

Castle Area Forest Land Use Zone: Linear Disturbances, Access Densities and Grizzly Bear Habitat Security Areas

By:

Peter Lee

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This is the second of several publications by Global Forest Watch Canada in celebration of the International Year of Forests.

This report examines linear disturbances in the Castle Area Forest Land Use Zone of southwestern Alberta and analyzes these disturbances for

- their use by motorized vehicles;*
- the Government of Alberta's management and policy intentions compared to actual use by motorized vehicles;*
- their potential impact on key grizzly bear areas.*

We note the following key results:

- 1. The total length of linear human disturbances in the Castle area FLUZ is 1,283 km (1.3 km/km²).*
- 2. The linear disturbance density averages more than double the Alberta Grizzly Bear Recovery Plan's recommended threshold of 0.6 km/km² and more than triple the threshold in several watersheds and within several important grizzly bear areas.*
- 3. The Castle Area Forest Land Use Zone portion of the larger Castle Grizzly Bear Core Conservation Area is not secure for grizzly bears according to thresholds for disturbances in core habitat – only small fragments of it are secure.*
- 4. The Castle Area Forest Land Use Zone is not being managed according to its mandate, regulations or stated purpose. Access is not being controlled, and is a threat to all other public values of this area.*
- 5. Alberta Government information on the monitoring of human uses in the Castle area, especially motorized vehicle use, either does not exist, or is not made publicly available.*



Castle Area Forest Land Use Zone (Alberta): Linear Disturbances, Access Densities and Grizzly Bear Habitat Security Areas

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We acknowledge the tremendous amount of information on Alberta grizzly bears published by many professional bear biologists and supported by many organizations and agencies such as Alberta Sustainable Resource Development, Alberta Conservation Association, Castle-Crown Wilderness Coalition, and Foothills Model Forest.



Linear disturbances and clearcuts in the upper West Castle River. Similar disturbances are increasingly common in the Castle area. (October 5/6 2010)



A dense network of well-developed off-highway vehicle trails like this lead into and through critical grizzly bear habitat. (October 5/6 2010)



A gate constructed in the middle of an open field does not restrict off-highway vehicles. Closure is not enforced. (October 5/6 2010)

Executive Summary

Ecological importance of the Castle area

- It is located within the Montane Natural Sub-Region of Alberta a sub-region comprising less than 1% of the land area of Alberta. The montane is disproportionately important for the conservation of biological diversity.
- The Castle area is biologically rich, containing for examples: half of Alberta's vascular plant species, half of them rare; the majority of Alberta's butterfly species; substantial populations of relatively pure, unhybridized westslope cutthroat trout; rare mammals, birds, fish, reptiles and amphibians.
- The Castle area receives more precipitation than any other comparably sized area in Alberta. Encompassing less than 4% of the total land area of the Oldman River Basin, it supplies an exceptional 30% of the annual water flow for the entire Basin. The basin encompasses much of southern Alberta and extends into northern Montana; consisting of 70 municipalities in Alberta, including the City of Lethbridge;
- The Castle area contains large areas of Prime Protection and Critical Wildlife Zones.
- The Alberta Government's Environmentally Significant Area assessments have rated landscapes of the Castle area as provincially and nationally ecologically significant.
- The Castle area is also an integral part of the international Crown of the Continent ecosystem.
- The Castle area is located within and is a subset of the Castle Grizzly Bear Core Conservation Area.
- Under its Special Places program, the Alberta Government announced the establishment of the Castle Area Forest Land use Zone in 1998 and described the announcement as a "*Milestone reached in preserving Alberta's Natural Heritage.*" Special Places was the Government of Alberta's protected areas policy.

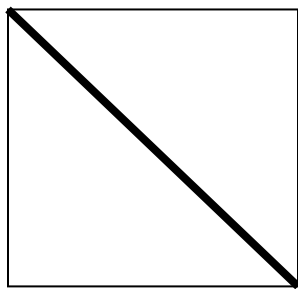
Purpose of this study

This study examined the extent of linear disturbances within the Castle Area Forest Land use Zone of south-western Alberta and analyzed these disturbances in terms of:

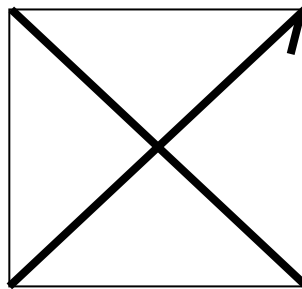
- their use by motorized vehicles;
- Alberta Government's management and policy intentions of motorized vehicle use compared to actual use, and;
- potential impact on grizzly bear habitat security areas and on the Alberta Grizzly Bear Recovery Plan objective of open route densities.

Key findings

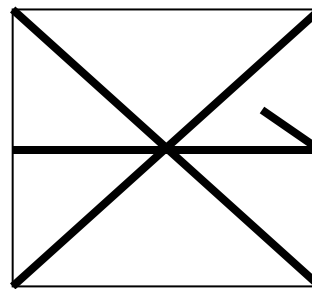
1. The total length of linear disturbances within the 1,003 km² Castle Area Forest Land Use Zone is 1,283 km.
2. The density of linear disturbances is 1.3 km / km² and one of the larger watersheds has a linear disturbance density exceeding 2.0 km / km².
3. The linear disturbance density averages more than double the Alberta Grizzly Bear Recovery Plan's recommended threshold of 0.6 km/km² and more than triple the threshold in several watersheds and within several important grizzly bear areas.



Maximum linear disturbance density recommended by the Alberta Government's grizzly bear recovery plan



Overall linear disturbance density of the Castle Area Forest Land Use Zone.



Linear disturbance density of several watersheds in the Castle Area Forest Land Use Zone.

4. There is almost double the amount of linear disturbance access points being used by motorized vehicles than have been authorized by the Alberta Government.
5. In 1998, when the Alberta Government announced the Castle area as a protected area under their Special Places program, there was already a density of linear disturbances that substantially exceeded recommended thresholds for grizzly bears. Since then, there are an estimated 81 km of new anthropogenic disturbances. Additional disturbances will occur following Alberta Government-approved commercial logging, which will entail new roads.
6. The Castle Area Forest Land Use Zone portion of the larger Castle Grizzly Bear Core Conservation Area is not secure for grizzly bears according to thresholds for disturbances in core habitat – only small fragments of it are secure.
7. The Castle Area Forest Land Use Zone is not being managed according to its mandate, regulations or stated purpose. Access is not being controlled, and is a threat to all other public values of this area.
8. Alberta Government information on the monitoring of human uses in the Castle area, especially motorized vehicle use, either does not exist, or is not made readily publicly available.

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Section 1. Introduction

Purpose

This report examines the extent of linear disturbances within the 1,003 km² Castle Area Forest Land Use Zone of south-western Alberta and analyzes these disturbances in terms of:

- their use by motorized vehicles;
- the Alberta Government's management and policy intentions of this area in regards to motorized vehicle use, compared to actual use, and;
- potential impact on grizzly bear habitat security areas and on the Alberta Grizzly Bear Recovery Plan¹ objective of open route (defined as “*a route without restrictions on motorized access*”) linear disturbances at or below 0.6 km/km² in Grizzly Bear Priority Areas (areas subsequently identified as Grizzly Bear Core Conservation Areas²).

Why was this study done?

Global Forest Watch Canada (GFWC) and specifically Peter Lee, Executive Director of GFWC, were retained by the Castle-Crown Wilderness Coalition and Mike Judd to conduct a study of linear disturbances in the Castle area as part of their intervention in an Alberta Energy Resources Conservation Board hearing in the matter of Shell Canada Proceeding No. 1614134. Shell Canada Limited proposed to drill a gas well referred to as Waterton 68 at 10-1-6-3 W5M in the Castle Area Forest Land Use Zone (Figures 1 and 2). This study is consistent with GFWC's mission to monitor forest management and developments within Canada's forest ecozones.



Off-highway vehicle tracks through streams and rivers are common: Left – through major stream (Lynx Creek); Right – through minor stream (near West Castle River). (October 5/6 2010)

¹ Alberta Grizzly Bear Recovery Plan 2008-2013. Alberta Sustainable Resource Development, Fish and Wildlife Division, Alberta Species at Risk Recovery Plan No. 15. Edmonton, AB. 68 pp. Available at: <http://www.srd.alberta.ca/ManagingPrograms/FishWildlifeManagement/BearManagement/GrizzlyBears/documents/GrizzlyBear-RecoveryPlan2008-13-revJuly23-2008.pdf>

² Alberta Sustainable Resource Development. 2008. September 24, 2008 Draft Core and Secondary Grizzly Bear Conservation Boundaries. Available at: <http://www.srd.alberta.ca/ManagingPrograms/FishWildlifeManagement/BearManagement/documents/GrizzlyBear-CoreSecondaryConservationBoundaries-Sep2008.pdf>

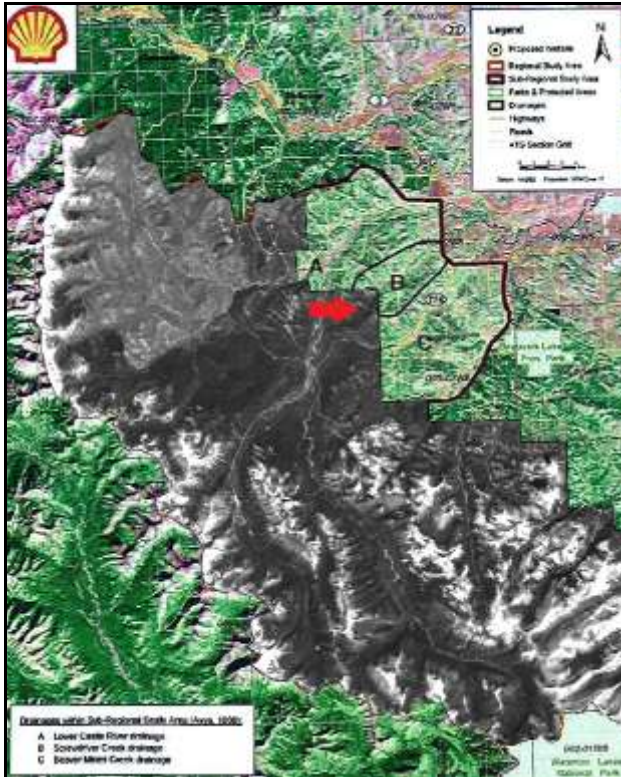


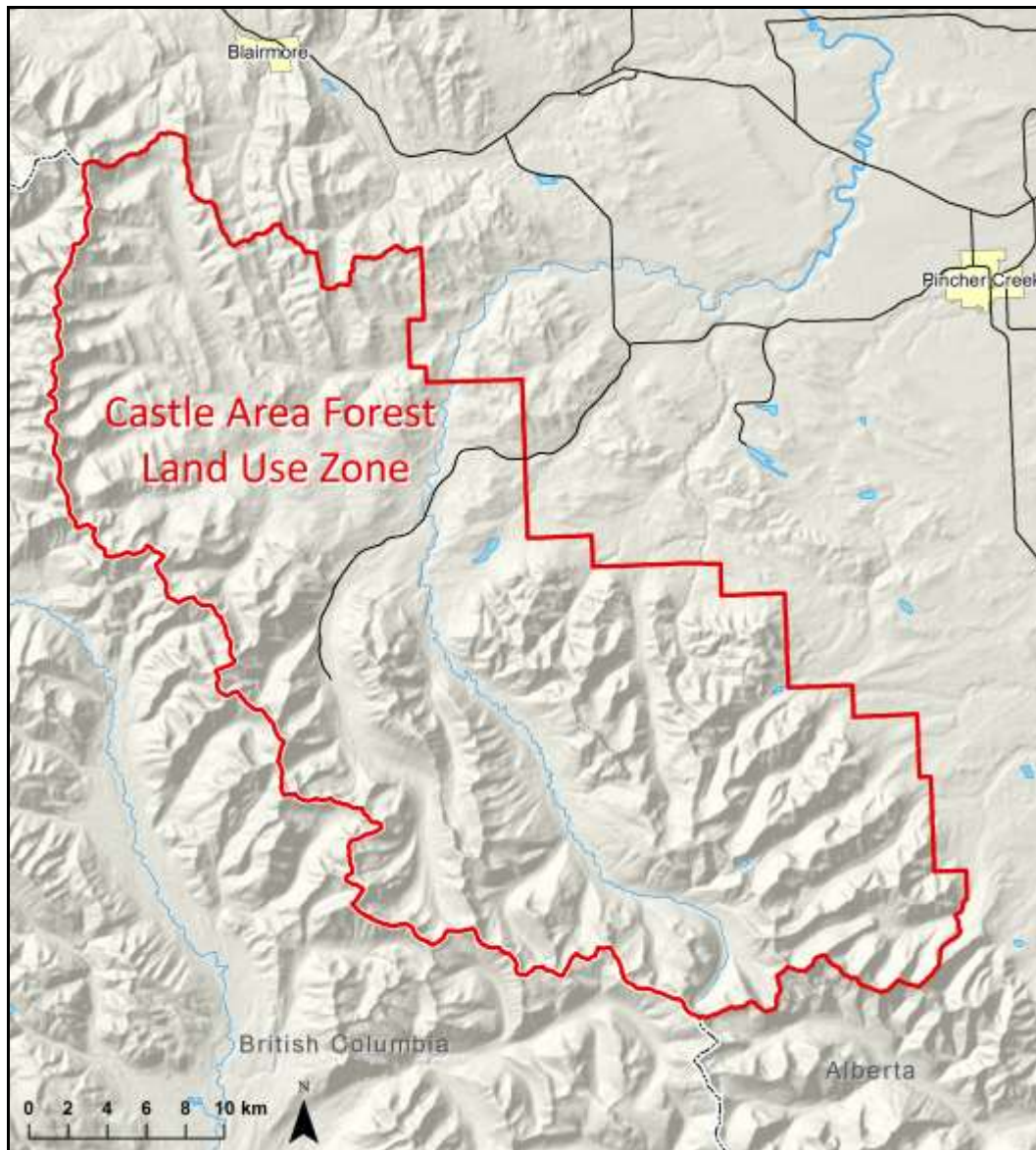
Figure 1. Location of Shell's proposed gas well and associated facilities in a regional context.



Figure 2. Location of Shell's proposed gas well and associated facilities in a local context.

The Study Area

The study area is the 1,003 km² Castle Area Forest Land Use Zone shown in Map 1 plus smaller areas imbedded within the broader Forest Land Use Zone boundary (e.g., Ecological Reserve, Freehold, Commercial Lease, Licensed Roads). This study area was selected as it is a legal entity and is under special management also known as the Castle Special Management Area.³ The gas well and associated facilities in the Shell application fall within the Castle Area Forest Land Use Zone.



Map 1. Castle Area Forest Land Use Zone with shaded relief.

³ see maps at:

<http://www.srd.alberta.ca/RecreationPublicUse/RecreationOnPublicLand/ForestLandUseZones/CastleAreaFLUZMapsPublications.aspx>

Section 2. Background to the Castle area and grizzly bears⁴

Provincial Ecological Context

The Castle area together with the adjacent Waterton Lakes National Park is recognized as Alberta's most biologically diverse area. Biological inventories have not been completed to the level they have for Waterton Lakes National Park, but it is known that the Castle area has rare plant communities (assemblages of native plants), such as the Big Sagebrush site (under provincial Crown Reservation for a Conservation class Natural Area) and a rare mammal (the Vagrant Shrew, *Sorex vagrans*) not recorded in the national park. The Carbondale basin that is within the Castle area is one of 2 still remaining in Alberta with substantial populations of relatively pure, unhybridized westslope cutthroat trout, recognized by Alberta as a threatened species. All other remaining pure populations are tiny, extremely fragmented and at very high risk of extinction.^{5 6} Examples of the level of diversity of the Castle area and its significance include: half of all the vascular plant species recorded in Alberta can be found here, and; 145 of them are rare.⁷ The majority (135 species) of the 174 species of butterflies recorded in Alberta can be found within the Castle area.⁸ 'At risk' and rare species lists include a total of 187 plant species (vascular and non-vascular), 6 plant communities, 14 mammals, 44 birds, 3 reptiles, 5 amphibians, 2 fish and 10 butterfly and spider species that reside in the Castle Area Forest Land Use Zone.⁹

Map 2 shows the locations of significant species (those noted as S1, S2 and S3 as reported in the Alberta Conservation Information Management System¹⁰). In this system, the conservation status of a species or ecosystem, termed Element Occurrence, is designated by a number from 1 to 5, preceded by a letter reflecting the appropriate geographic scale of the assessment (G = Global), N = National, and S = Subnational, such as province). The numbers have the following meaning: 1 = critically imperilled; 2 = imperilled; 3 = vulnerable; 4 = apparently secure; 5 = secure. For example, a rank of S3

⁴ Except where noted, the following is mostly from: *Diane Pachal's October 2010 submission to the Alberta Energy Resources Conservation Board hearing (in the matter of Shell Canada Proceeding No. 1614134)*

⁵ Mayhood, D.W. 2009. Contributions to a recovery plan for westslope cutthroat trout (*Oncorhynchus clarkii lewisi*) in Alberta: threats and limiting factors. Report prepared for Alberta Fish and Wildlife, Cochrane, AB. FWR Freshwater Research Limited FWR Technical Report No. 2009/05-2, Calgary, AB. ix+68 p. Available at: http://www.fwresearch.ca/Library_files/Mayhood%202009a.pdf

⁶ Mayhood D.W. 2010. Testing the H60 calculations in the 1998 Carbondale Basin interior watershed assessment Procedure. Freshwater Research Limited FWR Technical Note 2010/01-1.

