natural source of mortality for elk is predation. Elk are a major prey item for wolves, and are also preyed upon by cougars and grizzly bears, all of which occur in the WLSA.

#### 4.4.10.5 Abundance

Elk are known to occur in the WLSA during spring, summer, and fall, but they appear to be rare or absent from the area during winter based on wildlife camera trapping, winter tracking, and pellet count surveys conducted to date. Over the course of three winter seasons, two elk were detected in the WLSA and vicinity by the wildlife cameras. Of the four ungulate species recorded in the WLSA, elk were the least abundant at baseline.

Elk are expected to occur throughout the WLSA and WRSA. WMUs in the vicinity of the WLSA (WMUs 300, 302, 306, 308, 400, and 402) were last surveyed for elk during March 2000, when 3,060 elk were counted. This represented a slight decrease from the last survey conducted in 1996-1997 (ASRD, 2002). In winter 2000, a minimum of 1,450 elk were estimated to occur in the three winter ranges east of the Castle-Carbondale and Waterton Lakes region (Arc Wildlife Services, 2005).

Movement of elk from British Columbia into Alberta across the continental divide has been documented (Paton, 2012). Aerial elk surveys were conducted for British Columbia WMU 4-23(Elk Valley) in January and February 2013. Estimated elk density at that time was 1.7 elk/km$^2$ and the estimated calf/cow ratio was 25.2 calves/100 cows (Szkorupa *et al.*, 2013). Elk abundance in the WLSA and WRSA was expected to be similar to these reported population estimates at Baseline.

### 4.5 Special Status Species

The Project could potentially affect several special status or highly-valued wildlife species that were not selected as wildlife VCs through habitat loss and alteration, changes in movement, and increases in mortality risk. To address potential Project-related effects on these special status or highly valued species, a high level assessment was conducted. The wildlife species selected included those that were either confirmed to occur in the WLSA through baseline field surveys and/or incidental and First Nations observations or that would have a high likelihood of occurring in the WLSA based on the presence of potentially suitable habitats. These species include barn swallow, common nighthawk, short-eared owl, and wolverine which are listed as “May Be At Risk” provincially and/or “Threatened” or of “Special Concern” by SARA or COSEWIC, and bighorn sheep, mountain goat, bald eagle and golden eagle because of their value to wildlife watchers, traditional users, and/or hunters. Golden eagles and bald eagles have significant cultural and spiritual importance to Treaty 7 First Nations (*e.g.* Kainai Nation 2015, Piikani Nation 2015, Tsuut’ina Nation 2015). Additionally, bighorn sheep have been hunted in the area by members of the Kainai and Piikani Nations and are valued for their horns, meat, and hides (Kainai Nation 2015, Piikani Nation 2015, Tsuut’ina Nation 2015). Mountain goats and big horn sheep are also prized game species by hunters in Alberta.

#### 4.5.1 Barn Swallow

Barn swallows are small, insectivorous passerines that breed throughout North America south of the treeline and overwinter in southern Mexico, and Central and South America. They are found in all Natural Regions in Alberta but are most common in the Grassland Natural Region and least common in the Boreal Forest Natural Region (FAN, 2007). Barn swallow has a general provincial status of “Sensitive” because populations are declining in Alberta and surrounding jurisdictions although the reasons for the decline are unclear (AEP, 2010c). Barn swallow has not been assessed by Alberta's Endangered Species Conservation Committee. Although barn swallows remain widespread, Canadian populations started undergoing declines in the mid to late 1980s, and have been declining ever since (COSEWIC, 2011). Because of the magnitude of these declines, barn swallow was listed as "Threatened" by COSEWIC (COSEWIC, 2011) although they have not been listed on any schedule under SARA.

Breeding habitat for barn swallows typically consists of open areas (such as fields, meadows, or open wetlands) containing suitable structures for nesting (Brown and Bomberger Brown, 1999). Barn swallows almost always build their nests on human-built structures with vertical walls and overhangs, such as houses, sheds, barns, culverts, and bridges (Brown and Bomberger Brown, 1999). As the nests are built of mud pellets, they are usually built close to a body of water that provides mud (Brown and Bomberger Brown, 1999).

The decline of barn swallows has been attributed to several factors, including a loss of breeding habitat and declines in their prey base (flying insects) (COSEWIC, 2011). The destruction of old, wooden farm buildings, or their conversion to modern ones, has been hypothesized as being a contributor of barn swallow declines, although there are many reports of formerly-used nest sites being abandoned by barn swallows (COSEWIC, 2011). A decline in the abundance of flying insects is more likely to be contributing to declines in barn swallows, as other North American birds that feed on insects during flight (including common nighthawk and olive-sided flycatcher) are also experiencing widespread declines in numbers (Nebel *et al.*, 2010). Flying insects may be declining in abundance because of pesticide use, wetland loss, acid precipitation, changes in agricultural land-use practices, increases in light pollution, climate change, and/or the development of insect-resistant crops (COSEWIC, 2011).

