Phase 1 Elk Valley Cumulative Effects Management Report – Data and Assumption Summary

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1 Introduction

MacDonald Hydrology Consultants Ltd. (MacHydro) and the ALCES Group have been retained by the Ministry of Forests Lands, Natural Resource Operations, and Rural Development (FLNRORD) to complete further modelling and analysis related to the Elk Valley Cumulative Effects Management Framework (EV-CEMF). This work will integrate updated datasets as well as provide decision support through scenario modelling. As a first deliverable, Phase 1 includes a summary of the data inputs, Value Component (VC) equations, and modelling assumptions used in previous EV-CEMF work. Also highlighted in this report are suggestions for updates to data, and scenario assumptions.

2 ALCES Online

Modelling work in the EV-CEMF was completed using ALCES Online (ALCES; https://online.alces.ca/), a computer simulation model designed for comprehensive assessment of the cumulative effects of multiple land uses and natural disturbances to ecosystems (Carlson et al. 2014). ALCES applies a cell-based representation of the landscape and exposes it to user-defined changes in landscape composition depending on rates and spatial patterns of future development and natural disturbance. By doing so, ALCES can simulate landscape and forest age dynamics and track resulting changes in VC indicators.

ALCES models incorporate numerous land-uses such as forestry, mining, settlements, gas exploration, agriculture, transportation networks, as well as natural disturbances such as fire and insect outbreaks. VC indicators are applied to evaluate the condition of VCs and track the consequences of simulated changes in landscape composition. VC indicator results can be provided at the scale of individual cells or sub-regions.

ALCES Mapper was used to simulate natural disturbance and landscape change over time. Scenarios were built by defining a series of landscape changes (called actions), each of which caused one or more conversions (called transitions) in landscape composition, age, and/or origin. Examples include residential settlement expansion, forest harvest, road construction, fire, insect outbreaks, and mine expansion/reclamation.

Assumptions are explicitly defined in ALCES Mapper and can be applied in a deterministic or manner. Actions are used to simulate landscape trajectories, transitioning from one or multiple footprints or land cover types to another. Actions can occur in a range of user-defined spatial patterns, such as random clustered growth, radial growth, linear growth, or growth in specific predefined regions. Spatial patterns can be spatially weighted to preferentially occur based on set user-defined values. ALCES Mapper can be used to simulate annual or decadal timesteps for a user-defined period, with outputs available at each time step.

ALCES was applied in the EV-CEMF to evaluate a range of potential future scenarios over a 50-year period in the Elk Valley. ALCES was used to simulate six potential future scenarios: Reference, Minimum Development, Maximum Development, Increased Natural Disturbance, Moderate Mitigation, and Intensive Mitigation. The implications of the scenarios were assessed by mapping the future impacts to four VCs: Old and Mature Forests, Aquatic Ecosystems, Grizzly Bear, and Bighorn Sheep. Outcomes from the scenario analysis informed the assessment of cumulative effects in the Elk Valley and formation of management recommendations.

3 Input Data

ALCES requires a non-overlapping land cover dataset as its base. This non-overlapping land cover dataset is referred to as a “unity” dataset, inferring that 100% of the landscape is being represented. Creation of this unity dataset was done by merging several data sources representing footprint and natural land cover types. Footprint types represent land cover that is anthropogenic in nature, while natural land cover types represent all other types that are not considered footprint. Footprint datasets were received directly from the EV-CEMF Working Group, in the form of Predictive Ecosystem Mapping (PEM) data and were supplemented wherever necessary with open-source data from CanVec and DataBC. Land cover datasets included PEM data, and whenever necessary were supplemented with data from the National Hydrographic Network (NHN), and Agriculture and Agri-Food Canada (AAFC). Refer to Appendix A for further details on datasets used in the creation of the unity layer.

In 2018 an update to the unity dataset was completed by using an updated footprint layer provided by FLNRORD. See Appendix B for more information regarding data updates.

A hierarchy was assigned to data layers to inform data priorities in the case of overlapping layers (Appendix C). Specifically, Built Up Areas were given higher priority than roads, and mine types (reclaimed and open pit) were given highest priority. All priorities used in the EV-CEMF are summarized in Appendix C.

Forest age was derived from vegetation resource inventory (VRI) data, and where absent, a combination of data sources was used consisting primarily of the PEM structural stages that were converted to ages based on biogeoclimatic ecosystem classification (BEC) (age assigned using the midpoint of structural stage), disturbance history including insect outbreaks, fire and forest cutblocks, and an additional National Aeronautics and Space Administration (NASA) satellite interpretation (NASA North American Carbon Program Forest Age Maps at 1 km resolution for Canada). For remaining data gaps, interpolation for forest age was done by converting the study area and surrounding area to a raster (25 m resolution) and using known ages adjacent to the raster cells to assign forest age. This resulted in the entire study area having an assigned forest age. Forest origin was defined by the disturbance history in which previously burned portions of the forest are given an origin of “fire”, areas of previous insect outbreak are given an origin of “insect”, and areas of previous harvest are given an origin of “cut”. In the case of overlapping disturbances, the most recent is used.

Regions can also be imported to the model and can serve to summarize model outputs at different scales, or to scale model outputs based on location. Regional modifiers can assign higher weight to some areas, and lower (or zero) weight to other areas, while regional statistics can provide statistics (average or sum) of model results at different scales.

Regional modifiers that have been used in this model include:

- Riparian Area: delineated by remote-sensed data
- Stream Buffer: delineated by a 100m buffer around all water features
- Steep Slopes: delineated by slopes greater than 60%
- Grizzly Riparian Region: a grouping of the riparian PEM types
- Subalpine: a grouping of the subalpine PEM types
- Crown Forest Land Base: pre-existing region delineated by the Province of BC

- Motorized Vehicle Closure Areas: pre-existing regions delineated by the Province of BC
- BEC Zones: pre-existing regions delineated by the Province of BC

Regional statistics that have been used in this model include:

- Assessment Watersheds (AWs): pre-existing regions delineated by the Province of BC.
- Landscape Units (LUs): pre-existing regions delineated by the Province of BC.

4 VC Indicator Assumptions

Indicators of VC condition simulated in the EV-CEMF ALCES model include, Aquatic Hazard, Grizzly Bear Hazard, Old and Mature Forest Z-Score, Old and Mature Forest Patch Size, Old Forest Z-Score, Old Forest Patch Size, Bighorn Sheep Annual Range Hazard, Bighorn Sheep All Rank Winter Range Hazard, and Bighorn Sheep Rank 3 and 4 Winter Range Hazard. Sections below describe how each VC indicator was modelled and basic schematics are provided.

4.1 *Aquatic Hazard*

The Aquatic Hazard indicator (Aquatic Hazard Roll Up) is described in Davidson *et al.* (2018) and provides an assessment of hazard related to Westslope cutthroat trout (*Oncorhynchus clarki lewisi*) using a compilation of the following indicators:

- Stream crossing density: Stream-road intersections for all steam orders and minor roads, expressed as number of crossings per square kilometer.
- Equivalent clear-cut area (ECA): The area disturbed by anthropogenic footprint or forest disturbance, adjusted to account for hydrologic recovery.
- Riparian disturbance: ECA as a percentage of the riparian portion of the watershed.
- The density of roads near streams: The density of roads that are located within 100 m of streams.
- The density of roads on steep slopes: The density of roads that are located on slopes steeper than 60%.

All indicators were scaled from 0 to 1 and averaged to provide the final Aquatic Hazard value (***Figure 1***). A more detailed description of each sub-indicator is provided below.

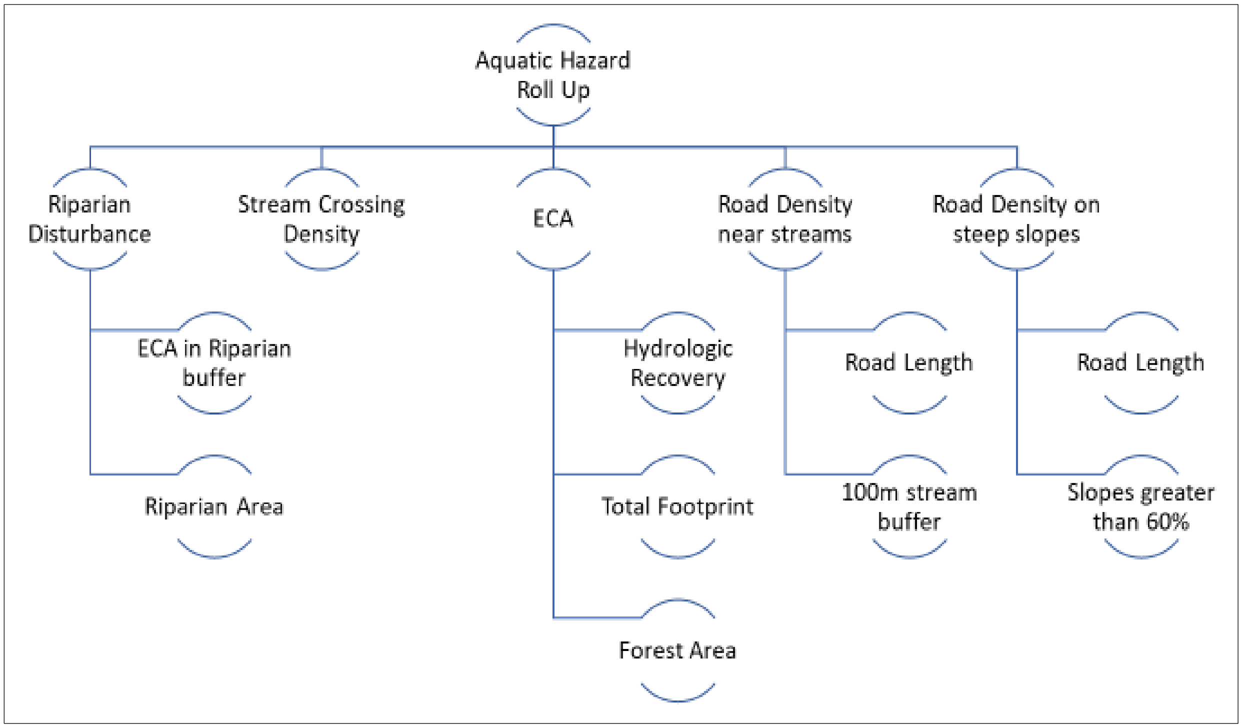

Figure 1. Aquatic Hazard Roll Up

4.1.1 ECA

ECA at the AW scale. Areas affected by fire, harvest, and insect disturbances were assigned a value representing the hydrologic recovery based on forest age (Davidson *et al*. (2018)). This value was then multiplied by forest area and added to the proportion of total footprint. ECA values were then averaged for the entire Assessment Watershed (AW).