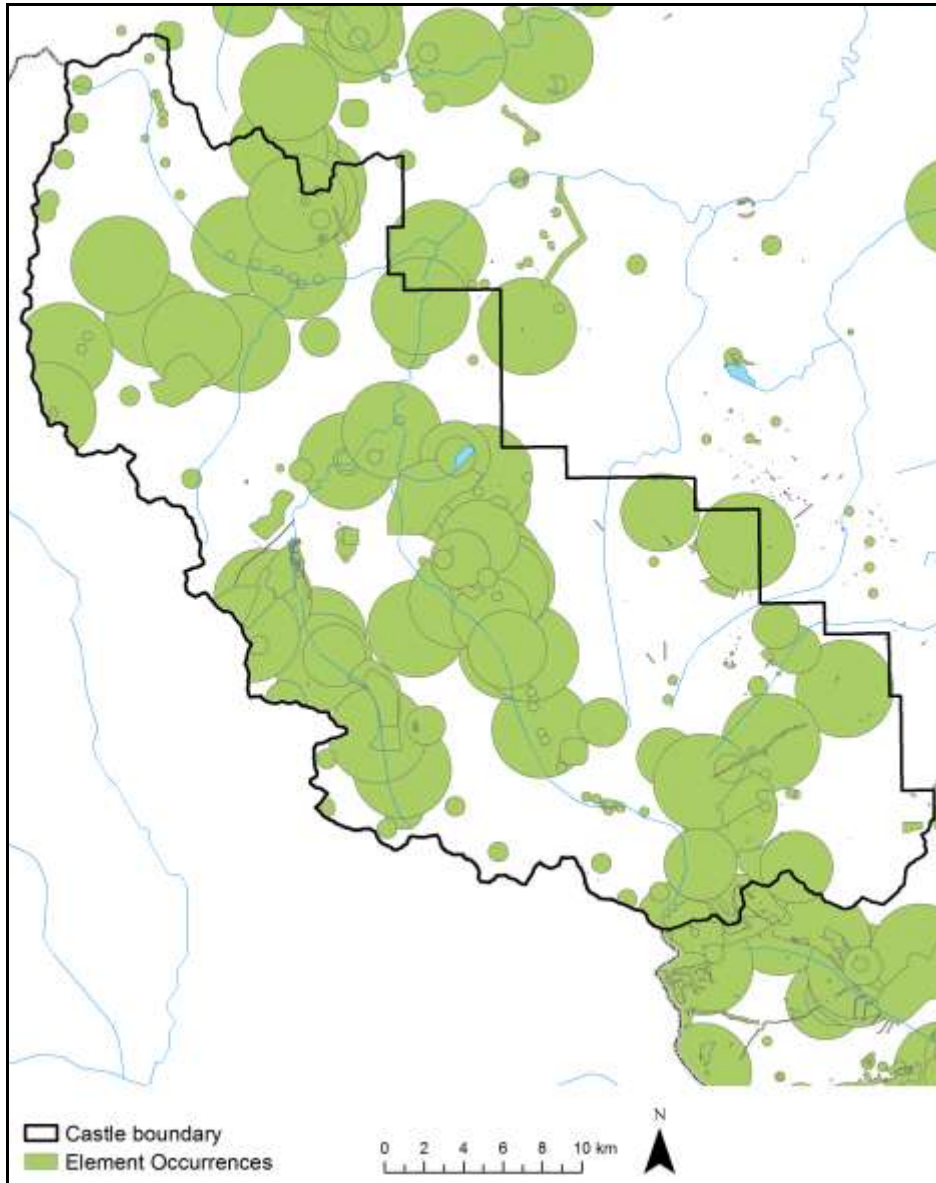
⁷ Sheppard, David. 2007. *Rare and Endangered Species List for the CASTLE SPECIAL PLACE in Southwest Alberta*. Updated April 2007. Pincher Creek, Alberta.

⁸ Andrew Colley, Lepidopterist, Pincher Creek, Alberta. Input to Castle Special Place Working Group, 2009.

⁹ Rare & Endangered Species List, note 3. Regarding butterflies, Andrew Colley, note 4. Regarding spiders John Handcock, Pincher Creek, Alberta, input to Castle Special Place Working Group, 2009.

¹⁰ Alberta Conservation Information Management System (Alberta Tourism, Parks and Recreation). 2010. Available at: <http://www.tpr.alberta.ca/parks/heritageinfocentre/default.aspx>

would indicate the species is vulnerable and at moderate risk within a particular state or province, even though it may be more secure elsewhere.¹¹ The Castle Area Forest Land Use Zone contains almost thirty times the concentration (analyzed per 1,000 ha) of rare and special species (Element Occurrences S1, S2 and S3) than Alberta as a whole. It is within the Upper Oldman Watershed contains more than two times the concentration as the watershed as a whole. It is within the Central Oldman-Belly Watershed and contains almost four times the concentration as the watershed as a whole. It is within the Northern Continental Divide Ecoregion and contains more than two times the concentration as the ecoregion as a whole (Table 1).



Map 2. Significant species locations (generalized) of the Castle area.

¹¹ NatureServe Conservation Status. 2010. Available at: <http://www.natureserve.org/explorer/ranking.htm#assessment>

Table 1. Castle Area Forest Land Use Zone: rare and special species concentrations in comparison to Alberta as a whole, and in comparison to two watersheds and one ecoregion.

Region	Region Total			Castle Portion of region		
	Total area (ha)	Number of High Value Element Occurrences	High Value Element Occurrences per 1,000 ha	Castle area (ha)	Number of High Value Element Occurrences	High Value Element Occurrences per 1,000 ha
Upper Oldman Watershed	488,060	1060	2.2	87,304	496	5.7
Central Oldman - Belly Watershed	474,357	1165	2.5	13,050	123	9.4
Northern Continental Divide Ecoregion	962,374	2639	2.7	100,342	580	5.8
Province of Alberta	66,354,539	10405	0.2	100,342	580	5.8

Since first completed in 1998, the province's Environmentally Significant Area assessments have rated landscapes of the Castle area as provincially and nationally significant. With the 2009 provincial update, the Castle area is part of a nationally significant Environmentally Significant Area.¹²

The Castle area receives more precipitation than any other comparably sized area in Alberta. Encompassing less than 4% of the total land area of the Oldman River Basin, it supplies an exceptional 30% of the annual water flow for the entire Basin.¹³ The basin encompasses much of southern Alberta and extends into northern Montana; consisting of 70 municipalities in Alberta, including the City of Lethbridge.

The Rosenberg International Forum on Water Policy identified the headwaters of the Oldman River Basin as good candidate for special watershed protection and that legislated protection of the Castle area will pay for itself over and over again in the value of the ecological services it provides.¹⁴ The Rosenberg report emphasizes the importance of undertaking special headwater protection in the face of significantly reduced water flows in the Saskatchewan River system of Canada's Prairie Provinces, and in the context of population growth and climate change which are poised to create a crisis in water scarce southern Alberta.

The Castle area is located within the Montane Natural Sub-Region of Alberta. Although comprising less than 1% of the land area of Alberta, the montane is disproportionately important for the conservation of biological diversity. As a Natural Sub-Region or ecoregion, it:¹⁵

¹² Fierra Biological Consulting. 2009. *Environmentally Significant Areas, Provincial Update 2009*. Alberta Tourism, Parks and Recreation Dept., Edmonton, AB. Available at: <http://tpr.alberta.ca/parks/heritageinfocentre/environsigareas/default.aspx>. Pp. vi, vii and 41.

¹³ Vaux, Henry Jr. and Robert Sandford. 2007. *Program Synopsis & Lessons for Canada & Alberta*. Rosenberg International Forum on Water Policy, Forum V, held Banff, Canada, Sept. 2006. Pp. 91.

¹⁴ Vaux, Henry Jr. and Robert Sandford. 2007. *Program Synopsis & Lessons for Canada & Alberta*. Rosenberg International Forum on Water Policy, Forum V, held Banff, Canada, Sept. 2006. Pp. 91.

¹⁵ Alberta Environmental Protection. 1995. *Alberta's Montane Subregion, Special Places 2000 and the Significance of the Whaleback Montane*. Nov. 1995. Heritage Protection & Education Branch, Parks Management Support Div., Natural Resources Service, Alberta Environmental Protection, Edmonton, AB.

- is among those with the richest small mammal habitat, cumulative high quality ungulate habitat and the richest potential for carnivore habitat;
- contains more habitats with high to moderate potential for amphibian and reptile species, than any other mountain or foothill ecoregion;
- provides (together with low elevation subalpine valleys) critical wildlife movement areas, particularly in the fall, winter and spring seasons;
- has several rare plant species and assemblages of rare and uncommon plants; and
- rivals the best areas in North America for songbird diversity.

The Castle area and the adjacent private and grazing lease lands constitute Alberta's second largest area of montane. The Whaleback-Porcupine Hills complex is the largest. Alberta Environmental Protection (1995) notes:¹⁶

“Montane areas are also among the most compromised landscapes in Alberta since they are very attractive for development and other land use activities. One estimate is that more than 70% of Alberta's montane has been heavily affected by various developments.

... It is important that the ecological integrity of montane landscapes not be compromised or severely modified through inappropriate or incompatible development or other land uses.”

The Castle Area contains large areas of Prime Protection and Critical Wildlife Zones¹⁷ (Map 3). The Eastern Slopes regional plan defines the Critical Wildlife Zone as one of two protection zones for the region (the other is Prime Protection), with the policy stating the intent of the protection as:

“To provide the highest level of protection for those areas which are known to form the unique character of the Eastern Slopes.”¹⁸

The Eastern Slopes regional plan defines the intent of the Critical Wildlife Zone:

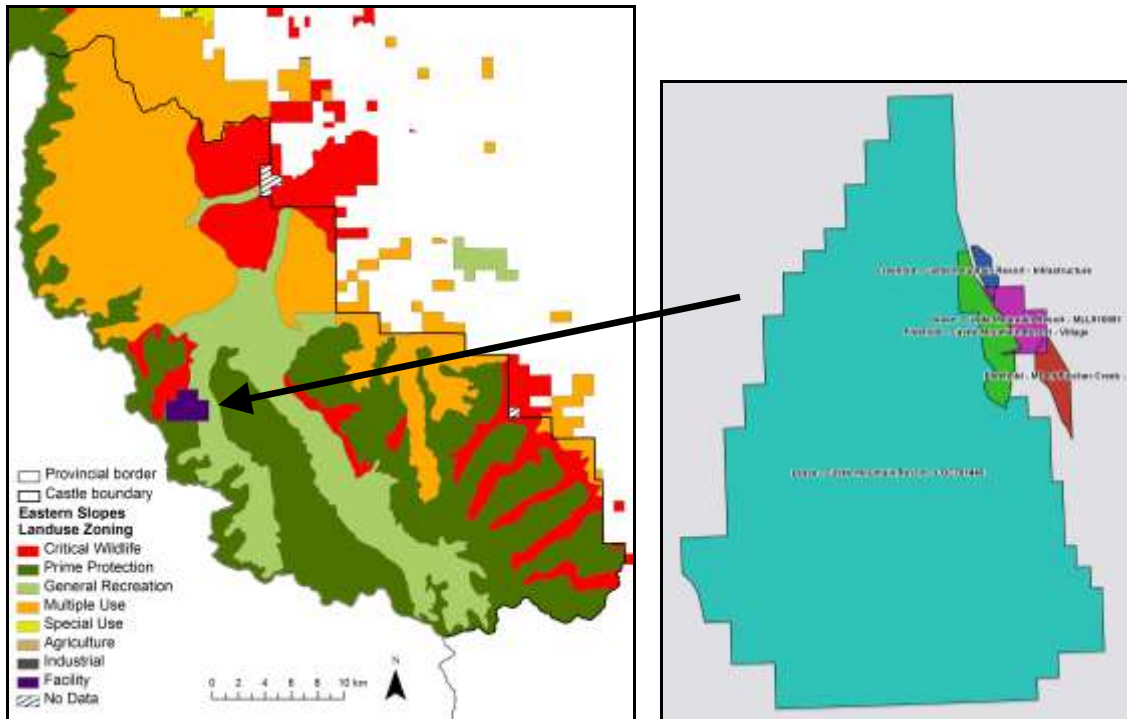
“... to protect ranges or terrestrial and aquatic habitats that are crucial to the maintenance of specific fish and wildlife populations.”¹⁹

¹⁶ Ibid

¹⁷ Alberta Government. 1985 *Castle River Sub-Regional Integrated Resource Plan* (Castle IRP) and in *A Policy for Resource Management of the Eastern Slopes Region Revised 1984* (Eastern Slopes policy) (Map 2).

¹⁸ Ibid. Pp. 3.

¹⁹ Alberta Government. 1984. *A Policy for Resource Management of the Eastern Slopes: Revised 1984*. Available at: <http://www.srd.alberta.ca/ManagingPrograms/Lands/Planning/documents/IntegratedResourcePlan-EasterSlopes1-1984.pdf> (Pp. 10).



Map 3. Castle Area Forest Land Use Zone Eastern Slopes Zones circa 1985 (plus updated Facility Zone 2009).

The Castle Integrated Resource Plan²⁰ provides the detail for the area-specific zone, including that the primary intent²¹ is to protect critical wildlife habitat. Guidance is also provided by the Eastern Slopes Policy with its seven stated guidelines, including:

- *uniqueness of the Eastern Slopes, due to its aesthetic qualities and combination of environments, will be maintained.*
- *recreational resources of the mountains and foothills will be maintained while increasing the opportunities for Albertans to enjoy this unique region.*
- *management of renewable resources is the long-term priority of the Eastern Slopes. Non-renewable resource developments will be encouraged in areas where this priority can be maintained.*

International ecological significance

The Castle area is an integral part of the international Crown of the Continent ecosystem (Map 4).

In October 2007, the Premier of Alberta and the Governor of Montana signed a *Memorandum of Understanding and Cooperation between the Government of the State of*

²⁰ Available at:

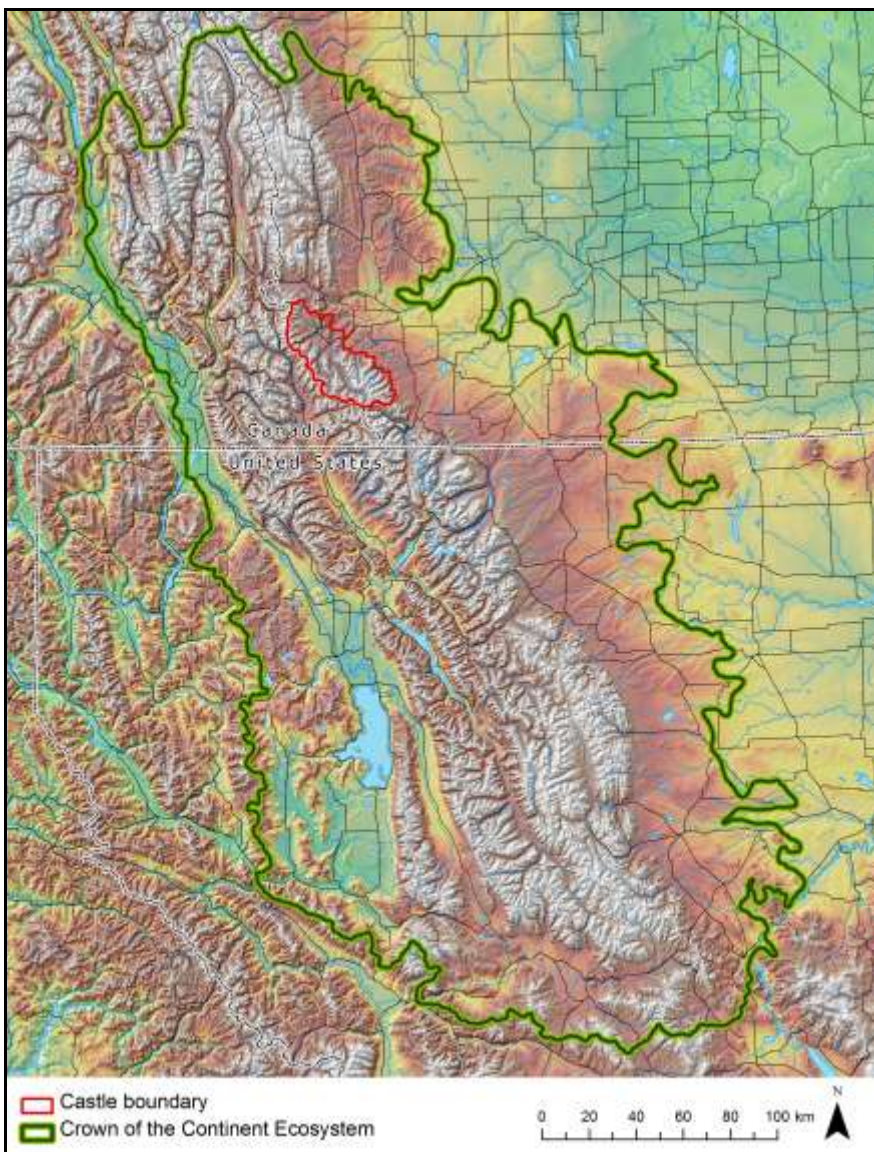
<http://www.srd.alberta.ca/ManagingPrograms/Lands/Planning/IntegratedResourcePlans.aspx>

²¹ Ibid. Pp. 47.

