

Crown Mountain Coking Coal Project

Figure 15.4-12
Bighorn Sheep Year-round Habitat Suitability in the Terrestrial LSA

LEGEND

Habitat Suitability

- Very High
- High
- Moderate
- Low
- Very Low
- Unclassified
- Terrestrial Local Study Area
- Project Footprint

- Highway
- Arterial/Collector Road
- Local/Resource Road
- Railway
- Transmission Line
- Watercourse
- Waterbody
- Wetland
- Provincial Park/Protected Area

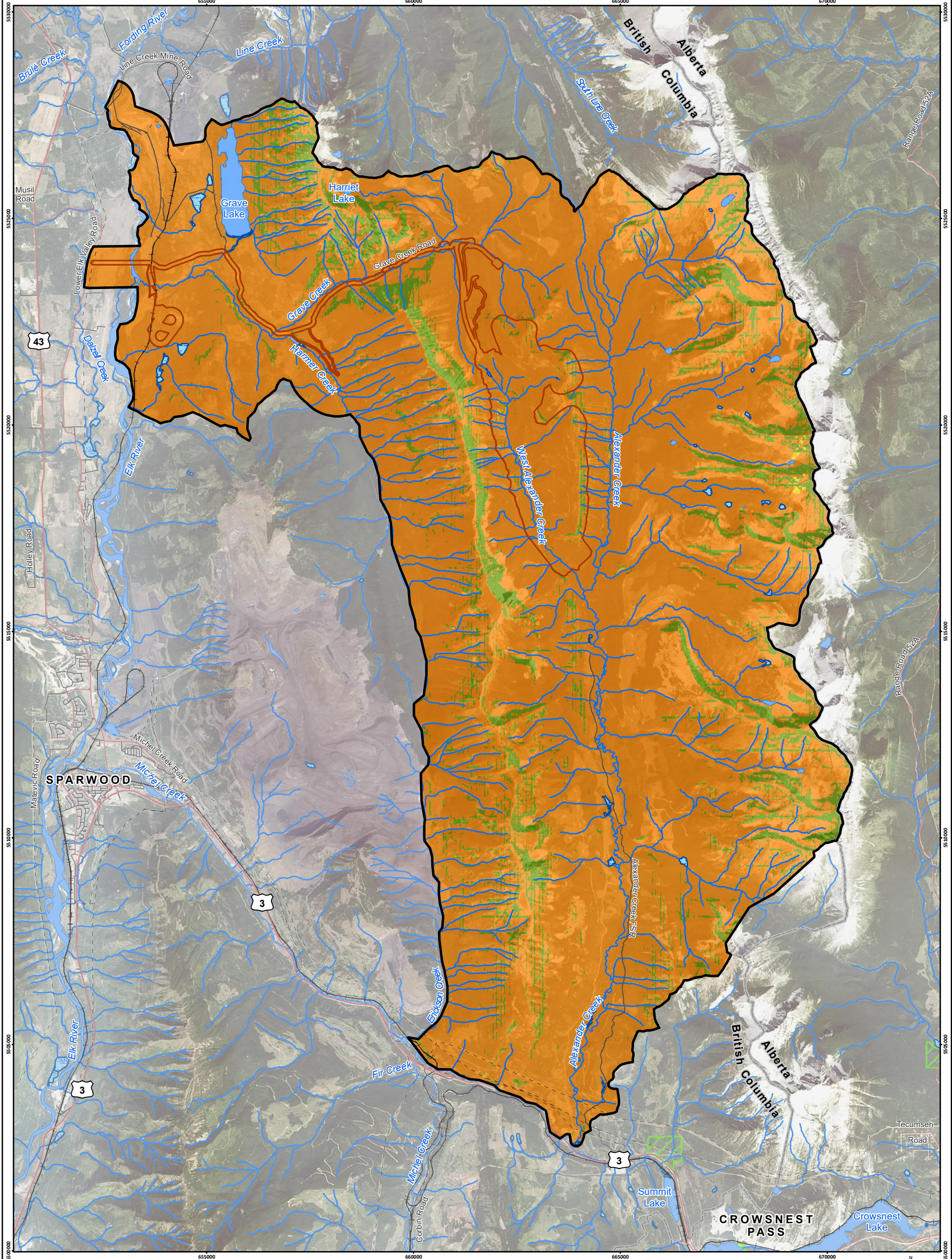
British Columbia/Alberta Border

Scale 1:85,000
0 2 4
Kilometres

Map Drawing Information:
Data Provided By NWP Coal Canada Ltd, Dillon Consulting Limited, Keefer Ecological Services Ltd, Province of British Columbia GeoBC Open Data, Government of Alberta Open Data, Natural Resource Canada.
Imagery Provided By Landsat 8 (Aug 2018), and GeoBC Ortho Imagery (Aug 2016).
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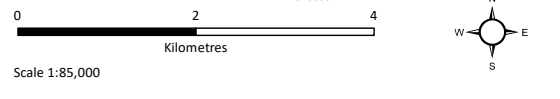
Figure 15.4-13
Mountain Goat Year-round Habitat Suitability in the Terrestrial LSA

LEGEND

Habitat Suitability

- High
- Low
- Very Low
- Unclassified
- Terrestrial Local Study Area
- Project Footprint
- Highway
- Arterial/Collector Road

- Local/Resource Road
- Railway
- Transmission Line
- Watercourse
- Waterbody
- Wetland
- Provincial Park/Protected Area
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Table 15.4-16: Mountain Goat Habitat Suitability in the Project Footprint, Terrestrial LSA, and Terrestrial RSA

Habitat Suitability	Habitat in the Project Footprint		Habitat in the Terrestrial LSA		Habitat in the Terrestrial RSA	
	Area (ha)	% of Project Footprint	Area (ha)	% of Terrestrial LSA	Area (ha)	% of Terrestrial RSA
Very High (0.8-.1)	0	0	0	0	0	0
High (0.6-0.8)	50	4	2,313	10	147,320	8
Moderate (0.4-0.6)	0	0	0	0	2	<1
Low (0.2-0.4)	0	0	12	0	1,529	<1
Very Low (0-0.2)	1,232	96	21,736	90	1,696,738	90
Unclassified	1	0	160	1	30,109	2

Approximately 202 ha of the Project footprint (16%) was predicted as very high or high habitat suitability for bighorn sheep annually. Approximately 6,192 ha of the Terrestrial LSA (26%) was predicted as very high or high habitat quality for bighorn sheep annually. Areas of quality winter habitat for bighorn sheep within the Terrestrial LSA are primarily located on Sheep Mountain and Erickson Ridge (Figure 15.4-12).

Approximately 50 ha of the Project footprint (4%) was predicted as very high or high habitat quality for mountain goat annually. Approximately 2,313 ha of the Terrestrial LSA (10%) was predicted as very high or high habitat quality for mountain goat annually. Areas of high-quality habitat for mountain goat within the Terrestrial LSA are primarily located on Sheep Mountain and Erickson Ridge (Figure 15.4-13).

15.4.3 Project Effects Assessment

15.4.3.1 Thresholds for Determining Significance of Residual Effects

The former Canadian Environmental Assessment Agency's (now the Impact Assessment Agency of Canada) guidance document titled *Determining Whether a Project is Likely to Cause Significant Adverse Environmental Effects* (CEAA, 2015b) and the KNC's document titled *Recommended Minimum Standards for Proponents in Determining Significance of Effects in Environmental Assessments (EAs) in the Elk Valley* (Ktunaxa Nation Council [KNC], 2020) provide guidance on significance determination and the role of thresholds beyond which an effect is considered unacceptable. For wildlife species listed under the federal *Species at Risk Act* (SARA), there are prohibitions against causing harm, injury or mortality of a species at risk as well as against destruction of mapped critical habitat (depending on the species and land ownership). This can readily be applied as a threshold that can be used for determining the significance of residual effects. Aside from mapped critical habitat, there are no government or industry regulations or established objectives, environmental standards, or established benchmarks to establish thresholds for the significance of residual effects on ungulate VCs resulting from the Project. The desired endpoint for wildlife management is for persistent and self-sustaining wildlife populations. Any effect then that diminishes the ability of a wildlife population to be persistent and self-sustaining were therefore used as a threshold for the determination of significance for a residual effect.

Thus, in consideration of the above, a significant adverse residual environmental effect on all ungulate VCs is one where the Project:

- Causes the non-permitted contravention of any of the prohibitions stated in Sections 32-36 of the *Species at Risk Act* including injury, harassment, or mortality of an ungulate species at risk;

- Results in the non-permitted loss of critical habitat for ungulate species at risk; or
- Causes a decline in abundance or change in distribution of ungulate populations such that the populations will not be sustainable in the Terrestrial RSA.

15.4.3.2 Project Effects

Potential effects on ungulate VC habitat availability, habitat distribution, known occurrences and abundance may occur as a result of Project activities associated with mine development. Potential effects on wildlife are discussed with respect to changes at both the individual level (i.e., behaviour, physiological condition, survival) and the population level (i.e., population size, distribution, mortality rate). Since potential effects at the population level are generally of greater importance than at the individual level, the assessment primarily focuses on the effects to local populations. The assessment focuses only on planned activities within the designed scope of the Project. Effects related to unplanned events (e.g., collisions, spills, equipment malfunctions, accidents) are presented in Chapter 21.

Potential effects to wildlife are interrelated with other assessment disciplines and components that represent pathways to effects on ungulate VCs:

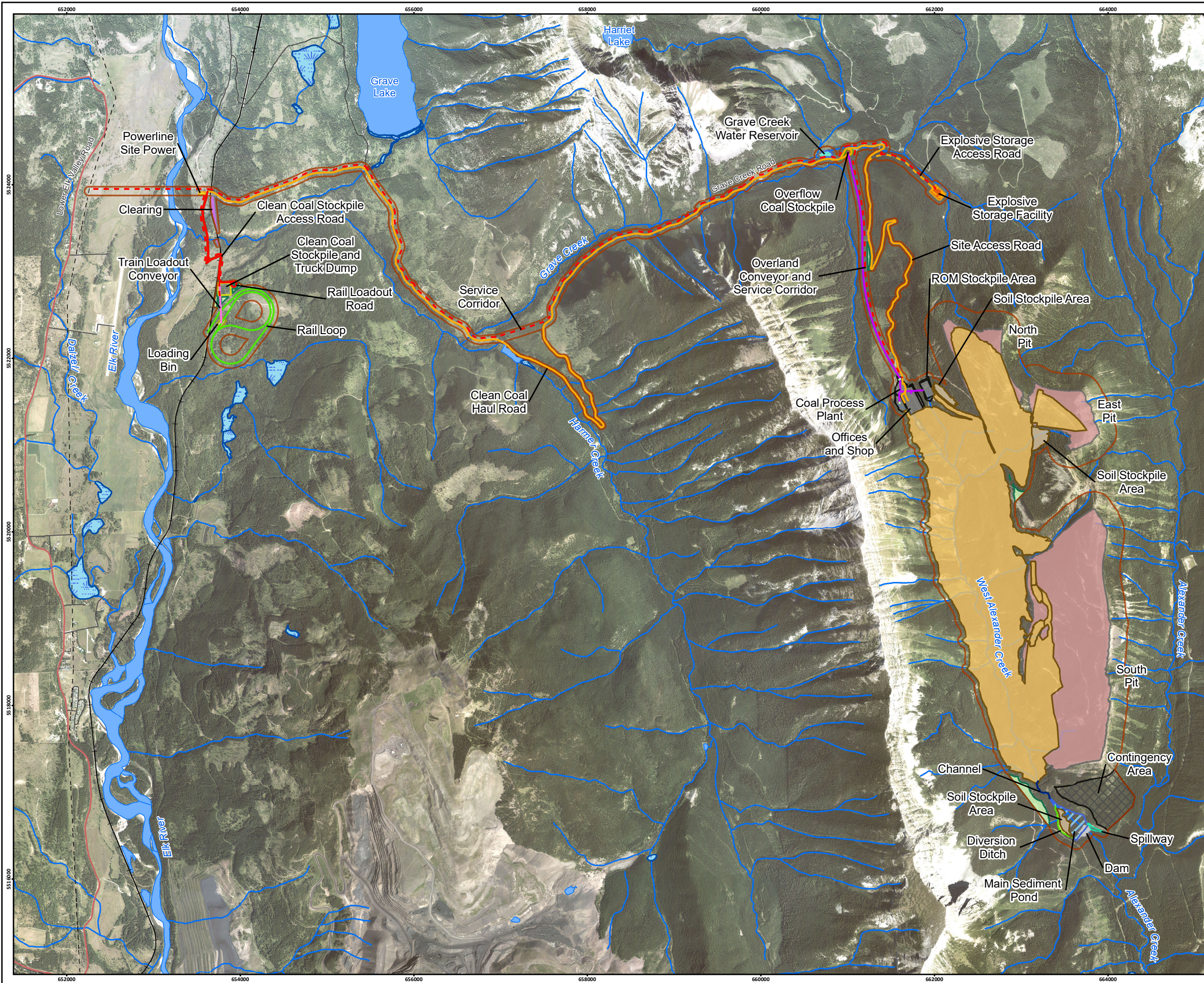
- Atmospheric Environment Assessment (Chapter 6);
- Acoustic Environment Assessment (Chapter 7);
- Soil and Terrain Assessment (Chapter 8);
- Groundwater Assessment (Chapter 9);
- Surface Water Quantity Assessment (Chapter 10);
- Surface Water Quality Assessment (Chapter 11);
- Landscapes and Ecosystems Assessment (Chapter 13); and
- Human and Ecological Health Assessment (Chapter 22).

15.4.3.2.1 Project Interactions

Project activities during the Construction and Pre-Production, Operations, Reclamation and Closure, and Post-Closure phases have the potential to affect ungulates. Key Project activities that are expected to interact with ungulates, with a potential for adverse effects, are presented in Table 15.4-17 and shown in Figure 15.4-14. Specific details on Project activities and components are discussed in Chapter 3.

Most Project activities have the potential to interact with ungulate VCs. The key interactions resulting in potential significant adverse effect or significant concern (indicated as level III in Table 15.4-17) are primarily those involving habitat loss or alternation and potential for increased mortality. Many of the potential adverse effects that are not key but require mitigation (indicated as level II) are related to noise and other sensory disturbance related to construction and operation and operation of vehicles. Project activities with no predicted interactions with ungulate VCs are:

- Stockpiling of wood waste in operation to be used for reclamation;
- Labour (hiring and training);
- Water management activities;
- The inactive rail line during Post-Closure; and
- Monitoring activities.