$$ECA\ (\%) = (Hydrologic\ Recovery * Forest\ Area) + Total\ Footprint \tag{1}$$

Where:

$$Hydrologic\ Recovery = if \begin{pmatrix} Forest\ Age\ Elk\ Valley < 24, then\ 1, \\ else\ Forest\ Age\ Elk\ Valley < 39, then\ 0.75, \\ else\ Forest\ Age\ Elk\ Valley < 48, then\ 0.5, \\ else\ Forest\ Age\ Elk\ Valley < 60, then\ 0.25, \\ else\ 0.1 \end{pmatrix} \tag{2}$$

$$Forest\ Area = ESSFwmw\ Dry\ Forest + ESSFwmw\ Intermediate\ Forest + ESSFwmw\ Wet\ Forest + ESSFwm1\ Wet\ Forest + ESSFwm1\ Dry\ Forest + ESSFwm1\ Intermediate\ Forest + ESSFdk\ Wet\ Forest + ESSFdk\ Dry\ Forest + ESSFdk\ Intermediate\ Forest + ESSFdkw\ Wet\ Forest + ESSFdkw\ Dry\ Forest + ESSFdkw\ Intermediate\ Forest + MS\ Dry\ Forest + MS\ Wet\ Forest + MS\ Intermediate\ Forest + MS\ Deciduous\ Floodplain + ICH\ Deciduous\ Floodplain + ICH\ Dry\ Forest + ICH\ Wet\ Forest + ICH\ Intermediate\ Forest + IDF\ Dry\ Forest + IDF\ Intermediate\ Forest + IDF\ Wet\ Forest + IDF\ Deciduous\ Floodplan + ESSF\ Deciduous\ Floodplain \quad (3)$$

$$Total\ Footprint\ = Built\ Up\ Areas + Campgrounds + Major\ Roads + Historic\ Mines + Open\ Pit\ Mines + Reclaimed\ Mines + Minor\ Roads + Railways + Trails + Transmission\ Lines \quad (4)$$

4.1.2 Riparian Disturbance

Riparian areas for the Elk Valley were delineated using remote-sensed data. Natural and anthropogenic disturbances were summarized for each AW within the derived riparian area (Davidson et al., 2018). Riparian Disturbance was calculated as the average ECA score within the riparian area in each AW, divided by the riparian area in each AW, then multiplied by 100.

$$Riparian\ Disturbance\ (\%) = \frac{ECA\ in\ Riparian\ Buffer}{Riparian\ Area} * 100 \quad (5)$$

Where:

$$ECA\ in\ Riparian\ Buffer = ECA * if(Riparian\ Area = 1, then\ 1, else\ 0) \quad (6)$$

$$Riparian\ Area = Spatial\ layer\ defined\ by\ CEMF\ working\ group\ where\ riparian\ area\ was\ given\ a\ value\ of\ 1 \quad (7)$$

4.1.3 Stream Crossings (#/km²)

Stream crossings were defined as any road that crossed a mapped stream. This was calculated using the intersection of roads and streams in ALCES and summarizing at the scale of the AW (Davidson *et al.*, 2018). Different types of stream crossings were not distinguished, although if they were determined to be bridges based on data provided by Canfor, crossings were removed from the analysis since they are not viewed as barriers to fish movement. An average was then calculated per AW to get a density metric.

4.1.4 Road Density near Streams

Road density near streams was determined by identifying roads that fell within a 100 m buffer around all streams and road density was reported by AW (Davidson *et al.*, 2018).

$$Road\ Density\ near\ Streams\ \left(\frac{km}{km^2}\right) = \frac{Road\ Length\ near\ Streams\ (km)}{AW\ Area\ (km^2)} \quad (8)$$

Where:

$$Road\ Length\ near\ Streams\ (km) = \big(Major\ Roads\ (km) + Minor\ Roads(km)\big) * if(Stream\ Buffer = 1, then\ 1, else\ 0) \quad (9)$$

$$AW = Assessment\ Watersheds, as\ described\ above \quad (10)$$

Where:

$$Stream\ Buffer = Spatial\ layer\ defined\ as\ 100\ m\ distance\ around\ all\ streams\ and\ given\ a\ value\ of\ 1 \quad (11)$$

$$Major\ Roads, Minor\ Roads = \ defined\ in\ Appendix\ A - \ Data\ Sources\ and\ Appendix\ B - \ 2018\ Unity\ Update \quad (12)$$

4.1.5 Road Density on Steep Slopes

Road density on steep slopes was determined by only accounting for roads that fall on steep slopes (defined as any slopes greater than 60%). Road areas were divided by width to acquire road length and road density was reported by AW (Davidson *et al.*, 2018).

$$Road\ Density\ on\ Steep\ Slopes\ \left(\frac{km}{km^2}\right) = \frac{Road\ Length\ on\ Steep\ Slopes\ (km)}{AW\ Area\ (km^2)} \quad (13)$$

Where:

$$Road\ Length\ on\ Steep\ Slopes(km) = \big(Major\ Roads\ (km) + Minor\ Roads(km)\big) * if(Steep\ Slope = 1, then\ 1, else\ 0) \quad (14)$$

$$AW = Assessment\ Watersheds, as\ described\ above \quad (15)$$

Where:

$$Steep\ Slopes = Spatial\ layer\ defined\ as\ areas\ greater\ than\ 60\ percent\ slope\ and\ given\ a\ value\ of\ 1 \quad (16)$$

$$Major\ Roads, Minor\ Roads = \ defined\ in\ Appendix\ A - \ Data\ Sources\ and\ Appendix\ B - \ 2018\ Unity\ Update \quad (17)$$

4.2 Grizzly Bear Hazard

Grizzly Bear Hazard was calculated as 1 minus habitat suitability, where suitability is dependant on habitat availability and the density of the road network (Mowat *et al.*, 2018). Habitat availability is largely dependant on the absence of built-up areas and the presence of riparian areas, berry areas, avalanche chutes, alpine areas, and young forests (***Figure 2***). Final hazard scores were then scaled from 0-1.

$$Grizzly\ Bear\ Hazard\ (index) = 1 - Grizzly\ Habitat\ Suitability\ (index) \qquad (18)$$