Montana, United States and the Government of the Province of Alberta, Canada, Respecting the Crown Managers' Partnership, that includes this statement:

“To improve understanding, raise awareness and promote collaboration on the management of the Crown of the Continent ecosystem, the Participants [the Province of Alberta and State of Montana] wish to pursue the following ... (d) ensure sustainable flow of economic, social and environmental benefits and preserve the ecological values of this outstanding landscape.”

The Crown of the Continent is one of only two linkages within the Yellowstone to Yukon region through which grizzly bear populations in Canada and those in the U.S. remain connected to each other.



Map 4. Crown of the Continent Ecosystem.

(Source. Crown Managers Partnership. Crown of the Continent Ecosystem. Available at: <http://www.crownmanagers.org/>)

Castle Area Forest Land Use Zone

A Forest Land Use Zone is an area of public land to which legislative controls apply under authority of the *Forests Act, Forest Recreation Regulation (343/1979)* to assist in the management of industrial, commercial, and recreational land uses and resources (Map 1 and Map 5).²²

The Castle Area Forest Land Use Zone was legally established in March 1998 and formally covers 1,003 square kilometres (387.3 square miles). The stated purpose is to “*Restrict motorized access to certain areas, and protect ecologically sensitive backcountry areas from the adverse effects of such activity.*”²³ Allowed activities most relevant to potential impacts on key wildlife include:

- random camping in tents and trailers;
- off-highway vehicles (OHV) permitted only on designated trails;
- snowmobiles permitted only on designated trails;
- regulated hunting and fishing is allowed.

Under its Special Places program, the Alberta Government announced the establishment of the 1,003 km² Castle Area Forest Land Use Zone in 1998 and described the announcement as a “*Milestone reached in preserving Alberta’s Natural Heritage*” which will “*Provide immediate legislated protection through a Forest Land Use Zone (FLUZ) which will regulate the existing access management plan, previously managed on a voluntary basis.*” The Government’s 1998 media release stated: “*The designation of six new Wildland Parks in the Canadian Shield Natural Region, and a range of preservation measures for the Castle area in the Rocky Mountain Natural Region will add approximately 2,800 sq km to Alberta’s protected areas network under Special Places.*” “*Special Places is the Government of Alberta’s protected areas policy.*”²⁴

Implementation was to proceed in two phases: “*In the first phase, a Special Management Area will be established as a Forest Land Use Zone to provide immediate legislated protection for the Castle area by regulating the existing Castle Access Management Plan, currently being managed through voluntary compliance. As part of this first phase, an Ecological Reserve will also be created in the wetland area in the West Castle River valley following the required 60-day notification period. Secondly, the government will conduct a full review and update of the Castle Sub-Regional Integrated Resource Plan (IRP), as recommended by the Local Committee.*”²⁵

²² Available at:

(<http://www.srd.alberta.ca/RecreationPublicUse/RecreationOnPublicLand/ForestLandUseZones/Default.aspx>)

²³ Available at:

(<http://www.srd.alberta.ca/RecreationPublicUse/RecreationOnPublicLand/ForestLandUseZones/CastleAreaFLUZ.aspx>)

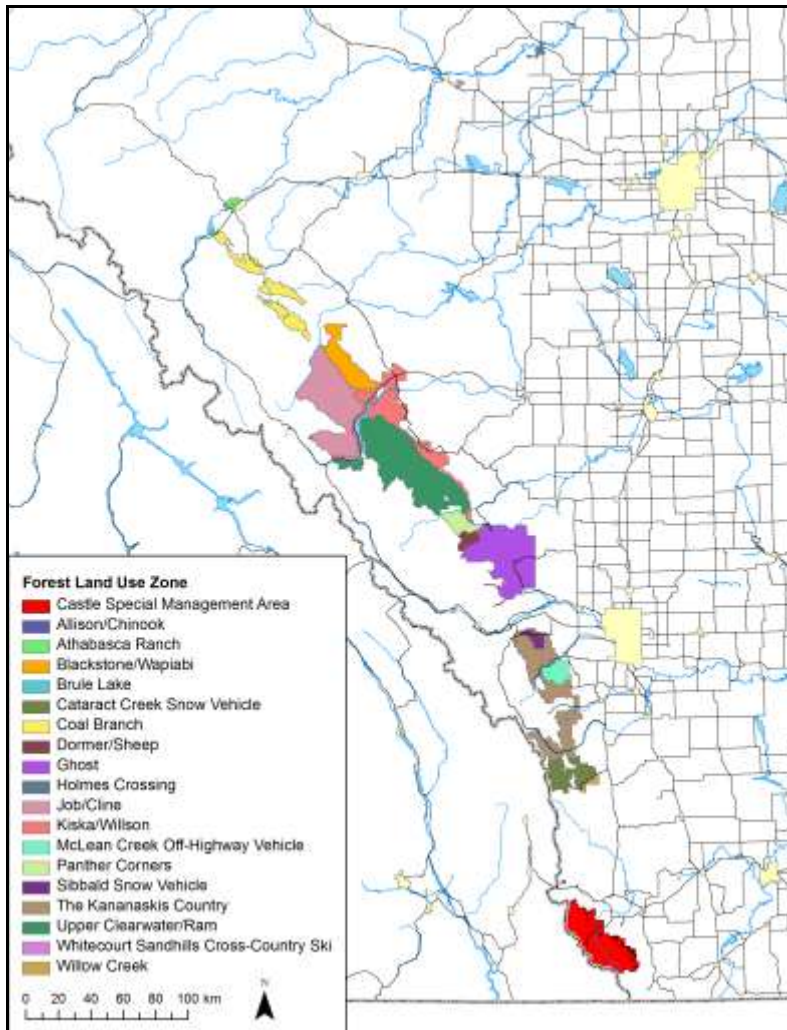
²⁴ Alberta Government. Alberta Environmental protection. 1998. Milestone Reached in Preserving Alberta’s Natural Heritage. News Release March 18 1998 No. 98-024. Available at:

<http://alberta.ca/home/NewsFrame.cfm?ReleaseID=/acn/199803/5992.html>

²⁵ Available at: <http://www.tpr.alberta.ca/parks/managing/establishing.asp> AND <http://www.tpr.alberta.ca/parks/managing/spdate.asp>

The Castle Area Forest land Use Zone is still, as of January 2011, listed by the Alberta Government as a protected area.

The Castle Area Forest Land Use Zone is located within and is a subset of the Castle Grizzly Bear Core Conservation Area²⁶ (Some reports refer to that same area as the Castle/Waterton core area, the Waterton unit of the Western Canada Grizzly Bear population, or simply as the Waterton unit²⁷).



Map 5. Forest Land Use Zones of Alberta.

(Source: AltaLIS. 2020. Available for download at: http://www.altalis.com/prod_base_bound.html)

²⁶ Alberta Sustainable Resource Development. 2008. September 24, 2008 Draft Core and Secondary Grizzly Bear Conservation Boundaries. Available at: <http://www.srd.alberta.ca/ManagingPrograms/FishWildlifeManagement/BearManagement/documents/GrizzlyBear-CoreSecondaryConservationBoundaries-Sep2008.pdf>

²⁷ Boulanger J and G Stenhouse. 2010. Demography of Alberta Grizzly Bears: 1999-2009. Available at: <http://www.srd.alberta.ca/ManagingPrograms/FishWildlifeManagement/BearManagement/GrizzlyBears/documents/GrizzlyBears-DemographyAlbertaGrizzlyBears-1999-2009.pdf>

Background to Alberta grizzly bears²⁸

In 2002, Alberta's Endangered Species Conservation Committee recommended the status of the provincial population of grizzly bear as *Threatened* (“a species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction”). The recommendation to list this species as Threatened under Alberta's *Wildlife Act* was accepted by the Minister of Sustainable Resource Development in June 2010.

There are an estimated 691 grizzly bears in lands under provincial jurisdiction plus Waterton Lakes National Park and portions of Banff and Jasper National Parks. South of Highway 1 and including the Castle Area Forest Land Use Zone, grizzly bears are restricted to a narrow strip of habitat along the British Columbia border. Human activities in bear habitat, particularly the expanding network of roads, leads to unsustainable levels of bear mortality. To reduce mortality, motorized access to bear habitat must be minimized and human activities that lead to conflicts with bears must be mitigated. The Alberta Grizzly Bear Recovery Plan²⁹ recommends open route (defined as “a route without restrictions on motorized access”) linear disturbances at or below 0.6 km/km² in Grizzly Bear Priority Areas (areas subsequently identified as Grizzly Bear Core Conservation Areas³⁰).

Map 6 shows the approximate current and historical distribution of grizzly bears in North America – the Castle Area Forest Land Use Zone is within the southern portion of the grizzly bears current North American range.

Map 7 shows grizzly bear core and secondary conservation boundaries – all of the Castle Area Forest Land Use Zone is within and is a subset of the Castle Grizzly Bear Core Conservation Area.

Map 8 shows estimates of grizzly bear population size in Alberta – the Castle Area Forest Land Use Zone comprises a large portion of a surrounding area estimated to contain 51 grizzly bears, or approximately 7.4% of Alberta's grizzly bear population (also see Table 2).

²⁸ Except where noted, the following is mostly from: *Alberta Sustainable Resource Development and Alberta Conservation Association. 2010. Status of the Grizzly Bear (Ursus arctos) in Alberta: Update 2010. Alberta Sustainable Resource Development. Wildlife Status Report No. 37 (Update 2010). Edmonton, AB. 44 pp.*

²⁹ Alberta Grizzly Bear Recovery Plan 2008-2013. Alberta Sustainable Resource Development, Fish and Wildlife Division, Alberta Species at Risk Recovery Plan No. 15. Edmonton, AB. 68 pp. Available at: <http://www.srd.alberta.ca/ManagingPrograms/FishWildlifeManagement/BearManagement/GrizzlyBears/documents/GrizzlyBear-RecoveryPlan2008-13-revJuly23-2008.pdf>

³⁰ Alberta Sustainable Resource Development. 2008. September 24, 2008 Draft Core and Secondary Grizzly Bear Conservation Boundaries. Available at: <http://www.srd.alberta.ca/ManagingPrograms/FishWildlifeManagement/BearManagement/documents/GrizzlyBear-CoreSecondaryConservationBoundaries-Sep2008.pdf>

Map 9 shows examples of sizes of individual grizzly bear home range in the context of the Castle Special Place (1998). (This is the same boundary as the Castle Area Forest Land Use Zone.) Note that the area of the Castle Area Forest Land Use Zone is less than the size of at least each of two of the three home ranges shown on this map. In Alberta, annual home ranges for females range from 152 km² to 2,932 km², and for males from 501 km² to 4,748 km².³¹

Table 2. Grizzly bear population estimates for Alberta, from DNA-based Capture-Mark-Recapture. (Alberta Sustainable Resource Development and Alberta Conservation Association. 2010. Status of the Grizzly Bear (*Ursus arctos*) in Alberta: Update 2010. Alberta Sustainable Resource Development. Wildlife Status Report No. 37 (Update 2010). Edmonton, AB. 44 pp [page 15].)

Unit	Year ^a	Bears ^b	P(capture) ^c	Estimated # of bears	95% CI	Density ^d
Castle	2007	27	0.17	51.2	34-87	18.1
Livingstone	2006	85	0.25	89.9	75-116	11.8
Clearwater	2005	41	0.52	45.4	41-52	5.2
Yellowhead	2004	39	0.33	42.0	36-55	4.8
Grande Cache	2008	271	0.26	353.3	288-516	18.1
Total				581.8		

^a Year of sampling

^b Number of different grizzly bears identified from DNA, including bears whose main range is outside the sampling grid.

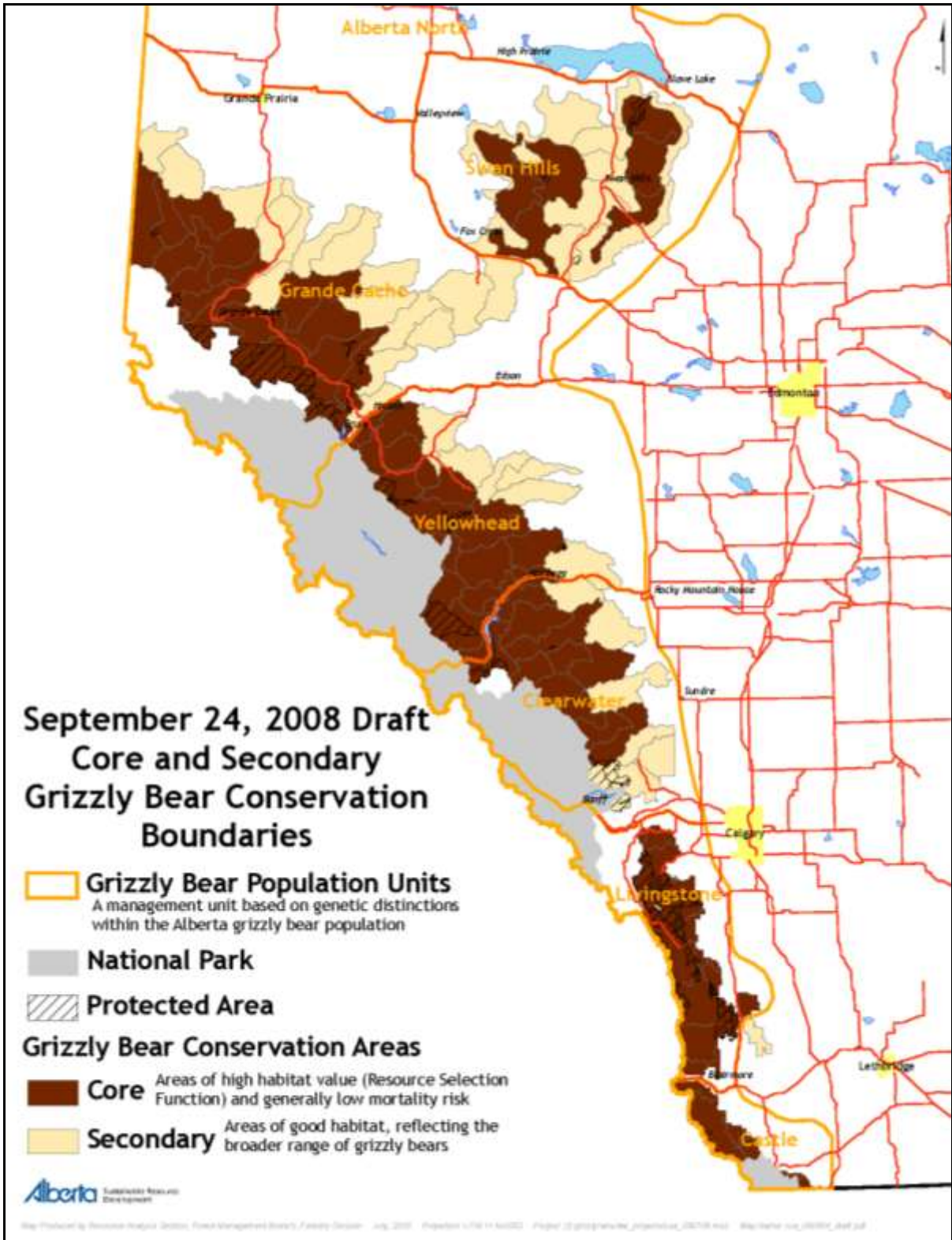
^c Probability of detection during a sampling session for all bears on the grid, including nonresidents.

^d # bears/1000 km² over the entire unit. Densities vary substantially within each unit.