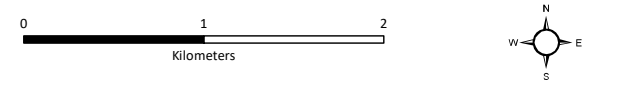


Crown Mountain Coking Coal Project

Figure 15.4-14
Project Footprint Infrastructure

LEGEND

	Project Footprint		Water Reservoir
	Channel to Ultimate Pond		Main Sediment Pond
	Clean Coal Haul Road\Site Access		Dam
	Explosive Storage Access\Facility Road		Spillway
	Rail Loadout Road		Diversion Ditch
	Rail Loop		Clearing
	Service Corridor		Additional Area
	Coal Process Plant Conveyor		Contingency Area
	Coal Process Plant Duct		Arterial/Collector Road
	Train Loadout Conveyor		Local/Resource Road
	Waste Dump		Railway
	Mined Area		Transmission Line
	Clean Coal Stockpile and Truck Dump		Watercourse
	Overflow Coal Stockpile		Waterbody
	Soil Stockpile Area		Wetland
	Explosive Storage Facility\Pad		British Columbia/Alberta Border
	Loading Bin		
	Plant Site\ROM Stockpile Area		
	Powerline-Site Power		



Scale 1:42,000

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Table 15.4-17: Project-Ungulate Interaction Matrix and Ranking

Project Phase	Project Component	Description of Activities	Moose	Elk	Bighorn Sheep	Mountain Goat	
Construction and Pre-Production	Transportation	Use of Highway 43, Line Creek Mine Road, Valley Road, and Grave Creek Road by highway transport trucks, light duty vehicles, and crew busses to transport personnel, materials, and consumable items	II	II	II	II	
	Logging of Merchantable Timber	Merchantable timber will be logged from the infrastructure and pre-production development footprint	III	III	II	II	
	Clearing and Grubbing	After the merchantable timber has been removed, the remaining vegetation will be cleared and grubbed from the infrastructure and pre-production development footprint	III	III	II	II	
	Stockpiling Wood Waste	Wood waste will be stockpiled on site and used for reclamation as a source of coarse woody debris	I	I	I	I	
	Quarry for Construction Materials	Excavation of road bed materials from the North Pit footprint for use on Grave Creek Road	II	II	II	II	
	Water Management or Water Management Structures		Water management structures to support initial construction activities will be built prior to soil being salvaged from the run of mine (ROM) and plant site	II	II	II	II
			Interim Sediment Pond will be built prior to the soil removal and stockpiling from the pit access road and initial phase of the North Pit	II	II	II	II
			Grave Creek Reservoir will be constructed to act as a back-up source of process water	II	II	II	II
	Soil Salvage		Soil will be salvaged from the footprint of the infrastructure	II	II	II	II
			Branch C Road will be widened and upgraded to facilitate construction and mine traffic to plant site area	II	II	II	II
	Road Upgrading and Construction		Grave Creek Road will be widened to facilitate the clean coal haul	II	II	II	II
			A new road will be constructed off the Valley Road to access the rail loadout for construction and operation	II	II	II	II
			Installation of the powerline	II	II	II	II
Linear Infrastructure		Installation of the natural gas line	II	II	II	II	
		Clearing, grubbing, and construction of overland conveyor from the plant site to Grave Creek Road	III	III	II	II	

Project Phase	Project Component	Description of Activities	Moose	Elk	Bighorn Sheep	Mountain Goat	
	Coal Handling Process Plant Construction	Excavating and pouring of foundation	II	II	II	II	
		Transportation of materials and personnel to site	II	II	II	II	
		Constructing of the Coal Handling Process Plant (CHPP)	II	II	II	II	
		Commissioning of the CHPP	I	I	I	I	
	Workshop / Mine Dry Construction	Excavating and pouring of foundations	II	II	II	II	
		Transportation of materials to site	II	II	II	II	
		Construction of workshop / mine dry	II	II	II	II	
		Equipment wash bay and heavy equipment parking	II	II	II	II	
		Administration, first aid, and mine dry building	II	II	II	II	
		Diesel tank farm	II	II	II	II	
		Warehouse	II	II	II	II	
		Potable water system	II	II	II	II	
		Septic system	II	II	II	II	
		Water supply pipelines from Grave Creek and West Alexander Creek	II	II	II	II	
		Commissioning of the facilities	I	I	I	I	
		Explosives Factory Construction	Construction of the explosives factory	II	II	II	II
			Excavation and preparation of the rail bed	II	II	I ¹²	I ¹²
		Rail Loadout Construction	Excavation and preparation of foundation stockpiling and coal handling systems	II	II	I ¹²	I ¹²
			Transportation of materials and personnel to site	II	II	I ¹²	I ¹²
Construction of rail loadout	II		II	I ¹²	I ¹²		
Connection to the Canada Pacific (CP) Fording Sub-line	II		II	I ¹²	I ¹²		
Commissioning of the rail loadout	II		II	I ¹²	I ¹²		

¹² Bighorn sheep and mountain goat not present in Rail Loadout area.

Project Phase	Project Component	Description of Activities	Moose	Elk	Bighorn Sheep	Mountain Goat
	Labour	Hiring of personnel for the mine, CHPP operations, administration, and coal haul	I	I	I	I
		Training of personnel	I	I	I	I
	Construction Waste Materials	Collection and transfer to a recycling facility or other approved facility	I	I	I	I
Operations	Transportation	Use of Highway 43, Line Creek Mine Road, Valley Road, and Grave Creek Road by highway transport trucks, light duty vehicles, and crew busses to transport personnel, materials, and consumable items	II	II	II	II
	Explosives Factory	Ammonium nitrate / emulsion storage facilities which have the ability to load explosive agents into delivery trucks	I	I	I	I
		Wash facility to decontaminate the bulk explosive delivery trucks	I	I	I	I
		Storage of explosives (detonators and boosters)	I	I	I	I
	Fuel Storage	Receiving bulk fuel deliveries	I	I	I	I
		On-site storage of fuel	I	I	I	I
		Dispensing fuel	I	I	I	I
		Transferring fuel to on-site delivery trucks	I	I	I	I
	Mine Roads Development	Building roads from material sourced on-site	II	II	II	II
		Progressive clearing	III	III	III	III
		Removal of unconsolidated material	II	II	II	II
		Loading, hauling, and stockpiling of soil	II	II	II	II
	Mining	Drilling and loading of blastholes	II	II	II	II
		Detonating the explosives	III	III	III	III
		Loading, hauling, and dumping of mine rock	II	II	II	II
Loading, hauling, and stockpiling of coal		II	II	II	II	

Project Phase	Project Component	Description of Activities	Moose	Elk	Bighorn Sheep	Mountain Goat
	Site Water Requirements	Using contact water as the primary process make-up water from Interim Sediment Pond (Year 1 to 5)	I	I	I	I
		Using contact water as the primary process make-up water from the North Pit (Year 5 to 15)	I	I	I	I
		Backup reservoir in Grave Creek as a secondary source of process make-up water	I	I	I	I
	Coal Processing	Run of mine coal sizing	II	II	II	II
		Washing coal	II	II	II	II
		Mechanical and thermal drying of coal	II	II	II	II
		Coal reject disposal (part of loading, hauling, and dumping of mine rock activities)	II	II	II	II
		Conveying clean coal	III	III	III	III
	Sewage Treatment	Sewage will be treated by a septic system constructed at the plant site which will support the administration, mine dry, and CHPP facilities	II	II	II	II
	Main Sediment Pond	Construction of Main Sediment Pond in Year 4	II	II	II	II
		Management of the Main Sediment Pond discharge	I	I	I	I
	Reclamation	Reclaiming available areas as soon as possible to achieve reclamation objectives	II	II	II	II
	Reclamation and Closure	Transportation	Use of Highway 43, Line Creek Mine Road, Valley Road, and Grave Creek Road by highway transport trucks, light duty vehicles, and crew busses to transport personnel, materials, and consumable items	II	II	II
Dismantling Infrastructure and Buildings		Dismantling of the CHPP, maintenance facilities, administration, and other facilities	II	II	II	II
		Dismantling, salvaging, collecting, and transferring materials to a recycling facility or other approved facility	II	II	II	II
Removal of Linear Infrastructure		Removal of the powerline	II	II	II	II
		Removal of the natural gas line	II	II	II	II
Reclamation	Reclaiming available areas as soon as possible to achieve reclamation objectives	II	II	II	II	

Project Phase	Project Component	Description of Activities	Moose	Elk	Bighorn Sheep	Mountain Goat
	Monitoring	Reclamation monitoring	I	I	I	I
		Geotechnical monitoring	I	I	I	I
	Water Management	Aquatic effects monitoring	I	I	I	I
		Management of the Main Sediment Pond discharge	I	I	I	I
Post-Closure	Water Management	Decommissioning the Main Sediment Pond once water quality objectives have been met	I	I	I	I
	Road Use	Branch C Road will remain as a permanent access road for future commercial and recreational use	II	II	II	II
	Rail Line	The rail line will remain as a permanent feature	I	I	I	I
	Monitoring	Reclamation monitoring	I	I	I	I
		Geotechnical monitoring	I	I	I	I
		Aquatic effects monitoring	I	I	I	I

Notes (after EAO, 2013):

I = No or negligible effect (positive or adverse) is anticipated; not carried forward in the assessment

II = Potential adverse effects requiring additional mitigation or substantive positive effects are expected; carried forward in the assessment

III = Key interaction resulting in potential significant adverse effect or significant concern; carried forward in the assessment

Project activities at lower elevations toward the Elk River have little to no interaction with bighorn sheep and mountain goat as they are not present in this area.

15.4.3.2.2 Overview of Potential Effects

Potential effects of the Project on ungulate VCs were identified through working group meetings, consultation, review of other developments in the region, through mitigation included with BMPs, scientific literature, and using technical expertise/professional opinion. Potential effects of the Project on ungulate VCs were categorized as:

- Habitat loss and degradation;
- Sensory disturbance;
- Disruption to movement; and
- Increased mortality risk.

The health effects of ungulate VC exposure to contaminants of potential concern are described in Chapter 22 and are therefore not repeated here.

Rationale and a description of each potential effect on ungulate VCs are provided in Table 15.4-18.

15.4.3.2.3 Discussion of Potential Effects

The potential effects (i.e., habitat loss and degradation, sensory disturbance, disruption to movement, and increased mortality risk) on ungulate VCs are discussed in the context of each Project phase below.

Habitat Loss and Degradation

The Project footprint overlaps with suitable habitat for ungulate VCs. The total Project footprint area is 1,283 ha, though this includes a buffer area intended to account for uncertainty in precise boundaries of disturbance and not all of the buffer areas will be cleared. The amount of ungulate VC habitat potentially lost varies among ungulate VCs (see Section 15.4.2.3.2 for a detailed summary of habitat suitability calculations).

Construction and Pre-Production

During Construction and Pre-Production, habitat loss will result from clearing and grubbing the infrastructure and pre-production development footprint which includes the quarry, Interim Sediment Pond, Grave Creek Reservoir, the Coal Handling Process Plant (CHPP) and workshop, initial portions of North Pit and Mine Rock Storage Facility area, upgrading of the mine site road and Grave Creek Road, construction of new road to the explosives factory, the overland conveyor, and the rail loadout.

Habitat degradation may occur in areas not yet cleared, in contingency areas and areas directly adjacent to the footprint through dust deposition, spread of invasive species, and sedimentation from surface water runoff.

Table 15.4-18: Potential Effects on Ungulate VCs

Potential Effect	Description of Effect
Habitat Loss And Degradation	<p>Project components and activities may cause habitat loss and degradation for ungulate VCs. Habitat loss and degradation includes the complete loss or reduction in value of a particular set of resources that the specific habitat provides, such as forage, security, thermal cover, reproduction, or movement. Physical disturbances including ground disturbance and vegetation clearing can cause direct loss of ecosystems and the corresponding resources they provide. A loss of key resources required to fulfill life requisites can result in reduced body condition, survivorship, and reproductive success. Ungulates may respond to habitat alteration by reducing their use of areas, avoiding habitats for a period of time (i.e., displacement), or abandoning portions of their current range. The potential effects of habitat alteration may be particularly high when Project activities and components are within or adjacent to seasonally limiting habitats including winter range and breeding areas.</p> <p>Habitat loss and degradation includes the potential effects of ground disturbance, logging and vegetation clearing, construction and use of building infrastructure, and linear features that results in: 1) the direct loss of ungulate forage including ungulate winter range, 2) the direct loss or reduction in value of ecosystems important for ungulate reproduction including avalanche chutes and riparian habitats, 3) the direct loss or reduction in value of ecosystems providing security and thermal cover including old and mature forests and riparian areas, 4) the direct loss or reduction of escape terrain features, 5) the direct loss or disturbance of trails and movement routes connecting seasonal or daily habitats, 6) direct loss or disturbance of important habitat features including mineral licks, 7) changes in terrain causing displacement or entrapment, and 8) changes to water distribution and amount.</p> <p>Habitat degradation can occur from potential introduction and spread of invasive species, changes in vegetation vigour from dust deposition, and surface water runoff from the Project footprint that can contain suspended solids and affect vegetation. Each of these may affect the availability of ungulate forage.</p>
Sensory Disturbance	<p>Project components and activities may cause sensory disturbance for ungulate VCs. Sensory disturbance includes behavioural responses by ungulates to Project-related noise, light, dust, and human presence. Sensory disturbances can lead to disruptions in animal behaviour, causing individuals to lose time and energy normally allocated to foraging, ruminating, breeding and avoiding predators. A loss of time towards fulfilling key life requisites can result in reduced body condition and reduced reproductive success. Ungulates may also respond to sensory disturbances by reducing their use of habitats near the source of disturbance, avoiding habitats for a period of time (i.e., displacement) or abandoning portions of their current range. Such behavioural responses by ungulates result in a functional loss of habitat.</p>
Disruption To Movement	<p>Project components and activities have the potential to create physical and/or sensory barriers that prevent or impede ungulate movements between daily or seasonal habitats. Physical and sensory barriers lead to disruptions in animal behaviour, causing individuals to lose time and energy normally allocated towards accessing forage and minerals, breeding and avoiding predators. All ungulate VCs exhibit seasonal movement patterns that are largely driven by forage availability. Ungulate VCs tend to follow predictable routes to access seasonal and daily habitats. Disruption to ungulate VC movement patterns can result in reduced body condition, enhanced predation rates and reduced gene flow between populations, which has implications for species population viability and long-term persistence. Disruption to movement may be particularly high when Project activities and components are within restricted terrain features including narrow valleys or canyons (e.g., Grave Creek Canyon and West Alexander Creek).</p>

Potential Effect	Description of Effect
Increased Mortality Risk	<p>Mortality risk includes changes to wildlife mortality via direct and indirect pathways. Direct mortality includes the potential effects of: 1) collisions with Project-related traffic during terrain disturbance and clearing of vegetation, 2) collisions with Project-related traffic on access or mine site roads and powerline, 3) entrapment during avalanche control, 4) collisions with rail, 5) operational mining activities including blasting, 6) ingestion of toxic products from materials stored on site and 7) entrapment during construction and operation of Project facilities such as CHPP, holding and sediment ponds or along access roads during winter due to high snowbanks.</p> <p>Roads increase ungulates risk of mortality indirectly by increasing hunter access and facilitating predator movement (i.e., enhanced predation rates). Enhanced predator access to winter ranges facilitated by linear landscape features (i.e., roads and off-road tracks) can reduce ungulate population density.</p> <p>Attractants includes the effect of any human activity or material that may attract wildlife and could lead to behavioural changes or increased human-wildlife conflict and result in increased risk of mortality. Attractants include salt used for road de-icing and dust suppression, food odours, food waste, domestic garbage, grey water, and sewage. Attractants also includes vegetation along roadways. Attractants are primarily associated with human activities and would therefore decline and eventually cease after operation.</p> <p>Chemical hazards (e.g., ingestion of toxic products) from materials stored on-site during Operations may reduce wildlife survival and reproduction.</p>

Operations

Direct habitat loss will occur during Operations as a result of progressive clearing of the pits, mine rock storage facility area, construction of mine roads, and clearing for the construction of the Main Sediment Pond. Clearing will continue until Year 15 of Operations.

Habitat degradation may occur in areas not yet cleared, in contingency areas, and in areas directly adjacent to the footprint through dust deposition, spread of invasive species, and sedimentation from surface water runoff.

Reclamation and Closure

There will be no additional loss of habitat for ungulate VCs during Reclamation and Closure. Habitat degradation may occur during decommissioning of mine site infrastructure and managing the Main Sediment Pond discharge through dust deposition, spread of invasive species, and sedimentation from surface water runoff.

Post-Closure

There will be no additional loss or degradation of habitat for ungulate VCs during Post-Closure, as all activities with the potential to result in habitat loss or degradation will be completed prior to mine closure. It is expected that some habitats would be gained following reclamation activities.

Sensory Disturbance

Sensory disturbance from Project-related noise, vibration, light, dust and human presence is a potential effect for all ungulate VCs during all Project phases. Sensory disturbance may decrease or eliminate use of suitable habitat by ungulate VCs in areas beyond the Project footprint.

The effects of noise and vibration on wildlife receptors is assessed in Chapter 7. Noise and vibration modelling was completed for the worst-case operating scenario. It was determined that operational Year 10 of the Project, was the worst-case year for noise and vibration effects from the Project on surrounding sensitive receptors. The effects of Project-related noise in all other years will be less than those arising during operational Year 10. Noise and vibration sources associated with the Project potentially affecting wildlife receptors were split into two primary categories: continuous operations and blasting operations. The area affected by continuous noise was based on the modelled noise levels for:

- Continuous Project-related noise ≥ 55 A-weighted decibels (dBA) – the daytime sound level from the Project that is expected to cause disturbances for wildlife; and
- Continuous Project-related noise ≥ 45 dBA – the nighttime sound level from the Project that is expected to cause disturbances for wildlife.