One barn swallow was identified during the songbird surveys conducted in 2014 and 2016. An average of three barn swallows/year were recorded on BBS Route 04-205 from 2008-2014 (see Table 2.4-7). Barn swallows appear to be present in the area in low numbers.

Under Baseline conditions, there are no major barriers to barn swallow movement in the WLSA. Barn swallows are highly mobile and are capable of moving thousands of kilometres over a variety of habitat types during the spring and fall migration periods.

Potential sources of mortality related to human activity for barn swallows in the WLSA in Baseline conditions may include collisions with vehicles and buildings (Erickson *et al.*, 2005), although Brown and Bomberger Brown (1999) note that collisions with buildings or transmission towers do not usually occur during migration. Natural sources of mortality would include predation and starvation (especially for chicks), parasite infestations, and cold weather during spring and summer (Brown and Bomberger Brown, 1999).

### 4.5.2 Common Nighthawk

Common nighthawk is a crepuscular insectivore from the nightjar family (Caprimulgidae). In Alberta, common nighthawk is listed as "Sensitive", although in Canada it is listed as "Threatened" and is a Schedule 1 species under SARA. Based on breeding bird survey data collected from 1995 – 2005, this species has experienced an average decline of 6.6% per year (COSEWIC, 2007b) which represents a 49.5% decline in the overall population. It should be noted, however, that breeding bird survey data are not ideally suited to examining common nighthawk population trends, as the species is crepuscular and can only be detected during the first hour or so of most surveys. Even so, sharp declines in nighthawk populations have been documented in several locations (Jones and Bock, 2002). The reasons behind these declines are not entirely clear, and it is likely that multiple factors are involved, including (but not limited to) reductions in food availability from pesticide use, habitat loss and loss of habitat (particularly from conversion of native prairie to agricultural land, climate change, and fire suppression), and declines in the use of gravel rooftops, which common nighthawks often nest on (COSEWIC, 2007b, Environment Canada, 2016b).

Common nighthawks reside in a variety of habitats, including beaches, grasslands, urban areas, mountains, pasture, and open forest. In Alberta, they occur in every Natural Region but are most abundant in the Grassland Natural Region and are least abundant in the Boreal Forest and Parkland Natural Regions (FAN, 2007). Because nighthawks do not construct nests, they require patches of exposed, bare ground where female nighthawks lay and incubate their eggs. Eggs may be laid on flat, gravel rooftops (Weller, 1958, Armstrong, 1965; Gramza, 1967), on patches of sandy gravel in logged and burned areas (Fowle, 1946), on bare patches of ground in pasture (Rust, 1947), and on sand dunes, gravel beaches, and bare ground in open forests and logged areas (Hagar *et al.*, 2004, Brigham *et al.*, 2011).

Foraging common nighthawks will use a wide variety of habitats. Common nighthawks forage during flight, preying on large flying insects. In a particularly productive location, dozens or hundreds of common nighthawks may gather to forage without showing territorial behaviour (Rust, 1947; Brigham *et al.*, 2011). Common nighthawks may gather to feed over rivers, wetlands, forest edges, grasslands, or pastures where flying insects are abundant (Brigham *et al.*, 2011). They may also forage near artificial sources of light that attract insects (Brigham *et al.*, 2011) and in urban areas, common nighthawk presence is positively associated with the number of artificial lights present (Viel, 2014). Common nighthawks may forage just above the ground or up to 175 m above it (Brigham *et al.*, 2011). While male common nighthawks often defend their breeding territories by chasing intruders (Roth and Jones, 2000), their feeding grounds may be up to three km from their breeding territories (Fisher *et al.*, 2004). Female common nighthawks incubating eggs will also leave them for up to 20 minutes to forage.

Common nighthawks are present in the WLSA. Three birds were seen incidentally during the songbird survey conducted during June 2014 (Table 2. 4-6 and Figure 2.4-3) and were occasionally seen on Breeding Bird Survey Route 04-205 (Table 2.4-7). They may be more common in the area than indicated by these survey results as they are crepuscular and are only likely to be active during the first hour of breeding bird surveys intended to target songbirds.

As common nighthawks are highly mobile, there are likely no major barriers to movement in the WLSA under Baseline conditions.