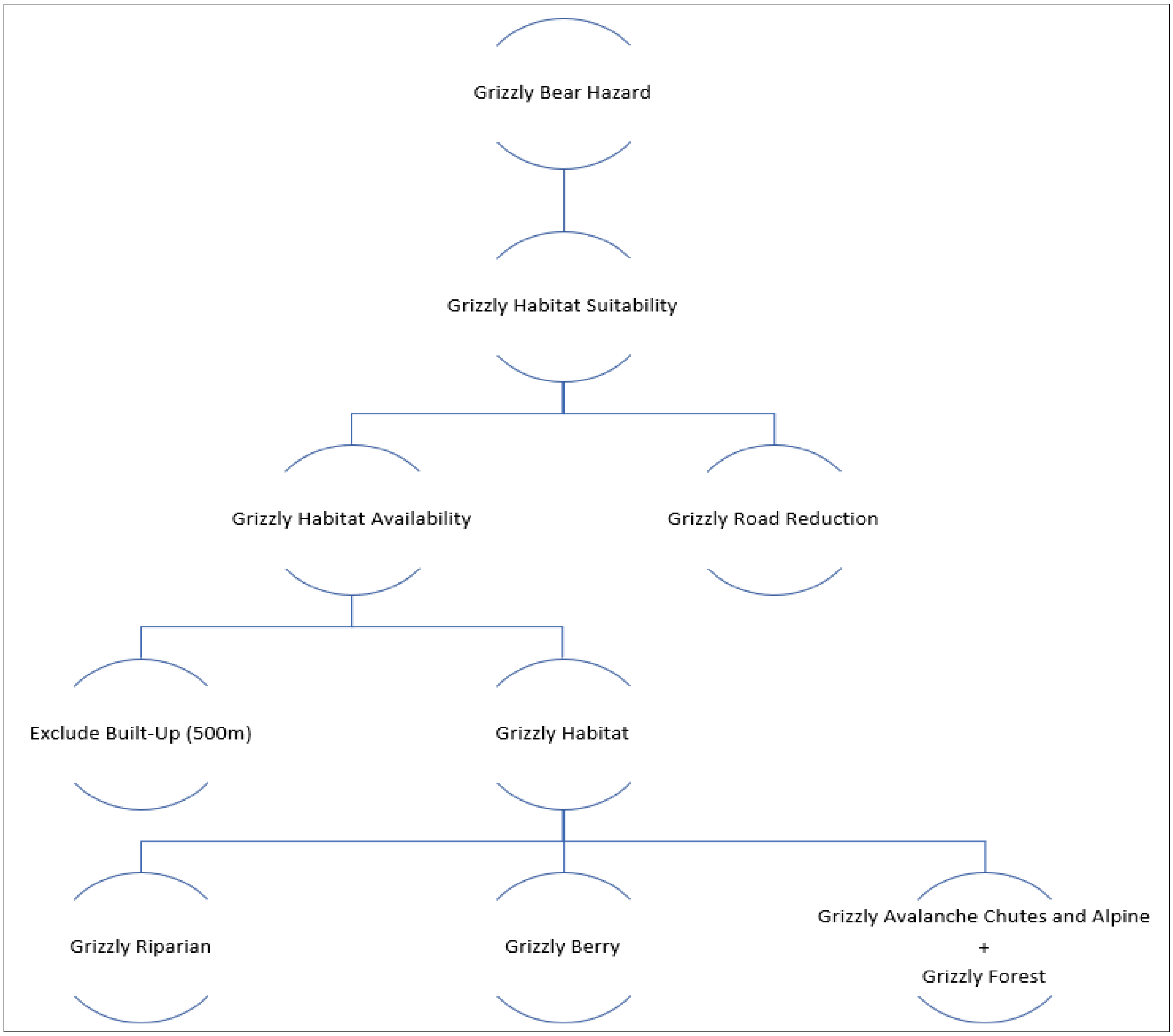

Figure 2. Grizzly Bear Hazard

4.2.1 Grizzly Habitat Suitability

Habitat Suitability was calculated as the difference between Grizzly Habitat Availability and the Grizzly Road Reduction value (Mowat *et al.*, 2018). See section 4.2.2.5 for a description of the Grizzly Road Reduction parameter.

$$Grizzly\ Habitat\ Suitability = Grizzly\ Habitat\ Availability - Grizzly\ Road\ Reduction \quad (19)$$

4.2.2 Grizzly Habitat Availability

Habitat Availability is calculated as the maximum value of either the Grizzly Riparian Habitat, Grizzly Berry Habitat, or Grizzly Avalanche Chutes/Alpine and Grizzly Forest (Mowat *et al.*, 2018). This value is set to zero if it falls within a 500 m buffer around Built-Up Areas.

$$Grizzly\ Habitat\ Availability = if(Built\ Up\ 500\ m\ Buffer = 1, then\ 0, else\ 1) * Max\big(Grizzly\ Riparian, Grizzly\ Berry, (Grizzly\ Avalanche\ Chutes\ and\ Alpine + Grizzly\ Forest)\big) \quad (20)$$

Where:

$$Built\ Up\ 500m\ Buffer = Spatial\ layer\ defined\ as\ 500\ m\ distance\ around\ Built\ Up\ Areas\ and\ given\ a\ value\ of\ 1 \quad (21)$$

4.2.2.1 Grizzly Riparian

Riparian habitat was calculated as the weighted proportion of naturalized land cover that exists within predefined Grizzly Riparian regions (Mowat *et al.*, 2018).

$$Grizzly\ Riparian = Natural\ Land\ Area * if\begin{pmatrix} Grizzly\ Riparian\ Region = 3, then\ 0.6, \\ else\ Grizzly\ Riparian\ Region = 2, then\ 0.4, \\ else\ Grizzly\ Riparian\ Region = 1, then\ 0.2, \\ else\ 0) \end{pmatrix} \quad (22)$$

Where:

$$Natural\ Land\ Area = Alpine\ Dwarf\ Shrub + Alpine\ Grassland + Alpine\ Meadow + Alpine\ Tundra\ Fellfield\ Meadow + Alpine\ Tundra\ Grassland + Alpine\ Tundra\ Meadow + Alpine\ Undifferentiated + Avalanche\ Herb + Avalanche\ Shrub + Avalanche\ Treed + ESSF\ Brushland + ESSF\ Deciduous\ Floodplain + ESSFdk\ Dry\ Forest + ESSFdk\ Intermediate\ Forest + ESSFdkw\ Dry\ Forest + ESSFdkw\ Wet\ Forest + ESSFdkw\ Intermediate\ Forest + ESSF\ Grassland + ESSFwm1\ Dry\ Forest + ESSFwm1\ Intermediate\ Forest + ESSFwm1\ Wet\ Forest + ESSFwmw\ Dry\ Forest + ESSFwmw\ Intermediate\ Forest + ESSFwmw\ Wet\ Forest + Glacier + ICH\ Brushland + ICH\ Deciduous + ICH\ Dry\ Forest + ICH\ Grassland + ICH\ Intermediate\ Forest + ICH\ Wet\ Forest + IDF\ Deciduous\ Floodplain + IDF\ Dry\ Forest + IDF\ Grassland + IDF\ Intermediate\ Forest + IDF\ Wet\ Forest + Krummholz + MS\ Brushland + MS\ Deciduous + MS\ Dry\ Forest + MS\ Grassland + MS\ Intermediate\ Forest + MS\ Wet\ Forest + Rock\ and\ Talus + Wetland\ Fen\ and\ Marsh + Wetland\ Swamp \quad (23)$$

$$Grizzly\ Riparian\ Region = Riparian\ areas\ defined\ by\ PEM \quad (24)$$

4.2.2.2 Grizzly Berry

Grizzly Berry habitat value was calculated as the maximum occurring within natural land cover, of either *Sheperdia* Berry value or Huckleberry value (Mowat *et al.*, 2018). Huckleberry values were provided by predetermined caloric models, with indices ranging from 0-1. *Sheperdia* values were simulated using a predetermined caloric model scaled from 0-1 and weighted by forest age and elevation in forested areas. For further details on weights and caloric models see Appendix D.

$$Grizzly\ Berry = Natural\ Land\ Area * max(Grizzly\ Sheperdia, Huckleberry\ Model) \tag{25}$$

Where:

$$Grizzly\ Sheperdia = if\left(\begin{pmatrix} Forest\ Age \leq 10\ OR\ Elevation > 2{,}200\ m\ OR \\ BEC\ Zone\ (ESSFdkp, ESSFwmp, or\ IMAun)\ OR\ Forest\ Area \end{pmatrix} \neq 0, \\ then\ 0.8, else\ if(Forest\ Age \leq 20, then\ 0.6, else\ 0)\right) \\ * Sheperdia\ Model \tag{26}$$

$$Forest\ Area\ from\ Equation\ 3\ above$$

4.2.2.3 Grizzly Avalanche Chutes and Alpine

Grizzly Avalanche Chute and Alpine Habitat value was simulated as the proportional weighted sum of Avalanche – Herb, Avalanche – Shrub, Alpine – Meadow, Alpine – Grassland, Alpine Skiing, and Reclaimed Mine land cover types. Weights were determined by their value to Grizzly bears, according to expert opinion and scientific literature (Mowat *et al.*, 2018).

$$Grizzly\ Avalanche\ Chutes\ and\ Alpine = Avalanche\ Herb * 0.8 + Avalanche\ Shrub * 0.6 \\ + Alpine\ Meadow * 0.8 + Alpine\ Grassland * 0.6 + Alpine\ Ski\ Resorts\ and\ Runs * 0.6 \\ + Reclaimed\ Mine * 0.4 \tag{27}$$

4.2.2.4 Grizzly Forest

Grizzly Forest habitat value is dependant on preferential use of high elevation young forests, with secondary use of mature forests older than 80 years, and no value given to intermediate aged forests between 20-80 years (Mowat *et al.*, 2018).

$$Grizzly\ Forest = if(\text{Forest Age} \leq 10\ OR\ Elevation > 2200m, then\ 0.6, \\ else\ Forest\ Age \leq 20, then\ 0.4 \\ else\ Forest\ Age > 80, then\ 0.2, \\ else\ 0) \\ * Forest\ Area * if(Subalpine = 1, then\ 0, else\ 1) \tag{28}$$

Where:

$$Forest\ Area\ from\ Equation\ 3\ above$$

$$Subalpine = Spatial\ layer\ using\ PEM\ subalpine\ classifications \tag{29}$$

4.2.2.5 Grizzly Road Reduction

Road reduction values, for the purpose of calculating habitat suitability, were assigned based on road density benchmarks. Road density was calculated as the linear km of major and minor roads (excluding minor roads occurring in access management areas) divided by the total AW area. Roads densities greater than 1.2 km/km^2 were given a reduction value of 0.4, densities greater than 0.6 km/km^2 were given a reduction value of 0.2, and any densities lower than 0.6 km/km^2 were assigned no reduction value (Mowat *et al*., 2018).

$$Grizzly\ Road\ Reduction = if\left(\begin{array}{c} Road\ Density > 1.2, then\ 0.4, \\ else\ Road\ Density > 0.6, then\ 0.2, \\ else\ 0 \end{array}\right) \quad (30)$$

4.3 *Old and Mature Forest*

4.3.1 Old and Mature Forest Z-Score

Old and Mature Forest Z-Score is used to assess change in the amount of old and mature forest from expected values to current observed values and is measured as a deviation from the historic mean (***Figure 3***). The result is the number of standard deviations the observed value is from the expected value (i.e., a z-score of -1 is one standard deviation below the expected value). Z-score was assessed at the Biogeoclimatic Ecosystem Classification (BEC) unit scale (Holmes *et al.*, 2018).