The area affected outside the Project footprint by continuous Project-related noise is approximately 242 ha in daytime and 1,118 ha in nighttime.

The area affected by noise from blasting operations was based on modelled peak noise (air overpressure) ≥ 108 decibels (dB) from blasting. This threshold is the peak noise level at wildlife receptors that is expected to cause disturbed habitat. This distance was estimated to be at 1,500 metres (m) from pit blast sites which affects 1,955 ha outside the Project footprint.

The key sources of ground vibration are rail and blasting operations. Rail-induced ground vibration was not expected to have a significant impact on wildlife (see Chapter 7).

Vibration levels from blasting greater than the threshold level of 10 millimetres per second (mm/s) will occur at distances of up to 400 m to 500 m from the pits. As such, terrestrial wildlife could be adversely affected by vibration within the Project site itself; however terrestrial wildlife are not anticipated to be present on-site during operations and no impacts are therefore expected.

Other types of sensory disturbance (light, dust and human presence) are expected to extend much shorter distances than noise and vibration.

Construction and Pre-Production

Sensory disturbance is expected from the transportation of personnel and materials, land clearing activities, soil salvage, road construction and upgrading, construction of the rail loadout, excavation of the quarry, construction of the Coal Handling Process Plant, and construction of water management infrastructure such as the Grave Creek Reservoir and Interim Sediment Pond. Increased human presence on the landscape is also expected to result in sensory disturbance to ungulate VCs.

Operations

During Operations, noise will be generated from progressive clearing and grubbing, further mine road development, detonating explosives (two to three times per week), loading, hauling and dumping of mine rock, coal processing, operation of the conveyor, hauling to the rail loadout, operation of the rail loadout and construction of the Main Sediment Pond. Progressive reclamation will also generate noise, dust, and have human presence.

Reclamation and Closure

During Reclamation and Closure, some sensory disturbance is expected to be generated from the dismantling of infrastructure and buildings and removal of linear infrastructure. Low-level sensory disturbance is also expected to be generated from human activity associated with monitoring and maintenance.

Post-Closure

Sensory disturbance is expected to be minimal during the Post-Closure phase of the Project. Sensory disturbance may arise from noise of light vehicle traffic and human activity associated with monitoring and maintenance activities.

Disruption to Movement

Project components and activities have the potential to create physical and/or sensory barriers that prevent or impede movements between daily or seasonal habitats for all ungulate VCs.

Construction and Pre-Production

Construction activities will create sensory disturbance through noise, light, and human presence that may partially or completely disrupt movements in localized construction areas. Ungulate VCs may avoid the mine and access roads due to noise from increased traffic and road upgrading and construction activities, thus disrupting movements across roads. Land clearing activities including logging of merchantable timber and clearing and grubbing of the infrastructure and pre-production development footprint will eliminate ungulate VC habitat, causing fragmentation and reducing functional connectivity that may disrupt ungulate VC movements. Built structures, like buildings and the CHPP will be a complete barrier, though on a localized scale. Steep pit walls may impede moose and elk movements, though may be used bighorn sheep and mountain goat. Tall and steep snowbanks from snow clearing along access roads may be a barrier to ungulate VCs in winter.

Construction of the conveyor may disrupt ungulate VC movements through obstruction, sensory disturbance and habitat loss. Underpasses will be created by elevating the conveyor to at least 2.4 m above ground (or higher where terrain can be used to create more clearance) at intervals of two per 1,000 m. The use of the conveyor underpasses by ungulate VCs may be affected by the noise of the conveyer.

Operations

Disruption to ungulate VC movement is expected to continue during Operations as a result of regular transportation on mine and access roads, mine roads development, pit and dump development, mining activities such as blasting and dumping of mine rock and conveying of the clean coal. The construction of the Main Sediment Pond may further reduce functional connectivity. Progressive clearing of pits and

dump areas will remove ungulate VC habitat causing fragmentation and reducing functional connectivity that will disrupt ungulate VC movements.

The conveyor with the underpasses at intervals of two per 1,000 m is likely to continue as a semi-permeable barrier to ungulate VC movements.

Reclamation and Closure

Disruption to movement is expected to be reduced during Reclamation and Closure as Project infrastructure is removed and habitats are reclaimed. Some disruption to movement is expected to arise from noise and human presence associated with dismantling of infrastructure and buildings and removal of linear infrastructure. Vegetation cover in reclaimed areas will develop and progressively restore functional connectivity.

Post-Closure

It is anticipated that disruption to movement will be minimal during the Post-Closure phase of the Project because these effects would result primarily from the vehicle traffic and human activity associated with monitoring and maintenance activities. Habitat fragmentation and loss of functional connectivity for ungulate VCs that require forest cover will be present for many decades until forest cover has been restored.

Increased Mortality Risk

There is potential for increased risk of direct and indirect mortality risk for all ungulate VCs in all phases of the Project.

Construction and Pre-Production

Direct mortality during Construction and Pre-Production may arise from collisions with Project-related traffic during terrain disturbance and clearing of vegetation, collisions with Project-related traffic on access or mine site roads, entrapment during avalanche control, collisions with rail, operational mining activities including blasting, ingestion of toxic products from materials stored on site, and entrapment in holding and settlement ponds or along access roads during winter due to high snowbanks.

Traffic along access roads from the rail loadout (RLO) to the respective plant and storage areas is estimated to be 140 round trips per day. 60% of these vehicle trips will be haul trucks.

The Project will involve loading of 120 trains per year. Trains will not be travelling at high speeds within the rail loadout and train-wildlife collisions in this area are unlikely. There will be an incremental increase in rail traffic on the main rail lines as a result of the Project (one additional train every three days on average), where the risk of wildlife-train collisions is higher.

The creation of new road access during Construction and Pre-Production may lead to indirect mortality of ungulate VCs by increasing hunter access. In addition, indirect mortality may arise from reduced body condition resulting from habitat loss and degradation, sensory disturbance, or disruption to movement. Seeded vegetation adjacent to roads and salt from de-icing and dust suppression may attract ungulates, leading to increased animal-vehicle collisions.

Public access along Grave Creek Road will be maintained during all Project phases and Post-Closure. This may provide increased access to hunters.

Operations

The potential for increased direct and indirect mortality risk described in Construction and Pre-Production will continue in Operations.

Reclamation and Closure

Direct mortality will progressively reduce due to reduced vehicle and equipment traffic and the end of active mining.

The potential for indirect mortality during Reclamation and Closure is similar to the preceding phases. In addition, the reclaimed pit and dump landscape may lead to increases in elk population size and/or changes in elk distribution, causing increased predation rates on less abundant species (bighorn sheep, mountain goat, and moose).

Post-Closure

The risk of direct mortality will be minimal during the Post-Closure phase as vehicle traffic will occur only occasionally with monitoring and maintenance activities.

Permanent roads created in earlier phases may lead to indirect mortality of ungulates by increasing hunter access. The reclaimed pit and dump landscape may lead to increases in elk population size and/or changes in elk distribution causing increased predation rates on less abundant species (bighorn sheep, mountain goat, and moose).

15.4.3.2.4 Transboundary Effects

Moose, elk, bighorn sheep, and mountain goat are highly mobile animals that cover large ranges, with known populations occupying both sides of the B.C./Alberta border. Movements across the Continental Divide by bighorn sheep and mountain goats have been documented in the Terrestrial RSA (Poole et al., 2009; Poole et al., 2018). It is highly likely that populations in the Terrestrial LSA exhibit transboundary movements to Alberta, and may exhibit movements to the closest federal lands to the Project, Dominion Coal Block Parcels 73 and 82 located outside the Terrestrial LSA and approximately 20 and 40 km southwest of the Project, respectively. Known or anticipated movement corridors along the Continental Divide include the Crowsnest, Deadman, and Racehorse passes. Residual effects to ungulate VCs (if present) have the potential to be considered transboundary effects within Alberta. The Canada/United States of America (U.S.A.) border to the south and all other federal lands described in Chapter 1, Section 1.3.3 are beyond the home range of any of the ungulate VCs. Residual effects to ungulate VCs (if present) are therefore not expected to be transboundary effects within the U.S.A or on federal lands located outside of the Elk Valley.

15.4.3.3 Mitigation Measures

The mitigation measures proposed for ungulate VCs are based on available BMPs, provincial and federal guidance documents, mitigation measures conducted and accepted for similar projects, and professional judgment. The identification and selection of technically and economically feasible mitigation measures

followed the mitigation hierarchy approach outlined by the provincial Environmental Mitigation Policy and related Environmental Mitigation Procedures (B.C. MOE, 2014a and 2014b). Technical and economic constraints dictated the highest level of the mitigation hierarchy that could be achieved for managing each potential effect.

Mitigation measures were identified for each potential effect on ungulate VC, though are applicable to the two remaining ungulates that were not selected as VCs: white-tailed deer and mule deer. For the purposes of this assessment, mitigation measures are defined to include Project design features, procedures, or practices that will reduce or eliminate Project-related effects to ungulate VCs. Potential Project-related effects to ungulate VCs will be reduced through design mitigation, regulatory requirements, and site reclamation that includes management plans, monitoring, and adaptive management. Where mitigation measures are considered to be completely effective, potential Project effects to ungulate VCs are not identified as residual effects.

Many of the measures to mitigate impacts to ungulate VCs are part of protocols described in the following management plans in Chapter 33:

- Wildlife Management and Monitoring Plan (Chapter 33, Section 33.4.1.13);
- Air Quality and Greenhouse Gas Management Plan (Chapter 33, Section 33.4.1.1);
- Ecological Restoration Plan (Chapter 33, Section 33.4.1.3);
- Erosion and Sediment Control Plan (Chapter 33, Section 33.4.1.4);
- Landform Design and Reclamation Plan (Chapter 33, Section 33.4.1.6);
- Noise and Vibration Management Plan (Chapter 33, Section 33.4.1.7);
- Site Water Management Plan (Chapter 33, Section 33.4.1.8);
- Soil Management Plan (Chapter 33, Section 33.4.1.9);
- Spill Prevention, Control, and Countermeasures Plan (Chapter 33, Section 33.4.1.10);
- Waste Management Plan (Chapter 33, Section 33.4.1.12); and
- Traffic Control Plan (includes access management; Chapter 33, Section 33.4.2.4).

The following subsections describe mitigation for potential Project effects on ungulate VCs. The Wildlife Monitoring Program in the Wildlife Management and Monitoring Plan (Chapter 33, Section 33.4.1.13) will be used to validate the efficacy of the proposed mitigation measures.

15.4.3.3.1 Mitigation Measures for Habitat Loss and Degradation

Loss and degradation of ungulate VC habitat will occur primarily through:

- Loss from clearing and grubbing, and
- Degradation through dust deposition, spread of invasive species, and sedimentation from surface water.

Measures to mitigate the impact of ungulate VC habitat loss and degradation include:

- Minimizing disturbance and encroachment into natural vegetation, to the extent feasible, by clearing and grubbing only what is required for Construction and Pre-Production activities and progressive development of pits and Mine Rock Storage Facility;
- Clearing vegetation only in the year in which the area will be required for construction or operation to minimize the extent of cleared vegetation, to the extent possible;

- Sequencing the development of pits and Mine Rock Storage Facility areas to limit total disturbance during any one period and maximize progressive reclamation opportunities;
- Progressively reclaiming areas, as described in the Ecological Restoration Plan (Chapter 33, Section 33.4.1.3) and Landform Design and Reclamation Plan (Chapter 33, Section 33.4.1.6), as soon as possible to restore habitat for ungulate use (further details on the post-mining landscape are described below);
- Implementation of the Erosion and Sediment Control Plan (Chapter 33, Section 33.4.1.4) to reduce the potential for sedimentation of riparian, wetland, and aquatic habitat used by ungulate VCs; and
- Implementation of the Air Quality and Greenhouse Gas Management Plan (Chapter 33, Section 33.4.1.1) to reduce deposition of dust on vegetation that can affect plant vigour.

Ecological restoration is the primary mitigation for habitat loss and degradation. The reclamation and closure of the Project footprint aims to restore the pre-existing landscapes and uses, including a vegetation mosaic of coniferous forest, open alpine tundra, rock outcrops, shrub and graminoid dominated brushland, talus slopes, wetlands and riparian areas, and habitat capability for key wildlife species (among other goals). Revegetation (reclamation) activities will begin during the Operations phase, soon after stable topography is created within the mine footprint and will proceed progressively as the area of stable topography grows during the Operations phase. Revegetation is planned to start in Year 6 of Operations with other revegetation taking place in Years 8, 10, 11, and 15 of Operations and continuing into the Reclamation and Closure phase.

As part of the planning, a post-mine terrestrial ecosystem map (TEM) has been developed to envisage the post-mine environment functioning and successional trajectory and guide the selection of appropriate species to revegetate the Project footprint. The post-mine TEM accounts for factors such as elevation, aspect, soil, and plant ecology, and as such, it is the lens for envisioning a realistic post-mine environment. Approximately 790 ha in seven ecosystem types are planned for reclamation within the Project footprint. Remaining areas within the Footprint include pit highwalls (to be left in their post-mine configuration with the intention of creating escape terrain habitat features for bighorn sheep [and mountain goats, slope dependent]), water features and buffer (or contingency) areas. Disturbed portions of the buffer areas (if any) will be assigned appropriate end-use objective according to their elevation, aspect, slope steepness and proximity to water features (for riparian and wetland ecosystems). Further details of the ecological restoration can be found in the Ecological Restoration Plan (Chapter 33, Section 33.4.1.3).

The mitigation measures described above will contribute to avoiding and minimizing the effects of habitat loss and degradation on ungulate VCs with moderate effectiveness. These measures will not eliminate all effects and there will be a residual effect of habitat loss and degradation on ungulate VCs as a result of the Project.

15.4.3.3.2 Mitigation Measures for Sensory Disturbance

Sensory disturbance to ungulates will occur from Project-related noise, light, dust, and human presence. Measures to mitigate the impact of sensory disturbance on ungulate VCs include:

- Implementation of the Noise and Vibration Management Plan (Chapter 33, Section 33.4.1.7) that includes the following measures:
 - Limit construction activities, especially those with high noise impact, to daytime hours;

- Appropriately time construction activities to minimize cumulative noise levels;
- Select equipment for construction activities that is appropriate for the task;
- Construction equipment at a minimum, is fitted with standard noise-damping devices such as mufflers or enclosures, where possible;
- Discourage unnecessary idling of construction equipment;
- Perform regular vehicle maintenance and inspections on all Project equipment, including replacement of old and worn parts;
- Inform employees of noise impacts and potential mitigation/control measures through appropriate training;
- Install and maintain noise mitigation measures, where possible, on and around Project infrastructure; and
- Clear blasting areas of terrestrial wildlife;
- Directed/focused lighting will be used where possible rather than broad area lighting to minimize sensory disturbance. Light in non-essential areas will only be used when necessary, without compromising worker safety; and
- Implementation of the Air Quality and Greenhouse Gas Management Plan (Chapter 33, Section 33.4.1.1) to minimize dust around wildlife in off-site areas.

The mitigation measures described above will contribute to minimizing the effects of sensory disturbance on ungulate VCs with high effectiveness. These measures will not eliminate all effects and there will be a residual effect of sensory disturbance on ungulate VCs as a result of the Project.

