The changes in abundance of moose and elk year-round in the WLSA are expected to follow a similar pattern as individuals of both species will be displaced into adjacent habitats. With the Access Control Policy and firearm prohibition by Project personnel, poaching and non-Aboriginal hunting of moose and elk will decline in the WLSA during the life of mine and may result in increased abundance of moose and elk in the areas accessible by First Nations groups.

Deer have similar habitat preferences and similar predators as moose and elk. Therefore, temporal patterns in distribution and availability of these species are expected to be similar to those described for moose and elk.

5.6.2.2 Grizzly Bear

The grizzly bear assessment results (Section 5.3.8) indicate that highly suitable grizzly habitat in the WLSA will decrease initially and then increase throughout the duration of progressive reclamation. Mortality risk also increases with project development (roads, linear features, pits and dumps, increased potential for human encounters) but then decreases with progressive reclamation. With reclamation, the Project footprint is expected to offer more suitable habitat (dietary resources) and lower mortality risk than under baseline conditions, which are anticipated to allow for an increase in the size of the grizzly population that the local area can support. Additionally, as with moose and elk, there is expected to be no poaching of grizzly during the life of mine as a result of Benga's policies.

6.0 PLANNED DEVELOPMENT CASE

The Planned Development Case (PDC) is also the cumulative effects assessment and includes the potential effects of the Project together with the combined effects of all other existing, approved, and planned projects at the regional (WRSA, GBRSA) scale.

6.1 Developments and Activities Included in Cumulative Effects Assessment

Baseline and approved projects and projects planned for the foreseeable future in the WRSA and GBRSA are summarized in Table 6.1-1. Most of the resource development currently occurring within the WRSA and GBRSA at baseline is associated with coal mining, forestry, and oil and gas activities. Other existing and approved developments and activities include various urban areas, road/rail/utility corridors, and recreational areas (including ski hills and golf courses). Several projects and activities are expected to occur in the reasonably foreseeable future including TECK Coal Michel Creek Coking Coal Project, expansion at the TECK Coal Elkview Baldy Ridge Expansion site, timber harvesting up to 2030 and beyond, Altalink Castle Rock Ridge to Chapel Rock Transmission Line, and a realignment of Highway 3 (Table 6.1-1). Including the Grassy Mountain Coal Project, planned developments will cover 11.1% (8,197.7 ha) of the WRSA (73,547.0 ha) and 6.8% (19,350.5 ha)

of the GBRSA (284,024.7 ha) (Table 6.1-2). Most of the area affected by future projects in the WRSA and GBRSA will be associated with forestry activities at Year 14 and Year 27. The Grassy Mountain Coal Project accounts for 18.6% of planned development in the WRSA and 7.9% of planned development in the GBRSA (Table 6.1-2).

Table 6.2-1 Grassy Mountain Coal Project Inclusion List: Existing, Approved and Planned (Reasonably Foreseeable) Projects using/within the Wildlife Regional Study Area and Grizzly Bear Regional Study Area

Company	Project	Existing & Approved Activity (Baseline Case)	Project (Application Case)	Planned Projects (CEA Case)
Mining Operations				
Benga Mining Limited	Grassy Mountain Coal Project		☑	
Various	Historic Mining Development ~1890 to 1990	☑		
Teck Coal Limited	Coal Mountain Operations	☑		
	Elkview Operations	☑		
	Elkview Baldy Ridge Extension			☑
	Michel Creek Coking Coal Project			☑
Timber Operations				
Crown	Operations to end of 2015	☑		
	Operations to 2025			☑
	Operations to 2030			☑
	Operations to 2041 - predicted			☑
	Operations to 2056 - predicted			☑
Oil and Gas Operations				
Devon Canada Corporation	Multiwell Gas Battery 02-19-011-03 W5M	☑		
	Compressor Station 04-13-009-04 W5M	☑		

Table 6.2-1 Grassy Mountain Coal Project Inclusion List: Existing, Approved and Planned (Reasonably Foreseeable) Projects using/within the Wildlife Regional Study Area and Grizzly Bear Regional Study Area

Company	Project	Existing & Approved Activity (Baseline Case)	Project (Application Case)	Planned Projects (CEA Case)
Harvest Operations Corp.	Burmis Gas Test Battery 12-19-007-02 W5M	☑		
HOC Energy Corp.	Single Well Gas Battery 10-07-006-02 W5M	☑		
Legacy Oil & Gas Inc.	Gas Single-Well Battery 13-35-007-03 W5M	☑		
Nova Gas Transmission Ltd.	Interconnect 01-15-008-05 W5M	☑		
	Interconnect 09-11-008-05 W5M	☑		
Shell Canada Limited	Single Well Gas Battery 10-01-006-03 W5M	☑		
	Compressor Station 06-12-006-03 W5M	☑		
	Multiwell Gas Battery 02-20-006-03 W5M	☑		
	Gas Gathering System 16-07-007-02 W5M	☑		
Misc.	Wellsites	☑		
	Access Roads	☑		
	Pipelines	☑		
Rural Development				
MD of Crowsnest Pass	Community of Coleman	☑		
	Community of Blairmore	☑		
	Community of Frank	☑		
	Community of Bellevue	☑		
	Community of Hillcrest	☑		
	Roadways, Utility Corridors & Services	☑		

Table 6.2-1 Grassy Mountain Coal Project Inclusion List: Existing, Approved and Planned (Reasonably Foreseeable) Projects using/within the Wildlife Regional Study Area and Grizzly Bear Regional Study Area