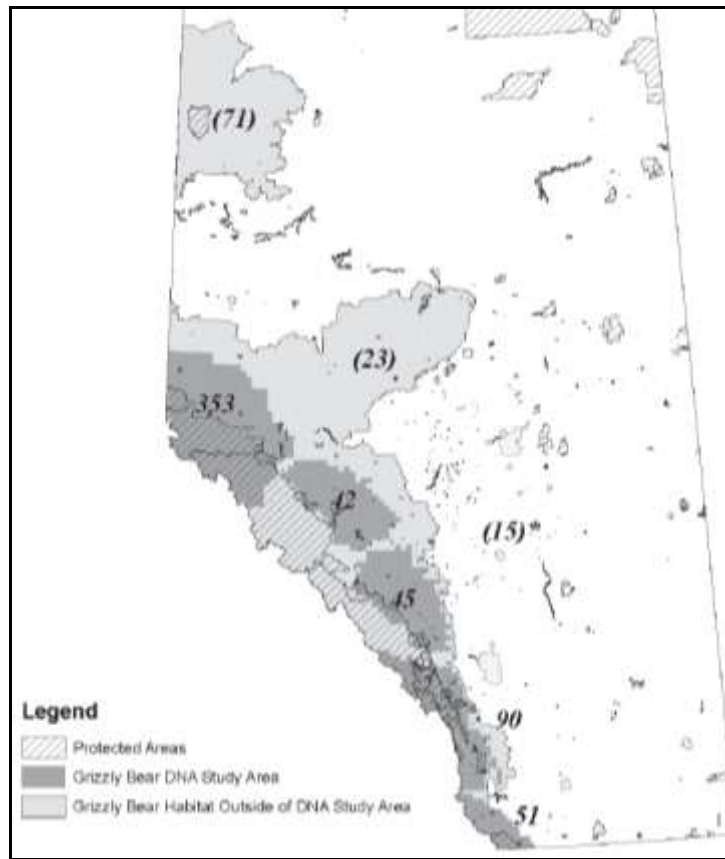


Map 6. Approximate current and historical range of grizzly bear in North America. (Source: Page 12 of: Alberta Sustainable Resource Development and Alberta Conservation Association. 2010. Status of the Grizzly Bear (*Ursus arctos*) in Alberta: Update 2010. Alberta Sustainable Resource Development. Wildlife Status Report No. 37 (Update 2010). Edmonton, AB. 44 pp.)

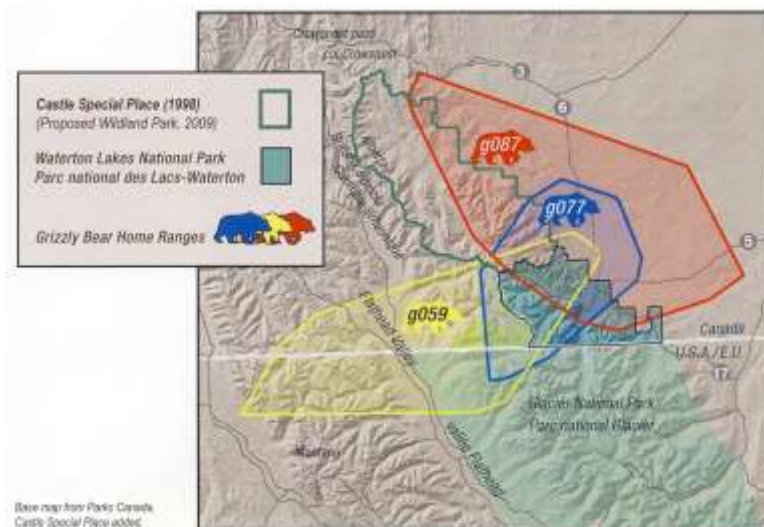
³¹ Boulanger J and G Stenhouse. 2010. Demography of Alberta Grizzly Bears: 1999-2009. Available at: <http://www.srd.alberta.ca/ManagingPrograms/FishWildlifeManagement/BearManagement/GrizzlyBears/documents/GrizzlyBears-DemographyAlbertaGrizzlyBears-1999-2009.pdf>



Map 7. Grizzly bear core and secondary conservation areas in Alberta.
 (As identified by Alberta Sustainable Resource Development in 2008. (Source: Available at: <http://www.srd.alberta.ca/ManagingPrograms/FishWildlifeManagement/BearManagement/documents/GrizzlyBear-CoreSecondaryConservationBoundaries-Sep2008.pdf>)



Map 8. The likely current distribution of grizzly bears in Alberta with population estimates. The un-bracketed numbers indicate the recent estimates of grizzly bear population size resulting from the DNA-based censuses. The numbers within brackets represent estimates derived through alternate methods. The asterisk (*) represents the Eastern Fringe grizzly bear population estimate. (Source: Page 11 of: *Alberta Sustainable Resource Development and Alberta Conservation Association. 2010. Status of the Grizzly Bear (Ursus arctos) in Alberta: Update 2010. Alberta Sustainable Resource Development. Wildlife Status Report No. 37 (Update 2010). Edmonton, AB. 44 pp.*)

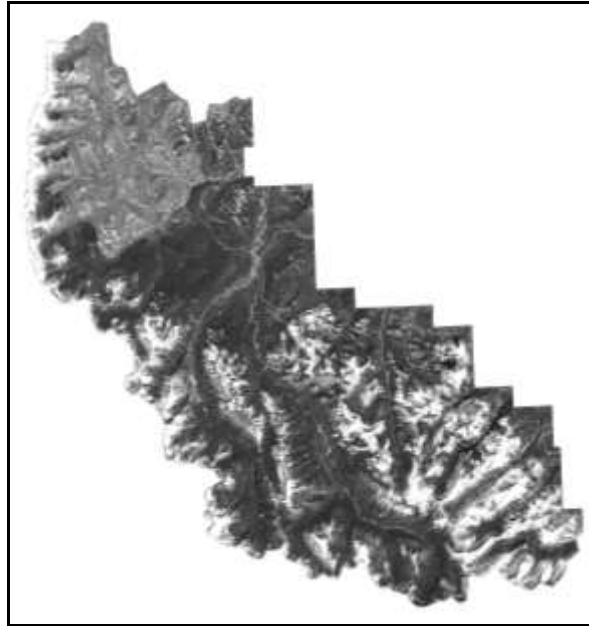


Map 9. Examples of sizes of grizzly bear home range in the context of the Castle Special Place (1998) (same boundary as the Castle Area Forest Land Use Zone). (Source: *Waterton Lakes National Park files*)

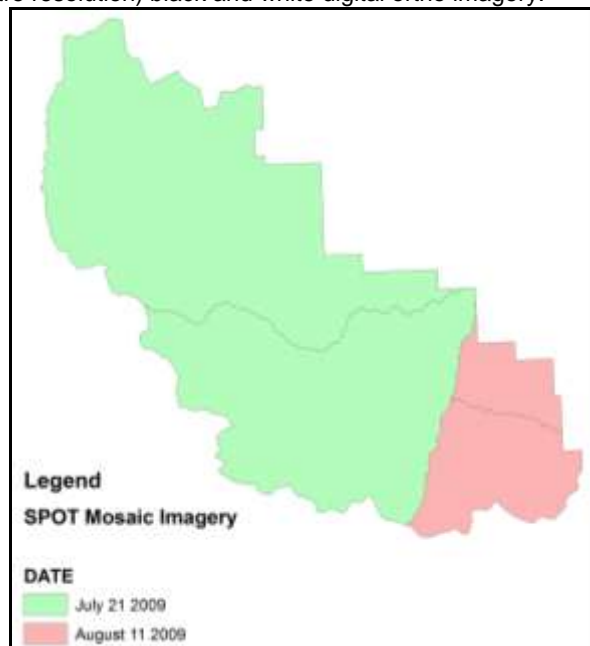
Section 3. Methods

Step 1. Selection of the base satellite data layer

SPOT 5 (2.5 metre resolution) black and white digital satellite imagery was selected in order to map linear disturbances at a high resolution. It covered the entire Castle Area Forest Land Use Zone (Map 10). The imagery was from two time periods – July 21, 2009 and August 11, 2009 (Map 11). Figures 3 and 4 show examples of zoom-ins using SPOT imagery.



Map 10. SPOT 5 (2.5 metre resolution) black and white digital ortho imagery.



Map 11. Dates of SPOT digital ortho imagery (also showing join lines between different images of same dates).



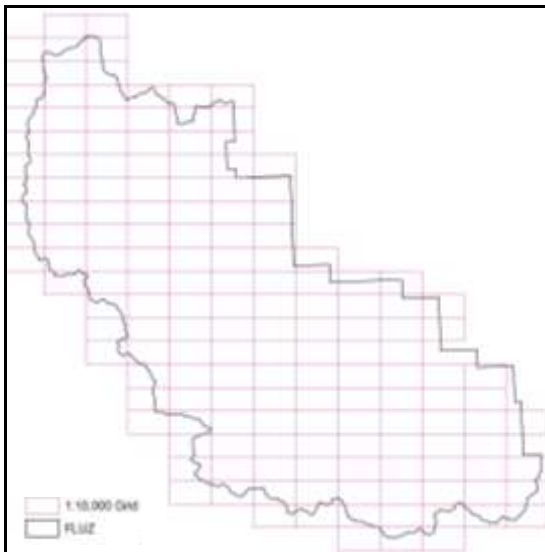
Figure 3. Example of SPOT zoom-in – Lynx Creek Campground area (approximately 11 km across).



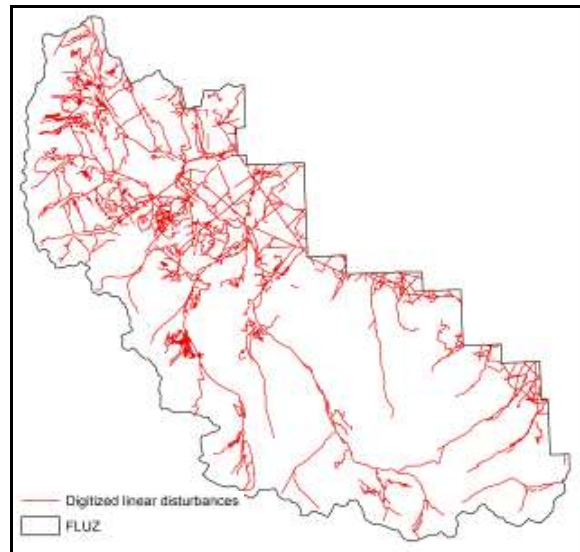
Figure 4. Example of SPOT zoom-in – Castle Falls Campground areas (approximately 2.1 km across).

Step 2. Digitization of linear disturbances

Anthropogenic linear disturbances were extracted through ‘heads-up’ digitizing of the SPOT imagery at a scale of 1:10,000. A 1:10,000 grid cell system (~4 km by ~2 km) was created so that digitizing could proceed in a structured manner within each grid cell (Map 12). Following completion of digitizing at 1:10,000, all major river and stream corridors were examined at 1:5,000 as these areas are known to potentially be subjected to motorized vehicle or snowmobile use. Any additional linear disturbances identified at this scale were then digitized.



Map 12. 1:10,000 grid over the study area.



Map 13. Digitized anthropogenic linear disturbances; first pass.

All interpreted linear anthropogenic disturbances were digitized into an ESRI file geodatabase feature class using ArcMap 9.3 (Map 13). Once the study area was digitized as a ‘first pass,’ the disturbances were checked and then re-checked for a total of three passes to minimize errors of omission and commission.

Step 3. Verification of digitized disturbances

GoogleEarth very high resolution GeoEye was used as the main verification dataset for all digitized linear disturbances as it has a resolution of 1.65 m and is multispectral. Figures 5 and 6 shows the comparison between SPOT imagery and GoogleEarth high resolution GeoEye at the area of the Castle Mountain Resort.

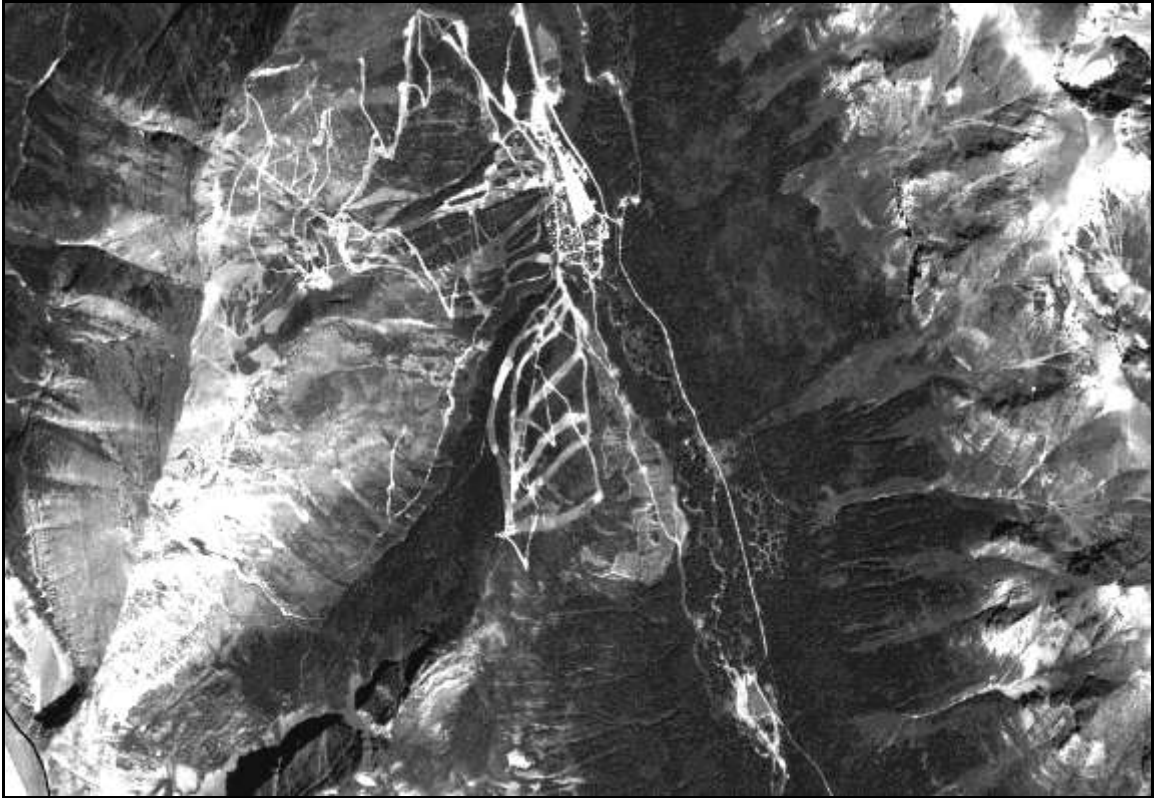


Figure 5. SPOT imagery at the area of the Castle Mountain Resort.



Figure 6. GoogleEarth high resolution GeoEye imagery at the area of the Castle Mountain Resort.

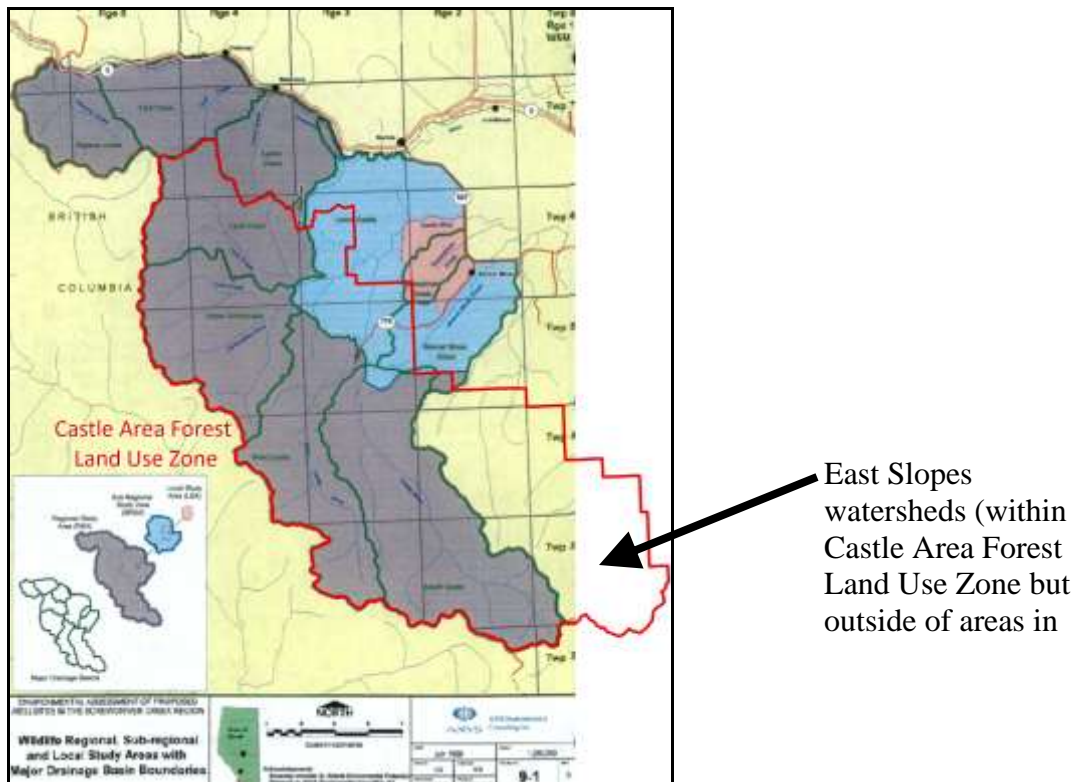
Step 4. Categorization of linear disturbances

Two categorizations of linear disturbances were identified as consistent with Government of Alberta maps:³²

1. Type 1 – Paved; Gravel; Unimproved; Trail; Cutline;
2. Type 2 – Open/closed to Snowmobiles in Winter; Motorized vehicles in Summer; Year-round access; Unknown.

