City of Maple Ridge
Community Wildfire Protection Plan
Update 2019

Submitted by:

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MAPLE RIDGE FIRE RESCUE EST. 1946

MAPLE RIDGE British Columbia

Deep Roots Greater Heights

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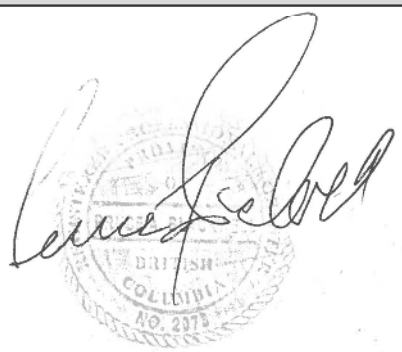
*Cover photo: Agnieszka Duszynska. View of Alouette Lake, Golden Ears Provincial Park

REGISTERED PROFESSIONAL SIGN AND SEAL

RPF PRINTED NAME	
Bruce A. Blackwell	RPF 2073
DATE SIGNED	
I certify that the work described herein fulfills the standards expected of a member of the Association of British Columbia Forest Professionals and that I did personally supervise the work.	
Registered Professional Forester Signature and Seal	
	

EXECUTIVE SUMMARY/ SUMMARY OF RECOMMENDATIONS

The Community Wildfire Protection Plan (CWPP) process was created in British Columbia (BC) as a response to the devastating 2003 wildfire in Kelowna. As an integral part of the Community Resiliency Investment (CRI) program, administered by the Union of BC Municipalities, CWPPs aim to develop strategic recommendations to assist in improving safety and to reduce the risk of damage to property from wildfires.

This CWPP Update will provide the City of Maple Ridge (CMR) with a framework that can be used to review and assess areas of identified high fire risk within the Area of Interest (AOI) which is defined by the municipal boundary. Additionally, the information contained in this report should help to guide the improvement and/or development of emergency plans, emergency response, evacuation plans, communication and education programs (including FireSmart), bylaw development in areas of fire risk, and the management of potentially hazardous forest lands adjacent to the community.

Since the development of the last CWPP in 2007, the City of Maple Ridge has made significant progress at implementing recommendations from the report. The most notable actions include implementation of the following[1]:

Structure Protection

- Addressed through the Wildfire Protection Development Permit Area requirements, setbacks of 10 m (the recommendation suggested a 10 m distance to align FireSmart's Fire Priority Zone 1) have been established for those homes and businesses immediately adjacent to the forest edge to limit direct contact of trees and vegetation with homes **(Recommendation 4)**.
- Reviewed existing bylaws and buildings codes to be consistent with the development of a FireSmart community to mandate fire resistant building materials and landscaping, provide access for emergency response, and specify fuel management on both public and private property in areas of identified high wildfire risk (**Recommendation 5**).
- New subdivisions within identified high risk areas of the City, require roofing materials that are fire retardant with a Class A and Class B fire resistance rating. This is in addition, to the implementation of a long-term replacement standard that is phased in over the roof rotation period to significantly reduced the vulnerability of the community in areas of historic development (**Recommendation 6**).

Emergency Response

- Ongoing improvements for access in areas of the community that are considered isolated or that have inadequately developed access for evacuation and fire control **(Recommendation 8)**.
- As the current evacuation plan is outdated, the CMR in conjunction with Pitt Meadows and the Katzie First Nation will apply in September 2020 for a grant through the UBCM to update the community evacuation plan (**Recommendation 9**).

[1]A full enumeration of recommendations from the 2007 CWPP can be found in **Error! Reference source not found.**.

- Developed an alternate incident command location (Fire Hall #1/Emergency Operations Center (EOC) and mobile facility in the event that the City needed evacuation (**Recommendation 10**).
- Purchased an all-terrain vehicle, trailer and related equipment to enable improved access for fire suppression in areas that are currently inaccessible (**Recommendation 12**).

Training

- Adopted an advanced program that fosters continuous improvements in available equipment and skill renewal related to interface fire response (**Recommendation 13**).

Fuel Management

- Continually cooperates and develops relationships with surrounding stakeholders to develop comprehensive fuel treatment programs (**Recommendation 14**).

The 2007 CWPP recommendations are also itemized in Appendix I.

Wildfire management requires a multi-faceted approach for greatest efficacy and risk reduction outcomes. A total of **53 strategic recommendations** are summarized in Table 1 below and are discussed in appropriate sections throughout the document. The recommendations within this plan are a toolbox of options to assist the community to reduce the threat of wildfire. There is no one course of action or combination of actions that is the singular answer to the challenge of wildfire risk in communities; the CMR must further prioritize based on resources, strengths, constraints, and availability of funding, regularly updating prioritizations and courses of action as variables and circumstance change through time.

Table 1. Summary of CWPP Recommendations by Document Section.

Document Section 2: Local Area Description (2.5: Linkages to Other Plans and Policies)				
Item	**Page No.**	**Priority**	**Recommendation / Next Steps**	**Estimated Cost ($) or Person hours**
Objective: Review and Amend the Current Regulatory Framework to Incorporate Wildfire Mitigation and Preparedness Considerations.				
1	31	Low	The CMR should work with the Province or local Medical Health Officer to develop a strategy for communities to reference when they are exposed to smoke from wildfire for extended periods of time. This strategy may include smoke exposure risk assessments, exposure reduction measures, and evacuation due to wildfire smoke.	4-6 CMR (EMC, MHO and Environmental) staff hours required for internal work with the province Additional 16 hours for material development and distribution.
2	32	Low	Consider reviewing and amending OCP, Chapter 2 – Growth Management to consider including wildfire risk and other natural hazards as they relate to Policy 2.1.2 *A Compact and Unique Community*, specifically (2-5) which outlines criteria for limiting urban scale development to areas where infrastructure can be provided in a manner that is cost-effective.	~15 in-house hours (Local Government funding/UBCM CRI Program Funding)
3	33	Low	Update the Parks, Recreation & Culture Department's Noxious Weed Management Strategy currently in place to include additional consideration for flammable invasive plant species that can / do occur in the wildland urban interface.	In-house cost (~60 hours)
4	33	High	The CMR should update the '*Maple Ridge Official Community Plan Amending Bylaw No. 7187-2015*, Section B Building Design and Siting, Exterior Cladding Item (a) to state that cladding on all elevations of a structure shall be constructed of ignition-resistant or non-combustible materials.	~24 in-house hours (Local Government funding)
5	33	High	Review and update *Maple Ridge Official Community Plan Amending Bylaw No. 7187-2015* Section 8.12.2 Guidelines to include language for management of non-compliant hedging and other vegetation in proximity to homes after the post-development inspection is signed-off by a Qualified Professional. This could include extending the landscape security fee for 1-2 years following occupancy and would be a joint initiative between Bylaw Enforcement, Development Planning and MRFRD.	~24 in-house hours for 2 meetings between Bylaw Enforcement, Development Planning and MRFRD. Implementation cost dependent on project size but may be included in development fees.

Document Section 2: Local Area Description (2.5: Linkages to Other Plans and Policies)				
Item	**Page No.**	**Priority**	**Recommendation / Next Steps**	**Estimated Cost ($) or Person hours**
6	33	Moderate	Review and update the *Maple Ridge Official Community Plan Amending Bylaw No. 7187-2015* and set a procedure for establishing fire rating test standards for exterior building materials for reference by manufacturers, builders, and developers to ensure alternative fire-resistant choices are pre-approved in a timely manner for use in the WUI. Alternatively, fire test standards can be developed by the Building Department as long as they are reviewed by an expert in the building materials industry and by a standards testing agency. A running list of approved building products should be maintained.	~ 24 in-house hours (development of fire rating test standards); 12 – 16 in house hours (updating pre-approved list) local government funding
7	35	Moderate	Review the *Solid Waste and Recycling Bylaw No. 6800* to include language specific to green waste, not just garbage, to ensure that there is a legally enforceable bylaw to prevent the accumulation of flammable debris to collect or remain on properties.	~ 5-10 in-house hours (municipal funding)
8	35	Moderate	Update Tree Protection Bylaw 7133, to include language that addresses tree management as it pertains to wildfire risk issues specifically targeting surface fuel build-up from windthrow, hazard trees on private and public properties, tree removals, as well as tree retention and tree replacement requirements.	16 in-house hours for meetings between Parks and Environment departments
9	36	Low	Review the strategic transportation plan and assess the planning, budgeting, and build-out timeline for Major Municipal Road connections: 1) 112th – 108th Avenue Connector which would consist of a new roadway between 252nd Street and 268th Street along the slope of Grant's Hill. The road would provide a complete east-west route between Lougheed Highway at the Haney Bypass (via Kanaka Way and 272nd Street; 2) Thornhill Connector connect to the Thornhill neighbourhood by extending 256th Street southward to Lougheed Highway and 3) 128th/Abernathy Connector which will not only provide improved routing for commerce but for wildfire evacuation management as well.	Appropriate funding stream to be identified. 10-person hours dependent upon CMR's role
10	37	Moderate	Review the OCP and revise the Parks, Recreation and Culture Master Plan to consider parks acquisition and maintenance through a wildfire risk lens including fuel treatments prior to acceptance by the City and consideration for long-term maintenance costs and access.	10-20 hours to review Parks, Recreation and Culture Master Plan, provide recommendations

Document Section 2: Local Area Description (2.5: Linkages to Other Plans and Policies)				
Item	**Page No.**	**Priority**	**Recommendation / Next Steps**	**Estimated Cost ($) or Person hours**
11	37	Moderate	Consider creating a Trails Master Plan for the long-term management of the CMR trails network. The Plan should address trail location, type, and width; as well as building and maintenance as these activities can either increase wildfire risk or decrease wildfire risk (though proper placement, clean-up of combustible fuels trailside and work practices which adhere to Wildfire Act and Regulations).	10-20 hours by Parks, Recreation & Culture to review current trails/map, provide recommendations

Document Section 3: Values at Risk				
Item	**Page No.**	**Priority**	**Recommendation / Next Steps**	**Estimated Cost ($) or Person hours**
Objective: Protect Critical Infrastructure and Mitigate Post-Wildfire Impacts				
12	44	Moderate	The use of fire-resistant construction materials, building design and landscaping should be considered for all CI when completing upgrades or establishing new infrastructure. Additionally, vegetation setbacks around critical infrastructure should be compliant with FireSmart guidelines.	Negligible in-house cost
13	44	High	It is recommended that formal FireSmart assessments (by a Qualified Professional) be completed of critical infrastructure such as the fire halls, emergency operations center, water infrastructure, and others as identified in this CWPP (Table 3) and by the City. The process could be initiated as a demonstration to City staff and MRFRD at Firehall #2.	~$1,500-2,000 per location (consultant cost)
14	45	Moderate	Develop utility right-of-way best management practices (BMPs) for regular brushing and clearing of woody debris and shrubs in coordination with BC Hydro to help reduce fire risk, utility pole damage and subsequent outages. In addition, BC Hydro should ensure rights-of-way do not contain fine fuel accumulations (< 7.5 cm, easily cured) and significant regeneration of conifer vegetation prior to and during the fire season and are maintained in a low hazard state. (to serve as fuel breaks).	~12 hours (local government hours for 2 meetings with BC Hydro)
15	45	Moderate	The Engineering and Public Works Departments should complete vulnerability assessments of all critical infrastructure, secondary power sources, and fuel availability. Review current capability of secondary power sources, identify vulnerabilities, and prioritize needs, in the case of prolonged or extensive power outages. Upgrade or realign resources, as prioritized.	~$1,500-$5,000 per location (consultant cost) or ~80 in-house hours or CRI program funding

16	52	Low	As part of the Integrated Stormwater Management Plan (ISMP) planning process currently underway, the CMR should consider the option to include assessments to explore the potential impacts from wildfire the hydrologic and geomorphic attributes of the watershed.	To be determined, this cost would depend on the scope of the assessment (~$10,000-$40,000). UBCM funding may be available

Document Section 4: Wildfire Treat and Risk Recommendations				
Item	**Page No.**	**Priority**	**Recommendation / Next Steps**	**Estimated Cost ($) or Person hours**
Objective: Reduce Wildfire Threat in the WUI				
17	62	Low	The City's Environment Planning section should implement findings from its invasive plant management pilot studies to Identify potential fuel loading issues along with forest structure attributes to determine future invasive plant maintenance strategies or management requirements. If fuel treatments will occur, address invasive species management during implementation in the WUI, in order to improve forest resilience and promote ecological restoration of degraded sites.	20 in-house hours by Environment Planning staff

Document Section 5: Risk Management and Mitigation Factors Recommendations				
Item	**Page No.**	**Priority**	**Recommendation / Next Steps**	**Estimated Cost ($) or Person hours**
Objective: Undertake Fuel Treatments to Improve Emergency Access and Reduce Wildfire Threat through Fuel Management				
18	78	High	Proceed with detailed assessment, prescription development and treatment of hazardous fuel units and FireSmart fuel treatment demonstration treatment areas identified and prioritized in this CWPP. Prescriptions must be developed within the context of the City's OCP Chapter 5-Natural Features and Metro Vancouver's Sensitive Ecosystem Inventory (SEI). Consult with a qualified biologist and First Nations during prescription development to address all concerns.	UBCM CRI Program Funding/Local Government Funding
19	85	Moderate	If and when operational fuel treatments are conducted within the AOI, treatment monitoring should be completed by a Qualified Professional in order to schedule the next set of maintenance activities (5 – 10 years out).	UBCM CRI Program Funding/Local Government Funding
Objective: Reduce Wildfire Hazard on Private Land				
20	92	Moderate	Expand the chipping program to areas now subject to the Open-Air Burning Ban) in order to provide alternate woody debris and green waste disposal methods. Additional programs for the CMR to consider may include scheduled community chipping opportunities, yard waste dumpsters available by month in neighbourhoods. Programs should be available during times of greatest resident activity (likely spring and fall).	May be eligible for UBCM/CRI Program funding. Additional time for advertisement of program availability will be required.
Objective: Reduce Wildfire Hazard on Private Land				

