Squamish Lillooet Regional District Area A
Community Wildfire Protection Plan
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Table of Contents

List of Tables

Appendix 1 Maps

Appendix 2 – Wildland Urban Interface Wildfire Threat Assessment Worksheets and Pictures

Acknowledgments

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John Courchesne – SLRD Area A Director

Bill Poppy – Aspen Planers Lillooet

Mike Aldred – BCWS Kamloops Fire Center Fuel Management Specialist

Verne Rasmussen – BCWS Lillooet Fire Zone Manager

SWPI Staff and Committee

List of Acronyms

AOI – area of interest

BCWS – British Columbia Wildfire Service

CFDRS - Canadian Forest Fire Danger Rating System

CRI – Community Resiliency Investment Program

CWPP – Community Wildfire Protection Plan

ESSF – Engelmann Spruce Sub-alpine Fir

FBP – Fire Behaviour Prediction

FESBC - Forest Enhancement Society of British Columbia

FRPA -Forest Planning and Practices Regulation

FTU(s) – Fuel Treatment Unit(s)

GIS - Geographic Information System

IDF – Interior Douglas Fir

MFLNRORD – Ministry of Forests, Lands, Natural Resource Operations and Rural Development

MS – Montane Spruce

NDT - Natural Disturbance Type

OGMA - Old Growth Management Areas

PSTA - Provincial Strategic Threat Analysis

SLRD – Squamish Lillooet Regional District

SWPI – Strategic Wildfire Prevention Program

UWR – Ungulate Winter Range

WHA – Wildlife Habitat Area

WUI - Wildland Urban Interface

Executive Summary

In 2017, Bruce Morrow Consulting Ltd was retained by the Squamish Lillooet Regional District to develop the SLRD Area A Community Wildfire Protection Plan. This plan encompasses several distinctive communities: Bralorne, Goldbridge, Gun Lake, Tyaughton Lake and surrounding development and Marshall Lakes.

The Community Wildfire Protection Plan (CWPP) Program was created in British Columbia to aid communities in developing plans to assist in improving safety and to reduce the risk of damage to property. To create this CWPP the author used the 2017 Strategic Wildfire Protection Initiative CWPP template with associated GIS data and templates.

The wildfires of 2017 have emphasized the need for greater consideration and due diligence with respect to fire risk in the wildland urban interface (WUI). Understanding the factors that contribute to wildfire risk is key for developing a comprehensive plan to identify and mitigate wildfire risk.

SLRD Area A was heavily impacted by wildfires in 2009. The Tyaughton fire was a stand initiating fire that burned over the entire area between Tyaughton Lake and Marshall Lake valley. Timber harvesting, extreme terrain and large water bodies all limit the potential impacts from another landscape level wildfire, especially south of Carpenter Lake.

The five communities do face significant wildfire challenges, especially on the north side of Carpenter Lake. All communities are surrounded by forest ecosystems. Pine beetle and Douglas Fir Beetle are impacting the local forest health, increasing surface fuel loads and reducing site access for wildfire suppression.

A total of twenty-four unique landscape and structure protection Fuel Treatment Units were identified within two kilometers of the private land in the area. Ten of these units appear to be merchantable timber and would benefit from harvesting activities. The other FTUs are non-merchantable timber, in high visual areas, or are immediately adjacent to structures where a non-harvest hand treatment may be more acceptable and practical.

As with all wildland urban interface communities, FireSmart education and activities would greatly benefit the private land around the structures. Fuel treating a narrow strip along private land will not be very effective in an aggressive wildfire unless the structures themselves have had FireSmart principles employed around them.

The CWPP process is an outlier in the normal forestry planning processes. The SLRD, while identifying and planning fuel management treatments is neither the Land Manager, nor the forest tenure holder. The SLRD has no ability to undertake timber harvesting planning or activities. They can access funding options for non-harvesting treatments.

Summary of Community Wildfire Protection Plan Recommendations

Table 1: Summary of CWPP Recommendations

	Objective/Priority	Recommendation/ Next Steps	Responsibility/ Funding Source
Section 2: Local Area Description	Communication with forest industry	**RECOMMENDATION #1:** Communicate regularly with MFLNRORD, forest licensees, BC Timber Sales, and individual woodlot licensees about coordinating fuel management activities.	SLRD
Section 3: Values at Risk	Identify and protect key cultural values	**RECOMMENDATION #2:** Consult with local First Nations about conducting preliminary field reconnaissance for identification of archaeological and cultural values in the prescription development stage.	SLRD
Section 4: Wildfire Threat	Utilize forest fuel management to protect key values	**RECOMMENDATION #3:** Collaborate with MFLNRORD and forest licensee staff on innovative approaches to undertake forest fuel management.	SLRD
	Enable site-specific recommendations and management	**RECOMMENDATION #4:** Encourage the MFLNRORD to develop locally relevant fuel management standards for acceptable post-harvest conditions for WUI areas.	SLRD
Section 5: Risk Management and Mitigation Factors	Maximize funding available annually, implement the plan in a timely manner	**RECOMMENDATION #5:** Apply for funding for prescription development and then implementation from UBCM, FESBC or other sources, aiming to tackle two or three hand treatment units annually.	SLRD or MFLNRORD
	Raise awareness of FireSmart with multiple audiences in multiple ways	**RECOMMENDATION #6:** Explore opportunities to implement FireSmart activities and raise awareness of FireSmart principles through various and multiple audiences. Key focus on distribution of FireSmart brochures, and engaging adjacent landowners when fuel management	SLRD

		operations are taking place.	
	Implement the plan in a timely manner	**RECOMMENDATION #7:** Assign responsibility for implementation of this plan to a dedicated staff person or consultant. Consider striking a multiparty implementation committee consisting SLRD, interested local First Nations, BCWS, MFLNRORD and forest industry representatives to coordinate resources, communicate regularly and work cooperatively to reduce fuel wildfire risk.	SLRD
	Implement the plan in a timely manner	**RECOMMENDATION #8**: Encourage the Land Manager and the local forest tenure holders, teamed with local First Nations, to take the lead on fuel management activities.	SLRD
Section 6: Wildfire Response	Enable trained capacity to respond to wildfires and emergencies	**RECOMMENDATION #9:** Encourage basic wildfire suppression training for volunteer fire departments	SLRD
		RECOMMENDATION #10: Maintain or develop mutual aid agreements between fire departments covering the area of interest.	SLRD
		RECOMMENDATION #11: Identify training options to build capacity for wildfire suppression and emergency response, and pursue mock exercises with BC Wildfire Service.	SLRD/BCWS
		RECOMMENDATION #12: Seek CRI and FESBC funding when available.	SLRD

SECTION 1: Introduction

In 2012, the Squamish Lillooet Regional District contracted Bruce Morrow Forest Consulting Ltd to develop a wildfire threat assessment plan for the Gun Lake and Goldbridge areas. This plan resulted in 181 hectares of fuel treatments recommended in the Gun Lake area. Through timber harvesting and fuel hand treatments a majority of the direct interface areas were treated up to 2016. The SLRD has initiated a new CWPP to cover the entire Area A which encompasses the communities of Bralorne, Goldbridge, Gun Lake, Tyaughton Lake and Marshall Lakes.

This plan contains the following sections:

Section 1: Planning Process

Section 2: Local Area Description

Section 3: Values at Risk

Section 4: Wildfire Threat and Risk

Section 5: Risk Management and Mitigation

Section 6: Wildfire Response Resources

1.1 Purpose

The purpose of this CWPP is to identify the wildfire risks within the area of intent (AOI), to describe the potential threat to human life, property, and critical infrastructure, and recommend treatment options to reduce the wildfire risk. These plans need regular updating as our understanding of wildfire risk, the land, resources, and communities' needs within the AOI change, after approximately five years. This plan attempts to provide an accurate assessment of the wildfire risk areas within the AOI and recommends fuel treatment and FireSmart concepts from which the area would benefit, as well as an overview of different forest fuel modifications options that can be utilised.

The CWPP planning process has provided a detailed framework to inform the implementation of specific actions that will ultimately result in:

- reduced likelihood of a wildfire entering the communities
- reduced impacts and losses to property and critical infrastructure
- reduced negative economic and social impacts to the communities
- reduced impacts on the local forest values
- improved wildfire suppression safety and fire control opportunities

The Community Wildfire Protection Plan process is an outlier in the normal forest management planning activities in the province of B.C. The process is initiated by the local government, in this case the Squamish Lillooet Regional District. But the SLRD is not the Land Manager on the crown land that surrounds the private land. The SLRD does not have a Forest Stewardship Plan nor an allocation of timber cut to implement timber harvesting activities in the name of wildfire threat reduction to the communities it serves. The SLRD has to take the fuel treatment planning completed in this plan to the Land Manager and local forest licensee for implementation. The SLRD does have access to funding sources for non-harvesting fuel management treatments through the Community Resiliency Investment Program and Forest Enhancement B.C.

1.2 CWPP Planning Process

The SLRD Area A CWPP was spearheaded by Ryan Wainwright from the SLRD. The field work and reporting was completed by Bruce Morrow, a Registered Professional Forester with over thirty years of local knowledge and fire management experience. The project was supported by Mike Aldred, the Kamloops Fire Center Fuel Management Specialist, BC Wildfire Service (BCWS), Bill Poppy from Aspen Planers, the local forest licensee, Verne Rasmussen, the BCWS Lillooet Fire Zone Manager and John Courchesne, the Area A director. Paragon Mapping in Williams Lake completed the mapping and spatial data requirements.

Fieldwork took place between September 5 and 12, 2018, with the completion of ninety-eight

WUI Wildfire Threat Assessment worksheets. See section 4.3 Local Wildfire Threat Assessment for further details.

SECTION 2: Local Area Description

SLRD Area A is located 100 kilometers west of Lillooet on the lee side of the B.C. Coast Mountains. The area can be accessed along highway 40 (Bridge River and Carpenter Lake) from Lillooet or the Hurley FSR from Pemberton to the southwest. The area is defined by steep mountains, limited road access, old natural resource extraction communities and extensive seasonal recreational accommodations and activities. Carpenter and Downton Reservoirs dominate the Bridge River Valley, effectively breaking the area in half. Timber harvesting and mining play a significant role in the local economy while hiking, mountain biking and related support services are a new economic driver in the area.

Understanding the relationship of the community to its surrounding environment, and what that means in terms of the wildfire hazard, threat and risk of loss, is critical to help the community plan for mitigation activities and to respond to wildfire events (SWPI CWPP template, 2016). To support this understanding, the BCWS has conducted a Provincial Strategic Threat Analysis (PSTA) that was used to aid in the identification of the Wildland Urban Interface, wildfire threat, and potential fire behaviour. This high level data provides a basis for the smaller scale wildfire threat assessments.