Step 5. Analytical units (primarily watersheds)

Analytical units were based on watersheds identified in the 1999 AXYS report³³ plus the remaining area in the SE Castle Area Forest Land Use Zone (termed East Slopes watersheds). This results in 9 analytical units: 8 watersheds plus one remaining area (East Slopes watersheds) (Map 14).



Map 14. Analytical units selected from watersheds identified in 1999 AXYS report + the remaining area in SE Castle Area Forest Land Use Zone.

³² Available at:

<http://www.srd.alberta.ca/RecreationPublicUse/RecreationOnPublicLand/ForestLandUseZones/CastleAreaFLUZMapsPublications.aspx>

³³ Wildlife Regional, Sub-regional and Local Study Areas with Major Drainage Basin Boundaries. Figure 9.1 Page 9.4. Canadian 88/Shell Canada Screwdriver Creek Wellsite Development Plan – Environmental Assessment: Study Approach. AXYS Environmental Consulting Ltd/. Calgary

Step 6. Linear disturbance densities and motorized access densities

Linear disturbance densities were calculated within each Analytical Unit. Minimum and maximum motorized access densities were determined by applying the Line Density feature in ArcGIS, assuming: 1) minimum motorized vehicle use was restricted to the known (approved) winter, summer and year-round linear disturbances, and; 2) maximum motorized vehicle use included all linear disturbances. This Line Density feature was used to calculate the density of linear features within a specified search radius of 0.5 miles for each output raster cell. Density is calculated as the length, in kilometres, of linear disturbances per square kilometre. A search radius of 0.5 miles (1 mile diameter) was specified to emulate the methods as described in the 1999 AXYS report.³⁴

Step 7. Grizzly bear habitat security areas

Grizzly Bear Habitat Security Areas were determined by generally applying the same decision rules as in the AXYS and Horeji reports.^{35 36}

Two approaches were used to map Grizzly Bear Habitat Security Areas because it is not known by the authors of this report which of the total linear disturbances are used by motorized vehicles. The minimum would be the known (approved) motorized vehicular access routes. But using this minimum is not reasonable since, based on anecdotal reports and our field checks, many other linear disturbances (e.g., oil and gas exploration lines, trails created by off-highway vehicles users) which are not approved for motorized vehicular access are nevertheless being used.

- 1) Known (approved) motorized vehicle access route:
 - a. Eliminating areas within a zone of influence of 500 metres of a known (approved) motorized vehicular access route;
 - b. Eliminating areas unusable for grizzly bear, including those areas >2,400 metres in elevation and areas consisting of rock, ice, bare soil and water;
 - c. Eliminating minimum feeding areas (<10.1 km²).
- 2) All anthropogenic linear disturbances:
 - a. Eliminating areas within a zone of influence of 500 metres of all anthropogenic linear disturbances;
 - b. Eliminating areas unusable for grizzly bear, including those areas >2,400 metres in elevation and areas consisting of rock, ice, bare soil and water;
 - c. Eliminating minimum feeding areas (<10.1 km²).

³⁴ AXYS. 1999. Screwdriver Creek Well Site Development: Environmental Assessment. Report Prepared for Canadian 88 Energy Corp. and Shell Canada Ltd. Calgary, Alberta

³⁵ AXYS. 1999. Screwdriver Creek Well Site Development: Environmental Assessment. Report Prepared for Canadian 88 Energy Corp. and Shell Canada Ltd. Calgary, Alberta

³⁶ Horeji B. 2004. Grizzly bears in southwest Alberta: A vision and plan for population and habitat recovery. Western Wildlife Environments Consulting Ltd. Calgary, Alberta. 132 pp. Available at: <http://www.cwcw.ab.ca/files/HorejsiGBReport.pdf>

Step 8. New Linear Disturbances

We attempted to estimate the extent of new linear disturbances since the Alberta's Government's 1998 announcement of the Castle area as a protected area under its Special Places program and since the 1999 publication of the AXYS report.³⁷ We used four sources of information regarding the locations of older linear disturbances and then compared this with the linear disturbances as mapped from the 2009 SPOT imagery:

1. Landsat satellite imagery (Path 41 Row 26) dated 2001 and 1988.
2. Maps of linear disturbances in the 1999 AXYS report.³⁸
3. Government of Alberta PDF maps.³⁹
4. An unpublished ~10 year-old dataset of linear disturbances held by the Mistakis Institute.

From these sources, it was only possible to derive an estimate of potential new linear disturbances. The Government of Alberta either does not monitor new linear disturbances in the Castle area or does not make the information publicly available.

Step 9. Field checks

- Field checks were conducted within the Castle Area Forest Land Use Zone October 5 and 6 2010 (Map 15, 16, 17).
- The Castle Falls Road and the Lynx Creek road plus a few side roads were driven for a total of 58.8 km. This route was termed the Primary Route. All of the Primary Route was authorized for motorized vehicular use, including Road Vehicles or OHVs or Snowmobiles use.
- 65 stops were made along the 58.8 km Primary Route, where a linear disturbance running off the side of the Primary Route was visually identified on the ground.
- At each stop, the vehicular use/non-use was verified by walking 50 metres along each linear disturbance, distinguishing between cattle trails or other tracks from vehicular trail use by requiring the observance of tire tracks on the trails.
- Photographs were taken and data was recorded (Photograph Number, Used or Not Used by Vehicles, GPS location) (Table 3) (Maps 16 and 17) (Appendix — issued as a separate document).
- The length of the Primary Route as a proportion of the total authorized-for-vehicular-access routes was calculated.

³⁷ AXYS. 1999. Wildlife Regional, Sub-regional and Local Study Areas with Major Drainage Basin Boundaries. Figure 9.1 Page 9.4. Canadian 88/Shell Canada Screwdriver Creek Wellsite Development Plan – Environmental Assessment: Study Approach. AXYS Environmental Consulting Ltd/. Calgary

³⁸ AXYS. 1999. Wildlife Regional, Sub-regional and Local Study Areas with Major Drainage Basin Boundaries. Figure 9.1 Page 9.4. Canadian 88/Shell Canada Screwdriver Creek Wellsite Development Plan – Environmental Assessment: Study Approach. AXYS Environmental Consulting Ltd/. Calgary

³⁹ Castle Special Management Area (see maps at:
<http://www.srd.alberta.ca/RecreationPublicUse/RecreationOnPublicLand/ForestLandUseZones/CastleAreaFLUZMapsPublications.aspx>

- All authorized-for-vehicular-access routes accessible off the Primary Routes, as identified in the Alberta Government’s Castle Area Forest Land Use Zone Maps and Publications,⁴⁰ were counted for field records of actual vehicular use.
- All field check sites were compared to the mapped linear disturbances access points that run off the Primary Route, as previously identified and mapped using SPOT 2.5m satellite imagery, and analyzed as to proportions of mapped/unmapped and used/not used for the entire Primary Route.
- Extrapolations were made to the entire Castle Area Forest Land Use Zone.

Table 3. Field check records of 65 stops or data points.

Latitude	Longitude	Photo number	Notes	Vehicles*
49.42077	-114.29507	4738-40	used	2
49.42082	-114.29265	4741	used	3
49.42056	-114.30235	4742-43	not used	3
49.41505	-114.31751	4744	not used	2
49.40938	-114.32154	4745	not used	2
49.40279	-114.33205	4746-48	used	1
49.38575	-114.34761	4749-53	used	2
49.38542	-114.34637	4754-57	used	2
49.38087	-114.35982	4759	used	2
49.38098	-114.36461	4760-64	used & not used	2
49.3772	-114.37776	4765-67	used	1
49.37499	-114.38409	4768-73	used	2
49.37276	-114.39045	4774-75	used	1
49.36489	-114.39993	4776-77	N=used: S=not used	1
49.35954	-114.40544	4778-79	not used	2
49.35024	-114.41189	4780-81	used	1
49.3454	-114.41604	4782-83	used	2
49.34156	-114.41728	4784-87	used	2
49.34037	-114.41772	4788-93	used & not used	2
49.3307	-114.41829	4794-98	used & ecological reserve	3
49.3218	-114.4156	4800-05	ski hill	1
49.31384	-114.40898	4806	used	3
49.30817	-114.40439	4807-09	used	2
49.30693	-114.40337	4810-12	used	3
49.30283	-114.40142	4813-15	used	2
49.30015	-114.40053	4816	used	1
49.29777	-114.4002	4917-20	used	2
49.29612	-114.40005	4921-24	used,bridge	1
49.28635	-114.39976	4825-27	used	2
49.37722	-114.37178	4832-34	used	2
49.38163	-114.33042	4835	used	2
49.37942	-114.33035	4836-38	used	2
49.37892	-114.33044	4839	used	1
49.37011	-114.32294	4840-41	used	1
49.36983	-114.29513	4842-46	used	1

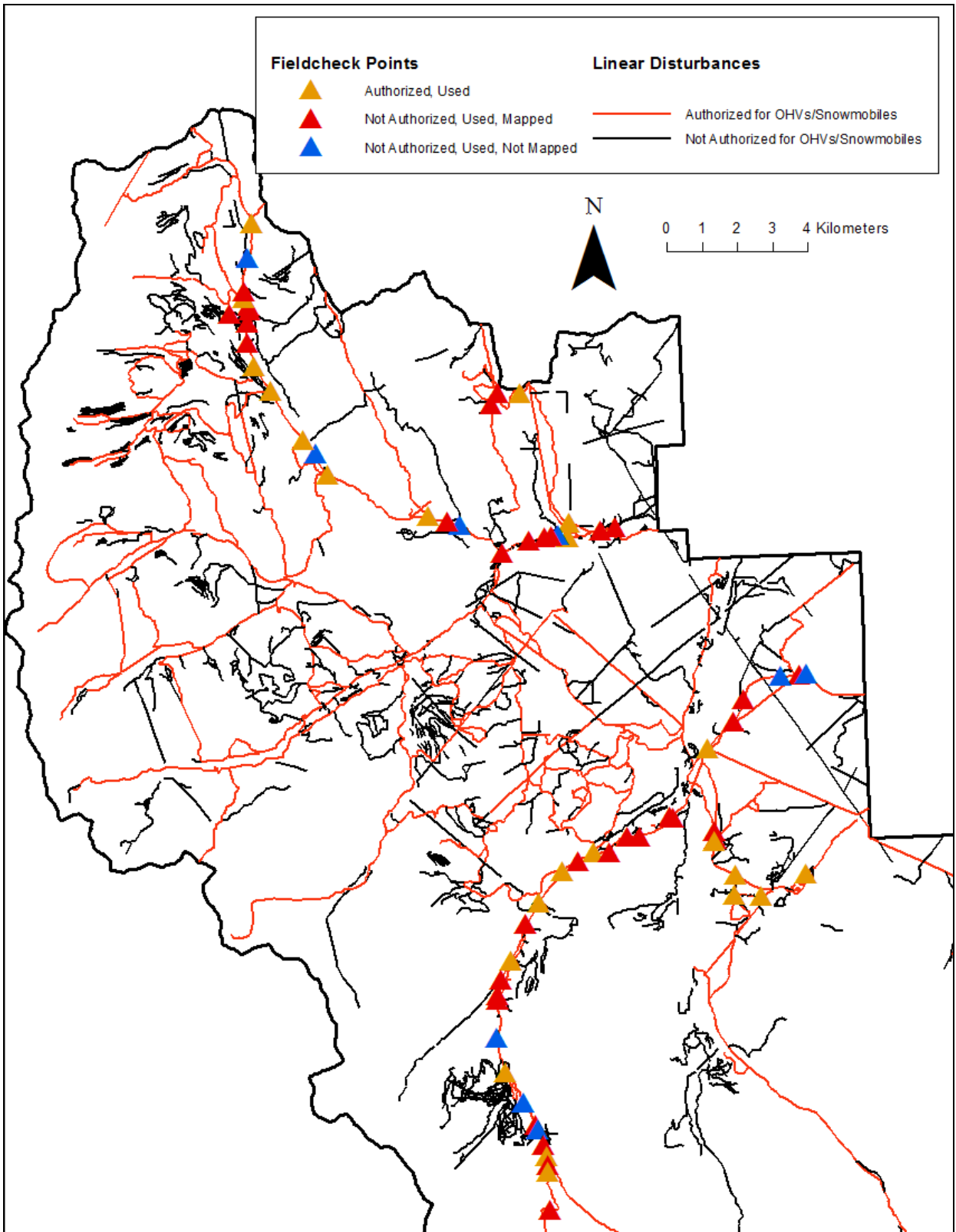
⁴⁰ Castle Special Management Area (see maps at: <http://www.srd.alberta.ca/RecreationPublicUse/RecreationOnPublicLand/ForestLandUseZones/CastleAreaFLUZMapsPublications.aspx>)

49.36462	-114.31291	4847-49	used	1
49.36505	-114.32371	4850-56	used	1
49.46019	-114.36521	4871-74	used	2
49.45922	-114.37095	4875	used	2
49.46153	-114.38312	4876	used	1
49.4952	-114.40043	4882	used	1
49.49544	-114.40958	4884	used	2
49.49267	-114.41211	4885-86	used	2
49.4579	-114.38383	4897-98	used	1
49.45846	-114.38753	4899	used	3
49.45846	-114.39043	4900	used	2
49.45811	-114.39282	4901-03	used	2
49.45732	-114.39923	4904-05	used	2
49.45461	-114.40981	4906-07	used	2
49.46191	-114.4259	4908	used	3
49.46283	-114.43085	4910	used	2
49.46465	-114.4382	4911	used	1
49.48154	-114.48155	4913	used	3
49.48491	-114.48605	4914-16	used	1
49.49799	-114.49809	4917	used	1
49.50438	-114.50457	4918	used	1
49.51027	-114.50671	4919-21	used	2
49.5154	-114.50651	4922	used	2
49.51802	-114.51368	4923-24	used	2
49.51848	-114.5055	4925	used	2
49.5196	-114.50598	4926-27	used	2
49.52173	-114.50767	4928-30	used	1
49.53214	-114.50578	4932.34	used	3
49.54089	-114.50346	4935-36	used	1
49.52335	-114.50761	4931	used	2
49.47585	-114.47673	4912	used	1