Document Section 5: Risk Management and Mitigation Factors Recommendations				
Item	**Page No.**	**Priority**	**Recommendation / Next Steps**	**Estimated Cost ($) or Person hours**
21	92	Moderate	The CMR should apply for funding from the UBCM CRI Program to develop a local FireSmart rebate program. This will allow homeowners to access partial rebates for FireSmart activities on their properties, if rated as high or extreme risk in a FireSmart home and property assessment. The rebate program is described in detail in the CRI Program 2020 FireSmart Community Funding and Supports – Program & Application Guide and must adhere to the goals and objectives of FireSmart, as outlined in Section 5.2.1. Before applying for funding, Fire Prevention Public Education should review CMR resources available to execute the program.	20-35 CMR staff hours
22	92	Moderate	Provide FireSmart information to homeowners prior to occupancy for new subdivisions in the WUI. Create a FireSmart brochure that includes lists of acceptable vs. non-acceptable vegetation for home landscaping.	16 in-house hrs. Brochure cost (~ $2,500) absorbed by the developer.
23	93	High	Consider commissioning a scenario-based cost/benefit analysis to understand the efficacy of the current security deposit system as an enforcement measure to ensure developer and builder compliance with FireSmart as per the WPDP. As an alternative to a study, update the WFDP bylaw and subject the granting of occupancy to compliance with the WFDP requirements.	10 – 12 in-house hours (local government funding)
24	93	Low	Develop a landscaping standard suitable for use in Maple Ridge which lists flammable non-compliant vegetation and landscaping materials, and provides alternative substitutes that are wildfire (non-flammable) drought and pest resistant. In addition, list tips on landscape design for watering requirements, avoid wildlife attractants and reduce maintenance costs. This Standard should be included in the FireSmart information package provided to new homeowners (Recommendation #23).	$2,000 - $3,000 to outsource. FireSmart landscaping information is free of charge, but is not regionally specific

Document Section 5: Risk Management and Mitigation Factors Recommendations				
Item	**Page No.**	**Priority**	**Recommendation / Next Steps**	**Estimated Cost ($) or Person hours**
Objective: Reduce Wildfire Hazard on Private Land & Increase Public Wildfire Awareness & Enhance Elected Official Awareness of Wildfire Initiatives & Wildfire Risks from Industrial Sources				
25	93	Moderate	Target education and outreach to promote FireSmart renovations of exterior elements to existing buildings within the Wildfire Protection Development Permit area. Incentives should target roof replacements as a first priority, followed by replacement of exterior siding and decking with fire resistant materials to increase the resiliency of homes and neighbourhoods in the WUI.	UBCM funding with the CRI program may be available
26	93	High	Apply for a FireSmart demonstration grant through the CRI program. Preferential sites should incorporate residential structures as they are more applicable for homeowners, and should include both exterior building material and landscaping elements to display FireSmart principles.	~20-25 in-house hours to complete application. CRI funding for treatment.
27	94	High	Post this CWPP report on the City's website and social media platforms. In addition, it should be shared with woodlots and local industry who may be interested in collaborating on fuel management treatments.	3-6 in-house hours (local government funding)
28	98	Moderate	Encourage and facilitate WUI neighbourhoods to attain FireSmart Canada Community Recognition Program status and encourage homeowners to complete the FireSmart home assessment and that neighbourhoods hold a home hazard assessment workshop as one of their FireSmart events. In addition, the City should promote the use of the FireSmart Home Partners Program which facilitates voluntary FireSmart assessments on private property to identify hazards and provide options to reduce the risk.	$5,000/neighbourhood and an additional 40 hours/initiative UBCM/CRI Program grant(s) available and ~1.5 hours /assessment
29	98	High	Develop and work with all key stakeholders (industrial operators, MFLNRORD, BCWS, woodlots, Malcolm Knapp Research Forest, BC Parks) to formalize an Interface Steering Committee in order to identify ongoing and emerging wildfire related issues in the area and to develop solutions to minimize wildfire risks. The following subject areas are recommended for the group to explore: 1) Public education needs; 2) fuel treatment projects/hazard abatement projects; 3) funding opportunities; and 4) right of way management.	~ 40 hours to initiate group; ~50 hours/year to plan, communicate, attend meetings; additional hours dependent on amount and size of projects
30	99	Moderate	Work towards educating homeowners within the Wildland Urban Interface (WUI), of the CMR's fire protection area to communicate potential suppression challenges and response times. It is common for them to be unaware of the lack of fire services in their area (in the event they call 911).	16 in-house hours. Local Government Funding

Document Section 5: Risk Management and Mitigation Factors Recommendations				
Item	**Page No.**	**Priority**	**Recommendation / Next Steps**	**Estimated Cost ($) or Person hours**
Objective: Reduce Wildfire Hazard on Private Land & Increase Public Wildfire Awareness & Enhance Elected Official Awareness of Wildfire Initiatives & Wildfire Risks from Industrial Sources				
31	99	High	Continue promoting and providing information to private landowners related to exterior residential sprinklers as a FireSmart prevention measure. At FireSmart events distribute information on exterior sprinkler component parts, manufacturers, and water supply system requirements to ensure they are effective measures to wet down homes and Fire Priority Zone 1 and discourage home ignition. Develop general costs of exterior sprinkler equipment for property owners	20-30 hours to assemble costs and suppliers, prepare materials and disseminate
32	99	Moderate	Work with the Malcolm Knapp Research Forest, woodlots, and forest tenures to ensure that high risk activities, such as vegetation management, pile burning and harvesting do not occur during high/extreme fire danger times to reduce chance of ignitions as per the Wildfire Act. It is recommended that communications are coordinated via weekly fire calls.	~4-6 hours
33	99	Moderate	Discuss options with the Malcolm Knapp Research Forest, woodlots and forest tenures adjacent to the City, to integrate future fuelbreaks with harvest planning using existing cutblocks and logging roads to address identified hazardous fuel types and spotting potential.	~15 hours
34	99	Moderate	The City should develop a plan for post-fire rehabilitation for inclusion into the CMR Emergency Plan's Wildfire Response section. Post-fire rehabilitation would consider the procurement of seed, seedlings and materials required to regenerate an extensive burn area (1,000-5,000 ha). Target efforts on slope stabilization and infrastructure protection to stabilize and rehabilitate the burn area.	~$18,000-20,000 (consultant cost).

Document Section 5: Risk Management and Mitigation Factors Recommendations				
Item	**Page No.**	**Priority**	**Recommendation / Next Steps**	**Estimated Cost ($) or Person hours**
Objective: Enhance Wildfire Equipment and Training & Encourage FireSmart Initiatives & Enhance Protection of Municipal Infrastructure from Wildfire				
35	100	Low	Develop a work experience program, for paid on-call firefighters, possibly in coordination with the Maple Ridge Firefighters Union Local 4449 to assist and support aspiring firefighters gain relevant training, experience and opportunities to build relationships and potential contacts within the FD.	24 in-house hours. Local Government Funding
36	101	High	Continue the current practice of delivering annual training to Fire Rescue Department members so they can engage in practical wildland fire training opportunities with BCWS that covers at a minimum: pump, hose, hydrant, air tanker awareness, and employment of SPUs.	Cost and time dependent upon training exercise (number of attendees etc.)
Objective: Improve Water Availability for Emergency Response				
37	101	High	All new development in the Protected Growth and Rural response zones in the MRFRD service area should have a water system which meets or exceeds minimum standards of NFPA 1142, Standard on Water Supplies for Suburban and Rural Fire Fighting2. MRFRD should review the water supply to ensure it provides sufficient placement, flow, and reliability for suppression needs and that secondary power is available in the event of power outages.	~5-10 hours per development
38	101	High	Commission a scenario-based cost/benefit analysis to improve limitations of the water system to support domestic water needs, and structural and wildland firefighting demands. Identify resources required to upgrade the current system, costs of implementation, and develop a workplan.	Local Government Funding. Outsource to qualified consultant. Cost would be between $5,000 – $7,000.
39	101	Moderate	Consider completing a fire flow/water vulnerability assessment to identify where upgrades to systems, flows, hydrant number or location, water storage, or secondary power is required.	Local Government Funding $10,000

[2]National Fire Protection Association (NFPA).2017. Standard on Water Supplies for Suburban and Rural Fire Fighting. Retrieved online at: https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=1142

Document Section 6: Wildfire Response Resources Recommendations				
Item	**Page No.**	**Priority**	**Recommendation / Next Steps**	**Estimated Cost ($) or Person hours**
Objective: Improve Access/Egress to Enhance Emergency Preparedness & Include Wildfire Considerations when Trail Planning				
40	103	Low	Complete an Emergency Evacuation Plan for the AOI, operationalize the plan by completing mock evacuation exercises at night to mimic poor visibility from smoke conditions. Consult with BC Corrections to align evacuation plans and jointly conduct a desk-top evacuation planning exercise.	Application for funding with the UBCM submitted
41	103	Moderate	In collaboration with the BCWS and Metro Vancouver Watershed Protection, Maple Ridge Fire Rescue Department should consider conducting a review of response times and crew mobilization staging areas to ensure they are adequate for wildfire call outs in all new subdivision developments in the WUI. Consider installing evacuation route signage in select portions of subdivisions with circuitous local roads.	16-20 hr in-house hours for review and 10 hr for mock evacuation exercise; ~$5,000 for signage
42	104	Moderate	Develop a wildfire pre-planning brochure that addresses the following: 1) locations of staging areas; 2) identifies water reservoirs, communications requirements (i.e., radio frequencies), minimum resource requirements for structure protection in the event of an interface fire, and values at risk; and 3) maps of the area of interest. This brochure would be for 1) internal CMR staff and included into the Wildfire Response section of the CMR Emergency Plan, 2) agencies that MRFRD has mutual aid agreements with, and 3) industrial operators (woodlot licensees, Malcolm Knapp Research Forest).	~$10,000-$15,000 to complete (estimated contractor costs).
43	104	Moderate	Develop a Total Access Plan in coordination with BC Parks, BCIT Woodlot and UBC Research Forest to map and inventory trail and road networks in natural areas for suppression planning; and to identify areas with insufficient access. Georeferenced maps with ground-truthed locations of potential optimal firebreaks should be developed as part of the Total Access Plan and shared with fire suppression personnel and BCWS to support emergency response in the event of a wildfire. The plan should be updated every five years, or more regularly, as needed to incorporate additions and/or changes.	~8,000-$10,000 to build plan, map, populate attributes and update (contractor estimate)
44	104	Moderate	Due to the fact that the CMR has some limited access and egress options in the WUI and areas east of Kanaka Creek Park, as part of the evacuation plan (if application funding is awarded), the CMR should assess the feasibility and available options for improving access and increasing public safety in the event of an emergency evacuation.	To be included in Evacuation Plan (if funding is awarded)

Document Section 6: Wildfire Response Resources Recommendations				
Item	**Page No.**	**Priority**	**Recommendation / Next Steps**	**Estimated Cost ($) or Person hours**
Objective: Improve Access/Egress to Enhance Emergency Preparedness & Include Wildfire Considerations when Trail Planning				
Objective: Enhance Wildfire Equipment and Training				
45	107	High	MRFRD should work with BCWS to initiate and/or maintain an annual structural and interface training program. As part of the training, conduct annual reviews to ensure PPE and wildland equipment resources are complete, in working order, and the crews are trained in their use. Also engage in yearly practical wildland fire training with BCWS that covers pump, hose, hydrant, air tanker awareness, and employment of SPUs. Interface training should include completion of a joint wildfire simulation exercise and safety training.	Cost and time dependent upon training exercise (scope, number of participating members etc.)
46	107	Moderate	MRFRD should engage in regular communication with the BCWS Coastal Fire Zone to foster a strong relationship and identify potential cooperative wildfire risk reduction opportunities.	~4 hours/ year

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COMMONLY USED ACRONYMS

AOI	Area of Interest
BCWS	British Columbia Wildfire Service
BEC	Biogeoclimatic Ecosystem Classification
CDC	B.C. Conservation Data Centre
CFFDRS	Canadian Forest Fire Danger Rating System
CI	Critical Infrastructure
CMR	City of Maple Ridge
CMT	Culturally Modified Tree
CRI	Community Resiliency Investment Program
CWPP	Community Wildfire Protection Plan
DPA	Development Permit Area
EOC	Emergency Operations Centre
ESA	Environmentally Sensitive Area
ESS	Emergency Support Services
FBP	Fire Behaviour Prediction System
FMP	Fire Management Plan
FRPA	*Forest and Range Practices Act*
FSCCRP	FireSmart Canada Community Recognition Program
GVWD	Greater Vancouver Water District
HCA	Heritage Conservation Act
HIZ	Home Ignition Zone
MFLNRORD	Ministry of Forests, Lands, Natural Resource Operations, and Rural Development
MKRF	Malcolm Knapp Research Forest
MRFRD	Maple Ridge Fire Rescue Department
MRFRD	Maple Ridge Fire & Rescue
NFPA	National Fire Protection Agency
OCP	Official Community Plan
OFC	Office of the Fire Commissioner
OGMA	Old Growth Management Area
PSTA	Provincial Strategic Threat Analysis
PTU	Proposed Treatment Unit
QP	Qualified Professional
RMZ	Riparian Management Zone
SEI	Sensitive Ecosystem Inventory
SPU	Structural Protection Unit
UBCM	Union of British Columbian Municipalities
VAR	Values at Risk
VFD	Volunteer Fire Rescue Department
WUI	Wildland Urban Interface

SECTION 1: INTRODUCTION

City of Maple Ridge ('CMR', 'the City') staff have recognized wildfire mitigation and planning to be an integral component of their emergency planning and preparedness. In 2019, B.A. Blackwell and Associates Ltd. was contracted to assist the City of Maple Ridge (CMR) in developing a Community Wildfire Protection Plan (CWPP) Update; hereinafter referred to as 'CWPP' or 'CWPP Update'. This CWPP Update will focus on integrating the newest version of the Provincial Strategic Threat Analysis (PSTA), updated BC Wildfire Service (BCWS) Fuel Type mapping, and the updated and improved wildfire threat analysis methodology into the document.

The 2003, 2004, 2009, 2010, 2015, 2017 and 2018 wildfire seasons resulted in significant economic, social and environmental losses in BC. The 2018 fire season was the most extensive in terms of area burned, surpassing the 2017 fire season. The total suppression costs for the 2018 season were calculated at $615 million and the 2017 fire season costs were estimated at over $649 million.[3] Recent wildfire disasters like those experienced in Slave Lake, Alberta (2011), Washington State (2014 and 2015), Fort McMurray, Alberta (2016) and BC and California (2017, 2018 and 2019) all display the vulnerability of communities and the potential toll of wildfires on families, neighbourhoods and the economy of entire regions. These events, along with critical lessons learned and important advances in knowledge and loss prevention programs have spurred the need for greater consideration and due diligence with respect to fire risk in the wildland urban interface (WUI).[4]

1.1 PURPOSE

The purpose of this CWPP Update is to identify the wildfire risks within the administrative boundary of the CMR, to describe the potential consequences if a wildfire was to impact the area, and to examine options and strategies to reduce the wildfire risks. Each community has a unique risk profile. This CWPP provides a re-assessment of the level of risk with respect to changes in the area that have occurred since 2007, in order to give the CMR a current and accurate understanding of the threats to human life, property and critical infrastructure from wildfires. The goal of this CWPP, in addition to defining the threats, is to identify mitigation measures and serve as a framework to inform decisions for implementation that will serve to: 1) reduce the likelihood of wildfire entering the community, 2) reduce the impacts and losses to property and critical infrastructure if wildfire were to enter, and 3) reduce the negative economic and social impacts of wildfire to the community.