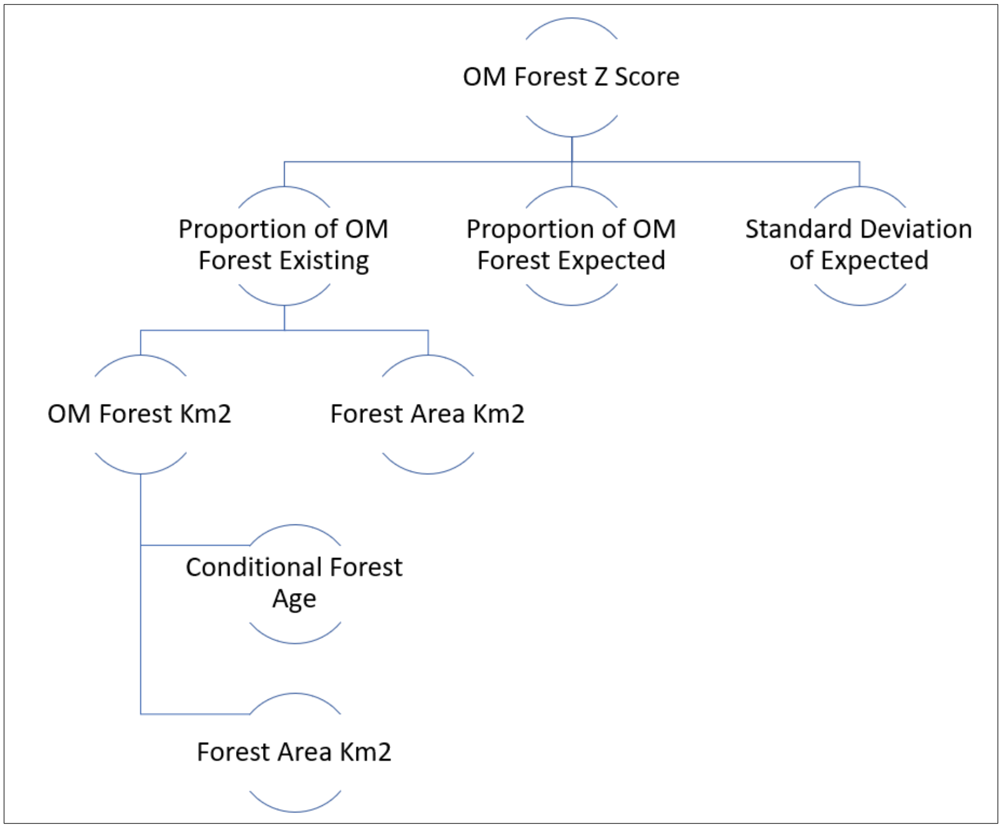

Figure 3. Old and Mature Forest Z-Score

Z-Score was calculated as the proportion of Old and Mature Forest existing (amount divided by total forested area) minus the proportion of Old and Mature Forest expected, divided by the expected standard deviation.

$$Old \quad and\ Mature\ Fo$$

$$= \frac{Existing\ OM\ Forest - Expected\ OM\ Forest}{Expected\ Standard\ Deviation} \#(31)$$

Where:

$$Existing\ OM\ Forest = \frac{OM\ Forest\ (km^2)}{Forest\ Area\ (km^2)} * if(Crown\ Forest\ Land\ Base = 1, then\ 1, else\ 0) \quad (32)$$

$$\begin{gathered} Expected\ OM\ Forest = if(BEC\ Zone = ESSFwm1\ OR\ ESSFwmw, then\ 48, \\ else\ if(BEC\ Zone = MSdw\ OR\ MSdk, then\ 44, \\ else\ if(BEC\ Zone = ICHmk4\ OR\ ESSFdk1\ OR\ ESSFdk2\ OR\ ESSFdkw, then\ 45.6, \\ else\ 50) \end{gathered} \quad (33)$$

$$\begin{gathered} Expected\ Standard\ Deviation = if(BEC\ Zone = ESSFdk1\ OR\ ESSFdk2\ OR\ ESSFdkw \\ OR\ ICHmk4, then\ 13, \\ else\ if(BEC\ Zone = ESSFwm1\ OR\ ESSFwmw, then\ 13.3, \\ else\ if(BEC\ Zone = MSdk\ OR\ MSdw, then\ 12.5, else\ 10) \end{gathered} \quad (34)$$

Where:

$$OM\ Forest\ (km^2) = if\left(\begin{gathered} Forest\ Age \geq 100\ in\ MSdk\ and\ ICHmk4\ OR \\ Forest\ Age \geq 120\ in\ all\ other\ BECs, then\ Forest\ Area\ (km^2), \\ else\ 0 \end{gathered} \right) \quad (35)$$

4.3.2 Old and Mature Forest Patch Size (km^2)

Patches of interior old and mature forest were defined by adding a 100 m buffer to the total footprint layer and subtracting that from the total size of the original old or mature patch (***Figure 4***; Holmes *et al.*, 2018).

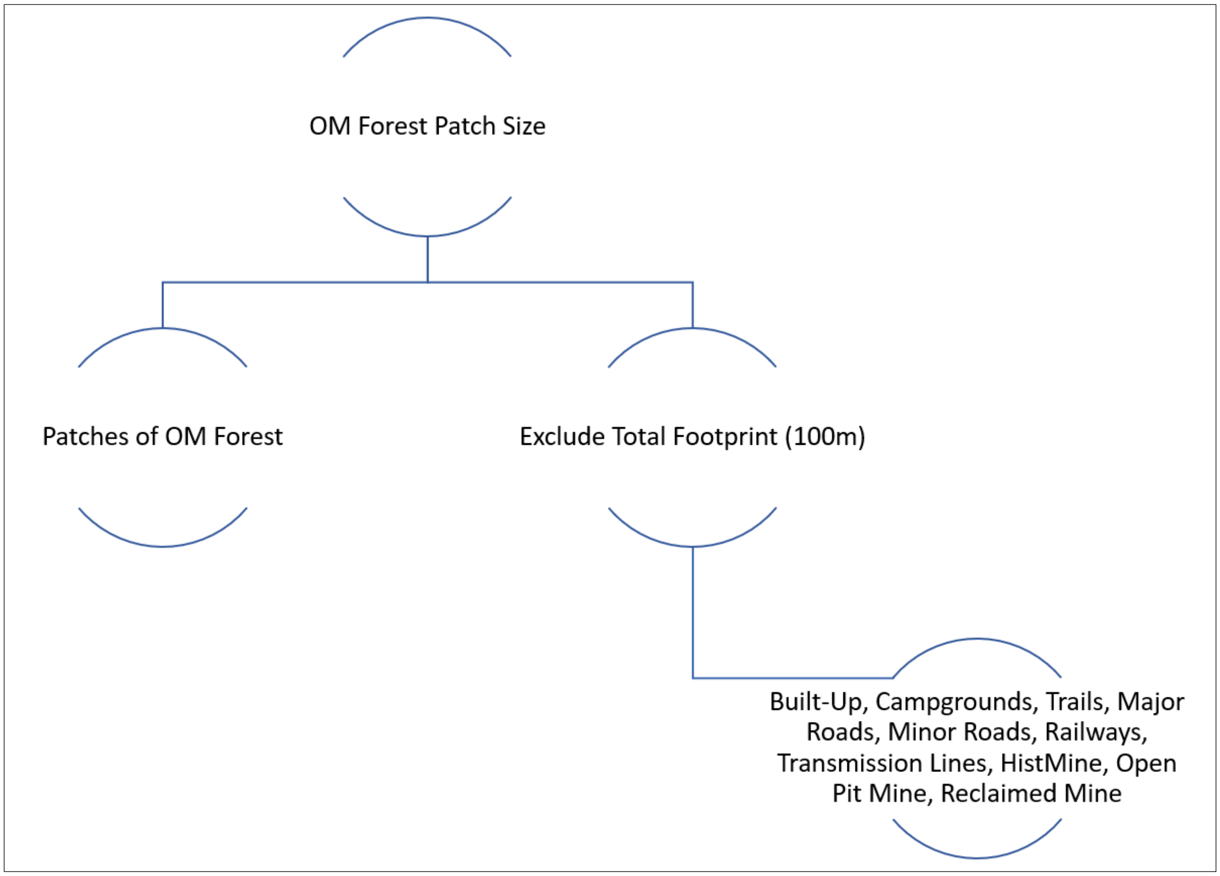

Figure 4. Old and Mature Forest Patch Size

$$OM\ Forest\ Patch\ Size\ (km^2) = Patches\ of\ OM\ Forest\ (km^2) - Buffered\ Disturbance\ Footprint (km^2) \quad (36)$$

Where:

$$Patches\ of\ OM\ Forest\ (km^2) = sum\ of\ area\ within\ individual\ OM\ Forest\ patches \quad (37)$$

$$Buffered\ Disturbance\ Footprint\ (km^2) = buffer(Total\ Footprint)\ by\ 100m \quad (38)$$

4.3.3 Old Forest Z-Score

Old Forest Z-Score is used to assess change in the amount of old forest from expected values to current observed values and is measured as a deviation from the historic mean (***Figure 5***). Similar to Old and Mature Forest, Old Forest Z-score was assessed at the Biogeoclimatic Ecosystem Classification (BEC) unit scale (Holmes et al., 2018).