The BCWS provided the following data for this CWPP:

- The Provincial Strategic Threat Analysis (PSTA)
    - BC Fuel Type
    - Wildfire Threat
    - Head Fire Intensity, Spotting, Fire History
    - Wildland Urban Interface (Structure Density Classes, Structures)
    - Proposed and completed fuel treatments post-2013

Other relevant data collected includes:

- Aspen Planers timber harvesting activities in the near term provided as shape files,
- 2013 Wildfire Threat Assessment mapping and report for Gun Lake and Goldbridge,
- Summary of forest fuel management treatments completed in the Gun Lake area - 2013-2016

2.1 CWPP Area of Interest

The Area of Interest (AOI) covered by this CWPP can be seen in Map 1 (see Appendix 1). The AOI is generally defined by the wildland-urban interface (WUI). The WUI is the area within 2 kilometres of a community with a minimum density of 6 structures per square kilometre, although no structures were ignored due to low structure density. In this case, due to the small sizes of the communities and the patchwork of private lands, the AOI boundary was created as a two kilometer buffer on private land. The CWPP covered the communities of Bralorne, Goldbridge, Gun Lake, Tyaughton Lake and surrounding access roads, and the Marshall Lake valley.

Table 2: The Area of Interest (AOI)

Jurisdiction within the AOI	Gross area (ha)
Private Land	1632.5
Crown Land including Woodlots	25532.4
First Nations and Federal Reserve Lands	0
Lakes, rivers, wetlands	2108.6
TOTAL	29273.5

2.2 Community Descriptions

The AOI is comprised of the following communities:

Bralorne

Bralorne is located fifteen kilometers south of Goldbridge and can be accessed from the Hurley FSR as well. 'Bralorne is a small community that is almost deserted with only very few people living here. The community is a cast off from the hectic heydays of the gold mining era when the Bralorne-Pioneer Mine was the richest gold mine in Canada and the most productive in British Columbia.' (OurBC.com). Cadwallader Creek, a very deep gorge, dominates the western edge of the town. The mine is still active and Bralorne has become a very popular biking, hiking and snowmobiling tourist area.

Goldbridge

Goldbridge is located in the valley bottom at the extreme western end of Carpenter Lake, the old Bridge River before the reservoir. Gold Bridge is an unincorporated community in the Bridge River Country of British Columbia, Canada. Although numbering only around 40 inhabitants, Gold Bridge is the service and supply centre for the upper basin of the Bridge River Valley. – Wikipedia

Tyaughton Lake

A well developed recreational area with lakeshore cabins and a major resort, accessed from highway #40 along Carpenter Lake. Gun Lake Road has numerous recreational and ranching properties southwest of the lake. Mountain biking in the summer and heli-skiing in the winter are regular activities in the local mountains. One private property is located north of Tyaughton Lake.

Gun Lake

Gun Lake has the highest density of structures in the area with over 100 lakeshore cabins and older residences in the area. It can be accessed from highway #40 along Gun Lake Road to the western end, the south central area by a local gravel road or on the east end by the Slim Creek FSR. This area has undergone significant forest health challenges resulting in significant harvesting by the local forest licensee.

Marshall Lakes

The Marshall Lakes is accessed from Highway #40 along Carpenter Lake. There is a small

group of seasonal cabins, a recreation site and some ranch homes near Marshall Lake plus a large private land holding on the southern end of Lisa Lake. This very narrow valley escaped most of the impacts of the 2009 Tyaughton Fire that burned most of the area west of the valley.

2.3 Past Wildfires, Evacuations and Impacts

The 2009 Tyaughton Fire had a large impact on the AOI. At over 30 000 hectares it burned the area south of Tyaughton Lake and east to Marshall Lakes. This high intensity stand initiation wildfire removed the coniferous forest cover within its boundaries and heavily impacted the sensitive pumice soils in the area. The reduction in the duff layer has set back the forest succession to a pre-timber brush type ecosystem. The returning vegetation is largely deciduous shrubs, most notably white rhododendron which had a deep enough root system to survive the wildfire. The surface fuel continuity is poor. The downed woody debris is growing in places where the dead trees are falling over but the low density stands in the area will not create a 'pine beetle style' surface fuel load to threaten the local area. The second highest impact fire was started at the Mowson Ponds Recreation Site on Tyaughton Lake Road south of the Lake in May 2012. This wildfire spread west, threatening the ranch properties along Gun Creek Road, reaching the Gun Creek gorge in places. This flat has responded with a heavy aspen cover which has significantly reduced the wildfire threats in that area.

2.4 Linkages to Other Plans and Policies

2.4.1 Local Authority Emergency Plan

All five main communities have emergency plans developed by the SLRD. They can be found at https://www.slrd.bc.ca/inside-slrd/reports. The reports all recognize wildfire threats and provide evacuation and FireSmart information.

2.4.2 Affiliated CWPPs

No other CWPPs overlap this area.

2.4.3 Higher Level Plans and Relevant Legislation

Multiple objectives for wildlife, environmental and social values exist through a variety of mechanisms, generally through MFLNRORD and legislation under that ministry. This information is summarised in Table 3 below.

Table 3: Objectives for Wildlife, Environmental and Social Values

Objectives/item or constraint	Purpose	Establishment mechanism	Forest Fuel Management opportunities
Old growth management areas	Set aside areas of old growth for maintenance of biodiversity, old forest	Land Act s.93.4	May be limited; understory options may be able to proceed. See

	attributes, connectivity		Section 4, Other Forest Values
Visual quality objectives	To maintain scenic areas or visual sensitivity classes	Forest Planning and Practices Regulation, FRPA	May be limited; understory options may be able to proceed. See Section 4, Other Forest Values
Mule deer (ungulate) winter range	Provide suitable winter cover and food sources for maintenance of mule deer populations	General Wildlife Measures, Forest and Range Practices Act	May be limited; understory options may be able to proceed. See Section 4, Other Forest Values
Wildlife Habitat Areas (WHA)	Protect high value wildlife habitat.	Government Actions Regulation, FRPA	May be limited; to be further explored.

2.4.4 Ministry or Industry Plans

Timber harvesting activities have focused on the accessible, merchantable timber in the area. This has been directed by a mountain pine beetle epidemic in the 1970 and 1980s, specifically around Gun Lake and a spruce beetle outbreak in the Cadwallader Creek drainage shortly afterwards. Pine beetle is still active in a number of areas, again focused on the Gun Lake area.

The Cascades Resource District is applying for funding to complete a landscape level fuel management plan for the District, including Area A.

RECOMMENDATION #1: Communicate regularly with MFLNRORD, forest licensees, BC Timber Sales, and individual woodlot licensees about coordinating fuel management activities

SECTION 3: Values at Risk

The intent of this section is to introduce the extent to which wildfire has the potential to impact values within the local communities. Values at risk (VAR) are the human or natural resources that may be impacted by wildfire. This includes human life, property, critical infrastructure, high environmental and cultural values, and resource values.

Updating VAR data is critical for effective mitigation planning. This can be achieved through the use of high quality imagery to identify areas of new development and values such as critical infrastructure.

3.1 Human Life and Safety

The intent of this sub-section is to clearly identify and understand where people and structures are located within the AOI in order to effectively determine the wildfire risk and identify mitigation activities. In the event of a wildfire approaching one of the communities in the AOI, the first priority is human life and safety, including the evacuation of at-risk areas. Wildfire can move quickly and unpredictably, and it takes time for people to evacuate an area. Residences on the

north and eastern edges of forest ecosystems are generally more at risk from wildfires than developments on the southern and western portions. Areas surrounded by forest ecosystems, as all the private land in Area A is, face the highest potential wildfire risks. Developments above forest ecosystems are at higher risk from wildfire events. Safe egress can be blocked by the fire itself or by vehicle congestion or accidents.

Area A is largely a rural area with lakeshore developments of mostly seasonal users and older communities of resource workers. The Provincial Strategic Threat Analysis (PSTA) data amalgamated by the BCWS provides a good database of rural structure distribution and location. The multiple sources used to create the structure data layer creates multiple points for many structures, points for minor outbuildings and address points with no structures. Map 2 in Appendix 1 shows the distribution of structures throughout the AOI. Access and egress stands out as the biggest risk for human life and safety. Tyaughton, Gun Creek Road and Marshall Lakes have only one access/egress road. That means in the event of an emergency there is only one way out. If that road is blocked by a wildfire the residents and recreationists behind the wildfire cannot evacuate the area.

3.2 Critical Infrastructure

The intent of this sub-section is to clearly identify and understand where critical infrastructure is located within the Wildfire Urban Interface (WUI) in order to effectively determine the wildfire risk and identify priority mitigation activities. Critical infrastructure assets are those physical resources, service and information technology facilities, networks and assets which, if disrupted or destroyed, would have a serious impact on the operation of an organization, sector, region or government. The PSTA data, Local Authority Emergency Plan and any available infrastructure data (DataBC) was reviewed as part of this planning process and updated for errors and omissions.

The following sections outline the risk that wildfire poses to the local infrastructure. As the hub of the Bridge River Valley, most infrastructure is centered in Goldbridge. There is a school, ambulance station, post office, library and general store.

3.2.1 Electrical Power

Major hydro transmission lines run from a run of the river power project up Downton reservoir down the Hurley on the west side of the AOI. Hydro line also follow the Lillooet Pioneer Road from Goldbridge to the Bralorne community. Hydro lines also follow Tyaughton, Gun Lake (North and South) and Gun Creek Roads. A hydro sub-station is located on Highway #40 within the Tyaughton Fire south of Mowson Pond. There are no gas lines in the area.

3.2.2 Communications and Municipal Buildings

There are no municipal buildings in the area, except for an ambulance station and school in central Goldbridge. Critical infrastructure can be limited to the Gun Lake and Bralorne Fire Departments in rural areas.

3.3 High Environmental and Cultural Values

The intent of this sub-section is to clearly identify and understand where high environmental and cultural values are located within the WUI in order to effectively determine wildfire risk and identify mitigation activities.

Environmental and cultural values are high throughout the area of interest. SLRD Area A and the surrounding area offer a range of outdoor activities that draw tourists including mountain biking, golfing, fishing, camping and hiking.

3.3.1 Cultural Values

First Nations cultural values in the area were heavily impacted with the flooding of the Carpenter and Downton reservoirs. To ensure any unknown cultural values located within any of the treatment areas, Preliminary Field Reconnaissance or other assessment tool is recommended to identify any high value or sensitive cultural values on the Crown lands within the area of intent that would be impacted. There will be ongoing consultation for all future fuel management projects.

RECOMMENDATION #2: Consult with local First Nations about conducting preliminary field reconnaissance for identification of archaeological and cultural values in the prescription development stage.

3.3.2 Recreation Sites and Trails

SLRD Area A and the surrounding region have been a hub for trail transportation for hundreds of years. The Bridge and Hurley Rivers were a busy travel corridor for First Nations connecting the Interior to the Coast. Miners and loggers have scoured this area for over a century. This has resulted in numerous historical backcountry trails, old logging roads and deactivated access through most of the river valleys. New roads are being constructed to access timber at the backends of many of the valleys. The area has become a mountain biking destination. New trails are linking up the old roads and trail system creating a mosaic of interconnected trails.