### 4.5.3 Short-eared Owl

Short-eared owls are protected under the Alberta *Wildlife Act* and by SARA. At the federal level, short-eared owl is a species of "Special Concern" (COSEWIC 2008) and is listed on Schedule 1 of the SARA. Short-eared owl has a general status of "May be at Risk" in Alberta as the species faces multiple threats, including intensive cultivation throughout its range in Alberta (AEP, 2010c). Elsewhere in Canada, short-eared owl populations have been declining for the past 40 years, likely because of habitat loss and degradation on its breeding and wintering ranges (COSEWIC, 2008).

Short-eared owls breed in all provinces and territories in Canada, but are most common in the prairie provinces (Alberta, Saskatchewan, and Manitoba) and along the Arctic coast (COSEWIC, 2008). In Alberta, the species is most common in the Grassland Natural Region, although it also occurs in the Parkland and Boreal Forest Natural Regions (Clayton, 2000; FAN, 2007). Short-eared owls nesting in Canada are typically migratory and overwinter in the United States (Wiggins *et al.*, 2006) but some birds overwinter in Alberta (Clayton, 2000). Short-eared owls are almost always associated with large expanses of open habitat, such as tundra, prairie grasslands, shrub-steppe lands, coastal grasslands, heathlands (Wiggins *et al.*, 2006), marshes, peatlands, and cut blocks (Clayton, 2000). On western grasslands, short-eared owls nest in open, dry habitats, and prefer sites with tall (30-60 cm), dense vegetation (Wiggins *et al.*, 2006). In Montana, short-eared owls have much higher nest success in ungrazed than grazed grasslands (Fondell, 1997).

Short-eared owls are nomadic and the number of birds breeding in an area depends strongly on the abundance of microtine rodents, their preferred prey (Wiggins *et al.*, 2006). Because of their high mobility, short-eared owls can track vole population increases without time lags (Korpimaki and Norrdahl, 1991) and they often appear in an area shortly after vole populations increase. Nest density in an area can vary dramatically depending on vole densities. For instance, at a site near Barrow, Alaska, no short-eared owls were seen for three years, one pair was seen yearly for two years, and then 28 pairs were seen during a single high-lemming year (Wiggins *et al.*, 2006).

Short-eared owls were not observed in the WLSA during any of the Baseline wildlife surveys conducted from 2013-2016, and they have not been documented along Breeding Bird Survey Route 04-205 (Table 2.4-6 and Table 2.4-7). However, an FWMIS query indicates that they have occurred in the WLSA. Short-eared owls likely are uncommon in the WLSA, as there is very little open grassland habitat present, and when present, habitat suitability is reduced by cattle grazing. Short-eared owls are more likely to occur in the eastern portion of the WRSA (Clayton, 2000; FAN, 2007) where more suitable open grassland habitats occur.

Short-eared owls are highly mobile and there are no major barriers to their movement in the WLSA or the WRSA. There is little known about short-eared owl mortality, and mortality from human activity in the WLSA and WRSA is likely low. Wiggins *et al.* (2006) notes that short-eared owls are occasionally hit by cars, shot, killed by hitting barbed wire fences, or caught in traps. Short-eared owl eggs and/or nestlings can also be damaged by cattle or equipment used to harvest hay (COSEWIC, 2008).

### 4.5.4 Bald Eagle

Bald eagles have a general status of "Sensitive" in Alberta because of their low population densities and their sensitivity to human disturbance during the breeding season (AEP, 2010c). The bald eagle is "Not at Risk" in Canada. Bald eagles occur in every natural region in Alberta with the highest densities associated with large lakes including Cold Lake, Lac la Biche, Slave Lake, and Lake Claire, and along large rivers, such as Athabasca and Peace Rivers (FAN, 2007).

Bald eagle nests are usually located in large trees associated with large bodies of water (such as lakes and rivers), although they are occasionally placed on cliffs (Buehler, 2000). Most bald eagles overwinter in the mainland Unites States, or in coastal Canada or Alaska (Buehler, 2000). There are overwintering records for bald eagles in Alberta most occurring in the southern portion of the province where open water provides foraging opportunities. Bald eagles may also overwinter in Edmonton near the North Saskatchewan River and around Wabamun Lake (McGillivray and Semenchuk, 1998). A small number of bald eagles overwinter in the Crowsnest Pass area, as four birds were seen during the Christmas Bird Count conducted in 2014 (Crowsnest Conservation Society, 2014). Bald eagles generally occur near water as they forage primarily on fish, although they will eat a variety of birds and mammals, including carrion (Buehler, 2000).