Company	Project	Existing & Approved Activity (Baseline Case)	Project (Application Case)	Planned Projects (CEA Case)
MD of Ranchlands	Roadways, Utility Corridors & Services	☑		
	Community of Maycroft	☑		
MD of Pincher Creek	Community of Burmis	☑		
	Community of Lundbreck	☑		
	Community of Cowley	☑		
	Community of Beaver Mines	☑		
	Roadways, Utility Corridors & Services	☑		
Alberta Transportation	Roadways and Transportation Corridors	☑		
	Highway 3 Re-Alignment			☑
CP Rail	Rail Lines	☑		
Altalink	Castle Rock Ridge to Chapel Rock Transmission Project			☑
Various	Recreation and Tourism Facilities	☑		

Table 6.2-2 Areal Extent of Planned Developments in the Wildlife Regional Study Area and the Grizzly Bear Regional Study Area

	WRSA		GBRSA	
Planned Development	Area (ha)	% of Total Planned Area	Area (ha)	% of Total Planned Area
Grassy Mountain Coal Project	1,520.7	18.6	1,520.7	1.9
Timber Harvest - Year 14	6,135.0	74.8	13,356.7	69.0

Table 6.2-2 Areal Extent of Planned Developments in the Wildlife Regional Study Area and the Grizzly Bear Regional Study Area

	WRSA		GBRSA	
Planned Development	**Area (ha)**	**% of Total Planned Area**	**Area (ha)**	**% of Total Planned Area**
Timber Harvest - Year 27	369.5	4.5	3,155.1	16.3
TECK Coal Michel Creek Coking Coal Project – Year 14	-	-	966.5	5.0
TECK Coal Elkview Baldy Ridge Extension – Year 27[1]	-	-	-	-
Altalink Castle Rock Ridge to Chapel Rock Transmission Project[2] – Year 27	81.0	1.0	259.5	1.3
Highway 3 Realignment - Year 27	91.5	1.1	91.5	0.5
Total	**8,197.7**	**100**	**19,350.5**	**100**

[1] Within the already-disturbed Elkview Baldy Ridge Project area

[2] Based on assumed route length of xx m and ROW of 120 m (route was not selected at time of submission of this application)

6.2 Other Future Factors and Activities

6.2.1 Climate Change

The phenomenon of global climate change (particularly a recent warming trend) has the potential to cumulatively affect wildlife worldwide (Thomas *et al.*, 2004). The effects of climate change are expected to increase over time, gradually affecting more species as their thresholds to environmental change are reached. Climate warming can increase the spatial variability of precipitation, which will likely result in increased mean annual precipitation for most of Canada (Christensen *et al.*, 2007). Drier conditions are still liable to develop if precipitation levels remain too low to offset elevated evapotranspiration levels resulting from higher temperatures (Zoltai *et al.*, 1991; Christensen *et al.*, 2007).

A warming trend will eventually lead to a higher elevation movement of the Montane and Subalpine Natural Subregions, leading to potential reduction/elimination of the Alpine Subregion. Climate change is expected to have species-specific effects. The changes to habitat may facilitate the range expansion of more generalist species like moose and deer. As predators such as wolves follow their expanding prey, increased predation on more sensitive species such as mountain goat can be expected.

6.2.2 Wildfires

Wildfire is an important natural disturbance that drives many processes within the forested Montane and Subalpine Natural Subregions. Although fire can negatively affect many species through direct mortality and habitat loss, it also has the effect of creating habitat for other species. Western toads, for example, will rapidly colonize recently burned habitat (Hossack and Corn, 2007). The Montane Natural Subregion is expected to have a shorter fire return interval and great annual disturbance from fire than the Subalpine Natural Subregion (AEP, 2012b). With the GBRSA, the Alpine areas are expected to have the longest fire return intervals and least disturbance from fire. A continued warming trend may increase the frequency of wildfires in North America, including in the GBRSA (Flannigan and Corn, 2000). It is reasonable to anticipate that wildfires will occur within the GBRSA during the life of the Project.

6.2.3 Land Use and Recreational Activities

Various land use and recreational activities occur in the GBRSA and are likely to continue in the future, including hunting, fishing and trapping, golfing, downhill skiing, and recreational ATV and snowmobile use. Access management by various Project proponents can limit access to the WLSA to authorized personnel and traditional land users, thereby reducing the hunting pressure on wildlife. Access management such as line blocking (Neufeld, 2006) may reduce the likelihood of predators following access routes to ease their travel and increase the encounter rate with prey.

6.3 Cumulative Effects Assessment

6.3.1 VC Selection

The cumulative effects assessment was conducted quantitatively (*e.g.* habitat suitability modeling, linear features density) where possible, and to provide a context for assessing potential effects on wildlife populations. Available literature and professional judgement were used to establish a conservative 20% habitat change threshold for the wildlife VCs at the regional (WRSA, GBRSA) scale (Section 3.2.5). Where sufficient quantitative information did not exist, effects ratings were based on existing literature and professional judgement, taking into consideration the results of the Application Case effects ratings, knowledge of planned developments and activities, and status of wildlife VCs and their sensitivities to disturbance. Wildlife effects related to the PDC were rated using the same key wildlife issues, spatial and temporal boundaries, and effects prediction criteria used in the Application Case assessment. As with the Application Case, Year 14 (maximum disturbance) and Year 27 (progressive reclamation) were used to determine the cumulative effects for the PDC. In assessing cumulative effects, there is typically a greater reliance on using qualitative methods and expert judgment because of the broader scope and uncertainty associated with data limitations and the likelihood that future developments occur.

Five wildlife VCs were chosen for cumulative effects assessment even though none had expected residual (post-mitigation) effects from the Project. Olive-sided flycatcher, little brown myotis, American marten, and Canada lynx were selected because they are all dependent on mature and/or old-growth forest and the predominant driver for cumulative effects in the WRSA and GBRSA over the next 30 years is timber harvest. It was believed that these four species may be particularly sensitive to loss of mature and old-growth forests in the regional area. Additionally, grizzly bear was selected because of the potential for increased mortality risk resulting from increased access at the regional level. With the exception of marten, the selected VCs for the cumulative effects assessment are federally-listed species at risk and/or have a special status designation in Alberta.

