25 March 2022

Regional District of East Kootenay 19 – 24 Avenue South Cranbrook, BC V1C 3H8

Attn: Krista Gilbert, Planning Technician

Re: Galloway Lands – Application for Land Use Amendment

Dear Ms. Gilbert,

On behalf of our clients, CH Nelson Holdings Ltd. and Handshake Holdings Inc., Haworth Development Consulting provide the following in response to the motion at the 14 January 2022 RDEK Board of Directors meeting seeking further information from the applicant to identify issues, such as septic; road access; community wildfire protection plan; wildlife corridors; life cycle of costs development; and covenant accountability and management.

Following the January 14th meeting, we re-engaged with our consultant team to review the issues identified by the RDEK. The consultant team providing this review comprises the following professionals:

Land Use Planning / Conservation Subdivision Design	Environmental Design Group 1 Discovery Ridge Landing SW Calgary, AB T3H 5H7
Environmental Consultant	Cascade Environmental Resource Group Unit 3 – 1005 Alpha Lake Road Whistler, BC V8E 0H5
Transportation Consultant	Bunt & Associates Engineering Ltd. Suite 113, 334 – 11th Avenue SE, Calgary, AB T2G 0Y2
Forest Fire Interface	B.A. Blackwell & Associates Ltd. Suite 270 -18 Gostick Place North Vancouver, BC V7M 3G3
Hydrological Consultant	Western Water Associates Ltd. #106, 5145 - 26 Street, Vernon, BC V1T 8G4
Civil Engineering	Mulyk Consulting Ltd. Suite 600, 1414 - 8 th Street SW Calgary, AB T2R 1J6

In addition to the work undertaken by these consultants, we also met with representatives of the RDEK, City of Fernie and Fernie Alpine Resort as outlined below.

Our additional review focused on responses to the items identified by the RDEK Board of Directors:

ROAD ACCESS

Access to the Galloway Lands is proposed via Snow Pine Drive at Fernie Alpine Resort. Concerns were expressed by the RDEK Board and within the local community regarding the suitability of this road to access the property and the impact of additional traffic within the community and at the intersection of Highway #3 and Fernie Ski Hill Road.

To address these concerns, we engaged Bunt & Associates Engineering Ltd. to complete a Transportation Impact Assessment (TIA). A TIA is normally completed at the subdivision stage of a project based on a terms of reference from the Ministry of Transportation and Infrastructure (MOTI). We accelerated the completion of a TIA to meet the request of the RDEK, while still complying with the requirements of MOTI.

The TIA completed by Bunt & Associates addressed both the intersection of Highway #3 and Fernie Ski Hill Road as well as the internal roads utilized to access the Galloway Lands.

The completed TIA is attached as "Appendix A - Galloway Lands Development, Transportation Impact Assessment – Winter Addendum, Final".

Bunt & Associates has also prepared a response to the technical memo prepared by Creative Transportation Solutions Ltd (CTS) for the Fernie Snow Valley Community Association, dated 24 December 2021, outlining their observations based on a site visit, review of the proposed site plan and a review of the transportation impact study completed for the proposed development. A copy of Bunt & Associates response is attached as "Appendix B - Galloway Lands Development, Response to CTS Review".

A summary of the findings of the TIA precedes the report in Appendix A.

COMMUNITY WILDFIRE PROTECTION PLAN

The ability to respond to wildfire is becoming more top of mind in many communities, including the Elk Valley. The Elk Valley OCP includes statements regarding interface fire hazard & public safety. While the Galloway Lands are designated as low and moderate hazard within the OCP, the RDEK Board sought further information regarding how fire protection could be provided to the property and what could be done to further reduce any potential for wildfire.

The proponent engaged BA Blackwell & Associates to provide recommendations for wildfire hazard reduction and a summary of relevant community wildfire protection plans and publicly available wildfire data.

The assessments completed by BA Blackwell & Associates are attached as "Appendix C – Recommendations for Wildfire Hazard Reduction for the Development of Galloway Lands, Fernie, BC" and "Summary of Relevant Community Wildfire Protection Plans and Publicly Available Wildfire Data".

The reports completed by BA Blackwell & Associates built upon the work completed by the same firm for the Regional District of East Kootenay

In addition to engaging BA Blackwell & Associates, the proponent also met with representatives of Fernie Alpine Resort (Andy Cohen) and the City of Fernie Assistant Fire Chief (Brendan Morgan) and communicated with the RDEK (Fiona Dercole) to discuss fire protection concerns within the proposed development. The proponent will continue to work with these and other relevant groups to ensure that the ability to respond to emergencies is coordinated and appropriate.

A summary of the findings of the BA Blackwell reports and discussions with FAR and City of Fernie is included in Appendix B.

WILDLIFE CORRIDORS

Concerns regarding potential impacts on wildlife, including aquatic habitat, were expressed by individuals that spoke at the January 13th RDEK Planning Committee meeting. These concerns ranged from impact on grizzly bear to fish species within Lizard Creek and cumulative impacts of development.

Cascade Environmental Resource Group was engaged to review these concerns based on available government data and other technical literature. Due to the season, an in-depth on-site review was not possible, although a site visit was conducted to obtain an overview of the property.

Cascade Environmental Resource Group has provided six technical memorandums, which are attached as Appendix D:

- Galloway Lands Comments on Cumulative Effects Assessment
- Galloway Lands Review on Elk River Alliance Post Open House Questions and Comments
- Galloway Lands Review on Frank and Swanson Post Open House Questions and Comments
- Galloway Lands Comments on Review by Clayton Lamb
- Galloway Lands Review of Wildsight Review and Comments
- Galloway Lands Review of BC Parks Review and Comments

A summary of the findings of Cascade Environmental Resource Group is included in Appendix D.

Some concerns about the proposed plans for the Galloway Lands relate to the use of Conservation Subdivision Design. The Elk Valley Official Community Plan (and most other community plans within the RDEK) specifically state that Conservation Subdivision Design is to be utilized for residential land use applications.

The Elk Valley OCP states in Section 4.3(1)(d) Residential Land Use:

- (d) "To minimize disturbance to environmentally sensitive areas (ESAs) and preserve agricultural land, future development is encouraged to consider the integration of Conservation Subdivision Design principles by:
 - (i) identifying and protecting conservation areas such as riparian areas, wetlands, Class 1 ungulate winter range, wildlife corridors, wildlife habitat areas, steep slopes, woodlands, agricultural land and buffers;
 - (ii) clustering development into nodes of smaller lots in order to preserve larger contiguous ESAs and agricultural zones; and
 - (iii) utilizing compact neighbourhood design with dwelling units built in close proximity to each other to minimize the overall development footprint and required infrastructure.

Further details on Conservation Subdivision Design can be found in Randall Arendt's Conservation Design for Subdivisions: A Practical Guide to Creating Open Space Networks. Washington, DC: Island Press, 1996; or the Conservation Subdivision Design Handbook. Southwestern Illinois Resource Conservation & Development, Inc., 2006."

Environmental Design Group Ltd. (EDG) has prepared a case study for the Galloway Lands to provide background for the use of Conservation Design and how it is used in the RDEK (*see Appendix E – Conservation Design: Linking Planning, Landscape and Ecology*).

SEPTIC

Concerns have been raised by the public regarding the suitability of the Galloway Lands for septic fields and potential contamination of Lizard Creek and potential contamination of Fernie Alpine Resort's water system. We believe that these concerns are based on experience with old septic systems and do not reflect either the current regulatory regime required for design and construction of a septic system or the requirements for treatment of drinking water by a regulated water utility in British Columbia.

Western Water Associates were engaged to review the potential for installation of drinking water wells on the property and any potential impact from adjacent septic fields. Mulyk Consulting Ltd. was engaged to provide review of the requirements for installation of a septic system in BC.

A copy of Western Water Associates' letter report is attached as "Appendix F - Groundwater Feasibility Assessment for the Galloway Lands, south of Fernie, BC". A summary of the findings of Western Water Associates' is included in Appendix F.

The Mulyk Consulting letter is attached as "Appendix G - Galloway Lands Project, Individual On-Site Lot/Home Wastewater Treatment". A summary of the findings of Mulyk Consulting is included in Appendix G.

In addition to the work completed by these consultants, we attempted to meet with representatives of Fernie Alpine Resort Utility Company to understand any potential limitations of their water system and potential for contamination of their water source from either groundwater or surface water infiltration. Unfortunately, Fernie Alpine Resort was not able to make their staff available to speak with us.

Based on publicly available information we understand that Fernie Alpine Resort Utility Company has one groundwater well and three surface water springs. The springs are used to supplement the groundwater supply when necessary. A second well was drilled in 2003 to supply water for snowmaking purposes and is currently not in use. The Utility is in the process of upgrading the second well for connection to the distribution system. Both wells are classified as Groundwater at Risk of Containing Pathogens (GARP) and are required to comply with the Drinking Water Treatment Objectives issued by the Ministry of Health.

Further, in May 2018, Fernie Alpine Resort Utility Company was granted approval to proceed with the construction of a new water treatment plant, new reservoir, and upgrades to the second well. Both wells are classified as GARP and are required to comply with the Drinking Water Treatment Objectives issued by the Ministry of Health. The GARP designation requires the raw water to have two types of treatment, namely ultra-violet (UV) light and chlorination. In conjunction with construction of a new water treatment plant, the Utility plans to retest and permanently activate the second well. The main well has sufficient capacity to serve existing customers but will not be adequate should future expansion of the service area occur. Current customers will benefit from having the second well activated as it will serve as a back-up supply. (*source: Province of British Columbia, Office of the Comptroller of Water Rights in the Matter of the Water Utility Act and the Utilities Commission Act and Resorts of the Canadian Rockies Inc. (Fernie Alpine Resort Utility Company) for Approval of Revenue Requirements and Water Rates Application, Decision and Order No. 2543, 2019).*

Based on the Decision and Order issued by the Comptroller of Water Rights, Fernie Alpine Resort Utility Company should have installed UV and chlorination for its drinking water system. Therefore, any contamination of the water source utilized by this utility, regardless of its origin, would be suitably addressed through the treatment means provided by the utility to ensure safe drinking water is always provided to its customers.

LIFE CYCLE OF DEVELOPMENT COSTS

Costs for maintenance and operation of community infrastructure is becoming a consideration in community planning. The RDEK Elk Valley OCP does not address this matter, but it was raised by the Board when requesting additional information about this project.

The largest potential expenses for a municipality are usually the ongoing costs of maintaining water and sewer infrastructure and the cost of road maintenance.

Water and sewer are proposed to be provided on-site for all lots. Therefore, there is no cost to the RDEK for maintenance of these utilities.

Roads within the development are proposed to be a mixture of pubic and private. Private roads are constructed by the developer, at no cost to the public, and are maintained by the property owners that own the road at their sole cost. There is no cost to the public for maintenance of these private roads. Public roads are constructed by the developer, at no cost to the public, to the standards of the Ministry of Transportation and Infrastructure (MOTI). These roads are then maintained by MOTI through a contractor. A portion of the property taxes paid by the property owners will pay for maintenance of these roads.

We are proposing that approximately 50% of the Galloway Lands – and area comprising 236 acres – will be zoned as park and available for public use through Nordic ski trail, mountain bike trails, walking trails and other multiuse trails. All costs for maintenance of these lands, which will comprise a significant amenity to the property owners and the larger Fernie community, will be maintained by the property owners at no cost to the public.

COVENANT ACCOUNTABILITY AND MANAGEMENT

We are offering covenants over the Galloway property to provide assurance to the RDEK and the general public that certain commitments made by the project proponent will be upheld in perpetuity. In discussion with RDEK staff, the covenants were proposed to be held by the RDEK. This proposal caused some concern at the Board meeting due to the time potentially required to administer and enforce these covenants. As a result, we have reviewed all proposed covenants and have revised our proposal for covenant management. Covenants have been grouped into two categories.

- Those covenants that are normally dealt with by planning staff at subdivision of a property. These are generally covenants where there is a commitment by the proponent to complete a specific task prior to subdivision and that do not have longer term administration requirements. These covenants would continue to be registered with the RDEK and would include the following covenants being offered by the proponent (note that all descriptions below are summaries. See Appendix H for detailed wording for covenants):
 - a. Limit the total number of residential units constructed on the Lands to not more than 75 single family dwellings.
 - b. Restrict permitted uses within the PG-2 zoned lands.
 - c. Prohibit two-family dwellings within the RR-1 zoned lands.
 - d. Within those parts of the Lands zoned PG-2, and those parts of the Lands zoned RR-1 over which a statutory right of way will be registered for public access.
 - e. Wildfire covenant.

- 2. Those covenants that require long-term administration and oversight will be registered in favour of the not-for-profit Society (or other legal entity registered in BC) that will oversee the Galloway Lands Recreation Fund. The entity overseeing this fund will be comprised of homeowners and members from local recreation and conservation groups (Fernie Nordic Society, Fernie Trails Alliance, Elk River Alliance, etc). The RDEK will continue to be named on these covenants as a backstop to prevent discharge by the covenant holder but will not provide administration or enforcement of the covenant terms unless the RDEK chooses to do so.
 - a. Restrict the type of horticultural uses permitted within the RR-1 zoned lands.
 - b. No build covenant within the Lizard Creek corridor.
 - c. No build covenant within the remainder of the PG-2 zoned lands.
 - d. Provide a "no-build" covenant over that part of each building lot that is outside of the Building Envelope.
- 3. Covenants held by other government agencies:
 - a. Provide an SRW to allow for future construction of a road connecting the Cedars development (via Sunset Lane) to Fernie Alpine Resort (via Snow Pines Drive). The SRW provided shall follow an alignment that permit construction of a future connector road at the discretion of MOTI.
 - b. Complete a Transportation Impact Assessment to the satisfaction of the Ministry.

We have also heard concern from the RDEK Board regarding the limitation of 75 single family homes if all or part of the property is annexed into the City of Fernie. To address this concern, we are proposing to amend this covenant term to add a clause which releases this limitation (ie. maximum of 75 homes) from those parts of the lands that are, at some time in the future, within the boundary of the City of Fernie.

In addition to the information provided herein, we have endeavoured to also respond to all questions submitted to us by the public through the Galloway Lands website. We have provided responses to dozens of questions on this website (<u>www.GallowayLands.com</u>). Our responses have been organized into topics based on the questions received: Transportation Impact Assessment; Water and Wastewater; Fire Safety; Planning Process; Trails and Public Use; Development Covenants; Fish and Wildlife; and Other Questions.

The proposal submitted for the Galloway Lands has been developed based on the requirements of the Elk Valley OCP. Through conservation design, as outlined in the OCP, and with consideration of neighbouring properties and environmentally sensitive areas of the site, a plan has been developed that permits limited development of the lands while continuing to allow long-term use of the property for recreation.

We look forward to working with the RDEK through the remainder of the zoning and OCP process.

Sincerely, Haworth Development Consulting Ltd.

Richard Haworth

Encl.

cc: Reto Barrington, Handshake Holdings Inc.

Appendix A

Galloway Lands Development, Transportation Impact Assessment Winter Addendum, Final

Bunt & Associates Engineering Ltd.

(Note that report attached does not include all Appendices. A full copy of the report will be submitted to the RDEK separately from this document)

SUMMARY OF FINDINGS / RECOMMENDATIONS

A Transportation Impact Assessment (TIA) has been completed by Bunt & associated Engineering. This assessment included the intersection of Highway #3 and Fernie Ski Hill Road and the internal roadways (Highline Drive, Boomerang Way and Snow Pines Drive) leading to the subject lands. The study utilized traffic data obtained from the Ministry of Transportation and Infrastructure (MOTI) for the Highway #3 corridor and traffic counts for the internal roads completed on January 20th and 22nd (*a busy ski weekend*) and February 19th, 20th and 22nd (*Family Day Weekend*).

The TIA determined that the proposed 74 residential lot Galloway Lands development would generate 28 weekend peak hour vehicle trips.

The intersection of Fernie Ski Hill Road & Highway #3 will reach capacity in coming years (2040), without consideration of new traffic generated by additional development at the ski resort. Potential improvement options available for implementation by MOTI include:

- Manual intersection control by RCMP officers during peak winter periods (specifically the afternoon peak for outbound traffic flows).
- A roundabout.
- Signalization with retention of current approach laning.
- The interchange improvement as per the Highway 3 West Fernie Access Study.

continued...

The most straightforward of the three options is the signalization of the intersection while maintaining the existing laning as it would be able to be implemented within the current physical constraints of the intersection. However, the TIA does not recommend upgrading this intersection at this time as the potential impact on year-round traffic flow along Highway #3 does not out-weigh the short-term and intermittent traffic congestion departing the ski hill on a few days of the year. It is recommended that MOTI monitor the intersection independent from the proposed development and that improvements be made for 2040 as needed.

All internal resort study intersections operate within acceptable capacity limits. No improvements are required. With the addition of new traffic generated by the proposed Galloway Lands development the study intersections will continue operating within acceptable capacity limits.

Regardless of the TIA demonstrating that all internal roads will operate within MOTI's requirements, there is a perception within the community that the roads are unsafe and that additional traffic could be problematic.

With or without development of the Galloway Lands, the speed limits on Highline Drive and Boomerang Way should be posted at 30 km/h and the roadways should be provided with "shared space" signage. We will work with Fernie Alpine Resort and MOTI to have these signs posted.

Delineation lighting (streetlights) are warranted on Fernie Ski Hill (FSH) Road at the Highway 3 intersection under existing conditions, without consideration of new traffic. The addition of the delineation lighting will fully illuminate the intersection.

While the intersection of FSH Road & Highway 3 meets the minimum sight distance, the collision history indicates that two casualties have occurred along FSH Road, with assumed one at the Highway 3 intersection, in the past 5 years. The implementation of the delineation lighting would help address this safety issue. We will work with Fernie Alpine Resort and MOTI to have these streetlights installed.

We also believe that installation of walking paths within the MOTI road right-of-way would alleviate some of the safety issues along Highline Drive and Boomerang Way. We will work with Fernie Alpine Resort, local residents and MOTI to design and construct this pathway system, including dedicated pedestrian bridges where required to cross watercourses.

The findings of the Bunt & Associates TIA and additional work to be undertaken by the proponent, as outlined above, confirm that the proposed development will not have a negative impact on road utilization or traffic safety.



Galloway Lands Development

Transportation Impact Assessment -Winter Addendum Final

Prepared for Handshake Holdings Inc.

Date March 23, 2022

Project Number 02-21-0081

CORPORATE AUTHORIZATION

Prepared By:	Daniel Blischak, EIT	Bunt & Associates Engineering	Ltd.
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Signed By:	Jason Dunn, P.Eng.	Date: 2022-03-23	
	Associate	Project #: 02-21-0081	
		Status: Final	

Engineer's Stamp

This document entitled "Galloway Lands Development Transportation Impact Assessment – Winter Addendum" was prepared by Bunt & Associates for the benefit of the client to whom it is addressed, in support of their Land Use Rezoning application to the BC Ministry of Transportation and Infrastructure (MoTI). The analysis and conclusions/recommendations in the report reflect Bunt & Associates' best professional judgment in light of the knowledge and information available to Bunt & Associates at the time of preparation.

The BC MoTI shall be entitled to rely on this report for the specific purpose for which it was prepared. The MoTI may provide copies of the report to MoTI Council, MoTI Employees, and MoTI Regulatory Boards, each of whom shall also be entitled to rely on this report in their official capacities for the specific purpose for which the report was prepared. The MoTI may also provide copies of the report to external governmental bodies having jurisdiction related to the project for which it was prepared.

Any use made of this report by a third party beyond those specifically noted here, or any reliance on or decisions based on it by any such third party, are the responsibility of such third parties. Bunt & Associates accepts no responsibility for damages, if any, suffered by such third parties as a result of decisions made or actions based on this report.

Galloway Lands Development | Transportation Impact Assessment - Winter Addendum | Final Project No. 02-21-0081 | March 23, 2022

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1. EXECUTIVE SUMMARY

Handshake Holdings Inc. is seeking approval of a Land Use Application for a site located north of the Fernie Alpine Resort, west of Highway 3. The proposed development will have 74 residential units.

This Transportation Impact Assessment (TIA) is an addendum to the *Galloway Lands Development* (August 27, 2021) completed by Bunt & Associates, included in **Appendix B**, and reviews the traffic impacts of the proposed development on the internal intersections and with peak ski hill traffic. Findings and recommendations are summarized below.

1.1 Trip Generation

Proposed development densities, phasing, and forecasted trip generation is summarized in **Table 1.1**. It is noted that the development will generate a very small amount of traffic; approximately 16 total trips, 21 total trips, and 28 total trips in the weekday AM, weekday PM, and weekend PM peak hours, respectively. This represents an extremely minimal increase to the background traffic, especially in the busier winter season. Note that for the purpose of analysis it was assumed that these residential units would generate their peak volumes year-round.



Table 1.1: Trip Generation

HORIZON	USE	DENSITY	TOTAL TRIP GENERATION				
			AM Peak Hour	PM Peak Hour	Wknd Peak Hour		
Opening Day (2030)	Recreational Homes	74 units	16	21	28		

1.2 Findings & Recommendations

Study findings and recommendations are described in Table 1.2.

Table	1.2:	Findings	&	Recommendations
-------	------	----------	---	-----------------

SECTION		FINDINGS
Safety		With or without development of the site, the speed limits on Highline Drive and Boomerang Way should be posted at 30 km/h and the roadways should be provided with "shared space" signage.
		Delineation lighting on Fernie Ski Hill (FSH) Road is warranted at the Highway 3 intersection under existing conditions, without consideration of new traffic. The addition of the delineation lighting will fully illuminate the intersection.
		While the intersection of FSH Road & Highway 3 meets the minimum sight distance, the collision history indicates that two casualties have occurred along FSH Road, with assumed one at the Highway 3 intersection, in the past 5 years. The implementation of the delineation lighting would help address the safety issue.
Intersection Analysis	Existing	All study intersections operate within acceptable capacity limits. No improvements are required.
	Opening Day (2030) Background	The study intersections are expected to continue operating within acceptable capacity limits.
	Long Term (2040) Background	The intersection of FSH Road & Highway 3 will reach capacity during the 2040 Background horizon, without consideration of new site traffic. Potential improvement options available for implementation by MoTI include:
		 Manual intersection control by RCMP officers during peak winter periods (specifically the afternoon peak for outbound traffic flows). A roundabout.
		 Signalization with retention of current approach laning, The interchange improvement as per the Highway 3 - West Fernie Access Study.
		The most straightforward of the three options is the signalization of the intersection while maintaining the existing laning as it would be able to be implemented within the current physical constraints of the intersection. However, as the peak condition occurs infrequently and only during the peak times of the ski season, and adding delay to a highway is not favorable, this intersection control improvement will not be required unless other ambient traffic conditions change beyond what has been assumed in this analysis for 2040. It is recommended that MoTI monitor the intersection independent from the proposed development and that improvements be made for 2040 as needed.
	Opening Day	All internal intersections will continue to operate within capacity limits.
	(2030) After Development	The addition of site traine has no significant impact of the study intersections.
	Long Term (2040) After Development	As noted in the 2040 Background horizon, the FSH Road & Highway 3 intersection will be a candidate for improvement based on the highest ski hill peak volumes. However, no improvements are recommended due to site traffic as the intersection will not operate with large delays as stop-controlled.
		All internal study intersections will continue to operate acceptably.

2. INTRODUCTION

2.1 Scope of Work

Based on discussions with BC Ministry of Transportation and Infrastructure (MoTI) and the approved Terms of Reference (TOR) from the 2021 TIA (**Appendix C**), the scope of work for of this addendum was confirmed to include the following:

Development Trip Generation

- Trip Generation Calculate development trips based on industry standards.
- Trip Assignment Assign development trips to the network based on expected draw.

Traffic

- Horizons Review traffic conditions for:
 - o Existing
 - Opening Day (2030)
 - o Long Term (2040)
- Intersection Capacity Complete winter weekend peak hour analysis, based on January and February 2022 counts, at:
 - Highway 3 & Fernie Ski Hill (FSH) Road.
 - Timberline Crescent & FSH Road.
 - Timberline Crescent/Highline Drive & FSH Road.
 - Highline Drive & Boomerang Way.
- Recommendations Identify improvements required to support background or development traffic.
- Safety Analysis Complete a collision history and sight distance review.
- Active Modes Review active modes connections to the site and at the study intersections.

This TIA Addendum provides complete analysis for the internal Fernie Alpine Resort intersections as well as updated counts for the four study intersections.

2.2 Site Context

The Galloway Lands site is located north of the Fernie Alpine Resort and is bounded by the City of Fernie and Mount Fernie Provincial Park to the north, Lizard Creek to the east, residential development to the south, and undeveloped lands to the west. The site context is illustrated in **Figure 2.1**.

Figure 2.1: Site Context



Base Map Source: Google Maps

3. DEVELOPMENT

The site plan is illustrated in Figure 3.1.

Figure 3.1: Site Plan



3.1 Densities

The development will include 74 single-family residential units, with an Opening Day full buildout by 2030.

3.2 Trip Generation

The trip generation rates used in this analysis are summarized in **Table 3.1**. The trip generation rates are based on the Institute of Transportation Engineers (ITE) *Trip Generation Manual (10th Edition)*.

ITE Land Use 260 for recreational homes was used for all base analysis given the nature of the dwellings and the proximity to the Fernie Alpine Resort The site traffic is expected to have a greater percentage of trips outside of peak hours based on the vacation nature of the resort as the residents would not be following standard office hours.

As a comparison, the existing dwelling units on Boomerang Way, comprised of 55 dwelling units, were observed to have a Saturday Peak Hour trip rate of 0.23 trips/unit on January 22, 2022, and 0.21 trips/unit on February 19, 2022. The ITE trip rate used is 0.38 trips/unit.

Table 3.1: Trip Generation Rates

USE	AM PEAK HOUR			PM PEAK HOUR			SATURDAY PEAK HOUR		
	Trip Rate	In	Out	Trip Rate	In	Out	Trip Rate	In	Out
Recreational Homes (ITE 260)	0.22 per unit	67 <i>%</i>	33%	0.28 per unit	41%	59 <i>%</i>	0.38 per unit	48%	52 <i>%</i>

The expected development generated trips using ITE 260 are summarized in Table 3.2.

Table 3.2: Vehicle Trip Generation

USE	DENSITY	AM PEAK HOUR			PM PEAK HOUR			SATURDAY PEAK HOUR		
		Total	In	Out	Total	In	Out	Total	In	Out
Residential	74 units	16	11	5	21	9	12	28	13	15

3.3 Trip Distribution

Vehicle trips were distributed based on expected draw. It is noted a portion of the generated trips would not be destined for the highway, given the proximity to the ski resort. However, this difference was not considered in the analysis, resulting in a more conservative analysis at the highway. The site trips are distributed 90% to/from the North on Highway 3 in the direction of the City of Fernie and 10% to/from the South on Highway 3. This distribution is a balance between the observed summer and winter movements.

3.4 Access

Access to the majority of the development will be provided from FSH Road. There are also two (2) of the 74 total units, located to the northeast of Lizard Creek, that will use the Mount Fernie Park Road access. The effect of those two residences on the operations at the Highway 3 & Mount Fernie Park Road intersection are negligible and were not analyzed in this report.

The site will be accessed using the road network of the Fernie Alpine Resort, specifically FSH Road, Highline Drive and Boomerang Way. These roads have a rural cross section with swales and no shoulders as well as no on-street parking. There is currently no separate pedestrian or cycling infrastructure associated with the Highline Drive and Boomerang Way. The resulting development generated traffic volumes for the 72 remaining units are illustrated in **Exhibit 3.1**.



Exhibit 3.1 Site Traffic Volumes



4. TRAFFIC CONDITIONS

4.1 Road Network

The characteristics of roadways near the site are summarized in Table 4.1.

TUDIE 4.1. LAISTING ROUGWAY CHARACTERISTIC	Table 4	4.1:	Existing	Roadway	Charact	eristics
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ROADWAY	CLASSIFICATION	CROSS-	SECTION	POSTED	FACILITIES	
		# Lanes	Median	SPEED	Shoulder	Illumination
Highway 3	Rural Arterial Undivided	2	No	80 km/h	Yes	At intersection
Fernie Ski Hill Road	Rural Collector	2	No	50 km/h	No	At intersection
Timberline Crescent	Rural Residential	2	No	N/A	No	None
Highline Drive	Rural Residential	2	No	N/A	No	None
Boomerang Way	Rural Residential	2	No	N/A	No	None

4.2 Intersections

Existing intersection configurations and controls at the study intersections are illustrated in Exhibit 4.1.

4.3 Sight Distance

A sight distance review was undertaken at study area intersections based on the Transportation Association of Canada (TAC) *Geometric Design Guide for Canadian Roads* (2017) for the following:

- *Minimum Stopping Sight Distance (SSD)*, which is the distance a vehicle travels from the instant the driver sights an object and decides to stop, to the instant the vehicle comes to a complete stop after applying brakes. This distance is usually sufficient to allow reasonably competent and alert drivers to come to a hurried stop under ordinary conditions. *(Source: Table 2.5.2)*
- Intersection Sight Distance (ISD), which is defined as the sight distance required for a vehicle to complete either a crossing or turning manoeuvre safely. (Source: Table 9.9.4 Case B1 left turn from stop for a passenger vehicle, as well as further calculations). Case B1 is the most conservative scenario as left turns require the highest gap time. Passenger cars require a gap time of 7.5 seconds, whereas it is 9.5 seconds and 11.5 seconds for single unit trucks and combination trucks (WB 19 and WB 20), respectively. The required intersection sight distance is calculated using the following formula:

$$ISD = 0.278V_{major}t_g$$

where V_{major} is the speed on the major road $\mbox{and } t_g \mbox{ is the gap time }$

Minimum sight distances based on design speeds are summarized in **Table 4.2**. The sight distances for the FSH Road intersection with Highway are greater than 500 metres from both the north and the south of the intersection. The review confirms sight distance requirements are met for the design speed of 110 km/h (posted speed of 80 km/h).

DESIGN SPEED	STOPPING SIGHT DISTANCE	PASSENGER CAR ISD	SINGLE UNIT TRUCK ISD	COMBINATION TRUCK ISD
60 km/h	85 m	130 m	160 m	195 m
70 km/h	105 m	150 m	185 m	225 m
80 km/h	130 m	170 m	215 m	260 m
90 km/h	160 m	190 m	240 m	290 m
100 km/h	185 m	210 m	265 m	320 m
110 km/h	220 m	230 m	295 m	355 m

Table 4.2: Sight Distance

The stopping sight distance is also achieved for the internal intersections with one exception. This is for north bound traffic on Highline Drive approaching Boomerang Way. However, given the tighter geometry of Highline Drive, it is not anticipated that vehicles will be travelling at 60 km/hr along this section of Highline Drive.

4.4 Collision History

The collision history for Highway 3 and FSH Road was sourced from the *Insurance Corporation of British Columbia* Reported Crashes. Note that no collisions were found to have occurred using the filter for intersections crashes at the convergence of Highway 3 and Fernie Ski Hill Road. Instead, the total number of non-parking lot crashes on Fernie Ski Hill Road is summarized in **Table 4.3** and included in **Appendix D**.

YEAR	TOTAL # OF COLLISIONS	SEVERITY - CASUALTY	SEVERITY – PROPERTY DAMAGE ONLY
2016	3	1	2
2017	2	0	2
2018	4	0	4
2019	3	0	3
2013	-	-	-
2020	3	1	2
TOTAL	15	2	12
IOTAL	15	Ζ	13

Table 4.3: Annual Collision History on Fernie Ski Hill Road

The data indicates that there have been two (2) casualties along FSH Road in the past five (5) years, with one assumed to have occurred at the intersection of Highway 3. Section 4.8 of the report identifies that delineation lighting on FSH Road is currently warranted for the intersection based on background volumes. This improvement will help address the collision severity at this location.

4.5 Volumes

4.5.1 Existing

Traffic counts were done by Bunt & Associates on two busy weekends in early 2022, one of which was the Family Day weekend in February. The traffic counts used in this study are summarized in **Table 4.4**. All traffic count data is included in **Appendix E**.

 Table 4.4: Traffic Data Summary

INTERSECTION	COUNT DATE	DAY OF WEEK	SOURCE
Highway 3 & FSH Road	2022/01/20	Thursday	Bunt & Associates
2	2022/01/22	Saturday	
	2022/02/18	Friday	
	2022/02/19	Saturday	
	2022/02/21	Monday	
Timberline Crescent & FSH Road	2022/01/20	Thursday	
	2022/01/22	Saturday	
	2022/02/18	Friday	
	2022/02/19	Saturday	
	2022/02/21	Monday	-
Timberline Crescent/Highline Drive &	2022/01/20	Thursday	-
FSH Road	2022/01/22	Saturday	
	2022/02/18	Friday	-
	2022/02/19	Saturday	-
	2022/02/21	Monday	-
Highline Drive & Boomerang Way	2022/01/20	Thursday	-
	2022/01/22	Saturday	
	2022/02/18	Friday	
	2022/02/19	Saturday	
	2022/02/21	Monday	

Of the many different traffic counts performed at the four study intersections, the highest peak hour traffic volumes were noted during on the following days:

- Weekday AM Peak Hour Monday, February 21, 2022
- Weekday PM Peak Hour Friday, February 18, 2022
- Weekend Peak Hour Saturday, January 22, 2022

These three peak hours were used as the basis for all analysis and represent peak conditions on the roadways. The counts were also balanced up in between the intersections. The existing traffic volumes used in this study are summarized in **Exhibit 4.2**.