Recreation Sites and Trails BC, a part of MFLNRORD, operate the following camping sites within the AOI:

1. Mowson Ponds on Tyaughton Lake Road
2. Kingdom Lake on Kingdom FSR off the Lillooet Pioneer Road.
3. Marshall Lake
4. Tyaughton Lake

A full inventory of the trail systems in the Bridge River Valley can be found at http://bridgerivervalleytrails.ca. The Trailforks app also details many of these trails.

3.3.3 Environmental Values

The extensive riparian areas in Area A are considered high environmental values, both for biodiversity, wildlife habitat and water quality. As part of the fuel treatment prescription phase, all prescriptions are recommended to be site specific and be developed with the proper referrals to identify habitat and species at risk considerations. There are several Mule Deer Winter Range areas within the AOI as well.

3.4 Other Resource Values

- Timber harvesting is the main natural resource extraction activity in the area.
- The Bralorne Gold Mine, located in southwestern British Columbia, has operated under trial production status since 2010 and remains in the exploration and evaluation stage. Avino Silver & Gold Mines acquired Bralorne Gold Mines in October of 2014, giving

Avino full control and ownership of the Bralorne mine. Avino is implementing a multi-stage, multi-year plan to increase gold resources, expand the mine's operating capacity and realize a much more efficient operation that will contribute significantly to Avino's overall production in the coming years. The Bralorne gold camp represents one of Canada's most prolific mining operations. From 1928 to 1971, the Bralorne and nearby Pioneer and King mines produced 4.15 million ounces of gold from 7.9 million tons of ore. Average head grades exceeded half-an-ounce per ton.

- Recreation is a large draw to this area. Resort lakes plus multiple outdoor activities makes Area A a playground for outdoor enthusiasts.

SECTION 4: Wildfire Threat and Risk

Community Wildfire Protection Plans (the Plan) are generally considered active for a five year period. Changes in timber harvesting, Fire Smart and fuel management efforts, development, community involvement and wildfire events can alter the needs of the local area. The treatment units identified in this plan focus on work that could be completed in a 5-7 year time frame. The fuel management locations recommendations in this plan do not completely reflect the entire scope of fuel treatments that should be considered in the SLRD Area A, but do include the highest priority identified sites. Recommended fuel treatment areas are all located on Crown land due to funding options. The SLRD Area A AOI can be threatened by wildfires in two basic scenarios. The first is a landscape level (large) wildfire establishing itself well outside the area and moving into this area, threatening the entire community and surrounding area. The second is a wildfire starting within the Area of Interest and very quickly threatening the adjacent structures.

4.1 Landscape Wildfires Impacting the Area of Interest

In B.C., while wildfires have the ability to spread in any direction, landscape level wildfires mainly spread hottest and fastest with the prevailing winds. Unsettled weather conditions that create cumulus clouds and thunderstorms can lead to very erratic, short term wildfire spread in multiple directions at once. Topography, water bodies and available fuels can also play a significant role in direction of spread and wildfire intensity. Wildfires tend to spread fastest and most aggressively with wind, on drier aspects (south and west) and upslope. This suggests that wildfires main direction of spread and highest intensity spread in this area, is to the north and east on the north side of Carpenter Lake. Wildfires are going to spread most aggressively on south and west aspects in this area, plus any areas where wind gets funnelled through narrowing valleys or draws. The large water bodies, specifically, Gun and Tyaughton Lakes, plus Carpenter and Downton Reservoirs will have a significant impact on potential wildfire spread. The reservoirs cut the AOI in half in a roughly east to west direction, greatly limiting wildfire spread potential and reducing the overall potential of the impacts by a landscape level wildfire.

The mosaic of timber age classes created by wildfire events and timber harvesting also reduce the potential for a landscape level wildfire in this area. The Tyaughton fire in 2009 is the biggest single wildfire, and ecosystem impact event in this area. The Fire History Map 5 shows that it dominates the area between Tyaughton and Marshall Lakes. This stand initiation event has created a brush ecosystem, dominated by white rhododendron over much of the area, with extensive stands of fire killed Douglas-fir. The wildfire had a significant impact on the surface

fuels, reducing horizontal continuity and fuel volatility over a majority of the fire area. It will likely take decades before the fuel continuity increases to a point where a landscape level wildfire could spread across most of the Tyaughton fire again.

An assessment of the Fire History map suggests that the wildfires of the past have been geographically limited, especially south of the Bridge River. Narrow valleys with significant fuel breaks such as lakes and alpine areas have limited most fires to single valleys. The wildfires on the north side of the Bridge River, having less severe topography, more favourable aspect for dry conditions, and fewer natural breaks, are larger in scope but mostly limited to the lower elevation southern aspects.

4.2 Local Wildfires Ignited Near Communities

Of equal or even greater concern is the potential for wildfires to establish themselves with the AOI itself and quickly threaten the local communities. All these communities are immediately surrounded by conifer dominated forest ecosystems with continuous surface fuels and the potential for aggressive wildfire behaviour under the right fire weather conditions. These sites have regular and often heavy public use with the potential of wildfire ignition through man caused starts. Summer storms are sometimes funnelled along the east side of the Coast Mountains into this area, but this is not known as a significant lightning belt where lightning ignition is a regular occurrence. The main concern with wildfires near structures is that they would almost immediately threaten buildings and human life due to the proximity to developed areas. They can become serious problems for structural and wildland fire crews during short term wind events.

The proximity to structures does not allow for all the wildfire suppression tools to be used effectively and the potential loss of life and property can quickly overwhelm available resources. A weather event causing multiple starts is likely.

4.3 Other Forest Values

Forest fuel management treatments can have direct impacts on forest resource values that need to be considered. It is important to note that forest fuel management activities are intended to protect and enhance other forest values by limiting or reducing the impact of wildfires on the landscape. The concept of protecting forest values by drawing a line on a map and not allowing forest management activities within that area to support or enhance a specific forest value does not provide for effective forest fuel management activities. Continuing to conduct wildfire suppression activities, but no other forest management, is also not a successful long-term strategy for protecting forest values. This is especially true in interior dry belt areas of continuous coniferous forest cover.

Recent wildfire history shows that wildfires that establish themselves in high wildfire threat areas, that is dense coniferous stands that are capable of supporting active candling crown fire behaviour, cannot be successfully contained under dry and hot conditions and tend to burn the entire timber type (Bruce Morrow, personal observation). This is especially true in stands impacted by the mountain pine beetle where the killed pine are now down or partly down, creating a continuous and heavy surface fuel load.

Forest fuel management, on a landscape scale, is designed to break up high wildfire threat stands to reduce the losses of entire timber types or ecosystems, thus reducing the wildfire impacts on other forest values. To protect large areas of coniferous forests, they need to be broken up to provide wildfire suppression opportunities to minimize wildfire impacts. To

significantly reduce the wildfire threats, there will be some impacts on other forest values. There needs to be a serious discussion with the land managers about the priority of forest fuel management and wildfire threat reduction activities in relation to other forest values and managing for other attributes on the land base. This discussion is ongoing after B.C. has suffered through its worst two wildfire seasons ever in 2017 and 2018.

The forest values and management strategies most directly impacted by forest fuel management activities include:

- Old Growth Management Areas – OGMAs attributes can be retained and enhanced while conducting properly planned and conducted forest fuel management activities. This is not a common practice at this time but will be necessary to implement this plan.
- Ungulate Winter Range – partial cut activities and long term controlled access, strategically placed, within a designated UWR area can have significant wildfire threat reduction benefits while only impacting (and potentially enhancing) a portion of the area.
- Visual Quality Objectives – forest fuel management activities visual impacts can be minimized through partial cut activities and hand treatments when sensitive sites are being treated.
- Recreational Opportunities – forest fuel management activities can enhance recreational opportunities by creating controlled access into presently inaccessible areas and providing roads and trails for multiple uses, to form the backbone of a trail and recreational area.
- Access Management – forest fuel management activities provide wildfire suppression opportunities through faster, more efficient access and egress, tie points for wildfire suppression activities, fuel breaks and burn off locations. This access often requires tight controls, seasonal closures and extensive public education to minimize impacts on other forest values.

RECOMMENDATION #3: Collaborate with MFLNRORD staff on innovative approaches to undertake forest fuel management.

4.4 Fire Regime

The populated portion of the AOI is dominated by the Interior Douglas Fir (IDF) biogeoclimatic zone and the Natural Disturbance Type (NDT) 4 fire regime. See Map 3, Appendix 1. This biogeoclimatic zone is characterized by a warm, dry climate regime with a long growing season during which moisture deficits are common. These forest ecosystems are included in the Natural Disturbance Type 4 fire regime where regular, low intensity, stand maintaining fires were the norm before European settlement and wildfire suppression activities. Stand initiating wildfires in these ecosystems occur every 150 to 250 years or more (Biodiversity Guidebook). This fire regime has been significantly impacted by wildfire suppression activities, allowing stand maintaining wildfires to burn more aggressively and have more impact on the forest ecosystem due to increased fuel loading created by a longer fire return interval.

The Montane Spruce (MS) and Engelmann Spruce Subalpine Fir (ESSF) biogeoclimatic zones are also present, mostly in the southern part of the AOI around Bralorne and at higher elevations. The NDT for the local biogeoclimatic zones are shown in the table below.

Table 4: Biogeoclimatic Zones and Related Natural Disturbance Types

Biogeoclimatic Zone	Natural Disturbance Types	General Conditions
IDF	4	Ecosystems with frequent

		stand maintaining events
MS	3	Ecosystems with frequent stand initiating events
ESSF	2	Ecosystems with infrequent stand initiating events

More information on Natural Disturbance Types in B.C. and fire regimes can be found at; http://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/biodiv/biotoc.htm

The following information was taken from the Biodiversity Guidebook for NDT3:

- Historically, these forest ecosystems experienced frequent wildfires that ranged in size from small spot fires to conflagrations covering tens of thousands of hectares. Average fire size was likely 300 ha in some parts of the Boreal White and Black Spruce (BWBS) biogeoclimatic zone, but went as high as 6000 ha in other parts of the zone where topographic features did not limit fire spread. The largest fires in the province occur in this NDT, often exceeding 100,000 ha and sometimes even 200,000 ha.
- Natural burns usually contained unburned patches of mature forest that were missed by fire. Consequently, these forests produced a mosaic of even-aged regenerating stands ranging in size from a few to thousands of hectares and usually containing mature forest remnants.
- There were also frequent outbreaks of defoliating insects and an extensive presence of root diseases caused by Armillaria and Phellinus (especially in the Interior Cedar Hemlock biogeoclimatic subzones). The impact of these infections on tree survival and stand structure ranged from low to severe. Tree mortality within mature forest remnants and regenerating stands resulted in dead trees, decaying logs, and canopy gaps. Riparian areas within the forest landscape provided special habitat characteristics not found in the upland areas.
- Mean return interval for disturbances is about 100 years for the wind-dominated Coastal Western Hemlock CWH and the fire-dominated Sub-boreal pine spruce SBPS and Boreal White and Black Spruce (BWBS) with deciduous species prominent. For the SBS and BWBS with coniferous species prominent, the mean fire return interval is about 125 years. The Engelmann Spruce sub-Alpine Fir ESSF, Interior Cedar Hemlock (ICH) and Montane Spruce MS units in this Natural Disturbance site NDT experience a mean disturbance return interval of about 150 years.
- The presence or absence of Douglas-fir does not influence the disturbance frequency, but determines the number and size of mature remnant stands that survive extensive crown fires to provide structural diversity. Douglas-fir is the most fire-resistant tree species in this NDT.