Columbia spotted frog, western toad, great gray owl, moose, and elk were screened from further consideration in the cumulative effects assessment. Although Columbia spotted frog and western toad are wetland-dependent species, wetland habitats are relatively uncommon in the WLSA and Project effects on these two species are expected to be localized and specific to the Project footprint (*i.e.* loss of breeding ponds). Both species occur elsewhere in the region, and since forestry is expected to be the main land use activity under the PDC, these species were not considered to be susceptible to regional cumulative effects. In addition, western toads have been reported to be resilient to landscapes fragmented by timber harvesting (Hab-Tech, 2012). Moose and elk are early to mid-successional species that will likely benefit from mining (post-reclamation) and forestry activities in the region. Great gray owl requires mid- to late successional coniferous or deciduous forest for nesting and early to mid-successional forests for foraging. Very little high-quality great gray owl habitat (1.4 ha) will be affected by the proposed Project (Table 5.3-4); it was therefore not included in the cumulative effects assessment.

Results from the cumulative effects assessment are summarized in Table 6.3-1 and described in Sections 6.3.2 to 6.3.6.

Table 6.3-1 Changes in Habitat Availability between the Baseline and PDC in the Wildlife Regional Study Area or Grizzly Bear Regional Study Area

Valued Component	Habitat Suitability Class	Baseline (ha)	Year 14			Year 27			Habitat Change Threshold (%)
			PDC (ha)	Change from Baseline		PDC (ha)	Change from Baseline		
				ha	%		ha	%	
Olive-sided flycatcher	High	3,868.1	5,393.6	1,525.5	39.4	5,338.2	1,470.1	38.0	-
	Moderate	18,415.5	16,836.1	-1,579.4	-8.6	16,713.6	-1,701.9	-9.2	-
	Low	19,080.0	12,816.1	-6,263.9	-32.8	12,586.5	-6,493.5	-34.0	-
	Nil	32,183.5	38,501.3	6,317.8	19.6	38,908.8	6,725.3	20.9	-
	Effective Habitat[1]	**22,283.6**	22,229.7	-53.9	-0.2	22,051.8	-231.8	-1.0	**-20**
Little brown myotis	High	2,440.0	2,420.5	-19.5	-0.8	2396.8	-43.2	-1.8	-
	Moderate	1,151.4	1,094.3	-57.0	-5.0	1,064.1	-87.2	-7.6	-
	Low	37,830.5	31,718.4	-6112.2	-16.2	31,319.7	-6,510.8	-17.2	-
	Nil	32,125.1	38,313.8	6,188.7	19.3	38,766.4	6,641.3	20.7	-
	Effective Habitat[1]	**3,591.4**	3,514.8	-76.5	-2.1	3,460.9	-130.5	-3.6	**-20**
American marten	High	19,817.1	15,748.3	-4,068.8	-20.5	15,574.0	-4,243.1	-21.4	-
	Moderate-high	1,056.1	839.2	-216.9	-20.5	849.3	-206.8	-19.6	-
	Moderate	17,853.1	15,818.8	-2,034.2	-11.4	15,513.9	-2,339.2	-13.1	-
	Moderate-low	4,796.7	4,558.5	-238.2	-5.0	4,587.9	-208.8	-4.4	-
	Low	11,966.6	17,434.4	5,467.8	45.7	18,478.6	6,512.0	54.4	-
	Nil	18,057.5	19,147.9	1,090.3	6.0	18,543.3	485.8	2.7	-
	Effective Habitat[2]	**38,726.2**	32,406.3	**-6,319.9**	**-16.3**	31,937.1	-6,789.0	**-17.5**	**-20**

Table 6.3-1 Changes in Habitat Availability between the Baseline and PDC in the Wildlife Regional Study Area or Grizzly Bear Regional Study Area

Valued Component	Habitat Suitability Class	Baseline (ha)	Year 14			Year 27			Habitat Change Threshold (%)
			PDC (ha)	Change from Baseline		PDC (ha)	Change from Baseline		
				ha	%		ha	%	
Canada lynx	High	19,827.9	15,721.8	-4,106.1	-20.7	15,602.2	-4,225.7	-21.3	-
	Moderate-high	10,115.6	8,718.1	-1,397.5	-13.8	8,573.6	-1,542.0	-15.2	-
	Moderate	1,087.3	992.4	-94.9	-8.7	986.0	-101.3	-9.3	-
	Moderate-low	13,703.1	12,777.9	-925.2	-6.8	12,629.2	-1,073.9	-7.8	-
	Low	5,511.1	5,379.2	-131.9	-2.4	5,351.1	-160.0	-2.9	-
	Nil	23,301.9	29,957.7	6,655.8	28.6	30,404.9	7,103.0	30.5	-
	Effective Habitat[2]	**31,030.8**	**25,432.2**	**-5,598.6**	**-18.0**	**25,161.8**	**-5,869.0**	**-18.9**	**-20**
Grizzly bear	Primary Sink	22,883.0	25,982.8	3,099.8	13.5	26,278.5	3,395.4	14.8	-
	Secondary Sink	18,683.9	15,472.4	-3,211.5	-17.2	15,221.6	-3,462.3	-18.5	-
	Non-critical Habitat	33,486.0	33,499.2	13.1	0.0	32,660.0	-826.0	-2.5	-
	Secondary Source	39,908.3	32,993.6	-6,914.8	-17.3	32,690.4	-7,217.9	-18.1	-
	Primary Source	35,078.6	42,106.1	7,027.6	20.0	43,189.2	8,110.6	23.1	-
	Effective Habitat[3]	**74,986.9**	**75,099.7**	**112.8**	**0.2**	**75,879.6**	**892.7**	**1.2**	**-20**