It is noted that the peak winter volumes observed in 2022 were lower than the winter volumes assumed in the 2021 TIA. As such, all winter analysis and results in this report supersedes the 2021 TIA.

4.5.2 Background

Background traffic is traffic that would be present on the road network in future years regardless of the development of the site. This traffic is representative of yearly growth on the roadways as well as other residential, commercial, or industrial developments that have been approved in the area.

From the BC MoTI Traffic Data Program, at the count station on the Lizard Creek Bridge, just north of the FSH Road access, the 2012 AADT was 5,815 vehicles/day and the 2018 AADT was 6,553 vehicles/day. This results in a 2.115% linear growth rate per year. For this study, a growth rate of 2.2% per annum was used. This is in line with the 2.1% rate used by Urban Systems in the Highway 3 functional study.

The 2.2% growth rate was applied to through volumes along the highway. Background traffic volumes are illustrated in **Exhibit 4.3** (Opening Day - 2030) and **Exhibit 4.4** (Long Term - 2040).

4.5.3 After Development

Development generated traffic volumes (Exhibit 3.1) were added to respective Background traffic volumes to forecast the After Development traffic volumes illustrated in Exhibit 4.5 (Opening Day – 2030) and Exhibit 4.6 (Long Term – 2040).



Exhibit 4.1 Existing Intersection Configurations





Exhibit 4.2 Existing Traffic Volumes





Exhibit 4.3 Opening Day (2030) Background Traffic Volumes





Exhibit 4.4 Long Term (2040) Background Traffic Volumes





Exhibit 4.5 Opening Day (2030) After Development Traffic Volumes





Exhibit 4.6 Long Term (2040) After Development Traffic Volumes



4.6 Intersection Analysis

Synchro 10 traffic analysis software was used to review intersection operational conditions based on the methods outlined in the Highway Capacity Manual. Traffic operations were assessed using the performance measures of volume-to-capacity (v/c) and Level of Service (LOS).

The volume-to-capacity (v/c) ratio of an intersection movement represents the ratio between the demand volume and available capacity. The Level of Service (LOS) rating is based on average vehicle delays ranging from LOS A (minimal delay) to LOS F (significant delay).

Intersection capacity analysis was completed for the summer and winter seasons with the following scenarios:

- Background
 - o Existing
 - Opening Day (2030)
 - Long Term (2040)
- After Development
 - Opening Day (2030)
 - Long Term (2040)

The analysis is completed with a saturation flow rate of 1850 vehicles per hour and a peak hour factor of 0.92. The analysis uses a minimum hourly volume of 5 vehicles per movement. The volume to capacity (v/c) ratio, level of service, average control delay (measured in seconds), and 95th percentile queue (measured in metres) are summarized in this report.

SIDRA 9 will be used as the software to analyze roundabouts. Synchro and SIDRA output reports are provided in **Appendix F**.

4.6.1 Background Analysis

Existing

Existing intersection analysis is based on the intersection configurations illustrated in **Exhibit 4.1**. The Winter Average analysis is summarized in **Table 4.5** based on the volumes illustrated in **Exhibit 4.2**.

Table 4.5: Existing Intersection Analysis

INTERSECTION	MOVEMENT		AM PE	AK HOU	R		PM PEAK HOUR			
	& LANES		v/c	LOS	Delay	Queue	v/c	LOS	Delay	Queue
Highway 3 &	EBL	1	0.15	В	10	<5	0.65	С	20	39
Fernie Ski Hill Road	EBR	1	0.15	В	10	<5	0.65	С	20	39
(EB Stop)	NBL	1	0.02	А	8	<5	<0.02	А	8	<5
	NBT	1	<0.02	А	0	<5	<0.02	Α	0	<5
	SBT	1	0.07	А	0	<5	0.21	Α	0	<5
	SBR	1	0.15	А	0	<5	0.08	Α	0	<5
	Overall		-	Α	2.8	-	-	Α	9.4	-
Timberline Crescent &	EB	1	0.08	А	0	<5	0.26	Α	0	<5
Fernie Ski Hill Road	WB	1	<0.02	А	1	<5	<0.02	Α	1	<5
(NB Stop)	NB	1	0.02	В	10	<5	0.04	В	12	<5
	Overall		-	Α	0.4	-	-	A	0.5	-
Timberline Crescent/	EB	1	<0.02	A	1	<5	0.02	A	1	<5
Highline Drive &	WB	1	<0.02	A	1	<5	0.03	Α	2	<5
Fernie Ski Hill Road	NB	1	0.08	В	11	<5	0.08	В	12	<5
(NB/SB Stop)	SB	1	0.11	В	12	<5	0.18	С	15	5
	Overall		-	Α	3.2	-	-	Α	3.3	-
Highline Drive &	EB	1	-*	A	1	<5	-	Α	1	<5
Boomerang Way	NB	1	-	А	1	<5	-	А	1	<5
(SB Stop)	SB	1	-	А	5	12	-	А	6	11
	Overall		-	Α	1.2	-	-	A	0.7	-
INTERSECTION	MOVEME	NT	SATUR	RDAY PE	ΑΚ ΗΟΙ	JR				
	& LANES		v/c	LOS	Delay	Queue				
Highway 3 &	EBL	1	0.71	С	18	50				
Fernie Ski Hill Road	EBR	1	0.71	С	18	50				
(EB Stop)	NBL	1	<0.02	А	8	<5				
	NBT	1	<0.02	А	0	<5				
	SBT	1	0.06	А	0	<5				
	SBR	1	0.09	A	0	<5				
	Overall		-	В	12.9	-				
Timberline Crescent &	EB	1	0.38	А	0	<5				
Fernie Ski Hill Road	WB	1	<0.02	А	1	<5				
(NB Stop)	NB	1	0.04	В	14	<5				
	Overall		-	Α	0.3	-				
Timberline Crescent/	EB	1	0.02	А	1	<5				
Highline Drive & Fernie Ski Hill Road (NB/SB Stop)	WB	1	0.02	А	1	<5				
	NB	1	0.08	C	17	<5				
	SB	1	0.15	С	18	<5				
	Overall		-	Α	2.1	-				
Highline Drive &	EB	1	-	Α	1	<5				
Boomerang Way	NB	1	-	A	1	<5				
(SB Stop)	SB	1	-	А	6	10				
	Overall		-	A	0.6	-				

*Synchro cannot calculate v/c ratio for this intersection configuration.

Opening Day (2030) Background

Opening Day (2030) Background intersection analysis is summarized in **Table 4.6** based on the volumes illustrated in **Exhibit 4.3**.

INTERSECTION	MOVEME	NT	AM PE	AK HOU	IR		PM PE	AK HOU	R	
	& LANES		v/c	LOS	Delay	Queue	v/c	LOS	Delay	Queue
Highway 3 &	EBL	1	0.15	В	10	<5	0.73	С	25	50
Fernie Ski Hill Road	EBR	1	0.15	В	10	<5	0.73	С	25	50
(EB Stop)	NBL	1	0.02	А	8	<5	<0.02	А	9	<5
	NBT	1	<0.02	А	0	<5	<0.02	А	0	<5
	SBT	1	0.09	А	0	<5	0.25	A	0	<5
	SBR	1	0.15	А	0	<5	0.08	A	0	<5
	Overall		-	Α	2.7	-	-	В	Delay Q 25 1 25 1 9 1 0 1 0 1 11.0 0 11.0 1 0.1 1 12 1 12 1 15 3.3 1 1 6 0.6	-
Timberline Crescent &	EB	1	0.08	А	0	<5	0.26	Α	0	<5
Fernie Ski Hill Road	WB	1	<0.02	А	1	<5	<0.02	Α	1	<5
(NB Stop)	NB	1	0.02	В	10	<5	0.04	В	12	<5
	Overall	DVENENT PAR FROM PM PEAR HOUR LANES v/c LOS Delay Queue v/c LOS Delay 1 0.15 B 10 <5	-							
Timberline Crescent/	EB	1	<0.02	А	1	<5	0.02	Α	1	<5
Highline Drive &	WB	1	<0.02	А	1	<5	0.03	Α	2	<5
Fernie Ski Hill Road	NB	1	0.08	В	11	<5	0.08	В	12	<5
(NB/SB Stop)	SB	1	0.11	В	12	<5	0.18	С	15	5
	WB 1 CO.02 NB 1 0.08 SB 1 0.11 Overall - EB 1 -* NB 1 - SB 1 - SB 1 - Overall - - Overall - - Overall - - Overall - - B 1 - Overall - - Overall - - B 1 - Overall - - EBL 1 0.73	А	3.2	-	-	A	3.3	-		
Highline Drive &	EB	1	-*	А	1	<5	-	А	1	<5
Boomerang Way	NB	1	-	А	1	<5	-	А	1	<5
(SB Stop)	SB	1	-	А	5	9	-	А	6	11
	Overall		-	Α	1.1	-	-	A	0.6	-
INTERSECTION	MOVEME	MOVEMENT		DAY PE	ΑΚ ΗΟΙ	JR				
	& LANES		v/c	LOS	Delay	Queue				
Highway 3 &	EBL	1	0.73	C	19	53				
Fernie Ski Hill Road	EBR	1	0.73	С	19	53				
(EB Stop)	NBL	1	<0.02	А	8	<5				
	NBT	1	<0.02	А	0	<5				
	SBT	1	0.07	А	0	<5				
	SBR	1	0.09	А	0	<5				
	Overall		-	В	13.3	-				
Timberline Crescent &	EB	1	0.38	А	0	<5				
Fernie Ski Hill Road	WB	1	<0.02	А	1	<5				
(NB Stop)	NB	1	0.04	В	14	<5				
	Overall		-	Α	0.3	-				
Timberline Crescent/	EB	1	0.02	А	1	<5				
Highline Drive &	WB	1	0.02	А	1	<5				
Fernie Ski Hill Road (NB/SB Stop)	NB	1	0.08	С	17	<5				
	SB	1	0.15	С	18	<5				
	Overall		-	Α	2.1	-				
Highline Drive &	EB	1	-	А	1	<5				
Boomerang Way	NB	1	-	А	1	<5				
(SB Stop)	SB	1	-	А	6	11				
	Overall		-	A	0.7	-				
	tio for this in	torco	ection cor	figuratio	n					

Table 4.6: Opening Day (2030) Background Intersection Analysis

Long Term (2040) Background

Long Term (2040) Background intersection analysis is summarized in **Table 4.7** based on the volumes illustrated in **Exhibit 4.4**.

INTERSECTION	MOVEME	NT	AM PE	AK HOU	R		PM PEAK HOUR			
	& LANES		v/c	LOS	Delay	Queue	v/c	LOS	Delay	Queue
Highway 3 &	EBL	1	0.16	В	11	<5	0.84	E	38	70
Fernie Ski Hill Road	EBR	1	0.16	В	11	<5	0.84	E	38	70
(EB Stop)	NBL	1	0.02	Α	8	<5	<0.02	А	9	<5
	NBT	1	<0.02	А	0	<5	<0.02	А	0	<5
	SBT	1	0.11	А	0	<5	0.25	А	0	<5
	SBR	1	0.15	А	0	<5	0.08	А	0	<5
	Overall		-	Α	2.6	-	-	С	15.3	-
Timberline Crescent &	EB	1	0.08	А	0	<5	0.26	А	0	<5
Fernie Ski Hill Road	WB	1	<0.02	А	1	<5	<0.02	А	1	<5
(NB Stop)	NB	1	0.02	В	10	<5	0.04	В	12	<5
	Overall		-	Α	0.4	-	-	Α	0.5	-
Timberline Crescent/	EB	1	<0.02	А	1	<5	0.02	А	1	<5
Highline Drive &	WB	1	<0.02	А	1	<5	0.03	А	2	<5
Fernie Ski Hill Road	NB	1	0.08	В	11	<5	0.08	В	12	<5
(NB/SB Stop)	SB	1	0.11	В	12	<5	0.18	С	15	5
	Overall		-	Α	3.2	-	-	А	3.3	-
Highline Drive &	EB	1	-*	А	1	<5	-	А	1	<5
Boomerang Way	NB	1	-	А	1	<5	-	А	1	<5
(SB Stop)	SB	1	-	А	5	12	-	А	6	11
	Overall		-	А	1.2	-	-	А	0.6	-
INTERSECTION	MOVEME	MOVEMENT		DAY PE	ΑΚ ΗΟΙ	JR				
	& LANES		v/c	LOS	Delay	Queue				
Highway 3 &	EBL	1	0.76	С	21	59				
Fernie Ski Hill Road	EBR	1	0.76	С	21	59				
(EB Stop)	NBL	1	<0.02	А	8	<5				
	NBT	1	<0.02	А	0	<5				
	SBT	1	0.09	А	0	<5				
	SBR	1	0.09	Α	0	<5				
	Overall		-	В	14.5	-				
Timberline Crescent &	EB	1	0.38	А	0	<5				
Fernie Ski Hill Road	WB	1	<0.02	А	1	<5				
(NB Stop)	NB	1	0.04	В	14	<5				
	Overall		-	Α	0.3	-				
Timberline Crescent/	EB	1	0.02	А	1	<5				
Highline Drive & Fernie Ski Hill Road (NB/SB Stop)	WB	1	0.02	А	1	<5				
	NB	1	0.08	С	17	<5				
	SB	1	0.15	С	18	<5				
	Overall		-	Α	2.1	-				
Highline Drive &	EB	1	-	А	1	<5				
Boomerang Way	NB	1	-	А	1	<5				
(SB Stop)	SB	1	-	А	6	10				
	Overall		-	Α	0.7	-				
nchro cannot calculate v/c	ratio for this ir	terse	ection con	figuratio	n.					

Table 4.7: Long Term (2040) Background Intersection Analysis

The eastbound movement at the Highway 3 & FSH Road nears capacity limits at the 2040 Background horizon. As the analysis uses the highest volumes expected during the year at this intersection, it is not likely that intersection improvements will need to be implemented to account for these peak volumes. Nonetheless, mitigation measures were investigated for the highway intersection based on the peak hour volumes.

Based on the BC MoTI Technical Circular T-06-08, a roundabout could be considered as a mitigation measure for this intersection. While a roundabout could not be currently constructed at the same location as the stop-controlled intersection due to physical constraints, analysis of a roundabout was still performed. It is noted that implementation of a roundabout will involve grading and realignment of the intersection.

Another possible mitigation measure, and one that could fit in the existing right-of-way, is the option of signalization. From the existing counts, the intersection satisfies 6 of the 9 criteria in the MoTI signal warrant, included in **Appendix G**.

The results of the analysis for the two improvement options are summarized in **Table 4.8** for the 2040 Background traffic volumes.

INTERSECTION	MOVEMENT & LANES		PM PE	ак нои	R		SATURDAY PEAK HOUR				
			v/c	LOS	Delay	Queue	v/c	LOS	Delay	Queue	
Highway 3 &	EBL	1	0.71	С	22	65	0.80	В	19	87	
Fernie Ski Hill Road	EBR	1	0.10	А	5	5	0.05	А	4	<5	
(Signalized)	NBL	1	0.02	А	8	<5	0.02	В	14	<5	
	NBT	1	0.47	В	12	36	0.54	C	20	41	
	SBT	1	0.77	С	20	72	0.33	В	16	26	
	SBR	1	0.22	А	3	7	0.28	А	5	11	
	Overall		-	В	16.6	-	-	В	16.7	-	
Highway 3 &	EB	1	0.59	В	14	40	0.57	В	10	33	
Fernie Ski Hill Road	NB	1	0.37	А	9	14	0.39	В	11	15	
(Roundabout)	SB	1	0.50	А	8	29	0.24	А	5	9	
	Overall		-	В	10.2	-	-	A	9.0	-	

Table 4.8: Long Term (2040) Background Intersection Analysis - Mitigation Measures

Note that signal timings were optimized in Synchro. Both mitigation measures allow for the intersection to operate within acceptable capacity parameter limits.

Another option would be the provision of temporary manual intersection control through the presence of RCMP officers during the critical winter PM peak hour peak period (as/when required). This would require involvement from Fernie Alpine Resort. This would be an interim improvement worthy of consideration with or without site generated traffic.

It is noted that the ultimate improvement to this intersection will be an interchange, with or without consideration of the site traffic, and that this analysis is provided purely as additional information. It is not recommended at this horizon to improve the stop-controlled intersection to accommodate the yearly

highest traffic volumes when the intersection will operate within capacity limits for the vast majority of the year. It is also noted that signalization would increase the delays for the much higher through traffic on Highway 3 year-round.

Background Analysis Summary

Background intersection capacity analysis indicates all study intersections will operate acceptably during in the existing and Opening Day (2020) Background horizons. In the Long Term (2040) horizon, the intersection of Highway 3 & Fernie Ski Hill Road will approach capacity limits. Several possible improvements were analyzed, including a roundabout and signalization. Signalization of the current approach laning will mitigate some of the delay and will have a lower cost. However, the roundabout would have better intersection operations.

With an interchange being designed as the ultimate improvement, it is not recommended to implement either signalization or a roundabout as the peak condition occurs infrequently and only during the peak times of the ski season. The intersection still operates reasonably well as stop-controlled, even using the highest observed volumes during the winter peak. All other study intersections will continue to operate well within capacity limits.

4.6.2 After Development

Table 4.9 provides some context of the addition of site traffic to the background volumes at the study intersections. The proportional impact of site-generated traffic compared to the background volumes is less than 5% at the three larger intersections. This also shows the impact the site has on the operation of the intersection, even on the peak weekend in the winter, is very minimal.

	AM PE	AK HOUR VO	LUMES	PM PE	AK HOUR VO	LUMES	SATURDAY PEAK HOUR VOLUMES			
INTERSECTION	BACK- GROUND	SITE	% CHANGE	BACK- GROUND	SITE	% CHANGE	BACK- GROUND	SITE	% CHANGE	
Highway 3 & FSH Road	625	16	2.5%	1177	20	1.7%	1030	27	2.6%	
Timberline Cr & FSH Road	388	16	4.1%	562	20	3.6%	745	27	3.6%	
Timberline Cr/ Highline Dr & FSH Road	438	16	3.7%	622	20	3.2%	798	27	3.4%	
Highline Dr & Boomerang Way	79	16	20.3%	150	20	13.3%	92	27	29.3%	

Table 4.9: Net Change in Future Intersection Vehicle Volumes with New Site Trips - Opening Day
Opening Day (2030) After Development

Opening Day (2030) After Development intersection analysis is summarized in **Table 4.10** based on the volumes illustrated in **Exhibit 4.5**.

INTERSECTION	MOVEME	MOVEMENT		AM PEAK HOUR				PM PEAK HOUR			
	& LANES		v/c	LOS	Delay	Queue	v/c	LOS	Delay	Queue	
Highway 3 &	EBL	1	0.16	В	10	<5	0.76	D	27	55	
Fernie Ski Hill Road	EBR	1	0.16	В	10	<5	0.76	D	27	55	
(EB Stop)	NBL	1	0.02	А	8	<5	<0.02	А	9	<5	
	NBT	1	<0.02	А	0	<5	<0.02	А	0	<5	
	SBT	1	0.09	А	0	<5	0.25	A	0	<5	
	SBR	1	0.16	А	0	<5	0.09	A	0	<5	
	Overall		-	Α	2.8	-	-	В	11.9	-	
Timberline Crescent &	EB	1	0.08	А	0	<5	0.27	A	0	<5	
Fernie Ski Hill Road	WB	1	<0.02	А	1	<5	<0.02	A	1	<5	
(NB Stop)	NB	1	0.02	В	10	<5	0.04	В	12	<5	
	Overall		-	А	0.4	-	-	A	0.5	-	
Timberline Crescent/	EB	1	<0.02	А	1	<5	0.02	Α	1	<5	
Highline Drive &	WB	1	<0.02	А	1	<5	0.03	Α	2	<5	
Fernie Ski Hill Road	NB	1	0.09	В	11	<5	0.08	В	12	<5	
(NB/SB Stop)	SB	1	0.12	В	12	<5	0.22	С	16	7	
	Overall	-	-	Α	3.2	-	-	A	3.6	-	
Highline Drive &	EB	1	-*	А	1	<5	-	Α	1	<5	
Boomerang Way	NB	1	-	А	1	<5	-	А	1	<5	
(SB Stop)	SB	1	-	А	6	13	-	А	6	13	
	Overall		-	Α	1.2	-	-	A	1.0	-	
INTERSECTION	MOVEME	NT	SATUR	DAY PE		JR					
	& LANES		v/c	LOS	Delav	Oueue					
Highway 3 &	EBL	1	0.75	С	20	56					
Fernie Ski Hill Road	EBR	1	0.75	C	20	56					
(EB Stop)	NBL	1	< 0.02	A	8	<5					
	NBT	1	<0.02	А	0	<5					
	SBT	1	0.07	A	0	<5					
	SBR	1	0.10	A	0	<5					
	Overall	<u> </u>	-	В	13.9	-					
Timberline Crescent &	EB	1	0.38	A	0	<5					
Fernie Ski Hill Road	WB	1	<0.02	A	1	<5					
(NB Stop)	NB	1	0.04	В	14	<5					
	Overall	<u> </u>	-	A	0.3	-					
Timberline Crescent/	FR	1	0.02	Δ	1	<5					
Highline Drive &			0.02	Λ	1	<5					
Formio Ski Hill Bood	WB			A 1							
Fernie Ski filli Rodu	WB NB	1	0.02	А С	17	<5					
(NB/SB Stop)	WB NB SB	1	0.02	C	17	<5 6					
(NB/SB Stop)	WB NB SB Overall	1 1 1	0.02 0.08 0.21	C C A	17 20 24	<5 <5 -					
(NB/SB Stop)	WB NB SB Overall FB	1 1 1 1	0.02 0.08 0.21 -	C C A	17 20 2.4 1	<5 6 - <5					
(NB/SB Stop) Highline Drive & Boomerang Way	WB NB SB Overall EB NB	1 1 1 1 1 1	0.02 0.08 0.21	C C A A	17 20 2.4 1	<5 6 - <5 <5					
Highline Drive & Boomerang Way (SB Stop)	WB NB SB Overall EB NB SB	1 1 1 1 1 1 1	0.02 0.08 0.21		17 20 2.4 1 1 6	<5 6 - <5 <5 13					
(NB/SB Stop) Highline Drive & Boomerang Way (SB Stop)	WB NB SB Overall EB NB SB Overall	1 1 1 1 1 1 1 1	0.02 0.08 0.21	C C A A A A A	17 20 2.4 1 1 6 1.0	<5 6 - <5 <5 13					

Table 4.10: Opening Day (2030) After Development Intersection Analysis

Long Term (2040) After Development

Long Term (2040) After Development intersection analysis is summarized in Table 4.11 based on the volumes illustrated in Exhibit 4.6.

INTERSECTION	MOVEME	AM PE	AM PEAK HOUR			PM PEAK HOUR				
	& LANES		v/c	LOS	Delay	Queue	v/c	LOS	Delay	Queue
Highway 3 &	EBL	1	0.16	В	11	<5	0.88	E	44	79
Fernie Ski Hill Road	EBR	1	0.16	В	11	<5	0.88	E	44	79
(EB Stop)	NBL	1	0.02	А	8	<5	<0.02	Α	9	<5
	NBT	1	<0.02	А	0	<5	<0.02	Α	0	<5
	SBT	1	0.11	A	0	<5	0.31	Α	0	<5
	SBR	1	0.16	А	0	<5	0.09	A	0	<5
	Overall		-	Α	2.7	-	-	С	17.8	-
Timberline Crescent &	EB	1	0.08	А	0	<5	0.27	А	0	<5
Fernie Ski Hill Road	WB	1	<0.02	А	1	<5	<0.02	А	1	<5
(NB Stop)	NB	1	0.02	В	10	<5	0.04	В	12	<5
	Overall		-	Α	0.4	-	-	Α	0.5	-
Timberline Crescent/	EB	1	<0.02	А	1	<5	0.02	А	1	<5
Highline Drive &	WB	1	<0.02	А	1	<5	0.03	А	2	<5
Fernie Ski Hill Road	NB	1	0.09	В	11	<5	0.08	В	12	<5
(NB/SB Stop)	SB	1	0.12	В	12	<5	0.22	С	16	7
	Overall		-	A	3.2	-	-	A	3.6	-
Highline Drive &	EB	1	-*	А	1	<5	-	Α	1	<5
Boomerang Way	NB	1	-	Α	1	<5	-	Α	1	<5
(SB Stop)	SB	1	-	A	6	13	-	Α	6	13
	Overall		-	Α	1.3	-	-	Α	0.9	-
INTERSECTION	MOVEME	ТИ	SATUR	DAY PE	ΑΚ ΗΟΙ	JR				
	& LANES		v/c LOS Delay Queue		Queue					
Highway 3 &	EBL	1	0.78	C	23	63				
Fernie Ski Hill Road	EBR	1	0.78	C	23	63				
(EB Stop)	NBL	1	<0.02	А	8	<5				
	NBT	1	<0.02	A	0	<5				
	SBT	1	0.09	А	0	<5				
	SBR	1	0.10	A	0	<5				
	Overall		-	В	15.2	-				
Timberline Crescent &	EB	1	0.38	A	0	<5				
Fernie Ski Hill Road	WB	1	<0.02	A	1	<5				
(NB Stop)	NB	1	0.04	В	14	<5				
	Overall		-	A	0.3	-				
Timberline Crescent/	EB	1	0.02	A	1	<5				
Highline Drive &	WB	1	0.02	A	1	<5				
Fernie Ski Hill Road	NB	1	0.08	C	17	<5				
(116/36 3100)	SB	1	0.21	C	20	6				
	Overall		-	A	2.4	-				
Highline Drive &	EB	1	-	A	1	<5				
Boomerang Way	NB	1	-	A	1	<5				
(SB STOP)	SB	1	-	A	5	13				
	Overall		-	A	1.1	-				
vnchro cannot calculate v/c ratio for this intersection configuration										

Table 4.11: Long Term (2040) After Development Intersection Analysis

*Synchro cannot calculate v/c ratio for this intersection configuration.

As identified in the 2040 Background analysis, the intersection of Highway 3 & FSH Road will be reaching capacity limits. Analysis was performed at this intersection for the two possible mitigation measures identified, a roundabout and a signal, and is summarized in **Table 4.12**.

INTERSECTION	MOVEME	MOVEMENT		MOVEMENT PM PEAK HOUR				SATURDAY PEAK HOUR			
	& LANES		v/c	LOS	Delay	Queue	v/c	LOS	Delay	Queue	
Highway 3 &	EBL	1	0.73	C	23	74	0.80	C	20	93	
Fernie Ski Hill Road	EBR	1	0.10	А	5	5	0.05	А	4	<5	
(Signalized)	NBL	1	0.03	В	9	<5	0.03	В	14	<5	
	NBT	1	0.47	В	12	36	0.55	C	21	41	
	SBT	1	0.77	C	20	72	0.33	В	17	26	
	SBR	1	0.23	А	3	8	0.31	А	5	11	
	Overall		-	В	16.9	-	-	В	16.9	-	
Highway 3 &	EB	1	0.61	В	15	42	0.58	В	10	34	
Fernie Ski Hill Road	NB	1	0.38	А	9	14	0.40	В	12	16	
(Roundabout)	SB	1	0.51	А	8	29	0.25	A	5	9	
	Overall		-	В	10.5	-	-	А	9.2	-	

Table 4.12: Long Term (2040) After Development Intersection Analysis – Mitigation Measures

After Development Analysis Summary

After Development intersection capacity analysis indicates the site traffic will have an insignificant impact on the operations of the Highway 3 & FSH Road intersection. As with the 2040 Background, the highway intersection warrants consideration for improvement, either by signalization or a roundabout, with or without the development of the site. However, improvement is not recommended as the intersection will still operate well within acceptable capacity limits for most of the year. Signalization would increase the delays for the much higher through traffic on Highway 3 year-round.

All other study intersections will continue to operate well within acceptable capacity limits and the new site traffic will have little effect on the intersections.

4.7 Active Transportation

Given the proximity to Fernie Alpine Resort, it is expected some of the residents will walk or cycle towards the ski hill. The ski hill also has bike trails during the summer months so it will generate active modes trips. While the rural standards of the interior roads, such as Boomerang Way and Highline Drive, do not offer any active modes infrastructure, the lower volumes on the roadways allow for active modes.

Figure 4.1: Existing Pedestrian Volumes on Highline Drive and Boomerang Way



With or without the development of the site, it is recommended that the speed limits of Highline Drive and Boomerang Way be reduced to 30 km/h. As well, there should be signage designating the roadways as a "shared space" between vehicles and pedestrians. The roadways currently operate as a shared space, but more signage and a formal reduction in the speed limit will increase pedestrian safety in the area.

There are also future plans to link FSH Road to West Fernie via a multi-use pathway on the west side on the highway. The Fernie Valley Pathway will be to the east of the site and will provide residents of the development safer active mode access towards both the ski hill and the City. The project is divided into three segments, with segment #3 running along FSH Road and providing access to Fernie Alpine Resort. **Figure 4.2**, from McElhanney's *Fernie Valley Pathway Preliminary Design Report* (June 29, 2020), illustrates the possible pathway alignment options near FSH Road. The pathway will be accessible to the

site via FSH Road and will continue to the north along the highway, providing good active mode connectivity to West Fernie. It is noted McElhanney has also expressed interest in realigning the pathway through the Galloway Lands, allowing further separation from roadways. This report was prepared for the City of Fernie and Fernie Trail Alliance.



Figure 4.2: Segment 3 Pathway Options at Fernie Alpine Resort

4.8 Illumination Warrants

An illumination warrant was completed at Highway 3 & FSH Road based on the Transportation Association of Canada (TAC) *Illumination of Isolated Rural Intersections* guide. The warrant for illumination is used to determine if lighting at an intersection is required based on several different factors such as geometrics, operations, environmental issues, and collision history.

TAC guidelines state full illumination is warranted at unsignalized intersections where a total score of 240 or more points is achieved. Partial or delineation lighting may be considered at intersections with a score of 120 points or more (partial illumination if 80/120 points achieved in Geometric score; delineation lighting if 120+ points achieved in Operational score). Partial lighting applies to the major road (Highway 3) and delineation lighting applies to the cross-street (FSH Road). Currently the intersection is partially illuminated.

The illumination warrant results if the intersection remains stop-controlled are summarized in Table 4.13 and are attached in Appendix G.

INTERSECTION	HORIZON	ILLUMINATION SCORE	COMMENT
Highway 3 &	Existing	228/240	Delineation Lighting Warranted
FSH Road	2030 Background	228/240	Delineation Lighting Warranted
	2040 Background	228/240	Delineation Lighting Warranted
	2030 After Development	228/240	Delineation Lighting Warranted
	2040 After Development	228/240	Delineation Lighting Warranted

Table 4.13: Illumination Warrant Summary

The lighting analysis confirms that delineation lighting for the FSH Road/Highway 3 intersection is currently warranted for FSH Road. The warrant score does not change throughout the different horizons, nor is it materially affected by the inclusion of site generated traffic.



Definitions



DEFINITIONS

Illumination Warrant: Analysis performed using the Transportation Association of Canada *Illumination of Isolated Rural Intersections* guide to determine what lighting treatment is warranted at an intersection. Potential illumination treatments include partial lighting (on the major road), delineation or cross-street lighting (on the minor road), and full illumination.

Delineation Lighting: Lighting located on the minor roads designed to illuminate traffic at an intersection on the minor legs.

Background Traffic: Traffic that is present on the road network in future years, regardless of the development of the site. The background traffic will be grown linearly to account for other developments in the area and an increase in vehicle traffic in general.

AM Peak Hour: The hour in the morning where the street experiences the highest traffic volumes. The AM peak hour is colloquially referred to as the morning rush hour.

PM Peak Hour: The hour in the afternoon where the street experiences the highest traffic volumes. The PM peak hour is colloquially referred to as the afternoon rush hour.

Saturday Peak Hour: The hour where the street experiences the highest traffic volumes on a Saturday. The peak hour is normally mid-afternoon on the Saturday.

APPENDIX B

August 2021 TIA



Galloway Lands Development

Transportation Impact Assessment

Final

Prepared for Handshake Holdings Inc.

Date August 27, 2021

Project Number 02-21-0081

CORPORATE AUTHORIZATION

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	Associate	Project #:	02-21-0081		
		Status:	Final		
APEGA Permit #:	P13898				

Engineer's Stamp

This document entitled "Galloway Lands Development Transportation Impact Assessment" was prepared by Bunt & Associates for the benefit of the client to whom it is addressed, in support of their Land Use Rezoning application to the BC Ministry of Transportation and Infrastructure (MoTI). The analysis and conclusions/recommendations in the report reflect Bunt & Associates' best professional judgment in light of the knowledge and information available to Bunt & Associates at the time of preparation.