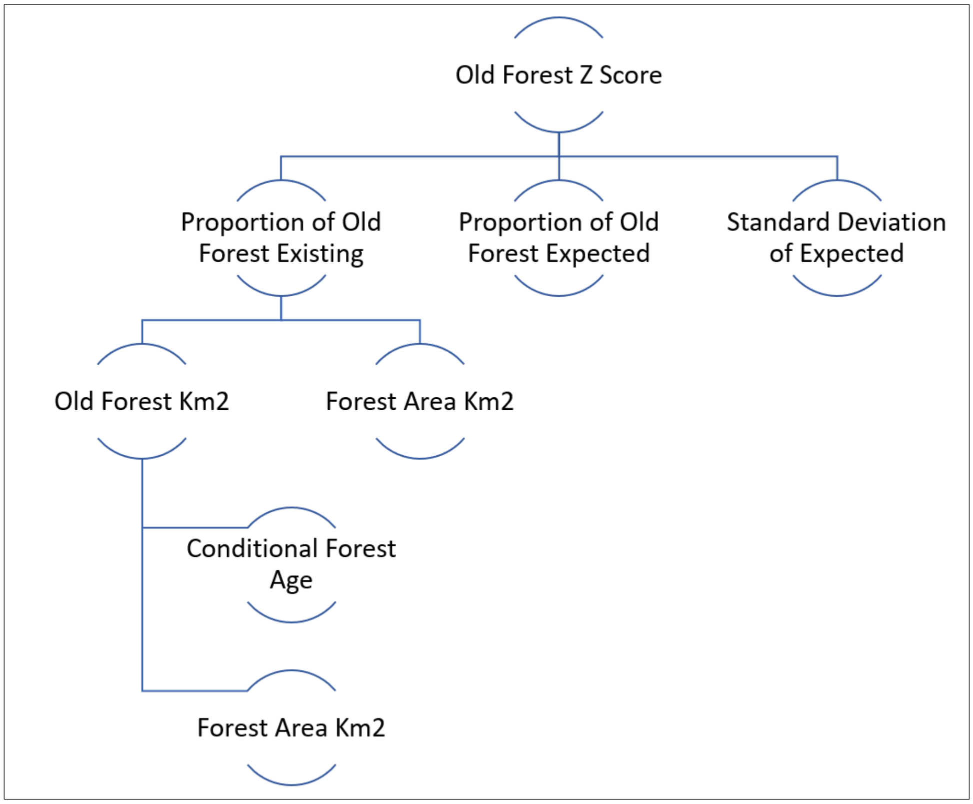

Figure 5. Old Forest Z-Score

$$Old\ Forest\ Z\ Score = \frac{Existing\ Old\ Forest - Expected\ Old\ Forest}{Expected\ Standard\ Deviation} \quad (39)$$

Where:

$$Existing\ Old\ Forest = \frac{Old\ Forest\ (km^2)}{Forest\ Area\ (km^2)} * if(Crown\ Forest\ Land\ Base = 1, then\ 1, else\ 0) \quad (40)$$

$$Expected\ Old\ Forest = if(BEC\ Zone = ESSFwm1\ OR\ ESSFwmw, then\ 28, \\ else\ if(BEC\ Zone = MSdw\ OR\ MSdk, then\ 32, else\ 40)) \quad (41)$$

$$Expected\ Standard\ Deviation = if(BEC\ Zone = ESSFwm1\ OR\ ESSFwmw \\ OR\ MSdk\ OR\ MSdw, then\ 12, else\ 13) \quad (42)$$

Where:

$$Old\ Forest\ (km^2) = if\begin{pmatrix} Forest\ Age\ \geq 250\ in\ ESSFdkw\ and\ ESSFwm1\ and\ ESSFwmw \\ OR\ Forest\ Age \geq\ 140\ in\ all\ other\ BEC\ Zones, \\ then\ Forest\ Area\ (km^2), else\ 0 \end{pmatrix} \quad (43)$$

4.3.4 Old Forest Patch Size (km2)

Patches of interior old forest were defined by adding a 100 m buffer to the total footprint layer and subtracting that from the total size of the original old patch area (***Figure 6***; Holmes et al., 2018).

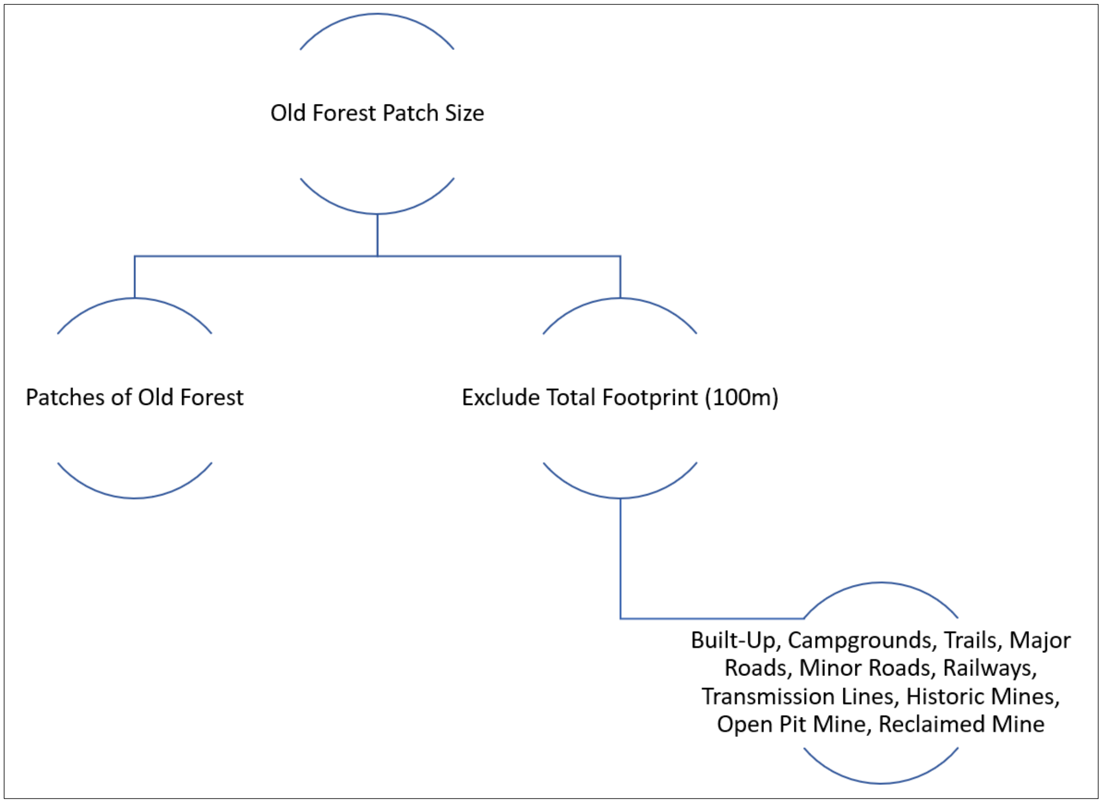

Figure 6. Old Forest Patch Size

$$Old\ Forest\ Patch\ Size\ (km^2) = Patches\ of\ Old\ Forest\ (km^2) - Buffered\ Disturbance\ Footprint(km^2) \quad (44)$$

Where:

$$Patches\ of\ Old\ Forest\ (km^2) = \ sum\ of\ area\ within\ individual\ Old\ Forest\ patches \quad (45)$$

$$Buffered\ Disturbance\ Footprint\ (km^2) = buffer(Total\ Footprint\ )\ by\ 100m \quad (46)$$

4.4 *Bighorn Sheep*

The status of bighorn sheep (BHS) habitat was evaluated by assessing annual range hazard, all rank winter range hazard, and rank 3 and 4 winter range hazard, at the scale of each bighorn sheep herd (Poole *et al.*, 2020).

4.4.1 Annual Range Hazard

Bighorn sheep annual range in the Elk Valley encompasses most open sub-alpine areas above 1,600m elevation (Poole et al. 2020). Annual range habitat is necessary for Bighorn sheep population persistence. Annual habitat was ranked based on the relationship of sheep use of open habitat at given distances from escape terrain. Escape terrain was defined as open slopes ≥37°, and open habitat was defined by the following PEM site series:

- ESSF Af, Ag, Ah, Am, AtAm, At, Atmf, Ro, Ro102, Rt, Sc, SkGb, Xh, Mi, Mr, Rz, Gg, Gb, GgGb, Yz
- ESSF dkp – Vh, Vs
- IMA Af, Ag, Ah, Am, AtAm, At, Atmf, Ro, Ro102, Rt, Sc, SkGb, Xh
- MS Mi, Mr, Rz

Habitat was then ranked based on distance to escape terrain:

- Rank 4: <=30 m from escape terrain
- Rank 3: 30-100 m from escape terrain
- Rank 2: 100-200 m from escape terrain
- Rank 1: 200-300 m from escape terrain

All ranks were summed, and the percent change (relative to historic annual range) was calculated and assigned hazard values based on the hazard benchmarks defined below (***Figure 7***; Poole *et al.*, 2020). Historic annual range was calculated using a 1950 PEM dataset.

$$\%\,Change\ in\ All\ Rank\ AR = \frac{BHS\ Historic\ All\ Rank\ AR\ -\ BHS\ Current\ All\ Rank\ AR}{BHS\ Historic\ All\ Rank\ AR} * 100 \quad (47)$$

- Low Hazard (1): < 15% change in All Rank Annual Range (AR)
- Moderate Hazard (2): 15% - 30% change in All Rank Annual Range
- High Hazard (3): > 30% change in All Rank Annual Range