The Rocky Mountains, including the Crowsnest Pass area, serve as an important flyway for migrating eagles. Complex mountain terrain is often favoured by migrating soaring birds because of the extra lift generated from thermals, wind deflecting off of ridges, and slope winds. Piitaistakis Ridge, a popular site for birdwatchers to gather to watch migrating raptors (particularly eagles), is located approximately 6 km southeast of the WLSA (Figure 2.4-4).

Non-migrating bald eagles range into the WLSA, as one bird was seen during the songbird survey conducted June 2014. No bald eagle nests have been located in the WLSA to date, although if they breed there it would likely be near the Crowsnest River as most bald eagles build their nests near large water bodies (Peterson, 1986).

Sources of human-related mortality for bald eagles that could occur in the WLSA include poisoning, collisions with vehicles and power lines, electrocution by power lines, and ingestion of plastics (Buehler, 2000). Bald eagles in Alberta have died from lead poisoning, likely from consuming animals that were shot with lead bullets (The Canadian Press, 2010).

### 4.5.5 Golden Eagle

Golden eagle has a general status of "Sensitive" in Alberta due to the presence of only 100 to 250 breeding pairs dispersed over a wide area of the province (AEP, 2010c). Federally, golden eagle is listed as "Not at Risk" and populations appear to be stable in Alaska, Canada, and the mainland United States (Kochert *et al.*, 2002; Millsap *et al.*, 2013). In Alberta, golden eagles are most common in the Rocky Mountain Natural Region and rarely occur in the Grassland, Parkland, and Boreal Forest Natural Regions (FAN, 2007). Golden eagles breeding in Alberta often migrate south during winter, although they can be found in the province year-round (FAN, 2007). There have been reports of golden eagles wintering as far north as Grande Prairie (McGillivray and Semenchuck, 1999).

Golden eagles will forage in a wide variety of open and semi-open habitats feeding primarily upon rabbits, hares, and ground squirrels, although larger mammals, birds, and fish are occasionally taken (Kochert *et al.*, 2002). Golden eagles often build their stick nests on cliffs, but nests may also be built in trees, on the ground, or on human-built structures such as electrical transmission towers (Kochert *et al.*, 2002).

No golden eagle nests were encountered during any of the Baseline wildlife surveys conducted in the WLSA. Mature golden eagles were seen flying over the area in October 2014, June 2015, and May 2016. Golden eagles were also sighted by members of the Tsuut'ina, Piikani, and Kainai First Nations during site visits conducted in the WLSA during 2014 (Piikani Nation 2015, Kainai Nation 2015, Tsuut'ina Nation 2015).

The Rocky Mountains serve as an important migration corridor for golden eagles (Kochert *et al.*, 2002) and numerous golden and bald eagles migrate through the WLSA. Golden eagles currently move through the area despite the presence of a major, high traffic-volume highway (Highway 3); a railway; and numerous urban areas (Blairmore, Coleman, and Frank).

Sources of human-related mortality for golden eagles include collisions with vehicles, transmission lines, and fences, electrocution by power lines, shooting, and poisoning (Kochert *et al.*, 2002; McIntyre, 2012). Golden eagles may be killed by eating poisoned bait intended to kill other animals (such as coyotes), and they have been killed by lead poisoning in Alberta (Wayland and Bollinger, 1999). Golden eagles may also abandon their nests if they are disturbed by humans, although this appears to be rare (Kochert *et al.*, 2002). The primary natural source of mortality in golden eagles is starvation (McIntyre, 2012).

The response of golden eagles to human disturbance varies widely. For instance, use of helicopters to monitor nests does not appear to affect nest productivity (Kochert and *et al.*, 2002). Golden eagles may abandon territories in response to increased urbanization (Kochert *et al.*, 2002).

### 4.5.6 Mountain Goats

Mountain goats have a general status of "Secure" in Alberta (AEP, 2010c) but they have not been assessed by COSEWIC. They are highly valued by wildlife watchers, photographers, and hunters, although legal hunting of mountain goats in Alberta is limited through a goat licence special draw.

In Alberta, mountain goats are associated with steep terrain in the Rocky Mountains. Poole *et al.* (2009) found that terrain ruggedness strongly correlated with mountain goat habitat use in British Columbia, and that during winter they selected warmer aspects. Mountain goats are often found on or near steep terrain as they use it to escape from predators.

The average home range sizes for male and female mountain goats in southeastern British Columbia were 32.6 $km^2$ and 83.5 $km^2$, respectively (Poole *et al.*, 2009). Mountain goat movements can become more restricted during winter, resulting in winter home ranges that may be 2.2 – 14% of the size of summer home ranges, depending on snow depth (Poole *et al.*, 2009).