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1. EXECUTIVE SUMMARY

Handshake Holdings Inc. is seeking approval of a Land Use Application for a site located north of the Fernie Alpine Resort, west of Highway 3. The proposed development will have 74 residential units.

The Transportation Impact Assessment (TIA) reviewed the traffic impacts of the proposed development. Findings and recommendations are summarized below.

1.1 Trip Generation

Proposed development densities, phasing, and forecasted trip generation is summarized in **Table 1.1**. It is noted that the development will generate a very small amount of traffic; approximately 16 total trips, 21 total trips, and 28 total trips in the weekday AM, weekday PM, and weekend PM peak hours, respectively. This represents an extremely minimal increase to the background traffic, especially in the busier winter season. Note that for the purpose of analysis it was assumed that these residential units would generate their peak volumes year-round.



Table 1.1: Trip Generation

HORIZON	USE	DENSITY	TOTAL TRIP GE	NERATION	
			AM Peak Hour	PM Peak Hour	Wknd Peak Hour
Opening Day (2030)	Recreational Homes	74 units	16	21	28

1.2 Findings & Recommendations

Study findings and recommendations are described in Table 1.2.

Table 1.2: Findings & Recommendations

SECTION		FINDINGS
Safety		The collision history indicates that two casualties have occurred at the FSH Rd/Highway 3 intersection in the past 5 years. The intersection improvements noted below should address the potential safety concerns at this intersection. The intersection of Fernie Ski Hill (FSH) Road/Highway 3 meets
		minimum sight distance requirements, and the collision history does not warrant further safety review.
		Delineation lighting is warranted at the FSH Road/Hwy 3 intersection under existing conditions due to background traffic, without consideration of new site traffic. Full illumination of the intersection will be required when the intersection is signalized.
Intersection Analysis Summer Af Developme	Summer Background	The intersection of FSH Road/Highway 3 operates within acceptable capacity limits in the Summer Existing and all the Summer Background horizons. No improvements are required.
	Summer After Development	The study intersection continues to operate acceptably in all the After Development horizons. No improvements are required to accommodate the site during the summer period.
	Winter Background	The intersection of FSH Road/Highway 3 is currently operating at capacity during the Winter Existing horizon due to background traffic without consideration of new site traffic. Potential improvement options available for implementation by MoTI include:
		 Manual intersection control by RCMP officers during peak winter periods (specifically the afternoon peak for outbound traffic flows).
		 Signalization with retention of current approach laning, Signalization and construct a dual EBLT lane from FSH Road onto Highway 3. This would necessitate the provision of two receiving lanes on Highway 3 for some distance downstream of the intersection.
		 The interchange improvement as per the Highway 3 - West Fernie Access Study.
		The easiest of the three options is the signalization with the existing laning as it would be able to be implemented within the current physical constraints of the intersection. It is noted that this option will have the EBL still operating at capacity at all Winter Background horizons. However, as the peak condition only occurs during the peak times of the ski season, this is considered the most appropriate option.
	Winter After Development	The addition of site traffic has no significant impact on the operation of the FSH Road/Highway 3 intersection at all the horizons.

2. INTRODUCTION

2.1 Scope of Work

Based on discussions with BC Ministry of Transportation and Infrastructure (MoTI) and the approved Terms of Reference (TOR) (**Appendix A**), the scope of work for of this study was confirmed to include the following:

Development Trip Generation

- Trip Generation Calculate development trips based on industry standards.
- Trip Assignment Assign development trips to the network based on expected draw.

Traffic

- Horizons Review traffic conditions for:
 - Existing
 - Opening Day (2030)
 - Long Term (2040)
- Intersection Capacity Complete summer weekday and winter weekend peak hour analysis at:
 - Highway 3 & Fernie Ski Hill (FSH) Road.
 - FSH Road at each of Timberline Crescent and Highline Drive.
 - Highline Drive at Boomerang Way.
- Recommendations Identify improvements required to support background or development traffic.
- Safety Analysis Complete a collision history and sight distance review.

Given the timing for the completion of this report in the summer of 2021, and the absence of useable internal road network traffic count data on FSH Road west of Highway 3 within the Fernie Alpine Resort area, Bunt was unable to complete analysis of intersections other than FSH Road/Highway 3 at time of submission of the report. Through discussions with MoTI it was confirmed that an addendum could be submitted by Bunt in early 2022 that will assess the traffic conditions for the internal intersections of Timberline Crescent & FSH Road, Highline Drive & FSH Road, and Highline Drive & Boomerang Way.

2.2 Site Context

The Galloway Lands site is located north of the Fernie Alpine Resort and is bounded by the City of Fernie and Mount Fernie Provincial Park to the north, Lizard Creek to the east, FSH Road and Boomerang Way to the south, and undeveloped lands to the west. The site context is illustrated in **Figure 2.1**.

Figure 2.1: Site Context



Base Map Source: Google Maps

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3. DEVELOPMENT

The site plan is illustrated in Figure 3.1.

Figure 3.1: Site Plan



3.1 Densities

The development will include 74 single-family residential units, with an Opening Day full buildout by 2030.

3.2 Trip Generation

The trip generation rates used in this analysis are summarized in **Table 3.1**. The trip generation rates are based on the Institute of Transportation Engineers (ITE) *Trip Generation Manual (10th Edition)*.

ITE Land Use 260 for recreational homes was used for all base analysis given the nature of the dwellings and the proximity to the Fernie Alpine Resort The site traffic is expected to have a greater percentage of trips outside of peak hours based on the vacation nature of the resort as the residents would not be following standard office hours.

USE	AM PEAK H	IOUR		PM PEAK H	IOUR		WEEKEND PEAK HOUR			
	Trip Rate	In	Out	Trip Rate	In Out		Trip Rate	In	Out	
Recreational Homes (ITE 260)	0.22 per unit	67%	33%	0.28 per unit	41%	59 <i>%</i>	0.38 per unit	48%	52%	

Table 3.1: Trip Generation Rates

The expected development generated trips using ITE 260 are summarized in Table 3.2.

Table 3	3.2:	Vehicle	Trip	Generation
---------	------	---------	------	------------

USE	DENSITY	AM PEA	K HOUR		PM PEA	K HOUR		WEEKEND PEAK HOUR			
		Total	In	Out	Total	In	Out	Total	In	Out	
Residential	74 units	16	11	5	21	9	12	28	13	15	

3.3 Trip Distribution

Vehicle trips were distributed based on expected draw. It is noted a portion of the generated trips would not be destined for the highway, given the proximity to the ski resort. However, this difference was not considered in the analysis, resulting in a more conservative analysis at the highway. The site trips are distributed 90% to/from the North on Highway 3 in the direction of the City of Fernie and 10% to/from the South on Highway 3. This distribution is a balance between the observed summer and winter movements.

3.4 Access

Access to the majority of the development will be provided from FSH Road. There are also two (2) of the 74 total units, located to the northeast of Lizard Creek, that will use the Mount Fernie Park Road access. The effect of those two residences on the operations at the Highway 3 & Mount Fernie Park Road intersection are negligible and were not analyzed in this report.

The site will be accessed using the road network of the Fernie Alpine Resort, specifically FSH Road, Highline Drive and Boomerang Way. These roads have a rural cross section with swales and no shoulders as well as no on-street parking. There is no separate pedestrian or cycling infrastructure associated with the roads. Further analysis of these interior intersections will be included in an addendum to this TIA as discussed in Section 2.1.The resulting development generated traffic volumes for the 72 remaining units are illustrated in **Exhibit 3.1**.



Exhibit 3.1 Site Traffic Volumes



4. TRAFFIC CONDITIONS

4.1 Road Network

The characteristics of roadways near the site are summarized in Table 4.1.

Table 4.1: Existing Roadway Characteristics

ROADWAY	CLASSIFICATION	CROSS-SECTION	POSTED	FACILITIES	
		# Lanes Median	SPEED	Shoulder	Illumination
Highway 3	Rural Arterial Undivided	2 No	80 km/h	Yes	At intersection
Fernie Ski Hill Road	Rural Collector	2 No	50 km/h	No	At intersection

4.2 Intersections

Existing intersection configurations and controls at the study intersection are illustrated in Exhibit 4.1.

4.3 Sight Distance

A sight distance review was undertaken at study area intersections based on the Transportation Association of Canada (TAC) *Geometric Design Guide for Canadian Roads* (2017) for the following:

- *Minimum Stopping Sight Distance (SSD),* which is the distance a vehicle travels from the instant the driver sights an object and decides to stop, to the instant the vehicle comes to a complete stop after applying brakes. This distance is usually sufficient to allow reasonably competent and alert drivers to come to a hurried stop under ordinary conditions. *(Source: Table 2.5.2)*
- Intersection Sight Distance (ISD), which is defined as the sight distance required for a vehicle to complete either a crossing or turning manoeuvre safely. (Source: Table 9.9.4 Case B1 left turn from stop for a passenger vehicle, as well as further calculations). Case B1 is the most conservative scenario as left turns require the highest gap time. Passenger cars require a gap time of 7.5 seconds, whereas it is 9.5 seconds and 11.5 seconds for single unit trucks and combination trucks (WB 19 and WB 20), respectively. The required intersection sight distance is calculated using the following formula:

$$ISD = 0.278V_{major}t_g$$

where V_{major} is the speed on the major road and t_g is the gap time

Minimum sight distances based on design speeds are summarized in **Table 4.2**. The sight distances for the FSH Road intersection with Highway are greater than 500 metres from both the north and the south of the intersection. The review confirms sight distance requirements are met for the design speed of 110 km/h (posted speed of 80 km/h).

DESIGN SPEED	STOPPING	PASSENGER CAR	SINGLE UNIT	COMBINATION
	SIGHT DISTANCE	ISD	TRUCK ISD	TRUCK ISD
60 km/h	85 m	130 m	160 m	195 m
70 km/h	105 m	150 m	185 m	225 m
80 km/h	130 m	170 m	215 m	260 m
90 km/h	160 m	190 m	240 m	290 m
100 km/h	185 m	210 m	265 m	320 m
110 km/h	220 m	230 m	295 m	355 m

Table 4.2: Sight Distance

The stopping sight distance is achieved for the internal intersections with one exception. This is for north bound traffic on Highline Drive approaching Boomerang Way. However, given the tighter geometry of Highline Drive, it is not anticipated that vehicles will be travelling at 60 km/hr along this section of Highline Drive.

4.4 Collision History

The collision history for Highway 3 and FSH Road was sourced from the *Insurance Corporation of British Columbia* Reported Crashes. Note that no collisions were found to have occurred using the filter for intersections crashes at the convergence of Highway 3 and Fernie Ski Hill Road. Instead, the total number of non-parking lot crashes on Fernie Ski Hill Road is summarized in **Table 4.3** and included in **Appendix B**.

YEAR	TOTAL # OF	SEVERITY -	SEVERITY -
	COLLISIONS	CASUALTY	PROPERTY
			DAMAGE ONLY
2016	3	1	2
2017	2	0	2
2018	4	0	4
2019	3	0	3
2020	3	1	2
TOTAL	15	2	13

Table 4.3: Annual Collision History on Fernie Ski Hill Road

The data indicates that there have been two (2) casualties at this intersection in the past five (5) years. As this report recommends improvements to the FSH Road / Highway 3 intersection, it is expected that the improvement will address the potential safety concerns at this intersection.

4.5 Volumes

4.5.1 Existing

Traffic counts used in this study were counted on Tuesday, July 23, 2021, during the summer peak. This count is used for the weekday AM and PM peak hour. Unfortunately, no current or historic winter peak period data was available at the time of the report. For the purpose of analysis of the FSH Road/Highway 3 intersection, the summer peak counts were factored to produce a winter peak base. From the Urban Systems *Highway 3 – West Fernie Access Study*, a conversion between summer and winter numbers was

used to produce winter existing numbers based of a count done the Sunday of the Family Day long weekend. The existing traffic volumes for the intersection of Highway 3 & FSH Road are summarized in **Exhibit 4.2**. All traffic count data is included in **Appendix C**. No data was available for the internal intersections on FSH Road west of Highway 3, and as noted in Section 2.1. data at those locations will be collected and compiled in an addendum to this report to be submitted in 2022.

4.5.2 Background

Background traffic is traffic that would be present on the road network in future years regardless of the development of the site. This traffic is representative of yearly growth on the roadways as well as other residential, commercial, or industrial developments that have been approved in the area.

From the BC MoTI Traffic Data Program, at the count station on the Lizard Creek Bridge, just north of the FSH Road access, the 2012 AADT was 5,815 vehicles/day and the 2018 AADT was 6,553 vehicles/day. This results in a 2.115% linear growth rate per year. For this study, a growth rate of 2.2% per annum was used. This is in line with the 2.1% rate used by Urban Systems in the Highway 3 functional study.

The 2.2% growth rate was applied to through volumes along the highway. Background traffic volumes are illustrated in **Exhibit 4.3** (Opening Day - 2030) and **Exhibit 4.4** (Long Term - 2040).

4.5.3 After Development

Development generated traffic volumes (**Exhibit 3.1**) were added to Background traffic volumes to forecast the After Development traffic volumes illustrated in **Exhibit 4.5** (Opening Day - *2030*) and **Exhibit 4.6** (Long Term - *2040*).



Exhibit 4.1 Existing Intersection Configurations





Exhibit 4.2 Existing Traffic Volumes





Exhibit 4.3 Opening Day (2030) Background Traffic Volumes





Exhibit 4.4 Long Term (2040) Background Traffic Volumes





Exhibit 4.5 Opening Day (2030) After Development Traffic Volumes





Exhibit 4.6 Long Term (2040) After Development Traffic Volumes



4.6 Intersection Analysis

Synchro 10 traffic analysis software was used to review intersection operational conditions based on the methods outlined in the Highway Capacity Manual. Traffic operations were assessed using the performance measures of volume-to-capacity (v/c) and Level of Service (LOS).

The volume-to-capacity (v/c) ratio of an intersection movement represents the ratio between the demand volume and available capacity. A v/c ratio of 0.85 or less is normally acceptable in a rural context. The Level of Service (LOS) rating is based on average vehicle delays ranging from LOS A (minimal delay) to LOS F (significant delay).

Intersection capacity analysis was completed for the summer and winter seasons with the following scenarios:

- Background
 - o Existing
 - Opening Day (2030)
 - o Long Term (2040)
- After Development
 - Opening Day (2030)
 - Long Term (2040)

The analysis is completed with a saturation flow rate of 1850 vehicles per hour and a peak hour factor of 0.92. The analysis uses a minimum hourly volume of 5 vehicles per movement. The volume to capacity (v/c) ratio, level of service, average control delay (measured in seconds), and 95th percentile queue (measured in metres) are summarized in this report.

In the winter peak hour analysis, SIDRA will be used as the software to analyze roundabouts. Synchro and SIDRA output reports are provided in **Appendix D**.

4.6.1 Summer Peak Background Analysis

Existing - Summer

Summer Existing intersection analysis is summarized in **Table 4.4** based on the intersection configurations illustrated in **Exhibit 4.1** and volumes illustrated in **Exhibit 4.2**.

Table 4.4: Summer Existing Intersection Analysis

INTERSECTION	MOVEMENT		AM PE	AK HOU	IR		PM PEAK HOUR				
	& LANES	& LANES		LOS	Delay	Queue	v/c	LOS	Delay	Queue	
Highway 3 &	EBL	1	0.08	В	10	<5	0.14	В	12	<5	
Fernie Ski Hill Road	EBR	1	0.08	В	10	<5	0.14	В	12	<5	
(EB Stop)	NBL	1	<0.02	А	8	<5	<0.02	Α	8	<5	
	NBT	1	<0.02	А	0	<5	<0.02	А	0	<5	
	SBT	1	0.10	А	0	<5	0.20	А	0	<5	
	SBR	1	0.04	А	0	<5	0.04	A	0	<5	
	Overall		-	A	2.7	-	-	A	2.4	-	

Opening Day (2030) - Summer

Summer Opening Day Background intersection analysis is summarized in **Table 4.5** based on the volumes illustrated in **Exhibit 4.3**.

Table 4.5: Summer	^r Opening Day	(2030) Background	Intersection Analysis
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INTERSECTION	MOVEMENT		AM PE	AK HOU	R		PM PEAK HOUR				
	& LANES		v/c	LOS	Delay	Queue	v/c	LOS	Delay	Queue	
Highway 3 &	EBL	1	0.09	В	11	<5	0.16	В	13	<5	
Fernie Ski Hill Road	EBR	1	0.09	В	11	<5	0.16	В	13	<5	
(EB Stop)	NBL	1	<0.02	А	8	<5	<0.02	Α	8	<5	
	NBT	1	<0.02	А	0	<5	<0.02	А	0	<5	
	SBT	1	0.13	А	0	<5	0.25	A	0	<5	
	SBR	1	0.04	А	0	<5	0.04	A	0	<5	
	Overall		-	А	2.7	-	-	A	2.4	-	

Long Term (2040) - Summer

Summer Long Term Background intersection analysis is summarized in **Table 4.6** based on the volumes illustrated in **Exhibit 4.4**.

INTERSECTION	MOVEMENT		AM PE	AK HOU	R	PM PE	AK HOUR			
	& LANES		v/c	LOS	Delay	Queue	v/c	LOS	Delay	Queue
Highway 3 &	EBL	1	0.10	В	11	<5	0.19	В	15	6
Fernie Ski Hill Road	EBR	1	0.10	В	11	<5	0.19	В	15	6
(EB Stop)	NBL	1	<0.02	А	8	<5	<0.02	А	9	<5
	NBT	1	<0.02	А	0	<5	<0.02	А	0	<5
	SBT	1	0.17	А	0	<5	0.32	А	0	<5
	SBR	1	0.04	А	0	<5	0.04	A	0	<5
	Overall		-	A	2.7	-	-	A	2.4	-

Table 4.6: Summer Long Term (2040) Background Intersection Analysis

Summer Background Analysis Summary

Summer Background intersection capacity analysis indicates the intersection of Highway 3 & Fernie Ski Hill Road will operate within all acceptable capacity limits in all background horizons. No improvements are required at the intersection based on summer background traffic.

4.6.2 Summer Peak After Development

Opening Day (2030) - Summer

Summer Opening Day After Development intersection analysis is summarized in **Table 4.7** based on the volumes illustrated in **Exhibit 4.5**.

INTERSECTION	MOVEMENT		AM PE	AK HOU	R		PM PEAK HOUR				
	& LANES		v/c	LOS	Delay	Queue	v/c	LOS	Delay	Queue	
Highway 3 &	EBL	1	0.10	В	11	<5	0.19	В	13	5	
Fernie Ski Hill Road	EBR	1	0.10	В	11	<5	0.19	В	13	5	
(EB Stop)	NBL	1	<0.02	А	8	<5	<0.02	A	8	<5	
	NBT	1	<0.02	А	0	<5	<0.02	A	0	<5	
	SBT	1	0.13	А	0	<5	0.25	Α	0	<5	
	SBR	1	0.05	А	0	<5	0.05	Α	0	<5	
	Overall		-	А	2.7	-	-	А	2.5	-	

Table 4.7: Summer Opening Day (2030) After Development Intersection Analysis

Long Term (2040) - Summer

Summer Long Term After Development intersection analysis is summarized in **Table 4.8** based on the volumes illustrated in **Exhibit 4.6**.

INTERSECTION	MOVEMENT		AM PE	AK HOU	R		PM PEAK HOUR				
	& LANES		v/c	LOS	Delay	Queue	v/c	LOS	Delay	Queue	
Highway 3 &	EBL	1	0.11	В	11	<5	0.22	С	15	7	
Fernie Ski Hill Road	EBR	1	0.11	В	11	<5	0.22	С	15	7	
(EB Stop)	NBL	1	<0.02	А	8	<5	<0.02	A	9	<5	
	NBT	1	<0.02	А	0	<5	<0.02	A	0	<5	
	SBT	1	0.17	А	0	<5	0.32	A	0	<5	
	SBR	1	0.05	А	0	<5	0.05	A	0	<5	
	Overall		-	Α	2.7	-	-	A	2.5	-	

Table 4.8: Summer Long Term (2040) Day After Development Intersection Analysis

Summer After Development Analysis Summary

Summer After Development intersection capacity analysis indicates the intersection of Highway 3 & Fernie Ski Hill Road will continue to operate within acceptable capacity limits in both Summer After Development horizons with the addition of site traffic. No improvements are required at the intersection based on summer volumes.

4.6.3 Winter Peak Background Analysis

Existing - Winter

Winter Existing intersection analysis is summarized in **Table 4.9** based on the intersection configurations illustrated in **Exhibit 4.1** and volumes illustrated in **Exhibit 4.2**.

INTERSECTION	MOVEMENT		PM PEAK HOUR				
	& LANES		v/c	LOS	Delay	Queue	
Highway 3 &	EBL	1	1.20	F	123	248	
Fernie Ski Hill Road (EB Stop)	EBR	1	1.20	F	123	248	
	NBL	1	<0.02	A	8	<5	
	NBT	1	<0.02	A	0	<5	
	SBT	1	0.08	А	0	<5	
	SBR	1	0.07	А	0	<5	
	Overall		-	F	95.9	-	

Table 4.9: Winter Existing Intersection Analysis

The substantially larger ski hill volumes cause the intersection to reach capacity limits in the winter peak hour. The study intersection would benefit from improvements today based on existing conditions, without consideration of site generated traffic. Based on the BC MoTI Technical Circular T-06-08, a roundabout could be considered as a mitigation measure for this intersection. While a roundabout could not be currently constructed at the same location as the stop-controlled intersection due to physical constraints, analysis of a roundabout was still performed. It is noted that implementation of a roundabout will involve grading and realignment of the intersection.

Another possible mitigation measure, and one that could fit in the existing right-of-way, is the option of signalization. From the existing counts, the intersection satisfies 7 of the 9 criteria in the MoTI signal warrant, included in **Appendix E**. With signalization, two subsequent options were reviewed:

- Keeping the same approach laning as the original stop-controlled, and
- Re-aligning the two northbound lanes north of the intersection as dual receiving lanes.

With the dual receiving lanes, dual eastbound left (EBL) turns could be viewed as a possible solution. The provision of dual eastbound left turn lanes would require widening on the outside of the approach. This option would require a review to establish specific land requirements for the widened roadway and back sloping.

The results of the analysis for all improvement options are summarized in **Table 4.10** for the current winter traffic volumes.

INTERSECTION	MOVEMENT		AM PE	AK HOU	R	
	& LANES		v/c	LOS	Delay	Queue
Highway 3 &	EB	1	0.79	С	18	111
Fernie Ski Hill Road	NB	1	0.26	В	10	8
(Roundabout)	SB	1	0.19	А	4	7
	Overall		-	В	14.2	-
Highway 3 &	EBL	1	0.99	D	41	265
Fernie Ski Hill Road	EBR	1	0.05	А	2	<5
(Signal)	NBL	1	0.06	C	34	6
	NBT	1	0.50	D	44	41
	SBT	1	0.51	D	44	42
	SBR	1	0.37	А	10	15
	Overall		-	D	37.4	-
Highway 3 &	EBL	2	0.76	В	14	47
Fernie Ski Hill Road	EBR	1	0.07	А	2	<5
(Signal and Dual EBL)	NBL	1	0.03	В	15	<5
	NBT	1	0.26	В	16	22
	SBT	1	0.27	В	17	23
	SBR	1	0.24	A	5	10
	Overall		-	В	13.5	-

Table 4.10: Winter Existing Intersection Analysis - Improved

While the signalization of the intersection with the existing approach laning does mitigate some of the capacity for the intersection, the EBL movement essentially remains at capacity. The roundabout and the signal with dual EBL provide the most improvement to the intersection.

Note that signal timings were optimized in Synchro. As such, for the single EBL option, the signal is operating at a 100 second cycle length, with 75 seconds allocated to the EB movement. For the dual EBL option, the signal can be reduced to a 60 second cycle length, with only 35 seconds being allocated to the highway – a preferred option for better corridor flow. These three improvement options, warranted in the existing horizon, are carried through for the remainder of the winter analysis.

It should also be noted that two other options exist for the accommodation of existing volumes. One would be the provision of temporary manual intersection control through the presence of RCMP officers during the critical winter PM peak hour peak period (as/when required). This would require involvement from Fernie Alpine Resort. This would be an interim improvement worthy of consideration with or without site generated traffic. It would need to be upgraded to one of the above noted mitigation options with the passage of time and growth in ski hill traffic and through traffic on Highway 3.

Opening Day (2030) - Winter

Winter Opening Day Background intersection analysis is summarized in Table 4.11 based on the volumes illustrated in **Exhibit 4.3**.

INTERSECTION	MOVEMENT		AM PEAK HOUR					
	& LANES		v/c	LOS	Delay	Queue		
Highway 3 &	EB	1	0.82	C	19	170		
Fernie Ski Hill Road	NB	1	0.30	В	11	10		
(Roundabout)	SB	1	0.21	А	4	8		
	Overall		-	В	15.3	-		
Highway 3 &	EBL	1	0.99	D	43	271		
Fernie Ski Hill Road	EBR	1	0.05	А	2	<5		
(Signal)	NBL	1	0.07	С	34	6		
	NBT	1	0.58	D	46	48		
	SBT	1	0.59	D	47	50		
	SBR	1	0.36	A	10	15		
	Overall		-	D	39.7	-		
Highway 3 &	EBL	2	0.76	В	15	49		
Fernie Ski Hill Road	EBR	1	0.07	А	2	<5		
(Signal and Dual EBL)	NBL	1	0.03	В	14	<5		
	NBT	1	0.31	В	17	26		
	SBT	1	0.32	В	17	27		
	SBR	1	0.23	А	5	10		
	Overall		-	В	13.9	-		

Table 4.11: Winter Opening Day (2030) Background Intersection Analysis

Long Term (2040) - Winter

Winter Long Term Background intersection analysis is summarized in **Table 4.12** based on the volumes illustrated in **Exhibit 4.4**.

INTERSECTION	MOVEME	NT	AM PE	AK HOU	R	
	& LANES		v/c	LOS	Delay	Queue
Highway 3 &	EB	1	0.85	С	22	212
Fernie Ski Hill Road	NB	1	0.37	В	12	13
(Roundabout)	SB	1	0.24	А	5	9
	Overall		-	В	17.0	-
Highway 3 &	EBL	1	1.00	D	47	271
Fernie Ski Hill Road	EBR	1	0.05	А	3	<5
(Signal)	NBL	1	0.07	C	34	6
	NBT	1	0.68	D	50	58
	SBT	1	0.69	D	51	59
	SBR	1	0.35	А	9	15
	Overall		-	D	43.1	-
Highway 3 &	EBL	2	0.77	В	15	53
Fernie Ski Hill Road	EBR	1	0.07	А	3	<5
(Signal and Dual EBL)	NBL	1	0.03	В	14	<5
	NBT	1	0.38	В	17	31
	SBT	1	0.38	В	18	32
	SBR	1	0.23	A	5	10
	Overall		-	В	14.5	-

Table 4.12: Winter Long Term (2040) Background Intersection Analysis

Winter Background Analysis Summary

Winter Background intersection capacity analysis indicates the intersection of Highway 3 & Fernie Ski Hill Road is currently operating at capacity. Several possible improvements were analyzed, including a roundabout and signalization with two different lane configurations. Signalization of the current approach laning will mitigate some of the delay, but the intersection will still operate near capacity. The two better options, a roundabout and signalization with a dual EBL, will both have a larger associated cost but will allow the intersection to operate within all acceptable capacity guidelines through all horizons.

4.6.4 Winter Peak After Development

Table 4.13 provides some context of the addition of site traffic to the background volumes at Highway 3 & FSH Road. The proportional impact of site-generated traffic compared to the background volumes is approximately 2%. This also shows the impact the site has on the operation of the intersection, even on the peak weekend in the winter, is very minimal.

	Table	4.13:	Net	Change in	Future	Intersection	Vehicle	Volumes	with	New Site	Trips -	- Winter
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HORIZON	BACKGROUND VOLUMES	SITE TRAFFIC	% CHANGE
Opening Day (2030)	1270	27	2.1%
Long Term (2040)	1333	27	2.0%

Opening Day (2030) - Winter

Winter Opening Day After Development intersection analysis is summarized in **Table 4.7** based on the volumes illustrated in **Exhibit 4.5**.
INTERSECTION	MOVEMENT		AM PE	AK HOU	R	
	& LANES		v/c	LOS	Delay	Queue
Highway 3 &	EB	1	0.83	С	20	189
Fernie Ski Hill Road	NB	1	0.31	В	11	10
(Roundabout)	SB	1	0.22	А	5	8
	Overall		-	В	16.0	-
Highway 3 &	EBL	1	1.01	D	48	278
Fernie Ski Hill Road	EBR	1	0.05	А	2	<5
(Signal)	NBL	1	0.07	С	34	7
	NBT	1	0.58	D	46	48
	SBT	1	0.59	D	47	50
	SBR	1	0.36	А	10	16
	Overall		-	D	42.1	-
Highway 3 &	EBL	2	0.77	В	15	50
Fernie Ski Hill Road	EBR	1	0.07	А	2	<5
(Signal and Dual EBL)	NBL	1	0.03	В	15	<5
	NBT	1	0.32	В	17	26
	SBT	1	0.32	В	17	27
	SBR	1	0.26	А	5	10
	Overall		-	В	13.9	-

Table 4.14: Winter Opening Day (2030) After Development Intersection Analysis

Long Term (2040) - Winter

Winter Long Term After Development intersection analysis is summarized in **Table 4.8** based on the volumes illustrated in **Exhibit 4.6**.

INTERSECTION	MOVEMENT		AM PE	AK HOU	R	
	& LANES		v/c	LOS	Delay	Queue
Highway 3 &	EB	1	0.86	С	23	232
Fernie Ski Hill Road	NB	1	0.37	В	13	14
(Roundabout)	SB	1	0.24	А	5	10
	Overall		-	В	17.9	-
Highway 3 &	EBL	1	1.02	D	51	278
Fernie Ski Hill Road	EBR	1	0.05	A	3	<5
(Signal)	NBL	1	0.08	С	34	7
	NBT	1	0.68	D	50	58
	SBT	1	0.69	D	51	59
	SBR	1	0.37	A	9	16
	Overall		-	D	45.5	-
Highway 3 &	EBL	2	0.77	В	15	55
Fernie Ski Hill Road	EBR	1	0.07	А	3	<5
(Signal and Dual EBL)	NBL	1	0.03	В	14	<5
	NBT	1	0.38	В	18	31
	SBT	1	0.39	В	18	32
	SBR	1	0.25	А	5	10
	Overall		-	В	14.5	-

Table 4.15: Winter Long Term (2040) After Development Intersection Analysis

Winter After Development Analysis Summary

Winter After Development intersection capacity analysis indicates the site traffic will have an insignificant impact on the operations of the Highway 3 & FSH Road intersection. As with the Winter Background, the intersection will require improvement, either by signalization or a roundabout, with or without the development of the site.

4.7 Active Transportation

Given the proximity to Fernie Alpine Resort, it is expected some of the residents will walk or cycle towards the ski hill. The ski hill also has bike trails during the summer months so it will generate active modes trips. While the rural standards of the interior roads, such as Boomerang Way and Highline Drive, do not offer any active modes infrastructure, the lower volumes on the roadways allow for active modes.

There are also future plans to link FSH Road to West Fernie via a multi-use pathway on the west side on the highway. The Fernie Valley Pathway will be to the east of the site and will provide residents of the development safer active mode access towards both the ski hill and the City. The project is divided into three segments, with segment #3 running along FSH Road and providing access to Fernie Alpine Resort. **Figure 4.1**, from McElhanney's *Fernie Valley Pathway Preliminary Design Report* (June 29, 2020), illustrates the possible pathway alignment options near FSH Road. The pathway will be accessible to the site via FSH Road and will continue to the north along the highway, providing good active mode connectivity to West Fernie. This report was prepared for the City of Fernie and Fernie Trail Alliance.



Figure 4.1: Segment 3 Pathway Options at Fernie Alpine Resort

4.8 Illumination Warrants

An illumination warrant was completed at Highway 3 & FSH Road based on the Transportation Association of Canada (TAC) *Illumination of Isolated Rural Intersections* guide. The warrant for illumination is used to determine if lighting at an intersection is required based on several different factors such as geometrics, operations, environmental issues, and collision history. Currently the intersection is partially illuminated.

TAC guidelines state full illumination is warranted at unsignalized intersections where a total score of 240 or more points is achieved. Partial or delineation lighting may be considered at intersections with a score of 120 points or more (partial illumination if 80/120 points achieved in Geometric score; delineation lighting if 120+ points achieved in Operational score).

The illumination warrant results if the intersection remains stop-controlled are summarized in **Table 4.16** and are attached in **Appendix E**.