[1.] Effective Habitat = High plus moderate habitat suitability classes; WRSA

[2.] Effective Habitat = High plus moderate-high plus moderate habitat suitability classes; WRSA

[3] Effective Habitat = Primary source plus secondary source habitat suitability classes; GBRSA

6.3.2 Olive-sided Flycatcher

6.3.2.1 Change in Habitat Availability

Cumulative effects on the area of effective habitat for olive-sided flycatchers in the WRSA will be minimal. In Year 14, approximately 53.9 ha (0.2%) of effective habitat will be lost, increasing to 231.8 ha (1%) by Year 27 (Table 6.3-1, Figures 6.3-1-6.3-3). This is below the 20% habitat loss threshold adopted by Benga for this assessment (*i.e.* it is assumed that species can tolerate up to a 20% loss of habitat at a broad regional scale). Most effective habitat loss for olive-sided flycatchers will be of moderate-quality habitat. The predicted area of high-quality habitat will increase in the PDC as forestry activities increase the area of edge habitat (*i.e.* where forested areas meet non-forested areas), which is often preferred by olive-sided flycatchers (Appendix C, Section 2.4).

A temporary indirect loss of habitat may occur as a result of sensory disturbances (*e.g.* vehicular traffic, heavy equipment, *etc.*) in the vicinity of the Project footprint and active forest cutblocks. These effects were incorporated into the olive-sided flycatcher habitat suitability model, as habitats surrounding noisy disturbances were rated as nil-quality.

The cumulative effects on olive-sided flycatcher habitat availability are predicted to be nil in magnitude and neutral, due to the increase in high-quality habitat (*i.e.* edge habitat) that will result from forestry activities. The confidence rating associated with these predictions is high, and the changes are predicted to be not significant at the regional level.

6.3.2.2 Change in Movement

As olive-sided flycatchers are highly mobile and are capable of migrating very long distances, neither Project development nor any of the planned projects in the WRSA are likely to present major barriers to movements. Olive-sided flycatchers do not rely on forest interior habitats, preferring to forage along habitat edges (Betts *et al.*, 2010). Thus, forest fragmentation resulting from forestry activities is not predicted to negatively affect olive-sided flycatchers.

The magnitude of the cumulative effects on movement is predicted to be nil and the proposed Project contribution is predicted to be nil. The confidence rating associated with these predictions is high.

6.3.2.3 Change in Mortality Risk

After mitigation, the development of the proposed Project is unlikely to result in an increased mortality risk for olive-sided flycatchers (Section 5.3.3.3). The same is true for the realignment of Highway 3. However, timber harvest may increase the risk of mortality for olive-sided flycatcher nestlings if trees are cut down before young birds have fledged from the nest. Recently harvested areas can act as "ecological traps" for olive-sided flycatchers that nest adjacent to habitats that been

harvested and subsequently suffer from high rates of nest predation (Robertson and Hutto, 2007). Predators of olive-sided flycatcher nests and nestlings, such as common ravens and gray jays, may increase in abundance in harvested forests (Robertson and Hutto, 2007).

Cumulative effects for olive-sided flycatcher mortality risk are predicted to be regional in extent, long in duration, continuous in frequency, reversible in the long term, and low in magnitude. The probability of occurrence is predicted to be moderate and the changes are predicted to be not significant. Changes are predicted to be long term and continuous because of the potential increases in the population sizes of nest predators that may occur following forest harvest. The confidence rating associated with these predictions is moderate, as it is difficult to predict the magnitude of the predicted increase in nest predators and the magnitude of the effect it may have on olive-sided flycatcher populations. The contribution of the planned developments to changes in olive-sided flycatcher mortality risk will be negative.

6.3.2.4 Change in Abundance

Of the planned development activities for the WRSA, forestry will have the largest effect on olive-sided flycatcher abundance. It is difficult to predict the precise effects of forestry on olive-sided flycatcher populations because they often breed in selectively-harvested forests or in forests bordering clear cut areas and nest success is often lower in such habitats (Robertson and Hutto, 2007). Forestry activities may also result in the destruction of olive-sided flycatcher nests or nestlings, which will result in temporary decreases in the abundance of flycatchers.

The cumulative effects on olive-sided flycatcher abundance are predicted to be regional in extent, long in duration, continuous in frequency, reversible in the long term, low in magnitude, and not significant. The proposed Project contribution to these changes will be nil, although the contribution of other planned activities (primarily forestry) will be negative. The probability of occurrence is moderate and the confidence rating associated with these predictions is moderate, because although there will be an increase in high-quality habitat for olive-sided flycatchers, nest success may be low.

6.3.3 Little Brown Myotis

6.3.3.1 Change in Habitat Availability

Very little high or moderate-quality little brown myotis roosting habitat will be affected by the planned developments in the WRSA (Table 6.3-1, Figures 6.3-4 to 6.3-6). By Year 14, approximately 19.5 ha (0.8%) of high-quality and 57.0 ha (5%) of moderate-quality habitat will be lost in the WRSA. By Year 27, this will increase to a loss of 43.2 ha (1.8%) of high-quality habitat and 87.2 ha (7.6%) of

moderate-quality habitat. Indirect habitat loss (*i.e.* bats avoiding areas where they may be disturbed by noise) was incorporated into the habitat suitability model.