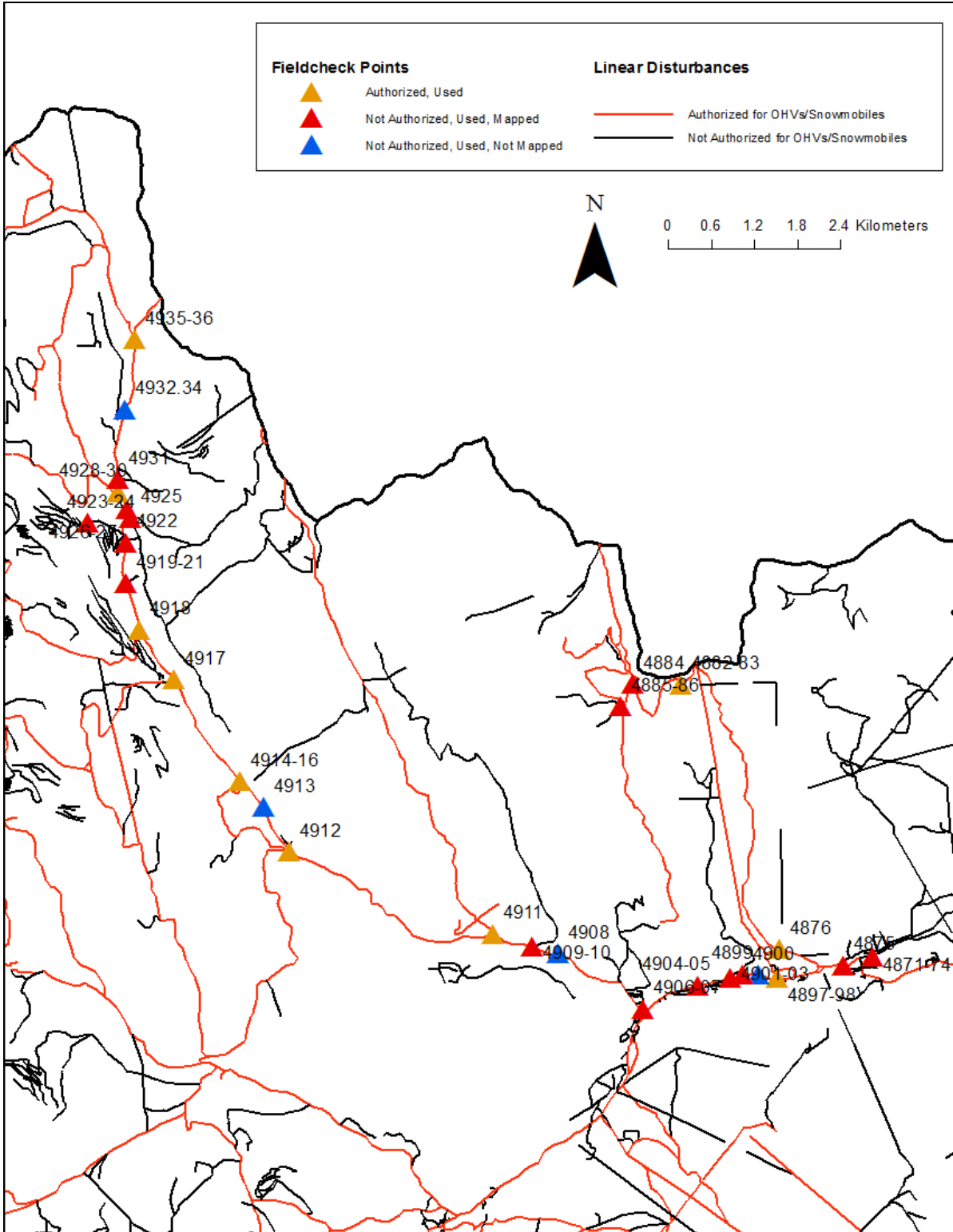
*Vehicles:

- 1 = Authorized for vehicular access; used for vehicular access
- 2 = Not authorized for vehicular access; mapped linear disturbance
- 3 = Not authorized for vehicular access; not mapped linear disturbance

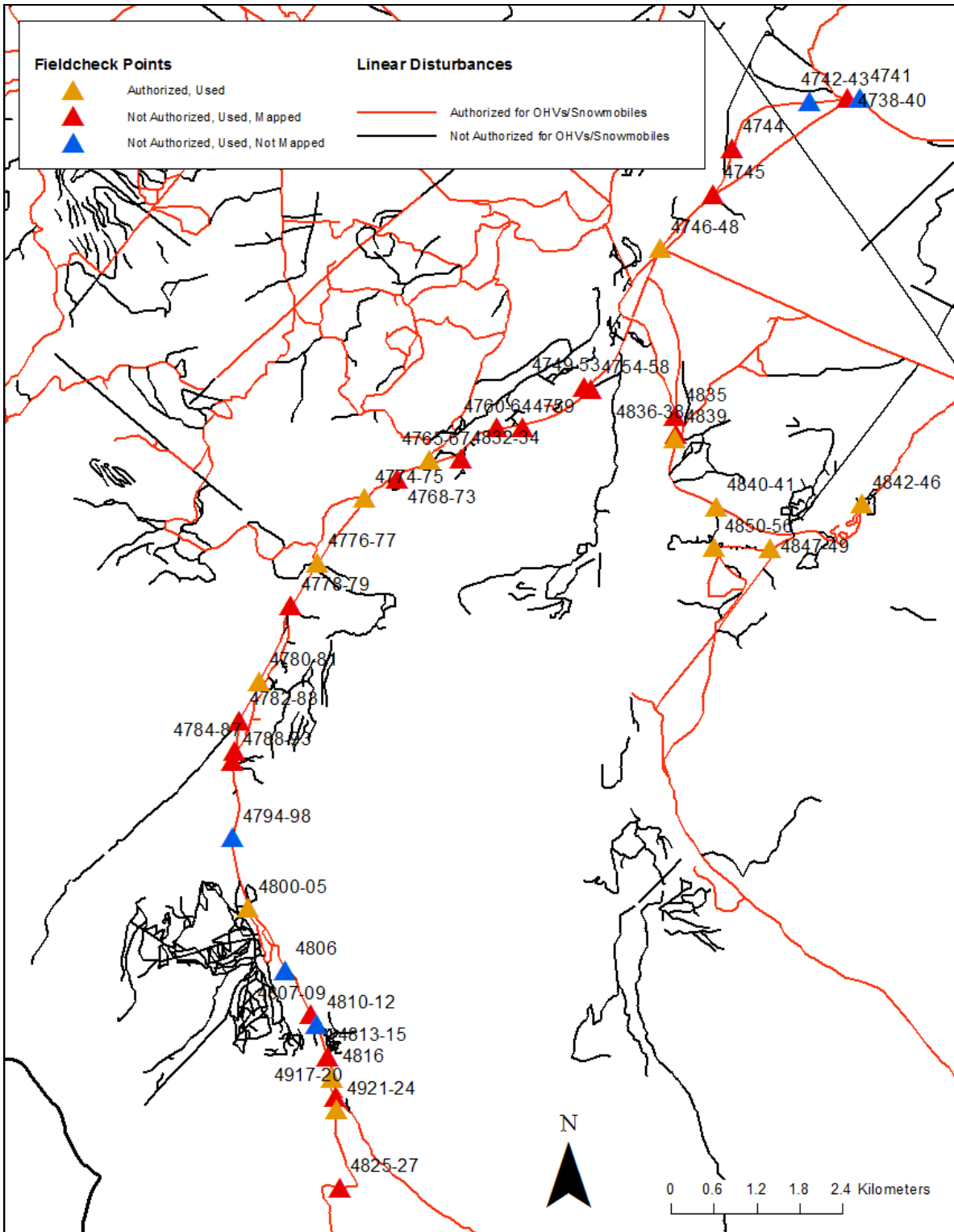




Map 15. Field check locations (October 5-6 2010) and summary of field check results.



Map 16. Field check points of northern portion of Primary Route (see Table 3 and photographs in Appendix) and summary of field check results (see Appendix for photographs referenced in this map).



Map 17. Field check points of southern portion of Primary Route (see Table 3 and photographs in Appendix) and summary of field check results (see Appendix for photographs referenced in this map).

Section 4. Results

Anthropogenic linear disturbances

Maps 18 and 19 show the two types of categories of linear disturbances:

- Linear Disturbance Type 1 –Paved; Gravel; Unimproved; Trail; Cutline;
- Linear Disturbance Type 2 –Snowmobiles in Winter; Motorized vehicles in Summer; Year-round access; Unknown.

The total length of anthropogenic linear disturbances within the Castle Area Forest Land Use Zone is 1,283 km.

Table 4 presents the length, by categories, of anthropogenic linear disturbances within each of the 9 analytical units within the Castle Area Forest Land Use Zone. The three analytical units with the greatest length of linear disturbances are:

1. Upper Carbondale = 264 km
2. Lynx Creek = 243 km
3. West Castle = 242 km.

The analytical units with the greatest length of Paved roads, Gravel roads, Unimproved roads, Cutline and Trail linear disturbances are:

1. Paved road – Lower Castle = 3.3 km
2. Gravel – East Slopes watersheds = 27.2 km
3. Unimproved road – East Slopes watersheds = 42.2 km
4. Cutline – Lower Castle = 53.5 km
5. Trail – Upper Carbondale = 236.0 km

The analytical units with the greatest length of Alberta Government-approved Year-round motorized access, Summer motorized access, Winter motorized access and Unknown motorized access are:

1. Year-round – Upper Carbondale = 87.8 km
2. Summer – Lynx Creek = 26.8 km
3. Winter – South Castle = 35.0 km
4. Unknown – East Slopes watersheds = 145.6 km

Table 5 presents the area of each analytical unit within the Castle Area Forest Land Use Zone. The total area of the Castle Area Forest Land Use Zone is 1,003.4 km². The three largest analytical units within the Castle Forest Land Use Zone are:

1. East Slopes watersheds = 26,160.5 ha
2. South Castle watershed = 24,661.4 ha
3. West Castle watershed = 15,162 ha

Linear disturbances density by analytical unit

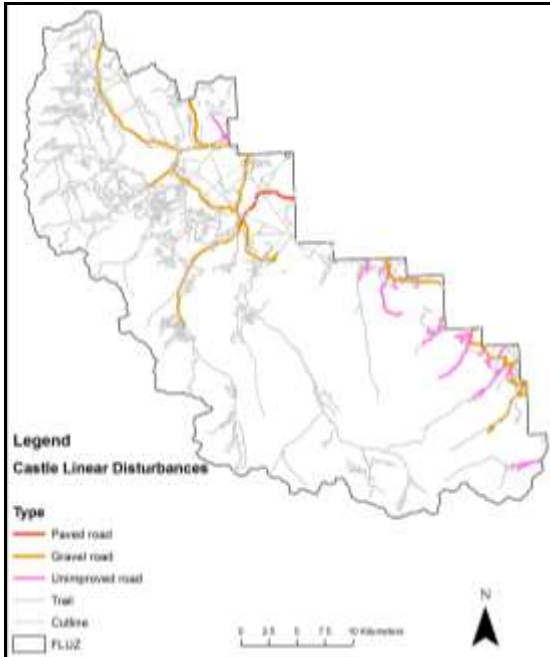
The average linear disturbance density of the Castle Area Forest Land Use Zone is 1.3 km / km² (Table 5).

The linear disturbance density of each of the 9 analytical units within the Castle Area Forest Land Use Zone ranges from 0.7 km / km² to 2.2 km / km² and are listed below for all units:

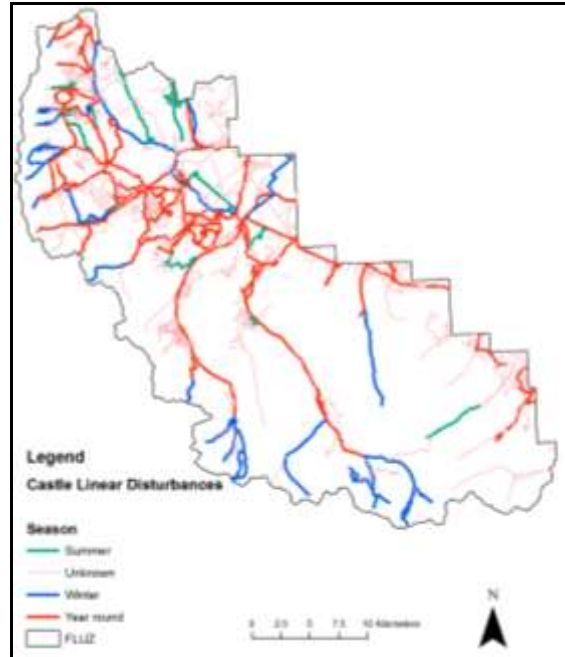
- East Slopes watersheds = 0.7 km / km²
- Upper Carbondale = 1.8 km / km²
- Lynx Creek = 2.2 km / km²
- West Castle = 1.6 km / km²
- Lower Castle = 2.0 km / km²
- Screwdriver Creek = 1.2 km / km²
- Beaver Mines Creek = 2.0 km / km²
- South Castle = 0.7 km / km²



In addition to wildlife disturbance, rutting and erosion caused by motorized vehicles in ecologically-rich valley bottoms is common in the Castle Area Forest Land Use Zone. (October 5/6 2010)



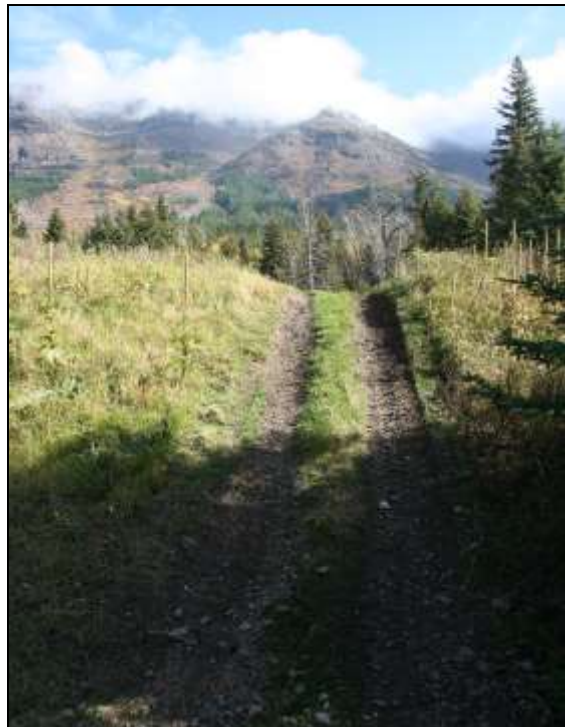
Map 18. Linear disturbances: Type 1 – Alberta Government-approved Year-round motorized access, Summer motorized access, Winter motorized access and Unknown motorized access



Map 19. Linear disturbances: Type 2 – Alberta Government-approved Year-round motorized access, Summer motorized access, Winter motorized access and Unknown motorized access.



Unauthorized motorized vehicle trail along upper ridges in Lynx Creek watershed. (October 5/6 2010)



Unauthorized motorized vehicle trail heading into upper elevations in West Castle valley. (October 5/6 2010)

Table 4. Linear disturbance lengths (metres) in each of the 9 analytical units.

Type	Season	East Slopes watersheds	Upper Carbondale	Lynx Creek	West Castle	Lower Castle	Screwdriver Creek	Beaver Mines Creek	South Castle	Grand Total
Paved road		0	0	0	714	3,393	0	2,627	0	6,734
Gravel road	Winter	0	2,145	17,348	5,978	2,945	0	0	0	28,416
	Year round	24,170	2,748	1,963	16,708	9,308	0	0	6,178	61,075
	Unknown	3,016	227	0	0	155	0	0	477	3,875
Gravel road Total		27,186	5,120	19,311	22,686	12,407	0	0	6,655	93,366
Unimproved road		42,227	261	0	0	4,474	0	0	0	46,962
Cutline	Summer	0	386	1,313	6	6,285	0	0	0	7,989
	Winter	0	1,282	836	0	3,359	436	1,317	0	7,230
	Year round	3,236	5,053	6,264	4,134	2,693	0	4,786	4,008	30,174
	Unknown	23,224	15,842	6,005	3,562	41,148	117	9,819	15,184	114,900
Cutline Total		26,460	22,562	14,418	7,703	53,484	553	15,922	19,192	160,293
Trail	Summer	5,699	4,792	25,522	5,964	1,517	0	1,182	2,453	47,129
	Winter	9,047	24,353	8,846	21,081	2,235	0	378	35,035	100,975
	Year round	7,649	81,230	39,093	53,235	4,388	0	810	31,292	217,696
	Unknown	77,092	125,627	136,302	130,134	49,193	824	9,423	80,811	609,407
Trail Total		99,487	236,002	209,764	210,413	57,333	824	11,793	149,591	975,207
Grand Total		195,360	263,945	243,493	241,516	131,092	1,377	30,342	175,438	1,282,563

Season	Type	East Slopes watersheds	Upper Carbondale	Lynx Creek	West Castle	Lower Castle	Screwdriver Creek	Beaver Mines Creek	South Castle	Grand Total
Summer	Cutline	0	386	1,313	6	6,285	0	0	0	7,989
	Trail	5,699	4,792	25,522	5,964	1,517	0	1,182	2,453	47,129
Summer Total		5,699	5,178	26,835	5,970	7,802	0	1,182	2,453	55,118

Winter	Gravel road	0	2,145	17,348	5,978	2,945	0	0	0	28,416
	Cutline	0	1,282	836	0	3,359	436	1,317	0	7,230
	Trail	9,047	24,353	8,846	21,081	2,235	0	378	35,035	100,975
Winter Total		9,047	27,780	27,031	27,059	8,539	436	1,695	35,035	136,622
Year round	Paved road	0	0	0	714	3,393	0	2,627	0	6,734
	Gravel road	24,170	2,748	1,963	16,708	9,308	0	0	6,178	61,075
	Cutline	3,236	5,053	6,264	4,134	2,693	0	4,786	4,008	30,174
	Trail	7,649	81,230	39,093	53,235	4,388	0	810	31,292	217,696
Year round Total		35,055	89,031	47,320	74,791	19,781	0	8,223	41,478	315,679
Unknown	Gravel road	3,016	227	0	0	155	0	0	477	3,875
	Unimproved road	42,227	261	0	0	4,474	0	0	0	46,962
	Cutline	23,224	15,842	6,005	3,562	41,148	117	9,819	15,184	114,900
	Trail	77,092	125,627	136,302	130,134	49,193	824	9,423	80,811	609,407
Unknown Total		145,559	141,957	142,307	133,696	94,969	941	19,242	96,472	775,144
Grand Total		195,360	263,945	243,493	241,516	131,092	1,377	30,342	175,438	1,282,563

Minimum and maximum motorized vehicular access densities

Minimum motorized vehicular access densities are based on the known (approved) Year-round, Summer Off-highway Vehicle and Winter Snowmobile linear disturbances as shown on Alberta Government maps.⁴¹ The average minimum motorized access density of the Castle Area Forest Land Use Zone is 0.5 km / km² (Table 5). The minimum motorized access density of each of the 9 analytical units ranges from 0.0 km / km² to 0.9 km / km² and are listed below for all units:

- East watersheds = 0.2 km / km²
- Upper Carbondale = 0.8 km / km²
- Lynx Creek = 0.9 km / km²
- West Castle = 0.7 km / km²
- Lower Castle = 0.5 km / km²
- Screwdriver Creek = 0.4 km / km²
- Beaver Mines Creek = 0.7 km / km²
- South Castle = 0.3 km / km²

Maximum motorized vehicular access densities are based on all anthropogenic linear disturbances mapped in this study. The overall average maximum motorized access density of the Castle Area Forest Land Use Zone is 1.3 km / km² (Table 5). The maximum motorized access density of each of the 9 analytical units ranges from 0.7 km / km² to 2.2 km / km² and are listed below for all units:

- East Slopes watersheds = 0.7 km / km²
- Upper Carbondale = 1.8 km / km²
- Lynx Creek = 2.2 km / km²
- West Castle = 1.6 km / km²
- Lower Castle = 2.0 km / km²
- Screwdriver Creek = 1.2 km / km²
- Beaver Mines Creek = 2.0 km / km²
- South Castle = 0.7 km / km²

Maps 20 and 21 show the minimum and maximum motorized access densities.