15.4.3.3.3 Mitigation Measures for Disruption to Movement

Disruption to ungulate VC movement may primarily occur from the creation of physical and/or sensory barriers that prevent or impede ungulate movements between daily or seasonal habitats and loss or degradation of habitat that provides connectivity among seasonal habitats. Measures to mitigate the impact of disruption to movement of ungulate VCs include:

- The mitigations for habitat loss and sensory disturbance listed above contribute to mitigation of disruption to movement;
- New road access is limited to the 900 m road to the explosives factory. There will be no other new roads outside of the pits and mine rock dumps;
- Underpasses will be created by elevating the conveyor to at least 2.4 m above ground (or higher where terrain can be used to create more clearance) at intervals of two per 1,000 m;
- Management of vehicle traffic contributes to minimization of sensory disturbance along roads and reducing the barrier effect of roads. Traffic related measures are documented in the Traffic Control Plan (Chapter 33, Section 33.4.2.4) and include:
 - Speed limits will be clearly marked and signed on all Project access roads. Lower speed limits will be set where monitoring and wildlife observation records indicate a high-risk area for animal-vehicle collisions (e.g., at identified wildlife crossings);
 - Wildlife will be given the right-of-way on all Project roads;
 - Project traffic will be minimized to the greatest extent practicable;
 - Site workers will travel on crews buses to limit road traffic; and
- Gaps will be created in snowbanks to allow for unimpeded ungulate passage across roads at regular intervals.

The mitigation measures described above will contribute to minimizing the effects of disruption to movement on ungulate VCs. The effectiveness of the proposed mitigations are as follows:

- The conveyor underpasses are expected to allow passage of ungulate beneath the conveyor; however, the degree of use by ungulates is unknown. This mitigation is predicted to have moderate effectiveness with moderate uncertainty;
- The traffic measures are expected to reduce the barrier effect of increased activity along Grave Creek Road; however, the degree to which ungulates will continue to cross Grave Creek Road is unknown. This mitigation is considered to have moderate effectiveness with moderate uncertainty; and
- All other mitigation measures are considered to have moderate effectiveness with low uncertainty.

These measures will not eliminate all effects and there will be a residual effect of disruption to movement on ungulate VCs as a result of the Project.

15.4.3.3.4 Mitigation Measures for Increased Mortality Risk

An increased risk of mortality of ungulate VCs may occur from:

- Collisions with Project-related traffic during terrain disturbance and clearing of vegetation;
- Collisions with Project-related traffic on access or mine site roads and powerline;
- Entrapment during avalanche control;
- Collisions with rail;
- Operational mining activities including blasting;
- Ingestion of toxic products from materials stored on site;
- Entrapment during construction and operation of Project facilities such as the CHPP, holding and sediment ponds, or along access roads during winter due to high snowbanks; and
- Increased hunter access Post-Closure.

Measures to mitigate the impact of increased mortality risk on ungulate VCs include:

- A wildlife education program (as described in the Wildlife Management and Monitoring Plan (Chapter 33, Section 33.4.1.13) will be developed to raise awareness of requirements and commitments to avoid wildlife and protect wildlife and wildlife habitat;
- Management of vehicle traffic and access contributes to minimization of direct mortality during all project phases. Traffic related measures are documented in the Traffic Control Plan (Chapter 33, Section 33.4.2.4) and include:
 - Speed limits will be clearly marked and signed on all Project access roads. Lower speed limits will be set where monitoring and wildlife observation records indicate a high-risk area for animal-vehicle collisions (e.g., at identified wildlife crossings);
 - Additional road signs will be posted for wildlife crossings, speed limit changes, advisory corner speeds, areas with limited visibility, and other potential road hazards;
 - Wildlife will be given the right-of-way on all Project roads;
 - Wildlife sightings and incidents will be reported to the site supervisor as soon as possible;
 - Project traffic will be minimized to the greatest extent practicable;
 - Site workers will travel on crew buses to limit road traffic;
 - Where possible, roads will be designed with clear lines of sight to increase the ability of drivers to see wildlife or other hazards; and

- Vegetation along Project roadsides will be mowed/brushed as necessary for visibility of wildlife and to reduce the risk of wildlife-vehicle collisions;
- Measures will be implemented to minimize potential Project effects on movement corridors (e.g., through Grave Creek Canyon); measures will include signage along Project roads to warn vehicle operators of the potential to encounter wildlife;
- Prior to winter avalanche control along the access road, avalanche control areas will be visually searched for wildlife prior to avalanche control activities; avalanche control activities will not be conducted when ungulates are present in potential slide areas;
- Clearing, grubbing and construction activities will be conducted in such a manner that if ungulates are present, there is escape;
- Prior to blasting at pits, the blast area will be searched for the presence and wildlife and cleared from the area if necessary;
- To avoid and minimize attractants that could lead to increased human-wildlife conflict, the following measures will be implemented:
 - Following construction and upgrades of Project access roads, disturbed areas will be revegetated with a seed mixture that is less attractive to foraging wildlife;
 - If a carcass is found along access roads, it will be reported and removed to discourage scavenging wildlife along access roads;
 - To minimize attraction to roads from de-icing materials, use of salt (sodium chloride) will be minimized where possible, the road will be maintained such that concentrations of salt in pools are minimized and alternatives to salt for de-icing will be explored; and
 - Implementation of the Waste Management Plan (Chapter 33, Section 33.4.1.12) that includes:
 - General waste will be separated at the source and will be handled, stored, and transported off-site for disposal at an approved facility; and
 - Wildlife-proof containers will be used for temporary on-site storage of waste; and
- To avoid and minimize the potential for exposure to chemical hazards, the following measures will be implemented:
 - The Spill Prevention, Control, and Countermeasures Plan (Chapter 33, Section 33.4.1.10) contributes to eliminating or minimizing exposure of wildlife to spills;
 - Petroleum products and chemicals will be stored in holding tanks or closed facilities that exclude wildlife; and
 - Grey water and sewage will be contained in a closed system of holding tanks that will be pumped out as required.

The mitigation measures described above are expected to contribute to avoidance and minimization of the risk of mortality on ungulate VCs with high effectiveness. The effects of increased mortality risk on ungulates are not expected to be fully mitigated and a residual effect may occur.

15.4.3.3.5 Summary of Mitigation Measures

A summary of the key mitigation approaches and their effectiveness to mitigate potential effects is provided in Table 15.4-19. The mitigations, their rationale, and the potential for residual effects are similar for all four ungulate VCs and are grouped for summary purposes.

Table 15.4-19: Summary of Proposed Mitigation Measures Related to Ungulate VCs

Valued Component	Potential Effect	Mitigation Measures	Rationale	Applicable Project Phases	Effectiveness	Residual Effect
All Ungulate VCs	Habitat Loss and Degradation	<ul style="list-style-type: none"> Minimization through Project design Delay clearing until needed Erosion and sediment control Air quality and dust management Progressive reclamation 	<ul style="list-style-type: none"> These measures contribute to avoidance, minimization, and restoration of habitat loss and degradation Not all effects of habitat loss and degradation are expected to be mitigated 	<ul style="list-style-type: none"> Construction and Pre-Production Operations 	Moderate	Yes
All Ungulate VCs	Sensory Disturbance	<ul style="list-style-type: none"> Noise and Vibration Management Plan Lighting management Management of vehicle traffic and site access 	<ul style="list-style-type: none"> These measures contribute to avoidance and minimization of sensory disturbance Not all effects of sensory disturbance are expected to be mitigated 	<ul style="list-style-type: none"> Construction and Pre-Production Operations Reclamation and Closure 	High	Yes
All Ungulate VCs	Disruption to Movement	<ul style="list-style-type: none"> Sensory disturbance measures Wildlife education Limited new roads Conveyor elevated to create underpasses Progressive reclamation Management of vehicle traffic and site access Gaps in snowbanks 	<ul style="list-style-type: none"> These measures contribute to avoidance, minimization, and restoration of habitat loss and degradation Not all effects of disruption to movement are expected to be mitigated 	<ul style="list-style-type: none"> Construction and Pre-Production Operation Reclamation and Closure 	Moderate	Yes

Valued Component	Potential Effect	Mitigation Measures	Rationale	Applicable Project Phases	Effectiveness	Residual Effect
All Ungulate VCs	Increased Mortality Risk	<ul style="list-style-type: none"> • Wildlife education • Management of vehicle traffic and site access • Prevent wildlife entrapment • Clear area before blasting and avalanche control • Minimize attractants • Manage chemical hazards 	<ul style="list-style-type: none"> • These measures contribute to avoidance and minimization of direct mortality • Not all effects of increased mortality risk are expected to be mitigated for all ungulate VCs 	<ul style="list-style-type: none"> • Construction and Pre-Production • Operations • Reclamation and Closure. • Post-Closure 	High	Yes

The potential for residual effects were assessed in consideration of the expected effectiveness of the mitigation measures to avoid, minimize, restore, or compensate for potential effects and the ungulate VC measurement indicators defined in the AIR (habitat availability and distribution and known occurrences and abundance).

Where mitigation measures do not or may not mitigate all effects or if there is a low level of confidence in their effectiveness, the effect is carried forward for further analysis of residual effects. For all four ungulate VCs, all four effects cannot be completely mitigated and are therefore carried forward for further analysis and characterization.

15.4.3.4 Characterization of Residual Effects, Significance, Likelihood and Confidence

15.4.3.4.1 Methods

The assessment of potential residual effects on ungulate VCs was characterized using a combination of quantitative methods and qualitative discussions. Quantitative methods were used to measure habitat loss and degradation and sensory disturbance. Qualitative discussions are based on scientific literature, baseline studies, habitat models, and professional judgement and were used to characterize disruption to movement, and increased mortality risk.

Habitat loss and degradation was measured by calculating the loss of high-quality habitat within the footprint. High-quality habitat was defined as areas with high and very high habitat suitability.

The effect of sensory disturbance used noise modelling presented in Chapter 7 and summarized earlier in Section 15.4.3.2.3. Sensory disturbance was evaluated by calculating the amount of high-quality habitat that the VC may abandon or be disturbed, based on the modelled noise levels for:

- Continuous Project-related noise ≥ 55 dBA – This is the daytime sound level from the Project that is expected to cause disturbances for wildlife;
- Continuous Project-related noise ≥ 45 dBA – This is the nighttime sound level from the Project that is expected to cause disturbances for wildlife; and
- Peak noise (air overpressure) ≥ 108 dB from blasting - This is the peak noise level from blasting at wildlife receptors that is expected to cause disturbed habitat. This was estimated to be at 1,500 m from pit blast sites.

Noise modelling was completed for the worst-case operating scenario. It was determined that operational Year 10 of the Project was the worst-case year for noise and vibration effects from the Project on surrounding sensitive receptors. The effects of Project-related noise in all other years will be less than those arising during operational Year 10.

Residual effects were characterised using the criteria described in Chapter 5, Section 5.3.4.5. The following limits were used for the magnitude of a residual effect on ungulates:

- Negligible: No detectable changes from baseline conditions;
- Low: 0-5% change;
- Moderate: 6-15% change; and
- High: >15% change.

The residual effects of contaminants of potential concern on ungulate VCs are described in Chapter 22 and are therefore not repeated here.

15.4.3.4.2 Moose

Moose were assessed for potential Project-related effects on habitat loss and degradation, sensory disturbance, disruption to movement, and increased mortality risk. Mitigation measures will contribute to avoidance, mitigation, and restoration of these effects but residual effects will remain. All four effects were therefore carried forward and a residual effects assessment is presented below. The determination of significance of adverse residual effects was completed for the combined effects of habitat loss and degradation, sensory disturbance, disruption to movement, and increased mortality risk.

Characterization of Residual Effects

Habitat Loss and Degradation

The Project footprint overlaps with high-quality moose habitat (Figure 15.4-15 and summarized in Table 15.4-20). Within the Terrestrial RSA, moose generally undergo seasonal movements that are largely determined by the depth and duration of snow cover and are thus closely tied to elevation. Moose tend to winter at low elevations where snow depths are typically lower. The moose model predicts that most high-quality fall and winter moose habitat is at lower elevations (Figure 15.4-15). The Project will result in a predicted loss of 149 ha of high-quality fall-winter habitat, representing 3.6% of the total amount of high-quality fall-winter habitat available in the Terrestrial LSA (4,172 ha). The majority of the loss will be from clearing for the rail loadout, the utility corridor, and upgrading of the lower portions of the access road. On a proportional basis, the availability of high-quality moose habitat is lower within the Project footprint compared to the Terrestrial LSA as whole (12% for Project footprint and 17% for the Terrestrial LSA), meaning high-quality habitat is more common outside the footprint than it is within.