INTERSECTION	HORIZON	ILLUMINATION SCORE	COMMENT
Highway 3 &	Summer Existing	208/240	Delineation Lighting Warranted
FSH Road	Winter Existing	228/240	Delineation Lighting Warranted
	Summer 2030 Bkgd	208/240	Delineation Lighting Warranted
	Winter 2030 Bkgd	228/240	Delineation Lighting Warranted
	Summer 2040 Bkgd	208/240	Delineation Lighting Warranted
	Winter 2040 Bkgd	228/240	Delineation Lighting Warranted
	Summer 2030 After Dev	208/240	Delineation Lighting Warranted
	Winter 2030 After Dev	228/240	Delineation Lighting Warranted
	Summer 2040 After Dev	208/240	Delineation Lighting Warranted
	Winter 2040 After Dev	228/240	Delineation Lighting Warranted

Table 4.16: Illumination Warrant Summary

The lighting analysis confirms that delineation lighting for the FSH Road/Highway 3 intersection is currently warranted. The warrant score does not change throughout the different horizons, nor is it materially affected by the inclusion of site generated traffic. Once the intersection is signalized, full illumination would be completed as a matter of course in developing the intersection.

HAWORTH Development Consulting

Appendix B

Galloway Lands Development, Response to CTS Review

Bunt & Associates Engineering Ltd.

SUMMARY OF FINDINGS / RECOMMENDATIONS

The Fernie Snow Valley Community Association engaged Creative Transportation Solutions to comment on the Highway #3 / Fernie Ski Hill Road TIA completed by Bunt & Associates.

Bunt & Associates has provided a response to CTS's comments.

The primary observation of the CTS review was that the traffic generation rates used by Bunt for the proposed Galloway Lands were insufficient. We undertook detailed traffic counts over two weekends in Winter 2022. These traffic counts determined that the existing dwelling units on Boomerang Way and Snow Pines Drive, comprised of 55 dwelling units, were observed to have a Saturday Peak Hour trip rate of 0.23 trips/unit on January 22, 2022, and 0.21 trips/unit on February 19, 2022.

The ITE trip rate used for the Galloway Lands is 0.38 trips/unit (approximately 65% greater than the actual trip rate observed).

Further, the TIA prepared by Bunt & Associates used "Recreational Home", rather than "Single Family Home" as the land use type for this development. It is Bunt's understanding that the homes to be constructed in the Galloway Lands will be occupied in a similar manner to the single family homes at Fernie Alpine Resort. As such, it is Bunt's opinion that the Recreational Home is the correct land use.

Based on the trip generation rates observed we believe that the ITE trip rate used for the Galloway Lands of 0.38 trips/unit is correct.

Additional comments from CTS are addressed in the letter from Bunt & Associates that follows.





MEMO

Date: Project: Subject:	March 23, 2022 Galloway Lands Development Response to CTS Review	Project #:	02-21-0081
To: From:	Reto Barrington Handshake Holding Jason Dunn		

Creative Transportation Solutions Ltd (CTS) prepared a technical memo for the Fernie Snow Valley Community Association, dated 24 December 2021, outlining their observations based on a site visit, review of the proposed site plan and a review of the transportation impact study completed for the proposed development.

The memo made the following recommendations;

- 1. Traffic analysis be updated to reflect a more realistic trip generation
- 2. Development proposal include a second access to Hwy 3
- 3. A detailed review of key internal existing intersection under winter conditions be completed.
- 4. A detailed CTMP be prepared and adhered to should the development be authorised to proceed.

This memo addresses the recommendations.

Trip Generation Rate

The TIA prepared by Bunt used Recreational Home, rather than Single Family home as the land use type for this development. It is Bunt's understanding that the homes to be constructed in the Galloway Development will be occupied in a similar manner to the single family homes in the Fernie Alpine Resort. As such, it is Bunt's opinion that the Recreational Home is the correct land use. As for the trip generation rate, this was confirmed as being appropriate by the comparison with the trips generated by the existing homes on Boomerang Way and Snow Pines Drive as counted in the 2022 winter traffic counts.

An extract from Section 3.2 of the TIA is listed below.

ITE Land Use 260 for recreational homes was used for all base analysis given the nature of the dwellings and the proximity to the Fernie Alpine Resort The site traffic is expected to have a greater percentage of trips outside of peak hours based on the vacation nature of the resort as the residents would not be following standard office hours.

As a comparison, the existing dwelling units on Boomerang Way, comprised of 55 dwelling units, were observed to have a Saturday Peak Hour trip rate of 0.23 trips/unit on January 22, 2022, and 0.21 trips/unit on February 19, 2022. The ITE trip rate used is 0.38 trips/unit.

Table 3.1: Trip Generation Rates

USE	AM PEAK HOUR			PM PEAK HOUR			SATURDAY PEAK HOUR		
	Trip Rate	In	Out	Trip Rate	In	Out	Trip Rate	In	Out
Recreational Homes (ITE 260)	0.22 per unit	67%	33%	0.28 per unit	41%	59%	0.38 per unit	48%	52%

Second Access to Hwy 3

It is Bunt's understanding that this is still being reviewed by the client group.

Winter Condition TIA

This is agreed and has been addressed in the recently completed Winter Addendum TIA.

Construction Traffic Management Plan (CTMP)

This is agreed and can be required of the lead construction contractor once construction of the development occurs.

This concludes the response to the recommendation of the CTS memo.

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Appendix C

Recommendations for Wildfire Hazard Reduction for the Development of Galloway Lands, Fernie, BC

Summary of Relevant Community Wildfire Protection Plans and Publicly Available Wildfire Data

B.A. Blackwell & Associates Ltd.

SUMMARY OF FINDINGS / RECOMMENDATIONS

Recommendations for Wildfire Hazard Reduction have been prepared by BA Blackwell & Associates for the proposed Galloway Lands development. The assessment completed reviewed a range of FireSmart strategies for the property including:

- Building Envelope and Construction Materials
- Vegetation and Fuel Management Strategies (defensible space and landscaping)
- Water and Power Supply
- Sprinkler Systems
- Road Network (access and egress, on-property roads, trail management, individual property access)
- Critical Infrastructure

The assessment makes a series of recommendations that would be good practice for all new development within the RDEK and will be part of the development of the Galloway Lands.

The objective of the recommendations is to:

- Reduce the vulnerability of the buildings to wildfire using FireSmart compliant materials.
- Reduce fuels within 100m FireSmart Priority Zones around the buildings.
- Increase the availability of water supplies and their availability to fire fighters.
- Utilization of sprinkler systems when water supply is scarce.
- Facilitate evacuation of residents from the area and accessibility to firefighters during wildfire.

The wildfire hazard covenant currently utilized in many parts of the RDEK (and to which the proponent has committed to registering on the Gall0way Lands) already addresses using FireSmart compliant building materials and reduction of fuel load around residential buildings. Additional recommendations can be added to the Wildfire Hazard Covenant as required by the RDEK.

continued...

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To facilitate fire protection within the lands a fire pond / reservoir is proposed that will provide suitable protection for structure fires and assist with forest fires. This reservoir would feed a series of fire hydrants spaced within the property.

A secondary emergency vehicle access (SEVA) to allow for simultaneous access for emergency equipment and evacuation of people. This route will be constructed to the standards required by MOTI and local fire authority and will provide emergency egress from the Galloway Lands and Fernie Alpine Resort as well as emergency access for fire department and other emergency responders.

The Statutory Building Scheme registered on each building lot will require:

- All buildings within the Galloway Lands to install external irrigation systems on the roof of the building to provide fire protection in the event of an interface forest fire.
- Landscaping that is consistent with and promotes FireSmart principles.
- Installation of a monument with a light and civic address at the end of each residential driveway.

The proponent will meet all recommendations of the report prepared by BA Blackwell & Associates. These recommendations exceed the normal requirements of the RDEK with within areas where a Wildfire Hazard development permit is required. The proponent will also register a Wildfire Hazard covenant over the property consistent with the requirements of the RDEK.

RECOMMENDATIONS FOR WILDFIRE HAZARD REDUCTION

FOR THE DEVELOPMENT OF Galloway Lands, Fernie, BC



PRIVATE AND CONFIDENTIAL

February28, 2022

Submitted by:

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COMMONLY USED ACRONYMS

BEC	Biogeoclimatic Ecosystem Classification
DBH	Diameter at Breast Height
FPZ	Fire Priority Zone
LCR	Live Crown Ratio
NFPA	National Fire Protection Agency
WUI	Wildland Urban Interface

EXECUTIVE SUMMARY

This document intends to provide recommendations with respect to FireSmart guidelines for building compliant materials, access/egress routes, water availability/accessibility and installation of sprinkler systems for the development of Galloway Lands, Fernie. These recommendations are general and aimed to assist the developers and designers to increase the resilience of residential area to wildfire.

Table 1. Recommendations to reduce wildfire hazard in Wildland Urban Interface for Galloway LandsDevelopment.

Item	Recommendation
Building	envelope and construction materials
Objectiv compliar	e: Reduce the vulnerability of the buildings to wildfire using FireSmart nt materials.
1	Use fire-resistant compliant materials for exterior of the buildings within WUI area.
2	Consider using non-combustible materials for buildings on the mid to upper portion of a slope. Buildings at the crest of a slope should have at least 10m setback from the crest of slope for one-storey buildings or proportionally greater, based upon their height.
3	Adjust local capacity for emergency management and efficient response to wildfire based on the number of residents.
4	Do not use any combustible material or vegetation within 1.5m around a building.
Vegetati	on and fuel management strategies
Objectiv	e: Reduce fuels within 100m FireSmart Priority Zones around the buildings
5	Remove all coniferous hedges, shrubs and surface fuels within 1.5 to 10m (FPZ1) of a building.
6	Within $10 - 30m$ around the building, reduce the stand conifer density to 500sph, reduce the fine and medium surface fuel to 2 kg/m ² and promote deciduous plants. Coniferous trees should be pruned up to 2m height.
7	Within 30 – 100m of structures, promote deciduous plants, follow thin from below regime, prune coniferous trees to minimum of 2m height and maintain the fine and medium surface fuel to 0.5 kg/m ² .
8	Avoid coniferous vegetation in the landscaping.
9	Landowners should regularly maintain the landscape and remove the flammable materials to maintain a low fire hazard.
Water a	nd power supply

Item	Recommendation
Objectiv fighters	res: Increasing the availability of water supplies and their availability to fire
10	During the development phase, ensure that reliable water supplies are available and accessible to firefighters during the fire season; and are appropriately located and spaced.
11	In areas where reliable water supply is limited, follow NFPA 1142 guidelines for minimum requirements of water supply.
12	Design the water sources / systems to be capable of supplying enough water for multiple house fire simultaneously.
Sprinkle	r systems
Objectiv	es: Application of sprinkler systems when water supply is scarce.
13	Consider the installation of sprinkler systems where the buildings do not have access to a reliable water source.
14	Between April to the end of October, the sprinkler system should be connected to a water supply (a well or cistern) and tested at the beginning of each fire season.
15	Sprinkler systems and water pumps should be connected to an independent power source in case of power outage.
Access a	nd egress
Objectiv accessib	es: Facilitating the evacuation of the residents from the area and its illity to firefighters during wildfire.
16	Designate multiple two-way routes with ample turnarounds to provide safe evacuation route for the residents and access to the fire by firefighters during the wildfire.
17	Within a 15m road buffer, maintain crown closure at 30-40% and prune all conifer crown bases to 2m from the ground.
18	Maintain the roads and the vegetation along the roads to allow firefighting trucks and equipment to access the area.
19	Consider the volume of on-street parking cars during the evacuation at subdivision level for the access design.
20	Consider designing on-property roads to access the entire property and to be able to support firefighting equipment.
21	Design on-property roads to provide two exit routes during wildfire.
22	Within the Development area, map the existing trail, identify their use (motorized and non-motorized) and collect their attributes such as width, surface type and clearance to prioritize all the trails for their suitability as

Item	Recommendation
	surface fuelbreaks and points of access. Share this information with agencies who may find it useful for suppression or planning purposes.
23	Prune coniferous trees on the side of the trails up to 2m height and remove the understory conifers within 5m buffer.
24	Remove, burn, or scatter, based on the volume, all the debris resulting from pruning or trail maintenance to avoid the accumulation of fuel.
25	Make individual property easy to be found to reduce response time.

1.0 INTRODUCTION

B.A. Blackwell & Associates Ltd. (the Consultant) were retained by Spike Camp L.P. (the Client) to providerecommendations regarding five aspects of the development to reduce the risk of wildfire for the future residential development of Galloway Lands, Fernie. The aspects are:

- 1. Fire smart compliant materials used for residential buildings,
- 2. Creating defensible zones around residential buildings by reducing fuel,
- 3. Water supply and accessibility during wildfire,
- 4. Sprinkler system requirements for residential buildings, and
- 5. Emergency access/egress.

This report includes relevant information in regard to the above-mentioned aspects. This report provides general information only and is not based on a field assessment of the developing area.

1.1 QUALIFICATIONS

Bruce Blackwell, MSc, RPF (#2073) has over 30 years' experience in fire and forest ecology, and fire and fuels management. Mr. Blackwell is a recognized wildfire risk analyst and planning specialist in BC and has managed numerous innovative projects related to fire risk identification and mitigation for the public and private sector on both large and small scales. Mr. Blackwell has also been on the leading edge of developing large urban forest strategies for communities in BC, Alberta, and Ontario. Ali Rahi, RPF, ISA Certified Arboriculture, has more than 10 years of experience in forestry and wildfire. Tove Pashkowski, RPF (#4740), Certified Local FireSmart Representative, with more than 15 years of experience in wildfire.

1.2 SITE DESCRIPTION

The Galloway Lands Development (Development) includes all or part of parcels with PID #s 011-359-471, 011-359-447, 011-359-404, and 011-359-323 (Figure 1). The area is approximately 185 ha and is located south of the City of Fernie, BC. The Development is designed for a maximum 75 homesites with minimum 1.0 ha lot size. The area will have 128.5 ha (70%) conservation area.

1.3 DEVELOPMENT PLAN

As of the date of this report, the Development isat zoning stage with a preliminary site plan. TheDevelopment plan consists of single-family detached homes in developable polygons intermixed within the forest¹This type of development scenario is at higher risk for damage from wildfire because of the isolation of the homes, proximity to the forest and the potential for evacuation and egressroutes to become blocked (Figure 1).

¹<u>https://gallowaylands.com/</u>.Accessed February 7, 2022.

Increases in human populations along the wildfire-urban interface (WUI) or in intermix developments increase the likelihood for wildfires to spread from human-caused ignitions to the forestand for wildland fires to spread to structures, which increases the wildfire hazard to vulnerable neighbourhoods or communities. Given the proximity to high-use recreation areas / trail systems (Fernie Alpine Resort, Fernie Nordic Center, Mount Fernie Provincial Park), this area is at risk from human ignitions. One of the goals for this development is to manage the forested area under the development to reduce the existing wildfire risk for the residential and the nearby recreational structures.



Figure 1. Illustratedpictureshowing the Galloway Lands wildland urban interface.

1.4 FIRE ENVIRONMENT

The province of British Columbia uses the Biogeoclimatic Ecosystem Classification (BEC) system to characterize distinct ecological communities based on species composition and climate factors. The Development area is within the Interior Cedar Hemlock Zone moist cool variant (ICH mk4). Within this BEC

zone, July, August, and September have "very high" and "extreme" danger-class days and comprise the period of greatest concern for extreme fire behaviour. The fire season is considered to start in April and extend through October.

Fire behaviour prediction is the science and application of predicting characteristics of wildland fire suchas ignition, spread rate and intensity². The main variables affecting wildland fire behaviour are fuels, weather and topography –characteristics that comprise the fire environment. Contributing factors to a community's exposure to wildfire danger are two attributes that cannot be modified – topography and climate – as they are fixed spatially and temporally.

The term 'fuels' encompassesvegetation and biomass structure, biomass loading, dominant species (especially for treed landscapes), and other characteristics such as forest floor characteristics and forest health issues; such as outbreaks of bark beetles or other insects that affect the flammability and availability of biomass for combustion. The fire hazard of a community is generally dictated by the proximity of fuel to developed areas. Fuels closest to the community pose a higher hazard compared to fuels at a greater distance to communities and infrastructure.

It is important to understand the likelihood of exposure to periods of high fire danger, which can vary from season to season. For a summary of the fuel types of the City of Fernie, refer to "Summary of Relevant Community Wildfire Protection Plans and Publicly Available Data" (2022) by Tove Pashkowski and "City of FernieCommunity Wildfire Protection Plan Update" (2018) by B.A. Blackwell & Associates.

²<u>https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/wildfire-management/fire-fuel-management/bcws_bc_provincial_fuel_type_layer_overview_2015_report.pdf</u>

2.0 FIRESMART STRATEGIES FOR POTENTIAL DEVELOPMENT

A variety of fuel management strategies are recommended to manage wildfire risk for development within the WUI. For home development, mitigation strategies typically focus on a "building envelope-out" approach using FireSmart standards. This focuses on protecting individual structures and managing the landscape within proximity to developments which determines the ignition potential and is referred to as the Home Ignition Zone (HIZ) (Cohen 2000 and Reinhardt et al. 2008). The HIZ includes the structure itself and fourconcentric, progressively wider Priority Zones. Priority Zones are based upon distance from the structure: 0-1.5m (Non-Combustible Zone), 0-10m (Priority Zone 1), 10-30m (Priority Zone 2), and 30-100m (Priority Zone 3). These zones help to guide risk reduction activities, with Recommended FireSmart Guidelines being most stringent closest to the structure. The likelihood of home ignition is mostly determined by the area within 30m of the structure.

Within the FireSmart Priority Zones (FPZ), mitigation measures typically involve landscaping, vegetation and fuel managementtechniques, and landscape-level fuel breaks, where the goal is to change the fire environment and limit wildfire spread. This is accomplished by reducing hazardous fuels and reducing the amount of fuel that can be burned in a wildfire event, as well as altering how a fire moves throughout the landscape.

In addition to fuel management, increasing resiliency and capacity for fire suppression is of the utmost importance. This would involve building redundancies in power supply systems, development of access/egress routes across the area, improvement to ensure access to sufficient and reliable water supply for fire suppression, and coordination with emergency services. All the homes would be considered within the WUI, as such, the recommendations apply to the entire development. These recommendations can be applied through a building scheme or covenant if the buildings would be constructed by the individual land owners.

2.1 BUILDING ENVELOPE AND CONSTRUCTION MATERIALS

The following recommendations should be taken as general guidelines based on the FireSmart standards. A qualified professional should be consulted during the construction to take into account the local characteristics such as topography and forest types for each building.

Multiple studies have shown that the principal factors regarding home loss to wildfire are the structure's characteristics and immediate surroundings. Recommended FireSmart guidelines address a multitude of hazard factors within the HIZ: building materials and design. Examples of compliant materials that can be used for exterior of the buildings are provided in Appendix A – FireSmart Compliant Materials.

Recommendation #1: Use fire-resistant compliant materials for exterior of the buildings within WUI area.

In Spring 2015, the Province passed the *Building Act* as the new legislation to guide building and construction in BC. This Act establishes the province as the sole authority to set building requirements and limits local government authority to set building requirements in their bylaws. The *British Columbia Building Code* does not have any wildfire-specific fire-resistant design components. Until revisions of the Building Code to include requirements specific to prevention of wildfire spread are completed, private developments can build to a higher standard and / or set exterior requirements for wildfire risk mitigation through a building schemes, covenants or guidelines registered on title.

Slope of the groundaffects fire behaviorand the rate of spread. Fire will burn morerapidly uphill than on a flat surface. It is important to consider the location of the building on the slope.Convective heat and firebrands from burningfuels on the slope below the building can readilyignite buildings located on the mid to upperportion or crest of a hill and therefore structures located on a slope must featureentirely non-combustible exteriors and FireSmartdesign principles. Structures located at the crest of ahill can be protected somewhat by setbackprovisions. A single-story building should be setback 10m from the crest of the slope. Taller buildings will need proportionately greatersetback distances.³

Recommendation #2: Consider using non-combustible materials for buildings on the mid to upper portion of a slope. Buildings at the crest of a slope should have at least 10m setback from the crest of slope for one-storey buildings or proportionally greater, based upon their height.

³https://www2.gov.bc.ca/gov/content/safety/wildfire-status/prevention/for-industry-commercial-operators/hazardassessment-abatement

Increasing Local Capacity

Local capacity for emergency management and efficient response to wildland urban interface fires can be enhanced by addressing the following steps:

- Development and/or maintenance of Structural Protection Units (SPUs)⁴ which can be deployed in the event of a WUI fire (e.g., sprinkler systems, Section 2.4);
- Conducting a comprehensive review of Emergency Management BC SPU deployment procedures for the purpose of fighting interface fires;
- Provision of sprinkler kits to community residents (Section 0); and
- Engagement in annual cross-training exercises with adjacent fire departments and/or BCWS in order to increase both local and regional emergency preparedness with regards to structural fire and wildfire training.

Recommendation #3: Adjust local capacity for emergency management and efficient response to wildfire based on the number of residents.

2.2 VEGETATION AND FUEL MANAGEMENT STRATEGIES

Fuel treatments for wildfire hazard mitigation are recommended for a 100m buffer around structures and a 50m buffer around access / egress routeswhen potential developments are adjacent to a high hazard fuel type. Fuel treatments around structures follow FireSmart standards and are subdivided into the FPZs of 0-1.5m 1.5-10m, 10-30m, and 30-100m zones (Figure 2). Within these zones, the recommendations are to reduce the potential fire hazard by treating flammable vegetation and/or fuels in close proximity to the planned development. The execution of these recommendations will reduce the likelihood of fire spread. The guidelines for each FPZ are provided below, but recommendations for each property may vary from what is listed here depending on the site context. All forest management decisions should be made by a qualified professional forester.

The following management strategies in FireSmart zones and associated recommendations can be applied through a building scheme or covenant if the properties would be managed by the individual land owners. Site-specific deviations from these guidelines may be appropriate and can be determined by a qualified professional.

The *Non-Combustible Zone* is a 1.5m combustible-free zone around the structure. This zone should be free of any vegetation and flammable materials such as bark mulch. This zone should only include non-flammable landscaping materials such as gravel, brick, or concrete, and must be cleaned regularly to

⁴A structure protection unit (SPU) is a cache of equipment stored in a trailer that is used by trained structure protection specialists to set up sprinklers on and around a structure. SPUs can be effective in reducing wildfire threats to some types of buildings, such as houses, cabins, barns or other outbuildings.

https://www2.gov.bc.ca/gov/content/safety/wildfire-status/about-bcws/wildfire-response/structural-protectionprogram#:~:text=A%20structure%20protection%20unit%20(SPU,cabins%2C%20barns%20or%20other%20outbuildings.

prevent accumulation of leaf litter or other combustible materials. Items such as construction materials, propane tanks, firewood, and combustible furniture should not be stored here.

Recommendation #4: Do not use any combustible material or vegetation within 1.5m around a building.

Priority Zone 1 (FPZ 1) is a 10m fuel free zone around structures whichincludes removal of most coniferous vegetation and removal of surface fuels and woody debris from the 10m zone. This ensures that direct flame contact with the building cannot occur, and reduces the potential for radiative heat to ignite the building (Partners in Protection, 2003).⁵ Combustible materials such as firewood or lumber should not be stored in this zone. Coniferous vegetation is highly flammable and must not be planted in this zone. Mature coniferous trees can be retained if they are at least5m from buildings, and spaced 3m from other coniferous vegetation.

Recommendation #5: Remove all coniferous hedges, shrubs and surface fuels within 1.5 to 10m (FPZ1) of a building.

Priority Zone 2 (FPZ 2) extends from 10m to 30m from the structure and thegeneral guidelines for fuel management includes the reduction of stand conifer density to 500 stems per ha (sph) and the reduction of surface fine and medium coarse woody debris to less than 0.5kg/m². In this zone, deciduous species should be favoured over coniferous vegetation as deciduous trees have much lower volatility. Coniferous trees can be planted so long as there will be a minimum of 3m of spacing between their mature crowns and that a 5 m distance between the crown to the building roof is able to be maintained (i.e., mature tree size, crown, and height are considered in plantings). Coniferous trees should be crown raised (pruned) to at least 2m from the ground in order to reduce ladder fuels. Ladder fuels provide a pathway for a ground fire to move into the crown of the tree. Any downed wood or other flammable material should also be cleaned up in this zone to reduce the likelihood of fire moving along the ground.

Recommendation #6: Within 10 - 30m around the building, reduce the stand conifer density to 500sph, reduce the fine and medium surface fuel to 2 kg/m² and promote deciduous plants. Coniferous trees should be pruned up to 2m height.

Priority Zone 3 (FPZ 3) extends from 30m to 100m from the structure deciduous trees should be preferred for retention or planting. Fuel treatments in this zone would follow a "thin from below" silviculture regime, in which small trees are thinned in the understory and surface fuels are removed, and tree crowns are pruned to create space between the forest floor and tree canopies. This consists of the thinning of trees <15cm diameter-at-breast height (DBH), pruning the lower limbs of trees greater than 15cm DBH to a minimum height of 2m above the ground surface, and the removal of fine surface woody

⁵https://www.firesmartcanada.ca/wp-content/uploads/2022/01/FireSmart-Protecting-Your-Community.pdf

debris (twigs, branches <12.5 cm DBH) toless than 2 kg/m². Tree crown base height should generally be separated by at least 2m to prevent the initiation of crown fire. These principles are particularly important in sloped areas and along road sides.

Recommendation #7: Within 30 - 100m of structures, promote deciduous plants, follow thin from below regime, prune coniferous trees to minimum of 2m height and maintain the fine and medium surface fuel to 0.5 kg/m².





2.2.1 DEFENSIBLE SPACE

By following FireSmart principles within the Non-Combustible Zone and FPZ 1, property owners can create what is called 'Defensible Space' around their home. Defensible space is a buffer created between a structure and any wildland/flammable vegetation nearby that allows for the following: slowing or stopping the spread of wildfire, reducing the likelihood of the structure catching fire, and providing a safe space for firefighters to work should there be a fire on or near the property⁶. In the event of a wildfire, firefighters may have to choose which houses they do or do not act on. Homes with defensible space are

⁶ Cal Fire, Defensible Space: <u>https://www.fire.ca.gov/programs/communications/defensible-space-prc-4291/</u>

safer for firefighters to work at and are more likely to survive a fire, and may be prioritized over homes without defensible space as a result.

2.2.2 LANDSCAPING

It is recommended that all landscaping within the development is designed and executed compliant to the FireSmart BC Landscaping Guide.⁷

FireSmart Landscaping

Landscaping choices within the FPZ 1 zone (1.5 - 10m from the building) should be limited to plant species with low flammability. Coniferous vegetation such as juniper, cypress, yew, and cedar should not be planted within this zone, as these species are considered highly flammable under extreme fire hazard conditions.



Figure 3. Examples of common coniferous vegetation planted within the urban landscape.

In addition to choosing species with low flammability, other factors such as sun exposure, hardiness zone, available space, water usage, and ease of maintenance should also be considered in the landscaping design and plans.

It is best to discuss options with a professional landscaper, looking together for plants that suit the aesthetics of the landscape design, are suitable for the climate and site, and are fire resistant. Plants that are fire resistant generally have the following characteristics:

• Foliage with high moisture content (moist and supple),

⁷https://firesmartbc.ca/resource/landscaping-guide/

- Little dead wood and do not tend to accumulate dry and dead foliage or woody materials, and
- Sap that is water-like and without a strong odour.

The FireSmart BC Landscaping Guide is a great resource with a fairly comprehensive plant list by hardiness zone. For further assistance in creating a FireSmart landscape, refer to the FireSmart Guide to Landscaping at https://firesmartbc.ca/wp-content/uploads/2021/04/FireSmartBC_LandscapingGuide Web v2.pdf Other helpful tips for finding fire resistant landscaping options can be found at: http://www.firefree.org/wp-content/uploads/2021/04/FireSmartBC_LandscapingGuide Web v2.pdf Other helpful tips for finding fire resistant landscaping options can be found at:

Recommendation #8: Avoid coniferous vegetation in the landscaping.

Maintenance of property in low fire hazard state

To ensure that a low fire hazard rating is maintained, landscaping should be properly maintained in low hazard conditions. This may require periodic maintenance including crown raising and/or reduction of trees (thinning). Crowns of coniferous trees should be kept a minimum of 2m from the ground or 5m from structures. All pruning should be completed by an ISA Certified Arborist to meet industry standards. The roof and gutters should be kept clean of debris to reduce the potential for spotting to ignite these materials during a wildfire event. Coniferous foliage should not be allowed to accumulate in gutters.

Grass, shrubs, and herbsshould be maintained in a state that reduces fire hazard by maintaining foliar moisture content. This can be accomplished by:

- Choosing plant species that are well-adapted to the site (microclimate and soil conditions of the parcel),
- Incorporating a landscape design where shrubs, herbs, and grasses are planted in discrete units manageable by hand watering, and/or
- Installing irrigation.

It should be recognized that relying on irrigation to maintain landscaping in a healthy state is limiting and may actually increase the fire hazard on the parcel, particularly in times of drought and watering restrictions. Lack of irrigation in times of watering restrictions may create a landscape that is unhealthy and unsightly, as well as dead, dry, and highly flammable.

Dead material should be removed annually. Placement of combustible materials such as firewood or wooden structures (sheds, storage, or other outbuildings) must be a minimum of 10m from the primary building (including neighbouring houses). Any unused firewood that is moved closer to the structure for easy access during the winter season should be removed outside PFZ1 for the fire season. This will limit the potential for these materials to be ignited and spread fire to an adjacent building.

⁸A Pacific Northwest Extension Publication: Oregon State University, Washington State University, University of Idaho. August 2006.

Recommendation #9: Landowners should regularly maintain the landscape and remove the flammable materials to maintain a low fire hazard.

2.3 WATER AND POWER SUPPLY

Reliable water supply is classified as available when a water source is present and usable during the entire fire season and accessible by firefighters and capable of sustaining water supply during peak demand interface fire events with power outage. High-volume community wells or irrigation systems can be considered available if they are accessible for quick hookup by firefighters. Residential wells and seasonal creeks should not be considered to be reliable water supply, as defined above.

Recommendation #10: During the development phase, ensure that reliable water supplies are available and accessible to firefighters during the fire season; and are appropriately located and spaced.

In areas where hydrants are limited or unavailable (or it is otherwise determined that adequate or reliable water supply systems may not exist), the NFPA 1142 (*Standard on Water Supplies for Suburban and Rural Firefighting*)⁹can be used to determine minimum requirements for alternative water supply (natural or artificial). Alternative water sources, such as dry hydrant systems, water usage agreements for accessing water on private land, private wells or cisterns should be reviewed by the planners and the fire department during subdivision phase. Water infrastructure for firefighting (the hydrant network) must be capable to deliver water to multiple house fires (minimum of four and up to six) simultaneously with enough pressure and capacity. Failure to do so has shown to cause serious implications during a multiple-ignition wildfire event.

Recommendation #11: In areas where reliable water supply is limited, follow NFPA 1142 guidelines for minimum requirements of water supply.

Recommendation #12: Design the water sources / systems to be capable of supplying enough water for multiple house fire simultaneously.

Higher standards for hydro infrastructure also need to be considered. Given the proximity to the forest, traditional electrical infrastructure delivering power to homes with above-ground wood pole lines can potentially cause electrical wildfire ignitions. Power outages can also occur during wildfire. Serious consideration should be given to installing power infrastructure underground within this development.

⁹<u>https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=1142</u>

2.4 SPRINKLER SYSTEMS

In high-hazard forested areawhere buildings do not access to a reliable source of pressurized water or a nearby hydrant, exterior rooftop sprinklers with a coverage to thoroughly wet down FPZ 1 are recommended (Appendix B). Sprinkler systems must include robust sprinkler components (such as Rainbird) with limited plastic materials. Two approaches can be used for sprinkler systems, roof mounted sprinklers on portable mounts or sprinklers incorporated in the roof (Figure 4). In cases where a building relies totally on its own water system, the sprinkler system must be permanent and incorporated into the roof structure. Between April to the end of October, sprinklers must be connected to a water supply (a well or cistern) and tested at the beginning of each fire season. The external sprinkler system must be independent of the internal system to allow for manual use during a wildfire. Also, an operational switch that is accessible from outside would assist firefighters to operate the sprinkler from outside of the building should the homeowner or resident be seasonal or evacuated from the premises.

Recommendation #13: Consider the installation of sprinkler systems where the buildings do not have access to a reliable water source.

Recommendation #14: Between April to the end of October, the sprinkler system should be connected to a water supply (a well or cistern) and tested at the beginning of each fire season.





Figure 4. Examples of rooftop mounted sprinkler systems: portable (L) and fixed (R).

In the event of a house fire, sprinklers should be turned on (if safe to do so) a minimum of two hours before the fire reaches the residence to wet the roof and adjacent forested vegetation. The use of sprinklers also raises the relative humidity around the residence. This will help reduce fire behaviour adjacent to the home by making fuels less flammable and reduce the probability of spotting igniting adjacent vegetation or structures.

Power supply to the property is vulnerable to disruption during a wildfire which has implications for water supply. To ensure that water supply for fire suppression is available, a designated water source for use during a fire and a system capable of operating sprinklers and water pumps (the water source is the well) during power loss is mandatory.

Recommendation #15: Sprinkler systems and water pumps should be connected to an independent power source in case of power outage.