No mountain goats were detected in the wildlife camera monitoring program between September 2013 and June 2016; nor were any seen during the other baseline wildlife surveys (pellet transects, winter tracking, incidentals) conducted in the WLSA and vicinity. Mountain goats are present in the WRSA. A mountain goat survey conducted in WMU 402 (Figure 2.2-2) during 2010 detected 120 adults, 15 kids, and 13 yearlings (Jokinen and Hale, 2012). Of the 148 goats observed, 58 (39.2%; 45 adults, four yearlings, and nine kids) were observed on Crowsnest Mountain, which is located approximately 10 km northwest of the WLSA. The Livingstone Range, which is located about 6 km east of the WLSA, was not included in the 2010 survey, but the area typically contains about 12 goats (Jokinen and Hale, 2012). Mountain goats were once absent from the Livingstone range but were reestablished through a translocation program. Twenty-four goats (seven males and 17 females) were translocated between 1987 and 1996 (ASRD, 2003).

Key winter and summer mountain goat habitats in the WRSA are concentrated in the Livingstone Range and along the continental divide (Weaver, 2013). Despite there being no quality mountain goat habitat within the WLSA, dispersing mountain goats may travel through it. For example, three radio-collared goats travelled through forested terrain from the Livingstone Range to Crowsnest Mountain (ASRD, 2003).

Sources of mortality for mountain goats in the WRSA are likely to include predation, avalanches, falls, and legal and illegal hunting.

#### 4.5.7 Bighorn Sheep

Bighorn sheep have a general status of "Secure" (AEP, 2010c) and have not been federally assessed. The bighorn sheep is Alberta's provincial mammal, and it is highly valued by First Nations, wildlife watchers, photographers, and hunters.

In Alberta, bighorn sheep occur in the Rocky Mountains and foothills. In 2011, an estimated 6,466 bighorn sheep occurred on provincial lands while an additional 4,500 lived in national parks (Government of Alberta, 2012). Provincial lands containing bighorn sheep are divided into 10 Sheep Management Units, with the WLSA falling into the Livingstone Sheep Management Unit (SMU 2). SMU 2 is encompasses WMUs 303A, 306, 308, and 402. In 2011, an estimated 355 bighorn sheep occurred in SMU 2 (Government of Alberta, 2012). The WRSA also overlaps SMU 2 as well as the Westcastle-Yarrow SMU (SMU 1). In 2011, SMU 1 contained an estimated 260 sheep (Government of Alberta, 2012).

Trophy sheep are hunted in the WMUs that overlap the WLSA and WRSA. Across Alberta from 1992-2011, an average of 138 bighorn sheep/year were harvested by residents and an average of 41 bighorn sheep/year were harvested by non-residents (Government of Alberta, 2012).

Range selection in bighorn sheep appears to be driven by a combination of forage quality, forage quantity, and predator avoidance. Bighorn sheep feed primarily on grasses, although they occasionally feed on forbs, lichens, and shrubs. Bighorn sheep ranges typically contain a combination of grasslands and/or open shrublands located close to rocky terrain that sheep will flee onto to escape from predators (Naughton, 2012).

Bighorn sheep often have separate summer and winter home ranges. For example, in southwestern Alberta, a population of bighorn ewes spent the winter in the foothills at elevations between 1,420 m and 1,740 m, where they preferred to use south-facing wind swept slopes with little or no snow

(Festa-Bianchet, 1988). The winter range contained a shale canyon that provided escape terrain and salt licks. During spring, they migrated to a higher-elevation range (1,800 m to 2,550 m) 12 km from the winter range. The high-elevation range consisted of rock and scree slopes, alpine meadows, and open coniferous forest. Pregnant ewes migrated to the higher-elevation range earlier than non-pregnant ewes. The pregnant ewes returned to their winter range after lambing in May, before again travelling to their summer range. In the Elk Valley area of British Columbia, which is located about 40 km northwest of the WLSA, most of the 41 GPS-collared bighorn sheep summered and wintered at elevations ranging from approximately 1,900 m to 2,350 m in the vicinity of five operating open-pit coal mines (Poole, 2013). Most migratory and non-migratory sheep movements between summer and winter centres of activity in the Elk Valley were 45.8 km and 10.5 km, respectively, with most movements following high elevation ranges and ridges (Poole, 2013). Bighorn sheep use of the five mine properties varied among mine area and individual animals although 10–18% of collared animals exhibited lower use of the mine properties between November-December and April compared to increased levels of approximately 60% to 65% in September-early October (Poole, 2013).