More information on the NDT3 can be found on:

https://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/biodiv/chap2b.htm

Fire exclusion and timber harvesting practices have significantly altered the forest ecosystems in the NDT3. Fire exclusion allowed mature pine stands to age and provide a good host for the mountain pine beetle. This has contributed to the large MPB epidemic that swept through the AOI in the 1980's and again in the 2000s. This resulted in extensive salvage harvesting followed by pine plantation establishment, creating a forest mosaic not unlike that resulting from

small fire events. These stands do not typically have an early seral stage dominated by deciduous shrubs and trees, as they do following a wildfire, but are planted to conifer trees with the deciduous component removed to speed free-to grow plantations.

4.5 Fire Weather Rating

Wildfire threat exposure within the AOI will vary throughout the fire season based on the fuels present, the moisture content of fuels, and fire weather conditions. Consequences of a threat may be realized when an ignition occurs during high or extreme wildfire conditions, as represented by Fire Danger Rating. A general indication of the likelihood of high fire threat to the community can be assessed by reviewing the level and frequency of high and extreme fire danger ratings typically experienced in the local area during the fire season.

Table 5: AOI Fire Weather Data Summary (2008-2018)

Wx Station	Moderate Average Days (Range)	High Average Days (Range)	Extreme Average Days (Range)	Maximum High and Extreme Days (year)
Gwyneth Lake	41.09	30.18	1.64	79 (2017)
Five Mile	42.82	56.45	11.45	130 (2017)
Lillooet	48.73	78.19	15.91	146 (2009)
French Bar	46.73	29.35	4.27	82 (2017)

The AOI fire weather data suggests that there are consistent and significant fire weather conditions in the area. The fire weather is concentrated in the July and August months as expected. The fire weather demonstrates the impact of elevation on the weather component of fire risk and the lower elevations have significantly higher high and extreme wildfire days.

4.6 Climate Change

In May 2013 the concentration of carbon dioxide in the atmosphere reached 400 parts per million, the highest since three million years ago (Rising Seas, National Geographic, 2013). This rise in greenhouse gases is expected to contribute to rising global temperatures and changes in weather patterns, moisture distribution and plant ecosystems. One of the main concerns relating to plant ecosystems is the expected rapid change in weather conditions. Plants will have to migrate to more suitable habitat in short periods of time. This will be very difficult for large plants with heavy seeds and narrow geographic ranges. The weather is expected to change faster than many plants can adapt. This could significantly impact the conifer species in the AOI.

Table 6: Predicted Impacts of Climate Change on Climate Variables and Forests in B.C. During the 21st Century

Expected Impact of Climate Change on Climatic Variables in B.C.

1 to 4 degree Celsius increase in surface air temperature with winter temperatures most affected
10 to 20% increase in annual precipitation with less snowfall and more rainfall
Reduced snow depth and an increase in the length of the growing season
Increasing the risk of summer drought and decreasing soil moisture
More thunderstorm activity
Predicted Impacts of Climate Change on B.C. Forests
Increase in frequency and severity of forest damaging events including forest fires
Higher than present treeline and northward migration of treeline
Major expansions of grasslands and shrublands
Disappearance of wetlands, shrinking lakes and changing hydrology
Increase in incidents of insects, disease outbreaks and spread of invasive species
New assemblages of species occurring in time and space
Overall loss of biodiversity
Changes in disturbance regimes and forest productivity
Forest migration into previously treeless landscapes
Reduced access for winter logging

The impacts of climate change on biogeoclimatic zones in the AOI area are likely to be:

- The biogeoclimatic zones that we know of today may also be shifted upwards in elevation and further north.
- Severe moisture stress and insect infestations. This may lead to increasing tree mortality on the lower slopes and drier areas dominated by Douglas-fir. This has already occurred in the Lodgepole Pine stands in the area.
- Climate change occurring at a rate faster than the forest can adapt, creating potentially catastrophic conditions. This could include high mortality of the present forest cover in a short period of time.
- Longer and more severe fire seasons.
- Increased wildfire starts from increased thunderstorm activity.
- Less available water for wildfire suppression activities.
- Stress on riparian area deciduous trees due to changing hydrology.
- Loss/alteration of lakeshore habitat.
- Changes in mule deer winter range.
- Additional stress on Species at Risk Act (SARA) listed species.
- Less opportunity to utilize heavy equipment on frozen ground for fuel management and timber harvesting to minimize site impacts.

4.7 Climate Change Impacts on Fuel Management/Wildfire Threat Reduction Activities in the AOI area

- The protection and enhancement of riparian/wetland areas must be a priority for any forest related activities.

- Tree mortality in the lower Douglas-fir stands can be expected to increase substantially.
- All fuel management activities must be designed to ensure stand resiliency through partial retention of all available tree species and size classes.
- Management for mule deer winter range should be conducted outside the presently identified winter range. This suggests more partial cut/select harvest type activities.
- Forest stands being managed specifically for wildfire threat reduction to communities and infrastructure are to be treated as required to reach the moderate wildfire threat goal while retaining biodiversity, stand resiliency and other forest values.
- Old Growth Management Areas located within the AOI should be moved elsewhere to allow for fuel management activities in these stands where required or alternatively allow for fuel management activities that decrease wildfire threats but still retain the OGMA attributes being managed for.
- Modify silvicultural practices and standards to allow for more deciduous trees in harvested areas to encourage a mixed stand over time.
- Develop access into and create wildfire suppression openings within areas of continuous conifer stands regardless of other forest management strategies in place.

RECOMMENDATION #4: Encourage the MFLNRORD to develop locally relevant fuel management standards for acceptable post-harvest conditions for WUI areas.

4.8 Provincial Strategic Threat Analysis (PSTA)

The PSTA data is a worthwhile reference tool for the AOI wildfire threat assessment (see Map 4A, Appendix 1). The historical wildfire and structure layers are valuable.

4.9 Spotting Impact

Spotting impacts are most severe in mature conifer types with lower crown base heights or ladder fuels that allow for consistent candling and crowning activity. Spotting potential is greatest downwind of candling and crowning forests, thus the south, southwest and western perimeters of the Quesnel developed areas are most likely to be exposed to spotting from approaching wildfires. See Map 4B, Appendix 1.

4.10 Head Fire Intensity

Table 7: Head Fire Intensity Classes and Associated Fire Behaviour

PSTA - HFI Class	Fire Intensity kW/m	Fire Intensity Class	Flame Length (meters)	Likely Fire Behaviour
1	0.01 – 1,000	2	< 1.8	Smouldering surface fire
2	1,000.01 – 2,000	3	1.8 to 2.5	Moderate vigour surface fire
3	2,000.01 – 4.000	4	2.5-3.5	Vigorous surface fire

4	4,000.01 – 6,000	5	3.5 to 4.2	Vigorous surface fire with occasional torching
5	6,000.01 – 10,000	5	4.2 to 5.3	Vigorous surface fire with intermittent crowning
6	10,000.01 – 18,000	6	12.3 to 18.2	Highly vigorous surface fire with torching and/or continuous crown fire
7	18,000.01 – 30,000	6	18.2 to 25.6	Extremely vigorous surface fire and continuous crown fire
8	30,000.01 – 60,000	6	>25.6	Extremely vigorous surface fire and continuous crown fire, and aggressive fire behaviour
9	60,000.01 – 100,000	6	>25.6	Blowup or conflagration, extreme and aggressive fire behaviour
10	≥ 100,000	6	>25.6	Blowup or conflagration, extreme and aggressive fire behaviour

NB: The descriptions in this table will vary by fuel type and should only be used as guidance for expected fire behaviour.

Head fire intensity is a very good indicator of wildfire suppression failure, candling and crowning potential, rate of spread and overall wildfire threat. The head fire intensity based on fuel type will be consistently underestimated in fuel types that do not recognize the downed pine surface fuel load. This will include many of the mixed forest types which had a significant component of lodgepole pine before the pine beetle epidemic. Head fire intensity is always greatest when wind and slope align. This suggests locations like Gun Lake Road, Marshall FSR, Gun Creek Road the steepest south aspects and mountainous terrain in the area have the greatest potential for high head fire intensity in a wildfire event. See Map 4C, Appendix 1.

4.11 Fire History

The fire history in the AOI suggests that wildfires are either a spot fire event with minimal impacts or a relatively significant wildfire event. This is consistent with the NDT3 and 4 fire regimes. The wildfire events are concentrated mostly north of Carpenter Lake on the south and west aspects. The area is dominated by the Tyaughton fire of 2009, a largely stand initiating event that extended from Tyaughton Lake to the west edge of the Marshall Lakes drainage in the NDT 4 identified IDF biogeoclimatic zone. This suggests a 150 to 250 year wildfire event. Wildfire exclusion policies and climate change may be changing the return interval and especially the wildfire intensity in these NDTs moving forward. Timber harvesting and silviculture activities have likely reduced the average wildfire size in the area by breaking up the continuous conifer forest cover required to create large wildfires. Significant terrain features limit wildfire spread south of Carpenter Lake. Large wildfires don't develop beyond a specific drainage or aspect. See Maps 4D and 5, Appendix 1.

4.12 Local Wildfire Threat Assessment

The wildfire threat assessment process used for the SLRD Area A Community Wildfire Protection Plan followed the 2012 Wildland Urban Interface Wildfire Threat Assessments in B.C. (the Guide) process. The threat worksheet used for the field assessments is a provincial form designed to quantify wildfire threats over all the forest ecosystems found in B.C. The worksheet has some limitations for quantifying specific ecosystems and requires some local 'fine tuning' to reflect specific threats found in this area. Ninety-eight worksheets were completed within the Area of Interest. The worksheet appears to very closely quantify the wildfire threats in the south facing Douglas-fir stands and the Tyaughton fire area. The challenging ecosystems included;

1. Dead and down pine – the worksheet does not accurately reflect the very high surface fuel loading in many stands with a dead pine component. The worksheet consistently underestimates the wildfire threat in these stands.