Water storage cisternscan be used as a water source during an emergency. Where gravity systems cannot deliver sufficient pressure to ensure adequate sprinkler coverage, a pump with an independent power source such as a generator must be connected to the rooftop sprinkler system and the water supply. For more details, refer to "*BC Design Guideline and Construction Standards 2019*"¹⁰

2.5 ROAD NETWORK

The development area is situated west of Highway 3 which heads towards east to Alberta border and west via Highway 93. The City of Fernie is served by the Elk Valley / South Country Subregion Evacuation Plan (2008).¹¹The City is in the process of developing a City of Fernie evacuation plan and core emergency response plan.

Road networks in a community serve three functions during a wildfire¹²:

- 1- As access routes for emergency responders and their vehicles and equipment. Access routes should be robust enough to cope with large, heavy equipment and vehicles (e.g., 20 tonne firetrucks),
- 2- As escape (or egress) routes for residents, and
- 3- As firebreaks to interrupt or slow the progress of the fire and assist firefighting efforts.

Access and evacuation during a wildfire emergency often must happen simultaneously and road networks should have the capacity to handle both. If wildfire were to block Highway 3 in either direction, evacuation of several communities would be severely limited. Smoke and poor visibility can further complicate

¹⁰<u>https://www.bchousing.org/partner-services/asset-management-redevelopment/construction-standards</u>

¹¹https://fernie.civicweb.net/document/14493

¹²https://nrc-publications.canada.ca/eng/view/ft/?id=3a0b337f-f980-418f-8ad8-6045d1abc3b3

evacuations and hinder safe passage. There is an opportunity for the Galloway Lands Development to design and construct appropriate access and egress for all area under development.

2.5.1 ACCESS AND EGRESS

The Development should designate multiple two-way access points to ensure an appropriate evacuation of all residents and access to the fire by the firefighters. Based on geotechnical and civil engineering feasibility studies by qualified professionals, access roads and evacuation points should be designed based on the number of proposed homes and the number of people that will live in the proposed neighborhoods. Wildfires in Fort McMurray and Williams Lake have highlighted the requirement for orderly and safe evacuation during a wildfire event, and the difficulties of conducting these evacuations during extreme wildfire events. Communities need to develop better neighbourhood plans for evacuation and egress during wildfire events. Alternative routes must be provided by planning for access and egress at two different points within the development sites. Access routes must lead to major arterials (i.e., Highway 3). All access roads should be capable of supporting two-way traffic. Additionally, roads need to have capacity for providing emergency services with ample turnaround space so that the fire truck and equipment can move during the evacuation without road blocks.

Recommendation #16: Designate multiple two-way routes with ample turnarounds to provide safe evacuation route for the residents and access to the fire by firefighters during the wildfire.

Within the road buffer's FireSmart zones (15m from the centerline of the road), crown closure should be between 30-40% and crown base heights of trees should be 2m off the ground, with tree crown spacing of at least 2m.

Recommendation #17: Within a 15m road buffer, maintain crown closure at 30-40% and prune all conifer crown bases to 2m from the ground.

Vegetation along the roads outside the FireSmart Zonesand the grading of the roads should also be maintained to a degree that allow firefighting trucks and equipment to access the area. The maintenance should follow the following criteria:

- Create a fuelbreak that extends 3m from the centerline of a roadway with substantially reduced ground cover adjacent to the road;
- Provide a minimum vertical clearance of 4m in the driving area to create an unobstructed view for firefighters;
- Provide a minimum horizontal clearing distance of 3.6m in the driving area;
- Thin and prune trees and shrubs adjacent to the road;

- Maintain the grading of the roads periodically to keep the surface in good shape, particularly when used heavily;
- Drainage structures such as water bars, ditches, and culverts should be regularly inspected to be sure they are clear of obstacles and able to function effectively and prevent substantial damage to the road when water flows;
- Road cut-banks may need to be seeded with grass or other vegetation to stabilize the soil, prevent damage to the road from erosion, and minimize movement of sediment into nearby streams. Also, clear downed logs and other obstacles from the roadway and brush from the edges of the road.

Recommendation #18: Maintain the roads and the vegetation along the roads to allow firefighting trucks and equipment to access the area.

Subdivision Design

On-street parking can contribute to fire hazards on narrow or dead-end roads, which are already unlikely to have a high capacity for vehicle traffic under heavy smoke conditions (Cova 2005). When the time for evacuation is limited, poor access has contributed to deaths associated with entrapments and vehicle collisions during wildfires (De Ronde 2005). Methods for access design at the subdivision level can provide tools that help manage the volume of the cars that need to egress an area within a given period of time and take into account the space that the parked cars may take during the evacuation. These factors should be considered during the development.

Recommendation #19: Consider the volume of on-street parking cars during the evacuation at subdivision level for the access design.

2.5.2 ON-PROPERTY ROADS

On-property access roads play important role for evacuation and access of fire trucks to the buildings on the property¹³. Each property should consider, according to the feasibility, to have an appropriate road system that allow the occupants to escape during fire. These roads may also access to all parts of the property and be capable of supporting the firefighting equipment. These criteria can be designed and constructed during the development phase and maintained at good conditions by the landowners. It is also recommended that there are at least two exit roads in case when one road is impassable during fire.

Recommendation #20: Consider designing on-property roads to access the entire property and to be able to support firefighting equipment.

¹³<u>https://catalog.extension.oregonstate.edu/sites/catalog/files/project/supplemental/pnw618/pnw618-chapter5.pdf</u>

Recommendation #21: Design on-property roads to provide two exit routes during wildfire.

2.5.3 TRAIL MANAGEMENT

The Development area includes a network of trails. These trails should be mapped and their use (motorized and non-motorized) be identified based on the direction provided by the City trail management in the Fernie Trail Master Plan (2015).¹⁴It should be recognized that trails can act as effective fuelbreaks for surface fires and, depending on width, clearance, and surfacing, can provide access for equipment and control lines for suppression efforts. Comprehensive mapping of the trail system could include attributes which could also serve for suppression planning purposes, including attributes such as width, surface type, and clearance which could be used to determine accessibility and utility as a surface fire fuel break. Additionally, comprehensive mapping could be useful in the event of trail closures or evacuations in a wildfire event. This information should be available to relevant agencies who may find it useful for suppression or planning purposes (e.g., BCWS, City of Fernie, or RDEK).

Recommendation #22: Within the Development area, map the existing trail, identify their use (motorized and non-motorized) and collect their attributes such as width, surface type and clearance to prioritize all the trails for their suitability as surface fuelbreaks and points of access. Share this information with agencies who may find it useful for suppression or planning purposes.

To reduce the chance of fire spread upon ignition and to act as a fuelbreak for surface fires, trail side conifers should be crown raised (pruned) to a minimum of 2 m from the ground, and higher on slopes. Thinning activities (removal of flammable understory and intermediate conifer ladder fuels) should be undertaken on 5 m of either side of the trail centreline. Furthermore, it is neither feasible, nor desirable to convert all trails into surface fuelbreaks and/ or make them accessible by ATVs or other motorized equipment. Trails should be reviewed and prioritized for their suitability to act as surface fuelbreaks and points of access based on their location, use, and current accessibility. It is recommended to engage other trail stakeholders or planners during trail planning.

Recommendation #23: Prune coniferous trees on the side of the trails up to 2m height and remove the understory conifers within 5m buffer.

It is important to note that trail building and maintenance should not result in residual fuels and an increase of the fire hazard, especially in very high-use areas where ignition potential is higher. Minor work (pruning or individual tree falling) can usually be mitigated by scattering fuels in a discontinuous manner at a distance of more than 5 m from the trail. Larger volumes of biomass resulting from larger thinning, pruning, or trail building operations should be burned or removed off-site. Small amounts of biomass may

¹⁴https://www.fernie.ca/EN/meta/whats-new/news-archives/2015-archive/fernie-trails-master-plan.html

be chipped and spread, but moderate to large accumulations should be burned or removed due to chipping impacts on fuel loading and potential ecological impacts. Fuels, if left to accumulate from trail work, can significantly increase the chance of ignition and increase the potential fire behaviour should an ignition occur, such as from an errant cigarette butt or other human-caused ignition.

Recommendation #24: Remove, burn, or scatter, based on the volume, all the debris resulting from pruning or trail maintenance to avoid the accumulation of fuel.

2.5.4 INDIVIDUAL PROPERTY ACCESS

The response time from firefighters to a property is crucial to stop the spread of fire from a building to the forested area. To reduce the response time, make individual properties easy to locate by:

- Using local standard signage
- Post road names on noncombustible stanchions
- Post the building number using materials visible day or night at the beginning of the driveway
- Avoid any duplication of road names (i.e., Fernie Drive and Fernie Way)
- Post road restriction signs such as dead-ends and weight and height limitations
- Provide firefighters with access key to the gate to the property and all points of access

Recommendation #25: Make individual property easy to be found to reduce response time.

2.6 CRITICAL INFRASTRUCTURE

The FireSmart Critical Infrastructure (CI) Guide¹⁵ is intended to reduce the vulnerability of essential systems, facilities, technologies, networks, assets and services. It includes five separate sections:

- A- Building
- B- Structure
- C- Non-combustible Zone
- D- Zone 1
- E- Zone 2

Depending on the features of the CI, the Building Section or Structure section may not be applicable; or they may be both applicable. The Non-Combustible Zone, Zone 1 and Zone 2 will apply for all CI assessments.

¹⁵<u>https://firesmartbc.ca/wp-</u>

content/uploads/2020/09/FireSmartBC_FireSmartCriticalInfrastructureGuideFINAL.pdf

3.0 LIMITATIONS

This report was prepared by B.A. Blackwell and Associates Ltd. for Galloway Lands Development, and its contents reflect the best available information and are not based any field assessment. Any use that a third party makes from this report, or any reliance on or decisions made based upon this report, are made at the sole risk of any such third parties. B.A. Blackwell and Associates Ltd. accepts no responsibility for any damages or loss suffered by any third party or by the Client as a result of decisions made or actions based upon the use or reliance of this report by any such party.

Although every effort has been made to ensure that these recommendationsare reasonably accurate, awildfire threat assessment should be conducted to understand the forest covers, fuel types, forest health and topography in the area and the distance of the properties to high-risk fuel types. Periodically re-evaluation should also be conducted to gain an understanding of changing forest conditions and the impact of human-caused changes (such as development) potentially impacting forest health and forest stand structure, which in turn affect fire behaviour patterns.

Notwithstanding the recommendations made in this report, B.A. Blackwell and Associates Ltd. accepts no responsibility for the implementation of all or any part of the planned mitigation treatments as outlined in this report. Acceptance of this report and implementation of potential development in no way implies any inspection or supervisory role on the part of B.A. Blackwell and Associates.

This report has 31 pages and shall be considered as a whole; no sections are severable, and the report shall be considered incomplete if any pages are missing. The original report has coloured illustrations. If the reader has a black and white copy the report shall be considered incomplete and any interpretation of the report may be incorrect in the absence of a full colour copy. B.A. Blackwell and Associates Ltd. accepts no responsibility for any such misinterpretations.

4.0 **REFERENCES**

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5.0



APPENDIX A – FIRESMART COMPLIANT MATERIALS

Table 2. Compliant materials for residential buildings and critical infrastructures.

Building Part	Homes	Critical infrastructures	Comments
Roof	Class A or B fire resistance as defined in the current BC Building Code in accordance with ASTM E 108, or equivalent.	Class A UL/ASTM fire rated with no gap or opening.	Examples: asphalt shingles or torch-on asphalt, metal, slate, and clay tile. Wood shake and shingle roofs are not acceptable.
Gutters & downspouts & connections	Metal (aluminum is acceptable) and must be enclosed at the point of attachment with the downspout.	Non-combustible material such as aluminum, metal or copper. No wood, plastic or vinyl	Clear of any debris. Gutters, downspouts, and connectors should be viewed as a location of potential combustible material accumulation.
Eaves &soffits ¹⁶	See siding and walls	Closed using blocking between roof rafters, soffit or sheathing.	All vents in the eaves should be covered with 3mm non-combustible screening, or ASTM rated ember resistant vents.
HVAC & active venting systems	All ventilation openings in exterior walls and vents in roofs must be accessible and covered with a non- combustible, corrosion-resistant wire mesh with a maximum mesh opening size of 3 mm.	Should be shut down to prevent the intake of embers into the venting system and the interior of the building.	Attic ventilation openings shall not be located in the soffits or other overhanging areas. If vents have louvres or flaps, ensure that they self- close when the vents are not expelling air.

¹⁶ Maximum allowable wood coverage: no greater than 20% combustible material and non-rated materials (wood, vinyl, and aluminum) can comprise each exterior elevation's surface area. Surface area includes fascia, soffits, trim, windows, and cladding but does not include roofing. Surface area calculations are the responsibility of the designer/builder/developer to conduct, record and make available upon request. Alternatively, up to 30% gross surface area use of combustible material (wood) with ALL wood surfaces to be sealed with a Class A fire-rated, CSA approved retardant finish according to the manufacturer's application and maintenance recommendations. Retardant requires re-application every 4-5 years.



Building Part	Homes	Critical infrastructures	Comments	
Siding and walls	Non-combustible materials approved for a minimum of 1-hour fire resistance rated construction on the exterior side. Examples of acceptable materials: stucco, metal siding (aluminum is acceptable if fire rating tests are reviewed and approved), brick, cement shingles or board (such as Hardi board), concrete block, poured concrete, or concrete composites, rock, and logs or heavy timber ¹⁷ .	Ignition resistant (cement fibre board, log), or non-combustible construction (stucco, metals, concrete, brick/stone)Non-combustible siding should be the minin buildings in locations where the priority zon standards, or slope set-back standards cannot be achieved. Siding should be free or holes with a minimum of 15cm ground-to-si non-combustible clearance. Vinyl is not an acceptable material due to its propensity to melt and fall away at high temperatures, and exposing underlying com- materials.		
Windows and doors	Exterior doors: non-combustible construction, metal clad (aluminum is acceptable if fire rated), solid core wood, or shall have received a 20- minute fire protection rating. Windows: glazed doors, windows within exterior doors and skylights must be double glazed and preferably made of tempered glass. Window frames must be metal or solid wood.	Tempered or double pane at minimum.	Tempered glass should be the minimum for buildings inlocations where the priority zone standards, or slope set-back standards cannot be achieved All exterior doors must meet the requirements of the North American Fenestration Standard (NAFS) and the current BC Building Code.	

¹⁷Heavy timber should be a minimum of 4x4"



Building Part	Homes	Critical infrastructures	Comments	
Balconies,	Heavy timber, ignition resistant	Should be closed in with non-	There should be no combustible debris or material	
Decks and	materials, or other non-	combustible or ignition resistant	under these features and a non-combustible surface	
Open	combustible material. Acceptable	skirting that meets the same	should be maintained under and extending for 1.5m	
Foundations	materials may include, but not be	standards as exterior wall	beyond thefurthest extent of the feature.	
	limited to: concrete, clay tile, rock,	construction, or constructed of	The underfloor of all exposed floors (<i>i.e.</i> , the	
	or Class A fire rated composites.	heavy timber, non-combustible	underside of balconies, decks, open roof, patio,	
		or fire rated materials.	crawlspaces, etc.) and all exposed structural	
			columns, beams, and supporting walls, must be	
			enclosed or sheathed with a 1 – hour fire resistance	
			rated construction material (such as 5/8" type x	
			gypsum board), ignition resistant material, or non-	
			combustible material. This condition eliminates	
			places for embers to blow underneath and get	
			trapped (common interface ignition point). Vinyi	
			and wood are not acceptable.	
Building Set-	All buildings situated mid-slope, or	All buildings situated mid-slope,		
Васк	at the top of a slope should be set-	or at the top of a slope should		
	back at least 10m (30 feet) per	be set-back at least 10m (30	-	
	story from the crest of the slope	feet) per story from the crest of		
		the slope		
Chimneys &	All outdoor burning devices fueled			
outdoor	by materials other than propane or			
burning	natural gas are not compliant.	-	-	
devices				



Building Part	Homes	Critical infrastructures	Comments
Fence line	Wooden fences are allowed under FireSmart criteria to acknowledge the lack of cost-effective material choices. As they can create a direct path between surrounding vegetation and the home, consider separating the house from the fence with a metal gate and maintain lawn or grasses along its alignment as they can become flashy fuels if left to mature and dry.	-	-
Sheds & outbuildings	If these are within 10m of the home footprint, their material construction must meet FireSmart guidelines.	-	-



APPENDIX B - ROOFTOP SPRINKLER SYSTEM

Given that trees will be retained in Priority Zone 1 and because of the location of the house in close proximity to extensive areas of flammable forest, installation of exterior rooftop sprinklers is required. Sprinkler systems must include robust sprinklers with limited plastic materials capable of wetting all of Priority Zone 1. Between April to the end of October, sprinklers must be connected to the house water system.

In the event of a house fire, sprinklers should be turned on (if safe to do so) to wet the adjacent forested vegetation. This will reduce the potential of radiative heat emanating from combustibles burning in the residence from igniting the flammable foliage of retained coniferous trees within Fire Priority Zone 1.

In the event of a wildfire, sprinklers should be turned on a minimum of two hours before the fire reaches the residence. Although the exterior building construction components will be made of Class A fire rated materials, combustible materials within the interior of the home could potentially ignite if radiant heat within Fire Priority Zone 1 under high or extreme temperatures. The use of sprinklers in the event of a wildfire is not only to wet down surfaces such as roofs and adjacent vegetation, but to raise the relative humidity around the residence. This will help reduce fire behaviour adjacent to the home by making fuels less flammable and reduce the probability of spotting igniting adjacent vegetation or structures.



Figure 5. Rooftop sprinklers can be highly effective in reducing fire behaviour.

Considering these factors, installation of a minimum of seven rooftop sprinklers with a coverage radius of 12 m is required. Sprinkler systems must include robust sprinklers (such as Rainbird sprinklers) with limited plastic materials. Two approaches can be used for sprinkler systems, roof mounted sprinklers on portable



mounts or sprinklers incorporated in the roof. Between April to the end of October, sprinklers must be connected to the water supply and tested at the beginning of each fire season. The external sprinkler system must be independent of the internal system to allow for manual use during a wildfire.

In order to complete the sign-off of the Wildfire Hazard Report, the rooftop sprinkler system must be installed to the manufacturer's specifications and demonstrated to be in good working order capable of delivering the volume of water at the required pressure to completely wet down all of Fire Priority Zone 1.

The following is a list of suppliers and manufacturers of exterior rooftop sprinkler systems:

- 1. Just in Case Fire Ltd Flash Fire & Safety (Alberta). Fire Caddy and ZoneONE Coverage rooftop sprinkler systems. Contact information <u>www.firecaddy.com</u>. Each unit contains:
 - a. Roof Caddy
 - b. 4 impulse sprinkler heads
 - c. Fire hose
 - d. Fire Caddy manifold connection

Cost: Contact <u>sales@firecaddy.com</u> 1-844-FLASH-44 (844.352.7444) for pricing

 One Stop Fire <u>www.onestopfire.com/sprinklers.htm</u>. Fascia Mount Sprinkler Assembly. Commercial sprinkler head and mounting bracket for attachment to fascia of a building. Ideal for placement on gable ends of a roof peak. Sprinkler is of brass and stainless steel construction with a performance rating of 18m radius and 17.6gpm at 60 psi. Female garden hose fitting is standard on assembly unit.

Cost: \$300.00 / unit CAD (excludes applicable taxes and shipping / delivery)

 Wildfire Automated Sprinkler Protection (WASP) <u>www.firerescue1.com</u> and <u>www.waspwildfire.com</u>. Gutter Mounted Sprinkler System. Unit contains fascia bracket, standard pole adapter, Nelson Sprinkler head, all connections and ribbed aluminum pole.

Cost: 250.00 CAD / unit (excludes applicable taxes and shipping / delivery)

- 4. Roof Saver Sprinklers <u>http://roofsaversprinklers.com/.</u> Made in the United States. Kit contains:
 - a. 1-Patented Roof Saver Sprinkler Base with Rainbird Brass Impulse Sprinkler
 - b. 1-3/4" X 50' Never kink Hose
 - c. 1-Ridgeline Hose Holder

Cost: \$249.00 USD / unit (excludes applicable taxes and shipping / delivery)

Requirements:

1- Installation of exterior sprinklers must cover thoroughly wet down Fire Priority Zone 1.



- 2- Sprinkler systems must include robust sprinkler components (such as Rainbird) with limited plastic materials. Two approaches can be used for sprinkler systems, roof mounted sprinklers on portable mounts or sprinklers incorporated in the roof.
- 3- Between April to the end of October, sprinklers must be connected to a water supply (a well or cistern) and tested at the beginning of each fire season. The external sprinkler system must be independent of the internal system to allow for manual use during a wildfire.
- 4- In order for sign-off of the Wildfire Hazard Report, the rooftop sprinkler system must be installed to the manufacturer's specifications, and demonstrated to be in good working order prior to sign-off. This must show that the system is capable of delivering the volume water at the required pressure to completely wet down all of Fire Priority Zone 1.



ALTERNATIVE MATERIALS

Alternative material choices: If an alternative material is proposed fire rating tests to an applicable recognized standard such as ISO, CSA, CAN-ULC, ASTM, or CSA must be provided. These tests will confirm that the material has been designed and tested in accordance with an applicable test for surface burning characteristics of building materials, specifically:

- The test must be extended for a 30-minute duration
- Exhibits a flame spread index (FSI) of not more than 25
- Shows no evidence of significant progressive combustion
- Flame front does not progress more than 10.5 ft (3.2 m) beyond the centerline of the burn at any time during the test If the manufacturer has paid for and performed these tests than it can be considered an alternative if all the criteria have been met.'

Galloway Lands Fernie, B.C.

Summary of relevant Community Wildfire Protection Plans and publicly available wildfire data

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COMMONLY USED ACRONYMS

BCWS	British Columbia Wildfire Service
BEC	Biogeoclimatic Ecosystem Classification
CWPP	Community Wildfire Protection Plan
CWRP	Community Wildfire Resiliency Plan
NFPA	National Fire Protection Association
RDEK	Regional District of East Kootenay



1.0 INTRODUCTION

B.A. Blackwell and Associates Ltd. (the Consultant) were retained by Spike Camp L.P. (the Client) to provide a summary of relevant, publicly available wildfire planning documents (Community Wildfire Protection Plans or CWPPs). The CWPPs are comprehensive planning documents with large geographic scopes. The summary will be limited to those aspects of the documents which are specific to the geographic area known as the Galloway Lands and relevant to the subdivision and development residential areas within the wildland urban interface.

This document shall not be considered a stand-alone document, but rather a companion to the reviewed and summarized documents (Section 1.2). Refer to the original documents for any additional, background, or more detailed information that may be required.

1.1 **Qualifications**

Tove Pashkowski RPF (#4740) has over 15 years' experience in forestry and fire and fuels management and planning. She holds Local FireSmart Representative status with Partners in Protection – FireSmart Canada.

1.2 Documents Reviewed

The following documents and data were reviewed for the purpose of this assessment:

- Community Wildfire Protection Plan Regional District of East Kootenay Electoral Area A: Considerations for Wildland Urban Interface Management, completed by B.A. Blackwell and Associates Ltd, dated April 27th, 2012¹
- 2. *City of Fernie Community Wildfire Protection Plan Update*, completed by B.A. Blackwell and Associates Ltd, dated September 2018²
- 3. BC Wildfire Fire Fuel Types, BC Wildfire Service, published April 1, 2020³

1.3 Property Description

What is referred to in this document as 'The Galloway Lands' (or subject area) include all or part of parcels with PID #s 011-359-471, 011-359-447, 011-359-404, and 011-359-323 (Figure 1).⁴

¹ <u>https://www.rdek.bc.ca/web/pdf/wildfire/AreaA_CWPP_2011_FinalDraft_February2.pdf</u>. Accessed February 7, 2022.

²<u>https://www.fernie.ca/assets/City~Hall/Departments/Planning~and~Development~Services/docs/FERNIE_CWPP_UPDATE_S</u> <u>UBMISSION2%20(002).pdf</u>. Accessed February 7, 2022.

³ <u>https://catalogue.data.gov.bc.ca/dataset/e18ef98c-e1bf-43ac-95e4-b473452f32ec</u>. Accessed via iMapBC February 7, 2022.

⁴ <u>https://gallowaylands.com/</u>. Accessed February 7, 2022.







Figure 1. The Galloway Lands, Fernie, B.C. as seen from directly overhead with north at the top of the photo (left) and obliquely as seen from the northeast (right).



2.0 COMMUNITY WILDFIRE PROTECTION PLANS

The Galloway Lands are located within the Interior Cedar Hemlock Zone moist cool variant (ICH mk4), as defined by the Biogeoclimatic Ecosystem Classification (BEC) system of British Columbia⁵. Within this BEC zone, July, August, and September have a component of very high and extreme danger class days and comprise the period of greatest concern for extreme fire behaviour, although the fire season is considered to start in April and extend through October.

Two Community Wildfire Protection Plans cover the subject area: the Regional District of East Kootenay (RDEK) CWPP and the City of Fernie CWPP Update. The Regional District of East Kootenay's CWPP was developed in 2011, and later finalized and signed in spring of 2012. The City of Fernie's CWPP update was completed in 2018. In the last 10 years, the provincial methodologies and standards have changed significantly. The province recommends that CWPPs, and the more current version of strategic wildfire planning, what are called Community Wildfire Resilience Plans (CWRPs), are reviewed and updated every 5 - 7 years. Therefore, it must be noted that the RDEK CWPP is no longer considered a current CWPP and the City of Fernie CWPP is nearing the end of its lifespan by provincial standards.

2.1 Regional District of East Kootenay Electoral Area A

2.1.1 **Fuels**

The summary of fuel typing from the RDEK CWPP characterizing the subject area are found outlined in Table 1.^{6,7}

 Table 1. A summary of fuel types, associated fire behaviour and areas within the Galloway Lands, as described in the RDEK

 Electoral Area A CWPP.

Fuel Type	Area (appx %)	Description	Wildfire Behaviour under High Wildfire Danger Level
M2r	70%	Moderately well-stocked mixed stand of	Surface, torching and crowning,
		conifers and deciduous species	moderate to very high intensity and
		regeneration, crowns nearly to the	spread rate (depending on slope
		ground	and percent conifer)

⁶ Displayed in Map 8, page 31.

⁷ Given the small-scale mapping available in the document, this summary is a rough visual estimate.



C7	13%	Open, uneven-aged forest, crowns separated from ground except in conifer thickets, understory of discontinuous grasses, herbs	Surface, torching, rarely crowning (slopes > 30%), moderate to high intensity and rate of spread
NF	13%	Non-fuel	N/A
С3	<5%	Fully stocked, mature forest, crowns separated from ground	Surface and crown fire, low to very high fire intensity and rate of spread

It should be noted that M2r fuel type is no longer utilized in provincial fuel typing. The most likely current equivalent would be M1/2 or C3, depending upon the coniferous component.

2.1.2 Wildfire Risk Management System (WRMS)

The WRMS is an assessment of fire risk through spatially quantifying the probability and consequence of wildfire, using several components and subcomponents (Figure 2).⁸

The consequence of wildfire for the subject area is classified as approximately 50% low and 50% moderate.⁹ Consequence does not exceed moderate, due to low density of structures at risk.¹⁰ The probability of wildfire of the subject parcel is low.¹¹

The overall fire risk for the subject area is mostly low with small areas of moderate.¹² Higher risk occurs in the subject area where there is a larger component of coniferous fuels and where steep slopes occur.¹³

¹¹ Map 26, 104

¹² Map 14, pages 42 - 43

¹³ Page 42

⁸ Figure 15, page 41

⁹ Map 21, page 99

¹⁰ Page 42



Figure 2. WRMS structure used in the RDEK CWPP to calculate final probability and consequence ratings.

2.1.3 Relevant recommendations

Relevant structure protection recommendations within the RDEK CWPP are based upon the FireSmart Canada¹⁴ and National Fire Protection Agency (NFPA)¹⁵ guidelines of the time. These documents have been updated several times since the publication of the CWPP; the current versions remain the go-to documents for structure protection and wildfire risk reduction for existing homes and new development. Current versions of these documents include:

- **NFPA 1141** Standard for Fire Protection Infrastructure for Land Development in Wildland, Rural, and Suburban Areas
- NFPA 1142 Standard on Water Supplies for Suburban and Rural Firefighting
- NFPA 1144 Standard for Reducing Structure Ignition Hazards for Wildland Fire
- FireSmart Canada Home Development Guide
- FireSmart Canada FireSmart Guide to Landscaping
- FireSmart Canada Protecting Your Community for Wildfire
- FireSmart Canada FireSmart Begins at Home Manual

¹⁴ Firesmartcanada.ca and Firesmartbc.ca

¹⁵ https://www.nfpa.org/



2.2 City of Fernie Community Wildfire Protection Plan Update

2.2.1 Fuels

The City of Fernie CWPP displays two sets of fuel typing data for the subject area:

- Provincial fuel typing, which classifies the entire province into fuel types for the purpose of modeling wildfire behaviour. The source data is primarily from B.C. Vegetation Resource Inventory polygons; the representation accuracy of fuel typing on private land, when available, is variable due to lack of source data.
- Updated provincial fuel typing based upon professional field assessments and orthophotography interpretation.

It must be noted that significant limitations with the fuel typing system exist.¹⁶ To that end, fuel typing should be utilized as a starting point for more detailed assessments and as an indicator of overall wildfire threat, rather as an operational or site level assessment.

Table 2 outlines the 2015 British Columbia Wildfire Service (BCWS) provincial fuel typing for the Galloway Lands found in the City of Fernie CWPP.¹⁷

Table 2. A summary of fuel types, associated fire behaviour and areas within the Galloway Lands. Fuel typing completed at a provincial scale by the BC Wildfire Service and as described in the City of Fernie CWPP update.

Fuel Type	Area (appx %)	Description	Wildfire Behaviour under High Wildfire Danger Level
C5	80%	Well-stocked mature forest, crowns separated from ground. Moderate understory herbs and shrubs. Often accompanied by dead woody fuel accumulations.	Moderate potential for active crown fire in wind-driven conditions. Under drought conditions, fuel consumption and fire intensity can be higher due to dead woody fuels
D1/2	10%	Deciduous stands	Always a surface fire, low to moderate rate of spread and fire intensity
O1a/b	10%	Matted and standing grass communities. Continuous standing grass with sparse or scattered shrubs and down woody debris. Vegetated, non-treed areas dominated by shrubs or herbs in dry ecosystems. Areas of very scattered trees. Hay fields.	Rapidly spreading, high- intensity surface fire when cured

¹⁶ Pages 16 – 17 and Appendix E, p 93.

¹⁷ Figure 4, page 21.



M1/2	<1%	Moderately well-stocked mixed stand of	Surface fire spread, torching of
		conifers and deciduous species, low to	individual trees and intermittent
		moderate dead, down woody fuels.	crowning, (depending on slope and
			percent conifer)

Table 3 outlines the updated fuel typing for the Galloway Lands in the City of Fernie CWPP.¹⁸

Table 3. A summary of fuel types, associated fire behaviour and areas within the Galloway Lands. Updated provincial fuel typing completed at a local scale by the document author, and as described in the City of Fernie CWPP update.

Fuel Type	Area (appx %)	Description	Wildfire Behaviour under High Wildfire Danger Level
C3	70%	Fully stocked, late young forest, crowns separated from the ground	Surface and crown fire, low to very high fire intensity and rate of spread
M1/2 50% conifer	14%	Moderately well-stocked mixed stand of conifers and deciduous species, low to moderate dead, down woody fuels.	Surface fire spread, torching of individual trees and intermittent crowning, (depending on slope and percent conifer)
C4	16%	Dense pole-sapling forest and young plantations, heavy standing dead and down, dead woody fuel accumulations, continuous vertical crown fuel continuity	Almost always crown fire, high to very high fire intensity and rate of spread
O1a/b	<1%	Matted and standing grass communities. Continuous standing grass with sparse or scattered shrubs and down woody debris. Vegetated, non-treed areas dominated by shrubs or herbs in dry ecosystems. Areas of very scattered trees. Hay fields.	Rapidly spreading, high- intensity surface fire when cured

2.2.2 Wildfire Threat

The City of Fernie CWPP does not assess threat on privately owned land, including the subject area, so any threat assessments from this document are limited to generalizations which encompass very large geographic areas and which may not accurately represent any given location within the larger areas. The threat assessment states:

¹⁸ Figure 5, page 22.

'The areas within the study area that represent the highest wildfire behaviour threat to the City are the slopes on the eastern side of the valley, **the area including and surrounding the Fernie Alpine Resort (north and south),** and on either side of Mount Fernie Park Road.'¹⁹

The general areas noted above are identified based upon larger geographic areas that fit the following criteria: 1) the presence of forested land, 2) upwind of the community based upon the predominant fire season wind direction, and / or 3) the presence of hazardous fuel types (C3, C4, M1/2 with a high component of conifer trees). The coarseness of the data does not allow for further comparison or ranking among or between the geographic areas, nor does it allow for interpretations of threat for a smaller subset of the larger area.

2.2.3 Relevant Recommendations

The City of Fernie CWPP update was developed for municipal government, therefore there are no relevant recommendations with regards to development within the Regional District.