[3] BCWS, 2020. Wildfire Season Summary. Retrieved From: https://www2.gov.bc.ca/gov/content/safety/wildfire-status/about-bcws/wildfire-history/wildfire-season-summary

[4] Wildland/urban interface is defined as the presence of structures in locations in which conditions result in the potential for their ignition from flames and firebrands/embers of a wildland fire (National Fire Protection Association). See Appendix E for a more detailed discussion.

1.2 CWPP PLANNING PROCESS

This CWPP is a review and synthesis of the background information and current data related to the Area of Interest (AOI) which represents the municipal boundary of the City of Maple Ridge and consists of four general phases outlined in Sections 1.2.1 to 1.2.4 as described below.

1.2.1 Consultation

Engagement with local government, Provincial government landowner representatives, stakeholders and First Nations played a key role in developing this CWPP Update.

The first step in the consultation process was to assemble the key players in the 'Wildfire Working Group'. This group was composed of key internal CMR staff, which included: Fire & Rescue Services, Parks & Facilities, Development Planning & Environmental Planning, and Engineering representatives. At the initial meeting of the Wildfire Working Group, the objective was to obtain information on wildfire risk mitigation initiatives currently in place or completed, existing plans and policies, current resources, areas of concern, and to determine priorities and potential mitigation strategies. Members of the Working Group were consulted on an ongoing basis throughout Plan development and were integral in providing review and approval.

BCWS representatives from the Coastal Fire Centre and Fraser Fire Zone - Cultus/Haig (Wildfire Prevention Officer and Forest Protection Specialist) were consulted as follows: 1) at the onset of the project planning phase and 2) throughout the CWPP development process, via the submission of Fuel Type Change Rationales and a questionnaire regarding concerns and priorities with respect to wildfire and emergency planning in the CMR; and 3) revision of draft document upon plan completion.

Information sharing took place with the Cowichan Tribes, Halalt First Nation, Katzie First Nation, Kwantlen First Nation, Kwikwetlem First Nation, Lake Cowichan First Nation, Leq'a:mel First Nation, Lyackson First Nation, Matsqui First Nation, Musqueam Nation, Penelakut Tribe, People of the River Referrals Office, Peters Band, Seabird Island First Nation, Semiahmoo First Nation, Shxw'ow'hamel First Nation, Shxw??whámel First Nation, Stó:l? Nation, Sto:lo Tribal Council, Stz'uminus First Nation, Tsawwassen First Nation, and Tsleil-Waututh Nation as identified through the Consultative Areas Database and in consultation with Ministry of Forests, Lands and Natural Resource Operations and Rural Development (MFLNRORD) and the CMR, regarding the CWPP and locations or potential for possible cultural values at risk requiring protection consideration. Information sharing consisted of an initial phone call, and subsequent distribution of a referral letter and information package (maps, explanation of CWPP, and CWPP draft).

Additional stakeholders were consulted to identify synergies, opportunities for collaboration, and ensure linkages with adjacent and overlapping planning. These stakeholders included the MFLNRORD Chilliwack Natural Resource District's Stewardship Forester, Sally Asu; the MFLNRORD Chilliwack Recreation District's Recreation Officer, Tom Blackbird; Malcom Knapp Research Forest, Justice Institute

of BC, Alouette Correctional Centre for Women, Fraser Regional Correctional Centre, BC Parks staff including the Area Supervisor – North Fraser, Lower Mainland Section – South Coast Region; and licensees/managers of Woodlot W0007 and First Nations Woodland License W0038. Combined, these various consultation and engagement opportunities have generated a shared understanding of the CWPP objectives and expected outcomes among local government, stakeholders, residents, and land managers.

1.2.2 Identification of Values at Risk and Local Wildfire Threat Assessment

The risks associated with wildfire must be clearly identified and understood before a CWPP can define strategies or actions to mitigate risks. The identified values at risk are described in Section 3 and concepts of wildfire threat and risk are elaborated on in section 4. The wildfire threat in the City of Maple Ridge was assessed through a combination of the following approaches:

- Natural fire regime and ecology (Section 4.1);
- Provincial Strategic Threat Analysis (section 4.2); and
- Local wildfire threat analysis (Section 4.3).

1.2.3 Development of a Risk Management Strategy

An effective risk management strategy was developed considering a full range of activities relating to the following:

- Fuel management;
- FireSmart planning and activities;
- Community communication and education;
- Structure protection and planning (i.e., FireSmart activities);
- Emergency response and preparedness;
- Evacuation and access; and
- Planning and development.

1.2.4 Building Community Engagement and Education Strategy

Engaging the community, from local government staff and officials, to key stakeholders and residents. in wildfire protection planning activities is key to ensuring successful implementation. Community engagement and education strategies are described in Section 5.3. A presentation to CMR Council will aim to ensure high level approval and support for this CWPP.

SECTION 2: LOCAL AREA DESCRIPTION

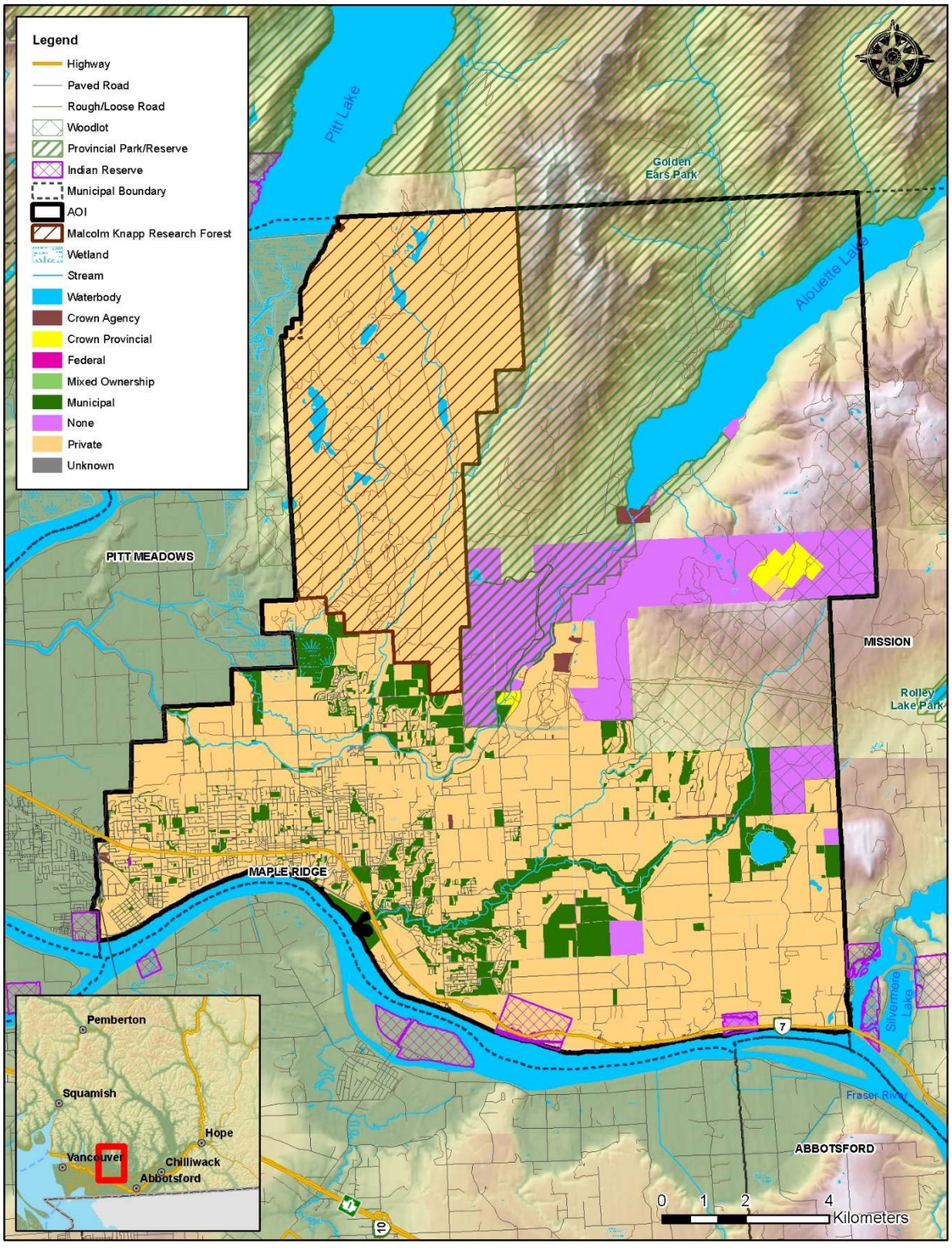
This section defines the Area of Interest (AOI) and describes the community of Maple Ridge. It also summarizes the current community engagement in wildfire prevention and mitigation and identifies linkages to other plans and policies with relevance to wildfire planning.

2.1 AREA OF INTEREST

The municipality of Maple Ridge is located in the south coast region of BC, in FLNRORD's Chilliwack Natural Resource District. Geographically, it is located in the northeastern section between the Fraser River and Golden Ears, which are the southernmost summits of the Garibaldi Ranges of the Coast Mountains. Maple Ridge is located adjacent to extensive forested land and approximately 60% of the AOI is forested. The southeastern portion of the AOI is approximately 35 kilometers (km) east of Vancouver and spans from the Pitt River east towards the District of Mission. The AOI has diverse topography including: flood plains, large lakes and rivers, rolling hills and mountainous terrain. Due to this variable topography, the elevation varies significantly, from roughly 300 metres (m) to roughly 1,500 m. The Fraser River is the largest freshwater body; however, the AOI also contains a few small lakes, such as Loon Lake and Whonnock Lake.

The AOI for the CWPP is illustrated below in **Error! Reference source not found.** and is defined by the municipal boundary. The AOI is characterized by a mix of commercial, institutional and industrial properties and contains many unique neighbourhoods and historical areas including: Albion/Kanaka, Port Haney, Ruskin, Silver Valley, and Thornhill. According to the 2016 Census, the CMR has a population of 82,256 people and covers an area of approximately 281 km^2.[5] A breakdown of the AOI's land ownership is provided in Table 2.

[5]Statistics Canada, 2016. City of Maple Ridge Census Profile. Retrieved From: https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/details/page.cfm?Lang=E&Geo1=CSD&Code1=5915075&Geo2=PR&Code2=59&SearchText=Maple%20Ridge&SearchType=Begins&SearchPR=01&B1=All&GeoLevel=PR&GeoCode=5915075&TABID=1&type=0



Map 1. Area of Interest (AOI).

Table 2. Summary of AOI by land ownership.

Land Ownership	Hectares
Crown Agency	117
Crown Provincial	12,685
Federal	0
Mixed Ownership	13
Municipal	1,845
Private	13,152
Unknown	253

*The land ownership source is ParcelMap BC, provided by the Land Title and Survey Authority (LTSA). This dataset does not differentiate Indian Reserves as Federal Crown parcels.

2.2 COMMUNITY DESCRIPTION

The City of Maple Ridge is one of 21-member municipalities that make up Metro Vancouver. As members of Metro Vancouver, the CMR is provided shared services such as drinking water, regional park management, solid waste management (recycling and transfer station facilities) and wastewater treatment. Partnerships also exist for recreation, environment, and parks. At the municipal level, services provided include City Hall services, business and development planning, fire protection services, garbage and recycling services, roads and sidewalk maintenance, and bylaw development and enforcement.

Prior to colonial settlement, Metro Vancouver was occupied by the Coast Salish aboriginal peoples including the Katzie, Kwantlen, Kwikwetlem, and Matsqui First Nations, some of whom continue to live within the CMR today. There are two Kwantlen Indian Reservations (Langley 5 and Whonnock 1) located within the CMR along its southern boundary adjacent to the Fraser River.

Services provided to residents of the CMR at the regional and municipal level include land use planning, an emergency response system, policing, fire protection and rescue services, water/waste water services, roads, transit, community parks, street lighting and much more. The CMR is also equipped with ambulance services and an emergency operations centre which provides support services in the event of an emergency.

The economy of the CMR was historically driven by the Canadian Pacific Railway (CPR) and other resource-based industries such as industrial manufacturing (brick and tile), forestry (logging and milling), agriculture, fishing and farming.[6]Although these industries continue to remain important to the communities within the AOI, the economic focus has shifted in recent decades to real estate, technology, commercial and retail, manufacturing, film, construction, health care, agriculture, and tourism.[7]

Fire protection within the AOI is the responsibility of Maple Ridge Fire Rescue Department (MRFRD) which is in charge of three fire halls, and a fourth currently under construction with a completion date set for Spring 2020. Formal reciprocal mutual aid agreements exist between the MRFRD and other neighbouring jurisdictions, such as the District of Mission, Pitt Meadows, and Township of Langley Fire Departments as well as Metro Vancouver and BCWS. The BCWS is responsible for responding to fires that are beyond the boundaries of MRFRD's Response Zone.

In the event of a wildfire, neighbourhood planning areas within the AOI such as Silver Valley, Golden Ears, Alico, and Blue Mountain have limited emergency access and egress routes. The Lougheed Highway (Highway 7) and Dewdney Trunk Road are the only two, reliable, paved access routes in and out of the AOI. Furthermore, a number of new developments (both multi-family and single-family lot redevelopment) within the AOI are located on single access roads which present challenges for

[6] Maple Ridge Museum, 2020. Permanent Exhibits. Retrieved From: http://mapleridgemuseum.org/exhibitions/permanent-exhibits/

[7] Maple Ridge, 2020. Industries. Retrieved From: https://www.mapleridge.ca/1339/Industries

emergency access and egress, and limits the ability of fire crews to respond to fires and safely evacuate residents. Please see Section 6.1.3 for more information on Access and Evacuation in the CMR.

2.3 PAST WILDFIRES, EVACUATIONS AND IMPACTS

BCWS Coastal Fire Zone Staff (Jordan Struthers) communicated that the majority of past wildfire activity within the AOI was human-caused and ignitions are primarily due to abandoned campfires and poor recreation practices (both boat and road access recreation areas). BCWS staff reported that slash accumulations following industrial logging can be an issue, particularly next to forest service roads.