Bighorn sheep have not been detected by the wildlife camera program from September 2013 to June 2016, nor have they been seen during any of the baseline wildlife surveys (pellet surveys, winter tracking, incidentals) conducted in the WLSA. This is likely related to the lack of suitable higher elevation summer and winter ranges in the WLSA that bighorn sheep prefer. Bighorn sheep are often seen along Highway 3 (Lee, 2007), which suggests that sheep may occasionally move through the WLSA. Bighorn sheep also occur in the WRSA.

Weaver (2013) modelled the distribution of bighorn sheep habitat in the southern Alberta Rocky Mountains west of Highways 22 and 6 and south of Kananaskis Country. The model was based primarily upon terrain ruggedness and was validated using summer and winter location data from the Castle-Yarrow bighorn sheep herd. The results indicate that, in the WRSA, the largest expanse of suitable wintering and summering habitats occurs in the Livingstone Mountain Range (Figure 5.4-1), located approximately 6 km east of the WLSA. There is also some suitable summering habitat for sheep along the Continental Divide located west of the WLSA. Project-related habitat losses are expected to be minimal for bighorn sheep in the WLSA.

The primary sources of mortality for bighorn sheep in the WRSA are likely to be hunting, falls, avalanches, predation, and disease. Bighorn sheep hunting is regulated in the region, and only trophy full curl rams may be harvested in WMUs that overlap the WLSA and WRSA. Poaching has occurred in the region, as three rams and two ewes were illegally killed in SMU 1 during the winter of 2006-2007 (Jokinen *et al.*, 2007). Pneumonia also caused major declines in the Yarrow-Castle bighorn sheep herd during the 1980s, when the population declined from approximately 400 individuals to 150 (Jokinen *et al.*, 2007). In southwest Alberta, some individual cougars learn to prey on sheep, although most cougars rarely kill sheep (Ross *et al.*, 1997). One individual cougar killed 9% of a bighorn sheep population in the Sheep River Wildlife Sanctuary over a single winter, so predation can represent a significant source of mortality for bighorns (Ross *et al.*, 1997). Wolves, and bears may also occasionally prey on bighorn sheep, and golden eagles may prey on lambs (Naughton, 2012).

Bighorn sheep are frequently attracted to roadsides because of the presence of road salt and can therefore be at high risk of being hit by vehicles. Collisions involving vehicles and bighorn sheep, however, appear to be relatively uncommon on Highway 3 between Bellevue and Coleman since only 0.18 sheep/km/year (at the east Blairmore Bridge) have been killed between 1997 and 2008 (Clevenger, *et al.* 2010). This compares to a collision rate of 2.55 sheep/km/year in the Crowsnest Lakes area, which is currently the focus of a directional fencing project by Alberta Transportation to minimize wildlife-vehicle collisions.

#### 4.5.8 Wolverine

In Alberta, wolverine has a general status of "May Be At Risk", as the provincial population has been estimated to contain fewer than 1,000 animals (AEP, 2010c). There is a high degree of uncertainty associated with this estimate. As wolverine occurs at low densities and has a scattered distribution in the province (Mowat, 2001), it was assigned a status of "Data Deficient" by Alberta's Endangered Species Conservation Committee (Petersen, 1997). Federally, wolverine is classified as a species of "Special Concern" because its range is becoming increasingly fragmented by industrial activities and wolverine populations require large, undisturbed areas to remain viable (COSEWIC, 2014b). Wolverines are also sensitive to human disturbance and are most abundant in areas protected from development (Fisher *et al.*, 2013). They do not currently have a SARA schedule.

Wolverines formerly occurred across the province but are now restricted to the western mountains and the northern boreal forest (Petersen, 1997). They are currently managed as furbearers under the provincial *Wildlife Act*. The wolverine trapping season is from November 1 to January 31 in most Registered Fur Management Areas (RFMAs) and only one wolverine may be trapped in each RFMA except in Fur Management Zones 7 and 8 (prairie and parkland regions of south and central Alberta), where wolverines may not be trapped (Government of Alberta, 2015). An average of 53 wolverine pelts were exported from Alberta each year from 2009 to 2014 (Government of Alberta, 2015).

Wolverines are generalist, opportunistic predators and scavengers that use a wide variety of habitat types although they are more likely to be associated with cooler, montane and subalpine forested ecosystems (Apps *et al.*, 2010). The habitat features that appear to best predict wolverine habitat use in mountainous regions include elevation, cover type, and levels of anthropogenic disturbance. Copeland *et al.* (2007) reported a positive correlation between elevation and wolverine presence year-round in central Idaho, although wolverines did display a slight shift to lower elevations in summer.