3.0 PROVINCIAL FUEL TYPING

The BCWS regularly updates the provincial fuel typing, as described in Section 2.2.1. The most current provincial data available for the subject area is from 2020; a summary of this data for the Galloway Lands is found in Table 4.

Table 4. A summary of fuel types of the Galloway Lands, completed at a provincial scale by the BC Wildfire Service, and as accessed from iMapBC.²⁰

Fuel Type	Area (appx %)
C7	50%
C3	20%
D1/2	15%
M1/2	8%
C5	7%
C4	<1%

¹⁹ Page 25.

²⁰ <u>https://maps.gov.bc.ca/ess/hm/imap4m/</u>. Accessed February 9, 2022.



4.0 LIMITATIONS

This document is an objective summary of previously published, publicly available documents. The forester has endeavored to use their skill, education, and knowledge to provide accurate replication of the information. The document does not provide any adjustments, assumptions, conclusions, interpretations, or recommendations beyond what is published in the documents summarized. The summary provided does not indicate agreement with, or confirmation of, the accuracy of the representation at the time of publication. Furthermore, the summary of the documents should not be interpreted as an indication that the information remains an accurate representation of the current conditions on the subject area.

The Consultant cannot accept responsibility for any issues or events that have arisen since the dates the reports were written. And further to that, it should be expected that the forested ecosystem within and surrounding the subject area has changed, and will continue to change over time, such that the assessments in the two original reports may no longer be appropriate references or accurate representations.



5.0 SIGNATURES

Project Forester

elle UTIS

Reviewing Professional

1. A. R

Ali Rahi, RPF B.A. Blackwell & Associates Ltd. February 15, 2022

Tove Pashkowski, RPF

B.A. Blackwell & Associates Ltd.

February 15, 2022

HAWORTH Development Consulting

Appendix D

Galloway Lands - Comments on Cumulative Effects Assessment

Galloway Lands – Review on Elk River Alliance Post Open House Questions and Comments

Galloway Lands - Review on Frank and Swanson Post Open House Questions and Comments

Galloway Lands – Comments on Review by Clayton Lamb

Galloway Lands – Review of Wildsight Review and Comments

Galloway Lands - review of BC Parks Review and Comments

Cascade Environmental Resource Group

SUMMARY OF FINDINGS / RECOMMENDATIONS

A review of the environmental considerations of the Galloway Lands was undertaken by Cascade Environmental Resource Group. This review focused on response to letters and presentations submitted to the RDEK by local special interest groups.

The general findings of the work completed by Cascade Environmental Resource Group found the following:

- The setbacks proposed from Lizard Creek exceed the requirements of the RDEK Floodplain bylaw and the Riparian Areas Protection Regulation.⁽¹⁾ The riparian corridor proposed for protection along Lizard Creek will ensure the integrity of this area.
- The risk to westslope cutthroat trout is very low due to the large setbacks provided from Lizard Creek and the retention of greenspace along the creek. The setbacks provided on site are, as noted above, in excess of that required by the Riparian Areas Protection Regulation.
- The risk to water quality due to development of the lands is minimal. The Galloway Lands will further reduce this low risk by implementing the requirements of *Develop with Care 2014: Environmental Guidelines for Urban and Rural Land Development in British Columbia.*

continued...

Note (1). The Riparian Areas Protection Regulation is referenced within this document because it was suggested as the minimum standard for the lands by some local special interest groups. However, the Riparian Areas Protection Regulation is not applicable within the Regional District of East Kootenay. This regulation is in effect in only select regions of British Columbia.

HAWORTH Development Consulting

- All land use, whether land development, mining, railways, forestry, or agriculture, has some form
 of cumulative effect on the natural environment. The plan developed for the Galloway Lands has
 been prepared to minimize any cumulative effect impact. The Galloway Lands represent an
 additional 0.01% of built-up area within the Elk Valley. Continued steps will be taken by the
 proponent where possible to minimize all impacts.
- Grizzly bear telemetry data indicate that bears utilize the property. However, the data indicates
 that grizzly bears cross through the property less often that surrounding areas. Movement to the
 Provincial Park occurs mostly from Orca peak, southwest of the Galloway Lands, and the Mount
 Fernie area, north of the Galloway Lands.
- Impact on Mount Fernie Provincial Park is believed to be inconsequential. A buffer of 100m will
 be provided to the nearest residential lot. BC Parks does not have a standard for buffers to
 provincial parks, but the distance provided for the Galloway Lands exceeds the recommendations
 of other jurisdictions.

The proponent believes that development of the lands can occur in accordance with the Elk Valley Official Community Plan and good planning practices while avoiding negative impact on wildlife and surrounding land uses.

TECHNICAL MEMORANDUM

DATE:	March 25, 2022
TO:	Richard Haworth, Haworth Development Consulting
	Handshake Holdings Inc.
FROM:	Cascade Environmental Resource Group Ltd.
FILE:	1082-01-02
RE:	Galloway Land – Comments on Cumulative Effects Assessment

Handshake Holdings Inc. wishes to develop a parcel for residential use in Fernie BC, referred to as the Galloway Lands. Their representative, Richard Haworth, Haworth Development Consulting, retained Cascade Environmental Resource Group Ltd. (Cascade) to review questions regarding environmental concerns of the proposed project. In this Memo Cascade addresses comments regarding the contribution of the Galloway Lands to the Elk Valley cumulative effects assessment. Cascade reviewed the following documents:

- Elk Valley Cumulative Effects Management Framework Working Group (EVCEMFWG). 2018. Elk Valley Cumulative Effects Assessment and Management Report.
- Davidson et al. 2018. Aquatic Ecosystems Cumulative Effects Assessment Report.
- Holmes et al. 2018. Old and Mature Forest Cumulative Effects Assessment Report.
- Mowat et al. 2018. Grizzly Bear Cumulative Effects Assessment Report.

These assessments did not consider the potential effect of the proposed development on the Galloway Lands. The cumulative effects assessments were conducted in 2015 and modeled the expected changes over a period of 50 years.

Contribution to the Elk Valley Cumulative Effects

The Elk Valley Cumulative Effects Assessment and Management Report (EVCEMFWG, 2018) modeled the expected increase in built-up area (residential and recreational) according to various scenarios between 2015 and 2065. The Elk Valley represents an area of approximately 365,000 ha. In 2015, 770 ha of built-up area was present. Under the reference scenario (current levels of economic development) and the maximum scenario, the model predicted the total built-up area would increase to 980 ha and 1170 ha respectively between 2015 and 2065. The Galloway Lands was not considered as part of the cumulative effects assessment conducted in 2015. However, the Galloway Lands is expected to add 35 ha to the built-up area in the Elk Valley (Table 1).

The increase in built-up area within the entire Elk Valley is expected to increase by approximately 0.077% under the reference scenario and 0.129% under the maximum scenario (EVCEMFWG, 2018). Based on the numbers presented in the previous paragraph, the Galloway Lands would represent an additional 0.01% of built-up area to the Elk Valley.

Table 1: Built-up are under reference and maximum scenario with and without the Galloway Lands

	Total built-up area (ha)	
	Reference scenario	Maximum scenario
Without Galloway Lands	980	1170
With Galloway Lands	1015	1205

Cumulative Effects on Wildlife and Wildlife Habitat

Bighorn sheep and grizzly bear were chosen as valued components in EVCEMFWG (2018) and Mowat *et al.* (2018). The Galloway Lands are outside the distribution range of the bighorn sheep therefore no contribution the cumulative effects are expected and will not be discussed further.

The simulation conducted by Mowat *et al.* (2018) determined that development rate may have a relatively small effect on the habitat availability and suitability of grizzly bear. Increased road density and loss of high-quality habitat such as young (<20 years), open-canopy forest were identified by Mowat *et al.* (2018) as the two main cumulative effects to grizzly bear. Analysis of air photos presented in the Galloway Lands Application for Land Use Amendment application, showed that most of the subject property was logged in 1988 and no further logging was observed since then. Therefore, the subject property is unlikely to contain young forest (<20 years).

Cumulative Effects on Aquatic Habitat

Davidson et al. (2018) identified the following impact indicators to aquatic ecosystems:

- Riparian disturbance (percent disturbed riparian area)
- Stream crossings (number per km², excluding bridges)
- Road density within 100 m of any stream (km of road per km²)
- Road density on steep slopes (>60% grade) (km or road per km²)
- Equivalent Clearcut Area (percent)
- Degree of westslope cutthroat trout (WCT)/rainbow trout hybridization (percent pure WCT)
- Average warmest month stream temperature (°C)

As the proposed development on the Galloway Lands is not expected to affect the last three impact indicators, these won't be discussed. Davidson *et al.* (2018) determined that the mining disturbance is likely to contributes the most intense hazard to aquatic habitat. The proposed development on the Galloway Lands is not expected to contribute to the riparian disturbance as the 30m setback on Lizard Creek and 15 m setback along all other creeks will be maintained (Map 1). However, the proposed development has the potential to contribute to an increase in stream crossings, road density within 100 m of streams and road density on steep slopes. Should the following measures be employed, the proposed development on Galloway Lands should avoid any contribution to the cumulative effects on aquatic habitat in the Elk Valley:

- Three stream crossings are currently proposed for the development. The stream crossings are already existing but the condition and current impact to the stream has not yet been assessed. Bridge crossing will be used to avoid any contribution to the cumulative effect on aquatic environment. No crossing of Lizard Creek are presented in the application. Old culverted stream crossing will be removed which has potential for ecological benefits.
- Roads near streams have the potential to increase overland runoff and fine sediment delivery to stream. To avoid increase in sediment transport to the streams, the road and road drainage design should ensure all water run off are directed away from any stream and treated appropriately.
- Roads on steep slopes have the potential to destabilize the slopes. Prior to development, A geotechnical report should be prepared to ensure no impact to the steep slope of the site occurs.

Cumulative Effects on Old and Mature Forest

Holmes *et al.* (2018) determined that the amount of old and mature forest is considerably reduced and is highly fragmented at lower elevations. The model shows a decline in potential for loss of old growth forests from land use development could decrease over the next 50 years as mature forests transition to old growth forest. Holmes *et al.* (2018) determined that natural disturbances are expected to have a larger

effect on potential for loss associated with mature forest than land use development. As the old growth forest present on the Galloway Lands will be protected, the development is not expected to contribute to the cumulative effects on old forests in the Elk Valley. The presence and amount of mature forest has not been assessed yet. Therefore, the contribution of the development to the cumulative effect on mature forest cannot be determined.

Summary

Overall, The Galloway Lands would represent a small area (0.01%) of to the Elk Valley. The Galloway Lands is unlikely to contribute to the cumulative effects on grizzly bear as the subject property is unlikely to contain young forest. Should adequate mitigation measures be followed the proposed development is unlikely to contribute to cumulative effects on aquatic habitat. As the old growth forest on the Galloway Lands will be protected, no contribution to the cumulative effects to old growth forest is expected. The amount of mature forest on the site should be assessed to determine contribution to cumulative effects to mature forest.

References

- Elk Valley Cumulative Effects Management Framework Working Group (EVCEMFWG). 2018. Elk Valley Cumulative Effects Assessment and Management Report.
- Davidson A, Tepper H., Bisset J, Anderson K., Tschaplinski P., Chirico A., Waterhouse A., Franklin W., Burt W., MacDonald R., Chow E., van Rensen C., and Ayele T. 2018. Aquatic Ecosystems Cumulative Effects Assessment Report.
- Holmes P, Sturt-Smith K., Mackillop D., Lewis D, Machmer M., Franklin W., MacDonald R., McGuinness K., Chow E., van Rensen C and Ayele T. 2018. Old and Mature Forest Cumulative Effects Assessment Report. Version 9
- Mowat G, Conroy C, Podrasky K, Morgan D, Davies R., MacDonald R, Chow E., van Rensen C and Ayele T. 2018. Grizzly Bear Cumulative Effects Assessment Report.





TECHNICAL MEMORANDUM

DATE:	March 25, 2022
то:	Richard Haworth, Haworth Development Consulting
	Handshake Holdings Inc.
FROM:	Cascade Environmental Resource Group Ltd.
RE:	Galloway Land – Review on Elk River Alliance Post Open House Questions and Comments

Handshake Holdings Inc. wishes to develop a parcel for residential use in Fernie BC, referred to as the Galloway Lands. Their representative, Richard Haworth, Haworth Development Consulting, retained Cascade Environmental Resource Group Ltd. (Cascade) to review questions regarding environmental concerns of the proposed project. In this Memo Cascade addresses comment from the Elk River Alliance.

Community Held Values of the Galloway Lands

Water quality, fish and fish habitat will be maintained to ensure undisturbed, clean, clear cold, aquatic habitat for spawn fish to develop to supply overwintering trout for Elk River angling.

Cross country skiing and mountain biking are the main recreation activities that take place within the Galloway Lands. The landowner has an informal agreement with the Fernie Nordic Society to permit use of the existing logging trails for Nordic skiing during winter months. The development plan includes the existing Nordic trails. Some will be rerouted to accommodate the proposed development and environmentally sensitive areas.

A network of mountain bike trails has also been established on the property. These trails are not sanctioned and have not been permitted by the property owner. However, the proponent will enter into communication with the local mountain biking association following the rezoning plan the proponent will develop a trails plan with the mountain bike association for the trails that enter the subject property. Some trails may be decommissioned or re-routed to accommodate the proposed development and environmentally sensitive areas.

Environmental Impacts

Risk to Westslope cutthroat trout habitat

To minimize disturbance to environmentally sensitive areas (ESAs) in areas zoned for residential land use the Elk Valley Official Community Plan (OCP) encourages the integration of Conservation Subdivision Design principles including identifying and protecting riparian areas and wetlands. Under Section 10(2)(a) of the OCP:

Development is encouraged to avoid streams, wetlands and riparian areas and to provide appropriate development setbacks and buffer areas.

While the Elk Valley OCP does not include defined setback requirements, the Elk Valley Floodplain Bylaw No. 829 specifies the following setback:

- (i) 30.0 metres (98.4 feet) of the ordinary high water mark of Boivin Creek, Brule Creek, Coal Creek, Elk River, Flathead River, Fording River and Michel Creek; or
- (ii) 7.5 metres (24.6 feet) of the ordinary high water mark of any lake, swamp or pond; or
- (iii) 15.0 metres (49.2 feet) of the ordinary high water mark of any other watercourse,

whichever is farther is designated as a Floodplain Setback area.

Within the subject property Lizard Creek was surveyed from top of bank to top of bank. The proposed development is outside of the 15m floodplain setback area specified in the Elk Valley Floodplain Bylaw. The Galloway Lands development proposes a minimum 30m setback from the residential lots. The building envelope is further setback from Lizard Creek with the conservation area that is covenanted for each lot. The buffers proposed within the Galloway Lands application exceeds the 30m Riparian Assessment Area (RAA) as defined by the Riparian Areas Protection Regulation (RAPR) (Map 1). The risk to westslope cutthroat habitat will be mitigated by maintaining setbacks proposed in the application and applying Best Management Practices for development through sediment and erosion protection mitigation measure and water quality monitoring during construction.

Effects from development on water quality in Lizard Creek (aquifer)

Development of Galloway Lands will follow *Develop with Care 2014: Environmental Guidelines for Urban and Rural Land Development in British Columbia.* Guidelines to protect water quality will include but are limited to the following:

- Monitor water quality before, during and after development to ensure that provincial water quality guidelines (and local water quality objectives if applicable) are being met;
- Maintain healthy wetlands, aquatic ecosystems, and riparian vegetation which can help to protect water quality in the event of a release of sediment or other pollutants;
- Control erosion and sediment generation at the source rather than attempting to treat sedimentladen water;
- Maintain equipment so that it does not leak contaminants on the development site and to ensure that stormwater control facilities perform at the design level. This helps to prevent problems such as clogging of facilities, and washout of sediments and trash from sumps. Ongoing and proper maintenance requires: a maintenance plan and schedule; identification of responsible parties; documentation of maintenance activities; and periodic review of maintenance activities.
- Protect groundwater systems from contamination by providing and using impervious sumps for concrete wash water and other potential construction contaminants

Disturbance to wildlife corridor and wildlife populations

Using the data analysed, Dr. Lamb determined that Galloway Lands are commonly used as a movement corridor for grizzly bear. However, Proctor *et al* (2015) used telemetry and an RSF model to identify movement corridors. The study only identified the southeast corner of the Galloway Lands as moderate movement potential while most of the site has low movement corridor potential. Proctor *et al* (2015) studied movement corridors on a larger scale throughout southeastern British Columbia and identified linkages between high quality core habitat while Lamb (2022) assessed movement on a smaller scale by focusing on the Fernie area with a landscape buffer. Analysis on a smaller scale, highlights a few bears moving through an area but this does not necessarily make it a movement corridor.

The Loss of movement through the Galloway Lands will be minimized by the conservation subdivision design. The impact to wildlife population has not been assessed yet.

Loss of effective conservation lands with edge effect to Fernie Provincial Park Boundary

The Galloway Lands will follow a conservation subdivision design and no development will occur within 120 m from the Fernie Provincial Park Boundary. Therefore, the development on the Galloway Lands is not expected to create an edge effect.

Provide full assessment of impact on fish and wildlife habitat

Assessment of fish and wildlife habitat will be conducted based on the requirements of the Regional District of East Kootenay through their Development Permit process and the Ministry of Transportation and Infrastructure through the subdivision approval process.

References

- Lamb C. 2022. Assessing wildlife use of the Galloway Lands and the effectiveness of a conservation subdivision design for large mammals. Prepared for Fernie Snow Valley Community Association, Wildsight and the Elk River Alliance.
- Ministry of Environment, 2014. Develop with Care 2014: Environmental Guidelines for Urban and Rural Land Development in British Columbia
- Ministry of Forest, Land, Natural Resource Operations and Rural Development, Fish and Aquatic Habitat Branch, 2019. Riparian Areas Protection Regulation Technical Assessment Manual, V1.1.
- Proctor M, Nielsen S, Kasworm W, Servheen C, Radandt T, Machutchon G and Boyce M. 2015. Grizzly bear connectivity mapping in the Canada-United States Trans-Border Region. The journal of Wildlife Management 79(4):544-558.

Regional District of East Kootenay, 1990. Elk Valley Zoning Bylaw No. 829, 1990 Consolidation.

Regional District of east Kootenay, 2014. Elk Valley Official Community Plan Bylaw No. 2532.







TECHNICAL MEMORANDUM

DATE:	March 25, 2022
TO:	Richard Haworth, Haworth Development Consulting
	Handshake Holdings Inc.
FROM:	Cascade Environmental Resource Group Ltd.
RE:	Galloway Land – Review of Frank and Swanson Questions and Comments

Handshake Holdings Inc. wishes to develop a parcel for residential use in Fernie BC, referred to as the Galloway Lands. Their representative, Richard Haworth, Haworth Development Consulting, retained Cascade Environmental Resource Group Ltd. (Cascade) to review questions regarding environmental concerns of the proposed project. In this Memo Cascade addresses comments from Leslie Frank and Stella Swanson.

What is the contribution of the Galloway lands to the Wildlife Cumulative Effects?

Cascade reviewed the Grizzly Bear Cumulative Effects Assessment Report by Mowat *et al.* 2018 and the Elk Valley Cumulative Effects Assessment and Management Report by the Elk Valley Cumulative Effects Management Framework Working Group (EVCEMFWG), 2018 to address the contribution of the Galloway Lands to the Elk Valley wildlife and wildlife habitat.

Bighorn sheep and grizzly bear were identified as valued components in both reports. However, the Galloway Lands are outside the distribution range of the bighorn sheep therefore no contribution the cumulative effects are expected.

Mowat *et al.* (2018) determined that development rate may have a relatively small effect on grizzly bear habitat availability and suitability through increased road density and loss of high-quality habitat such as young (<20 years), open-canopy forest. However, analysis of air photos presented in the Galloway Lands Application for Land Use Amendment application showed that the majority of the subject property was logged in 1988 and no further logging was observed since then. Therefore, the subject property is unlikely to contain young forest.

Concerns with leaving Lizard Creek as the primary wildlife corridor to Upland Fernie Provincial Park

Grizzly bear telemetry data presented in Lamb (2022) shows that some grizzly bears use the Galloway Lands to gain access to the Provincial Park. Movement to the Provincial Park occurs mostly from the Orca Peak southwest of the Galloway Lands and the Mount Fernie area north of the Galloway Lands (Figure 1). However, based on the telemetry data grizzly bears cross through the Galloway Lands less often than surrounding areas. Figure 2 shows that grizzly bears spent less time in the Provincial Park habitat than other habitat surrounding Fernie.

CASCADE ENVIRONMENTAL RESOURCE GROUP LTD



Figure 1: Grizzly bear movement paths collected between 2016-2021 from Lamb (2022). The Galloway Lands is shown in red.



Figure 2: Grizzly bear telemetry relocations collected between 2016-2021 from Lamb (2022). The Galloway Lands is shown in red.
What are the effects of decreased wildlife corridors on wildlife movements?

A minimum width is required for a wildlife corridor to be effective. The minimum corridor width will vary based on the wildlife species of interest. If the width of the corridor decreases below the minimum requirement for a certain wildlife species, a reduction in that species' ability to move across the corridor can be expected. Ford *et al.* (2020) showed that the zone of influence from residential areas on grizzly bear can range from 4000 to 8000 m with 6000 m being the median size. The report suggests that grizzly bears would be negatively impacted by residential developments in a corridor with a width of less then 6000 m. However, this does not signify that the animals would be absent from the corridor. Currently the forest between the Fernie Alpine Resort and the closest development on the northeast side of Lizard Creek is approximately 720m wide. This would indicate that grizzly bears currently using the Galloway Lands to move across the landscape are already influenced by residential development in the area. This is supported by the telemetry data which shows low levels of use by grizzly bears. In addition, Ford *et al.* (2020) also showed that trails can have a zone of influence on grizzly bears ranging from 21 to 8000 m with a median of 628 m. Therefore, the existing trails in the Galloway Lands further reduce the effective corridor width. The proposed development has the potential to increase the zone of influence for grizzly bear and other wildlife and may reduce the wildlife movement in the vicinity of the development.

Personal observations of wildlife movements in adjacent property and concerns of pressures from other subdivisions in the area.

Proctor *et al* (2015) used grizzly bear telemetry and an RSF model to identify movement corridors. The study only identified the southeast corner of the Galloway Lands as moderate movement potential while the majority of the site has low movement corridor potential. The main movement corridor was identified south of Cokato. See first question for additional comments regarding the use of the Galloway Lands as movement corridor.

Concerns of increased recreational pressures on environmental values

Cross country skiing and mountain biking are the main recreation activities that take place within the Galloway Lands. Both activities are intended to be incorporated into the development design. The existing Nordic skiing north loop (The Grunt and The Runt trails) will be retained and a small section partially relocated to accommodate the proposed development and environmentally sensitive areas.

The Galloway Lands development will result in the closure of some mountain biking trails. The mountain bike trails are unsanctioned trail network on private land. As the mountain bike trails were not planned or sanctioned, they are relatively high-density network throughout most of the property area. Existing trails will be rerouted wherever possible, and the development is committed to retaining a meaningful mountain bike network. Therefore, recreation pressure on these trails is not expected to significantly increase due to this trail retention design and the presence of an existing trail network and trail connectivity through the property.

Trails will not be rerouted within the Lizard Creek riparian area preserving wildlife habitat in this sensitive riparian area. The development also offers the opportunity to construct the rerouted mountain bike trails with the Fernie Trail alliance to provincial trail standards to help mitigate recreation use impacts on surrounding habitat. As existing trails were constructed without approval, they likely do not meet provincial trail standards and the development offers an opportunity to upgrade the trail quality to mitigate against wildlife impacts through sustainable trail planning. Trails can be rerouted with environmentally sensitive trail routing design by creating suitable crossing over watercourses minimizing trails in riparian areas and creating effective sightlines on the trail to prevent trail users startling wildlife.

What does "top of bank to top of bank" protection of Lizard Creek mean?

Top of Bank is defined in the Riparian Areas Protection Regulation (RAPR) as:

 a) the point closest to the boundary of the active floodplain of a stream where a break in the slope of the land occurs such that the grade beyond the break is flatter than 3:1 at any point for a minimum distance of 15 metres measured perpendicularly from the break, and

b) for a floodplain area not contained in a ravine, the edge of the active floodplain of a stream where the slope of the land beyond the edge is flatter than 3:1 at any point for a minimum distance of 15 metres measured perpendicularly from the edge.

Although the Regional District of East Kootenay (RDEK) has not adopted the RAPR the proponent has pledged to protect Lizard Creek from development disturbance within the property boundary. This includes from top of bank on river left to top bank on river right and all areas in between as described in the RAPR.

Concerns on designation of riparian buffer from Lizard Creek

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Under the Riparian Areas Protection Regulation (RAPR), the Riparian Assessment Area (RAA) is 30m on either side of a stream if the bank slopes are less than 3:1.

The Elk Valley Official Community Plan (OCP) encourages developers to avoid streams, wetlands and riparian areas and to provide appropriate development setbacks and buffer areas. The OCP also encourages the integration of Conservation Subdivision Design principles to minimize disturbances to environmentally sensitive areas (ESAs) for residential land use. This includes the identification of riparian areas and steep slopes. The RDEK Elk Valley Zoning bylaw requires a floodplain setback area designation of 15m of the ordinary highwater mark for most watercourses in the Elk Valley including Lizard Creek and the smaller creeks within the Galloway Lands. The proposed development is outside of the 15m floodplain setback for Lizard Creek as defined by the RDEK and the RAA as defined by the RAPR (Map 1).

Under the RAPR a QEP assessment report is not required for development outside of the RAA as defined by the RAPR.

References

- Lamb C. 2022. Assessing wildlife use of the Galloway Lands and the effectiveness of a conservation subdivision design for large mammals. Prepared for Fernie Snow Valley Community Association, Wildsight and the Elk River Alliance.
- Ministry of Forest, Land, Natural Resource Operations and Rural Development, Fish and Aquatic Habitat Branch, 2019. Riparian Areas Protection Regulation Technical Assessment Manual, V1.1.
- Proctor M, Nielsen S, Kasworm W., Servheen C., Radandt T., Machutchon A. and Boyce M. .2015. Grizzly bear connectivity mapping in the Canada-United States trans-border region. Journal of Wildlife Management 79(4):544-588.

Regional District of East Kootenay, 1990. Elk Valley Zoning Bylaw No. 829, 1990 Consolidation.

Regional District of east Kootenay, 2014. Elk Valley Official Community Plan Bylaw No. 2532.







TECHNICAL MEMORANDUM

DATE:	March 25, 2022
TO:	Richard Haworth, Haworth Development Consulting
	Handshake Holdings Inc.
FROM:	Cascade Environmental Resource Group Ltd.
RE:	Galloway Land – Comments on Review by Clayton Lamb

Handshake Holdings Inc. wishes to develop a parcel for residential use in Elk Valley near Fernie BC, referred to as the Galloway Lands. Their representative, Richard Haworth, Haworth Development Consulting, retained Cascade Environmental Resource Group Ltd. (Cascade) to provide comments on the review of the proposed project carried out by Clayton Lamb.

Using the best available data, Dr. Lamb summarised the current habitat and connectivity value of these lands for grizzly bears across all seasons, and ungulates such as moose in the winter. Dr. Lamb briefly discussed impacts to aquatic systems. Then finally conducted a literature review to assess if conservation subdivisions and associated design principles were well-suited to safeguard these wildlife values.

Grizzly Bear

The telemetry data show low to medium habitat use of the Galloway Lands compared to the surrounding area. The data show few bear moving through the site while the majority of the movement occurs south east of the Town of Fernie. Using the biophysical attributes of the site and the telemetry data, Dr. Lamb created a Resource Selection Function (RSF Model) to assess habitat quality. The model shows an isolated high quality habitat patch in May-July surrounded by low quality habitat. Medium quality between August and November and low denning quality habitat.

Using the data analysed, Dr. Lamb determined that Galloway Lands are commonly used as a movement corridor for grizzly bear. However, Proctor *et al* (2015) used telemetry and an RSF model to identify movement corridors. The study only identified the southeast corner of the Galloway Lands as moderate movement potential while most of the site has low movement corridor potential. Proctor *et al* (2015) studied movement corridors on a larger scale throughout southeastern British Columbia and identified linkages between high quality core habitat while Lamb (2022) assessed movement on a smaller scale by focusing on the Fernie area with a landscape buffer. Analysis on a smaller scale, highlights a few bears moving through an area but this does not necessarily make it a movement corridor.

Ungulate Winter Range

Dr. Lamb states that the Galloway Lands comprise important moose winter range. The Ungulate Winter Range (UWR) layer on iMap BC confirms the presences of said winter range (BC Gov, 2022). However, the RDEK Elk Valley Official Community Plan (OCP) does not identify the Galloway Lands as Class 1 or Class 2 UWR. In addition, UWR are not protected on private land. Therefore, the presence of a UWR on the Galloway Lands should not be a constraint to the proposed development.



Lizard Creek

Dr. Lamb raises the concern about development impact to Westslope Cutthroat present in Lizard Creek. Maintaining an adequate undisturbed vegetated buffer should avoid any impact to Lizard Creek. Environmental considerations listed in the Elk Valley OCP encourage developers to avoid streams, wetlands and riparian areas and to provide appropriate development setbacks and buffer areas. The OCP also encourages the integration of Conservation Subdivision Design principles to minimize disturbances to environmentally sensitive areas (ESAs) for residential land use. This includes the identification of riparian areas and steep slopes. The RDEK Elk Valley Zoning bylaw requires a floodplain setback area designation of 15m of the ordinary highwater mark for most watercourses in the Elk Valley including Lizard Creek and the smaller creeks within the Galloway Lands.

Although not applicable to the RDEK, under the Riparian Areas Protection Regulation (RAPR), the Riparian Assessment Area (RAA) is 30m on either side of a stream if the bank slopes are less than 3:1.

The buffers proposed within the plan submitted for the Galloway Lands and the proposed zoning as park exceed the floodplain setback on the RDEK Elk Valley Zoning bylaw for Lizard Creek. It also exceeds the RAA as defined by the RAPR. In addition, employing adequate erosion and sediment control measures and runoff management during development and occupation of the Galloway Lands should prevent any impact to the Creek and the cutthroat population.

In addition, employing adequate erosion and sediment control measures and runoff management during development and occupation of the Galloway Lands should prevent any impact to the Creek and the cutthroat population.

Conservation Subdivision

Dr Lamb conducted a literature review on conservation subdivisions and their effectiveness on large mammals. He determined that the conservation subdivision protect more land than traditional subdivisions but this doesn't translate to meaningful benefits to wildlife. The conservation subdivision design is the requirement of the Elk Valley OCP.

References

- Proctor M, Nielsen S, Kasworm W, Servheen C, Radandt T, Machutchon G and Boyce M. 2015. Grizzly bear connectivity mapping in the Canada-United States Trans-Border Region. The journal of Wildlife Management 79(4):544-558.
- BC Government. 2022. iMap BC. <u>https://maps.gov.bc.ca/ess/hm/imap4m/</u> website accessed on March 2, 2022.

TECHNICAL MEMORANDUM

DATE:	March 25, 2022
то:	Richard Haworth, Haworth Development Consulting
	Handshake Holdings Inc.
FROM:	Cascade Environmental Resource Group Ltd.
RE:	Galloway Land – Review of Wildsight Review and Comments

Handshake Holdings Inc. wishes to develop a parcel for residential use in Fernie BC, referred to as the Galloway Lands. Their representative, Richard Haworth, Haworth Development Consulting, retained Cascade Environmental Resource Group Ltd. (Cascade) to review questions regarding environmental concerns of the proposed project (Map 1). In this Memo Cascade addresses comments raised by Wildsight on their review of the development application.

Negative impact to a documented wildlife connectivity zone

Wildsight states that this area is important to carnivore connectivity in the Canadian Rockies and is a multi-species movement zone for animals such as grizzly bears and wolverines. Proctor *et al* (2015) used grizzly bear telemetry and an RSF model to identify movement corridors. The study only identified the southeast corner of the Galloway Lands as moderate movement potential while the majority of the site has low movement corridor potential. The main movement corridor was identified south of Cokato. Grizzly bear telemetry data presented in Lamb (2022) shows that some grizzly bears use the Galloway Lands. However, based on the telemetry data grizzly bears cross through the Galloway Lands less often than surrounding areas (Figure 1).



Figure 1: Grizzly bear movement paths collected between 2016-2021 from Lamb (2022). The Galloway Lands is shown in red.

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Wolverine as a species do not have easily defined habitat features as they require a range of habitat variables across large home ranges. The provincial data layers were consulted in order to determine the potential occurrence of wolverine on the Galloway Lands. The closest records available were located at least 40 km from the Galloway Lands in Fort Steel and near Akamina Ridge (Map 2). Presence of wolverine on the Galloway Lands has not been confirmed.