2. Twenty to thirty-year-old conifer plantations – There are numerous twenty plus year old conifer plantations, especially in the Bralorne and north Tyaughton areas. These plantations are typically very high in crown closure and with a low crown base height. This leads to an overestimation of the wildfire threat in these plantations as these healthy stands do not burn very aggressively, tend to have low surface fuel loads from vegetation, often deciduous brush understories and the surface is well shaded, slowing drying initial fire spread and narrowing the burn window. The wildfire threat in these plantations does vary with condition of the previous stand (pine salvage blocks tend to have the highest surface fuel loads post-harvest) and the intensity the site preparation work completed. It appears that timber value, most notably pulp wood prices, also play a factor in harvesting intensity and post-harvest debris. There is typically very minimal crown fire potential in these green healthy stands. Many have old Pl surface fuels which are partly decayed but will still burn hot enough to girdle and kill the surrounding trees but unlikely to candle. The plantations less than twenty years old are still fairly open and are unlikely to produce aggressive wildfire behaviour. At 20-40 years old the crown closure is very high and lower branches on the conifers are dying creating a vertical dead fuel load which increases the potential for higher flame heights and increased wildfire behaviour. The raising crown height allows more sunlight to the surface, often promoting pinegrass and creating drier surface conditions. This is likely to increase over time and after fifty years old these stands are likely to produce mature conifer crown fire behaviour. The potential for aggressive wildfire behaviour in the conifer plantations increases with slope and on west and south aspects which are the driest. Those plantations with a significant deciduous brush component are more moderate.

3. The historical fire weather and wildfire starts and sizes used on the worksheet may not reflect the present and future weather in the AOI area.

A change in the fuel management funding criteria that allows for areas not rated as high and extreme to be funding eligible, with reasonable rationale, is a positive step towards managing all serious wildfire issues in the area. An attempt was made to quantify wildfire threats within the first 200 meters of private land with structures throughout the Area of Interest. This was achieved in a majority of locations but not all. Private land barriers and limited access to many sites did not allow for full ground truthing of all the Wildland Urban Interface boundaries. Outside of the immediate Wildland Urban Interface (WUI) area, the forest ecosystems were sampled to attempt to quantify wildfire threats in all the fuel complexes found in the area. The most common fuel complexes sampled included, in no particular order;

- aspen stands,

- mixed conifer plantations from 20-30 years old,
- Dry pure Douglas-fir stands,
- Douglas-fir stands, with patches of dead Lodgepole pine,
- 2009 Tyaughton fire stand initiation sites,
- Past fuel management areas on the southwest corner of Gun Lake,
- Disturbed mix conifer and deciduous stands
- Clearcuts less than five years old.

The dead and down pine component on these stands greatly impacts on the fire intensity, initial attack failures, fire holdovers and other wildfire suppression and wildfire threat challenges. These types of stands are only a serious wildfire threat under extreme wildfire weather conditions, similar to those exhibited in the summer of 2017 and 2018. The wildfire threat assessment also does not fully reflect the wildfire threats found in the deciduous dominated sites during the early spring when very short term, aggressive surface fires can occur between the snow free period and the spring green up, when the deciduous trees are still dormant and in a low moisture content state.

The private land has not been included in the wildfire threat assessment, due to funding stipulations, except to focus the proposed Crown land treatments on the highest wildfire threat and highest density structure areas.

The two kilometer buffer placed on the private land in the AOI does not fully account for landscape level fuel treatments that could contribute to wildfire threat reduction. As discussed previously, landscape level wildfire threats are significantly mitigated by variable terrain and aspects, changes in elevation, large water bodies and the Tyaughton fire.

There are five general groupings of private land and WUI challenges with the AOI. The overall wildfire threat to each community is discussed here.

Bralorne

At first assessment, Bralorne appears to be the community most at risk to wildfire. There are some local challenges. The Cadwallader River draw runs along the western edge of town, there are buildings close to the lip of the draw and the mine is in the draw itself. The draw is steep, with broken terrain and very little access, wildfire suppression in the draw in the Bralorne area is highly unlikely. But an approaching wildfire must move either from the north, down the draw, or south up the draw, not a typical fire progression. But very extreme slopes and no access means Bralorne is easily cut off from its main access road in the event of a wildfire north of the community. A secondary access onto the Hurley FSR is very important.

On the positive side there has been lots of disturbance around town from mining activity and deforestation to support mining and construction, especially on the south end. Multiple wildfires in the area were noted on the Fire History map, most likely related to land clearing and development. Aspen trees have done very well on the disturbed areas and in the openings created by the pine beetle mortality.

Gun Lake

Past fuel management activities in the area have focused on the southwest corner of Gun Lake. Slope and prevailing winds suggest that Gun Lake is most likely to be impacted from a wildfire

starting on the Gun Lake Road hill or down towards Downton Lake, and spreading upwards into the community. Heavy past spruce budworm and Douglas-fir beetle impacts have caused mortality in a significant component of the Douglas-fir veterans on the lower north side of the lake. This will create safety issues, and future heavy surface fuel loads, along Gun Lake Road West and the powerlines along the road. A majority of the development in Area A is located along Gun Lake. A majority of the lakeshore is developed, most heavily on the southern side and western end. The community is accessed by three different methods. The paved access is along Downton Lake, climbing steeply up to the area. The lake can also be accessed from Slim Creek FSR at the eastern end that leads to Carpenter Lake and also by a road which crosses the hill between Goldbridge and the lake and connects onto Lakeshore Road along the southern side of the lake about half way down the lake. Predominant winds come from the southwest, following the paved access road to the lake. There has been some fuel management and recent timber harvesting in the area that partly breaks the fuel continuity in this area. Heavy timber on the private land in this area provides wildfire access into the community. Recent pine beetle activity in the hand treatment areas along Gun Lake Road will reduce the effectiveness of the work done there.

Alternately, a wildfire could establish on the north side of the lake (south aspect) and push down onto the lakeshore structures during the evening downslope wind event common in these mountains.

A multi-year spruce budworm infestation on the Douglas-fir in the Gun Lake area has weakened many of the veteran firs in the area. A significant number of the trees along the northern shore (the driest area) succumbed to Douglas Fir Beetle in the last three years, creating a largely dead stand of large Douglas-fir with a thick conifer understory. This area has a very high wildfire hazard and the dead trees will pose a safety risk to both people using Gun Lake West Road and the hydro transmission lines along the road. Long term, the Douglas-fir trees will create a very high surface fuel load in the area if not properly managed. New pine beetle attack in the southwest corner of the lake, even in the fuel treated areas, suggesting more hand treatments in pine types ineffective or impractical at this time. A volcanic ash layer makes area very dry due to lack of water retention. This minimizes grasses and herbs while promoting deciduous shrubs that have deeper root systems, biggest benefactor is white rhododendron with willow and vaccinium also very common.

The flats surrounding the airstrip at the east end of the lake are covered with continuous twenty year old lodgepole pine with very little surface cover. This forest type extends all the way to Gun Creek. At present, this forest will not support an aggressive wildfire but mortality in the stand or the introduction of pinegrass on some other deeper or continuous surface fuel will create a very serious wildfire issue. The pine on the private land adjacent is denser, with dead lower branches and is a serious concern.

Goldbridge

Goldbridge is relatively well positioned to resist wildfire impacts at the bottom, of a north aspect with a major river drainage to the west. Pine beetle in the numerous dense pine stands above the town suggest a growing wildfire hazard long term as these trees die and fall over. Fires to approach town would have to spread west along north aspect or move downhill through pine stands. Not your standard wildfire spread profile in this area, although strong outflow winds do occur during the fire season.

Tyaughton Lake and Gun Creek Road

The Tyaughton fire removed the conifer stands east of Tyaughton Lake. Timber harvesting on the southern end of the lake has greatly altered the coniferous forests there. The volcanic ash surface cover is easily disturbed, and harvesting has left very patchy surface fuels in this area. There are still multiple leave patches with high mortality and significant surface fuels that could

cause a wildfire problem. Recent strip harvesting along the west side of Tyaughton Lake has provided a reasonable fuel continuity break for the lakeshore structures and resort area. Gun Creek Road is a linear development with acreages surrounded north and south by dry forest ecosystems dominated largely by lodgepole pine with new pine beetle attack. There is coniferous fuel continuity from Gun Creek Road towards Tyaughton Lake. North of Tyaughton Lake is much wetter, with the valley bottom broken by young plantations. The upper slopes in this area are inaccessible due to extreme terrain, the tops of the mountains are alpine tundra.

Marshall Lakes
The first five kilometers of the Marshall Lake access road follows a steep canyon of dry Douglas-fir. No ground wildfire suppression activities could be undertaken in this area. A wildfire establishing itself in the lower canyon would likely be pushed north with the prevailing winds and a fire created wind. The valley opens up slightly at the 76 K road board. This creates a wider riparian area in the valley bottom with deciduous trees and dense deciduous brush that would prevent aggressive wildfire spread. The eastern side of the valley is very steep and largely inaccessible, dominated by open grown Douglas-fir stands with low crowns, ideal for crown fire behaviour and fast wildfire spread. The western side of the valley has an east to northeast aspect and grows the best trees in the area. Timber harvesting is a common feature in this area, breaking the mature conifer continuity with three passes of timber harvesting. New cutblocks, mostly clearcuts with veteran Douglas-fir reserves, wrap themselves along the edges of 20-30 year old plantations. There is very little fuel continuity in this area until past Marshall Lake. The Tyaughton wildfire of 2009 burned the extreme western edge of the drainage on the steep southwest aspects above Carpenter Lake. The fire largely stopped at the height of land but in numerous places the fire spotted into the valley bottom and burned back uphill to the top of the hills, further increasing the breaks in fuel continuity. If the fire had crossed the valley onto the east side, the situation in the valley would have been quite different. Small scale harvesting is occurring on the eastern side of the valley, with new roads stretching from the valley bottom to two-thirds the way up the valley. Extensive new cutblocks have been developed in the northeast corner of the study area.

4.13 Fuel Type Verification

The following table shows the fire behaviour potential of the Fire Behaviour Prediction (FBP) fuel types grouped into 4 categories based on their relevance to a wildfire threat assessment (provided 2018 CWPP template).

Table 8: Fuel Type Categories and Crown Fire Spot Potential

Fuel Type Categories	Fuel Type - Crown Fire/ Spot Potential
1: C1, C2, C4, M3-M4 (>50% C/DF)	High
2: C3, C7, M3-M4 (<50% C/D) M1-M2 >50% Conifer	Moderate
3: C5, C6, O1a/b, S1- S3[1] M1-M2 (26-49% Conifer)	Low
4: D1, D2, M1-M2 (<26% Conifer)	Very Low

The fuel typing provided in the provincial data is the best product available and has been reproduced as provided (Map 6, appendix 1). The fuel typing was not used for wildfire threat assessments or any other assessment or planning functions. It should not be used for fire modelling or wildfire threat assessments in the Wildland Urban Interface.