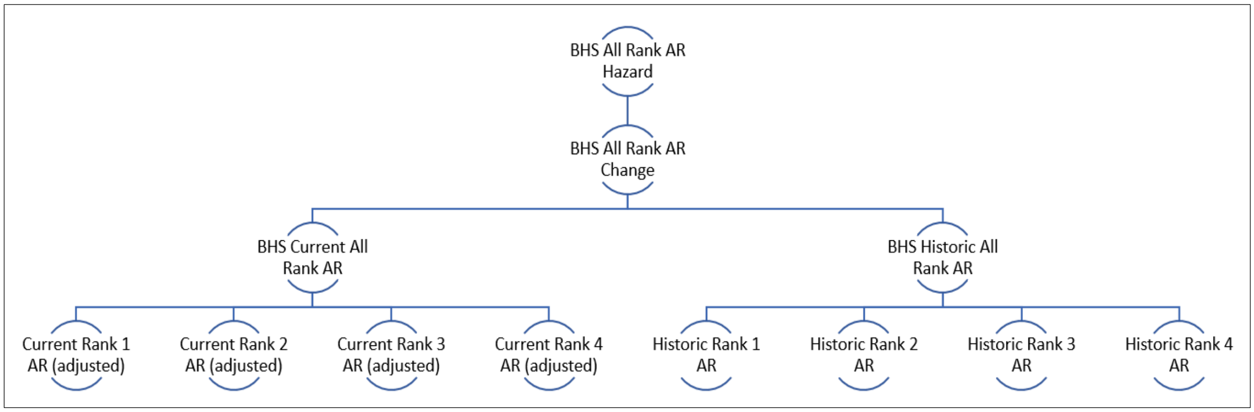

Figure 7. BHS All Rank Annual Range Hazard

4.4.2 All Rank Winter Range Hazard

Bighorn sheep winter on high elevation grasslands and associated open habitats (Poole *et al.* 2020). This habitat is rare on the landscape and considered critical for population persistence. Suitability of winter range (WR) is an important component of BHS health, and winter range habitat ranking should be stepped down when not in good health.

Winter range was mapped and ranked based on PEM site series classes. Habitat class ranking was restricted to habitats within identified winter range polygons. Rankings ranged from Rank 4 – highly selected or highly used – through to Rank 1 – low selection or limited use, with Rank 0 being nil habitat:

- Rank 4: ESSF Ag, ESSF Atmf, ESSF Gg, IMA_Ag, IMA Atmf
- Rank 3: ESSF AtAm, IMA AtAm, ESSF GbGg, ESSF Rt, IMA Rt, ESSF Mi, ESSF Mr, MS Mi, MS Mr, ESSF Yz
- Rank 2: ESSF Ro, IMA Ro
- Rank 1: ESSF Gb, ESSF Rz, MS Rz
- Rank 0: all other habitats not shown above

Within the Greenhills Operations footprint, Mi (mine) and Mr (mine reclaimed) site series were discounted from Rank 3 to Rank 2 habitats. Furthermore, ranked habitat was stepped-down on ranges that are not in proper functioning condition, as assessed by Smyth (2014).
All ranks were summed, and the percent change (relative to historic all rank WR) was calculated and assigned hazard values based on the hazard benchmarks defined below (***Figure 8***; Poole *et al.*, 2020). Historic winter range was calculated using a 1950 PEM dataset.

$$\%\ Change\ in\ All\ Rank\ WR = \frac{BHS\ Historic\ All\ Rank\ WR\ -\ BHS\ Current\ All\ Rank\ WR}{BHS\ Historic\ All\ Rank\ WR} * 100 \quad (48)$$

- Very Low Hazard (1): ≤ 5% change in All Rank Winter Range (WR)
- Low Hazard (2): 5 - 15% change in All Rank Winter Range
- Moderate Hazard (3): 15 - 25% change in All Rank Winter Range

- High Hazard (4): 25 - 35% change in All Rank Winter Range
- Very High Hazard (5): > 35% change in All Rank Winter Range

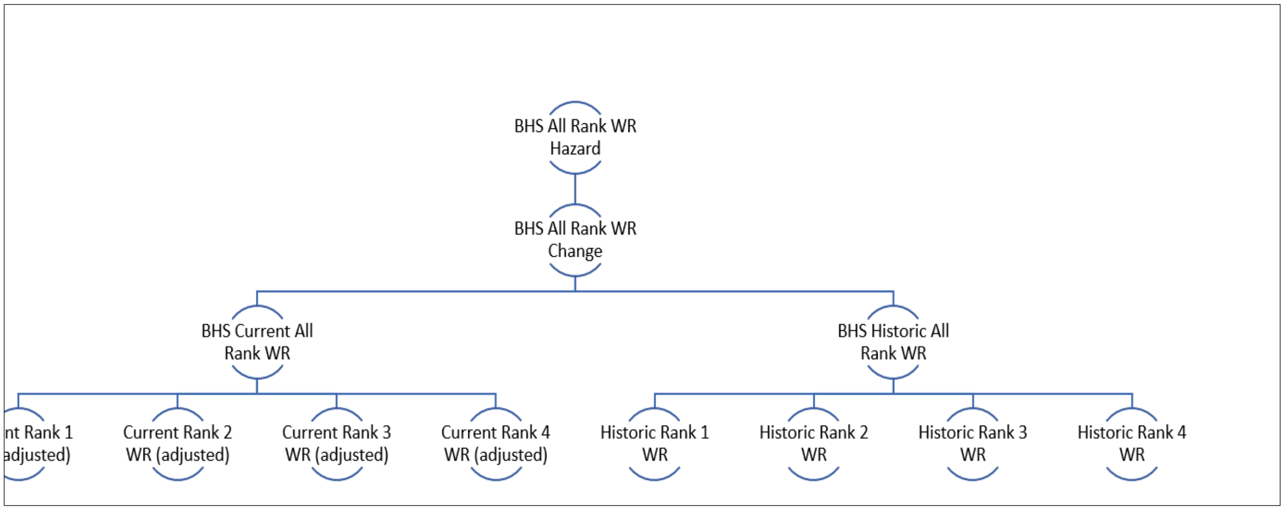

Figure 8. BHS All Rank Winter Range Hazard

4.4.3 Rank 3 and 4 Winter Range Hazard

Rank 3 and 4 Winter Range Hazard was assessed independently, since they represent limiting high quality habitat. Habitat was summed for rank 3 and 4 and a percent change, relative to historic, was calculated. Hazard ratings were then assigned based on benchmarks defined for Ranks 3 and 4 below (***Figure 9***; Poole *et al.*, 2018).

$$\%\ Change\ in\ Rank\ 3\ \ 4\ WR = \frac{BHS\ Historic\ Rank\ 3\ \&\ 4\ WR - BHS\ Current\ Rank\ 3\ \&\ 4\ WR}{BHS\ Historic\ Rank\ 3\ \&\ 4\ WR} * 100 \quad (49)$$

- Very Low Hazard (1): ≤ 2.5% change in Rank 3 and 4 Winter Range (WR)
- Low Hazard (2): 2.5 - 7.5% change in Rank 3 and 4 Winter Range
- Moderate Hazard (3): 7.5 - 12.5% change in Rank 3 and 4 Winter Range
- High Hazard (4): 12.5 - 17.5% change in Rank 3 and 4 Winter Range
- Very High Hazard (5): > 17.5% change in Rank 3 and 4 Winter Range

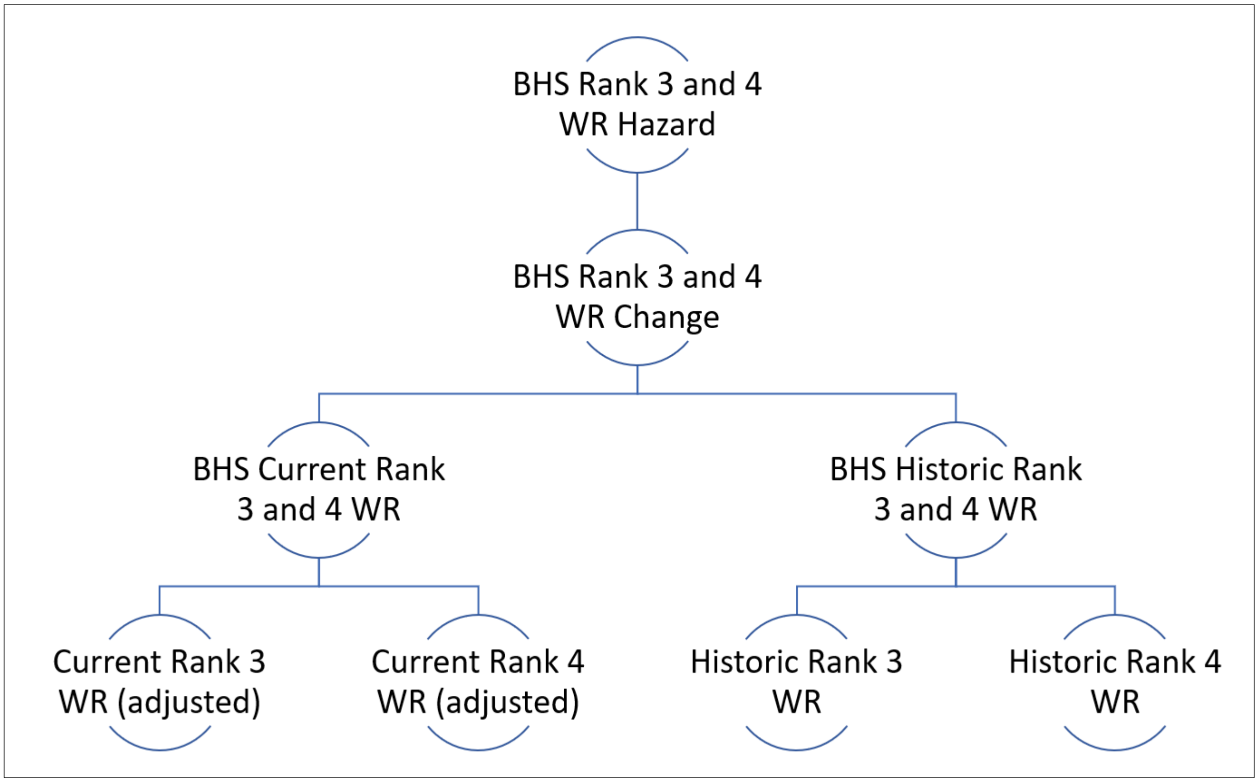

Figure 9. BHS Rank 3 and 4 Winter Range Hazard

5 Scenario Assumptions

Three future development scenarios as part of the Elk Valley CEMF, as well as an increased natural disturbance scenario based on maximum development. Two mitigation scenarios were also simulated, aimed to decrease the effects of the natural disturbance scenario. Descriptions of each scenarios are included below:

1) Reference Scenario: This scenario represents a “business as usual” progression in development. Current rates of change in indicators were used to model future conditions.