Wildsight also states that severing movement option could lead to increase wildlife human conflict. As grizzly bears occasionally move across the Galloway Lands, it is possible that the development would result in human-wildlife conflict with the bear that do use the area. In order to minimize any potential increase in human-wildlife conflict, the residents of the Galloway Lands should follow a bear smart approach such as:

- Bear attractants should be removed. This includes bird feeders, fruit trees and berry bushes, gardens, compost, dirty barbecues, or pet food (Get Bear Smart Society, 2022).
- Wildlife access of attractants should be prevented. Garbage should be kept indoor or used bearproof containers (Get Bear Smart Society, 2022).
- Given the impact of off-leash dogs on wildlife, it is recommended that dogs should be kept on leash at all times when outside the building envelopes.

In addition, a Wildlife Management Plan should be prepared prior to commencement of the construction phase. This plan should include a wildlife human interaction prevention plan that will address workers' behavior around wildlife. Workers should be taught adequate behavior around wildlife to prevent wildlife harassment or attraction, including management of pets.

Impact to Lizard Creek and westslope cutthroat trout spawning habitat.

The Galloway Lands application proposes septic systems for each lot. Wildsight expressed concern for the proximity of the septic systems to Lizard Creek and other tributaries on the property and the potential impact to Westslope cutthroat trout spawning habitat and water quality. In BC septic systems are regulated under the *Public Health Act Sewarage System Regulation* which describes health hazards and regulated activities.

The regulation states that:

- 2.1(1) The following are prescribed as health hazards:
 - (a) the discharge of domestic sewage or effluent into
 - (i) a source of drinking water, as defined by the Drinking Water Protection Act,
 - (ii) surface water, or
 - (iii) tidal waters;
 - (b) the discharge of domestic sewage or effluent onto land;

(2) The construction and maintenance of a holding tank or sewerage system described in section 2 are prescribed as regulated activities.

3 (1) The owner of every parcel on which a structure is constructed or located must ensure that all domestic sewage originating from the structure

- (a) is discharged into
 - (i) a public sewer,

(ii) a holding tank that is constructed and maintained in accordance with Part 2 [Holding Tanks], or



(iii) a sewerage system that is constructed and maintained in accordance with Part 3 [Sewerage Systems], and

(b) does not cause a health hazard.

The installation of the septic systems for the Galloway Lands is regulated under the Sewerage System Regulation. The proponent will comply the regulation to ensure that the constructed systems do not cause a health hazard. There are no anticipated impacts from permitted and professionally installed septic systems.

Degradation of high value moose habitat

The provincial data layers were consulted in order to determine the potential occurrence of moose on the Galloway Lands. Moose occurrences were recorded around the Galloway Lands, but no occurrence was recorded on the site (Map 3). As no vegetation data is available for the Galloway Lands, it is not possible to determine the quality of the potential moose habitat.

Conservation Area and wildlife corridor

Ford *et al.* (2020) showed that the zone of influence from residential areas on grizzly bear can range from 4000 to 8000 m with 6000 m being the median size. The report suggests that grizzly bear would be negatively impact by residential developments a corridor with a width of less then 6000 m. However, this does not signify that the animals would be absent from the corridor. Currently the forest between the Fernie Alpine Resort and the closest development on the northeast side of Lizard Creek is approximately 720m wide. This would indicate that grizzly bears currently using the Galloway Lands to move across the landscape are already influenced by residential development in the area. This is supported by the telemetry data which shows low levels of use by grizzly bears. In addition, Ford *et al.* (2020) also showed that trails can have a zone of influence on grizzly bears ranging from 21 to 8000 m with a median of 628 m. Therefore, the existing trails in the Galloway Lands further reduce the effective corridor width. The movement through the Galloway is therefore already affected by the adjacent developments and the presence of trails. The conservation subdivision design will leave between 97 and 270 m of undisturbed forest along the northeast border of the property and additional undisturbed forest throughout the subject site. Therefore, the proposed development has the potential to increase the zone of influence for grizzly bears and other wildlife and may reduce the wildlife movement in the vicinity of the development.

Reference

3

- Ford a., Sunter E., Fauvelle C., Bradshaw J., Ford B., Hutchen J., Philipow N., and Teichman K. 2020. Effective corridor width: Linking the spatial ecology of wildlife with land use policy. European Journal of Wildlife Research 66:69.
- Get Bear Smart Society. 2022. Bear Smart at Home. <u>https://www.bearsmart.com/live/overview/</u> Website accessed on March 23, 2022.

Government of BC, 2005. Public Health Act Sewerage Systems Regulation B.C. Reg. 326/2004.

- Lamb C. 2022. Assessing wildlife use of the Galloway Lands and the effectiveness of a conservation subdivision design for large mammals. Prepared for Fernie Snow Valley Community Association, Wildsight and the Elk River Alliance.
- Polfus J. and Krausman P. 2012. Impacts of residential development on ungulates in the Rocky Mountain West. Wildife Society Bulletin 36(4):647-657
- Proctor M, Nielsen S, Kasworm W, Servheen C, Radandt T, Machutchon G and Boyce M. 2015. Grizzly bear connectivity mapping in the Canada-United States Trans-Border Region. The journal of Wildlife Management 79(4):544-558.













TECHNICAL MEMORANDUM

DATE:	March 25, 2022
то:	Richard Haworth, Haworth Development Consulting
	Handshake Holdings Inc.
FROM:	Cascade Environmental Resource Group Ltd.
RE:	Galloway Land – Review of BC Parks Review and Comments

Handshake Holdings Inc. wishes to develop a parcel for residential use in Fernie BC, referred to as the Galloway Lands. Their representative, Richard Haworth, Haworth Development Consulting, retained Cascade Environmental Resource Group Ltd. (Cascade) to review questions regarding environmental concerns of the proposed project. In this Memo Cascade addresses comments raised by BC Parks on their review of the development application.

Impacts to movement corridors and access to Lizard Creek for grizzly bear and ungulates.

Ford *et al.* (2020) showed that the zone of influence from residential areas on grizzly bear can range from 4000 to 8000 m with 6000 m being the median size. The report suggests that grizzly bears would be negatively impacted by residential developments in a corridor with a width of less then 6000 m. However, this does not signify that the animals would be absent from the corridor. Currently the forest between the Fernie Alpine Resort and the closest development on the northeast side of Lizard Creek is approximately 720 m wide. This would indicate that grizzly bears currently using the Galloway Lands to move across the landscape are already influenced by residential development in the area. This is supported by the telemetry data which shows low levels of use by grizzly bears. In addition, Ford *et al.* (2020) also showed that trails can have a zone of influence on grizzly bears ranging from 21 to 8000 m with a median of 628 m. Therefore, the existing trails in the Galloway Lands further reduce the effective corridor width.

The response of ungulates to residential development is highly variable (Polfus and Krausman, 2012). Avoidance response can occur from ungulate because of the residential development (Polfus and Krausman, 2012). However, ungulates can habituate to human activity development (Polfus and Krausman, 2012) which could result in a positive effect. Some species can have a higher survival rate in close proximity to residential development due to a decrease in predation or increase availability of fertilized yards (Polfus and Krausman, 2012).

Overall, the Galloway Lands is not an identified wildlife corridor (Proctor *et al.*, 2015). However, telemetry data (Lamb, 2022) show that grizzly occasionally use the Galloway Lands to move across the landscape. The proposed development has the potential to increase the zone of influence for grizzly bear and may reduce the movement of grizzly bear in the vicinity of the development.

Rerouting of existing trails will further impact wildlife habitat and increase recreation pressure.

The Galloway Lands development will result in the closure of some mountain biking trails. The mountain bike trails are an unsanctioned trail network on private land. As the mountain bike trails were not planned or sanctioned, they are relatively high-density network throughout most of the property area. Existing trails will be rerouted wherever possible, and the development is committed to retaining a meaningful mountain bike network. Therefore, recreation pressure on these trails is not expected to significantly increase due to this trail retention design. Trails will not be rerouted within the Lizard Creek riparian area preserving wildlife habitat in this sensitive riparian area. The development also offers the opportunity to construct the rerouted mountain bike trails with the Fernie Trail Alliance to provincial trail standards to help mitigate recreation use impacts on surrounding habitat. As existing trails were constructed without

approval, they likely do not meet provincial trail standards and the development offers an opportunity to upgrade the trail quality.

CASCADE ENVIRONMENTAL

Concerns over the proximity of the building envelopes to the Mt. Fernie Provincial Park and enforcement of covenants

Approximately half of the north boundary of the Galloway lands abuts Mt. Fernie Provincial Park. Mt. Fernie Provincial Park is a part of BC's protected areas and is managed provincially by BC Parks under the *Park Act*. Land use management for Mt. Fernie Provincial Park was researched and currently the park does not have a developed management plan but does have a purpose statement and zoning plan. The primary listed role of the park is to protect remnant old growth cottonwood and riparian ecosystems within the park boundaries (BC Parks, 2003). The secondary listed role is to provide recreation and camping opportunities (BC Parks, 2003).

The Galloway Lands have considered the adjacent boundary of Mt Fernie Provincial Park in its development design and provided a secondary conservation area from the boundary of the park to proposed building envelopes. Secondary conservation areas will not be developed and provide a naturally forested buffer to the park boundary from proposed building envelopes. Current designs have an approximate 100 m secondary conservation natural forested buffer to park boundaries from building envelopes.

Potential impacts of developing the site in relation to the park boundary include an ecological edge effect from anthropogenic development negatively influencing ecological conditions within the protected area. Potential impacts from edge effect can include increased risk of parasitism or disease, increased risk of predation, adverse microclimate conditions, and competition from invasive species (US DAA, 2008). Studies on wolverine density in national parks in Canada also found a density decrease towards park boundaries due to edge effect (Barrueto, Sawaya and Clevenger, 2020). However, the anthropogenic disturbance was from trapping activities at park boundaries and not development. As edge effects are difficult to quantify the study does not recommend buffer distances and only details that buffer should be applied to park boundaries (Barrueto, Sawaya and Clevenger, 2020). The Galloway Lands is designating 100 m buffers to park boundaries in its design and meets recommendations of the paper.

Buffer distances from park boundaries are not listed within BC Parks management direction. The provincial environmental guidelines for Urban and Rural Land Development in British Columbia Develop with Care Section 4 lists target development buffers distances for environmentally valuable resources (BC MOE, 2014). Parks and protected areas are designated a 100m target buffer distance if in an undeveloped state within the guidelines (BC MOE, 2014). As per current Galloway Lands designs the secondary conservation area and 100 m buffer distance to the Mt. Fernie Park Boundary meets these target buffer distances.

The document *Conservation Buffers; Design Guidelines for Buffers, Corridors, and Greenways* by the US Department Agency of Agroforestry also lists edge effect distances from a collection of scientific sources on ecological edge effects (US DAA, 2008). The document provides an estimate of edge effect zone impacts as below.

Edge Effect Impact	Distance of Edge Effect Observed			
Edge Enect impact	Min. zone distance edge effect observed	Max zone distance edge effect observed		
Microclimate	0-11 m	0-235 m		
Bird Response	0-45 m	0-305 m		
Mammal Response	0-40 m	0-91 m		
Invasive Plants	0-6 m	0-137 m		

Table 1: Open Corridor Edge Effect Impacts in Woodland Habitat

The Galloways Lands secondary conservation area and 100 m buffer is beyond the minimum distances edge effect zones observed for all impact factors and beyond the max effect for mammal response.

The Galloway Lands will protect primary and secondary conservation areas through local government planning tools including zoning areas as parkland and restrictive covenants within private lots. The provincial document development with care also recommends protecting environmentally valuable resources through park land zoning and covenants local government land use tools (BC MOE, 2014). As per other land use planning tools including the *Riparian Areas Protection Regulation* covenant enforcement is conducted by local government and importance of the covenant area will be highlighted to residents through education, communication, and bylaw enforcement.

Reference

- BC Ministry of Environment 2014. Develop with Care 2014 Environmental Guidelines for Urban and Rural Land Development in British Columbia. <u>https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/best-management-practices/develop-with-care/dwc-section-4.pdf</u>
- BC Parks, 2003. Mount Fernie Provincial Park-Purpose Statement and Zoning Plan. https://bcparks.ca/planning/mgmtplns/mtfernie/mtfernie_ps.pdf?v=1647989374683
- Ford A., Sunter E., Fauvelle C., Bradshaw J., Ford B., Hutchen J., Philipow N., and Teichman K. 2020. Effective corridor width: Linking the spatial ecology of wildlife with land use policy. European Journal of Wildlife Research 66:69.
- Lamb C. 2022. Assessing wildlife use of the Galloway Lands and the effectiveness of a conservation subdivision design for large mammals. Prepared for Fernie Snow Valley Community Association, Wildsight and the Elk River Alliance.
- Polfus J. and Krausman P. 2012. Impacts of residential development on ungulates in the Rocky Mountain West. Wildife Society Bulletin 36(4):647-657
- Proctor M, Nielsen S, Kasworm W, Servheen C, Radandt T, Machutchon G and Boyce M. 2015. Grizzly bear connectivity mapping in the Canada-United States Trans-Border Region. The journal of Wildlife Management 79(4):544-558.
- US Department Agency of Agroforestry, 2008. Conservation Buffers; Design Guidelines for Buffers, Corridors, and Greenways. <u>https://www.fs.usda.gov/nac/buffers/docs/conservation_buffers.pdf</u>
- M. Barrueto, M.A. Sawaya, and A.P. Clevenger. 2020. Low wolverine (Gulo gulo) density in a national park complex of the Canadian Rocky Mountains. NRC Research Press. Can. J. Zool. 98: 287– 298.

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HAWORTH Development Consulting

Appendix E

Conservation Design: Linking Planning, Landscape and Ecology

Environmental Planning Group Ltd.



Conservation Design: linking planning, landscape and ecology

Galloway Lands case study - Fernie, British Columbia

Prepared by: Douglas Leighton RPP, MCIP, MRAIC - Environmental Design Group (EDG)

Report prepared for Handshake Holdings Ltd, Fernie BC

18 March 2022

Purpose

This paper provides a case study of applying Conservation Design principles to the 'Galloway Lands' - a large site within the Regional District of East Kootenay.

The purpose is to:

- Provide the policy context for the Official Community Plan's emphasis on 'conservation subdivision design' and application to the Galloway Lands
- Summarize the principles and practice of Conservation Design (CD)
- Confirm the extent to which CD is considered as planning best practice
- Summarize the research interface between CD, landscape, and ecology
- Highlight why CD was likely included in Elk Valley Official Community Plan
- Describe how this approach was applied to the Galloway Lands site
- Outlining potential outcomes of this approach

Background and Scope

The Galloway Lands ('the Site') is located within the Regional District of East Kootenay ('RDEK'). The property is approximately 185 hectares (457 acres) in area. A 74 lot conservation community is proposed. The site is currently the subject of an application for Land-Use Amendment.

Although the Elk Valley Official Community Plan encourages "conservation subdivision", some have questioned this planning approach and its applicability to the Galloway Lands site.

This paper includes a summary of the REDEK policy context, 'refresher' on Conservation Design, overview of current literature and research, recap of the planning process and how the site will be managed in future.



Conservation Design – high percentage of protected areas & common space

Policy Context

All land use planning in British Columbia is guided by a hierarchy of policy plans. The Elk Valley Official Community Plan (OCP) is the region's long-term strategic planning document. It represents the collective vision of the Regional District of East Kootenay.

Some of the overall Goals of the OCP are maintaining 'rural character' and 'enhanced utilization' by 'supporting rural subdivision that does not interfere with the future development and expansion of municipalities'. Other Goals in the OCP mention 'recreational activity' and 'connectivity' as well as 'preserving unique ecosystem features such as riparian areas, dry grasslands and sensitive habitat'.

The Elk Valley OCP therefore focuses on accommodating growth while maintaining rural character, recreational activities, connectivity and conservation. A difficult balancing act - how is this to be achieved?

The OCP is very clear. It goes on to support and recommend Conservation Subdivision Design as its preferred planning approach. It further suggests that rural residential development applications integrate *'…the Conservation Subdivision Design provisions outlined in subsection 4.3(1) d."*

This section of the OCP directly refers to the books 'Conservation Design for Subdivisions: A Practical Guide for Creating Open Space Networks (author Randell Arendt) 1996 and The Conservation Subdivision Design Handbook SW Illinois Resource Conservation and Development Inc. 2006.'

Conservation Subdivision Design is repeatedly mentioned and supported throughout the Official Community Plan. Conservation Subdivision Design, increasingly known as Conservation Design (CD), is a planning tool used to increase land utilization while maintaining rural character, recreation and conservation: precisely the goals of the OCP.

About Conservation Design

Conservation Design ('CD') is an alternative approach to conventional rural development. While new forms of CD are still developing, its most common tool remains through conservation subdivision design. It can best be summarized as: 'An approach to laying out subdivisions so that a significant percentage of buildable uplands is permanently protected in such a manner as to create interconnected networks of conservation lands" (Randall Arendt 1996)

This planning technique was popularized by Randall Arendt's 1996 book, *Conservation Design for Subdivisions*, followed by *Growing Greener* 1999 and *Rural by Design* 2015). Its foundation, however, was Ian McHarg's famous book *Design With Nature* (1992), which attempted to link ecology and planning. CD also builds on the idea of clustered development or subdivision, which dates to the 1960's. Some historians trace this planning approach still further back to the Garden City Movement of the early 20th century (Clark, 2003).

Conservation Design (CD) is 'among the most commonly used land-use planning tools for conservation' and 'across the Western US 31% of all counties have enacted CD ordinances. (Miller et al 2009). It has been strongly supported by the American Planning Association for at least twenty-five years. A search on the APA member website ('Conservation + Subdivision') returns 683 results. It has been widely adopted by governments and the planning profession across North America and around the world. This author helped introduce the concept to New Zealand in 1999, where it has since become common planning practice.

At least two Canadian provinces have adopted the CD approach. The Province of Manitoba commissioned a manual for Conservation Subdivision Design (*Managing Change in Rural Manitoba*) in 2014; and New Brunswick has been championing its version ("Sustainable Community Design) since 2006, with numerous built examples. Many Canadian regional governments have adopted or absorbed CD principles into their plans. Western Canadian examples include Strathcona County (AB), District of Highlands, Victoria (BC) and the Alberni-Clayoquot Regional District (BC). **Appendix A** includes the Alberni Clayoquot Regional District's endorsement of Conservation Design and its benefits to the region.

The Elk Valley Official Community Plan directly references *Conservation Design for Subdivisions* (1996) as a guide and key planning criterion for rural development and land use amendments. This book established both the metrics and a step-by-step process for conservation subdivision design. The planning of the Galloway Lands followed these steps and meets these metrics.

For example, the first step in the CD planning process is to identify Primary and Secondary Conservation Areas.

In the case of the Galloway Lands, initial literature search (Hauer, Locke et al 2016), site modelling and local discussions resulted in the entire valley floor along Lizard Creek being identified as the most important 'primary conservation' area to be protected from development and even trails and pathways. This gravel-bed river floodplain, together with tributary riparian areas and steeper slopes were identified and mapped on a digital terrain model as Primary Conservation Areas.

Additional Secondary Conservation areas were then mapped and added. The remaining CD planning steps: (1) locate homesites, 2) connecting homesites, streets and trails, and 3) delineating lots and boundaries) were carefully followed to ensure that the resulting plan met Conservation Design objectives and criteria.

The resulting masterplan proposes that 51% of the site be rezoned as Park, with a further 19% protected by conservation covenant. A very low density is proposed: 74 homesites on this 185 hectare (457 acre) site. The planning and design process, application of CD principles, resulting masterplan and ongoing conservation mechanisms are described in the detailed Application for Land Use Management submitted to the Regional District of East Kootenay in August 2021.

"Perhaps the greatest strength of Conservation Subdivision Design is the process involved in determining the final layout of the land being developed."

Strathcona County AB, Appendix A (pg 50)



Galloway Lands

(dark green = primary / pale green = secondary conservation areas)

Literature Research

There is extensive literature re Conservation Design as a planning and land use tool. There is less research, however, into the linkages between Conservation Design and ecology, and the more specific issue of wildlife movement. Lamb (2022) completed a Google Scholar search and found only six results for 'conservation subdivision' + 'large mammal'; and only one paper that included a specific assessment of larger mammals' (deer and elk) movements.

While the migration routes of large mammals are very important, these large, regional-scale land use elements are normally mapped, verified, and included in a Region's Official Community Plan. The publication *Linking Conservation and Land Use Planning* (Michilak and Lenner – Defenders of Wildlife 2006) recommends that wildlife corridors be identified early, as part of high-level regional plans. It suggests that the least effective, most costly and controversial approach is to raise issues late in the planning process for development applications on individual sites (**Appendix B**).

A recent academic paper *entitled Effective corridor width: linking the spatial ecology of wildlife with land use policy* (Ford A. et al – European Journal of Wildlife Research 2020) has also caused controversy by proposing a new concept entitled 'effective corridor width' involving multiple factors. Based on their consolidation of literature and research, the authors recommend "3,000 to 6,000m for residential areas and 400 to 1,000m for trails'.

This proposition has major implications for all development, trails and transportation networks throughout the Elk Valley and the region. It clearly requires considerable further study, verification and consideration by the RDEK when the next Elk Valley Official Community Plan is developed. No wildlife corridor has been identified or included in the current Elk Valley OCP that would affect this site. The proposed site plan includes, however, "an interconnected network of conservation lands" (Arendt 1996) including trails. As previously noted, the Lizard Creek riparian area was identified as Primary Conservation Area and set aside early in the process. As stated in the application: "no part of the property is identified in the OCP as wildlife habitat area...or ungulate winter range".



Galloway Lands - existing trails

Conservation Design - Benefits and Barriers

Conservation Design is a key part of the Elk Valley Official Community Plan and is encouraged and referenced throughout this statutory document.

The broad consensus among planning professionals, academics and planning agencies is that the CD planning tool has been successful in balancing residential development with conservation; and produces better outcomes than conventional rural subdivision and exurban development.

The objectives of the Conservation Design approach are highly aligned with BC planning legislation, which seeks to create positive environmental, economic and social outcomes for regions, cities and towns.

A scan of the available literature, research and papers suggests the following advantages to Conservation Design relative to other approaches:

Environmental

- Conserves more land in a natural or undeveloped state
- Better protects wildlife habitat and environmentally sensitive areas
- Ongoing management of protected areas through conservation covenants and easements
- Improved ecological connectivity through network of protected areas
- Better supports integrated stormwater management

"Conservation Subdivision Design protects water quality and manages water quality by slowing and filtering stormwater runoff through wetlands, bio-detention facilities and best management practices that maximize soil water infiltration and percolation".

(UNL Water – Institute of Agriculture and Natural Resources)

Social

- Supports and can expand connecting trail and path networks
- Can better support recreational activities (depending on design)
- Creates common, shared spaces and places
- Can enhance social interaction and sense of community

"Without any parks, commons, or community woodlands, there are no informal places where neighbors can easily meet, engage in casual conversation, and gradually become better acquainted with each other."

(Arendt, 1996, p. 6)

Economic and Fiscal

- Generates economic activity and local spending
- Increased local employment (initial and ongoing)
- Creates wider variety of housing choice (vs rural acreages)
- Generates ongoing management and operational investment
- Increases local tax base and municipal revenues

"Conservation subdivisions have fewer impacts on landscapes than the wide dispersal pattern of typical exurban development and have been shown to have more economic benefits than conventional subdivisions."

(Community Planning and Land Use Community of Practice 2019)

ting trail and path networks activities (depending on design) and places and sense of community

local spending al and ongoing) choice (vs rural acreages) and operational investment icipal revenues These benefits may be the reason that Conservation Design has been so widely adopted by state, provincial, regional, and local governments across North America. In some jurisdictions DC is even 'as of right'.

Appendix A is a publication of the Alberni – Clayoquot Regional District promoting Conservation Design. This plain-English document outlines the benefits (from regional government perspective) and encourages landowners to adopt this approach.

This Region, like RDEK, is facing considerable growth pressures and wishes to maintain its rural character and conservation values.

While design is very important, research suggests that effective conservation must go well beyond this stage. Hostetler & Drake (2009) note that damage to the environment during construction and post-construction must be avoided and mitigated.

Potential and confirmed purchasers should be educated in how to continue conservation efforts on the site. This can be ensured by well-structured conservation covenants and an ongoing management body to oversee ongoing conservation efforts.

Finally, the literature identifies common barriers to CD, and found these to be mainly administrative. If existing local or regional government policy only allows conventional rural subdivision, this can be a major obstacle and the benefits of CD cannot be realized.

By this standard, the Regional District of East Kootenay has been progressive in supporting Conservation Design through the goals and policies of the Elk **River Official Community Plan.**



Galloway Lands site (looking west to Lizard Range)

"The challenge is how to accommodate these newcomers in ways that are sustainable, affordable, economically viable, energy and water efficient, but that also protect rural character, agricultural resources, and the environment.

Conservation subdivisions are one alternative to traditional development that local governments may offer to balance the potential influx of new residents with the conservation of open space, scenic vistas, and agricultural lands."

(Community Planning and Land Use Community of Practice 2019)

Conclusions

The conclusions of this paper are that:

- 1) Conservation Design (CD) is widely regarded by the planning profession, other organizations and many governments as a best- practice tool for producing positive environmental, economic, and social outcomes.
- 2) The Regional District of East Kootenay deserves credit for not only encouraging but requiring a Conservation Design approach to rural development and land use applications.
- 3) The Elk Valley Official Community Plan goals include better utilization of rural areas (and further rural development) while protecting rural character, recreational activities, connectivity and conservation.
- 4) The Conservation Design approach (including 'conservation subdivision') was developed specifically to achieve these goals; and has been practiced widely across North America.
- 5) A Conservation Design approach is referenced throughout the OCP and specifically required for land use applications like the Galloway Lands.
- 6) This approach was followed throughout the site analysis, mapping, design, and planning of the site; and is reflected in the detailed Application for Land Use Amendment for the Galloway Lands.
- 7) The major environmental features highlighted in the OCP were mapped, modelled, and protected in the proposed masterplan.
- 8) Ongoing protection and management of conservation values is proposed through a combination of rezoning and ongoing common management through conservation covenants.



Doug Leighton RPP MCIP MRAIC

Principal EDG - Environmental Design Group

About the Author

Doug Leighton is a registered professional planner, urban designer, lecturer, and advocate of conservation planning and design. Doug has over 35 years international experience in both the public and private sectors.

He is founder and Principal of EDG (Environmental Design Group), specializing in tourism and conservation planning and design. His academic qualifications include a BA (Honours) Geography and ME.Des (Masters - Environmental Design) from the University of Calgary and further studies at the Banff Centre, Queens and Harvard University (Graduate School of Design). Doug is a Lecturer and Planner in Residence at UCalgary's School of Architecture, Planning, and Landscape, where he teaches spatial planning and urban design.

Conservation has been a constant through Doug's career, starting with an early job as summer Warden for Parks Canada, later his first consulting clients. Conservation was again a key issue in his role as founding Planning Director of Banff's Planning Department in 1990. In 1997 Doug relocated to New Zealand to become Principal of a leading planning and environmental consulting firm (www.boffamiskell.co.nz). His first conference presentation was *Conservation Subdivision Design: Recent NZ Case Studies*. He has since led the planning and design of many conservation projects across New Zealand and North America.

Doug's volunteer roles include serving on the Boards of the BC, Alberta, and New Zealand Planning Institutes; and as Director and later Chair of the Alberta Real Estate Foundation from 2018-2021.

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Appendix A

Examples of **Conservation Design**

1. District of Highlands

The District of Highlands, near Victoria, addresses most development applications through unique zoning. An example of this kind of development is the subdivision of a 190 hectare property at Scafe Hill.

Previous zoning on the property would have permitted a subdivision of 15 lots with a minimum lot size of 12 hectares (29.6 acres) and no retained public green space. Due to environmentally sensitive areas and the cost of building roads, spot zoning was brought in to encourage cluster development. As a result, 26 lots were created, averaging 1.5 hectares (3.7 acres), and 145 hectares (358.3 acres) was protected for residents and public use and was added to an adjacent regional park.

The land owners, municipality and a conservation trust also registered joint conservation covenants on the newly created lots in order to protect smaller environmental features. This resulted in approximately 90% of the original property remaining in its natural state.2

2. Strathcona County, Alberta

Strathcona County promotes more compact development to lessen the encroachment onto agricultural and environmentally sensitive land.

Deer Mountain Estates was a 53 lot development with a minimum parcel size of 2 hectares (5 acres). Due to the application of conservation design, 43% of the property was preserved as open space. Conservation easements were used to create wildlife corridors around the perimeter of the development and each lot contains a 50m (164 ft) conservation covenant, a legal document requiring vegetation retention. An additional 7.8 hectare (19.2 acre) marsh area was protected as a Public Utility lot.3

Conservation Design

Conservation design, or cluster development, refers to the practice of concentrating new development on one part of a property while leaving the remainder largely undisturbed or rehabilitated. It is an alternative to the typical "cookie-cutter" style of subdivision and is beneficial in the protection of environmentally sensitive areas.



Figure 1: Conventional Development Pattern¹



Figure 2: Subdivision by Conservation Design'

Note: Same overall density across the parcel, but ler lots ensure that environmentally sensitive areas are protected as open space.

Under the conservation design method, the first stage of a development application would be a site assessment to determine the portion of the parcel that is most suitable for development.

In a conservation design scenario, the developer would be allowed to concentrate density in areas appropriate for development in exchange for setting aside the remaining land for environmental protection. This would result in the same number of lots, only smaller in size, with less road surface and more public green spaces. This type of subdivision commonly results in higher property values due to the increased green space included in the development

How can conservation design be applied in the Alberni-Clavoguot Regional District?

Conservation development in the Regional District is not common. However, the use of conservation design principles for new development could be a great benefit to the Alberni Valley. New development in key areas such as Sproat Lake and along the Somass and Stamp Rivers would see improved environmental protection with cluster development.

With these principles, potential subdivision of farm land across the Regional District would also be less detrimental to agriculture in the Valley. Development is clustered on less productive land while protecting the remainder for active agricultural use.

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Advantages of **Conservation Design**

- > Developments are designed to minimize impact on environmentally sensitive areas.
- > Protected green space corridors are created, which provide habitat for wildlife.
- > Improved storm water filtration through protected watercourse riparian setbacks.
- > Protection of agricultural land.
- > Vegetation retention acts as a carbon sink by removing CO, and other pollutants from the atmosphere.
- > Preserves rural character of the area.
- Reduced water usage by creating smaller lots.
- > Houses can be sited in areas with the most suitable soils for sewage disposal.
- > Maintaining open spaces and public parks can benefit tourism.



- > Lower cost to the developer due to less road and utilities infrastructure.
- > Higher property values due to protected green spaces and common use parks.
- > Provides the opportunity to create public park land at no cost to the taxpayer.

Appendix B – Linking Conservation and Land Use Planning (2007) Michalak and Lerner - Defenders of Wildlife)



Figure 2: Diagram of the connections between the Action Plans and land use planning

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HAWORTH Development Consulting

Appendix F

Groundwater Feasibility Assessment for the Galloway Lands, south of Fernie, BC

Western Water Associates Ltd.

SUMMARY OF FINDINGS / RECOMMENDATIONS

Western Water Associates reviewed available literature and data to confirm the availability of suitable water for development of individual drinking water wells for the subject property. Western Water Associates found that there are two mapped aquifers in the vicinity of the proposed subdivision: Aquifer 532 located underlying the eastern part of the proposed subdivision, and Aquifer 534 located to the northwest in the Cedar Valley. The bulk of the subject site is not underlain by a mapped aquifer, but it is very likely Aquifer 534 or a similar fractured bedrock aquifer is present, but has not yet been mapped as such due to a lack of reported wells in the area. A small area in the eastern part of the site likely overlies sand and gravel Aquifer 532. There is a very good potential for wells intercepting this aquifer to have yields that easily surpass the RDEK Subdivision Bylaw Quantity requirement. Wells drilled on the majority of the property are expected to be completed in a fractured bedrock aquifer similar to Aquifer 534 to the north. The average driller-reported well yield for wells completed in bedrock near the site is 9 USgpm, which is substantially above the Bylaw sustainable yield requirement of 0.42 USgpm. While many of the well logs are missing details on well yield, only one dry well was noted (a very shallow test well at the ski hill).

Overall, Western Water finds that the groundwater development potential for the contemplated subdivision, utilizing individual onsite domestic wells, is favourable. The Fernie area receives significant annual average precipitation of more than 1.2 m, which is available to recharge aquifers and there are several drainages traversing the property, which can also serve as seasonal recharge sources.



July 23, 2021

WWAL Project: 21-046-01VR

Haworth Development Consulting Ltd. PO Box 223, Suite 203, 927 – 7th Avenue, Invermere, BC VOA 1K0

Via email: richard@haworthconsulting.ca

Re: Groundwater Feasibility Assessment for the Galloway Lands, south of Fernie, B.C.

Western Water Associates Ltd. (WWAL) is pleased to provide this hydrogeological assessment related to a rezoning application for several properties located near Fernie, B.C. We understand that the proponent has purchased four adjoining parcels totaling 450 acres, and intends to apply for rezoning for the purpose of a future subdivision. We understand that should the rezoning be successful, a conceptual subdivision will comprise 75 single family lots. Our understanding is that lot sizes would be variable with a minimum size of 1 hectare, and each lot would have its own well and septic field. Parcel ID numbers for the subject properties are provided below in Table 1.