Based on the BCWS historical wildfire dataset, a number of large fires burned within the AOI in the 1930's. The two largest fires to occur within the AOI burned in 1931 at 3,642 ha (hectare) and 1,843 ha respectively, and covered a combined area of 5,486 ha. Both of these fires were human- caused. The most recent recorded historical wildfire occurred in 1993, was approximately 36 ha in size and ignited near the north western corner of the AOI, less than a kilometer from Loon Lake which is situated in the Malcom Knapp Research Forest (MKRF).The fire cause, although undetermined, was likely due to human activity based on the surrounding land use rather than lightning.[8]

The BCWS historical ignition dataset demonstrates that the proportion of human-caused fires within the AOI is substantially greater than that of the province as a whole.[9] The ignition data shows that within the AOI, approximately 64% of all ignitions since 1950 have been human-caused (a conservative estimate not including miscellaneous causes), versus 40% in the province of BC.[10] This statistic may be explained by the inclusion of Golden Ears provincial park, which is one of the most used provincial parks in the Metro Vancouver area for camping, and a lower proportion of occurrences of dry lightning strikes in wet coastal regions of the province and the presence of high elevation mountain ranges that intercept large storm systems. Furthermore, accessibility and high recreational use within many parts of the AOI, specifically for camping, and the prevalence of forestry activities, transportation corridors, railways, and other industrial activities within the AOI, also contribute to this statistic.

Access and evacuation vulnerabilities are present in various locations throughout the AOI, specifically related to single access and evacuation routes leading into campgrounds and recreation sites in Golden Ears Provincial Park, and leading into subdivisions in the Silver Valley, Allco, Blue Mountain and Rothsay neighbourhoods in the northern portions of the AOI. In addition, neighbourhoods in the south eastern portion of the City including Ruskin, Albion and Whonnock have limited connection with the major east-west arterial roads bisecting Maple Ridge due the alignment of Kanaka Creek and Kanaka Creek Park. Residents must rely on 280th Street as the only arterial route leading to Lougheed Highway. New subdivisions within the Wildfire Development Permit Area (DPA) must address access / evacuation issues

[8]University of British Columbia, 2020.Malcolm Knapp Research Forest – History. Retrieved From: https://www.mkrf.forestry.ubc.ca/about/history/

[9] BC Wildfire Service: Fire Incident Locations - Historical

[10] BCWS, 2019

and are subject to scrutiny during the rezoning, subdivision, and application and development permitting stages.

2.4 CURRENT COMMUNITY ENGAGEMENT

With regards to engagement efforts to communicate the threat posed to the community by wildfire, CMR staff is very proactive but public interest and uptake is variable. Since the 2007 CWPP, the CMR has spearheaded community engagement in FireSmart initiatives, including enhancing the Fire & Rescue page of the City's website, advertising events through social media platforms to share and distribute information online, and updating FireSmart and wildfire preparedness messaging on the digital display sign at Fire Hall #1. MRFRD have set up booths displaying FireSmart information at the Vancouver Home Show, installed numerous static displays in conjunction with CMR's Hot Summer Nights events during the wildfire season, and have participated in, and set up events for Community Wildfire Awareness Day at Fire Hall #2. Two portable flag signs have been purchased for Fire Hall #2 to entice the public's attention to issues of concern during the wildfire season.

In addition, MRFRD have three paid staff trained as Local FireSmart Representatives (LFR) who have conducted a number of home and property assessments for interested residents and have given FireSmart presentations. In addition, by providing CMR residents the opportunity to sign up for FireSmart assessments, MRFRD aims to not only provide residents the opportunity to sign up for FireSmart assessments but to build capacity by actively recruiting people to take the LFR training and become local leaders in their neighbourhood. Additional staff training for MRFRD's LFRs is ongoing through attendance at annual FireSmart seminars.

The City of Maple Ridge has been a leader in Metro Vancouver for implementing and refining a Wildfire Development Permit Area (DPA) bylaw which has been adopted into the City's Official Community Plan (OCP) and integrated into each department's routine business practices. Before the Wildfire DPA was adopted, extensive internal and external consultation was held with CMR departments, the general public, and the real estate, development and building industries. The Wildfire DPA was instituted implemented to address new development in the wildfire urban interface (WUI), and sets standards based on FireSmart principles for subdivision design, building material use, landscaping and appropriate setbacks from forested areas.

Overall, public response has been very poor as only a handful of residents have followed through from sign-up to actually getting crews to conduct a FireSmart home and property assessment. The advertised event at Fire Hall #2 for Community Wildfire Preparedness Day was staffed by firefighters with limited attendance by the public. Factors contributing to low community engagements could potentially be due to a general lack of understanding of risk factors and lack of recent impactful fires in the area.

Future community education initiatives should continue to focus engagement efforts during times of high public uptake (during or post- wildfire season) in order to maximize the CMR's resources.

Recommendations for further education and communication initiatives that may be undertaken by the CMR and the MRFS are provided in Section 5.3.

2.5 LINKAGES TO OTHER PLANS AND POLICIES

The following is a summary of CMR and provincial policies and guidelines that relate to strategic wildfire management, wildfire threat reduction, operational fuel treatments and emergency planning.

2.5.1 Local Authority Emergency Plan

Emergency preparedness and response is managed by the CMR, which has created a comprehensive Emergency Response Plan to serve the municipality.[11] This Emergency Response Plan was developed to optimize the response, resources and planning in the event of a major emergency. To help support and complement the Emergency Response Plan, hazard- specific (earthquake, flooding, landslides, major power outage, pandemic, etc.) and more detailed departmental plans are developed and routinely updated to inform staff and volunteer call-out procedures, forms, and detailed site procedures. For example, the hazard type 'fire' has its own web-page dedicated to assisting residents learn to prepare for and prevent wildfire, and appropriate actions to take both during and after a fire event. Wildfire Safety and Home Fire Safety checklists have been developed by the City that focus on FireSmart principles and steps to prepare for an evacuation. The CMR also has links to a multitude of resources for fire specific hazards such as a general emergency preparedness guide, a fire recovery guide, the emergency management program bylaw, a pdf document outlining designated disaster response routes.

The CMR has the option of activating an official Emergency Operations Center (EOC) that functions as a "mission control" center during any major disaster event where key personnel and other agencies meet to set priority actions. [12]The EOC does not command or control on-scene response efforts, but does carry out important support functions through analyzing incident command and jurisdictional impacts, collecting, evaluating and disseminating incident information such as public alerts and notifications, and coordinating with all levels of government to facilitate a coordinated response. For a more efficient response, the CMR and City of Pitt Meadows may combine EOCs into one location if both municipalities are impacted.

RECOMMENDATION #1: The CMR should work with the Province or local Medical Health Officer to develop a strategy for communities to reference when they are exposed to smoke from wildfire for extended periods of time. This strategy may include smoke exposure risk assessments, exposure reduction measures, and evacuation due to wildfire smoke.

[11] City of Maple Ridge Emergency Response Plan https://www.mapleridge.ca/1242/Emergency-Plan

[12]City of Maple Ridge Emergency Operations Centre (EOC) https://www.mapleridge.ca/1293/Emergency-Operations-Centre-EOC

2.5.2 Affiliated CWPPs

As stated earlier in the Executive Summary of this document, a previous CWPP was developed for the City of Maple Ridge in 2007 (at that time the municipality was incorporated as a District entity). Currently, a CWPP is also being developed for the District of Mission by Blackwell and both documents were reviewed for relevance to ensure consistency in recommendations and synergies within proposed future fuel treatment works.

2.5.3 Local Government Policies and Recommendations

The intent of this section is to review all relevant local government plans, policies and bylaws and identify sections within that are relevant to the CWPP Update. The following municipal bylaws, strategies and policies are relevant to wildfire planning in the City of Maple Ridge.

Maple Ridge Official Community Plan Bylaw 7060 -2014

The Official Community Plan (OCP) for Maple Ridge provides the City with a long-range framework to guide, monitor and evaluate future land uses and development within the area. The following sections contain objectives and policies which are directly relevant to wildfire risk reduction, emergency response and community resilience post-disaster.

- Maple Ridge OCP, 2014, Chapter 2, Growth Management

To accommodate future growth, this OCP policy section states that the majority of future population growth will be accommodated within the Urban Area Boundary where services are readily available, infrastructure is already in place or can be provided in an efficient and cost-effective manner. This approach of contained growth supports the agricultural land base, heritage of CMR, targets high density population in the Town Centre; and those areas as identified Community Commercial Nodes, and neighbourhoods with Area Plans, some of which are located in the WUI. Increased density leads to a higher likelihood of fire starts from human ignitions.

RECOMMENDATION #2: Consider reviewing and amending OCP, Chapter 2 – Growth Management to consider including wildfire risk and other natural hazards as they relate to Policy 2.1.2 *A Compact and Unique Community*, specifically (2-5) which outlines criteria for limiting urban scale development to areas where infrastructure can be provided in a manner that is cost-effective.

- Maple Ridge OCP, 2014, Chapter 5, Natural Features

This chapter establishes an ecological planning approach based upon natural features and systems, combining watershed management with land-based planning to incorporate land, water and air resource components into a comprehensive ecosystem planning model. The objective is to manage development through the lens of Environmentally Sensitive Areas (ESA), conservation areas, and hazard lands including steep slopes and the wildland urban interface (WUI) in order to address the increase of risk to human safety, property loss, and ecosystem degradation .The City will evaluate groundwater flows for new development adjacent to areas reliant on well water . This chapter focuses on the need for proactive measures to mitigate the risk of forest fires.

RECOMMENDATION #3: Update the Parks, Recreation & Culture Department's Noxious Weed Management Strategy currently in place to include additional consideration for flammable invasive plant species that can / do occur in the wildland urban interface.

- Maple Ridge OCP, 2014, Chapter 6, Employment

This chapter recognizes the forest as an integral economic resource for the City. Policy 6-74 includes the retention of parts of the northern slope of Thornhill as forest to protect ecological diversity.

- Maple Ridge OCP, 2014, Chapter 8 Development Permit Area Guidelines

This chapter sets guidelines for development permit areas (DPA) including a wildfire DPA, which outlines subdivision design and construction, acceptable building design, siting and materials as well as landscaping standards.

RECOMMENDATION #4: The CMR should update the '*Maple Ridge Official Community Plan Amending Bylaw No. 7187-2015*, Section B Building Design and Siting, Exterior Cladding Item (a) to state that cladding on all elevations of a structure shall be constructed of ignition-resistant or non-combustible materials.

RECOMMENDATION #5: Review and update *Maple Ridge Official Community Plan Amending Bylaw No. 7187-2015* Section 8.12.2 Guidelines to include language for management of non-compliant hedging and other vegetation in proximity to homes after the post-development inspection is signed-off by a Qualified Professional. This could include extending the landscape security fee for 1-2 years following occupancy and would be a joint initiative between Bylaw Enforcement, Development Planning and MRFRD.

RECOMMENDATION #6: Review and update the *Maple Ridge Official Community Plan Amending Bylaw No. 7187-2015* and set a procedure for establishing fire rating test standards for exterior building materials for reference by manufacturers, builders, and developers to ensure alternative fire-resistant choices are pre-approved in a timely manner for use in the WUI. Alternatively, fire test standards can be developed by the Building Department as long as they are reviewed by an expert in the building materials industry and by a standards testing agency. A running list of approved building products should be maintained.

- Maple Ridge OCP, 2014, Chapter 10 Silver Valley Area Plan

This chapter establishes how the planning and development of four discreet neighbourhoods comprising the Silver Valley Area Plan will proceed in formerly rural areas adjacent to intact forest interface areas, while managing risks from natural hazards, including wildfire.

Maple Ridge Bylaws

Maple Ridge Bylaw No. 4111, 1988: Fire Prevention

This bylaw includes general regulations to prevent accidental ignitions inside and outside properties, including. This bylaw includes regulations on use of flammable or combustible liquids and on the use the of standpipes and hydrants. The bylaw empowers designated municipal officials to serve notice against property owners or business license holders who are responsible for maintaining premises in a non-hazardous condition. Notice served will give a timeline within which business licensees must remedy the hazardous condition.

Maple Ridge Bylaw No. 5535, 1997: Outdoor Burning Regulation

This bylaw outlines the types of outdoor fires exempt from requiring a permit, and those outdoor fires requiring a permit prior to burning. In addition, it describes the types of permits that may be reacquired including agricultural, backyard, and recreational fire permits. This bylaw states that the ventilation index must be forecast as 'good' prior to starting or maintaining any fire requiring a permit. The bylaw gives the Fire Chief authority to inspect and order compliance with the bylaw.

Maple Ridge Bylaw No. 5879, 1999: Development Procedures

This bylaw establishes procedures to amend the Official Community Plan or a Zoning Bylaw or to issue a permit. The bylaw establishes application requirements for each of those development scenarios.

Maple Ridge Bylaw No. 6002, 2001: Water Services

Regulates provision of waters services, including those installed to provide fire protection. Water services installed to provide fire protection services will be installed by a designated engineer who is permitted to turn off water services if they are being used for other purposes besides fire-fighting.

Maple Ridge Bylaw No. 6279, 2004: Fireworks

This bylaw regulates, prohibits and imposes requirements in relation to fireworks, firecrackers, and explosives. The bylaw establishes permitting process under which fireworks may be obtained and discharged. and regulates the storage of fireworks and firecrackers, and fireworks events.

Maple Ridge Bylaw No. 6401, 2006: Fire Alarm Bylaw

This bylaw was established to reduce false fire alarms. The bylaw outlines the responsibility of owners to install and maintain code required fire alarms. Owners are responsible for: 1) being able to receive phone calls from the Fire Rescue Department, 2) provide access to the property with the fire alarm for the Fire Rescue Department, and 3) being capable of operating the alarm system.

Maple Ridge Bylaw No. 6487, 2007: Emergency Planning and Management

This bylaw establishes an emergency management organization to meet, develop and implement emergency plans based on principles of the British Columbia Emergency Response Management System.

Maple Ridge Bylaw No. 6533, 2007: Unsightly Premises

This bylaw regulates the accumulation of discarded materials, rubbish storage in unsuitable containers, and the overgrowth of grasses. "Rubbish" includes combustible and non-combustible wastes.

Maple Ridge Bylaw No. 6800-2011: Solid Waste and Recycling

This bylaw summarizes the policies and objectives for the removal of solid waste and recyclable materials throughout the CMR. It states that no person shall cause, allow, or permit any garbage to collect, accumulate or remain on the property, unless contained within a specified solid waste container.

RECOMMENDATION #7: Review the *Solid Waste and Recycling Bylaw No. 6800* to include language specific to green waste, not just garbage, to ensure that there is a legally enforceable bylaw to prevent the accumulation of flammable debris to collect or remain on properties.