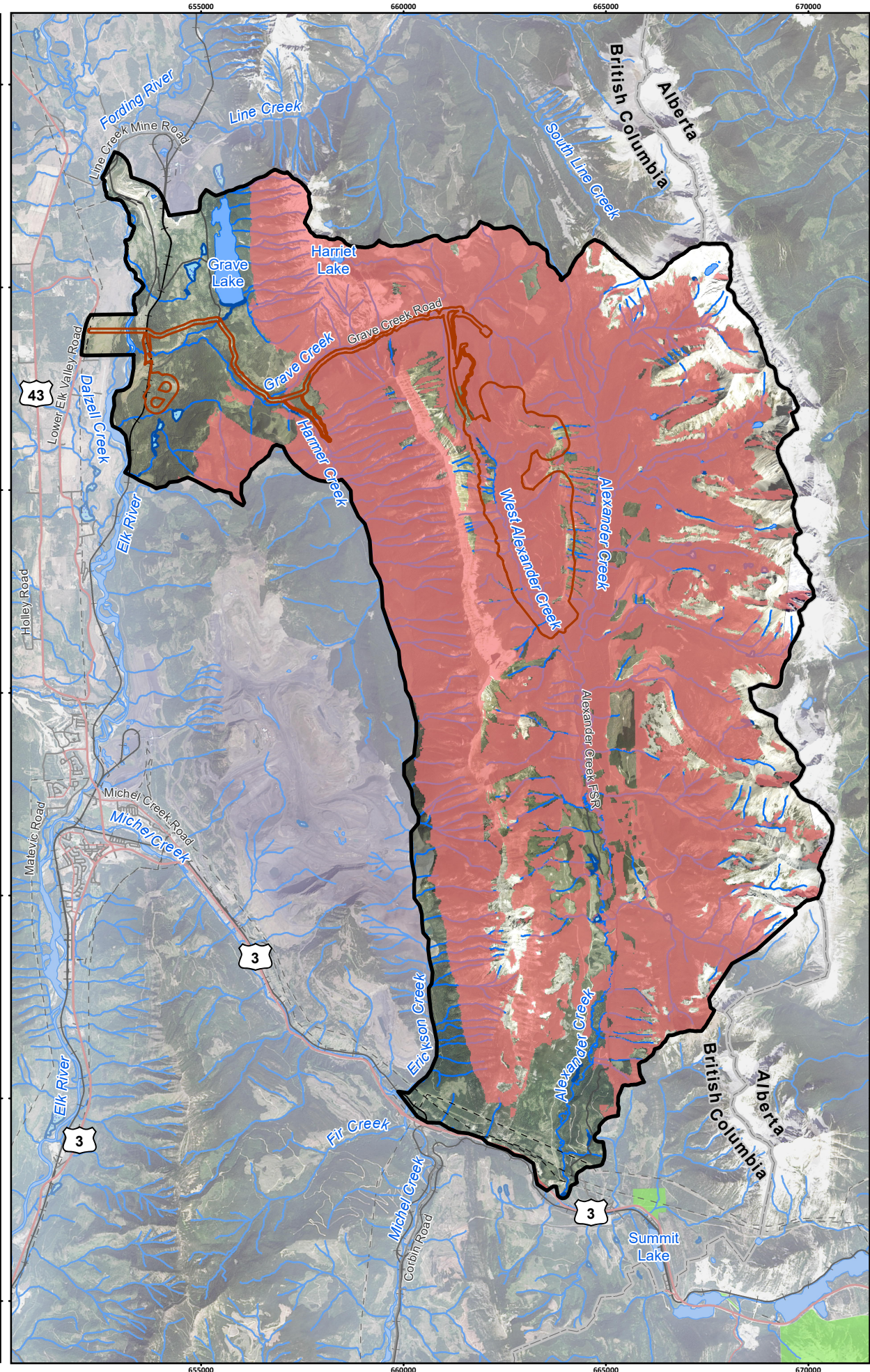
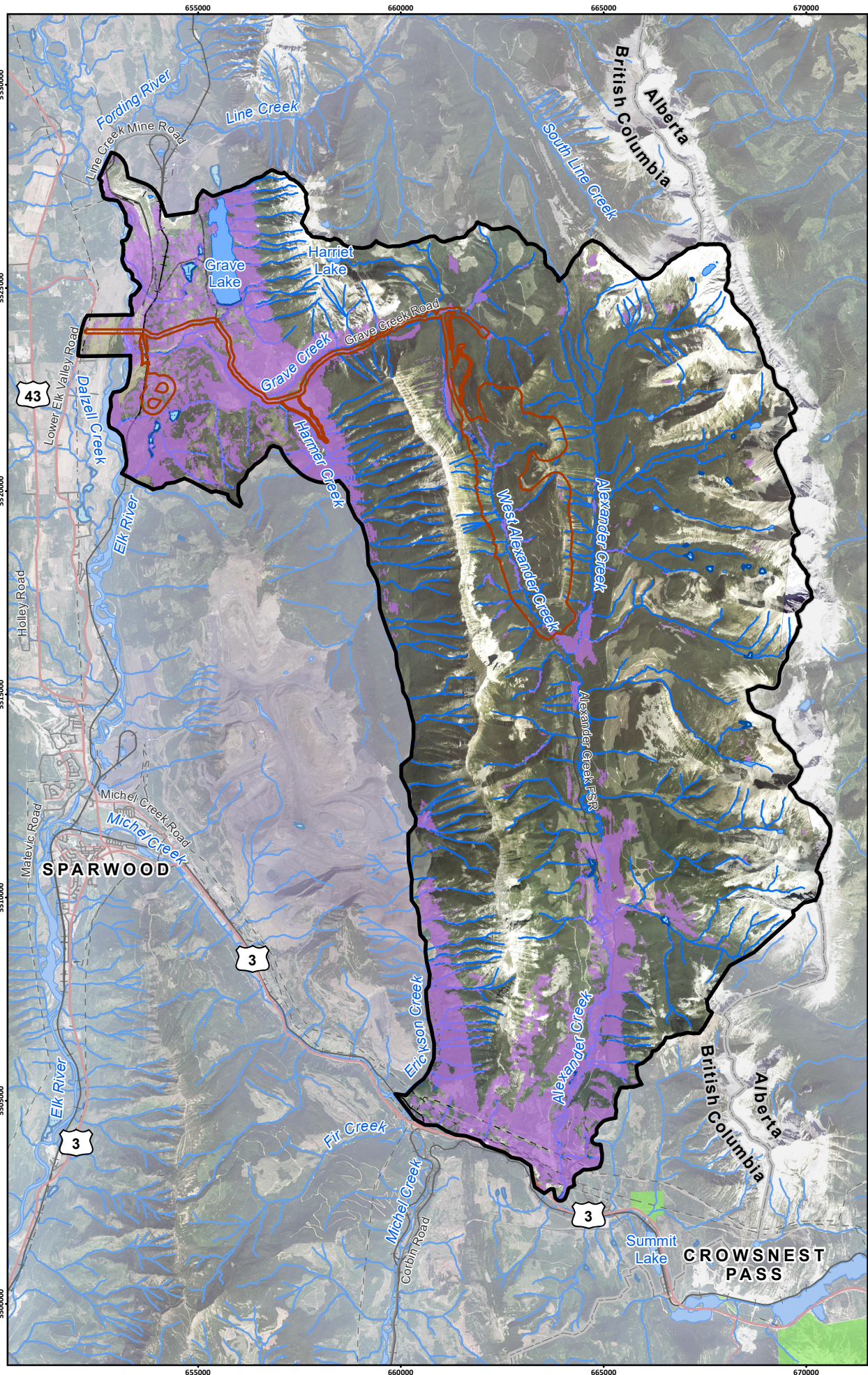
Moose move to higher elevations in spring for quality forage and security from predators. Predicted high-quality spring-summer habitat is widespread in the Terrestrial LSA and occurs throughout most of the mine site footprint. The Project will result in a predicted loss of 1,041 ha of high-quality spring-summer habitat, representing 6.4% of the total amount of high-quality spring-summer habitat available in the Terrestrial LSA (16,144 ha). On a proportional basis, the availability of high-quality moose habitat in spring-summer is higher within the Project footprint compared to the Terrestrial LSA as whole (81% for Project footprint and 67% for the Terrestrial LSA), meaning high-quality habitat is more common inside the Project footprint than it is outside.

Table 15.4-20 Change in High-Quality Moose Habitat in the Project Footprint and Relative to the Terrestrial LSA

Season	Area (ha) of High-Quality Moose Habitat in Project Footprint	% of Total Area of Project Footprint	Area (ha) of High-Quality Moose Habitat in Terrestrial LSA	% of Total Area of Terrestrial LSA	Change as Proportion of Total Area of High-Quality Moose Habitat in the Terrestrial LSA
Fall-Winter	149	12	4,172	17	-3.6%
Spring-Summer	1,041	81	16,144	67	-6.4%

FALL-WINTER

SPRING-SUMMER

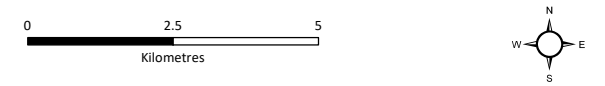


Crown Mountain Coking Coal Project

Figure 15.4-15
High-Quality Moose Fall-Winter and Spring-Summer Habitat
in the Terrestrial Local Study Area

LEGEND

- High-Quality Moose Fall-Winter Habitat
- High-Quality Moose Spring-Summer Habitat
- Terrestrial Local Study Area
- Project Footprint
- Highway
- Arterial/Collector Road
- Local/Resource Road
- Railway
- Transmission Line
- Watercourse
- Waterbody
- Wetland
- Provincial Park/Protected Area
- British Columbia/Alberta Border



Scale 1:130,000

Map Drawing Information:
Data Provided by NWP Coal Canada Ltd, Dillon Consulting Limited, Keefer Ecological Services Ltd, Province of British Columbia GeoBC Open Data, Government of Alberta Open Data, Natural Resource Canada.
Imagery Provided by Landsat 8 (Aug 2018), and GeoBC Orthoimagery (Aug 2016).

Map Created By: PR
Map Checked By: JM
Map Coordinate System: NAD 1983 UTM Zone 11N



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Status: FINAL
Date: 2022-01-14

Clearing will begin in Construction and Pre-Production with initial portions of the 1,283 ha Project footprint (including the buffer) prepared for the mine site facilities, a portion of the North Pit, the Interim Sediment Pond, roads, the conveyor, the powerline and the rail loadout. During Operations, progressive clearing of the pits, Mine Rock Storage Facility, and Main Sediment Pond will continue through to Year 15. Habitat loss will have a continuous adverse effect until progressive reclamation begins in Year 10 of Operations. With progressive reclamation between Years 10 and 15 and continued reclamation in the Closure and Reclamation phase, the effect of habitat loss will begin to decline.

The service corridor with the 138 kilovolts (kV) powerline will be cleared during Construction and Pre-Production. The area beneath the powerlines and between power poles will naturally revegetate and will be accessible to moose. Areas that were previously forest will no longer provide security and thermal protection but will provide forage for moose. After decommissioning, trees will eventually return, though not established as a forest for several decades following Closure.

A 100 m wide corridor has been allocated for construction of the 2.7 km long overland coal conveyor. Not all portions of the corridor will require clearing and temporary construction areas will rapidly revegetate and provide forage for moose in spring-summer (though may be avoided due to sensory disturbance).

Post mine reclamation will restore a mosaic of coniferous forest, open alpine tundra, rock outcrops, shrub and graminoid dominated brushland, talus slopes, wetlands and riparian areas (described in Section 15.4.3.3.1 and in the Ecological Restoration Plan, Chapter 33, Section 33.4.1.3). Most of the restored ecosystems (all aside from sparsely vegetated talus) will provide habitat for moose (i.e., food, security, or thermal protection) over time. Reclamation will begin in Year 10 of Operations for limited areas and then accelerating at the end of Operations. Within five years of closure, graminoids, forbs and some shrubs will have become established and will begin to provide food for moose, though the quality will be variable and may be limited in many areas. Food availability will progressively improve at 25 and 50 years post-closure. Forest will begin to become established at 50 years post-closure onward, especially at low elevations, and begin to provide security and thermal protection. The Project footprint is ultimately expected to be a landscape similar in structure and composition to the pre-Project landscape.

Habitat degradation can occur from potential introduction and spread of invasive species, changes in vegetation vigour from dust deposition, and surface water runoff from the Project footprint that can contain suspended solids and affect vegetation. Mitigation for each of these effects was described in Chapter 13 and found to have no residual effects to each of the ecosystem VCs.

The Project footprint includes a buffer area intended to account for uncertainty in precise boundaries of disturbance. Not all of the buffer area will be disturbed, and the calculations of habitat loss are therefore conservative and may be overestimated.

The residual effect to moose from habitat loss and degradation is characterized as follows:

- Duration: *Long-term and permanent*, as some lost habitat will be restored prior to the end of the Post-Closure phase and the remainder not restored until forest is established after the Post-Closure phase.
- Magnitude: *Moderate*, there will be a 6.4% loss of high-quality moose habitat in spring-summer and 3.6% loss of high-quality moose habitat in fall-winter in the Terrestrial LSA due to the development of the Project footprint.

- Geographic Extent: *Discrete*, as the effect of habitat loss will be within the Project footprint only.
- Frequency: *Continuous*, the effect of habitat loss and degradation is expected to be continuous until lost habitat is restored.
- Reversibility: *Reversible long-term*, the effect of habitat loss is anticipated to be reversed though not fully for many years after Post-Closure.
- Context: *Neutral*, moose present within the Project footprint will be able to utilize alternate areas and thus have a degree of resiliency, though are sensitive to loss of habitat at the landscape scale.

Sensory Disturbance

Moose habitat will be functionally lost or disturbed due to sensory disturbance. This is in addition to direct habitat loss from clearing. Sensory disturbance for moose includes behavioural responses to Project-related noise, vibration, light, dust, and human presence. Sensory disturbance from noise and vibration has the potential to extend further than light, dust, and human presence and is the focus of the residual effects assessment. Potential effects arising from vibration, light, dust, and human presence would be expected to be less than those arising from noise.

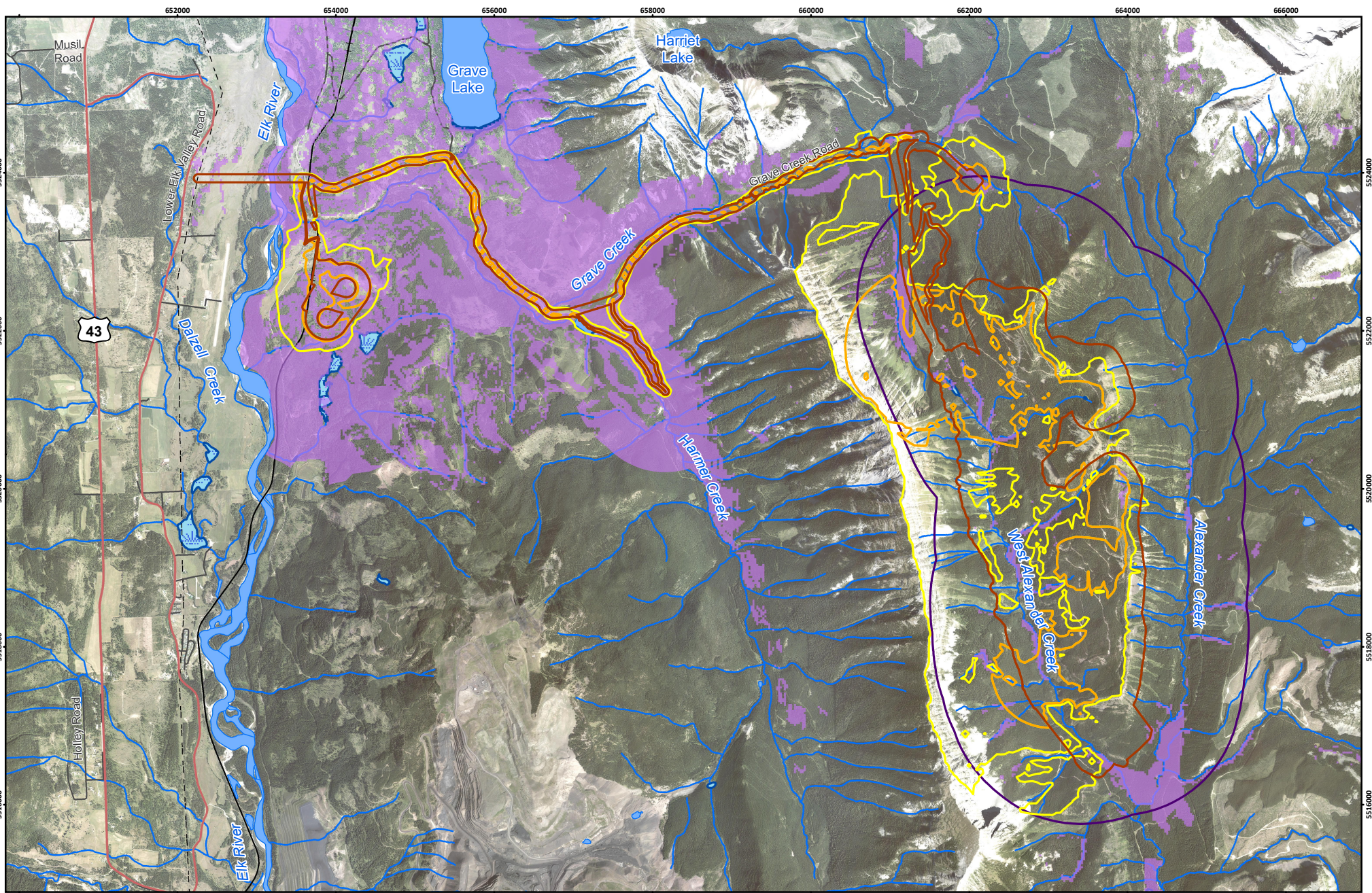
Continuous project-related noise at ≥ 45 dBA (nighttime threshold) will affect up to 1,118 ha outside the Project footprint. This overlaps with up to 132 ha of high-quality fall-winter habitat and 790 ha of high-quality spring-summer habitat (Figure 15.4-16 and Table 15.4-21) when Project-related noise is at its peak in Year 10 of Operations. This represents 3.2% and 4.9% of fall-winter and spring-summer high-quality habitat in the Terrestrial LSA, respectively. A much smaller amount of high-quality habitat may be affected in daytime using the ≥ 55 dBA daytime threshold.

Peak noise from blasting could affect 109 ha of high-quality fall-winter habitat and 1,703 ha of high-quality spring-summer habitat (Figure 15.4-16 and Table 15.4-21). This represents 2.6% and 10.5% of fall-winter and spring-summer high-quality habitat in the Terrestrial LSA, respectively.