Probable motorized vehicular access densities based on field work

- 11.9% of all the access points leading to the authorized-for-vehicular access routes were field checked.

⁴¹ Available at:

<http://www.srd.alberta.ca/RecreationPublicUse/RecreationOnPublicLand/ForestLandUseZones/CastleAreaFLUZMapsPublications.aspx>

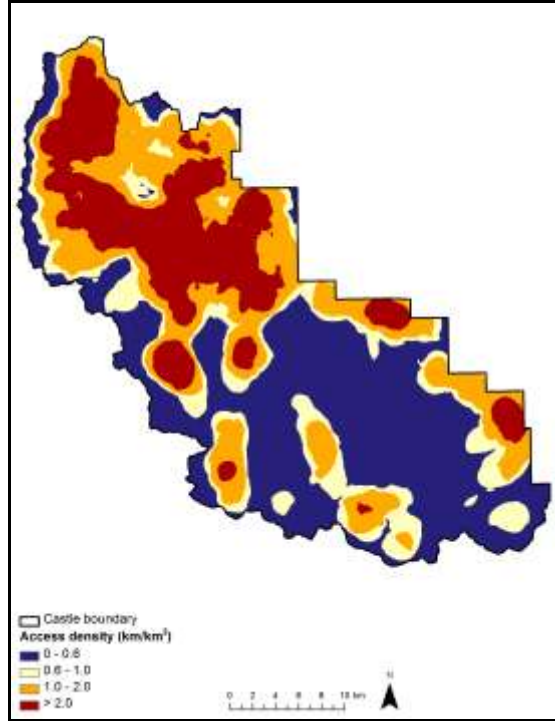
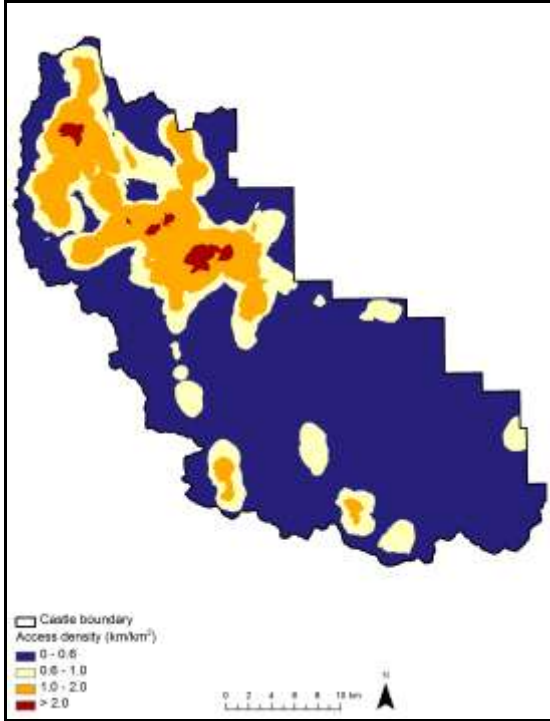
- ALL (n=23) authorized-for-vehicular access routes running off the Primary Route had evidence of being used by motorized vehicles, as indicated by vehicular tracks and trails.
- Of the 42 linear disturbances running off the Primary Route that were not authorized-for-vehicular access, 39 (92.9%), had evidence of being used by motorized vehicles, as indicated by vehicular tracks and trails.
- Of the 33 linear disturbances, running off the Primary Route, that were not authorized-for-vehicular access and that had previously been identified and mapped using SPOT 2.5 satellite imagery, 31(93.9%) had evidence of vehicle use. Two had no evidence of being used by vehicles.
- Of the 39 linear disturbance access points that had evidence of being used by motorized vehicles (of the total 42 identified linear disturbance access points), 8 (20.1%) had evidence of being used by motorized vehicles but had not been identified and mapped used SPOT 2.5 satellite imagery.



Authorized motorized vehicle use on a trail, Castle Area Forest Land Use Zone. (October 5/6 2010)e

Table 5. Vehicular access densities assuming 100%, 75%, 50% and 25% vehicular use of the Unknown category.

	East Slopes watersheds	Upper Carbondale	Lynx Creek	West Castle	Lower Castle	Screwdriver Creek	Beaver Mines Creek	South Castle	Grand Total
Area of unit (ha)	26,160.5	14,713.1	11,275.3	15,162.7	6,706.2	112.5	1,550.0	24,661.4	100,341.7
Linear Density km/km²	0.7	1.8	2.2	1.6	2.0	1.2	2.0	0.7	1.3
Access density @ 100% of all linear disturbances	0.7	1.8	2.2	1.6	2.0	1.2	2.0	0.7	1.3
Access density @ 100% of all Summer, Winter and Year--round 0% of Unknown linear disturbances	0.2	0.8	0.9	0.7	0.5	0.4	0.7	0.3	0.5
Access density @ 100% of all Summer, Winter and Year--round and 75% of Unknown linear disturbances	0.6		0.6	1.4	1.6	1.0	1.6	0.6	1.1
Access density @ 100% of all Summer, Winter and Year--round and 50% of Unknown linear disturbances	0.5	1.3	1.5	1.2	1.2	0.8	1.3	0.5	0.9
Access density @ 100% of all Summer, Winter and Year--round and 25% of Unknown linear disturbances	0.3	1.1	1.2	0.9	0.9	0.6	1.0	0.4	0.7
Access density @ 100% of all Summer, Winter and Year--round and 0% of Unknown linear disturbances	0.2	0.8	0.9	0.7	0.5	0.4	0.7	0.3	0.5



Authorized motorized vehicle trail. (October 5/6 2010)

Grizzly bear habitat security areas

Maps 22 and 23 show the minimum and maximum motorized vehicular access linear disturbances buffered by 500 m (same decision rule as in the AXYS report (AXYS. 1999. *Screwdriver Creek Well Site Development: Environmental Assessment. Report Prepared for Canadian 88 Energy Corp. and Shell Canada Ltd. Calgary, Alberta*).

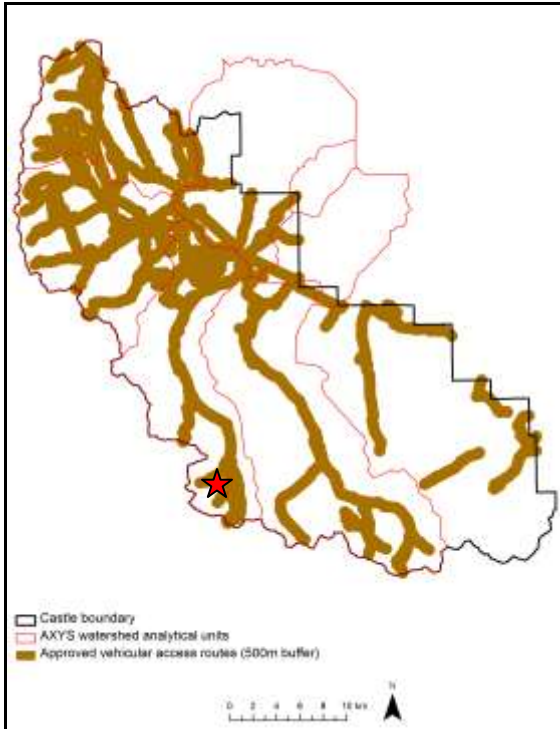
Map 24 shows areas >2,400 metres in elevation and areas consisting of rock, ice, bare soil and water (same decision rule as in the AXYS report (AXYS. 1999. *Screwdriver Creek Well Site Development: Environmental Assessment. Report Prepared for Canadian 88 Energy Corp. and Shell Canada Ltd. Calgary, Alberta*).

Maps 25 and 26 shows maximum and minimum grizzly bear habitat security areas (based on buffered minimum and maximum motorized vehicular access densities (known [approved] motorized vehicular access routes plus areas >2,400 metres in elevation and areas consisting of rock, ice, bare soil and water).

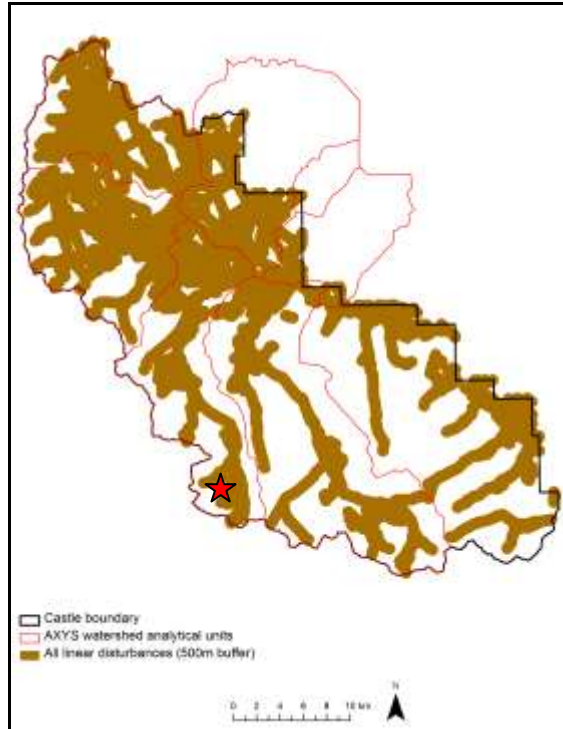
The analyses of maximum and minimum motorized vehicular access density and grizzly bear habitat security area were conducted because it is not known by the authors of this report how many of the total linear disturbances are used by motorized vehicles. The minimum would be the known (approved) motorized vehicular access routes. But using this minimum is not reasonable since, based on anecdotal reports and field checks, many other areas which are not approved for motorized vehicular access are nevertheless being used, including in the Screwdriver Creek area.



Entrance to grizzly bear den in Castle region, near proposed Shell Canada gas well. (Barrie Gilbert)



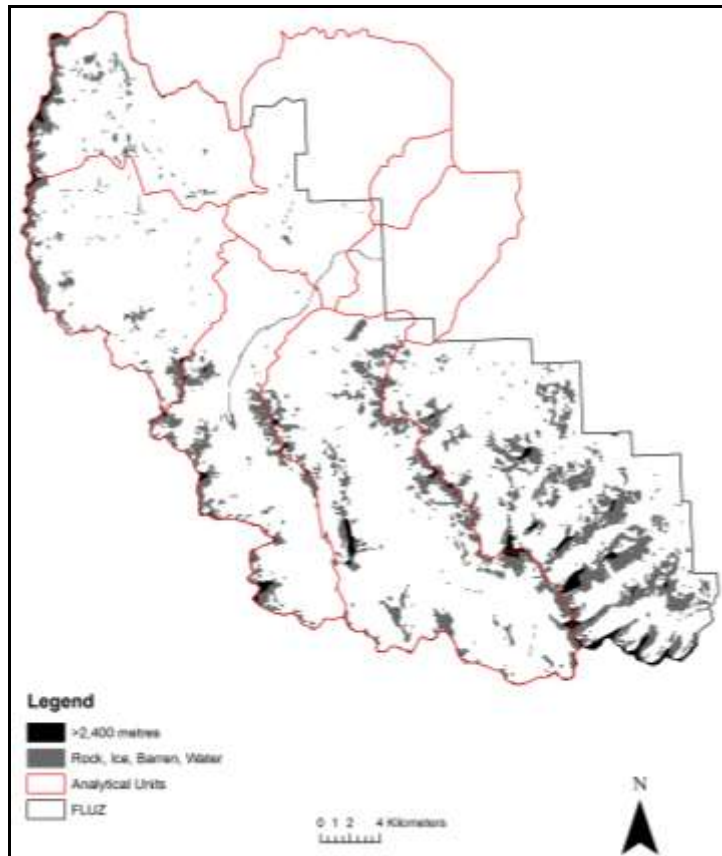
Map 22. Minimum – 500 metre buffer from a known (approved) vehicular access routes. Add new data layer.



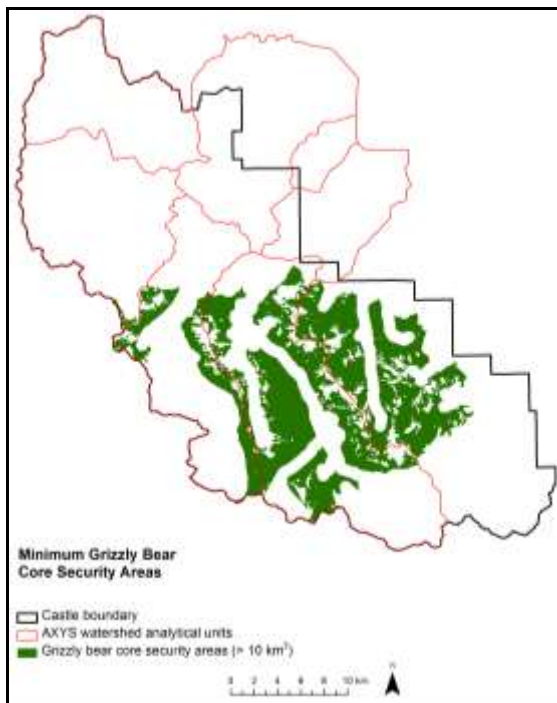
Map 23. Maximum – 500 metre buffer from all anthropogenic linear disturbances.



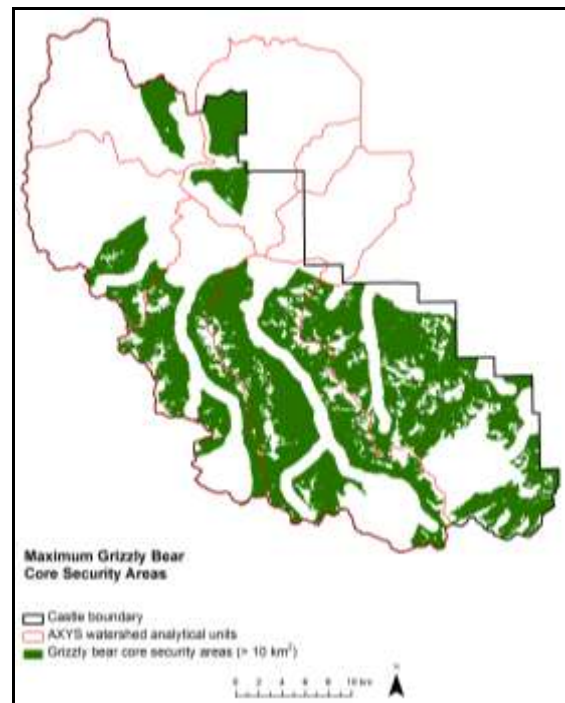
Motorized vehicles on roads within the Castle Mountain Resort. (October 5/6 2010)



Map 24. Areas >2,400 metres in elevation and areas consisting of rock, ice, bare soil and water.