Maple Ridge Bylaw No. 6925, 2012: Building

This bylaw regulates building construction by establishing prohibitions, permit conditions and application processes. The bylaw includes requirements for fireplace and chimney permits.

Maple Ridge Bylaw No. 6958, 2012: Vacant/Abandoned Building

This bylaw regulates the responsibilities of owners with respect to the management of vacant buildings. Vacant/abandoned buildings include those that are in a state of disrepair where a fire starting in them is likely to spread rapidly. Abandoned buildings must be secured against unauthorized entry. The bylaw enables Council to order demolition of vacant/ abandoned buildings that compromise safety of general public.

Maple Ridge Bylaw No. 6968, 2013: Smoking Regulation

This bylaw regulates smoking in buildings, vehicles for hire, public transit, common and certain commercial areas, swimming beaches, and in municipals parks and municipal buildings in certain areas. The bylaw also regulates where and how signage must be installed.

Maple Ridge Bylaw No. 7085, 2014: Parks and Recreation Facilities

This bylaw outlines general prohibitions including rules against depositing waste, breaking/defacing vegetation, starting fires, discharging fireworks except under particular circumstances.

Maple Ridge Bylaw No. 7133, 2015: Tree Protection and Management

This bylaw establishes a permit system for tree cutting. The bylaw prohibits tree cutting in Heritage Tree Protection Areas, Conservation Areas, on highways, parks or City land, and other damage to the tree or growing space around it. The bylaw stipulates the plans and conditions that must be submitted as part of permit application, disposal requirements, protection requirements, and replacement requirements around tree cutting.

RECOMMENDATION #8: Update Tree Protection Bylaw 7133, to include language that addresses tree management as it pertains to wildfire risk issues specifically targeting surface fuel build-up from windthrow, hazard trees on private and public properties, tree removals, as well as tree retention and tree replacement requirements.

Maple Ridge Bylaw No. 7425, 2018: Drinking Water Conservation

This bylaw outlines how water use may be restricted seasonally to conserve drinking water.

2.5.4 Higher Level Plans and Relevant Legislation

City of Maple Ridge Strategic Transportation Plan (2014)

This plan defines how Maple Ridge will address its future transportation needs. It provides guidance to the City on transportation-related decisions and investments over the next 20 years (to 2034). The framework is based on four strategic goals which align with the directions contained in the OCP to improve CMR's road network; and provide better options for walking, cycling, and using transit; for best management of the transportation system into the future. The four strategic goals are:

- Access & Mobility
- Transportation Choice
- Community & Environment
- Affordable Transportation System

The Road Network Plan (Section 4) describes major and minor road infrastructure improvements and identifies the City's long-term approach to improvement, ranging from major corridor projects such as widening and new roadways to neighbourhood traffic management initiatives.

The transportation directions outlined in the plan that are relevant to wildfire management planning include long-term connections for Major Municipal Roads. Identified to improve access to rural areas as well as emerging growth areas (*e.g*. Silver Valley), such road network improvements will also address the single access routes that lead to a number of neighbourhood in the north east and south east areas of the AOI. This is important for evacuation planning and ensuring safe access and egress in the event of a wildfire including smoke and poor-visibility situations.

RECOMMENDATION #9: Review the strategic transportation plan and assess the planning, budgeting, and build-out timeline for Major Municipal Road connections: 1) 112th – 108th Avenue Connector which would consist of a new roadway between 252nd Street and 268th Street along the slope of Grant's Hill. The road would provide a complete east-west route between Lougheed Highway at the Haney Bypass (via Kanaka Way and 272nd Street; 2) Thornhill Connector connect to the Thornhill neighbourhood by extending 256th Street southward to Lougheed Highway and 3) 128th/Abernathy Connector which will not only provide improved routing for commerce but for wildfire evacuation management as well.

Maple Ridge and Pitt Meadows Parks, Recreation and Culture Master Plan (2010)

This 10-year Master Plan establishes a vision for Parks, Recreation and Culture to promote and support a healthy, safe and sustainable community who are active participants in a wide range of recreation and cultural activities while balancing environmental values. The document provides defines the range of park types, outlines current operational pressure points and service levels, and identifies the possibility for new facilities and capital projects. Included are a number of opportunities for municipal and regional park land acquisition. Section 2.2 analyzes parkland supply by community population size, accessibility needs, and future development scenarios to target areas for future parkland acquisition.

With regards to wildfire, high-use recreational parks and trails can be beneficial and provide increased early detection and reporting for fires. Alternatively, these areas can also potentially be locations of increased ignitions in the interface (high–use areas). For trails in particular, depending upon the width, clearance and surfacing, they can provide points of access and control lines for suppression, and serve as surface fire fuel breaks if a fire is nearby. As of 2020, the Parks, Recreation and Culture Master Plan is due for renewal.

RECOMMENDATION #10: Review the OCP and revise the Parks, Recreation and Culture Master Plan to consider parks acquisition and maintenance through a wildfire risk lens including fuel treatments prior to acceptance by the City and consideration for long-term maintenance costs and access.

RECOMMENDATION #11: The Parks, Recreation & Culture Department should consider the preparation and adoption of a Trails Master Plan for the long-term management and enhancement of the CMR trail network for multiple users. A Trails Master Plan should address trail placement, type, and width; as well as trail building and maintenance as these activities can either increase wildfire risk (through fuels accumulations and unsafe work practices) or decrease wildfire risk (though proper placement, clean-up of combustible fuels trailside and work practices which adhere to Wildfire Act and Regulations).

Urban Forest Climate Adaptation Framework for Metro Vancouver 2017[13]

This document provides a comprehensive framework for building urban forest resilience and addressing climate change requirements at a regional level, through the following steps:

1. Risk identification within regional and urban forests;
2. Assessment of urban forest vulnerabilities to issues such as forest health, pests, invasive species, and wildfire;
3. Development of guidelines to build resilience (i.e., through species selection, management techniques, soil and planting infrastructure and water management guidelines); and
4. Development of a 144 species selection decision support tool.

The framework is complemented by a *Design Guidebook*[14]and a tree species selection database[15], which considers urban forest climate change adaptation requirements and provides best management practices for landscape and development design. Additionally, the guidebook serves as a reference guide for Metro Vancouver member municipalities in support of landscape design for existing and new developments. This framework has relevance to fuel treatment planning, particularly if re-planting or species conversion treatments are prescribed.

[13]Diamond Head Consulting. 2017. Urban Forest Climate Adaptation Framework for Metro Vancouver. Tree Species Selection, Planting and Management

[14]Diamond Head Consulting. 2017. Design Guidebook – Maximizing Climate Adaptation Benefits with Trees

[15]Diamond Head Consulting. 2017. Urban Forest Climate Adaptation – Tree Species Selection Database. Available online at: http://www.metrovancouver.org/services/regional-planning/conserving-connecting/resources/Pages/default.aspx

Metro Vancouver 2040 Shaping Our Future, 2017[16]

This document outlines a regional vision and strategy for sustainable growth within all 21-member municipalities. The document identifies the importance of environmental protection and climate change impact (Goal 3), and provides the following four strategies to guide high-level management decisions within Metro Vancouver:

Strategy 3.1: Protect conservation and recreation lands;
Strategy 3.2: Protect and enhance natural features and connectivity;
Strategy3.3: Encourage land use and transportation infrastructure that reduce energy consumption and greenhouse gas emissions, and improve air quality; and
Strategy 3.4: Encourage land use and transportation infrastructure that improve the ability to withstand climate change impacts and natural hazard risks (wildfire, earthquakes, flooding, mudslides, etc.).

Sensitive Ecosystem Inventory for Metro Vancouver and Abbotsford, 2011-2012[17]

This technical report uses standard provincial methodology to identify sensitive ecosystems across the land base of Metro Vancouver and Abbotsford. Orthophotography and existing Terrestrial Ecosystem Mapping (TEM) were used to assign Sensitive Ecosystem Inventory (SEI) values to ecosystem polygons. This inventory is an important resource to support land and environmental decisions and is relevant in the context of fuel treatment planning. Much of the area bordering the City of Maple Ridge to the north, east (District of Mission), and south (Fraser River) is classified as a 'Sensitive Ecosystems' (i.e., wetlands and old forest) or a 'Modified Ecosystems' (human modified but with significant ecological and biological value). Several class and subclasses within each ecosystem type are assigned and delineated in the inventory. Information from the SEI is being incorporated into the updated ESA Management Strategy. Both Metro Vancouver's SEI and the City's Environmentally Sensitive Area data and mapping should be reviewed during fuel treatment planning to ensure that sensitive ecosystems are protected and potential co-benefits are achieved.

Old Growth Management Areas

Spatially explicit ministerial orders pertaining to Old Growth Management Areas (OGMA) and Visual Quality Objectives as well as areas designated as critical habitat for federally listed species at risk (non-masked), were identified within the AOI. These orders must be reviewed, considered, and addressed during the fuel management prescription-level phase. Fuel management within these areas should aim to enhance these values within the AOI, whenever possible, and the land manager and/or stewardship Forester (Chilliwack Natural Resource District) must be consulted regarding any overlapping values at risk, spatially explicit ministerial orders, or other notable values on the land base, during prescription development.

[16]Metro Vancouver. Regional Growth Strategy. Adopted 2011 and updated to 2017.
[17]Metro Vancouver. Sensitive Ecosystem Inventory Technical Report 2014. Retrieved from: http://www.metrovancouver.org/services/regional-planning/PlanningPublications/SEITechnicalReport.pdf

Sustainable Resource Management Plans (SRMPs)

The Lower Fraser Sustainable Resource Management Plan[18] covers the three landscape units (LU) - Alouette, Hatzic and Widgeon - in the Chilliwack Natural Resource District that overlap with the AOI. SRMPs describe the resource tenure holders in the LU, the resource values present, existing higher-level plans, First Nations, an analysis of the Old Growth Management Areas (OGMAs) and Wildlife Tree Retention within the LU, and a discussion regarding LU objectives. OGMAs and Landscape Level Biodiversity have been established under ministerial order (M 053)[19]within the Alouette and Hatzic LUs in the 'Lower Fraser SRMP Legal Order and Objectives (February 4th, 2013). Across the Chilliwack Resource District there are wildlife habitat areas (WHAs) designated for many of the species at risk, and ungulate species including Mountain Goat (UWR), Black-tailed deer (DWR), Spotted Owl, Grizzly Bear, Tall Bugbane, Pacific Water Shrew and Mountain Beaver.

Spotted Owl Management Plan[20]

The Spotted Owl Management Plan is a guidance document for spotted owl management within the Chilliwack and Squamish Forest Districts. The goal of this plan is to stabilize, and ideally increase, spotted owl populations over time while avoiding substantial impacts to forestry employment and timber supply. It includes a strategic management plan with objectives and policies and operational guidelines for forest practices and creating operational plans in spotted owl management areas. Best management practices to manage forests within Spotted Owl habitat were subsequently updated as a component of the Spotted Owl Management Plan[21]. This document should be reviewed and integrated into any fuel management activities that are proposed within spotted owl management areas, Wildlife Habitat Areas (WHAs), or in areas of suitable spotted owl habitat such as late seral stage forests.

2.5.5 Ministry or Industry Plans

Reviewing and incorporating other important forest management planning initiatives into the CWPP planning process is a critical step in ensuring a proactive and effective wildfire mitigation approach in the AOI.

Forest Development Units

Forest Development Units (FDU) are the broad, geographic locations to which a common set of objectives, results, strategies, and measures are applicable. They have associated Forest Stewardship Plans (FSPs) which set specific forest practices obligations that are applicable to specific forest licensees. There is one approved FDU located within the AOI - the Alouette FDU.

[18]Lower Fraser SRMP. Retrieved from: https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/southcoast-region/chilliwack-lu/chilliwack_lu_lowerfraser_plan_jan2013.pdf

[19]Ministerial Order M053 (2016). Retrieved from: http://www.bclaws.ca/civix/document/id/mo/mo/2016_m053

[20]The Province of BC, 1997.

[21] Spotted Owl Best Management Practices Working Group, 2009. Retrieved online from: https://www.for.gov.bc.ca/ftp/DCK/external/!publish/LOCAL_DATA/Spotted_Owl_Management_Plan/DOCUMENTS/SPOWBestManagementPractiesJul2009.pdf

Forest Stewardship Plans (FSPs)

There is only one Forest Stewardship Plan (FSP) referred to as British Columbia Timber Sales (BCTS) TCH Chilliwack District FSP that overlaps the AOI.[22] This plan is a map-based, landscape level plan that outlines the potential forest development activities that are allowed to occur within the area. All tenure holders and forest agreement holders must provide a government approved plan before any harvesting or road building activities can occur. These plans are critical at the prescription level phase and must be consulted before any implementation occurs.

Woodlot License Plan (WLLP)[23]

The BCIT Forest Resources Society manages and operates a woodlot license (#W0007) which is a type of forest tenure that grants license holders exclusive rights to manage and harvest Crown timber within the woodlot license area. Woodlot License #W0007 is located in the north eastern portion of the AOI and contains 275 ha. In exchange for the right to harvest timber on Crown land, license holders are required to prepare a WLLP as required by Section 44 (10) of the *Forest Act* that outlines the timber resource inventory, and how the licensee intends to manage the ecological and cultural resources associated with the Woodlot License land base.

First Nations Woodland License Plan[24]

First Nations woodland licenses are an area-based, long-term forest tenure unique to First Nations that recognize their asserted land and resource interests, including the protection of traditional-use practices and the harvest and management of timber and non-timber forest products. Under Section 43.55 of the *Forest Act,* a First Nations Woodland License requires its holder to submit a Management Plan describing how the objectives set by government under the *Forest Range & Practices Act* and *Regulation.* The Katzie and Kwantlen First Nations have been granted First Nation Woodland License #N2Z (K&K FNWL #N2Z) and have prepared Management Plan #1, March 1, 2018.

Both the WLL and FNWL plans must be reviewed, and planned harvesting operations known prior to any fuel treatment prescription development.

Forest Health

Forest health management within the Fraser Timber Supply Area (TSA)is guided by the Coast Area 2015-17 Coastal Timber Supply Areas Forest Health Overview[25].This plan must be reviewed, considered, and addressed during the prescription-level phase. Fuel management and prescriptions aimed at reducing wildfire hazard within the AOI should aim to incorporate the guiding principles and best management practices (BMPs) presented within this aforementioned plan.

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[22]BCTS Chilliwack FSP #643. Retrieved from: https://www2.gov.bc.ca/gov/content/industry/forestry/bc-timber-sales/fsp/chilliwack-fsp

[23] BC Forest Resources Society. Woodlot License Plan #W0007. 2009-2019.