Parcel PID	Area (acres)
011-359-323	58.29
011-359-404	79.01
011-359-447	160.0
011-359-471	160.0

Table 1. Parcels That Are the Subject of This Assessment

Our assessment evaluates the potential for groundwater supplies to be developed that meet the Regional District of East Kootenay (RDEK) Subdivision Servicing Bylaw 1954 ('the Bylaw') requirements. Bylaw 1954 outlines the requirements for water quantity and quality from private wells. Key components of the Bylaw requirements include:

- New wells must be drilled to a minimum depth of 15 m (50 ft). If shallower, an assessment by a hydrogeologist is required.
- A new well must be located on each lot to be created and serve only that lot (i.e. no shared wells unless considered a community water system).
- Each well must be test pumped and shown to be capable of producing 2,270 L/day, equivalent to 0.42 USgpm continuously.
- With regards to water quality, samples are to be collected and evaluated against the Canadian Guidelines for Canadian Drinking Water Quality (GCDWQ). Where chemical and microbiological water quality parameters meet the current GCDWQ but fail to meet an aesthetic, or where raw groundwater is found to be not potable a covenant must be registered on the proposed lot(s) pursuant to Section 219 of the Land and Title Act.
- For subdivisions of more than five lots where the average parcel size is less than 1 hectare, a Professional must supervise the siting, testing and evaluation of all wells.

1. SITE PHYSIOGRAPHY, HYDROLOGY AND GEOLOGY

Figure 1 shows an overview of the proposed subdivision area. The proposed subdivision is located along the west edge of the Elk River Valley. It is bordered by the Lizard Mountains to the west, and the Elk River to the east. The City of Fernie is located 3 km to the north, and the Cedar Valley is located to the northwest. The Fernie Alpine Resort is located immediately to the south. The largest surface water feature near the proposed subdivision is the Elk River, which flows southward and discharges to the Kootenay River approximately 37 km to the southwest. Two small lakes, Isbe and Snow Lake, are located south of the proposed subdivision at the ski resort. Mt. Fernie Provincial Park borders the subject properties to the north.



Figure 1: Site overview of the subject properties, looking north up the Elk River Valley

Image source: Google Earth.

Land within the proposed subdivision area slopes mainly to the east with elevations ranging from ~1150 m asl (above sea level) in the west to ~1000 m asl near the Elk River. Historical air photos indicate that the property has been selectively logged in the past. Mapping shows the proposed subdivision appears to be incised by smaller creeks, including Lizard Creek, which originates from the Lizard Mountains and Cedar Valley to the northwest of the proposed subdivision. Lizard Creek flows southeast, draining into the Elk River. Other creeks include tributaries to Lizard Creek, as well as several unnamed drainages located in the southern part of the proposed subdivision.

The Fernie Climate Station (Station ID 1152850) is located approximately 3 km to the north. The recorded average annual temperature and total precipitation from 1981 to 2010 were 5.3°C and 1227.1 mm/year,

respectively (Environment Canada, 2019). July and August are typically the warmest months and December and January the coldest. Mean monthly precipitation ranged from 51.9 mm in August to 179.1 mm in November and is fairly consistent throughout the year. Note that these are published climate normals from past decades. Most climate change models for the interior of B.C. predict shifts in the overall seasonal pattern of temperature and precipitation from past "normals." The main changes expected are warmer, drier summers, and somewhat wetter winters with more precipitation falling as rain (as opposed to snow, resulting in decreased snowpack), particularly in lower elevations. Earlier peak runoff from snowmelt is another outcome of climate change that has already been documented in B.C.

The project area is located on the western portion of the Foreland Belt in the Southern Canadian Rocky Mountains, in a segment of the regional Fold-And-Thrust belt, where older Proterozoic to Paleozoic-aged formations have been thrust over younger, Mesozoic-aged formations by major northwest-southeast striking Thrust Faults (Mossop et al., 1994; Massey et al., 2005).

Bedrock underlying the potential development is mapped as Fernie Group and is comprised of shale, siltstone, and limestone dated to the Jurassic 201 to 145 million years before present (Price, 1979; Leach, 1958). Driller logs from the Provincial GWELLS database have identified the upper-most bedrock unit as shale. The subject property is located between two major thrust faults which trend northwest to southeast following the orientation of the Elk River Valley. The undulating terrain on the west side of the valley is likely related to steeply dipping geologic structures associated with the regional setting, and the glacial history of the area as discussed below.

The unconsolidated deposits overlying bedrock are the result of mechanisms and processes from the last glacial period. A review of available terrain inventory mapping for the area shows that the proposed subdivision is underlain by a blanket of undulating till (ENV, 2011). The unconsolidated deposits on the western and higher elevation part of the site are mapped as thin veneers of colluvium derived from bedrock and frequent bedrock outcrop. Unconsolidated deposits in the Elk River Valley are comprised of recent fluvial deposits deposited by the Elk River and/or by receding glaciers at the end of the last glacial period, overlying thick relatively continuous glaciolacustrine clay deposits.

A review of local well driller's logs shows that bedrock is present at shallower depths in the higher elevation areas to the west of the subject property with the thickness of surficial deposits over bedrock increasing towards the Elk River Valley bottom to the east. Local drill logs indicate that bedrock is generally overlain by sand and gravel with clay or till lenses in some areas. In the Elk River valley, the productive unconsolidated deposits are overlain by a thick deposit of clay.

2. HYDROGEOLOGIC SETTING

WWAL reviewed available aquifer mapping from the Province. Mapping shows two aquifers in the area near the proposed subdivision: Aquifer 534 (ENV, 2014), and Aquifer 532 (ENV, 2015). Aquifer 534 is located to the northwest in the Cedar Valley, and Aquifer 532 is located along the Elk River valley bottom. Aquifer 532 is mapped as present in the lower elevation eastern part of the subject site, while no mapped aquifer is present in the higher elevation western part of the site. Select details for these aquifers are

provided in Table 2, below. Figure 2 illustrates mapped aquifer boundaries and the locations of reported water wells in the area, with nearby wells labelled with their well tag number.

Aquifer ID	Geologic Formation	Overlying Materials	Aquifer Type	Demand	Productivity	Vulnerability
532	Sand and Gravel	Silty clay, fluvial gravel, till, boulders, morainal, glaciolacustrine and alluvial deposits	Confined sand and gravel	Moderate	Moderate	Low
534	Jurassic, shale, sandstone and limestone of the Fernie Formation	Morainal and lacustrine deposits, gravel and sand	Fractured sedimentary rock aquifer	Moderate	Low	Low

Table 2.	Provincially mapped aquifers near the subject property	У
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2.1 AQUIFER 532

Aquifer 532 is mapped as underlying the eastern, lower elevation part of the proposed subdivision (Figure 2). The aquifer boundaries were delineated using available well logs and geology mapping in the area. Aquifer 532 is comprised of fine sand to coarse gravel glacial deposits, and is overlain by silty clay, fluvial gravel, till, boulders, morainal, glaciolacustrine and alluvial deposits. The aquifer is mainly confined with possible windows in the overlying confining sediments between modern fluvial sediments and the productive aquifer. Depth to water in wells completed within the aquifer reportedly range from flowing artesian to 42.67 m (140 ft). The aquifer has moderate productivity, with well yields ranging from 0.03 to 159.1 L/s (0.5 to 2045 USgpm), with a geometric mean of 1.5 L/s (23.2 USgpm). The City of Fernie's James White Park municipal supply wells are completed in Aquifer 532 and are very productive. Fernie Alpine Resort's supply wells are located immediately south of the subject site, are also completed in Aquifer 532 and are quite productive. Groundwater recharge occurs from infiltration of precipitation, snowmelt, local surface runoff from upland creeks, and infiltration from the Elk River. Groundwater flow is likely topographically driven, from upland areas towards the Elk River, and then southerly along the Elk River Valley.

2.2 AQUIFER 534

Aquifer 534 is hosted in fractured bedrock and is located to the northwest of the proposed subdivision (Figure 2). The aquifer boundaries were delineated using available well logs and geology mapping in the area. Aquifer 534 is comprised of shale, sandstone and limestone of the Fernie formation. The overlying materials are comprised of till, silt, clay, and gravel and sand. The aquifer is confined. Depth to water ranges from flowing artesian to 30.5 m (100 ft). The aquifer is classified by the Province as having low productivity, with reported yields ranging from 0.1 to 1.7 L/s (2 to 27.5 USgpm), with a geometric mean of 0.3 L/s (4 USgpm). Groundwater recharge occurs from infiltration of precipitation, snowmelt, local
surface water runoff in upland areas, and along local creeks draining to the Elk River. Groundwater flow is likely from upland areas towards the Lizard Creek valley bottom.

3. EXISTING WELL INFORMATION

WWAL completed a search of existing wells reported to the Province's GWELLS Application in the area. There is one reported well located within the boundary of the proposed subdivision, however upon inspection of the well log, we determined that this well is actually located across the Lizard River to the north on a neighbouring property. There are 71 wells (including abandoned wells) west of the Elk River and within ~3 km radius of the property. Until 2016, submission of well driller's logs to the province was voluntary, so more wells may be present in the area than indicated by the database. Table 3 provides a summary of depth and yield info for the wells. Note that the reported yields are driller's estimates and not necessarily indicative of long-term capacity derived from a well pumping test.

Based on the well survey, there are 28 wells completed in fractured bedrock, and 43 wells completed in overburden. From the local drilling information, the depth to bedrock in wells that fully penetrated the overburden deposits ranged from 1.2 to 39.3 m (4 to 129 ft) below the ground surface.

Wells drilled into fractured bedrock had an average depth of 64.4 m (211 ft). Most local bedrock wells were located to the north and northwest of the proposed subdivision, in the Cedar Valley. The driller's estimated yields for bedrock wells ranges from 0 to 4.1 L/s (65 USgpm), with an average yield of 0.6 L/s (9 US gpm). Several nearby wells indicate good groundwater potential in fractured bedrock:

- WTN 86473 is located 2 km to the northwest of the proposed subdivision in the Cedar Valley, and is completed to 59.7 m (196 ft) depth in shale. The well has a driller's yield of 1.6 L/s (25 USgpm) based on an airlift test.
- WTN 59306 was drilled in 1990 and is located 600 m to the southeast at the Fernie Ski Hill, and is completed to 19.8 m (65 ft) depth in shale. The well has a driller reported yield of 4.1 L/s (65 USgpm).

Wells completed in overburden deposits had depths ranging between 27.4 to 132 m (36 to 225 ft), with an average well depth of 26.5 m (87 ft). Wells completed in overburden were generally found at lower elevations within the Elk River valley. The driller's estimated yields for overburden wells ranges from 0.2 L/s (3 USgpm) to 9.7 L/s (154 USgpm), with an average yield of 1.6 L/s (25 USgpm). Several wells located within 200 m of the south boundary of the proposed subdivision provide evidence that there is good groundwater development potential in the unconsolidated deposits:

- WTN 94343 was drilled in 2003 and is screened in gravel, sand and cobbles between 11.6 to 14.3 m (38 to 47 ft) depth. The well was altered in 2008 to include a surface seal. The driller indicated a yield of 6.4 L/s (100 USgpm).
- WTN 59365 was drilled in 1990. The driller reported highly productive fine sand and coarse gravel from 5.5 m to 8.5 m (18 to 28 ft) depth underlying silty clay, and indicated a yield of 3.8 to 5.7 L/s (50 to 75 IGPM) within this zone.

- WTN 117416 was drilled in 2019, and the driller indicated a zone of loose sand and gravel between 26.5 and 29.0 m (87 and 95 ft) depth with a yield of 3.2 L/s (50 USgpm).
- WTN 48316 was drilled in 1981 near the south boundary of the proposed subdivision. It was completed to 18.3 m (60 ft) depth. The driller indicated a yield of >3.2 L/s (50 USgpm) within coarse gravel, boulders and clay between 10.7 and 16.8 m (35 and 55 ft).

Several of the notable wells discussed above are associated with Fernie Alpine Resort located immediately south. There are several fairly shallow bedrock wells reported in the upper developed portion of the resort with high reported well yields in the 25 – 65 US gpm range. A note was included on one of the well logs (WTN48316) that there was insufficient flow from the well in the winter months, but that the well was likely over taxed being one of two wells supplying the lodge. Several other high-capacity wells associated with the ski hill are reported near the Elk River and completed in Aquifer 532. No technical reports regarding these wells were found in our online searches, but WWAL is anecdotally aware that the ski resort operates two high-capacity wells near the Elk River (300+ US gpm) that supply potable water to the resort.

WTN ¹	Final Well Depth		Bedrock Depth		Water Depth		Well Yield		Material?	A
	ft	m	ft	m	ft	m	USgpm	L/s	Iviaterial-	Aquiter
324	225	68.6	-	-	140	42.7	10	0.63	OB	532
30296	54	16.5	-	-	8	2.4	15	0.95	OB	532
30297	54	16.5	-	-	8	2.4	15	0.95	OB	532
33496	80	24.4	-	-	34	10.4	14	0.88	OB	532
33507	80	24.4	-	-	34	10.4	14	0.88	OB	532
33508	93	28.3	-	-	68	20.7	14	0.88	OB	532
33529	90	27.4	-	-	68	20.7	16.8	1.06	OB	532
34219	70	21.3	-	-	35	10.7	12	0.76	OB	532
37889	190	57.9	-	-	40	12.2	7	0.44	OB	532
39570	102	31.1	-	-	65	19.8	10	0.63	OB	532
41265	68	20.7	-	-	46	14.0	6	0.38	OB	532
42724	93	28.3	-	-	58	17.7	8	0.50	OB	532
45775	130	39.6	-	-	80	24.4	4	0.25	OB	532
48309	70	21.3	65	19.8	0	0.0	4	0.25	OB	532
48316	60	18.3	45	13.7	6	1.8	40	2.52	OB	-
52998	136	41.5	-	-	16	4.9	4	0.25	OB	532
55029	115	35.1	-	-	15	4.6	10	0.63	OB	532
59363	36	11.0	-	-	-	-	50-75	-	OB	532
59365	41	12.5	-	-	15	4.6	39	2.46	OB	532
83706	36	11.0	-	-	-	-	15	0.95	OB	532
88020	53	16.2	-	-	35	10.7	20	1.26	OB	532
90801	82	25.0	-	-	16	4.9	15	0.95	OB	532
90804	80	24.4	-	-	44	13.4	3	0.19	OB	532
94322	50	15.2	-	-	-	-	-	-	OB	532
94323	48	14.6	-	-	10	3.0	-	-	OB	532
94324	48	14.6	51	15.5	-	-	-	-	OB	532
94343	47	14.3	-	-	12	3.7	100	6.31	OB	532
95305	96	29.3	-	-	30	9.1	40	2.52	OB	532
95306	97	29.6	-	-	30	9.1	20	1.26	OB	532
99760	124	37.8	-	-	-	-	15	0.95	OB	532
109587	105	32.0	-	-	15	4.6	150	9.46	OB	532
113160	91	27.7	-	-	60	18.3	154	9.72	OB	-

Table 3: Select well construction details for wells completed within 3 km of the proposed subdivision.

July 23, 2021 Galloway Lands Groundwater Feasibility

WTN ¹	Final Well Denth		Bedrock Denth		Water Denth		Well Vield			
	ft	m	ft	m	ft	m	LISgnm	1/s	Material ²	Aquifer
113442	106	32.3	-	-	17	5.2			OB	532
113443	120	36.6	_		16	4 9	-	_	OB	532
115530	83	25.3	-	-	15	4.5	20	1 26	OB	-
115532	56	17.1	_	_	15	4.6	8	0.50	OB	-
115753	85	25.9	85	25.9	12	3.7	5	0.30	OB	-
115758	62	18.9	-	-	14	43	20	1.26	OB	-
117416	95	29.0	_	_	5	0.3	50	3 15	OB	-
118341	115	35.1	-	_	-	-	-	-	OB	-
120409	102	31.1	-	_	25	7.6	20	1.26	OB	-
120410	117	35.7	-	_	25	7.6	20	1.26	OB	_
122308	40	12.2	-	_	8	2.4	20	1.26	OB	_
122309	56	17.1	-	_	8	2.4	15	0.95	OB	_
18790	200	61.0	106	32.3	30	9.1	5	0.32	BED	534
46904	180	54.9	27	8.2	32	9.8	3	0.19	BED	534
48282	30	9.1	25	7.6	-	_	Shallow test	well. drv	BED	-
48283	360	109.7	4	1.2	-	-	2	0.13	BED	-
49039	250	76.2	110	33.5	-	-	7	0.44	BED	534
53036	160	48.8	129	39.3	-	-	3	0.19	BED	534
59306	65	19.8	51	15.5	5	1.5	65	4.10	BED	-
66274	135	41.1	-	-	46	14.0	2	0.13	BED	534
66365	97	29.6	-	-	6	1.8	3	0.19	BED	534
66472	140	42.7	-	-	28	8.5	4	0.25	BED	534
66476	160	48.8	-	-	38	11.6	4	0.25	BED	534
66572	210	64.0	-	-	-	-	4	0.25	BED	534
66599	310	94.5	-	-	-	-	3	0.19	BED	534
66702	166	50.6	-	-	20	6.1	3	0.19	BED	534
66767	200	61.0	15	4.6	20	6.1	3	0.19	BED	534
86252	255	77.7	45	13.7	-	-	5	0.32	BED	534
86473	196	59.7	56	17.1	-	-	25	1.58	BED	534
86475	296	90.2	70	21.3	10	3.0	1	0.06	BED	534
86477	356	108.5	30	9.1	10	3.0	10	0.63	BED	534
86478	96	29.3	90	27.4	-	-	-	-	BED	534
86480	595	181.4	24	7.3	100	30.5	10	0.63	BED	534
89812	80	24.4	-		40	12.2	3	0.19	BED	534
94771	95	29.0	70	21.3	-	-	8	0.50	BED	534
105101	136	41.5	80	24.4	90	27.4	4	0.25	BED	-
107243	335	102.1	55	16.8	60	18.3	4	0.25	BED	534
113770	196	59.7	26	7.9	70	21.3	6.5	0.41	BED	-
115995	375	114.3	105	32.0	100	30.5	2.5	0.16	BED	-
117/12	205	120 /	102	21.1	120	36.6	15	0.95	RED	_

Notes:

¹ WTN is Well Tag Number

² OB is unconsolidated deposits, BED is fractured bedrock

4. GROUNDWATER QUALITY

We reviewed EcoCat (an online database of environmental and hydrogeological reports) and the well logs for this assessment. There is limited water quality information available from well records in the area, and therefore groundwater quality in the area is unknown. Our expectation would be that groundwater would be considered very hard, which is typical or aquifers in the interior of the province. It is likely that iron and manganese could be found above their respective water quality guidelines, both of which are

very common aesthetic issues in private domestic wells. The aquifer mapping report for bedrock Aquifer 534 does not indicate any reported water quality concerns. The mapping report for Aquifer 532 indicates high hardness is common, and a sulphur smell in water can sometimes be present.

5. WATER LICENSING CONSIDERATIONS

With the implementation of the *Water Sustainability Act* in 2016, groundwater licensing was introduced. The *Act* requires that all non-domestic water users apply for and obtain a water licence. Domestic groundwater use (the use of one well to provide water to one lot for indoor and outdoor domestic uses) does not require a groundwater licence; instead all groundwater users that submit a well log to the Province are deemed a water right of at least 2 m³/day. So as it relates to the proposed subdivision, no Provincial water licences would be required if wells were only used for domestic purposes.

If groundwater to be used for other purposes at some lots within the proposed subdivision, for example irrigation, a water licence application would need be made for the non-domestic purposes. Further, if community supply wells were to be considered as water supply for some or all of the subdivision, a water licence would also be required.

6. CONCLUSIONS

Based on the results of our assessment, we offer the following conclusions:

- **C1** There are two mapped aquifers in the vicinity of the proposed subdivision: Aquifer 532 (unconsolidated sediments in the valley bottom) located underlying the eastern part of the proposed subdivision, and Aquifer 534 (fractured bedrock) located to the northwest in the Cedar Valley. The bulk of the subject site is not underlain by a mapped aquifer, but it is very likely Aquifer 534 or a similar fractured bedrock aquifer is present, but has not yet been mapped as such due to a lack of reported wells in the area.
- **C2** A small area in the eastern part of the site likely overlies sand and gravel Aquifer 532. There is a very good potential for wells intercepting this aquifer to have yields that easily surpass the RDEK Subdivision Bylaw Quantity requirement.
- **C3** Wells drilled on the majority of the property are expected to be completed in a fractured bedrock aquifer similar to Aquifer 534 to the north. The average driller-reported well yield for wells completed in bedrock near the site is 9 US gpm, which is substantially above the Bylaw sustainable yield requirement of 0.42 US gpm. While many of the wells logs are missing details on well yield, only one dry well was noted (a very shallow test well at the ski hill).
- **C4** Overall, the groundwater development potential for the contemplated subdivision, utilizing individual onsite domestic wells, is favourable. The Fernie area receives significant annual average precipitation of more than 1.2 m, which is available to recharge aquifers and there are several drainages traversing the property, which can also serve as seasonal recharge sources.

C5 While not specifically being considered, it is likely that high-capacity community supply wells could be constructed on the property, at low elevation near the Elk River, which could be used as a community water source for some or all of the development.

7. DISCUSSION AND RECOMMENDATIONS

While groundwater development potential for the subject site appears good, we note that there are no existing wells on the property. The property owner may wish to drill and test a few wells on the site before proceeding too far with road building and other site servicing to verify our assessment of the site is accurate. This would also help in project budgeting, such that well depths and costs could be better constrained prior to proceeding with the project.

As the proposed development is early in the development process at the rezoning stage, detailed development plans including lot layouts and sizes were not available. Several factors should be considered should the project move into more detailed planning and design:

- Lot sizing. Our understanding is that lots in the development will be variable in size, likely dependent on slopes and access. The fact that the minimum lot size being proposed is 1.0 hectares (2.5 acres) is positive, as this typically allows for adequate well spacings to minimize well interference effects. It is often the case that clusters of lots are created where topography is favourable. In these areas we recommend siting wells as far apart as feasible.
- <u>Septic systems.</u> Septic systems and wells must be a minimum of 30 m apart. This setback applies to on-lot wells and septic systems as well as those on neighbouring lots. We recommend consideration be given to confirming the feasibility of onsite septic systems early in the project prior to drilling, especially in areas of higher density. This would avoid the scenario of creating lots where appropriate setbacks between wells and septic fields could not be maintained.

8. CLOSURE

We trust that the professional opinions and advice presented in this document are sufficient for your current requirements. Should you have any questions, or if we can be of further assistance in this matter, please contact the undersigned.

WESTERN WATER ASSOCIATES LTD.

Tim Sivak, MGISA, P.Geo. Geoscientist

ESSI ROVINC OF R. M. RHODES -2021 #32839 BRITISH OLUMBI SCIEN

Ryan Rhodes, P.Geo Senior Hydrogeologist

Attachments: Figures 1.1 and 2

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EXISTING CONDITIONS

31 MAY 2021 CLIENT REVIEW ONLY 12224 RH RH DRAWN BY DRAWING TITLE

AS NOTED SCALE DATE ISSUED FOF

GALLOWAY LANDS

REVISIONS

REV# DY/MN/YR DESCRIPTION

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Appendix G

Galloway Lands Project, Individual On-Site Lot/Home Wastewater Treatment

Mulyk Consulting Inc.

SUMMARY OF FINDINGS / RECOMMENDATIONS

Mulyk Consulting Ltd. has summarized the requirements of the BC Public Health Act - Sewerage System Regulation [B.C. Reg. 326/2004].

All septic systems must comply with the BC Health Sewerage System Regulation, which is designed to ensure that public health is protected, including the protection of drinking water supplies and protection of the environment.

A Registered On-Site Wastewater Practitioner (ROWP) or professional engineer must carry-out an onsite inspection of the land and provide a report that demonstrates each newly created parcel has appropriate site conditions so that onsite sewerage does not contaminate water and will not cause a health hazard. During the subdivision process each proposed lot is evaluated to determine that land is suitable for onsite sewerage. The ROWP must submit a report to Interior Health that meets the requirements of the "Subdivision Report Criteria for Authorized Persons.

When the sewerage systems are constructed on the homesites, the ROWP must provide further documentation to Interior Health to confirm that the septic system has been installed in accordance with all applicable regulations.

If the conditions for provision of septic fields cannot be met, the subdivision will not be permitted by MOTI.

We are confident that the requirements for septic systems can be met on all lots within the development.

Mulyk CONSULTING

Suite 600, 1414 - 8TH Street SW Calgary, AB T2R 1J6 Phone: 403.244.2172 Fax: 403.229.3778

4 January 2022

File No.:1176-1-1

Via Email: richard@haworthconsulting.ca

Haworth Development Consulting Ltd. PO Box 223 Suite 203, 927-7th Avenue Invermere, BC V0A 1K0

Attention: Mr. Richard Haworth

Re: Handshake Holdings Inc. – Galloway Lands Project Individual On-Site Lot/Home Wastewater Treatment

Dear Sir:

It is understood that Handshake Holdings Inc. is in the process of rezoning the subject Galloway Lands [457 acres] to allow for its future residential subdivision development of 75 single family lots. Although the lot sizes would vary, their minimum area would be no less than 1.0 hectare and each lot would have its own groundwater supply well and individual wastewater treatment and dispersal field system.

We have reviewed the information provided and, to paraphrase Western Water Associates Ltd.'s (WWAL's) conclusion regarding the use of onsite domestic wells for water supply, the use of onsite individual lot wastewater treatment and dispersal fields for the proposed subdivision is considered favourable.

It is noted that individual on-site sewerage systems must comply with and adhere to the B.C. Public Health Act – Sewerage System Regulation [B.C. Reg. 326/2004]. Several key items in the Sewerage System Regulation are noted as follows:

"Application

2. This regulation applies to the construction and maintenance of

(b) a sewerage system that serves a single family residence or a duplex.

Discharge of domestic sewage

- 3. (1) The owner of every parcel on which a structure is constructed or located must ensure that all domestic sewage originating from the structure
 - (a) is discharged into

(b) does not cause a health hazard.

Setback from wells

3.1 (2) Subject to subsections (3) and (4) (b), a person must not construct

(c) a sewerage system less than 30 metres from a well.

Letter of certification

- 9. (1) Within 30 days of completing construction of a sewerage system to which Section 8 [filing] applies, an authorized person must
 - (d) file with the health authority a signed letter certifying that
 (v) if operated and maintained as set out in the maintenance plan, the sewerage system will not cause a health hazard."

As has been noted & recommended in the WWAL and BC Interior Health information provided, we would concur that carrying out onsite investigations and confirming the wastewater dispersal field locations early in the project's subdivision process would be appropriate. These works would define appropriate setbacks and provide the necessary information for the appropriate design of the sewerage system.

Should you have any questions or information requirements, please do not hesitate to contact the undersigned.

Yours very truly, Mulyk Consulting Inc. [EGBC Permit No. 1001636]

Peter Mulyk, P.Eng.



⁽iii) a sewerage system that is constructed and maintained in accordance with Part 3 [Sewerage Systems], and

Appendix H

Proposed Covenant Language

Covenants are proposed to be registered as follows:

- 1. Covenants registered in favour of the Regional District of East Kootenay:
 - 1.1 Limit the total number of residential units constructed on the Lands to not more than 75 single family dwellings. Should all or part of the Lands be subject to a boundary expansion and become within the City of Fernie, the limitation on number of units shall not apply to that portion of the Lands within the City of Fernie municipal boundary.
 - 1.2 Within those parts of the Lands zoned PG-2, prohibits all Permitted Uses, as defined by RDEK Elk Valley Zoning Bylaw No.829, except:
 - a) Local, Regional, Provincial and Federal parks and park reserves;
 - b) Conservation areas, ecological reserves and wildlife sanctuaries; and
 - c) Uses permitted under Section 4.03 of this Bylaw.
 - 1.3 Within those parts of the Lands zoned RR-1, prohibits Two-Family Dwellings.
 - 1.4 Wildfire covenant as per terms of standard RDEK Wildflire DP Covenant.
 - 1.5 Within those parts of the Lands zoned PG-2, and those parts of the Lands zoned RR-1 over which a statutory right of way will be registered for public access (including, the Nordic ski loop and associated connector trails) as illustrated on Schedule "B" (Trail Plan), to permit members of the public the right to pass by foot, ski, snowshoe or bicycle during between the hours of 5:00am and 11:59pm for the purpose of recreational activities and shall include provisions for risk and indemnification. The covenant registered shall be substantially similar to covenant CA1547821 registered over lands known as Island Land Lodge.
- 2. Covenants registered in favour of the not-for-profit Society (or other legal entity registered in BC) that will oversee the Galloway Lands Recreation Fund and the Regional District of East Kootenay. The RDEK shall be named to prevent discharge or modification of the covenants and has no obligation to enforce the covenants.
 - 2.1 Within those parts of the Lands zoned RR-1, prohibits "horticulture" and the "keeping of farm animals" as a permitted use on the lands. For the purposes of this covenant, Horticulture means the growing of flowers for commercial purposes, and any growing of fruits, vegetables, forages and grains, and nurseries.
 - 2.2 Within the "Lizard Creek Corridor, provide a "no-build" covenant that shall include terms that:
 - a) prohibit the construction or placement of buildings or structures;
 - b) prohibit excavation;
 - c) prohibit the placement of fill;
 - d) prohibit the cutting, trimming, pruning, or removal of any vegetation within the covenant area except:
 - i. removal of non-native invasive species of grass and shrubs;
 - ii. pruning and removal of vegetation in accordance with a wildfire / interface prescription and treatment plan prepared by a member of the Association of BC Forest Professionals and approved by the Regional District;
 - iii. pruning and removal of danger trees as determined by a member of the Association of BC Forest Professionals.
 - e) prohibit the construction of new recreational amenities, including trails, walkways, bridges or other recreational amenities.

Except that this covenant shall not apply to:

- a) maintenance and use of existing trails and trail infrastructure, including replacement and reconstruction of existing trails and trails infrastructure;
- b) construction, maintenance and use of a public road or emergency access route as required by the Ministry of Transportation and Infrastructure or other government agency with jurisdiction.

For the purposes of this covenant, the Lizard Creek Corridor means that area of PG-2 zoned lands within 100m of the normal high-water mark of Lizard Creek.

- 2.3 Within those parts of the Lands zoned PG-2, except within the Lizard Creek Corridor, provide a "nobuild" covenant that shall include terms that:
 - (a) prohibit the construction or placement of buildings or structures;
 - (b) prohibit excavation;
 - (c) prohibit the placement of fill; and,
 - (d) prohibit the cutting, trimming, pruning, or removal of any vegetation within the covenant area except:
 - (i) removal of non-native invasive species of grass and shrubs;
 - (ii) pruning and removal of vegetation in accordance with a wildfire / interface prescription and treatment plan prepared by a member of the Association of BC Forest Professionals;
 - (iii) pruning and removal of danger trees as determined by a member of the Association of BC Forest Professionals.

Except that this covenant shall not apply to:

- (a) Construction, maintenance, and use of walking trails, cycling trails, snowshoeing trails or Nordic skiing trails or amenities, buildings and structure associated with such trails if such amenities, buildings or structures are available for public use.
- (b) Construction, maintenance, and use of ski lifts and ski-in or ski-out trails.
- (c) Construction, maintenance, and use of parking areas intended for recreational users.
- (d) Construction, maintenance, and use of roads, including public roads, private access routes, common lot access routes, emergency access routes or other vehicular access route required for development of the Lands.
- 2.4 Provide a "no-build" covenant over that part of each building lot that is outside of the Building Envelope that shall include terms that:
 - (a) prohibit the construction or placement of buildings or structures;
 - (b) prohibit construction of fencing;
 - (b) prohibit excavation;
 - (c) prohibit the placement of fill; and,
 - (d) prohibit the cutting, trimming, pruning, or removal of any vegetation within the covenant area except:
 - (i) removal of non-native invasive species of grass and shrubs;
 - (ii) pruning and removal of vegetation in accordance with a wildfire / interface prescription and treatment plan prepared by a member of the Association of BC Forest Professionals;
 - (iii) pruning and removal of danger trees as determined by a member of the Association of BC Forest Professionals.

Except that this covenant shall not apply to:

(a) Construction and maintenance of a driveway, within a clearing not exceeding 15m in width, from the frontage road to the Building Envelope.

The Building Envelope for each lot shall be in general conformance with the plan attached hereto as Schedule "C" (the "Building Envelope Plan").

- 3. Covenants registered in favour of the Ministry of Transportation and Infrastructure.
 - 3.1 A Statutory Right of Way, not less than 25 meters in width, shall be provided in favour of the Ministry of Transportation and Infrastructure to allow for future construction of a road connecting the Cedars development (via Sunset Lane) to Fernie Alpine Resort (via Snow Pines Drive). The SRW provided shall be provided at the discretion of the Ministry of Transportation and Infrastructure to provide an alignment that permits construction of a future connector road, such right-of way location to be determined jointly between the Ministry and the land owner.
 - 3.2 The applicant shall complete a Transportation Impact Assessment to the satisfaction of the Ministry of Transportation and Infrastructure prior to subdivision approval.