During summer, adult males displayed a preference for rock habitats while females preferred high-elevation whitebark pine forests (Copeland *et al.*, 2007). Both sexes also used mid-elevation lodgepole pine forests and avoided grass-shrub habitats (Copeland *et al.*, 2007).

Weaver (2013) modelled wolverine habitat quality in the southern Alberta Rocky Mountains south of Kananaskis Country and west of Highways 6 and 22. This area includes the WLSA and the WRSA. The model used was developed by Copeland *et al.* (2010) and divided habitat into three categories: 3 (Maternal Habitat), 2 (Future Primary Habitat) and 1 (Primary Habitat). Maternal habitat is habitat likely to be used by female wolverines to raise young and was concentrated along high-elevation areas along the Continental Divide (Weaver, 2013). Overall, 8% of the southern Alberta Rockies is comprised of potential maternal habitat for wolverines. Currently, 49% of the southern Alberta Rockies is comprised of primary wolverine habitat although this was predicted to decrease to only 30% by 2045 because of climate change (Copeland *et al.*, 2010; Weaver, 2013). The model suggests that most of the habitat along Highway 3 is not suitable for wolverines, likely because of high levels of human disturbance. Primary wolverine habitat is present in the northern and southern regions of the WRSA. Apps *et al.* (2010) similarly found that their landscape suitability model predicted higher suitability in the mountains and higher foothills throughout much of their study area in southwestern Alberta although wolverine populations were highly vulnerable along major transportation corridors in southeastern British Columbia and southwestern Alberta (Figure 5.4-2). They also reported that many of the areas of high grizzly bear suitability were also good for wolverines (Apps *et al.*, 2010).

Although wolverines are known to occur in southwest Alberta (Petersen, 1997), none have been detected in the WLSA during baseline inventory studies including the wildlife camera trapping program, winter tracking, scat surveys, or incidentally. However, because wolverines can have large home ranges (75 $km^2$ to 1,500 $km^2$, Naughton 2012) and may disperse long distances, they are difficult to detect even though they may periodically travel through the WLSA and WRSA. At Baseline, some potentially suitable habitat exists for the wolverine, most of which is associated with forested and rock/barren habitats located in higher elevation montane and subalpine areas in the northern half of the WLSA.

Currently, the urban and industrial corridor associated with Highway 3 likely functions as a movement barrier for wolverines, bisecting north to south population connectivity (Apps *et al.*, 2010; Weaver, 2013, Figures 5.4-3 and 5.4-3). Wolverines generally avoid heavily developed areas (Fisher *et al.*, 2013). In Banff and Yoho National Parks, wolverines avoided areas within 100 m of the Trans-Canada Highway, preferring habitats >1 km from it (Austin, 1998). However, wolverines will sometimes cross highways, with subadults the most likely to cross (Packila *et al.*, 2007).

The primary sources of wolverine mortality are likely to be hunting and trapping, predation, and starvation. For example, of the 62 documented wolverine mortalities across North America between 1972 and 2001, 22 were attributed to trapping/hunting, 11 to predation, 18 to starvation, three to vehicle or train collisions, and eight to unknown causes (Krebs *et al.*, 2004).

## 4.6 Migratory Birds

The federal *Migratory Birds Convention Act* (MBCA) recognizes the following groups of birds: waterfowl, cranes, rails, coots, shorebirds, doves, insectivorous birds (excluding blackbirds), grebes, bitterns, herons, gulls, terns, seabirds, and loons. Of the 157 bird species with the potential to occur in the WLSA (Appendix D), 117 are protected under the MBCA. Sixty-six of these protected species were detected within the WLSA (Table 2.4-49).

Many of the migratory birds present in the WLSA have habitat requirements that overlap those of the wildlife VCs and special status species included in this assessment (Table 4.6-1). For example, the Project effects on habitat availability for the Columbia spotted frog were expected to be similar for shorebirds and other migratory bird species that rely on ponds, streams and wetlands.

Coniferous and mixedwood forests cover a large area of the WLSA (~70%), and host the highest species richness and diversity of all habitats occurring in the WLSA.

Several species prefer habitats that are more limited in the WLSA. The scarcity of these habitats limits the presence and abundance of these species in Baseline conditions. There are only 18 ha of shrubby wetland, 5 ha of treed wetland, and 64 ha of waterbody habitats in the WLSA, limiting the presence and abundance of shorebirds, waterfowl, and other wetland-dependent birds in the WLSA. Similarly, grassland species (*e.g.* mountain bluebird and vesper sparrow; Table 4.6-1) are also limited in the WLSA due to the relative scarcity of grassland habitat (290 ha) and upland shrub habitat (< 1 ha). Some species display a strong preference for mature and old-growth forests (*e.g.* woodpeckers), and those that prefer old growth are limited by the presence of only 169 ha of in the WLSA. Species preferring open, rocky habitats, including alpine habitats have 49 ha of suitable habitat in the WLSA.

