# Assessing wildlife use of the Galloway Lands and the effectiveness of a conservation subdivision design for large mammals

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Wildsight, and the Elk River Alliance

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**Executive Summary**

A housing development has been proposed on the Galloway Lands, which is situated between the City of Fernie and Fernie Alpine Resort. The development aims to use conservation design principles to create a conservation subdivision that will have minimal impacts on wildlife and the environment. I summarised the current habitat and connectivity value of these lands for grizzly bears across all seasons, and ungulates such as moose in the winter. I briefly consider impacts to aquatic systems. I then conducted a literature review to assess if conservation subdivisions and associated design principles were well-suited to safeguard these wildlife values.

The Galloway Lands contain medium to high quality grizzly bear habitat in all seasons except the denning season and are used as a movement corridor by bears as they travel between Morrisey and Lizard Creek. Use of this corridor is partly due to its' habitat quality but also because other natural movement corridors along the valley bottom have already been substantially impacted by residential developments within the City of Fernie and Fernie Alpine Resort. There is significant identified ungulate winter range—especially for moose—within the Galloway Lands. Adjacent creeks are important westslope cutthroat trout spawning habitats, which may be degraded by runoff from development.

A review of the literature revealed that conservation subdivisions generally protect more land than traditional subdivisions but that this conserved land often has marginal benefits to wildlife—especially large mammals—due to the fragmented and development-affected nature of the conserved lands. Further, most conservation subdivisions are targeted at conserving small to medium sized mammals, birds, and amphibians, and are rarely designed to conserve large mammals such as those common in the Elk Valley: grizzly bear, cougar, wolves, elk, and moose.

The effects to wildlife can be mitigated by reducing housing density for developments and creating more contiguous habitat patches. Effective mitigations ensure that the area left for wildlife is far enough from the development that its' effects have attenuated, and the remaining corridor width outside the developments' zone of influence is thus more ecologically functional. The zone of influence from residential development on wide-ranging species such as bears, cougars, and wolves is often 3-6 km. This influence is wider than many individual parcels of developable land in British Columbia, thus providing challenging conditions to create housing developments with internal corridors that work for wide-ranging species. Without land planning that designates corridors at the landscape level (i.e., across private parcels and Provincial land) this situation will continue to arise. The proposed housing density in the Galloway Lands, paired with the proposed narrow and fragmented corridors that compose the conservation lands are unlikely to facilitate connectivity of large mammals. In addition, the possible development of these narrow corridors into human recreation areas will further degrade their ecological function and connectivity potential. A housing development on the Galloway Lands will increase wildlife conflicts. These conflicts can be reduced through strict and evidence-based regulations that mandate bear proof garbage containers, preclude fruit-bearing trees, and ensure any livestock is protected with electric fencing that is professionally installed and well maintained; but even with the best practices some conflict will still occur. Changes in connectivity from this proposed development may increase conflicts elsewhere in the area as animals shift their movement patterns.

## Purpose

Summarise wildlife use within and adjacent to the Galloway Lands and assess potential impacts of development within this area for wildlife habitat and connectivity. Conduct a literature review to assess the effectiveness of conservation subdivisions in reducing negative impacts to wildlife and the environment.

## Scope

This analysis considers the ecological aspects of developing the Galloway Lands into a subdivision and uses the best available ecological data. I do not consider the social (housing needs), legal (land ownership etc.), or planning (road access, urban sprawl, land planning etc.) aspects of this project, which form important additional dimensions of the overall project decision.

## Methods

*Wildlife habitat assessment for the Galloway Lands:* In 2016, a grizzly bear telemetry study was initiated in the Elk Valley to monitor grizzly bear population demography and habitat use. To date 65 bears have been monitored. Grizzly bears tend to use valley bottom areas near the Elk River, adjacent riparian areas, and low slope habitat nearby. At higher elevations, bears select for avalanche chutes, alpine areas, and herbaceous open slopes. Bears in the lower Elk Valley tend to die at higher rates than they can reproduce due to conflicts with people at their residences and collisions with cars and trains (Lamb et al. 2020). Reducing conflicts, collisions, and providing safe habitats for bears and other wildlife in the valley are the primary objectives of ongoing conservations actions, many of which focus on reducing human-sourced attractants. I

summarized grizzly bear habitat use as observed from the telemetry relocations as well as grizzly bear habitat quality from resource selection functions developed from these data (Apps and Lamb 2019). I also summarized ungulate winter range areas from the Province of BC, and briefly consider the impacts to aquatic systems.