The Canadian Forest Fire Danger Rating System (CFFDRS) fuel typing system was never intended for use as a determination of wildfire threat or risk as described in the 2017 CWPP Guide. The biggest challenge is that there are no fuel types within the CFFDRS that accurately reflects many of the forest ecosystems found in B.C. Fuel type verification cannot be completed as described.

4.14 Proximity of Fuel to the Community

Fuel closest to the community usually represents the highest hazard. The recommended approach is to treat fuels to achieve a desired level of hazard reduction, from the value or structure outward, ensuring mitigation continuity. Untreated areas between treatment areas and the value or structure may allow a wildfire to build in intensity and rate of spread, which can increase the risk to the value. To capture the importance of fuel proximity in the local wildfire threat assessment, the WUI is weighted more heavily from the value or structure outwards. Fuels adjacent to the values and/or structures at risk receive the highest rating followed by progressively lower ratings moving out.

The local wildfire threat assessment process subdivides the WUI into 2 areas – the first 200 meters and 201 to 500 meters. These zones provide guidance for classifying threat levels and subsequent priorities of treatments (see Table 8). The maps provided with this CWPP show the two kilometer WUI buffer as provided in the PSTA data. There have been no significant changes in structure density of developments that would change this boundary.

Table 9: Proximity to the Interface

Proximity to the Interface	Descriptor*	Explanation
WUI 0-200	(0-200 m)	This Zone is always located adjacent to the value at risk. Treatment would modify the wildfire behaviour near or adjacent to the value. Treatment effectiveness would be increased when the value is FireSmart.
WUI 500	(201-500m)	Treatment would affect wildfire behaviour approaching a value, as well as the wildfire's ability to impact the value with short- to medium- range spotting; should also provide suppression opportunities near a value.

** Distances are based on spotting distances of high and moderate fuel type spotting potential and threshold to break crown fire potential (100m). These distances can be varied with appropriate rationale, to address areas with low or extreme fuel hazards.*

Wildland Urban Interface forest fuel management activities should always target from the values being protected outwards as the first priority. Continuous treatment, from the FireSmart immediate treatment around structures and values, to the forest fuel management activities on crown land provides the most effective wildfire threat reduction. The private landowner plays a big part in this process. Conducting forest fuel management activities on crown land can only be effective if the private land around the structure has FireSmart principles applied to it. The larger the untreated gap between the treated forest and the structure, the less effective the overall threat reduction work and the less defendable the value.

In general, fuel management treatments on forested land should be a minimum of two tree lengths in width to allow for proper danger tree management. The actual width of the treatment will be very site specific. The main considerations are economics, treatment capacity, wildfire threat, continuity of forest fuels, intensity of treatment, community buy-in and number of structures being protected. Treatments may also be conducted in phases such that the first 100 meters around values are completed in the first pass to provide as many areas as possible with some wildfire threat reduction, then further widening the treatments over time as capacity and funding allow.

Landscape level fuel treatments are most effective when they create access into, and break the continuity of, coniferous dominated forest land. The type and intensity of the fuel break is highly variable and very site specific. The style and intensity of the treatment often depends on the other forest values being managed for in the area. Low intensity treatments over large areas can often be the most effective treatment as it minimizes the impacts on other forest values, compared to high intensity treatments. It also provides the most options for wildfire suppression.

4.15 Summary of Fire Risk Classes

Low (Green): The combination of the local fuel hazard, weather influences, topography, proximity to the community, fuel position in relation to fire spread patterns, and known local wildfire threat factors make it a lower potential for threatening a community. These stands will support surface fires, single tree or small groups of conifer trees could torch/ candle in extreme fire weather conditions. Fuel type spot potential is very low, low risk to any values at risk.

Moderate (Yellow): The combination of the local fuel hazard, weather influences, topography, proximity to the community, fuel position in relation to fire spread patterns and known local wildfire threat factors make it possible that a wildfire in this area would threaten the community. Areas of matted grass, slash, conifer plantations, mature conifer stands with very high crown base height, and deciduous stands with 26 to 49% conifers. These stands will support surface fires, single tree or small groups of conifer trees could torch/ candle. Rates of spread would average between 2-5 meters/ minute. Forest stands would have potential to impact values in extreme weather conditions. Fuel type spot potential is unlikely to impact values at a long distance (<400m).

High (Orange): The combination of the local fuel hazard, weather influences, topography, proximity to the community, fuel position in relation to fire spread patterns, and known local wildfire threat factors make it likely that a wildfire in this area would threaten the community. This includes stands with continuous surface/ crown fuel that will support regular torching/ candling, intermittent crown and/or continuous crown fires. Rates of spread would average 6 - 10 meters/ minute. Fuel type spot potential is likely to impact values at a long distance (400 - 1000m).

Extreme (Red): The combination of the local fuel hazard, weather influences, topography, proximity to the community, fuel position in relation to fire spread patterns, and known local wildfire threat factors make it very likely that a wildfire in this area would threaten the community. Stands with continuous surface/ crown fuel and fuel characteristics that tend to support the development of intermittent or continuous crown fires. Rates of spread would average >10 meters/ minute. Fuel type spot potential is probable to impact values at a long distance (400 -1000m or greater). These forest stands have the greater potential to produce extreme fire behaviour (long range spotting, fire whirls and other fire behaviour phenomena.

SECTION 5: Risk Management and Mitigation Factors

The intent of this section is to outline the strategies the community can put into practice to reduce the risk and the impact of a wildfire. Risk mitigation choices can vary by community, fuel type, ecology, hazard, terrain factors, land ownership, other unique local risk factors, Local Government and First Nation capacity, and/or public acceptance.

5.1 Forest Fuel Management

The intent of this section is to propose more detailed work on the highest local risk areas of the WUI and design logical treatment units for future prescription development and operational fuel treatments within the highest risk areas. See Map 8, Appendix 1.

Table 10: AOI Fuel Treatment Summary

FTU #	Total Area	Priority	Fuel Break Type	Local Wildfire Threat	Wildfire Threat Plot	Overlapping Values/ Constraints	Treatment Type	Rationale
1	22.8	10	Interface Fuel Break	High	Yes	None Identified	Harvest	Value Protection
2	18.6	18	Interface Fuel Break	High	Yes	None Identified	Harvest	Structure Protection
3	64.0	16	Landscape Fuel Break	High	No	None Identified	Harvest	Structure Protection
4	32.9	17	Landscape Fuel Break	High	No	None Identified	Harvest	Structure Protection
5	13.3	20	Interface Fuel Break	High	Yes	Rec Site	Hand	Structure Protection
6	3.4	9	Interface Fuel Break	High	Yes	None Identified	Hand	Value Protection
7	19.8	10	Interface Fuel Break	High	Yes	None Identified	Hand	Value Protection
8	56.9	21	Landscape Fuel Break	High	No	None Identified	Harvest	Value Protection
9	16.7	12	Landscape Fuel Break	High	Yes	None Identified	Harvest	Access Protection
10	77.9	11	Interface Fuel Break	High	Yes	None Identified	Harvest	Structure Protection

11	9.2	1	Primary Fuel Break	High	Yes	Pinnacles Prov Park	Harvest	Structure Protection
12	52.4	2	Interface Fuel Break	High	Yes	None Identified	Harvest	Structure Protection
13	5.1	13	Interface Fuel Break	High	No	None Identified	Hand	Structure Protection
14	9.1	14	Interface Fuel Break	High	Yes	None Identified	Hand	Structure Protection
15	3.6	15	Interface Fuel Break	High	No	None Identified	Hand	Structure Protection
16	24.7	22	Interface Fuel Break	High	No	None Identified	Hand	Structure Protection
17	20.5	23	Primary Fuel Break	High	No	None Identified	Hand	Structure Protection
18	5.7	24	Primary Fuel Break	High	Yes	None Identified	Hand	Structure Protection
19	9.2	6	Primary Fuel Break	High	No	None Identified	Hand	Structure Protection
20	23.9	4	Interface Fuel Break	High	Yes	None Identified	Hand	Structure Protection
21	2.9	7	Interface Fuel Break	High	No	None Identified	Hand	Structure Protection
22	3.7	5	Interface Fuel Break	High	No	None Identified	Hand	Structure Protection
23	5.9	3	Interface Fuel Break	High	Yes	None Identified	Hand	Structure Protection
24	24.7	8	Interface Fuel Break	High	Yes	None Identified	Harvest	Structure Protection
TOTAL 526.7 ha								

5.2 Wildfire Threat Reduction Options

Reducing the wildfire threat to existing communities, homes, and to future developments can be a very complex planning process. All plans or prescriptions for wildfire threat reduction must be site specific, aesthetically pleasing, economically feasible and environmentally sensitive.

The objective of wildfire threat reduction efforts should not be to stop all fires, which is not realistic or achievable. The objectives should be:

- to alter wildfire behaviour on the forested land adjacent to developments, through forest fuel management, to greatly reduce the potential for house and structure losses,
- to create safe access for wildland fire crews to more efficiently and effectively control wildfires, and
- to construct and maintain houses that are designed to withstand a wildfire.

Table 11: Recommended Wildfire Hazard Reduction Guidelines for Each Wildfire Hazard Class

Wildfire Behaviour Threat Class[1]	Forest Fuel Description[2]	Wildfire Behaviour	Maximum Fire Intensity Rank	Wildfire Threat Reduction Requirements [3]
Low	None	Smoldering	1	None
Moderate	Grass/Sage, fuel reduced forested areas, Deciduous forest - Surface Fuels Only	Surface Fires	2 - 3	Priority Zone 1 and 2 (as required)
High	Conifers dominated stands and Surface Fuels	Candling/Crown Fires	4 – 5	Priority Zone 1 and 2 and 3 (as required)
Extreme	Continuous, Dense Conifers and Surface Fuels	Aggressive Crown Fires	4 - 6	Priority Zone 1, 2 and 3 (as required)

FireSmart Interface Zones

1 *Wildfire Hazard Class for Priority Zone 2 from FireSmart*

2 *See full definitions for each Priority Zone 2 Hazard Class*

3 *Priority Zones from FireSmart*

5.2.1 Forest Fuel Modification

Wildfire behaviour is based on three factors.

- Forest Fuel – the woody material available to burn, configuration and continuity
- Weather – daytime temperature, the amount of drying and wind
- Topography – the lay of the land, slope, aspect and terrain

Of these three factors, only the forest fuels are within our control. Reducing the volume and continuity of the forest fuels can reduce the intensity, maximum behaviour and the rate of

spread of a wildfire, thus reducing the wildfire threat. The objectives for forest fuel management should be:

- Reducing the crown fire potential,
- Reducing the surface fire intensity,
- Improving wildland fire suppression opportunities through better access, better site lines and fewer danger trees,
- Maintaining bio-diversity and wildlife habitat, and
- Minimizing site impacts during fuel management activities.

Other important benefits include better firefighter safety and greater effectiveness of aerial wildfire suppression resources.