2) Minimum Scenario: This scenario is meant to present a case where the intensity of human activities in the Elk Valley declines. This scenario takes the reference case and either subtracts from it or substitutes activities which are assumed to be associated with fewer environmental impacts.

3) Maximum Scenario: This scenario is meant to provide decision-makers with an understanding of cumulative effects from the combination of all currently proposed or projected (as of 2015) human activities in the Elk Valley. It should be noted that some of the proposed development under this scenario has already been approved.

4) Higher Natural Disturbance Scenario: This scenario is meant to assess the effects of human activities from the Maximum Scenario in combination with elevated rates of natural disturbance on the landscape as expected with a four degree increase in annual average air temperature. This is similar to climate change projections under RCP 8.5, where there would be no substantial reduction in greenhouse gas emissions. It is meant to provide

decision-makers with an understanding of the combined cumulative effects of human activity and maximum development with increased rates of fire and insect outbreak due to climate change.

5) Moderate Mitigation Scenario: This scenario is meant to assess the effect of different mitigation actions concerning forestry, municipal development, and linear development, on VC condition. These mitigation actions are layered onto the natural disturbance scenario.

6) Intense Mitigation Scenario: This scenario is meant to assess the effect of different mitigation actions concerning mining development, forestry, municipal development, linear development, and fire management, on VC condition. These mitigation actions are layered onto the natural disturbance scenario. The Intense Mitigation Scenario differs from the Moderate Mitigation Scenario in that the mitigative actions taken are stronger.

5.1 *Reference Scenario*

Development	Assumptions	Exclusions
Metallurgical Coal Mining	• Fording River Operations (FRO) grows at a rate of 106 ha per year for the 25-year period 2016-2040, as per the FRO Swift Environmental Assessment (EA). Total footprint growth over this period is 2650 ha. Growth is confined to the FRO shape provided by Teck • Line Creek Operations (LCO) grows at a rate of 70.9 ha per year for the 20-year period 2016-2035, as per the LCO Phase 2 EA. Total footprint growth over this period is 1418 ha. Growth is confined to the LCO shape provided by Teck. • Greenhills Operations (GHO) grows at a rate of 29.5 ha per year between 2020-2050, as per the CPX expansion EA. Total footprint growth over this period is 886 ha. Growth is confined to the CPX shapefile provided by Teck. • Elkview Operations (EVO) grows at a rate of 74 ha per year, between 2020-2050, as per the Baldy Ridge Expansion (BRE) EA. Total footprint growth over this period is 2,220 ha. Growth is confined to the BRE shape provided by Teck. • Reclamation for FRO (952 ha), LCO (637 ha), GHO (340 ha), EVO (843 ha), and Coal Mountain Operations (CMO) (36 ha) is	No exclusions

	included.	
Forestry	• Simulate any planned harvest until 2020 based on Annual Allowable Cut (AAC) • After 2020, each operator's AAC will be applied in a random distribution with clustering for all potential harvest blocks until 2060 • Preferential harvest of burnt forest (salvage logging) will be simulated. • Forestry roads will be built based on existing road densities using a least-cost-path algorithm in ALCES Online. Canfor - 18,685,000 m^2 / decade Teck - 10,545,000 m^2 /decade Nature Conservancy of Canada (NCC) - 370,000 m^2 / decade CanWel - 35,150,000 m^2 / decade	• Avoid harvest in previously cut areas • Avoid harvest of forest < 60 years • Preferentially harvest previous burns (age=1 and origin=fire).
Municipal	• Growth according to the Official Community Plans (OCP), where: - Fernie uses the near to medium term growth predicted - Sparwood and Elkford grow to 50% of the area of the OCP polygons • Growth rate determined using Statistics Canada data for each community Fernie - 388,850 m^2 / dec Sparwood - 84,532 m^2 / dec Elkford - 90,168 m^2 / dec	This exclusion only applies to the Fernie action: Only within 300m of previously existing built-up

Recreation	NA	NA
Mineral, Oil and Gas	NA	NA
Aggregate	• Only Racehorse gravel pit is assumed to be developed in this scenario, based on a pre-scheduled area in the aggregate mask.	
Agriculture	NA	NA
Linear Development	NA	NA
Fire	• Historical annual burn rate was calculated by dividing the annual burned area by the current area of forest, grassland, and brushland in the Elk Valley. • The resulting low average fire rate (0.077%) is consistent with Boulanger et al. (2014) for the Southern Cordillera fire regime zone. Total of 18,314 ha is burned in reference scenario	Don't burn forests less than or equal to 10 years old.
Insect	• 0 ha of insect impacts for Pine Beetle • 2,100 ha of insect impacts for Spruce Beetle	Only in the Old and Mature forest stands

5.2 *Minimum Development Scenario*

Development	Assumptions	Exclusions
Metallurgical Coal Mining	• FRO grows at a rate of 106 ha per year for the 25-year period 2016-2040, as per the FRO Swift EA. Total footprint growth over this period is 2650 ha. Growth is confined to the FRO shape provided by Teck. • LCO grows at a rate of 70.9 ha per year for the 20-year period 2016-2035, as per the LCO Phase 2 EA. Total footprint growth over this period is 1418 ha. Growth is confined to the LCO shape provided by Teck. • Reclamation for FRO (952 ha), LCO (637 ha), GHO (340 ha), EVO (843 ha), and CMO (36 ha) is included.	

Forestry	• Will simulate any planned harvest until 2020 • After 2020, a reduction of 10% of the Annual Allowable Cut (AAC) will be applied in a random distribution with clustering for all potential harvest blocks until 2060 • Preferential harvest of burnt forest (salvage harvest) will be simulated • Forestry roads will be built based on existing road densities using a least-cost-path algorithm in ALCES Online Canfor - 16,907,400 m^2 / decade Teck - 9,541,800 m^2 /decade NCC - 334,800 m^2 / decade CanWel - 31,806,000 m^2 / decade	• Avoid harvest in previously cut areas • Avoid harvest of forest < 60 years • Preferentially harvest previous burns (age=1 and origin=fire).
Municipal	• Growth according to the OCPs, where: - Fernie uses the near to medium term growth predicted - Sparwood and Elkford grow to 25% of the area of the OCP polygons • Growth rate determined using Statistics Canada data for each community and will be 20% relative to reference scenario. Fernie - 311,080 m^2 / dec Sparwood - 67,626 m^2 / dec Elkford - 72,134 m^2 / dec	This exclusion only applies to the Fernie action: Only within 300m of previously existing built-up
Recreation	NA	NA
Mineral, Oil and Gas	NA	NA
Aggregate	NA	NA
Agriculture	NA	NA
Linear Development	NA	NA
Fire	• Historical annual burn rate was calculated by dividing the annual burned area by the current area of forest, grassland, and brushland in the Elk Valley. • The resulting low average fire rate (0.077%) is consistent with Boulanger et al. (2014) for the Southern Cordillera fire regime zone. Total of 18,314 ha is burned in reference scenario	Don't burn forests less than or equal to 10 years old.

Insect	• 0 ha of insect impacts for Pine Beetle • 2,100 ha of insect impacts for Spruce Beetle	Only in the Old and Mature forest stands

5.3 *Maximum Development Scenario*

Development	Assumptions	Exclusions
Metallurgical Coal Mining	• FRO grows at a rate of 106 ha per year for the 25-year period 2016-2040, as per the FRO Swift EA. Total footprint growth over this period is 2650 ha. Growth is confined to the FRO shape provided by Teck. • LCO grows at a rate of 70.9 ha per year for the 20-year period 2016-2035, as per the LCO Phase 2 EA. Total footprint growth over this period is 1418 ha. Growth is confined to the LCO shape provided by Teck. • CMO grows at a rate of 3.8 ha per year for the 30-year period 2016-2045, as per instructions. Total footprint growth over this period is 114 ha. Growth is confined to the CMO shape provided by Teck. • EVO grows at a rate of 73.5 ha per year for the 30-year period 2016-2045, as per instructions. Total footprint growth over this period is 2205 ha. Growth is confined to the EVO shape provided by Teck. • GHO grows at a rate of 27.9 ha per year for the 30-year period 2016-2045, as per instructions. Total footprint growth over this period is 837 ha. Growth is confined to the GHO shape provided by Teck. • North Coal Michel Creek grows at a rate of 14 ha per year for the 30-year period 2021-2050, as per instructions. Total footprint growth over this period is 420 ha. Growth is confined to the Loop Ridge Mine shape provided by North Coal. • Jameson Crown Mountain grows at a rate of 22.9 ha per year for the 30-year period 2021-2050, as per instructions. Total footprint growth over this period is 687 ha. Growth is confined to the shapes provided by Jameson Resources. • The Bingay mine grows at a rate of 59.5 ha per year for the 30-year period 2021-2050, as per instructions. Total footprint growth over this period is 1785 ha. Growth is confined to the Bingay tenure boundary noted above • Coal Mountain Operations 2 (CMO2) - 4,820,000 m^2 per decade for 3 decades. • Reclamation for FRO (952 ha), LCO (637 ha), GHO (340 ha), EVO (843 ha), CMO (36 ha), CMO2 (308 ha), Loop Ridge (88 ha), Bingay (381 ha), and Crown Mtn (147 ha) is included.	Mine footprint for reclamation must be 10 years old minimum