*Conservation subdivision literature review:* I conducted a review of the peer-reviewed literature on conservation subdivisions. I searched the Web of Science data base using the keyword "conservation subdivision" and then conducted a second search specific to the local context in Fernie which consisted of two searches: 1) "conservation subdivision" AND "large mammal", and 2) "conservation subdivision" AND "grizzly bear", "conservation subdivision" AND "elk", "conservation subdivision" AND "moose", "conservation subdivision" AND "bear".

**Results and Discussion**

*Wildlife habitat assessment for the Galloway Lands:* Of the 65 bears monitored throughout the Elk Valley, 26 animals spent time within the landscape buffer and 8 used the Galloway Lands directly (Fig 1). Note that this is a minimum assessment of use because not all bears in the valley are collared, and the collars only send 4-12 relocations per day. Thus, animals may pass through these lands without collars on or during the period between relocations. The Galloway Lands provide medium and high-quality grizzly bear habitat from spring to fall and low-quality denning habitat due to its' valley bottom location (Fig 2). These lands are commonly used as a movement corridor for grizzly bears (Fig 3), as this is one of the undeveloped and intact corridors that allows bears to travel between Morrissey and Lizard Creek. Bears generally avoided the City of Fernie and the residential development at Fernie Alpine Resort. The corridor between the City of

Fernie and Fernie Alpine Resort is getting narrower as the Cedars development expands. Development of the Galloway Lands would essentially create a continuous band of human development between the City of Fernie and Fernie Alpine Resort that would severe this corridor.

Considering other species, the Galloway Lands comprise important winter range for moose (Fig 4). On the aquatic side, Lizard Creek —which is directly downslope from the proposed Galloway Lands—has been identified as an important spawning tributary for westslope cutthroats (Prince and Morris 2003). Westslope cutthroat trout are species of special concern with a limited range that face a variety of threats to their persistence in Canada (Canada 2017). Urban development is listed as a key concern for westslope cutthroat trout conservation, especially relating to runoff and changes to the impervious surface and natural vegetation adjacent to the stream (Canada 2017); all of which would be altered through the development of the Galloway Lands.

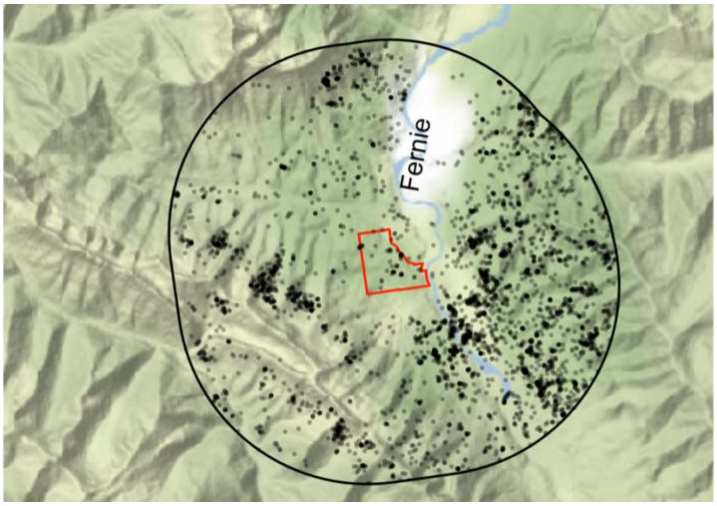


**Fig 1.** Grizzly bear telemetry relocations collected between 2016-2021 within the landscape buffer (black) and the Galloway Lands (red). These data represent 3,888 relocations from 26 individual bears, 8 of which use the Galloway Lands.