There are two basic approaches to wildfire threat reduction or forest fuel management. The chosen method will depend on numerous site-specific factors.

5.2.2 Timber Harvesting/Mechanical Fuel Management Treatments

Timber harvesting in interface areas can be a very effective management tool. In large areas of commercially viable forest, a form of timber harvesting to remove a portion of the stand is the most logical option. The wildfire threat reduction work can be self-funding and a valuable resource gets properly utilized. The intensity and method of harvesting will depend on the topography, trees species, forest health, wildfire threat, community acceptance and a variety of other site-specific factors. Clearcut harvesting, while usually not a very popular option for any community, may be the only solution in pure pine or spruce forest stands decimated by bark beetles.

Where necessary, a form of partial or selective harvesting is better accepted. Removal of targeted tree species, based on forest health, wind firmness, diameter limits and a wide assortment of other factors is a common practice.

Harvesting for fuel management, or wildfire threat reduction, is significantly different from conventional commercial harvesting. The emphasis should be directed towards the final product left behind in the forest, not necessarily the timber removed from the site. This can result in additional costs. The post-harvest fuel loading standards, where cleanup is required above and beyond the standard harvesting opening can also significantly increase costs.

5.2.3 Hand Crew Forest Fuel Management

In immature, inaccessible, steep, highly visible, sensitive and small patches of forestland where harvesting is not an option, wildfire threat reduction efforts can be completed without timber extraction. Treatments can be carried out by hand, with equipment or a combination of the two. These treatments are rarely self-funded and require a funding source for completion. Treatments can vary in cost from $2800 to $7000 per hectare. Hand crew treatments are effectively an understory treatment where the main canopy stays in place but the suppressed and poorly formed understory conifers are removed, the crown base height is raised through pruning and surface fuels are reduced. These treatments are often not as effective as harvesting activities and usually need to be wider to provide a similar amount of wildfire threat reduction.

Reducing the amount and configuration of the forest fuels consists of five basic activities.

- Danger Tree Removal

Dead and dangerous trees that will add significantly to the future surface fuel loading should be

targeted for removal. Dead trees that can reach private land or access roads must be removed before fuel management activities commence. Retention of high value wildlife trees must be considered.

- Spacing or Thinning

Spacing, thinning or tree removal involves the reduction of the number of stems and associated branches and needles within the forest canopy. There are a number of different techniques. The spacing treatment necessary is dependent on many factors including; tree species, forest health, age of the stand, stand structure and other factors. Spacing treatments must be designed on a site-specific basis. In some cases, small scale forest harvesting may be the best method to space the area and cover the costs of the treatment. Any forest harvesting in interface areas must be well planned and supervised.

Spacing activities in multi-layered stands involves the removal of the weakest trees on site. These trees have usually been outcompeted, damaged or suffered forest health issues and are falling out of the stand. Caution must be taken to ensure the multi-aged characteristics of the stand are maintained. This is often referred to as 'spacing from below', or forest health style spacing. This usually increases the crown base height and creates a healthier, more vigorous forest. In relatively even aged stands, spacing the trees so the crowns are separated by a set average distance is a reasonable treatment option. This inter-crown distance should be increased on slopes. This spacing distance is also dependent on crown base height and the amount of surface fuel remaining after the site treatment.

- Pruning

Pruning involves the removal of the lower live and dead branches of coniferous tree species to separate the crown fuels from the surface fuels. By raising the Crown Base Height (CBH) within the stand, it will be more difficult for a surface fire to spread upwards into the tree canopy where it will spread quickly, greatly increase the wildfire intensity and create ember showers, or spotting, onto adjacent structures. The required height of the pruning is variable depending on; canopy closure, tree species, topography and amount of surface fuels remaining after the site treatment.

One commonly used convention for pruning is a three meter crown base height. This is based as much on the crew's reach as on crown fire initiation concerns. Again, there is no one prescription to manage all situations. Pruning must take into account the tree height and amount of live crown. The tree must be left a certain portion of its live crown to remain healthy and vigorous.

- Surface Fuel Reduction

Surface fuel reduction involves the collection of the accumulated felled, spaced and pruned material, and sometimes additional downed and dead material that will contribute to wildfire spread. Collection of the fine (small diameter) fuels is the priority as these fuels dry out quickly, ignite easily and are the main contributor to surface fire spread on most sites. Surface fuel treatments are often considered the most important component of any fuel modification activities and the most expensive. Overly aggressive surface fuel clean up can cause serious environmental impacts including erosion, introduction of noxious weeds and loss of wildlife habitat.

- Debris Removal

A fuel management project is not complete until the created debris is removed from the site. This can be accomplished through open burning, chipping and spreading or removal from the site. Open burning is almost always the least expensive option and necessary on steep sites

with poor access but is discouraged close to communities due to air quality issues. Removing the debris from the site is far most costly but done properly creates a wood product for use.

Hand crew techniques should only be employed on the forested land adjacent to homes or new developments in all High and Extreme wildfire behaviour threat class areas to reduce the wildfire threat. Landscape level treatments should be mechanized operations. No one prescription will solve all wildfire threat problems. All prescriptions must be site specific and developed by an experienced individual.

5.2.4 Other Factors to Consider When Conducting Fuel Management

The 'All Things Considered' approach is necessary when conducting any forest management activity; fuel management is no exception. Fuel management plans and prescriptions must address other forest values that could be impacted by the planned treatments. The other values include: visuals, water, wildlife habitat, site stability, noxious weeds, access, biodiversity, Old Growth Management Areas and endangered species.

A widely spaced and pruned forest will not support crown fires.

5.2.5 Implications of Wildfire Threat Reduction Work

Reducing wildfire threats through the reduction of the forest fuels sounds simple enough, but forest fuel treatments can have a wide range of implications. Fuel treatments can have both positive and negative effects on wildfire threats.

Mechanized timber harvesting as a stand-alone treatment can be very effective in reducing crown fires but usually results in a significant increase in finer surface fuels composed of needles, limbs and tops. This surface debris can increase surface fire intensity.

Hand crew treatments of dead and danger tree removal, spacing, pruning and surface fuel removal techniques can create lower fuel loaded, more open forest stand. Open forest stands:

- allow more light to reach the surface, often drying out the site or allowing more grass, herb and shrub growth, creating heavier, more continuous surface fuels
- can lengthen the fire season on the site by allowing the site to dry up faster and stay dry longer,
- allow more wind to move through the stand and along the surface, possibly increasing the rate of spread of surface fires, and
- often have lower relative humidity in the summer months from the increased sunlight and temperatures.

The positive effects of wildfire threat reduction through forest fuel reduction include;

- lower probability of crown fires due to the more open forest canopy and higher crown base height,
- lower intensity surface fires from the reduced forest fuels,
- easier and safer access for wildland firefighters, and
- more effective aerial fire control efforts with air tankers.

In general, properly planned and implemented forest fuel reduction work reduces the crown fire potential and overall intensity of wildfires within the treatment area. This will increase the survivability of the trees in the stand and of adjacent homes and structures. Forest fuel reduction work can also increase the dryness on the site, and allow more wind to reach the surface, creating conditions for fast moving, low intensity wildfires to spread.

5.2.6 Effectiveness of Hand Fuel Management Treatments

Hand crew treatments are usually the preferred fuel management option, compared to mechanized harvesting and treatments, immediately adjacent to structures because of:

- Better visuals and aesthetics,
- Limited impact on recreational opportunities and established trails,
- Less overall site impacts and soil disturbance, minimizing noxious weed potential impacts, and
- Better protection of wildlife habitat, biodiversity and water resources.

Hand crew completed fuel management treatments usually consist of a combination of danger tree removal, spacing, pruning and surface fuel removal, at varying intensities. The main forest canopy is often kept in place. Much of the work on Crown land is often restricted by merchantable timber utilization standards, where only live trees below the utilization standards can be cut and removed.

This type of treatment can be very effective for small fires that start in the community or within the treatment area. Good visuals, reduced danger trees and ladder fuels can allow safe, fast, aggressive wildfire suppression action within the managed area. Initial attack success can be far higher under these circumstances. Hand crew treatments can be less effective in a landscape level wildfire event that sweeps into the treatment area from the unmanaged forestland. A well-developed Rank 5 or 6 wildfire (continuous crown fire) that spreads into a hand treatment area surrounding a community, may easily spread quickly and aggressively through all or a portion of the hand treated fuel management treatment area, providing only minimal safety to the community. The aggressiveness of the treatment will also need to determine the width of the treatment. A lower intensity treatment will have to be wider than a more aggressive treatment to be as effective.

Hand crew fuel management treatments are most effective when supported by forest harvesting along the treatment area perimeter. If the harvesting can reduce the wildfire intensity significantly before the wildfire enters the hand treatment areas, the effectiveness of the hand

treatments is significantly increased.

5.3 FireSmart Planning & Activities

The intent of this section is to summarize the current level of FireSmart activities that have been completed, are under implementation, and to identify areas that are FireSmart, or have received FireSmart recognition through the FireSmart Canada Recognition Program, and to identify future FireSmart activities within the AOI.

5.3.1 FireSmart Landscaping

Separating homes and other structures from the forest environment involves establishing FireSmart landscaping around the structure so a wildfire cannot spread directly up to the structure. Direct radiant and convective heat can ignite structures. Creating a barrier between the structure and the combustible material will greatly increase structure survivability in the event of a local wildfire. FireSmart landscaping can include a wide variety of plants and surface covers, as long as they do not support combustion. FireSmart landscaping is referred to as Priority Zone One in the FireSmart manual and is discussed in detail in Chapter 3 of that publication.

A minimum of 10 meters of FireSmart landscaping from the structure to unmanaged forested land is recommended. This distance should be increased with increasing slopes and the extent of the wildfire threat in the adjacent forest. For example, a 10-meter buffer would likely be sufficient on flat ground adjacent to an unmanaged field of matted grass. The distance should be increased greatly, or combined with other treatments in an area of continuous, dense, tall coniferous trees on a steep (greater than 20%) slope. FireSmart landscaping alone is suitable for structures adjacent to Low and Moderate (relatively flat ground) Wildfire Behaviour Threat Class areas as identified on the maps attached to this report.

FireSmart landscaping alone is not enough to increase house survivability in the areas identified as high and extreme Wildfire Behaviour Threat Class areas in this report. The high and extreme wildfire behaviour threat class areas will need much wider FireSmart landscaping or some other type of forest fuel modification on the adjacent forest lands. Landowner awareness and buy-in are the only options for reducing the wildfire hazard to their own property. FireSmart information needs to be distributed to the private landowners in established developments with unacceptably high wildfire threat.

5.3.2 FireSmart Construction

Building construction materials and design are outside the scope of this report but are discussed in detail in the FireSmart manual, Chapter 3. Improving structure survivability through forest fuel management has two key components; one, separating the structures from the forest with FireSmart landscaping, and two, reducing or modifying the forest fuels in the surrounding forest to reduce the wildfire behaviour.