The cumulative effects on roosting habitat availability for little brown myotis are predicted to be regional, extended in duration, continuous in frequency, reversible in the long term, and low in magnitude. The effects are predicted to be extended in duration because old deciduous trees are most likely to provide high-quality little brown myotis roosting habitat (see Appendix C, Section 2.6) and once such trees are removed, it can take many decades (and up to a century) for suitable roosting trees to regrow. The confidence rating associated with these predictions is moderate, because little brown myotis may also roost in abandoned buildings, the availability of which could not be modelled. The probability of occurrence is moderate and the changes are predicted to be not significant at the regional level, as less than 20% of effective roosting habitat will be affected by planned developments.

6.3.3.2 Change in Movement

Planned development activities in the WRSA are unlikely to negatively affect habitat connectivity and movement for little brown myotis. This species will frequently travel and forage along the edges of clear cuts and in forest gaps (Patriquin and Barclay, 2003; COSEWIC, 2013). Commuting bats may avoid areas with high levels of anthropogenic noise and artificial lights (such as highways or industrial sites). Little brown myotis are most active at night when levels of anthropogenic noise are generally lower.

The magnitude of cumulative effects on movement for little brown myotis is predicted to be nil, and the confidence rating associated with this prediction is high.

6.3.3.3 Change in Mortality Risk

Significant increases in mortality risk to little brown myotis are unlikely to occur as a result of the development of the proposed Project or the Highway 3 realignment. Timber harvesting is also unlikely to result in significant bat mortality, unless a tree being used as a maternity roost is removed. Mortality from this risk is expected to be low and infrequent.

Cumulative effects on mortality risk for little brown myotis are predicted to be regional in extent, short in duration, occasional in frequency, reversible in the short term, and low in magnitude. The cumulative effects are predicted to be negative, the probability of occurrence is low, and the effects are not significant. The confidence rating associated with this prediction is moderate because it is difficult to predict if and to what degree forestry activities will alter little brown myotis mortality risk.

6.3.3.4 Change in Abundance

Changes in abundance are most likely to be correlated with losses in roosting habitat. As a result, cumulative effects on abundance will be regional, extended in duration and long-term (due to a loss of suitable roosting trees), negative, and low in magnitude. The effects are predicted to be not significant at the regional level. The confidence level associated with these predictions is moderate and the probability of occurrence is moderate.

6.3.4 American Marten

6.3.4.1 Change in Habitat Availability

The primary effect to American marten is loss of preferred forest habitats. By Year 14, 6,319.9 (16.3%) of effective American marten habitat in the WRSA is predicted to be lost and by Year 27, 6,789 ha (17.5%) of effective habitat will be lost (Table 6.3-1, Figures 6.3-7 to 6.3-9). The habitat suitability model for American marten incorporated indirect habitat losses resulting from sensory disturbances. The majority of habitat loss (approximately 90.4%) is expected to be a result of planned forestry activities, which can be mitigated if patches of coarse woody debris are left on the landscape, and AEP recommends retaining some debris on a harvested landscape to enhance furbearer and microtine habitat (ASRD, 2006).

The cumulative effects on habitat availability in the WRSA are predicted to be regional in extent, extended in duration, continuous in frequency, reversible in the long term, and low in magnitude. They are predicted to be extended and reversible in the long term because of the marten's preference for mature to old-growth forests, which will take many decades to regrow from reclaimed and reforested landscapes. Although American martens prefer mature to old-growth forests, they are sometimes found in recently harvested forests (Mowat, 2006). The confidence rating associated with this prediction is high and the probability of occurrence is high, as numerous studies have demonstrated that American martens prefer mature, coniferous forests (Appendix C, Section 2.7). As less than 20% of effective American marten habitat will be lost at the regional scale, the changes are predicted to be not significant.

6.3.4.2 Change in Movement

Planned development will result in increased fragmentation of American marten habitat, primarily because of forestry activities. Under baseline conditions, there is a large amount of contiguous high-quality American marten habitat in the north-central and southwest sections of the WRSA (Figure 6.3-7). At Year 27, these areas of high-quality habitat will be interspersed with low-quality habitat patches (Figure 6.3-9), primarily composed of recently harvested forests. American martens generally avoid moving through open habitats, such as recent cutblock. As shrubs become re-

established, martens are likely to begin moving through these areas again. It will take several decades for regenerating forests to develop into high-quality American marten habitat.

Highway 3 bisects the WLSA which may restrict north-south movements for American martens. Within the PDC, there are plans to realign Highway 3 and wildlife crossing structures have been proposed as part of that development (Black, 2014). Should the wildlife crossings be constructed, movement of marten populations between the north and south sides of Highway 3 may be improved under the PDC.

The cumulative effects on American marten movement resulting from habitat fragmentation and Project effects on habitat connectivity are predicted to be regional in extent, extended in duration, continuous in frequency, reversible in the long term, and low in magnitude. They are predicted to be extended in duration and reversible in the long term because of the long periods of time required for reclaimed or reforested areas to re-mature into high-quality American marten habitat. The cumulative effects are predicted to be negative overall, and the probability of occurrence is high. The effects are predicted to be not significant and the confidence rating associated with these predictions is high.

6.3.4.3 Change in Mortality Risk

Significant cumulative effects on American marten mortality risk are unlikely to occur. American marten appear to avoid roads (Appendix C, Section 2.7) and therefore the risk of collisions with vehicles is low. Various mitigation measures will be implemented by Benga to minimize wildlife mortality within the Project footprint (Section 7.0). Isolated instances of mortality resulting from timber harvesting may occur if a tree containing non-mobile American marten kits is removed.

Increases in trapper effort and success may occur as access to previously remote areas increases from forestry and other planned developments that create linear access features such as cutlines, access roads, *etc*. Access to remote areas in the WRSA under baseline conditions is generally good due to the presence of existing trails and forestry roads and planned developments are therefore unlikely to result in significant increases in marten trapping mortality. Trapping in Alberta is regulated and marten trapping throughout the province is generally sustainable.