**Table 4.6-1 Migratory Bird Species[1] with the Potential[2] to Occur in the WLSA and Their Habitat Preferences**

| Migratory Bird Group | Species Included | SARA-Listed Species | Habitat Preferences | VCs With Similar Requirements |
|---|---|---|---|---|
| Shorebirds and Other Birds Reliant on Marshes or Rivers | American Dipper, Bank Swallow, Common Yellowthroat, Killdeer, Lincoln's Sparrow, Marsh Wren, Northern Waterthrush, Sora, Spotted Sandpiper, Wilson's Snipe, Wilson's Phalarope, Wilson's Warbler | None | Wetlands, ponds, lakeshores, streams. Wet, shrubby area in case of Wilson's Warbler and Common Yellowthroat. | Columbia Spotted Frog, Western Toad |
| Waterfowl | American Coot, American Wigeon, Barrow's Goldeneye, Blue-winged Teal, Bufflehead, Canada Goose, Common Goldeneye, Common Merganser, Green-winged Teal, Harlequin Duck, Hooded Merganser, Lesser Scaup, Mallard, Northern Shoveler, Northern Pintail, Ring-necked Duck, Redhead, Wood Duck | None | Wetlands, lakes, rivers, streams | Columbia Spotted Frog, Western Toad |
| Grassland or Open Country Birds | American Goldfinch, American Pipit, Baird's Sparrow, Bobolink, Brewer's Sparrow, Clay-colored Sparrow, Common Nighthawk, Eastern Kingbird, Fox Sparrow, Grasshopper Sparrow, Golden-crowned Sparrow, Mountain Bluebird, Mourning Dove, Savannah Sparrow, Tree Swallow, Vesper Sparrow, Western Bluebird, Western Kingbird, Western Meadowlark, White-crowned Sparrow | Bobolink, Common Nighthawk | Grasslands. Shrubby habitats at forest edges (Fox, Golden-crowned and White-crowned Sparrow) | Elk |
| Old-Growth Forest Birds | American Three-toed Woodpecker, Black-backed Woodpecker, Brown Creeper, Evening Grosbeak, Pileated Woodpecker | None | Mature to Old Growth Forests | Great Gray Owl, American Marten |

**Table 4.6-1 Migratory Bird Species[1] with the Potential[2] to Occur in the WLSA and Their Habitat Preferences**

| Migratory Bird Group | Species Included | SARA-Listed Species | Habitat Preferences | VCs With Similar Requirements |
|---|---|---|---|---|
| Coniferous-dominant Forest Birds | Boreal Chickadee, Cassin's Finch, Cordilleran Flycatcher, Golden-crowned Kinglet, Hammond's Flycatcher, Mountain Chickadee, Olive-sided Flycatcher, Pine Grosbeak, Purple Finch, Red-breasted Nuthatch, Red Crossbill, Ruby-crowned Kinglet, Townsend's Solitaire, Townsend's Warbler, Varied Thrush, Western Tanager, White-winged Crossbill, Winter Wren, Yellow-rumped Warbler | Olive-sided Flycatcher | Coniferous or Coniferous-dominant Mixedwood Forests | Olive-sided Flycatcher, American Marten, Canada Lynx<br><br>Common nighthawk was assessed as a special status species |
| Deciduous-dominant Forest Birds | Alder Flycatcher, American Redstart, Baltimore Oriole, Black-capped Chickadee, Black-headed Grosbeak, Downy Woodpecker, Gray Catbird, Lazuli Bunting, Least Flycatcher, Nashville Warbler, Ovenbird, Red-eyed Vireo, Red-naped Sapsucker, Veery, Warbling Vireo, White-breasted Nuthatch, Willow Flycatcher, Yellow Warbler | None | Deciduous or Deciduous-dominant Mixedwood Forests. | Little Brown Myotis, Moose |
| Anthropogenic Habitat Birds | Barn Swallow, Eastern Phoebe | Barn Swallow | | None<br><br>Barn Swallow was assessed as a special status wildlife species in Section 5.4.1. |

[1] Refers to species that are protected under the *Migratory Birds Convention Act*

[2] Refers to migratory bird species with a high, moderate or confirmed Probability of Occurrence rating in Table 2.4-2, CR#9.