[24]First Nations Woodland License #N2Z. Management Plan#1. K&K Forestry Operations Ltd. 2018.

[25]Ministry of Forests, Lands and Natural Resource Operations. 2015. Coast Area 2015-17 Coastal Timber Supply Areas Forest Health Overview. 2015.

Fire Management Plans

The South Coast Response Fire Management Plan (FMP)[26] was developed for the Sea to Sky Natural Resource District (NRD), the Sunshine Coast NRD, and the Chilliwack NRD. The FMP was reviewed to identify any regional fire management planning objectives and their interpretation in the context of management considerations for the AOI. The 2018 South Coast FMP identifies values at risk and prioritizes broad categories of values as 'themes' for response planning through the Resource Strategic Wildfire Allocation Protocol (RSWAP). The South Coast FMP briefly speaks to the concept of wildfire prevention engineering within the region, which includes fuel management such as locally identified fuel breaks, proposed treatment areas, or demonstration and operational treatment areas. In order to reduce local fire threat and to build defensible space around critical infrastructure and/or residential neighbourhoods, this CWPP identifies various fuel treatment opportunities (Section 5.1.1).

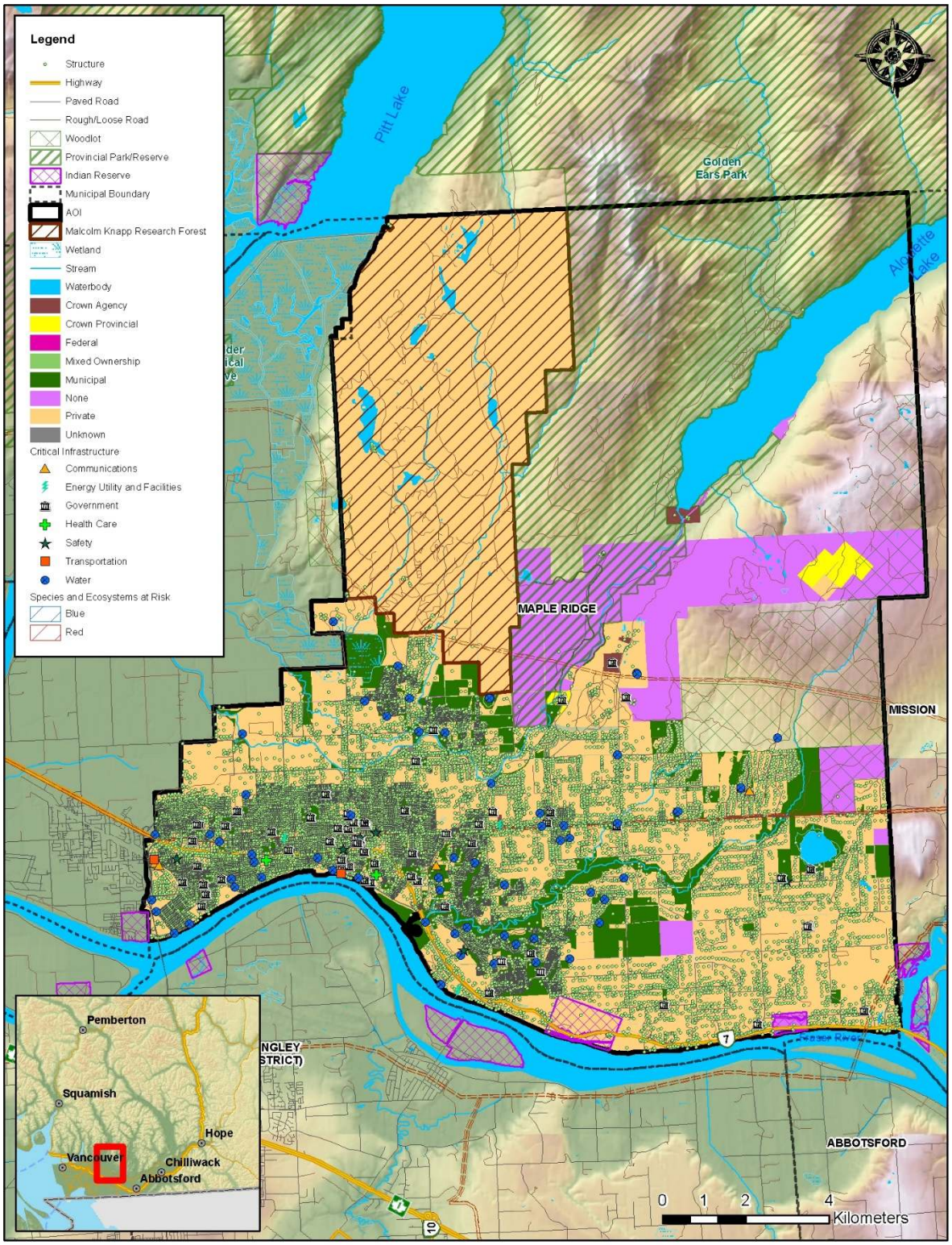
Golden Ears Park Management Plan[27]

Approved in 2013, the purpose of the Golden Ears Park Management Plan is to guide decision-making regarding ongoing management and operations within the park. As well as outlining a vision for the park, this plan defines the role and significance park in the provincial protected areas system; identifies the significant features and values of the park, and notes challenges and opportunities, while providing a framework for operational decision-making. This plan was developed in consideration of surrounding land uses including the University of British Columbia's Malcolm Knapp Research Forest, the Alouette and Stave reservoirs, and Pinecone Burke Park and Garibaldi Parks.

SECTION 3: VALUES AT RISK

Following is a description of the extent to which wildfire has the potential to impact the values at risk (VAR) within the City of Maple Ridge (CMR). VAR or the human and natural resources that may be impacted by wildfire include human life and property, critical infrastructure, high environmental and cultural values, and other resource values. VAR also include hazardous values that pose a safety hazard. Key identified VAR are illustrated below in Map 2.

[26]South Coast Fire Management Plan. 2018. (Internal government document)
[27]BC Parks. Golden Ears Park Management Plan. 2013. Retrieved from: http://www.env.gov.bc.ca/bcparks/explore/parkpgs/golden_ears/#Management



Map 2. Values at Risk within the AOI.

3.1 HUMAN LIFE AND SAFETY

One of the primary goals of the BCWS is to support emergency response and provide efficient wildfire management on behalf of the BC government. BCWS aims to protect life and values at risk, while enhancing the health and resilience of BC ecosystems.[28]

Human life and safety are the first priority in the event of a wildfire. A key consideration is the evacuation of at-risk areas and safe egress. Evacuation can be complicated by the unpredictable and dynamic nature of wildfire, which can move quickly. Evacuation takes time and safe egress routes can be compromised by wildfire causing limited visibility, or by traffic congestion and/or accidents (see Section 6.1.3).

The population distribution (both people and structures) within the AOI is important in determining the wildfire risk and identifying mitigation activities. The population of the CMR has significantly increased in recent years and was measured at 82,256 residents in the 2016 Census; up 8.2% from the 2011 Census.[29]The CMR has a higher growth rate compared to the average growth rate of 5.6% for BC as a whole. Within the CMR there are approximately 31,400 private dwellings, 3.6 % of which are occupied on a part-time basis. The CMR attracts visitors for hiking and biking, horseback riding, fishing, camping, canoeing, motor boating, and other recreational endeavors, particularly during the fire season (May – October). Several parks and recreation sites throughout the AOI are highly used during the summer months, including Golden Ears Provincial park, Kanaka Creek Regional Park, Memorial Peace Park, Jerry Sulina Park and Cross's Cabins Park. Furthermore, the Lougheed Highway (Highway 7) is a main transportation corridor between the Fraser Valley and the Vancouver and would be the evacuation route carrying people away from Maple Ridge in the event of a wildfire.

Knowledge of, and access to updated structure locations within the CMR is a critical step in efficient and successful emergency response planning. Through field visits and review of recent orthophotography and spatial data, a new spatial layer with current structure locations was created.

3.2 CRITICAL INFRASTRUCTURE

Publicly and provincially owned critical infrastructure (CI) are assets owned by the Provincial government, local government, public institution (such as health authority or school district), First Nation or Treaty First Nations. These CIs are essential to the health, safety, security or economic well-being of the community and the effective functioning of government, and assets identified in spatial data provided by the CMR's GIS department and identified in their Emergency Response Plan.

Protection of critical infrastructure (CI) during a wildfire event is an important consideration for emergency response effectiveness, ensuring that coordinated evacuation can occur if necessary, and that essential services can be maintained and/or restored quickly in the case of an emergency. Critical

[28]BC Provincial Coordination Plan for Wildland Urban Interface Fires. 2016. https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/provincial-emergency-planning/bc-provincial-coord-plan-for-wuifire_revised_july_2016.pdf

[29]Statistics Canada. 2016 Census

infrastructure includes emergency and medical services, electrical services, transportation, water and sanitation, social services, and communications infrastructure. A critical infrastructure dataset was provided by the CMR's GIS staff and this data is included in Map 2. The critical infrastructure detailed in Table 3 details an inventory of critical infrastructure identified by the CMR and confirmed via field visits and stratified into the following sub-sections: Municipal Buildings, Water & Sewage, Electrical Power; and Communications.

Protection of critical infrastructure has shown itself to be an essential wildfire preparedness function. Survival and continued functionality of these facilities not only support the community during an emergency but also determine, to a great degree, the extent and cost of wildfire recovery and economic and public disruption during post wildfire reconstruction. Critical infrastructure provides important services that may be required during a wildfire event or may require additional considerations or protection. As outlined in Section 5.2, FireSmart principles are important when reducing wildfire risk to structures and are reflected in the outlined recommendations. During field visits, it was observed that the CMR's critical infrastructure (i.e., fire halls, community centers, and schools etc.) are in compliance with FireSmart principles with the exception of older buildings and variability in surrounding hazardous landscaping / vegetation. Generally, there was a greater degree of variability between all CI types and proximity to flammable vegetation.

RECOMMENDATION #12: The use of fire-resistant construction materials, building design and landscaping should be considered for all CI when completing upgrades or establishing new infrastructure. Additionally, vegetation setbacks around critical infrastructure should be compliant with FireSmart guidelines.

RECOMMENDATION #13: It is recommended that formal FireSmart assessments (by a Qualified Professional) be completed of critical infrastructure such as the fire halls, emergency operations center, water infrastructure, and others as identified in this CWPP (Table 3) and by the City. The process could be initiated as a demonstration to City staff and MRFRD at Firehall #2.

3.2.1 Electrical Power

Electrical service for most of the CMR is received from BC Hydro through a network of above- and below-ground distribution lines (lower voltage) which receive power from local generating substations which in turn receive power from the east-west high voltage transmission line that across the lower-central portion of the AOI. Ten transmission lines bisect the CMR, one of which is 500 volts and the others are 69 volts in power. These transmission lines connect to various substations within and surrounding the AOI. There are two substations within the AOI, they include the Haney substation and the Maple Ridge substation. This system is well-mapped and BC Hydro states that staff will work with local Fire Rescue Departments and BCWS to mitigate impacts to this infrastructure in the event of a wildfire.[30]

[30] https://www.bchydro.com/safety-outages/emergency-preparation/natural-disasters.html

The main distribution lines run along Dewdney Trunk Road and the Lougheed Highway and due to the wood pole construction, the Dewdney Trunk Road line is vulnerable to wildfire with a potential to impact the neighbourhoods in the WUI. The majority of neighbourhoods, especially those in the wildland urban interface and rural areas are serviced by above-ground, street-side wooden poles that connect to homes and are therefore particularly vulnerable to fire. A large fire has the potential to impact this service by causing a disruption in network distribution through direct or indirect means. For example, heat from the flames or fallen trees associated with a fire event may cause power outages. Consideration must be given to protecting this critical service and providing power back up at key facilities to ensure that the emergency response functions are reliable.

Secondary power sources are important to reduce critical infrastructure vulnerability in the event of an emergency which cuts power for days, or even weeks. Secondary power is largely available for the majority of critical infrastructure such as Fire Hall #'s 1 (EOC), 2, and 3; RCMP headquarters, the City Hall complex; the Operations Centers; schools; and water and sewer pumping stations; via backup diesel generators. Vulnerabilities for secondary power sources include mechanical failure, potentially insufficient power sources should a wide-scale outage occur, and fuel shortage in the event of very long outages. Refer to Section 6.1.2 for discussion and recommendations related to backup power and water availability for fire suppression.

RECOMMENDATION #14: Develop utility right-of-way best management practices (BMPs) for regular brushing and clearing of woody debris and shrubs in coordination with BC Hydro to help reduce fire risk, utility pole damage and subsequent outages. In addition, BC Hydro should ensure rights-of-way do not contain fine fuel accumulations (< 7.5 cm, easily cured) and significant regeneration of conifer vegetation prior to and during the fire season and are maintained in a low hazard state. (to serve as fuel breaks).

RECOMMENDATION #15: The Engineering and Public Works Departments should complete vulnerability assessments of all critical infrastructure, secondary power sources, and fuel availability. Review current capability of secondary power sources, identify vulnerabilities, and prioritize needs, in the case of prolonged or extensive power outages. Upgrade or realign resources, as prioritized.

3.2.2 Communications, Pipelines and Municipal Buildings

Within the AOI there are no airports, however there is one hospital, the Ridge Meadows Hospital that services residents of the CMR. There is also a significant Fortis BC gas main that intersects the AOI, north of Albion towards Fire Hall #1 and then continues in a westerly direction through the AOI. In addition, there are 12 intermediate pipeline segments that intersect the southern portion of the AOI, these segments are active and are owned and managed by FortisBC Energy Inc. In the event of an emergency, the FortisBC company website states that employees will consult with local authorities and BCWS in the event of a wildfire. A full inventory of critical infrastructure for emergency services, education and municipal city buildings with updated locations is presented in Table 3 below. Pipelines are inventoried with other hazardous infrastructure in

Table 6.

Table 3. Critical Infrastructure Identified in CWPP field visits.