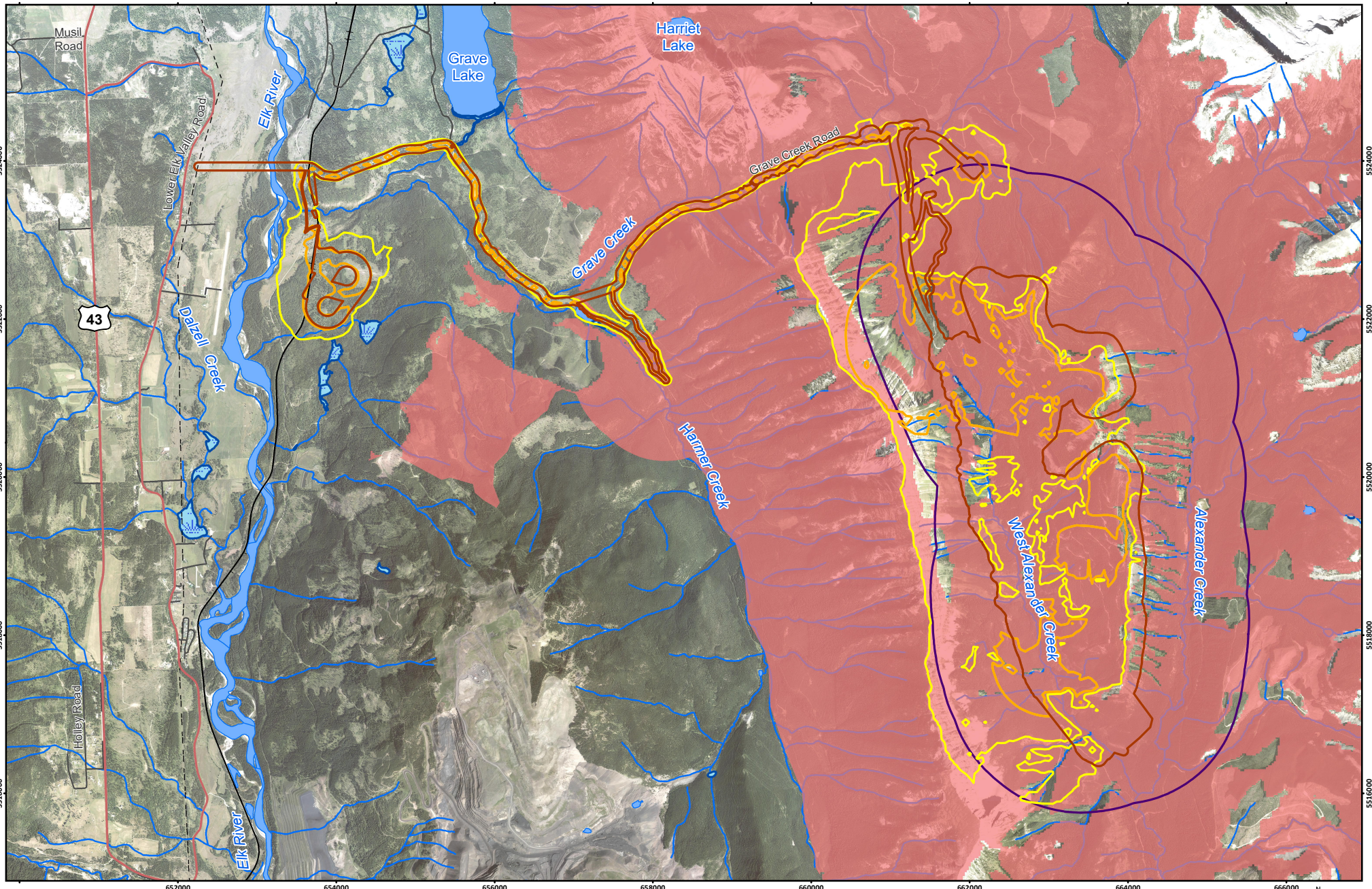
Table 15.4-21: Area of Sensory Disturbance outside the Project Footprint and Overlapping with High-Quality Moose Habitat

Season	Zone of Influence Area (ha)	Area (ha) of High-Quality Moose Habitat Affected Outside Project Footprint	Area Affected as Proportion of High-Quality Moose Habitat in Terrestrial LSA
Continuous Project-related noise ≥ 55 dBA (daytime threshold)			
Fall-Winter	242	18	0.4%
Spring-Summer		153	1.0%
Continuous Project-related noise ≥ 45 dBA (nighttime threshold)			
Fall-Winter	1,118	132	3.2%
Spring-Summer		790	4.9%
Peak noise ≥ 108 dB from blasting			
Fall-Winter	1,955	109	2.6%
Spring-Summer		1,703	10.5%

FALL-WINTER


















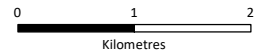
SPRING-SUMMER



Crown Mountain Coking Coal Project

LEGEND

- | | | |
|--|---|---|
|  High-Quality Moose Fall-Winter Habitat |  Project Footprint |  British Columbia/Alberta Border |
|  High-Quality Moose Spring-Summer Habitat |  Highway | |
|  Continuous Project Related Noise - 45 dBA Contours |  Arterial/Collector Road | |
|  Continuous Project Related Noise - 55 dBA Contours |  Local/Resource Road | |
|  Offsite Peak Noise Levels From Blasting >108 dB |  Railway | |
| |  Transmission Line | |
| |  Watercourse | |
| |  Waterbody | |
| |  Wetland | |



Scale 1:65,000

Map Drawing Information:
 Data Provided By NWP Coal Canada Ltd, Dillon Consulting Limited, Keefer Ecological Services Ltd, Province of British Columbia GeoBC Open Data, Government of Alberta Open Data, Natural Resource Canada.
 Imagery Provided By ESRI.

Map Created By: PR
 Map Checked By: JM
 Map Coordinate System: NAD 1983 UTM Zone 11N



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Moose may be displaced within the noise zones of influence. Habitat is not lost but moose may spend less time in areas affected by noise, effectively degrading the quality of habitat or eliminating availability completely. The zone of influence from noise is largest at the pit where the CHPP and most heavy equipment is located. The overlap of the zone of influence with high-quality habitat in this area mostly in spring-summer habitat. Since high-quality spring-summer habitat is widely available in the Terrestrial LSA, displaced moose will have alternate areas available. In winter when suitable habitat is most limited, Project-related noise is primarily from access road traffic and activity at the rail loadout.

Noise from blasting will be intermittent. Since blasting will occur only at active pits, blasting will affect almost much less fall-winter habitat when high-quality habitat is most limited.

Once the Operations phase is complete, noise will substantially decrease and noise from blasting will cease. Noise during Reclamation and Closure will be from decommissioning and removal of infrastructure and reclamation activities.

The residual effect to moose from sensory disturbance is characterized as follows:

- Duration: *Long-term*, as sensory disturbance will continue through to the end of Operations, and to a lesser extent during Reclamation and Closure.
- Magnitude: *Low to Moderate*, up to 4.9% of high-quality habitat for continuous Project-related noise and 10.5% of high-quality habitat for peak noise from blasting will be affected in the Terrestrial LSA.
- Geographic Extent: *Local*, as the effect of sensory disturbance will be outside the Project footprint and within the Terrestrial LSA.
- Frequency: *Continuous*, though at varying levels till the end of Operations, peaking at Year 10 of Operations. Noise from blasting will be intermittent.
- Reversibility: *Reversible long-term*, the effect of noise will decline substantially at the end of Operations and continue at lower levels during Reclamation and Closure.
- Context: *Neutral*, moose have neutral sensitivity and resilience to disruption noise and may be able to adapt to certain levels of noise.

Disruption to Movement

Moose make daily movements between habitats that provide food, security, and thermal protection and seasonal movement between mid and high elevation subalpine area in spring-summer and lower elevation valley areas in fall-winter. The Project has the potential to disrupt both daily and seasonal movements and disruption cannot be fully mitigated.

Baseline studies showed that moose utilize the Grave Creek Canyon (within the access road footprint), Alexander Creek drainages, and secondary roadways during both winter and summer. Other connectivity habitats included the Deadman, Racehorse, and North Fork Passes in the eastern portion of the Terrestrial LSA. Transboundary mountain passes, avalanche chutes and tertiary streams were used primarily during spring and summer (described in Section 15.4.2.3).

When the Project is at its largest extent and prior to any large areas of reclamation (around Year 10 of Operations), the mine site footprint will occupy a large portion of West Alexander Creek valley and will be a nearly impermeable barrier. The upper slopes of the west side of the valley will remain intact, but will

be degraded by sensory disturbance and use for connectivity between daily or seasonal habitats may be reduced.

Along the conveyor, underpasses will be created by elevating the conveyor to at least 2.4 m above ground (or higher where terrain can be used to create more clearance) at intervals of two per 1,000 m. Use of the conveyor underpasses and habitats adjacent to the conveyor will be dependent on moose sensitivity to the physical presence of the conveyor and the noise that is generated. The conveyor is expected to represent a semi-permeable barrier to moose.

The explosives factory will be accessed by 900 m of new road. All other access roads are pre-existing aside, from those in the pits and Mine Rock Storage Facility areas). Access roads will be upgraded and will have higher levels of daily traffic relative to existing conditions. Moose generally avoid roads, though can still be attracted to roads for shrubby roadside vegetation and salt from application of de-icing materials. Moose were recorded along Grave Creek Road in both summer and winter. In general, roads represent a semi-permeable barrier to moose, provided that no physical barriers are created during road upgrade or unbroken snowbanks created from snow clearing. The predicted traffic level of 140 vehicles per day is unlikely to affect crossing success, especially with speed reductions in areas known to have frequent wildlife (e.g., Grave Creek Canyon) and provided that wildlife have the right-of-way.

The utility corridor is primarily composed of the powerline and the buried gas line. Suitable habitat will be present beneath the powerline after construction. The powerline may not be a barrier to movement on its own, but since it parallels the road, it may be avoided due to proximity and function as a semi-permeable barrier in combination with the road.

The residual effect to moose from disruption to movement is characterized as follows:

- Duration: *Long-term*, as some effects will continue to the end of Reclamation and Closure.
- Magnitude: *Moderate*, given the semi-permeable nature of the linear infrastructure.
- Geographic Extent: *Local*, as the effect will extend outside the Project footprint and within the Terrestrial LSA.
- Frequency: *Continuous*, as the effect will continue through Operations to Reclamation and Closure.
- Reversibility: *Reversible long-term*, the effect will decline substantially at the end of Operations and continue at lower levels during Reclamation and Closure.
- Context: *Neutral*, moose have neutral sensitivity and resilience to disruption to movement and may be able to adapt to altered movement corridors.

Increased Mortality Risk

Pathways of increased risk of mortality (described in Sections 15.4.3.2.3) that are unlikely to be fully mitigated are collisions with Project-related traffic on access or mine roads and increased hunter access after closure.

Even with the traffic control mitigation measures described in Section 15.4.3.3.4, vehicle collisions with moose may still occur. The number is expected to be small. Wildlife sightings and wildlife-vehicle collisions will be recorded and monitored. Further mitigation measures will be implemented to further minimize the risk of collision, if required.

The Project will involve loading of 120 trains per year. Trains will not be travelling at high speeds within the rail loadout and train-wildlife collisions in this area are unlikely. There will be an incremental increase in rail traffic on the main rail lines as a result of the Project (one additional train every three days on average) where the risk of wildlife-train collisions is higher. The extent to which the Project will contribute to an incremental increase in moose mortalities from train collisions is unknown.

The upgraded Grave Creek Road will remain open post-closure and may provide increased access to hunters. The current condition of the road is rough, though is currently accessed by 4x4 vehicles, snowmobiles, and all-terrain vehicles. Access up from Grave Creek Road to the mine site will be open to the public. The road to the explosives factory will be decommissioned and reclaimed. A change in access by hunters and leading to increased hunting of moose is difficult to predict, but an incremental increase is assumed.

The residual effect to moose from increased mortality risk is characterized as follows:

- Duration: *Long-term*, as some effects will continue to the end of Reclamation and Closure.
- Magnitude: *Low*, as moose mortalities as a result of the Project are expected to be uncommon.
- Geographic Extent: *Discrete*, as the effect will be within the Project footprint.
- Frequency: *Intermittent*, as moose mortalities may be at sporadic intervals during any phase of the Project.
- Reversibility: *Reversible long-term*, as the potential for increased mortality risk will end after Reclamation and Closure.
- Context: *High*, as any moose mortalities as a result of the Project are expected to be small relative to other sources of mortality.

Determination of Significance

There are approximately 4,000 to 7,000 moose in the Kootenay region with a stable regional population trend (Government of B.C., 2017). In the Elk Valley (WMU 4-23), there is an estimated 509 individual moose and a corresponding population density of 0.38 individuals/km² (Gooliaff and Stent, 2018). This is 50% lower than the previous estimate in 2005/2006, indicating a potential 50% local population decline in the Elk Valley in a decade (FLNRORD, 2018). Further moose monitoring is required to confirm population trends and effects of land use on moose in the Elk Valley.

Baseline surveys showed moose within and adjacent to the Project footprint in all seasons. High quality moose habitat in the Elk Valley may support a late winter population density of 0.38 individuals/km² (Gooliaff and Stent, 2018). Based on this assumption, the high-quality habitat available to moose in the Terrestrial LSA (41.7 km²) can support approximately 16 moose during late winter. For the Project footprint, this would translate to displacement or impact to 0.57 moose. Using the same assumed population density, loss of high-quality spring-summer habitat would translate to displacement or impact to 5.8 moose. Though the loss of spring-summer high-quality habitat is greater than fall-winter, the consequence of lost habitat is likely lower as high-quality spring-summer habitat is widely available in the Terrestrial LSA (67% of the Terrestrial LSA contains high-quality spring-summer habitat). Sensory disturbance may further displace moose.

Based on the characterization of the residual effects and local and regional moose population levels, the Project would not limit the ability of moose to persist and maintain self-sustaining populations in the

Terrestrial LSA. The residual effects of habitat loss and degradation, sensory disturbance, disruption to movement, and increased mortality risk on moose arising from the Project during all phases are therefore considered not significant.

Likelihood and Confidence

Effects that are determined to be not significant do not require a characterization of likelihood.

There is a good understanding of moose ecology, their habitat availability and distribution, known occurrences and abundance in the Terrestrial LSA. There is uncertainty in the moose population trend in the Elk Valley, though there is low risk that the Project effects could exceed the threshold used in this assessment. The confidence in the determination of the significance of residual effects to moose is high.

15.4.3.4.3 Elk

Elk were assessed for potential Project-related effects on habitat loss and degradation, sensory disturbance, disruption to movement, and increased mortality risk. Mitigation measures will contribute to avoidance, mitigation, and restoration of these effects but residual effects will remain. All four effects were therefore carried forward and a residual effects assessment is presented below. The determination of significance of adverse residual effects was completed for the combined effects of habitat loss and degradation, sensory disturbance, disruption to movement, and increased mortality risk.

Characterization of Residual Effects

Habitat Loss and Degradation

The Project footprint overlaps with high-quality elk habitat (Figure 15.4-17 and summarized in Table 15.4-22).