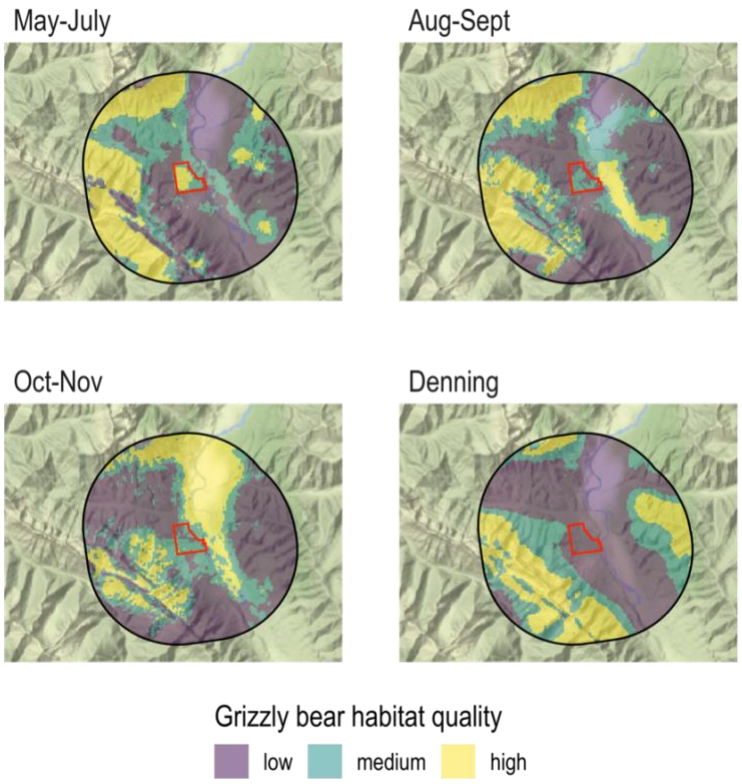


**Fig 2.** Seasonal habitat quality for grizzly bears from Apps and Lamb (2019) within the landscape buffer (black) and the Galloway Lands (red). Habitat quality ranged from 0-1, which was reclassified as low (0-0.5), medium (0.5-0.7), and high (0.7-1).

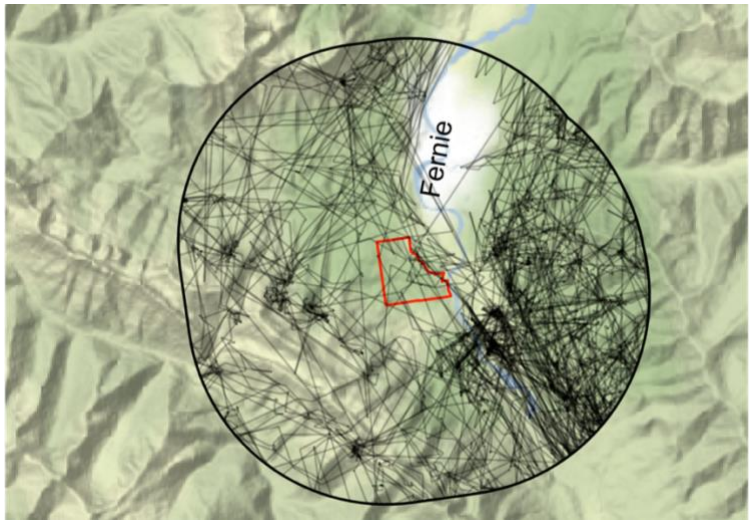


**Fig 3.** Grizzly bear movement paths collected between 2016-2021 within the landscape buffer (black) and the Galloway Lands (red). These data represent 3,888 relocations from 26 individual bears, 8 of which use the Galloway Lands.

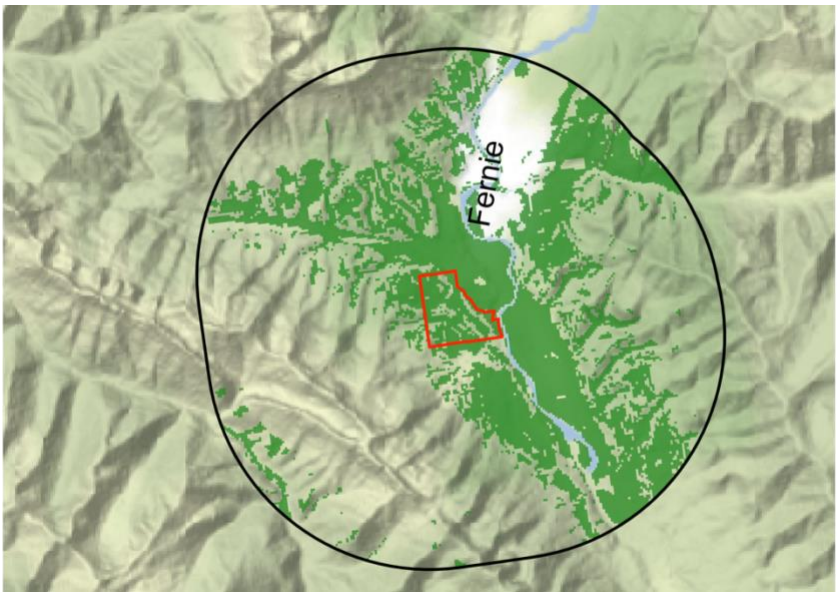


**Fig 4.** Identified ungulate winter range (green) from the Province of British Columbia within the landscape buffer (black) and the Galloway Lands (red).