Any cumulative effects on American marten mortality risk are likely to be regional in extent, short in duration, isolated in frequency, reversible in the short term, low in magnitude, and negative in direction. The confidence rating associated with these predictions is high, the probability of occurrence is low, and any effects are likely to be not significant.

6.3.4.4 Change in Abundance

Cumulative effects on American marten abundance may result in small decreases because of the increased habitat fragmentation and habitat loss that will occur under the PDC scenario. Multiple studies have found negative correlations between American marten abundance, habitat loss and habitat fragmentation (Appendix C, Section 2.7). However, martens will utilize clearcuts and non-forested habitat types if they contain structure in the form of young or regenerating deciduous or conifer vegetation and may tolerate much higher levels of fragmentation and forest loss under these circumstances (Steventon and Major 1982, Katnik 1992, Potvin and Breton 1997). For instance, Soutiere (1979) found that marten continued to use areas with up to 60% of the forested area removed, although population levels were lower than in undisturbed areas. Marten home ranges have been found to contain up to 50% clearcut forest (Steventon and Major 1982). Under baseline conditions, 62.6% of the WRSA is forested, although much of the non-forested land occurring in the WRSA remains in a natural (*i.e.*, grassland, open water, rock barren) or semi-natural (*i.e.*, pasture) state. As such, marten populations may naturally occur at low density in the WRSA under baseline conditions. With mitigation, progressive reclamation, and use of acceptable forestry practices in the WRSA, marten populations are expected to be able to tolerate the additional proposed habitat losses and fragmentation under the PDC scenario. The majority of further loss and fragmentation of American marten habitat will be a result of forestry activities (approximately 90% of total). The proposed mine plan aims to maximize the aggregation of disturbances, which will in turn retain the largest amount of interior forest habitat for marten in the WRSA.

With mitigation, cumulative effects on marten abundance in the WRSA are predicted to be regional in extent, extended in duration, continuous in frequency, reversible in the long term, and low in magnitude. They are predicted to be negative, the probability of occurrence is moderate, and the effects are not significant. The confidence rating associated with these predictions is moderate, due to a lack of information on American marten density at the regional scale under baseline conditions.

6.3.5 Canada Lynx

6.3.5.1 Change in Habitat Availability

Cumulative effects in the WRSA are predicted to result in a net loss of effective winter habitat for Canada lynx (Table 6.3-1; Figures 4.4-8, 6.3-10, and 6.3-11). By Year 14, approximately 5,598.6 ha (18%) of effective lynx winter habitat will be lost from the WRSA. Most of this loss will be high-quality (4,106.1 ha) habitat. By Year 27, 5,869 ha (18.9%) of effective Canada lynx winter habitat will be lost from the WRSA. Most of the habitat losses (90.4%) will be associated with planned forestry activities in the WRSA.

Benga Mining adopted a precautionary approach for assessing habitat change, and used a conservative threshold of 20% (*i.e.* a species will tolerate up to a 20% loss of effective habitat at the regional scale) for valued species at the regional level. The area of effective winter habitat loss for Canada lynx by Year 27 is slightly below this threshold level. Canada lynx are expected to persist in the WRSA, although they may avoid highly disturbed areas, such as recently harvested forest blocks (Squires *et al*., 2010). Forest cutblocks are not expected to benefit lynx until approximately 20 years after clearing when snowshoe hare densities (their major prey species) are expected to increase in abundance (Koehler, 1990). Habitat losses associated with forestry activities are expected to be temporary. Because of their ability to disperse long distances and their good reproductive potential (Poole, 2003), lynx in the region are likely to recolonize disturbed areas as they mature.

The cumulative effects on Canada lynx habitat availability are predicted to be regional in extent, extended in duration, continuous, reversible in the long-term, low in magnitude, and negative. The effects are considered reversible in the long term and extended in duration because harvested forests will regenerate and areas disturbed by the proposed Project will be reclaimed. However, it may take up to 20 years for cleared areas to mature into suitable lynx habitat. The confidence level associated with these predictions is high and the probability of occurrence is high, as forestry and mining activities will temporarily decrease the availability of Canada lynx habitat. As the area of effective habitat lost will be lower than 20%, the cumulative effects on lynx habitat availability predicted to be not significant.

6.3.5.2 Change in Movement

Currently, the primary barrier to movement of Canada lynx in the WRSA is Highway 3 and this is not expected to change much under the PDC. Highway 3 is still likely to affect north-south connectivity for wildlife populations in the region. The planned realignment of Highway 3 has the potential to improve north-south connectivity for wildlife in the region if wildlife crossings are incorporated into the project. Biologists have proposed that crossing structures be added to Highway 3 in the Crowsnest Pass in order to reduce wildlife-vehicle collisions and improve connectivity between wildlife populations to the north and south of the highway (Black, 2014).

Canada lynx are also likely to avoid other areas in the region where heavy equipment is active, such as areas where trees are being harvested. Lynx are likely to resume travel through cleared areas after harvesting has ceased. Recently harvested areas may also attract snowshoe hares, the lynx's primary prey, and may be used for hunting, particularly during summer. During winter, lynx prefer to hunt in coniferous forests (Squires *et al*., 2010).

Cumulative effects on Canada lynx movement as a result of planned development activities in the WRSA are predicted to be regional in extent, extended in duration, continuous, reversible in the long-

term, low in magnitude, and negative. The effects are considered reversible, as Canada lynx are likely to begin to travel through the Project area following mitigation and through harvested areas once work in them ceases. The confidence level associated with these predictions is high and the probability of occurrence is high, as Canada lynx are known to avoid areas with high levels of human activity. Changes in movement are predicted to be not significant although north-south connectivity may be improved by the inclusion of wildlife overpasses as part of the planned twinning of Highway 3.