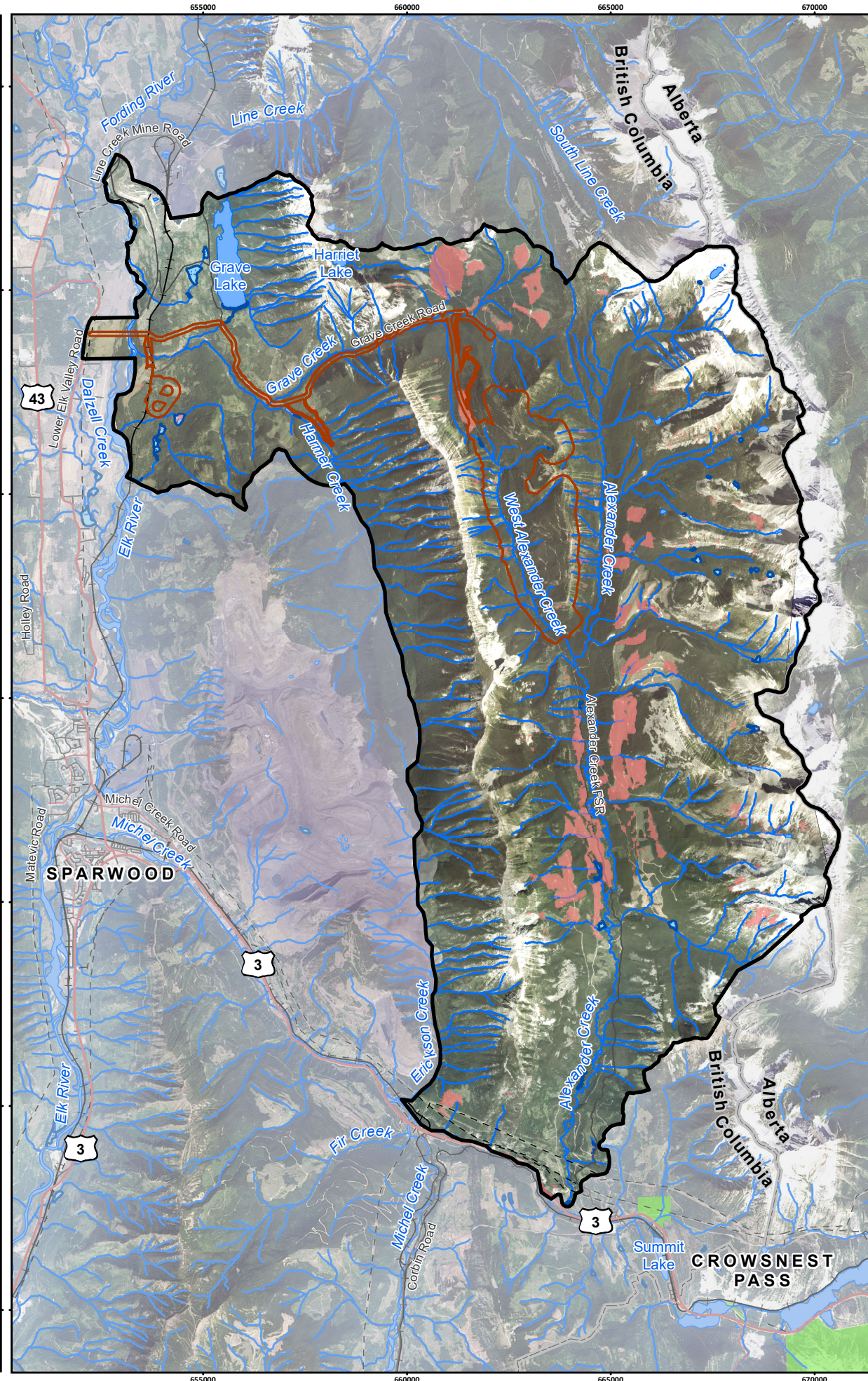
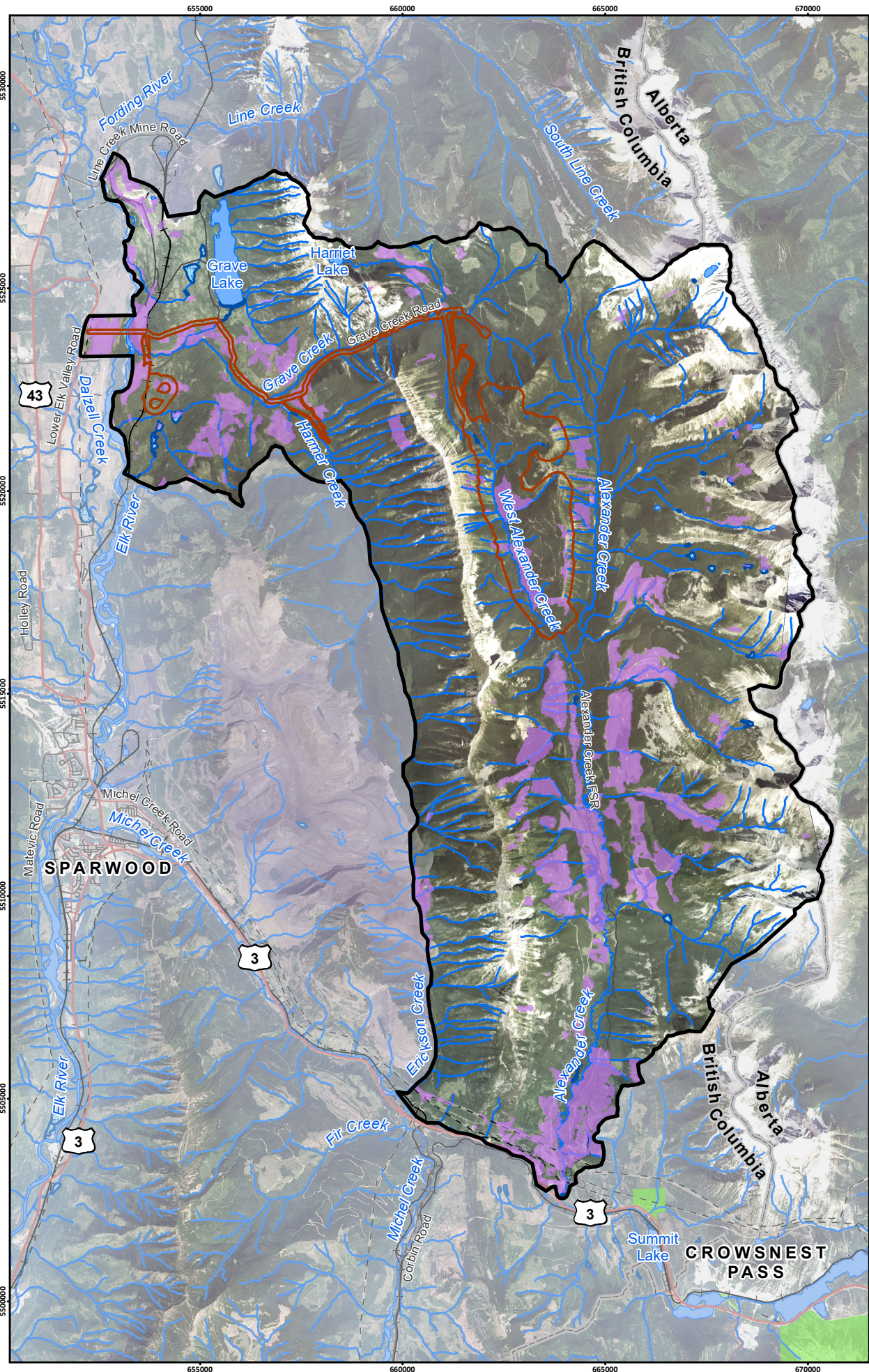
Table 15.4-22: Change in High-Quality Elk Habitat in the Project Footprint and Relative to the Terrestrial LSA

Season	Area (ha) of High-Quality Elk Habitat in Project Footprint	% of Total Area of Project Footprint	Area (ha) of High-Quality Elk Habitat in Terrestrial LSA	% of Total Area of Terrestrial LSA	Change as Proportion of Total Area of High-Quality Elk Habitat in the Terrestrial LSA
Fall-Winter	191	15	2,671	11%	-7.1%
Spring-Summer	23	2	863	4%	-2.7%

The Project will result in a predicted loss of 191 ha of high-quality fall-winter habitat, representing 7.1% of the total amount of high-quality fall-winter elk habitat available in the Terrestrial LSA (2,671 ha). Loss will be in various portions of the Project footprint, including the rail loadout, the utility corridor, the Mine Rock Storage Facility, and pits. On a proportional basis, the availability of high-quality fall-winter elk habitat is higher within the Project footprint compared to the Terrestrial LSA as whole (15% for Project footprint and 11% for the Terrestrial LSA), meaning high-quality habitat is more common within the footprint than it is outside.

FALL-WINTER

SPRING-SUMMER

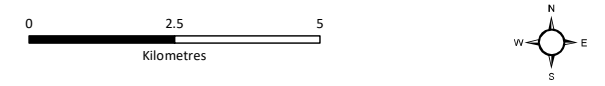


Crown Mountain Coking Coal Project

Figure 15.4-17
High-Quality Elk Fall-Winter and Spring-Summer Habitat in the Terrestrial Local Study Area

LEGEND

- High-Quality Elk Fall-Winter Habitat
- High-Quality Elk Spring-Summer Habitat
- Terrestrial Local Study Area
- Project Footprint
- Highway
- Arterial/Collector Road
- Local/Resource Road
- Railway
- Transmission Line
- Watercourse
- Waterbody
- Wetland
- Provincial Park/Protected Area
- British Columbia/Alberta Border



Scale 1:130,000

Map Drawing Information:
Data Provided By NWP Coal Canada Ltd, Dillon Consulting Limited, Keefer Ecological Services Ltd,
Province of British Columbia GeoBC Open Data, Government of Alberta Open Data, Natural
Resource Canada.
Imagery Provided By Landsat 8 (Aug 2018), and GeoBC OrthoImagery (Aug 2016).

Map Created By: PR
Map Checked By: JM
Map Coordinate System: NAD 1983 UTM Zone 11N



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The Project will result in a predicted loss of 23 ha of high-quality spring-summer habitat, representing 2.7% of the total amount of high-quality spring-summer elk available in the Terrestrial LSA (863 ha). On a proportional basis, the availability of high-quality elk habitat in spring-summer is lower within the Project footprint compared to the Terrestrial LSA as whole (2% for Project footprint and 4% for the Terrestrial LSA), meaning high-quality habitat is more common outside the Project footprint than it is within.

Clearing will begin in Construction and Pre-Production with initial portions of the 1,283 ha Project footprint (including the buffer) prepared for the mine site facilities, a portion of the North Pit, the Interim Sediment Pond, roads, the conveyor, the powerline, and the rail loadout. During Operations, progressive clearing of the pits, Mine Rock Storage Facility, and Main Sediment Pond will continue through to Year 15. Elk habitat loss will have a continuous adverse effect until progressive reclamation begins in Year 10 of Operations. With progressive reclamation between Years 10 and 15 and continued reclamation in the Reclamation and Closure phase, the effect of habitat loss will begin to decline.

The service corridor with the 138 kV powerline will be cleared during Construction and Pre-Production. The area beneath the powerlines and between power poles will naturally revegetate over time and will be accessible to elk. Areas that were previously forest will no longer provide security and thermal protection but will provide forage. After decommissioning, trees will eventually return, though not established as a forest for several decades following Reclamation and Closure.

A 100 m wide corridor has been allocated for construction of the 2.7 km long overland coal conveyor. Not all portions of the corridor will require clearing and temporary construction areas will rapidly revegetate and provide forage for elk in spring-summer.

Post mine reclamation will restore a mosaic of coniferous forest, open alpine tundra, rock outcrops, shrub and graminoid dominated brushland, talus slopes, wetlands and riparian areas (described in Section 15.4.3.3.1 and in the Ecological Restoration Plan, Chapter 33, Section 33.4.1.3). Most of the restored ecosystems (all aside from sparsely vegetated talus) will provide habitat for elk (i.e., food, security or thermal protection) over time. Reclamation will begin in Year 10 of Operations for limited areas and then accelerating at the end of Operations. Within five years of closure, graminoids, forbs, and some shrubs will have become established and will begin to provide food for elk, though the quality will be variable and may be limited in many areas. Food availability will progressively improve at 25 and 50 years post-closure. Forest will begin to become established at 50 years post-closure onward, especially at low elevations, and begin to provide security and thermal protection. The Project footprint is ultimately expected to be a landscape similar in structure and composition to the pre-Project landscape.

Reclaimed mining areas tend to be heavily used by elk in the Terrestrial RSA and habitat availability has likely increased (Teck Coal Limited, 2014). Elk show strong selection for grassland habitats on reclaimed mine sites in the Elk Valley, and several herds remain on mining habitats year-round (Gibson and Sheets, 1997). It is likely that elk are selecting for reclaimed mining areas partially due to the vegetation conditions, in addition to the inferred protection from predators (Olsson et al., 2007; Christianson and Creel, 2010; Sawyer, et al., 2010; Smallidge et al., 2010).

The Project footprint includes a buffer area intended to account for uncertainty in precise boundaries of disturbance. Not all of the buffer area will be disturbed, and the calculations of habitat loss are therefore conservative and may be overestimated.

Habitat degradation of ungulate habitat can occur from potential introduction and spread of invasive species, changes in vegetation vigour from dust deposition, and surface water runoff from the Project footprint that can contain suspended solids and affect vegetation. Mitigation for each of these effects was described in Chapter 13 and found to have no residual effects to each of the ecosystem VCs. Effects of habitat degradation on ungulates was therefore considered to be nil or so small in magnitude relative to direct habitat loss that it was not quantified further.

The residual effect to elk from habitat loss and degradation is characterized as follows:

- Duration: *Long-term and permanent*, as some lost habitat will be restored prior to the end of the Post-Closure phase though not fully restored after the Post-Closure phase.
- Magnitude: *Moderate*, there will be a 2.7% loss of high-quality elk habitat in spring-summer and 7.1% loss of high-quality elk habitat in fall-winter in the Terrestrial LSA due to the development of the Project footprint.
- Geographic Extent: *Discrete*, as the effect of habitat loss will be within the Project footprint only.
- Frequency: *Continuous*, the effect of habitat loss and degradation is expected to be continuous until lost habitat is restored.
- Reversibility: *Reversible long-term*, the effect of habitat loss and degradation is anticipated to begin to be reversible once the Project footprint is restored.
- Context: *High*, elk have low sensitivity and high resilience to human activities.