*Conservation subdivision literature review*: The "conservation subdivision" query produced 26 results, while the "conservation subdivision" AND "large mammal" as well as the species-specific query both produced 0 results. I conducted an additional post-hoc query to assess whether the 0 results pertaining to large mammals was due to a paucity of evidence or an artefact of the search terms or search engine. I searched google scholar using "conservation subdivision" AND "large mammal", which returned 6 results, however upon inspection none of the six results were directly related to the influence of conservation subdivisions on large mammals. Thus, I concluded there was a paucity of peer-reviewed evidence to support assessment of the effectiveness of conservation subdivisions in conserving the movement and habitat of large mammals. Within the 26 papers from the original search, one of the papers included an assessment of larger mammals (deer and elk).

Of the 26 results from the "conservation subdivision" query, 10 documents explored the influence of conservation subdivisions on land, wildlife, or water conservation. The remaining 16 explored the social or regulatory aspects of conservation subdivisions such as consumer perspectives, willingness to pay, and regulatory challenges to their implementation and success. Within these documents several different names for conservation subdivisions were also used, such as "Conservation Development", 'Water Sensitive Design', or 'Low Impact Urban Design and Development", suggesting that the search terms used were broad enough to capture a range of literature relating to this type of development. The literature on conservation subdivisions suggests that most of these developments are in the central and northeastern United States. Outside this area, these subdivisions also occur in Boulder and Larimer counties in Colorado.

The consensus in the literature—based off the 10 documents that explored the influence of conservation subdivisions on the environment—was that conservation subdivisions have been successful at protecting land area. Compared to traditional subdivision designs, conservation subdivisions conserved more land in an undeveloped state (Arendt 2004, Milder and Clark 2011, Göçmen 2014, Mockrin et al. 2017). For example, in Waukesha County, Wisconsin, Göçmen (2014) showed that traditional subdivisions protected only 11% of the land while conservation subdivisions protected 50%. However, the composition of these protected lands (natural vegetation, woodland, or mowed grass) was similar between development type, suggesting that the proportion of land left natural versus mown in these protected lands was similar. Conservation subdivisions also resulted in the conservation of wildlife habitat (11% of wildlife habitat developed vs 38% in traditional subdivisions) and environmental corridors (13% of corridors developed vs 73% in traditional subdivisions). In a country-wide analysis of conservation developments in the United States, Milder and Clark (2011) show that conservation

subdivisions have protected at least 19,763 million ha. However, Milder and Clark (2011) also provide evidence that conservation subdivisions protect much less land (~57% of area) than other conservation developments such as reserved-homesite projects (98%), limited development projects (94%), and conservation oriented master-planned projects (71%).

While the area of land protected is a helpful measure, the configuration of these lands is equally important for ecological function. For example, Göçmen (2014) suggests that "the preservation of lands distributed in small patches, especially at the outer edges of subdivisions, as observed in five of the Waukesha County conservation subdivisions, may provide a buffer from surrounding developments, an outcome that community residents, planners, and public officials find desirable. However, this outcome may do very little for local wildlife needs", and in addition "the presence of corridors in a landscape does not guarantee that the wildlife will move from one habitat patch to the other. Depending on the corridor's width, length, shape, and vegetation, as well as the similarity of the environment between the patch and its surroundings (i.e., the matrix), wildlife may choose to avoid the corridor when moving between patches". While conserving land is a key step to maintaining ecological function, area itself is not always enough to produce the desired outcomes which include wildlife being able to move, eat, and live in these habitats.