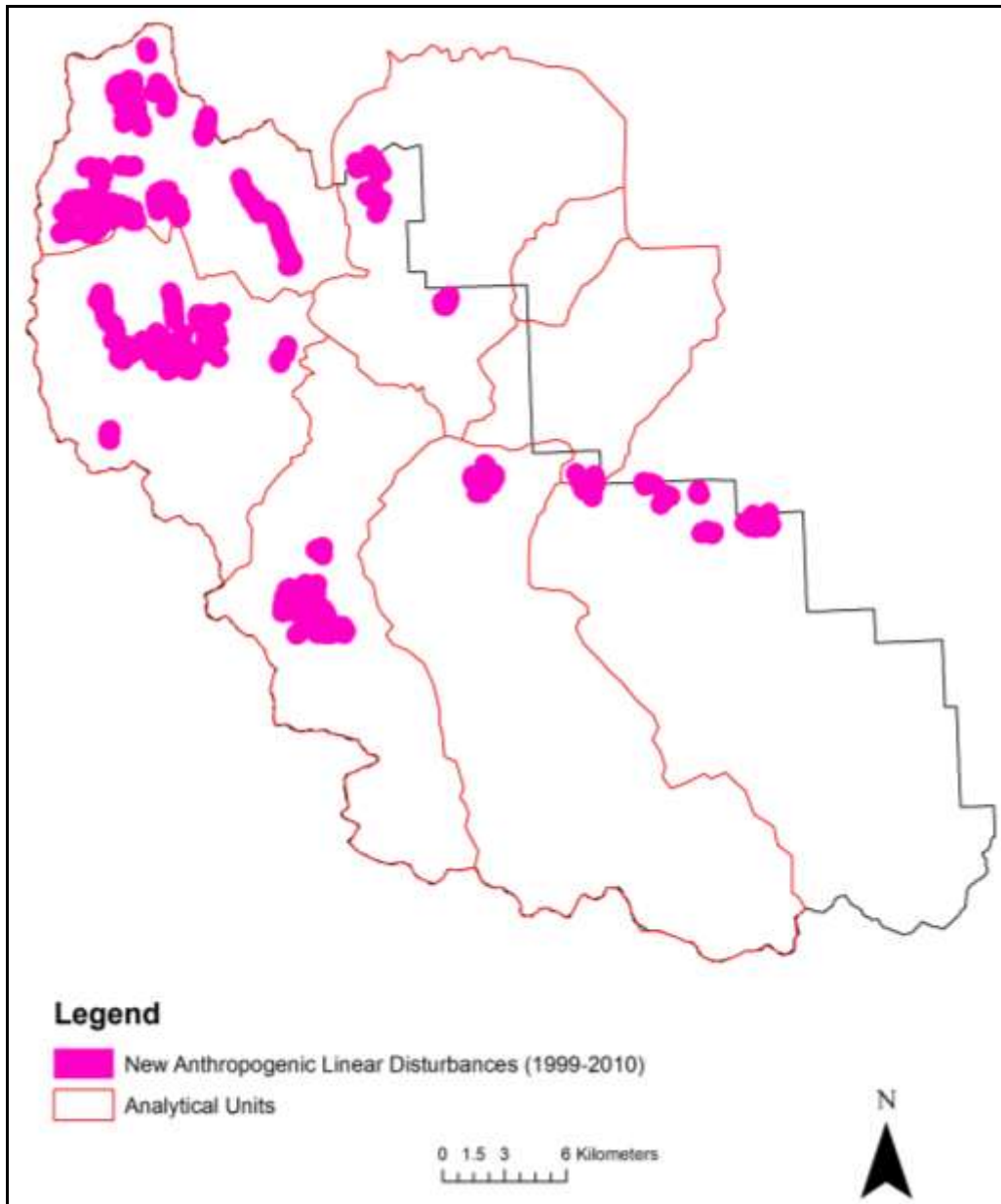
Map 25. Grizzly Bear Habitat Security Areas based on maximum vehicular access densities (known [approved] vehicular access routes).



Map 26. Grizzly Bear Habitat Security Areas based on minimum vehicular access densities (known [approved] vehicular access routes).

Potential new anthropogenic disturbances (1999-2010)

Map 27 shows new potential anthropogenic disturbances 1999-2010 (after the Alberta Government's announcement of the Castle as a protected areas under the Special Places program). There are an estimated 81 km of new potential anthropogenic disturbances and 89 km² of new potential anthropogenic disturbances when buffered by 500 m. Further disturbances will occur following Alberta Government-approved commercial logging, which will entail new roads.



Map 27. New potential anthropogenic disturbances 1999-2009.

Section 4. Discussion

The Castle area is an ecologically important area in the context of the Province of Alberta, Canada and North America. Under its Special Places program, the Alberta Government announced the establishment of the Castle Area Forest Land Use Zone in 1998 and described the announcement as a “*Milestone reached in preserving Alberta’s Natural Heritage*” (which will) “*Provide immediate legislated protection through a Forest Land Use Zone (FLUZ) which will regulate the existing access management plan, previously managed on a voluntary basis.*” The Government’s 1998 media release stated: “*The designation of six new Wildland Parks in the Canadian Shield Natural Region, and a range of preservation measures for the Castle area in the Rocky Mountain Natural Region will add approximately 2,800 sq km to Alberta’s protected areas network under Special Places.*” “*Special Places is the Government of Alberta’s protected areas policy.*”

This study examined the extent of linear disturbances within the Castle Area Forest Land Use Zone of south-western Alberta and analyzed these disturbances in terms of:

- their use by motorized vehicles;
- Alberta Government’s management and policy intentions of motorized vehicle use compared to actual use, and;
- potential impact on grizzly bear habitat security areas and on the Alberta Grizzly Bear Recovery Plan objective of open route linear disturbances at or below 0.6 km/km² in Grizzly Bear Priority Areas (also known as Grizzly Bear Core Conservation Areas).

Our results are similar to the road (i.e., linear) density results reported in previous independent studies of the Castle Area Forest Land Use Zone:

- Road densities in the least roaded part (71% of the entire Castle Area Forest Land Use Zone) to be 0.60 km/km² in a 1992 study.⁴² Adjusted road density for the same area but excluding rock and talus to be 0.94 km/km². (This compares to 0.7 km/km² for linear disturbances in our 2010 study.)
- Road densities within townships within or mostly within the Castle Area Forest Land Use Zone ranged from 0.74 to 1.86 km/km² in a 1993 study;⁴³ (This compares to 0.7 km/km² to 2.2 km/km² for linear disturbances in watershed units in our 2010 study.)
- Road density of 2.21 km/km² for the Carbondale watershed in 1996 (comprising 30% of the Castle Area Forest Land Use Zone). (This compares to 1.8 km/km² for

⁴² Gibbard MJ and DH Sheppard. 1992. Castle Wilderness Environmental Inventory. Special Publication No. 1. Castle-Crown Wilderness Coalition. Pincher Creek, Alberta 168 pp.

⁴³ Sawyer MD, 1993. Cumulative effects of the proposed Westcastle expansion. Report submitted to the Natural Resources Conservation Board Hearing. Pincher Creek, Alberta.

linear disturbances in our 2010 study, although our study only included the upper Carbondale watershed.)⁴⁴

- Road density of 0.62 km/km² for the below treeline portion of the South Castle River Basin (which comprises approximately 34% of the Castle Area Forest Land Use Zone). (This compares to 0.7 km/km² for linear disturbances for the entirety of the South Castle River Basin in our 2010 study)⁴⁵
- Linear feature density of 1.90 km/km² for grizzly bear home ranges in the north portion of the Castle Area Forest Land Use Zone and 0.75 km/km² for grizzly bear home ranges in the south portion of the Castle Area Forest Land Use Zone in 2004.⁴⁶ (This compares to 2.0 km/km² and 1.1 km/km² for linear disturbances in our 2010 study.)

Our study found that the total length of anthropogenic linear disturbances within the Castle Area Forest Land Use Zone is 1,283 km (1.3 km / km²). This is more than double the threshold of 0.6 km/km² within important grizzly bear areas, as recommended in the Alberta Grizzly Bear Recovery Plan⁴⁷ for open routes (defined as “*a route without restrictions on motorized access*”). Several watersheds within the Castle Area Forest Land Use Zone have a linear disturbance density exceeding three times the threshold of 0.6 km/km² within important grizzly bear areas, as recommended in the Alberta Grizzly Bear Recovery Plan.

Our results confirm a 2002 study that stated: “*The field survey indicated that many roads considered closed under the Alberta Land and Forest Service’s Access Management Plan were being used by off-highway vehicles during the spring and summer of 2001. In addition, this study identified the existence of roads that are not shown on the Land and Forest Service road inventory map. All roads on the inventory map for the present study area were in use during the spring/summer of 2001.*”⁴⁸ Of the area we field checked we

⁴⁴ Sawyer MD and DW Mayhood. 1998. Cumulative effects analysis of land-use in the Carbondale River catchment: implications for fish management. Pp 429-444 in MK Brewin and DMA Monita, tech. cords. Forest-Fish Conference: Land Management Practices Affecting Aquatic Ecosystems. Proc Forest-Fish Conference May 1-4, 1996, Calgary Alberta. Can. For. Ser. North For. Cent. Edmonton, Alberta. Inf. Rep. NOR-X-356. Available at: http://www.fwresearch.ca/Library_files/Sawyer%26Mayhood1998.pdf

⁴⁵ Sheppard DH, G Parkstrom and JC Taylor. 2002. Bringing it Back: A restoration framework for the Castle Wilderness. Castle-Crown Wilderness Coalition. Oincher Creek, Alberta. 188 pp. Available at: http://www.cwc.ab.ca/news_reports.php

⁴⁶ Horeji B. 2004. Grizzly bears in southwest Alberta: A vision and plan for population and habitat recovery. Western Wildlife Environments Consulting Ltd. Calgary, Alberta. 132 pp. Available at: <http://www.cwc.ab.ca/files/HorejsiGBReport.pdf>

⁴⁷ Alberta Grizzly Bear Recovery Plan 2008-2013. Alberta Sustainable Resource Development, Fish and Wildlife Division, Alberta Species at Risk Recovery Plan No. 15. Edmonton, AB. 68 pp. Available at: <http://www.srd.alberta.ca/ManagingPrograms/FishWildlifeManagement/BearManagement/GrizzlyBears/documents/GrizzlyBear-RecoveryPlan2008-13-revJuly23-2008.pdf>

⁴⁸ Sheppard DH, G Parkstrom and JC Taylor. 2002. Bringing it Back: A restoration framework for the Castle Wilderness. Castle-Crown Wilderness Coalition. Oincher Creek, Alberta. 188 pp. Available at: http://www.cwc.ab.ca/news_reports.php

found that there were almost double the number of linear disturbance access points being used by motorized vehicles than were authorized by the Alberta Government.

The minimum (approved) motorized vehicular access results in a significant reduction of grizzly bear habitat security areas in the Forest Land Use Zone portion of the Castle Grizzly Bear Core Conservation Area. However, the more likely maximum or close-to-maximum motorized vehicular access (all linear disturbances) results in an even much more significant reduction of habitat security in the Forest Land Use Zone portion of the Castle Grizzly Bear Core Conservation Area. This result is consistent with an earlier 2004 study that stated that: “*Road density in southwest Alberta is far in excess of thresholds that harm grizzly bears.*”⁴⁹

Since 1998, when the Alberta Government announced the Castle area as a protected area within their Special Places program, there are an estimated 81 km of new anthropogenic disturbances and 89 km² of new anthropogenic disturbances when buffered by 500 m. Further disturbances will occur following Alberta Government-approved commercial logging, which will entail new roads.

If we apply the same proportions found in the field check sample area to the entire Castle Area Forest Land Use Zone, an additional 354 motorized vehicular access points that are not authorized by the Alberta Government for motorized vehicular access, occur in the Castle Area Forest Land Use Zone, and 1,403.4 km of potential linear disturbances are used by motorized vehicles, representing an additional 907.5 km more than the authorized-for-vehicular access routes.

The Castle Area Forest Land Use Zone portion of the Castle Grizzly Bear Core Conservation Area is not secure for grizzly bears according to thresholds for disturbances in core habitat – only fragments of it are secure.

The Castle Area Forest Land Use Zone is not being managed according to its mandate, regulations or stated purpose. Access is not being controlled, and is a threat to all other public values of this area.

The risk to the ecological integrity and specifically grizzly bears of the Castle Area Forest Land Use Zone have not diminished but have increased in the intervening years between previous similar studies in late 1990s - early 2000s, and our 2010 study.

Alberta Government information on the monitoring of human uses, especially motorized vehicle use in the Castle area either does not exist, or is not made publicly available.

⁴⁹ Horeji B. 2004. Grizzly bears in southwest Alberta: A vision and plan for population and habitat recovery. Western Wildlife Environments Consulting Ltd. Calgary, Alberta. 132 pp. Available at: <http://www.ccwc.ab.ca/files/HorejsiGBReport.pdf>



Castle area. (October 5/6 2010)

Appendix: Review Comments

A key principle of Global Forest Watch Canada is that transparency and accountability are essential for developing improved forest management. In the interest of promoting open, public, transparent information policies, all Global Forest Watch projects include a review process and the publication of a summary of the major comments provided by the reviewers, including how these comments were addressed.

We sent out 16 invitations to review the preliminary methodology and draft results of this project to government agencies, environmentalists and biologists, and also posted a review invitation to the general public on the front page of our website (www.globalforestwatch.ca). The review materials were available for three months.

We received 11 responses from invited reviewers and also received very helpful advice from a few experts during our development of the methodology.

In general, those who provided feedback found our methodology to be pragmatic and sound. They found our results generally as expected given past somewhat-similar studies of the area from the 1990s and early 2000s – and relevant for providing a credible and useful baseline of data on linear disturbances. The use of SPOT satellite imagery was particularly highlighted as useful and cost-effective. Many comments emphasized the need for more explanation and clarity of the results.

Following are the major comments, focussing on those that were not addressed in changes to the report:

Other maps and analysis recommended we include as part of this project?

Would be helpful or will certainly be needed soon, a comparison of the methodologies between this report and that being done by Cornel Yarmoly for the Ghost Watershed Alliance Society using Brad Stelfox's ALCES model, from the perspective of what is most effective for answering the key questions that arise when implementing grizzly bear recovery plans..

Yes, we agree this would be helpful. However we did not do this comparison as it was not part of the core project. In regards to grizzly bear habitat security areas, we were simply trying to emulate previous work done by AXYS Environmental Consulting Ltd. and similarly by Dr. Brian Horeji.

Usefulness of this project

This report illustrates that such assessments are needed for all of Alberta's Core and Secondary Grizzly Bear Conservation Areas as mapped and available on the Alberta Sustainable Resource Development website.

One reviewer wrote: “I appreciate that Global Forest Watch has done this research and is making the results widely available. Solid information such as this helps to remove the rhetoric and conflicting opinions in defining management challenges for this special place. It provides valuable information on using linear disturbances and access densities as indicators of appropriate management and as a benchmark for evaluating management actions in future. I hope the report is heeded by area managers.”

We agree that such mapping would provide a consistent and credible baseline of anthropogenic linear disturbances that could be tracked over time and analyzed for effects on grizzly bear habitat security areas.

Methods and Costs

With total size of Core Conservation Areas as per above map, can cost out total cost for doing such an assessment in all core habitat, which should be done as part of the information base for implementing recovery action 7.1.2.

The cost to generate the geospatial data for this project was \$14,000 (\$4,000 for the SPOT satellite image + \$10,000 for labour/digitizing) or approximately \$14 per square kilometre. The cost per square kilometre would change depending on the amount of linear disturbances and, of course, the geographic area of SPOT imagery required.

More explanation is needed of methods.

Although we did provide some more explanation, readers may wish further explanation from the author, Peter Lee at peter@globalforestwatch.ca

When you looked at the 500 m disturbance corridor along roads, did you look at roads just outside the boundary of the Castle (e.g. Shell Road), whose effect would reach into the Castle?

We did NOT look at roads just outside the boundary of the Castle Area Forest Land Use Zone. This is a methodological flaw in our mapping and analysis. This should have been done to produce a more accurate picture of linear disturbance impacts and grizzly bear habitat security areas within the Forest Land Use Zone. Due to the numerous linear disturbances outside the eastern boundary of the Forest Land Use Zone, the expected result would be an even greater impact within the Forest Land Use Zone.

OHV licensing data

The report should present data on the growth or licensing of ORV in the nearby region. This can serve as a surrogate for the amount of ORV traffic that roads data represents in the report and will tie in with images of habitat damage by ORVs.

This is an excellent suggestion, but beyond the scope of our project.

Scientific Review

Further peer scientific review should be sought regarding methodology and conclusions.

We agree that if a science publication of this study is pursued, more scientific review is warranted and would occur in the normal course of publishing in a peer-reviewed science journal. The sections of our study concerning grizzly bears and their habitat security areas could benefit from further comment from grizzly bear experts.