Forestry	• Will simulate any planned harvest until 2020 • After 2020, an increase of 20% of the Annual Allowable Cut (AAC) will be applied in a random distribution with clustering for all potential harvest blocks until 2060 • Preferential harvest of burnt forest (salvage harvest) will be simulated • Forestry roads will be built based on existing road densities using a least-cost-path algorithm in ALCES Online Canfor - 22,543,200 m^2 / decade Teck - 12,722,400 m^2 / decade NCC - 446,400 m^2 / decade CanWel - 42,408,000 m^2 / decade	• Avoid harvest in previously cut areas • Avoid harvest of forest < 60 years • Focus harvest on previous burns
Municipal	• Growth according to the OCPs, where: - Fernie uses the near to medium term growth predicted - Sparwood and Elkford grow to 100% of the area of the OCP polygons • Growth rate determined using Statistics Canada data for each community with a 20% increase in population relative to the reference scenario Fernie - 564,110 m^2 / dec Sparwood - 124,544 m^2 / dec Elkford - 108,000 m^2 / dec • Expand rural residential footprint by 70,800 m^2 per decade in a clustered growth allocation within the Agricultural Land Reserve. This growth is contained within 400 m of existing major roads in the urban growth mask.	• This exclusion only applies to the Fernie action: Only within 300m of previously existing built-up
Recreation	• Fernie Alpine Resort will grow to 50% of the area that is allocated as part of the OCP (73,000 m^2 per decade)	

Mineral, Oil and Gas	• Well Greenhills: Projected well total for Greenhills was not available. It was assumed that Greenhills will have 52 wells, which is 40% of the number of wells projected for the Mist Mountain project because the project area is 40% that of Mist Mountain. Each well pad is 1.44 ha; each pad will have an average of 2.5 wells. Grow 52 wells over 50 years by adding 1 well (i.e., 14400 m^2) in 48 of the years and 2 wells (i.e., 28800 m^2) in 2 of the years. Did not implement a minimum well spacing because the wells that exist in the region currently are relatively close to each other. • Well Mist Mountain: Mist Mountain will have 130 well pads over 50 years based on the report "State of the Play East Kootenay Basin" by the Oil and Gas Commission. Each well pad is 1.44 ha; each pad will have an average of 2.5 wells. Grow 130 wells over 50 years by adding 3 wells (i.e., 43200 m^2) in 30 of the years and 2 wells (i.e., 28800 m^2) in 20 of the years. Did not implement a minimum well spacing because the wells that exist in the region currently are relatively close to each other. • Well Site Road: Least Cost Path between existing road network and new well sites	Only exclusion is water type land covers
Aggregate	• Add 121 ha of new aggregate mine in a clustered growth in close proximity to existing road network. This equates to 1.5 times historical growth rates.	Only in pixels that also contain road
Agriculture	NA	NA
Linear Development	• The Ministry of Transport has no large-scale plans to expand major roads in the study area within the next 10 years, only developments would be changes to existing roadways. Highway 3 was buffered by 1.5x its current width to approximate the potential growth of passing lanes • Transmission line growth would accompany new mine development • Railway line growth would accompany new mine development • Trails growth - this is simulated by random growth to reach a total area of 10,000 m^2 in the Sparwood trails shapefile. As well as the addition of other trails as a Least Cost Path between existing trail network and predefined trail points.	Sparwood trails mask and predefined trail points.
Fire	• Historical annual burn rate was calculated by dividing the annual burned area by the current area of forest, grassland, and brushland in the Elk Valley. • The resulting low average fire rate (0.077%) is consistent with Boulanger et al. (2014) for the Southern Cordillera fire regime zone. Total of 18,314 ha is burned in reference scenario	Don't burn forests less than or equal to 10 years old.
Insect	• 0 ha of insect impacts for Pine Beetle • 2,100 ha of insect impacts for Spruce Beetle	Only in the OM forest stands

5.4 *Maximum Development Scenario with Increased Insect Outbreak and Fire*

Same assumptions as the Maximum Scenario but with extra fire and insect outbreak growth

Disturbance	Assumptions
Future Fire	• Burnt area is projected to reach 19,000 ha by the year 2060, as referenced from FLNRO (2014). A linear increase in burnt area was extrapolated from current condition to reach 19,000ha by 2060. Fire is simulated to grow out in a random clustered distribution for all areas within the basin. • Don't burn forests less than or equal to 10 years old.
Future Insect outbreaks	• 7,114 ha of insect outbreak for Pine Beetle • 18,643 ha of insect outbreak for Spruce Beetle • Only in the Old and Mature forest stands

5.5 *Moderate Mitigation Scenario*

Applied to the Maximum Development Scenario with Increased Insect outbreak and Fire

Development	Mitigation Action Assumptions
Metallurgical Coal Mining	
Forestry	• 1/3rd drawdown rule: - no more harvest if total mature is < 14% in low Biodiversity Emphasis Options (BEO) Landscape Units (LUs) • Avoid riparian in Crown Forest Land Base: - If the forest is within the 30 m buffer of streams and the CFLB, do not harvest. • ECA exclusions: applies a dynamic ECA filter which says if ECA is above threshold, then harvest = zero. Specifically, limit ECA to 30% in sensitive watersheds, and to 40% in all others. • Do not harvest of forests < 60 years, and preferentially harvest recent burns (salvage logging). • Focus logging in areas that support berries. • Focus harvest away from trees older than 90 years, away from OM patches over 4 ha, and away from trees within 100m of existing Old Growth Management Areas.
Municipal	Do not allow municipal expansion into Old Forests
Recreation	NA
Mineral, Oil and Gas	NA
Aggregate	NA
Agriculture	NA
Linear Development	• Reclaim all minor roads above 1500 m and within 100 m of streams orders 1, 2, or 3.

5.6 *Intensive Mitigation Scenario*

Applied to the Maximum Development Scenario with Increased Insect outbreak and Fire

Development	Assumptions
Metallurgical Coal Mining	• Exclude all winter range from mining development. • Allow the Rank 4 BHS Winter range to grow into a buffer by 5-10 % of the total range.
Forestry	• Exclude harvest of mature forests. Exclude harvest above H60. Exclude harvest on biologically productive CanWel lands (P. Holmes Pers. Comm.). Exclude harvest within 30m buffers of streams (both on CFLB and private lands). • Focus harvest away from trees older than 90 years, away from OM patches over 4 ha, and away from trees within 100 m of existing OGMAs. • ECA exclusions: Applies a dynamic ECA filter which says, if ECA is above threshold, then harvest = zero. Specifically, limit ECA to 30 % in sensitive watersheds, and to 40% in all others. *The H60 line is the elevation above which 60% of the watershed lies
Municipal	• Do not allow municipal expansion into Old + Mature forest stands.
Recreation	NA
Mineral, Oil and Gas	NA
Aggregate	NA
Agriculture	NA
Linear Development	• Reclaim all minor roads above 1400 m and within 100 m of streams orders 1, 2, or 3.
Fire	• Don't burn newly cut forest (if age < 10, and has been previously cut, then exclude). • Focus fire in areas of huckleberry occurrences used by Grizzly.

5.7 *Data and Scenario Assumptions that require updating in 2020-2021 work*

Further discussion on this section is required with FLNRORD and potentially the EV-CEMF Working Group. However, general data and scenario update recommendations are provided below.

- Base case data:
  - Disturbance
  - TEM
  - PEM

Scenario assumptions:

  - Mining development and reclamation projections
  - Forestry cutblock and road projections
  - Fire and insect outbreak projections

- Recreation development (including trail development)
- Mitigation assumptions

6 References

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7 Appendices

I. *Appendix A – Data Sources*

See attached Excel file labelled "LTFT_UnityDatasetV1.0_Area_ElkValley_IndicatorInfo.xlsx"

II. *Appendix B – 2018 Unity Update*

See attached Excel file labelled "Indicator_Updates.csv"

III. *Appendix C – Footprint Priorities*

Elk Valley Finalized Footprint Precedence October 15, 2015		
Hierarchy	**General Name**	**ALCES_FT Name**
1	Reclaimed Mine	ReclaimMine
2	Mine Open Pit	OpenMine
3	Mining Spoils Pond	MinePond
4	Gravel Sand Pit	GravelPit
5	Abandoned Pit	AbandPit
6	Historic Mine	HistMine
7	Lumber Yard	LumberYd
8	Pile	Pile
9	Tailing Ponds	TailingPd
10	Built Up Areas	BuiltUpArea
11	Major Roads	MajorRoad
12	Alpine Skiing	SkiHill
13	Minor Roads	MinorRoad
14	Railways	Railways
15	Rural Structures	RuralStruc
16	Farm Structures	FarmStruc
17	Landfills	Landfills
18	Energy Processing Plants/Facilities	OGFacility
19	Transformer Stations	TransStn
20	Wellsites	Wellsites
21	Airfields	Airstrips
22	Golf Courses	GolfCourse
23	Campgrounds	Campground
24	Inblock Roads	InBlockRd

25	Pipelines	Pipeline
26	Powerlines	Transmission
27	Trails	Trails
28	Seismic Lines	Seismic
29	Cutblocks	Cutblock