Despite the ability of conservation subdivisions to protect land area, the realized benefits for wildlife and waterways were equivocal across studies and none provided evidence of benefits for large mammals. For example, Lenth et al. (2006) explored different housing configurations (clustered versus dispersed) and found no effect of configuration on safeguarding conservation values such as songbird and ground-nesting bird density, mammal presence, and native plant

cover. This finding suggests that the conservation subdivision's approach, whereby "Conservation subdivisions are generally "density-neutral", meaning that the overall number of dwellings built is not different from that done in conventional developments" (Arendt n.d.) are unlikely to safeguard ecological values through configuration adjustments alone. Housing density would need to be lower than traditional subdivisions as well. Compared to undeveloped land, Lenth et al. (2006) showed that both clustered and dispersed housing developments "had significantly higher densities of non-native and human-commensal species and significantly lower densities of native and human-sensitive species than undeveloped areas". While Farr et al. (2017) found smaller differences between undeveloped and developed lands—possibly due to their use of the less informative metric of species occurrence (i.e., >1) as opposed to Lenth et al. (2006)'s richer abundance metric for birds—their analysis confirmed that most large mammals occurred slightly less frequently in conservation subdivisions than in undeveloped land, especially when the development had <80% preserved natural space. In addition, Farr et al. (2017) suggested that "species with home ranges >5 $km^2$ dominated the number of detections in [developments] with 80% or more preserved open space, whereas small-bodied mammals dominated the species assemblage when [developments] had 60% or less preserved open space". Conservation subdivisions without sufficient natural space are likely to preclude large mammals. Finally, water run-off and impacts to waterways was not always improved by the conservation subdivision design (Roon 2020). For example, Göçmen (2013) suggested that the conservation subdivisions' "commonly identified goals of protection of lands with conservation value, creation of a regional network of open spaces, and contribution to improved water quality are often not reached".

Overall, I suggest that the literature supports the idea that conservation subdivisions protect more land area than traditional subdivisions, but this extra space rarely translates to meaningful benefits to wildlife. Even with more space conserved, the impacts of the housing development end up impacting the adjacent conserved land within the development, which is often heavily fragmented and provides degraded habitat that does not function well for many species. Most large mammal species of interest in the Elk Valley such as elk, moose, grizzly bear, wolverine, and cougars, are not present (or have been extirpated) from the areas where most conservation subdivisions have been designed. Where evidence was available, it appeared that conservation subdivisions would function poorer for these large-bodied animals compared to the smaller mammals and amphibians many of these developments are designed for. The conservation area would need to be >80% and corridors quite wide (>1 km) to allow these developments to support conservation values for large-bodied wildlife. Without corridors that are wide enough to allow for the attenuation of the development effect and space for the animals to move, the corridor will not be functional (Ford et al. 2020). The zone of influence from residential development on wide-ranging species such as bears, cougars, and wolves is often 3-6 km. This influence is often wider than many individual parcels of developable land in British Columbia, thus creating challenging conditions to create housing developments that also work for wide-ranging species without land planning that designates corridors at the landscape level (i.e., across parcels). Steps to reduce the impact of developments are crucial to increasing land stewardship, but it must be noted that even with mitigations, developments can still have a strong negative impact which will depend on the housing density, private land stewardship (i.e., wildlife-friendly fencing versus exclusion fencing), and the configuration and quality of the conserved habitat.

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## Appendix

Justification for “Conservation Subdivision” literature review:

“The Galloway Lands has been envisioned through the principles of Conservation Subdivision Design as promoted by Randall Arendt.”
https://d3n8a8pro7vhmx.cloudfront.net/elkriveralliance/pages/1369/attachments/original/1637964873/21-08-15_Galloway_Lands_-_Land_Use_Application_V2_as_submited-lower_file_size.pdf?1637964873

GALLOWAY
LANDS

APPLICATION FOR LAND USE

### INTRODUCTION

The Galloway Lands are a proposed acreage residential development located at the base of the southeast slopes of the Lizard Range in the rural Fernie area of the Regional District of East Kootenay (RDEK) and within the traditional territory of the Ktunaxa Nation. This document is submitted to the RDEK in support of an application for land use approval (zoning and Official Community Plan amendments) and to provide an overview of the land use planning process undertaken to date and the overall vision for the project that will carry through the subdivision process and continue with individual homeowners.

### Vision

The Galloway Lands aims to be a residential enclave situated gently within the natural environment. All aspects of the Galloway Land’s development seek to complement the lands and to conserve large tracts of the property as natural area, with significant opportunities for public use and enjoyment.

The Galloway Lands has been envisioned through the principles of Conservation Subdivision Design as promoted by Randall Arendt.

The principles of Conservation Design are discussed in more detail throughout this proposal. The vision for the Galloway Lands has guided all land use planning and design completed to date.