5.3.3 Key Aspects of FireSmart for Local Governments

The intent of this sub-section is to provide a summary of FireSmart activities that can be used to measure current level of implementation and to recommend next steps. There are many different ways that members of the community and stakeholders can provide options to mitigate the risk (FireSmart, 2003).

Table 12: FireSmart Practices and Activities

Topic	FireSmart Examples
Communication, Education & Partnerships	• Host a FireSmart day in each community • Use local government newsletters, content in local print media, SLRD website and social media • Undertake FireSmart Local Representative or Community Champion training • Form a FireSmart committee • Encourage homeowners and/or neighborhoods to undertake FireSmart site assessments and area assessments through FireSmart Canada – see https://www.firesmartcanada.ca/firesmart-communities/get-your-application-ready-canada-wildfire-community-preparedness-day-2018 • Distribute FireSmart brochure in annual property tax notice, utility bill or similar mailed content
Vegetation management	• Develop a sample plot or yard to demonstrate Fire Smart principles for Priority Zones 1 and 2. • Provide access to a chipper or dumpster for debris drop-off from pruning or thinning on private properties • Promote deciduous or low flammability fuel breaks in green belt areas
Planning & Development	• Develop policies and practices for FireSmart construction and maintenance of public buildings • Maintain or develop mutual-aid fire control agreements with neighbouring volunteer fire departments
Increasing local capacity	• Develop and maintain Structural Protection Units (SPU) and/or learn how Emergency Management BC deploys SPUs for interface fires • Provide sprinkler kits (at cost, or subsidized) to residents • Cross-train fire departments to include structural fire and wildfire training

5.4 Community Communication and Education

The intent of this section is to describe ways to build engagement and support within the community for the CWPP, including education on fire prevention practices, outreach and community programs.

- The CWPP and associated maps will be posted on the City of Quesnel website at https://www.quesnel.ca/city-hall/major-initiatives/community-wildfire-protection-plan

- A concise summary of local wildfire threat, values at risk, proposed treatment units and FireSmart principles will be created in a poster format, and will be distributed.
- During the fire season, communications staff at City of Quesnel and Cariboo Regional District will be encouraged to remind people of FireSmart principles, and how to leave your house in the event of a wildfire for emergency personnel to access water, etc.
- A supply of FireSmart brochures will be made available at local government offices, and Fire Department staff will be encouraged to distribute them.

5.5 Other Prevention Measures

Fire prevention can be achieved through communication and education initiatives, as well as through the development and implementation of policies and regulations, including operational guidelines and restrictions. Fire prevention can be addressed at the community level through various avenues. Danger class rating signs within fire protection zones, public communication, industrial work restrictions and fire bans are examples of public fire prevention measures (CWPP Guide, 2017).

FireSmart principles that promote deciduous trees (i.e., aspen) are favourable as the high moisture content and lack of resins means they are not susceptible to wildfires like conifers. Homes around Fort McMurray adjacent to deciduous forests were not as impacted as those adjacent to conifers. Another bonus is for energy efficiency: shading in the summer, but letting light through in the winter around homes (Westhaver, 2017).

5.6 Summary of Recommendations

RECOMMENDATION #5: Apply for funding for prescription development and then implementation from UBCM, FESBC or other sources, aiming to tackle two or three hand treatment units annually.

RECOMMENDATION #6: Explore opportunities to implement FireSmart activities and raise awareness of FireSmart principles through various and multiple audiences. Key focus on distribution of FireSmart brochures, and engaging adjacent landowners when fuel management operations are taking place.

RECOMMENDATION #7: Consider striking a multiparty implementation committee consisting SLRD, interested local First Nations, BCWS, MFLNRORD and forest industry representatives to coordinate resources, communicate regularly and work cooperatively to reduce fuel wildfire risk.

RECOMMENDATION #8: Encourage the Land Manager and the local forest tenure holders, teamed with local First Nations, to take the lead on fuel management activities.

SECTION 6: Wildfire Response Resources

Interface fires are complex incidents that typically involve both wildland and structural fires. During times when many fires are burning in the Province and threatening multiple communities at the same time, resource requests can exceed the resources available. In B.C. these resources are deployed according to BC Provincial Co-ordination Plan for Wildfire Revised July 2016 (CWPP Guide, 2016) .

6.1 Local Government and First Nation Firefighting Resources

The intent of this sub-section is to identify implications of wildfire that impact firefighting efforts

(eg. loss of electrical power and water pressure and supply), the contingencies that have been put in place, and any recommended measures that would help to make community firefighting more effective, including a high level summary of mutual aid agreements.

6.1.1 Fire Departments

Volunteer Fire Departments are located at Gun Lake and Bralorne.

RECOMMENDATION #9: Encourage basic wildfire suppression training for volunteer fire departments**.**

RECOMMENDATION #10: Maintain or develop mutual aid agreements between fire departments covering the area of interest.

6.1.2 Access and Evacuation

Emergency Plans for this area have been developed by the SLRD. This is beyond the scope of a CWPP. Tyaughton and Marshall Lakes are single access/egress areas with their only access southward in the direction of the most likely wildfire approach.

6.1.3 Training

Identify training options to build capacity within the suppression and emergency management area. Maintain the current level of structural protection training for response staff. Increase focus on interface training in S100 Basic Wildfire Suppression and S215 Advanced wildfire suppression training and mock exercises in partnership with BC Wildfire Service. Training funding is available through the CRI program (see 6.3).

RECOMMENDATION #11: Identify training options to build capacity for wildfire suppression and emergency response, and pursue mock exercises with BC Wildfire Service.

6.2 Structure Protection

The intent of this section is to provide a summary of what is available to the community for structure protection, and provide any recommendations.

Structure protection systems for protecting buildings during a wildfire include transport trailers, bladders, pumps and sprinkler systems to wet down around structures and provide a relative humidity boost to the area immediately around a structure, reducing the potential for ember to ignite structures. These can be deployed by fire departments with minimal training and can be an effective method for reducing potential structure losses to wildfires.

6.3 Available Provincial Funding

Projects that can be funded through the 2019 Community Resilience Investment Program (CRI) include;

1. Education	• Develop and/or promote local FireSmart educational activities and tools. Refer to BC FireSmart Resources for FireSmart materials that are currently available. • Develop and/or promote education for the reduction of human-caused fires • Encourage active participation in Wildfire Community Preparedness Day • Organize and host a community FireSmart day, FireSmart events and workshops, and wildfire season open houses • Apply for FireSmart Canada Community Recognition
2. Planning	**Community Wildfire Protection Plans** • Develop or update a CWPP, primarily within the administrative boundary, completed on the 2019 CRI CWPP template **Local Planning Activities** • Develop policies and practices for design and maintenance of FireSmart publicly owned land and First Nations land, such as parks and open spaces • Develop policies and practices for design and maintenance of FireSmart publicly owned buildings • Conduct site visits and FireSmart and/or risk assessments for publicly owned lands, First Nation lands and publicly owned buildings
3. Development considerations	• Amend Official Community Plans, Comprehensive Community Plans and/or land use, engineering and public works bylaws to incorporate FireSmart policies • Revise landscaping requirements in zoning and development permit documents to require fire resistant landscaping • Establish Development Permit Areas for Wildfire Hazard in order to establish requirements for the exterior design and finish of buildings[4] • Include wildfire prevention and suppression considerations in the design of subdivisions (e.g. road widths, turning radius for emergency vehicles, and access and egress points) • Amend referral processes for new developments to ensure multiple departments, including the fire department and/or emergency management staff, are included
4. Interagency co-operation	• Develop and/or participate in regional or local FireSmart planning tables • Participate in multi-agency fire and/or fuel management tables
5. Emergency planning	• Develop and/or participate in cross-jurisdictional meetings and tabletop exercises, including seasonal readiness meetings • Review structural protection capacity (i.e. Fire safety assessments)
6. Cross training	• Cross-train fire departments to include structural fire and interface wildfire training (e.g. S-100) • Provide or attend training for Local FireSmart Representatives and community champions • Support professional development to increase capacity for FireSmart activities

	Note: Applicants that are already part of the Home Partners Program pilot may apply for further for Home Ignition Zone training.
7. FireSmart Demonstration Projects	• Undertake FireSmart Demonstration Projects for publicly owned buildings or publicly and provincially owned critical infrastructure. This may include: ○ Replacing building materials (i.e. siding or roofing) with fire-resistant materials ○ Replacing landscaping with fire-resistant plants as outlined in the FireSmart Guide to Landscaping *Note: To be eligible for funding, the proposed structure must be designated for emergency response, such as an Emergency Operations Centre or emergency social services facility (i.e. reception centre, group lodging) and have a completed FireSmart assessment. In addition, demonstration projects must include a community education component.*
8. FireSmart Activities for Private Land	• Planning for private land (only with private property owners' consent) ○ Develop FireSmart Community Plans for specific areas ○ Conduct FireSmart home and property assessments *Note: Applicants that are already part of the Home Partners Program pilot may apply for further Home Ignition Zone structure and site hazard assessments.* • Offer local rebate programs to home owners on private land and First Nations land that complete eligible FireSmart activities on their own properties *Note: Refer to Appendix 2 for requirements for funding this activity.* • Provide off-site debris disposal for private land owners who have undertaken their own vegetation management, including: ○ Provide a dumpster, chipper or other collection method ○ Waive tipping fees ○ Provide curbside debris pick-up
9. Fuel & Vegetation Management	• Undertake fuel and/or vegetation management on publicly owned land, First Nation lands or for publicly or provincially owned critical infrastructure. This may include: ○ Vegetation management activities ○ Fuel management prescriptions consistent with the Fuel Management Prescription Notes to Assist that meet minimum requirements set out in the example Fuel Management Prescription ○ Burn plans completed on Burn Plan Template ○ New fuel management treatments or maintenance activities, including activities on grasslands ○ Prescribed burns primarily for fuel management objectives *Note: Refer to Appendix 3 for requirements for funding above activities*

Funding for provincial crown land projects relating to forest fuel management can also be obtained through grants from Forest Enhancement Society of B.C. (fesbc.ca). These grants can be obtained by local governments for land outside their municipal boundaries.

RECOMMENDATION #12: Seek CRI and FESBC funding when available.

6.4 Summary of Recommendations

Table 13: Summary of Section 6 Recommendations:

Recommendation	Responsibility/Funding Source	Next Steps
Encourage basic wildfire suppression training for volunteer fire departments.	SLRD	Contact the Lillooet Fire for fire training expertise.
Maintain or develop mutual aid agreements between fire departments covering the area of interest.	To be explored.	Fire Chiefs to pursue
Identify training options to build capacity for wildfire suppression and emergency response, and pursue mock exercises with BC Wildfire Service.	SLRD/BCWS	Contact the Lillooet Fire Zone and Fire Chiefs to pursue cross training opportunities.
Seek FESBC and CRI funding where available.	SLRD	Pursue funding before 2019 deadlines.