6.3.5.3 Change in Mortality Risk

Significant cumulative effects on Canada lynx mortality risk are unlikely to occur. Canada lynx appear to avoid the area within approximately 5 km of Highway 3 (Apps *et al.*, 2007) and are therefore unlikely to be hit by vehicles travelling on the highway. Increases in mortality resulting from increases in trapper effort and success are also unlikely to occur under the PDC (see Section 5.3.3.3). The magnitude of cumulative effects on Canada lynx mortality is nil, and the effects are predicted to be not significant. The confidence rating associated with this prediction is high.

6.3.5.4 Change in Abundance

As noted in Section 6.3.4.1, Canada lynx are likely to persist in the WRSA along with the planned developments, although they may avoid recently disturbed areas, such as cutblocks and the Project footprint during the construction and operations phases. At Year 27, there will be 25,161.8 ha of effective Canada lynx habitat in the WRSA, and 15,602.2 ha of this will be of high-quality habitat (Table 6.3-1, Figures 4.4-8, 6.3-10, and 6.3-11). Large patches of high-quality habitat are located north and northwest of the Project footprint, and south of Highway 3. Canada lynx also have good dispersal abilities and are capable of recolonizing harvested and reclaimed areas as early seral stages mature and snowshoe hare populations increase.

The cumulative effects on Canada lynx abundance are predicted to be regional in extent, extended in duration, continuous in frequency, reversible in the long term, and of low magnitude. They are predicted to be extended and continuous because Canada lynx generally avoid recently harvested areas and open habitats. They will likely resume use of reclaimed areas after approximately 20 years. The changes are likely to be low in magnitude as less than 20% of lynx habitat will be affected and no significant changes in mortality risk are predicted. The confidence rating associated with these predictions is high, the probability of occurrence is moderate, and the changes are likely to be not significant.

6.3.6 Grizzly Bear

6.3.6.1 Change in Habitat Availability

Under the PDC scenario, increases of 112.8 ha (0.2%) and 892.7 ha (1.2%) in effective grizzly bear habitat in the GBRSA are predicted for Year 14 and Year 27 compared to baseline conditions (Table 6.3-1). These increases will largely be related to reclamation of the Project footprint and forestry activities. Grizzly bears frequently forage in newly regenerating forests, including recent cutblocks since these habitats can provide abundant food including insects, berries, *Hedysarum* roots, and forbs (Nielsen *et al*., 2004).

The cumulative effects are likely to be short-term indirect habitat losses associated with sensory disturbances, as grizzly bears frequently avoid areas with high levels of human activities (Gibeau *et al*., 2002; Linke *et al*., 2003). Grizzly bears will likely avoid the Project footprint and active timber harvesting areas. It is expected that with the cessation of these activities, grizzly bears will likely begin to use the disturbed habitats again.

The cumulative effects on grizzly bear habitat availability in the GBRSA are predicted to be regional in extent, and positive because of a predicted increase in early seral-stage habitats. Since the increases are predicted to be relatively small, the magnitude of the change will be low. The duration of impact is predicted to be long, the frequency continuous, and not significant. As the cumulative effects are positive, no predictions regarding the ability for recovery are presented. The probability of occurrence of the changes is high and the confidence rating for these predictions is high.

6.3.6.2 Change in Movement

Long-term and significant cumulative effects on grizzly bear movements at the regional scale are unlikely to occur. Grizzly bears frequently avoid areas affected by high levels of human activity, and are likely to avoid active mine sites, Highway 3, and active forestry areas. Once mining and forestry activities have ceased, grizzly bears are likely to begin using the disturbed habitats again. Grizzly bears will often travel and forage in recently reclaimed areas (see Section 6.3.5.1). Benga will incorporate wildlife crossing structures to the proposed coal conveyor which will improve habitat connectivity in the area south of the active mine site (see Section 7.0 for details). The north-south connectivity may also be improved by the inclusion of wildlife overpasses as part of the planned twinning of Highway 3 (see Section 6.3.3.2).

The magnitude of cumulative effects on habitat fragmentation and movement for grizzly bears is predicted to be nil in magnitude and not significant. The probability of effects occurring is low and the confidence rating is high.

6.3.6.3 Change in Mortality Risk

By Year 14 of the PDC scenario, there will be a 3,099.8 ha (13.5%) increase in grizzly bear primary sink habitat (high quality habitat with high human-caused mortality risk) and a 3,211.5 ha (17.2%) reduction in grizzly bear secondary sink habitat (moderate quality habitat with high mortality risk) (Table 6.3-1). By Year 27, it is predicted that primary and secondary sink habitats will increase by 3,395.4 ha (14.8%) and decrease by 3,462.3 ha (18.5%), respectively (Table 6.3-1). The increases in primary sink habitats indicate that there could be increased risk of grizzly bear human-caused mortalities in Years 14 and 27. These risks are expected to be related to an increased potential for human-grizzly bear encounters resulting from collisions with vehicles and trains, and perhaps from poaching.

At the local level, Benga will take several steps to reduce the mortality risk for grizzly bears in the area. These include enforcing a speed limit on the access road, limiting public access and prohibiting use of firearms within the Mine Permit Boundary, and decommissioning roads and trails (see Section 5.3.8.3 and Section 7.0 for details). These and other best management practices appear to be effective in minimizing grizzly bear mortalities, as no grizzly bear mortality on mine permit lands have occurred in west-central Alberta (where there are numerous coal mines) over a period of 40 years (Symbaluk, 2008).