** Place names with an asterisk have multiple structures within the building complex*

Critical Infrastructure	Location
Albion Elementary School*	10031 240 St, Maple Ridge
Alexander Robinson Elementary School	11849 238b St, Maple Ridge
Alouette Correctional Centre for Women*	24800 Alouette Rd, Maple Ridge
Alouette Elementary School*	22155 Isaac Crescent, Maple Ridge
Arcus Community Resources*	North-eastern end of 277 St, Maple Ridge
BC Ambulance Service - City of Maple Ridge	22320 Selkirk Ave, Maple Ridge
BC SPCA Maple Ridge Branch	10235 Jackson Rd, Maple Ridge
Blue Mountain Elementary School	12153 248 St, Maple Ridge
CEED Center	11739 223 St, Maple Ridge
ċəsqənelə Elementary	24093 104 Ave, Maple Ridge
Chartwell Willow Retirement Community*	12275 224 St, Maple Ridge
Eric Langton Elementary School	12138 Edge St, Maple Ridge
Fairview Elementary School	12209 206 St, Maple Ridge
Fraserview Village Hall/ Preschool Imagination Center	22538 116 Ave, Maple Ridge
Fraternal Order of Eagles	23461 Fern Crescent, Maple Ridge
Fraser Regional Correctional Centre*	13777 256 St, Maple Ridge
Garibaldi Secondary School*	24789 Dewdney Trunk Rd, Maple Ridge
Glenwood Elementary School	21410 Glenwood Ave, Maple Ridge
Golden Ears Elementary School	23124 118 Ave, Maple Ridge
Golden Ears Winter Club	23580 105 Ave, Maple Ridge
Greg Moore Youth Center	11925 Haney Pl, Maple Ridge
Greystone Manor - congregate care facility	11657 Ritchie Ave, Maple Ridge
Hammond Community Center	20601 Westfield Ave, Maple Ridge
Hammond Elementary School	11520 203 St, Maple Ridge
Haney Presbyterian Church PCC	11858 216 St, Maple Ridge
Harry Hooge Elementary School	12280 230 St, Maple Ridge
Holyrood Manor - Long Term Care Facility	22710 Holyrood Ave, Maple Ridge
Holy Spirit Anglican Church	27123 River Rd, Maple Ridge
Justice Institute of British Columbia (JIBC) - Maple Ridge Campus	13500 256 St, Maple Ridge
Kanaka Creek Elementary School	11120 234a St, Maple Ridge
Imagination Station Child Care Centre	11485 227 St, Maple Ridge

Critical Infrastructure	Location
Legion House - assisted living facility	11797 Burnett St, Maple Ridge
Laity View Elementary School	21023 123 Ave, Maple Ridge
Maple Crescent Lodge	20591 Maple Crescent, Maple Ridge
Maple Ridge Community Church	20450 Dewdney Trunk Rd, Maple Ridge
Maple Ridge Christian Academy School	12140 204b St, Maple Ridge
Maple Ridge Elementary School	20820 River Rd, Maple Ridge
Maple Ridge Fire Hall #1	22708 Brown Ave, Maple Ridge
Maple Ridge Fire Hall #2 (Volunteer)	27501 112 Ave, Maple Ridge
Maple Ridge Fire Hall #3	11777 203 St, Maple Ridge
Maple Ridge - Pitt Meadows School District No.42 – School Board Office	22225 Brown Ave, Maple Ridge
Maple Ridge Planning Dept	11995 Haney Pl, Maple Ridge
Maple Ridge Leisure Center	11925 Haney Pl, Maple Ridge
Maple Ridge Museum & Community Archives	22520 116 Ave, Maple Ridge
Maple Ridge Public Works*	23925 Dewdney Trunk Rd, Maple Ridge
Maple Ridge Public Library*	22470 Dewdney Trunk Rd, Maple Ridge
Maple Ridge Seniors Village - congregate care facility	22141 119 Ave, Maple Ridge
Meadow Ridge Private School	12224 240 St, Maple Ridge
Meadows Montessori	11391 Dartford St, Maple Ridge
Municipal Hall	11995 Haney Pl, Maple Ridge
Maple Ridge Secondary School*	21911 122 Ave, Maple Ridge
Maple Ridge Seniors Activity Center	12150 224 St, Maple Ridge
Open Door Church/ Meadows Montessori	11391 Dartford St, Maple Ridge
Prince David Masonic Lodge	22272 116 Ave, Maple Ridge
Randy Herman Centre for Community Safety	11960 Haney Place, Maple Ridge
Revera Sunwood Retirement Residence	12241 224 St, Maple Ridge
Ridge Meadows Hospital*	11666 Laity St, Maple Ridge
Royal Canadian Legion Maple Ridge Branch 88	12101 224 St, Maple Ridge
Royal Canadian Mounted Police (RCMP)	11990 Haney Pl, Maple Ridge
Ridge Meadows Association for Community Living	11641 224 St, Maple Ridge
Ridge Meadows College	20575 Thorne Ave, Maple Ridge
Ridge Meadows Search and Rescue	23598 Jim Robson Way, Maple Ridge
Ruskin Community Hall	28395 96 Ave, Maple Ridge

Critical Infrastructure	Location
Samuel Robertson Technical Secondary School	10445 245 St, Maple Ridge
School District 42 Maintenance Dept.*	23889 Dewdney Trunk Rd, Maple Ridge
St. Andrew's Heritage Church Hall	22279 116 Ave, Maple Ridge
St. John the Evangelist Anglican Church	27123 River Rd, Maple Ridge
St Patrick's Private School	22589 121 Ave, Maple Ridge
The ACT Arts Centre& Theatre	11944 Haney Pl, Maple Ridge
The Family Education & Support Centre	22554 Lougheed Hwy, Maple Ridge
Thomas Haney Secondary School	23000 116 Ave, Maple Ridge
Thornhill Hall	26007 - 98 Avenue, Maple Ridge
WCE - Port Haney Station	22300 River Rd, Maple Ridge
WCE - Maple Meadows Station	20010 Dunn Ave, Maple Ridge
Webster's Corners Elementary School	25554 Dewdney Trunk Rd, Maple Ridge
Westview Secondary School	20905 Wicklund Ave, Maple Ridge
Whonnock Elementary School*	27471 112 Ave, Maple Ridge
Whonnock Lake Centre	27871 113 Ave, Maple Ridge
Willow Manor - congregate care facility	12275 224 St, Maple Ridge
WorkBC Centre Maple Ridge	22470 Dewdney Trunk Rd #170, Maple Ridge
Yennadon Elementary Annex	12854 232 St, Maple Ridge

3.2.3 Water and Sewage

The City of Maple Ridge receives all of its domestic water supply from Metro Vancouver's Greater Vancouver Water District (GVWD), which sources its water from Coquitlam Lake via the Coquitlam Lake reservoir and water treatment plant.[31] Under the permit of the Fraser Health Authority the CMR distributes this water to approximately 80,000 residents within the City.[32] From the reservoirs water is transmitted via large diameter Metro Vancouver transmission mains and then eventually through roughly 400 km of smaller water mains.[33] In total, the water system is made up of approximately 19,000 service connections, 6 drainage pump stations, 9 water pump stations, 12 reservoir tanks, and 38 sanitary pump stations. In the event of a service disruption or emergency, Metro Vancouver has the capacity to transfer water the Seymour/Capilano watersheds to Maple Ridge. The GVWD and the CMR have adopted a multi-barrier approach to reducing the risk of water borne infections, which includes: watershed protection, water treatment, distribution system maintenance and water quality monitoring.

[31]City of Maple Ridge, 2018. Drinking Water Quality Report. Retrieved From: https://www.mapleridge.ca/DocumentCenter/View/1914/2018-Drinking-Water-Quality-Report-PDF

[32] City of Maple Ridge. Drinking Water Quality webpage. Retrieved From: https://www.mapleridge.ca/715/Drinking-Water-Quality

[33]City of Maple Ridge, 2018. Drinking Water Quality Report. Retrieved From: https://www.mapleridge.ca/DocumentCenter/View/1914/2018-Drinking-Water-Quality-Report-PDF

The GVWD has decommissioned unnecessary access roadways within all of its watersheds (Capilano, Seymour, Coquitlam) to avoid contamination of the water source from human activities.

The CMR has two separate sewer drainage systems: storm and sanitary. Stormwater drains into local waterways, which flows through underground pipes and the occasional exposed ditch, all sources north of Dewdney Trunk Road flow into Latimer Creek, a tributary of Alouette River and all sources south of Dewdney Trunk Road flow into the Fraser River.[34]The sanitary system currently drains into the Annacis Island Wastewater Treatment Plant. However, there are plans for an upgraded Northwest Langley Wastewater Treatment Plant to receive sewage from Maple Ridge via new pipes, pump station and storage tank that would connect sewage from Maple Ridge to the new treatment plant.[35] The project is set to begin in 2022, and is expected to take four years to complete.

Water availability for fire suppression varies throughout the AOI. Heavily densified areas in west and central Maple Ridge are all hydrants protected; however, in more rural areas such as the Whonnock neighbourhood in the eastern part of the municipality, and areas near the northern WUI boundary, there is no hydrant protection.

Critical water supply and sewage system infrastructure was not identified in the 2004 CWPP. Locations for water and sewage infrastructure (current as of 2020) within the CMR AOI are detailed below in Table 4.

Table 4. Critical Water and Sewage Infrastructure Identified in CWPP field visits.

Critical Infrastructure	Location
Albion Reservoir	Eastern end of 104 Ave, Maple Ridge
Blue Mountain Reservoir(x2)	Northeast of McNutt Rd, Maple Ridge
Drainage Pump Station #1	20420 Wharf, Maple Ridge
Drainage Pump Station #2	23402 Fisherman Rd, Maple Ridge
Drainage Pump Station #3	North End of Hazelwood St on 11310 Kingston St, Maple Ridge
Drainage Pump Station #4	Intersection of Tamarack/Lougheed, Maple Ridge
Garibaldi Secondary Reservoir	Southwest of 122A Ave and 248 St intersection, Maple Ridge
Northeast Reservoir	Northeastern end of 270A St, Maple Ridge
ROW Reservoir #1	East of 256 st across from the Fraser Regional Correctional Centre
ROW Reservoir #2	East of 256 st across from the Fraser Regional Correctional Centre
SilverValley Reservoir #1	Northeast of 240 St, Maple Ridge
SilverValley Reservoir #2	Northeast of 240 St, Maple Ridge

[34] City of Maple Ridge, 2004. Technical Bulletin- Rainwater Management in Maple Ridge. Retrieved From: https://www.mapleridge.ca/DocumentCenter/View/832/Technical-Bulletin-on-Rainwater-Management-for-Maple-Ridge?bidId=

[35] Maple Ridge News. Metro Vancouver expands Northwest Langley sewage plant. Retrieved From: https://www.mapleridgenews.com/news/metro-vancouver-expands-northwest-langley-sewage-plant/

Critical Infrastructure	Location
Thornhill Reservoir	East of Carmichael St and 108 Ave intersection, Maple Ridge
Sanitary Pump Station – Wharf	20208 Wharf St, Maple Ridge
Sanitary Pump Station – S207	20686 120B Ave, Maple Ridge
Sanitary Pump Station – S208	20810 Dewdney Trunk Rd, Maple Ridge
Sanitary Pump Station - Steeves	20937 River Rd, Maple Ridge
Sanitary Pump Station - Golf	20975 Golf Lane, Maple Ridge
Sanitary Pump Station - Culter	21198 Cutler Pl, Maple Ridge
Sanitary Pump Station - Anderson	11583 Anderson Pl, Maple Ridge
Sanitary Pump Station - Meadow	12463 Meadow Brook Pl, Maple Ridge
Sanitary Pump Station - Cliff	22010 Cliff Ave, Maple Ridge
Sanitary Pump Station - Bend	22197 River Rd, Maple Ridge
Sanitary Pump Station – S225	11555 225 St, Maple Ridge
Sanitary Pump Station - Dump	11589 Cottonwood Dr, Maple Ridge
Sanitary Pump Station - Cotton	11335 234A St, Maple Ridge
Sanitary Pump Station - Lane	23527 Tamarack Lane, Maple Ridge
Sanitary Pump Station - Fair	23588 105 Ave (Fair grounds), Maple Ridge
Sanitary Pump Station - Loop	23680 108 Loop, Maple Ridge
Sanitary Pump Station – S239	11600 238A St, Maple Ridge
Sanitary Pump Station – S113	24195 113 Ave, Maple Ridge
Sanitary Pump Station – S249	11804 249 St, Maple Ridge
Sanitary Pump Station – S250	24927 Dewdney Trunk Rd, Maple Ridge
Sanitary Pump Station – Maple Creek	11881 250 St, Maple Ridge
Sanitary Pump Station - McClure	24300 McClure Drive, Maple Ridge
Sanitary Pump Station –S245	24483 106B Ave, Maple Ridge
Sanitary Pump Station - Fern	23291 132 Ave, Maple Ridge
Sanitary Pump Station – S136	22680 136 Ave, Maple Ridge
Sanitary Pump Station - Trails	24185 106 B Ave, Maple Ridge
Sanitary Pump Station – S241	12510 241 St (Academy Pk.), Maple Ridge
Sanitary Pump Station – S232	Anderson Creek Drive, Maple Ridge
Sanitary Pump Station - Nelson	New Development west of 232 st, Maple Ridge
Sanitary Pump Station – S236	near south of 11706 236 St, Maple Ridge
Sanitary Pump Station – 104 Ave	24020 104 Ave, Maple Ridge
Unnamed Reservoir	Northeast of 270A St and 123 Ave intersection, Maple Ridge
Water Pump Station #1	Northeast of Dewdney Trunk Rd and 246 St intersection, Maple Ridge
Water Pump Station #2	Northeast of 270A St and 123 Ave intersection, Maple Ridge

Critical Infrastructure	Location
Water Pump Station #3	Northwest of 264 St and Dewdney Trunk Rd intersection, Maple Ridge
Water Pump Station #4	Southeast of 236 St and 132 Ave Intersection, Maple Ridge
Water Pump Station #5	Directly south of 104 Ave and 245 St intersection, Maple Ridge
Water Pump Station #6	Northwest of 120A Ave and 201 St, Maple Ridge
Water Pump Station #7	East of 136 Ave and 232 St intersection, Maple Ridge
Water Pump Station #8	Southwest of 112 Ave and Palmer Rolph St intersection, Maple Ridge
Water Pump Station #9	West of 256 St and 128 Ave, Maple Ridge
Webster's Corners Reservoir	Northwest intersection of 264 St and Dewdney Trunk Rd, Maple Ridge
Water Pump Station #1	Northeast of Dewdney Trunk Rd and 246 St intersection, Maple Ridge
Water Pump Station #2	Northeast of 270A St and 123 Ave intersection, Maple Ridge
Water Pump Station #3	Northwest of 264 St and Dewdney Trunk Rd intersection, Maple Ridge
Water Pump Station #4	Southeast of 236 St and 132 Ave Intersection, Maple Ridge
Water Pump Station #5	Directly south of 104 Ave and 245 St intersection, Maple Ridge
Water Pump Station #6	Northwest of 120A Ave and 201 St, Maple Ridge
Water Pump Station #7	East of 136 Ave and 232 St intersection, Maple Ridge
Water Pump Station #8	Southwest of 112 Ave and Palmer Rolph St intersection, Maple Ridge
Water Pump Station #9	West of 256 St and 128 Ave, Maple Ridge
Webster's Corners Reservoir	Northwest intersection of 264 St and Dewdney Trunk Rd, Maple Ridge

3.3 HIGH ENVIRONMENTAL AND CULTURAL VALUES

The following section identifies high environmental and cultural values and where they are located. Environmental, cultural and recreational values are high throughout the AOI. A more detailed account of environmental and biodiversity aspects of this region is presented in Section 4.1.