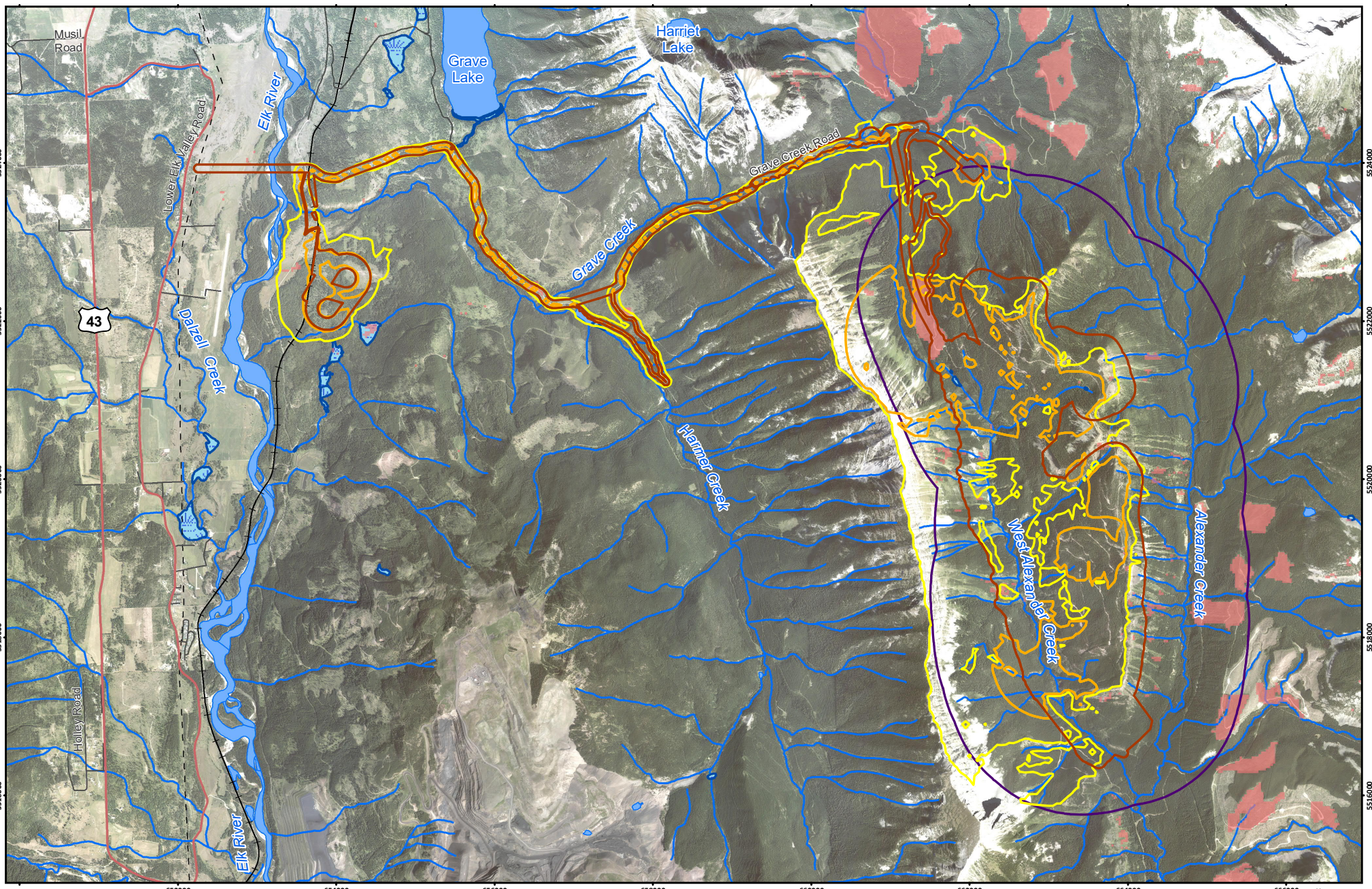
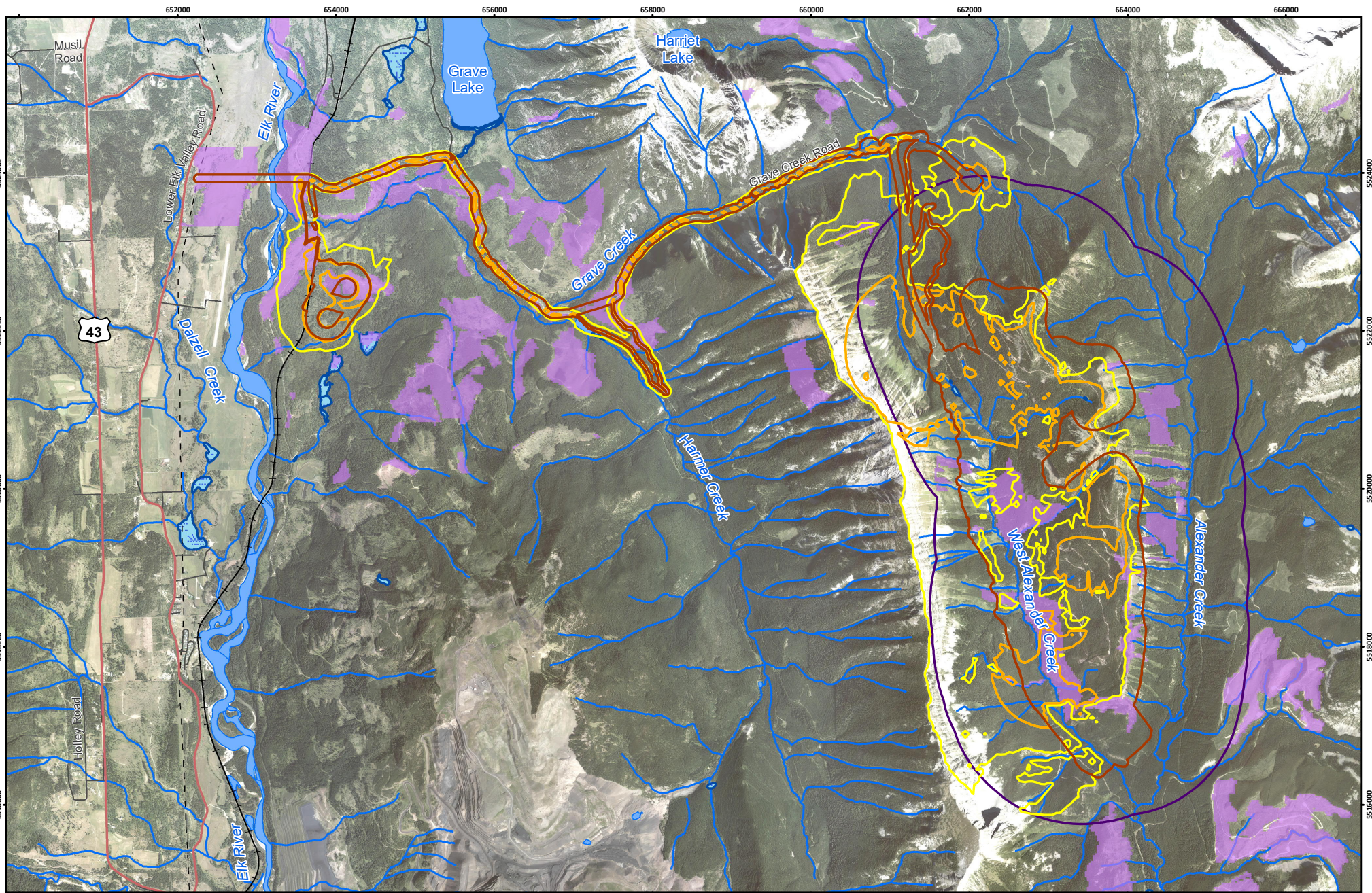
Sensory Disturbance

Elk habitat may be functionally lost or disturbed due to sensory disturbance. This is in addition to direct habitat loss from clearing. Sensory disturbance for elk includes behavioural responses to Project-related noise, vibration, light, dust, and human presence. Sensory disturbance from noise and vibration has the potential to extend further than light, dust, and human presence and is thus the focus of the residual effects assessment, for conservatism.

Continuous Project-related noise at ≥ 45 dBA (nighttime threshold) will affect up to 1,118 ha outside the Project footprint. This overlaps with up to 66 ha of high-quality fall-winter habitat and 22 ha of high-quality spring-summer habitat (Figure 15.4-18 and Table 15.4-23) when Project-related noise is at its peak in Year 10 of Operations. This represents 2.5% and 2.6% of fall-winter and spring-summer high-quality habitat in the Terrestrial LSA, respectively. A much smaller amount of high-quality habitat may be affected in daytime using the ≥ 55 dBA daytime threshold.

Peak noise from blasting could affect 74 ha of high-quality fall-winter habitat and 67 ha of high-quality spring-summer habitat (Figure 15.4-18 and Table 15.4-21). This represents 2.8% and 7.8% of fall-winter and spring-summer high-quality habitat in the Terrestrial LSA, respectively.

Elk may be displaced within the noise zones of influence. Habitat is not lost, but elk may spend less time in areas affected by noise, effectively degrading the quality of habitat or eliminating availability completely. Elk frequently habituate to human disturbance and are often associated with built-up areas and roadways and in close proximity to active mine sites if winter forage availability is high. The effect of sensory disturbance may therefore be less relative to other ungulates.



Crown Mountain Coking Coal Project

LEGEND

- High-Quality Elk Spring-Summer Habitat
- High-Quality Elk Fall-Winter Habitat
- Continuous Project Related Noise - 45 dBA Contours
- Continuous Project Related Noise - 55 dBA Contours
- Offsite Peak Noise Levels From Blasting >108 dB
- Project Footprint
- Highway
- Arterial/Collector Road
- Local/Resource Road
- Railway
- Transmission Line
- Watercourse
- Waterbody
- Wetland
- British Columbia/Alberta Border

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Kilometres

Scale 1:65,000

Map Drawing Information:
Data Provided by NWP Coal Canada Ltd, Dillon Consulting Limited, Keefer Ecological Services Ltd, Province of British Columbia GeoBC Open Data, Government of Alberta Open Data, Natural Resource Canada.
Imagery Provided by ESRI.

Map Created By: PR
Map Checked By: JM
Map Coordinate System: NAD 1983 UTM Zone 11N

Figure 15.4-18
High-Quality Elk Fall-Winter and Spring-Summer Habitat in Relation to the Project Footprint and Noise Contours



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Table 15.4-23: Area of Sensory Disturbance outside the Project Footprint and Overlapping with High-Quality Elk Habitat

Season	Zone of Influence Area (ha)	Area (ha) of High-Quality Elk Habitat Affected Outside Project Footprint	Area Affected as Proportion of High-Quality Elk Habitat in Terrestrial LSA
Continuous Project-related noise \geq 55 dBA (daytime threshold)			
Fall-Winter	242	6	0.2%
Spring-Summer		9	1.0%
Continuous Project-related noise \geq 45 dBA (nighttime threshold)			
Fall-Winter	1,118	66	2.5%
Spring-Summer		22	2.6%
Peak noise \geq 108 dB from blasting			
Fall-Winter	1,955	74	2.8%
Spring-Summer		67	7.8%

Once the Operations phase is complete, noise will substantially decrease and noise from blasting will cease. Noise during Reclamation and Closure will be from decommissioning and removal of infrastructure and reclamation activities.

The residual effect to elk from sensory disturbance is characterized as follows:

- Duration: *Long-term*, as sensory disturbance will continue through to the end of Operations and to a lesser extent in Reclamation and Closure.
- Magnitude: *Low to moderate*, up to 2.6% of high-quality habitat for continuous project-related noise and 7.8% of high-quality habitat for peak noise from blasting will be affected in the Terrestrial LSA.
- Geographic Extent: *Local*, as the effect of sensory disturbance will be outside the Project footprint and within the Terrestrial LSA.
- Frequency: *Continuous*, though at varying levels till the end of Operations, peaking at Year 10 of Operations. Noise from blasting will be intermittent.
- Reversibility: *Reversible long-term*, the effect of noise will decline substantially at the end of Operations and continue at lower levels during Reclamation and Closure.
- Context: *High*, elk have low sensitivity and high resilience to human activities.

Disruption to Movement

Elk make daily movements between habitats that provide food, security, and thermal protection and seasonal movement between mid and high elevation subalpine area in spring-summer and lower elevation valley areas in fall-winter. The Project has the potential to block both daily and seasonal movements and the disruption cannot be fully mitigated.

Known elk movement corridors in the Terrestrial LSA include:

- A north-south corridor that connects the Erickson Ridge to Sheep Mountain (Grave Creek Canyon);
- Corridors of forested habitat along the Elk River's tributaries;

- A north-south corridor along Natal Ridge;
- Corridor from Natal Ridge to Alexander Creek drainage;
- Corridor from Natal Ridge to Harmer Valley via Erickson Valley; and
- A north-south corridor that connects Alexander Creek and Michel Creek.

The north-south corridor that connects Erickson Ridge to Sheep Mountain (through Grave Creek Canyon) intersects with the access road. The access road will be upgraded and will have higher levels of daily traffic relative to existing conditions. Elk can still be attracted to roads for suitable forage and salt from application of de-icing materials. Elk were recorded along Grave Creek Road in both summer and winter. In general, roads represent a semi-permeable barrier to elk, provided that no physical barriers are created during road upgrade or unbroken snowbanks created from snow clearing. The predicted traffic level of 140 vehicles per day is unlikely to affect crossing success, especially with speed reductions in areas known to have frequent wildlife (e.g., Grave Creek Canyon) and provided that wildlife have the right-of-way. No new access roads will be created (aside from those in the pits and dump areas).

When the Project is at its largest extent and prior to any large areas of reclamation (around Year 10 of Operations), the mine site footprint will occupy a large portion of West Alexander Creek valley and will be a nearly impermeable barrier. The upper slopes of the west side of the valley will remain intact, but may be degraded by sensory disturbance and use for connectivity between daily or seasonal habitats may be reduced.

Along the conveyor, underpasses will be created by elevating the conveyor to at least 2.4 m above ground (or higher where terrain can be used to create more clearance) at intervals of two per 1,000 m. Use of the conveyor underpasses and habitats adjacent to the conveyor will be dependent on their sensitivity to the physical presence of the conveyor and the noise that is generated. The conveyor is expected to represent a semi-permeable barrier to elk.

The utility corridor is primarily composed of the powerline and the buried gas line. Suitable habitat will be present beneath the powerline after construction. The powerline may not be a barrier to movement on its own, but since it parallels the road, it may be avoided due to proximity and function as a semi-permeable barrier in combination with the road.

The residual effect to elk from disruption to movement is characterized as follows:

- Duration: *Long-term*, as some effects will continue to the end of Reclamation and Closure.
- Magnitude: *Moderate*, given the semi-permeable nature of the linear infrastructure.
- Geographic Extent: *Local*, as the effect will extend outside the Project footprint and within the Terrestrial LSA.
- Frequency: *Continuous*, as the effect will continue through Operations to Reclamation and Closure.
- Reversibility: *Reversible long-term*, the effect will decline substantially at the end of Operations and continue at lower levels during reclamation and Closure.
- Context: *High*, elk have low sensitivity and high resilience to human activities.

Increased Mortality Risk

Pathways of increased risk of mortality for elk (described in Section 15.4.3.2.3) that are unlikely to be fully mitigated are collisions with Project-related traffic on access or mine roads and increased hunter access after closure.

Even with the traffic control mitigation measures described in Section 15.4.3.3.4, vehicle collisions with elk may still occur. The number is expected to be small. Wildlife sightings and wildlife-vehicle collisions will be recorded and monitored. Further mitigation measures will be implemented to further minimize the risk of collision, if required.

The Project will involve loading of 120 trains per year. Trains will not be travelling at high speeds within the rail loadout and train-wildlife collisions in this area are unlikely. There will be an incremental increase in rail traffic on the main rail lines as a result of the Project (one additional train every three days on average) where the risk of wildlife-train collisions is higher. The extent to which the Project will contribute to an incremental increase in elk mortalities from train collisions is unknown.

The upgraded Grave Creek Road will remain open post-closure and may provide increased access to hunters. The current condition of the road is rough, though is currently accessed by 4x4 vehicles, snowmobiles, and all-terrain vehicles. Access up from Grave Creek Road to the mine site will be open to the public. The road to the explosives factory will be decommissioned and reclaimed. A change in access by hunters and leading to increased hunting of elk is difficult to predict, but an incremental increase is assumed.

The residual effect to elk from increased mortality risk is characterized as follows:

- Duration: *Long-term*, as some effects will continue to the end of Reclamation and Closure.
- Magnitude: *Low*, as elk mortalities as a result of the Project are expected to be uncommon.
- Geographic Extent: *Discrete*, as the effect will be within the Project footprint.
- Frequency: *Intermittent*, as elk mortalities may be at sporadic intervals during any phase of the Project.
- Reversibility: *Reversible long-term*, as the potential for increased mortality risk will end after Reclamation and Closure.
- Context: *High*, as any elk mortalities as a result of the Project are expected to be small relative to other sources of mortality.

Determination of Significance

The elk population trend in the East Kootenay region is stable (<20% change over the last 3 years; Government of B.C., 2017). Elk population estimates in the Rocky Mountain Trench indicate a 53% decline over the past decade (from 14,115 elk in 2007/2008 to 6,671 in 2017/2018). The population decline is poorly understood, but attributed to legal harvest of cows that was implemented in an effort to reduce conflicts on agricultural lands during 2010 to 2012, followed by poor calf recruitment during 2013 to 2017 (Gooliaff and Stent, 2018).

The Project will result in loss of only a small amount of high-quality winter habitat when elk habitat availability is most limited. Sensory disturbance has the potential to further displace elk; however, given that elk frequently habituate to human disturbance and are known to occur in close proximity to active

mine sites, the effect of sensory disturbance is likely to be small. The reclaimed mine landscape will provide high-quality elk habitat.

Based on the characterization of the residual effects and local and regional elk population levels, the Project would not limit the ability of elk to persist and maintain self-sustaining populations in the Terrestrial LSA. The residual effects of habitat loss and degradation, sensory disturbance, disruption to movement, and increased mortality risk on elk arising from the Project during all phases are therefore considered not significant.

Likelihood and Confidence

Effects that are determined to be not significant do not require a characterization of likelihood.

There is a good understanding of elk ecology, their habitat availability and distribution, known occurrences, and abundance in the Terrestrial LSA. The confidence in the determination of the significance of residual effects to elk is high.

15.4.3.4.4 Bighorn Sheep and Mountain Goat

Bighorn sheep and mountain goat were assessed for potential Project-related effects on habitat loss and degradation, sensory disturbance, disruption to movement, and increased mortality risk. Mitigation measures will contribute to avoidance, mitigation, and restoration of these effects but residual effects will remain. All four effects were therefore carried forward and a residual effects assessment is presented below. The determination of significance of adverse residual effects was completed for the combined effects of habitat loss and degradation, sensory disturbance, disruption to movement, and increased mortality risk.

Characterization of Residual Effects

Habitat Loss and Degradation

The Project footprint overlaps with high-quality bighorn sheep and mountain goat habitat (Figure 15.4-19 and Figure 15.4-20 and summarized in Table 15.4-24).

Table 15.4-24: Change in High-Quality Bighorn Sheep and Mountain Goat Habitat in the Project Footprint and Relative to the Terrestrial LSA

Season	Area (ha) of High-Quality Habitat in Project Footprint	% of Total Area of Project Footprint	Area (ha) of High-Quality Habitat in Terrestrial LSA	% of Total Area of Terrestrial LSA	Change as Proportion of Total Area of High-Quality Habitat in the Terrestrial LSA
Bighorn Sheep	202	16	6,192	26	-3.3%
Mountain Goat	50	4	2,313	10	-2.2%