The Alberta Grizzly Bear Recovery Plan (2008) also lists several best management practices that can be implemented at a regional scale to reduce the mortality risk to grizzly bears. Some of these include limiting intensive human activity to seasons when bears are inactive, decommissioning access roads when they are no longer used, and implementing "BearSmart" plans to reduce the risk of bear-human encounters.

The cumulative effects on grizzly bear mortality risk are predicted to be nil in magnitude, neutral, and not significant. As a result, no predictions regarding the geographic extent, duration, frequency, or ability for recovery will be presented here. The probability of cumulative effects occurring is low and the confidence rating is moderate, as these predictions rely on the assumption that foresters will follow practices intended to minimize grizzly bear mortality risk.

6.3.6.4 Change in Abundance

As no negative cumulative effects on grizzly bear habitat availability or mortality risk are anticipated to occur in the GBRSA, no significant changes in grizzly bear abundance are predicted to occur. The magnitude of the cumulative effects on grizzly bear mortality risk is predicted to be nil and the effects neutral. As a result, no predictions regarding the geographic extent, duration, frequency, or ability for recovery will be presented here. The probability of any effects occurring is low and the confidence rating is moderate, as these predictions rely on the assumption that regional mitigation measures

outlined for the Project (Section 7.0) and in the Alberta Grizzly Bear Recovery Plan (2008) are implemented successfully.

6.4 Summary of Cumulative Effects

Adverse effects on the persistence of wildlife populations (habitat loss, habitat fragmentation and connectivity, mortality risk, and abundance) during all phases of the Project will be minimized by implementing the Project design features and mitigation measures described in the Wildlife Mitigation and Monitoring (Section 7.0) and the Conservation & Reclamation Plan (see Application (Benga, 2015), Section F). The incremental effects of the Project to wildlife populations are small and no significant cumulative effects to wildlife population persistence are predicted (Table 6.4-1). Benga is committed to fulfilling their responsibilities to mitigate Project effects throughout the construction, development and reclamation phase and collaboratively participating in any regional initiatives with regulators, stakeholders (*e.g.* public, First Nations) and other industry partners to minimize the effects of resource development on wildlife.

Table 6.4-1 Summary of Residual Cumulative Effects Ratings for the Planned Development Case

Wildlife VC	Geographic Extent[1]	Duration[2]	Frequency[3]	Reversibility[4]	Magnitude[5]	Direction[6]	Confidence Rating[7]	Probability of Occurence[8]	Significance[9]
Change in Habitat Availability									
Olive-sided flycatcher	N/A[10]	N/A[10]	N/A[10]	N/A[10]	Nil	Neutral	High	N/A[10]	Not Significant
Little brown myotis	Regional	Extended	Continuous	Long term	Low	Negative	Moderate	Moderate	Not Significant
American marten	Regional	Extended	Continuous	Long term	Low	Negative	High	High	Not Significant
Canada lynx	Regional	Extended	Continuous	Long term	Low	Negative	High	High	Not Significant
Grizzly bear	Regional	Long	Continuous	N/A[11]	Low	Positive	High	High	Not Significant
Change in Habitat Fragmentation/Connectivity									
Olive-sided flycatcher	N/A[10]	N/A[10]	N/A[10]	N/A[10]	Nil	Neutral	High	N/A[10]	Not Significant
Little brown myotis	N/A[10]	N/A[10]	N/A[10]	N/A[10]	Nil	Neutral	High	N/A[10]	Not Significant
American marten	Regional	Extended	Continuous	Long term	Low	Negative	High	High	Not Significant
Canada lynx	Regional	Extended	Continuous	Long term	Low	Negative	High	High	Not Significant
Grizzly bear	N/A[10]	N/A[10]	N/A[10]	N/A[10]	Nil	Neutral	High	Low	Not Significant
Change in Mortality Risk									
Olive-sided flycatcher	Regional	Long	Continuous	Long term	Low	Negative	Moderate	Moderate	Not Significant
Little brown myotis	Regional	Short	Occasional	Short term	Low	Negative	Moderate	Low	Not Significant
American marten	Regional	Short	Isolated	Short term	Low	Negative	High	Low	Not Significant
Canada lynx	N/A[10]	N/A[10]	N/A[10]	N/A[10]	Nil	Neutral	High	N/A[10]	Not Significant

Table 6.4-1 Summary of Residual Cumulative Effects Ratings for the Planned Development Case

Wildlife VC	Geographic Extent[1]	Duration[2]	Frequency[3]	Reversibility[4]	Magnitude[5]	Direction[6]	Confidence Rating[7]	Probability of Occurence[8]	Significance[9]
Grizzly bear	N/A[10]	N/A[10]	N/A[10]	N/A[10]	Nil	Neutral	Moderate	Low	Not Significant
Change in Abundance									
Olive-sided flycatcher	Regional	Long	Continuous	Long term	Low	Negative	Moderate	Moderate	Not Significant
Little brown myotis	Regional	Extended	Continuous	Long term	Low	Negative	Moderate	Moderate	Not Significant
American marten	Regional	Extended	Continuous	Long term	Low	Negative	Moderate	Moderate	Not Significant
Canada lynx	Regional	Extended	Continuous	Long term	Low	Negative	High	Moderate	Not Significant
Grizzly bear	N/A[10]	N/A[10]	N/A[10]	N/A[10]	Nil	Neural	Moderate	Low	Not Significant

[1] Local, Regional, Provincial, National, Global

[2] Short, Long, Extended, Residual

[3] Continuous, Isolated, Periodic, Occasional

[4] Reversible in short term, Reversible in long term, Irreversible – rare

[5] Nil, Low, Moderate, High

[6] Neutral, Positive, Negative

[7] Low, Moderate, High

[8] Low, Medium, High

[9] Not Significant, Moderate, Significant.

[10] No effects are predicted to occur.

[11] Predicted effects are positive in magnitude