3.3.1 Drinking Water Supply Area and Community Watersheds

As outlined above, the City of Maple Ridge receives its potable water primarily from the Greater Vancouver Water District Coquitlam reservoir, and if needed, from the Capilano and Seymour reservoirs. Protection from contamination for these valuable water sources is ensured through the following avenues: 1) restricted access to watersheds; 2) restoration of disturbed areas and deactivation of watershed roads that are no longer in use; 3) management of watershed via minimal intervention (i.e.,

in the event infrastructure is required); and 4) cooperative management with adjoining municipalities to preserve water quality.[36]

City staff did not express immediate concerns related to water availability from the Greater Vancouver Water District distribution system. Recent drinking water quality reports are available on the City of Maple Ridge website and yearly drinking water supply reports are available on the Metro Vancouver Regional District's website from 2013 onwards. These CMR drinking water reports provide information pertaining to bacteriological quality, physical parameters, chemical parameters and response to potential contamination.

According to the iMap BC, there are 12 identified watersheds that exist within the AOI, all 12 of these watersheds have been classified as 3rd order or greater based on the Strahler stream order classification system. These watersheds include the Fraser River, Katzie Slough, Alouette River, North Alouette River, Kanaka Creek, Stave River, Blaney Creek, Sturgeon Slough, Pitt River, Raven Creek, Gold Creek and one unnamed watershed. As stated above, portions of the Blaney, North Alouette, Alouette, Kanaka, Fraser and Stave watersheds are designated as community watersheds (Flap Jack, Viking, Service and Kathryn) and have therefore been assigned additional protection under the *Forest & Range Practices Act* (FRPA).

The potential impacts to watercourses from wildfire may extend past the time a fire is extinguished and is dependent on fire size and burn severity, there is the potential for significant hydrological, soil, and channel impacts.[37] Some areas may have a lower threshold for precipitation-triggered events and would be particularly vulnerable to post-wildfire debris flows, mass wasting, landslides, or flooding. This may directly impact the community (i.e., structure loss, risk to public safety) or indirectly, through loss or damage of critical infrastructure, roads, or impacts on the watershed affecting water quality.

RECOMMENDATION #16: As part of the Integrated Stormwater Management Plan (ISMP) planning process currently underway, the CMR should consider the option to include assessments to explore the potential impacts from wildfire the hydrologic and geomorphic attributes of the watershed.

3.3.2 Cultural Values

The Coast Salish are the main Aboriginal peoples group whose territory overlaps the CMR. Within this group, a total of 18 First Nations and one treaty organization with aboriginal interests in the AOI were identified in the BC Consultative Areas Database. These include the Cowichan Tribes, the Halalt First the Katzie First Nation, the Kwantlen First Nation, the Kwikwetlem First Nation, the Lake Cowichan First Nation, the Lyackson First Nation, the Matsqui First Nation, the Musqueam First Nation, the Penelakut Tribe, the Stó:l? Nation, the Peters First, the Seabird Island Band, the Semiahmoo First Nation, the Leq'á:mel First Nation, the Skawahlook First Nation, the Shxw'ow'hamel First Nation, the Soowahlie First

[36]Metro Vancouver Drinking Water Management Plan 2011. Available online at: http://www.metrovancouver.org/services/water/WaterPublications/DWMP-2011.pdf

[37]Jordan, P., K. Turner, D. Nicol, D. Boyer. 2006. Developing a Risk Analysis Procedure for Post-Wildfire Mass Movement and Flooding in British Columbia. Part of the 1st Specialty Conference on Disaster Mitigation. Calgary, AB May 23 -26, 2006.

Nation, the Stó:l? Tribal Council, the St'zuminus First Nation, the Tsawwassen First Nation and the Tsleil-Waututh Nation.

Archaeological sites and remains in BC that pre-date 1846 are protected from disturbance, intentional and inadvertent, by the *Heritage Conservation Act* (HCA), which applies on both private and public lands. Sites that are of an unknown age that have a likely probability of dating prior to 1846 (i.e., lithic scatters) as well as Aboriginal pictographs, petroglyphs, and burials (which are likely not as old but are still considered to have historical or archaeological value) are also protected. Under the HCA, protected sites may not be damaged, altered or moved in any way without a permit. It is a best practice that cultural heritage resources such as culturally modified tree (CMT) sites be inventoried and considered in both operational and strategic planning.

Due to site sensitivity, the locations of archaeological sites may not be made publicly available. However, data provided by the MFLNRORD Archaeology Branch confirms that numerous sites exist in the AOI. The City should ensure that they have direct access to Remote Access to Archaeological Data (RAAD) which the City can procure at the fuel management prescription phase for fuel treatments. Access to RAAD, will allow the City to look up or track any archeological sites in the area.[38] Prior to stand modification for fire hazard reduction, and depending on treatment location, preliminary reconnaissance surveys may be undertaken to ensure that cultural heritage features are not inadvertently damaged or destroyed.

Pile burning and the use of machinery have the potential to damage artifacts that may be buried in the upper soil horizons. Above ground archaeological resources may include features such as CMTs, which could be damaged or accidentally harvested during fire hazard reduction activities. Fuel treatment activities should include consultation with all identified First Nations at the site level and with sufficient time for review and input regarding their rights and interests prior to prescription finalization or implementation.

3.3.3 High Environmental Values

The AOI overlaps with multiple non-legal and legal OGMAs. Any proposed fuel treatment that may overlap these areas requires MNFLRORD oversight at the prescription development phase, and works can only occur following MNFLRORD consultation and approval.

The Conservation Data Centre (CDC), which is part of the Environmental Stewardship Division of the Ministry of Environment and Climate Change Strategy, is the repository for information related to plants, animals and ecosystems at risk in BC. To identify species and ecosystems at risk within the CMR, the CDC database was referenced. Two classes of data are kept by the CDC: non-sensitive occurrences for which all information is available (species or ecosystems at risk and location); and masked, or sensitive, occurrences where only generalized location information is available.

[38] MFLNRORD, Archaeology. Retrieved online at: https://www.for.gov.bc.ca/archaeology/accessing_archaeological_data/obtaining_access.htm

There are 127 species at risk present within the AOI with multiple occurrences documented in the CDC database. These include 6 red-listed species, 7 blue-listed species, 3 yellow-listed species and one non-status species (Table 5). There are no masked species at risk occurrences. Within the AOI, multiple polygons identifying critical habitat for federally listed species at risk do exist; for example, for Marbled Murrelet (*Brachyramphus marmoratus*).

Through consultation with the CDC and a biologist or qualified professional, all site level operational plans must determine if the occurrence will be impacted by fuel management or other wildfire mitigation activities. All future fuel treatment activities or those associated with recommendations made in this plan should consider the presence of, and impact upon, potentially affected species. Additionally, all site level operational plans should consult the most recent data available to ensure that any new occurrences or relevant masked occurrences are known and considered in the operational plan to mitigate any potential impacts on species at risk.

Table 5. Publicly available occurrences of Red and Blue-listed species recorded within the AOI.

Common Name	Scientific Name	Category	BC List	Habitat Type	Area (Ha)
Autumn Meadowhawk	*Sympetrum vicinum*	Invertebrate Animal	Blue	LACUSTRINE	19,977.3
Autumn Meadowhawk	*Sympetrum vicinum*	Invertebrate Animal	Blue	LACUSTRINE; PALUSTRINE; POND; BOG/FEN	1,248.5
Emma's Dancer	*Argia emma*	Invertebrate Animal	Blue	RIVERINE; CREEK; MODERATE GRADIENT	15,606.9
Emma's Dancer	*Argia emma*	Invertebrate Animal	Blue	RIVERINE; CREEK; MODERATE GRADIENT; FOREST NEEDLELEAF	31,215.1
Georgia Basin Bog Spider	*Gnaphosa snohomish*	Invertebrate Animal	Red	PALUSTRINE: Bog/Fen	702.3
Grappletail	*Octogomphus specularis*	Invertebrate Animal	Red	RIVERINE: Creek; TERRESTRIAL: Forest Mixed	163,878.4
Great Blue Heron, Fannini Subspecies	*Ardea herodias fannini*	Vertebrate Animal	Blue	TERRESTRIAL: Woodland Broadleaf, Forest Broadleaf, Forest Mixed; RIVERINE: Riparian	40,069.3
Green Heron	*Butorides virescens*	Vertebrate Animal	Blue	RIVERINE; RIPARIAN	19,822.0

Green Heron	*Butorides virescens*	Vertebrate Animal	Blue	RIVERINE; RIPARIAN; FOREST BROADLEAF	18,025.1
Johnson's Hairstreak	*Callophrys johnsoni*	Invertebrate Animal	Red	TERRESTRIAL: Woodland Needleleaf	3,901,811.5
Northern Red-legged Frog	*Rana aurora*	Vertebrate Animal	Blue	TERRESTRIAL: Forest Needleleaf	7,803.9
Northern Red-legged Frog	*Rana aurora*	Vertebrate Animal	Blue	TERRESTRIAL: Forest Needleleaf; LACUSTRINE	7,803.5
Oregon Forestsnail	*Allogona townsendiana*	Invertebrate Animal	Red	TERRESTRIAL: Forest Broadleaf	2,291.9
Oregon Forestsnail	*Allogona townsendiana*	Invertebrate Animal	Red	TERRESTRIAL: Forest Mixed	7,803.3
Pacific Water Shrew	*Sorex bendirii*	Vertebrate Animal	Red	LACUSTRINE; RIVERINE: Riparian; TERRESTRIAL: Forest Needleleaf	62,430.5
Pacific Water Shrew	*Sorex bendirii*	Vertebrate Animal	Red	TERRESTRIAL: Forest Mixed; RIVERINE: Riparian	702.3
Painted Turtle - Pacific Coast Population	*Chrysemys picta pop. 1*	Vertebrate Animal	Red	LACUSTRINE: Shallow Water, Riparian	7,508.2
Pygmy Longfin Smelt	*Spirinchus sp. 1*	Vertebrate Animal	Red	LACUSTRINE; DEEP WATER	2,103.6
Roell's Brotherella	*Brotherella roellii*	Nonvascular Plant	Red	TERRESTRIAL: Forest Mixed, Coarse Woody Debris	52,792.2
Two-edged Water-starwort	*Callitriche heterophylla var. heterophylla*	Vascular Plant	Blue	LACUSTRINE; RIPARIAN; SHALLOW WATER	3,448.6
White Sturgeon (Lower Fraser River Population)	*Acipenser transmontanus pop. 4*	Vertebrate Animal	Red	RIVERINE: Big River; High Gradient; Low Gradient; Moderate Gradient; ESTUARINE: River Mouth; Tidal Flat	90,788.1

3.4 OTHER RESOURCE VALUES

There are multiple resources values associated with the land base, including recreation and tourism, timber supply, and agriculture.

Recreational and tourist values in the City are significant. Several top ranked tourist attractions and heavily visited sites and trails are located in the AOI including: Golden Ears Park, Kanaka Creek Regional Park, Maple Ridge Park, Jerry Sulina Park and Whonnock Lake Park and many others. In addition to a vast network of hiking trails within Golden Ears Provincial park, there are also extensive boating opportunities on Alouette Lake, and multiple picnic and camping areas within the park. Consequently, the City serves as a busy recreational area and access hub to backcountry areas beyond. Considerations for raising awareness of wildfire prevention among the public and backcountry user groups (i.e., hikers, bikers, boaters, trail runners, dog walkers and others) are discussed in Section 5.3.

The AOI is encompassed by the Fraser Timber Supply Area (TSA) which is located within the South Coast Natural Resource Region and administered by the Chilliwack Natural Resource District. The last Timber Supply Review (TSR) was completed in 2016[39] and the most recent Allowable Annual Cut (AAC) adjustment was completed in 2019 after the First Nations Woodland Licence (FNWL) N2Z was established. The current AAC is 1,200,808 cubic meters per year (the AAC is not applicable to private managed forest land).

Numerous forest tenures exist on Crown land in the AOI including, but not limited to the B.C.I.T. Woodlot (W0007), the Blue Mountain Woodlot (W0038), and woodlot W0086 which is operated by S'eyem Qwantlen Resources Ltd, and First Nations Woodland Licence #N2Z (K&K Forestry Operations Ltd). Fuel reduction treatments on provincial Crown land are not anticipated to have a measurable effect on the timber harvesting land base. Typically, forest stands identified for fuels treatments are highly constrained for conventional logging and are often in undesirable or uneconomic stand types.

3.5 HAZARDOUS VALUES

Hazardous values are defined as values that pose a safety hazard to emergency responders and have the fuel that could ignite during an ember shower. A comprehensive list of hazardous values within the AOI is itemized in

[39] Ministry of Forests Lands and Natural Resource Operations, 2016. Fraser TSA – Rationale for Annual Allowable Cut (AAC) Determination. Retrieved From: https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/stewardship/forest-analysis-inventory/tsr-annual-allowable-cut/fraser_tsa_rationale.pdf

Table 6. The management and treatment of fuels in proximity to hazardous infrastructure is critical in order to reduce the risks associated with both structural fire and wildfire. Specifically, best management practices recommended for management of hazardous values include: 1) incorporating FireSmart planning and setback requirements for all infrastructure in this category; 2) maintaining emergency fuel/propane emergency shut off procedures to be enacted immediately and efficiently in the event of an approaching wildfire or ember shower; and 3) reducing hazardous materials in the wildland urban interface.

Table 6. Hazardous Infrastructure Identified in CWPP field visits.

Critical/Hazardous Infrastructure Name	2018 Location
FortisBC Transmission Pipe – LIV COQ 323	Transects the lower portion of the AOI in the west and runs parallel to the municipal boundary
FortisBC Transmission Facility – Han Reg	2227 St and Dewdney Trunk Rd, Maple Ridge
FortisBC Transmission Facility – Ham Reg	206 St and Dewdney Trunk Rd, Maple Ridge
Fortis BC Transmission Facility - Mackay Ave Stn	Mackay Ave and River Rd, Maple Ridge
Haney Substation	Northwest of 243 St and Dewdney Trunk Rd intersection
Maple Ridge Substation	Southwest intersection of Dewdney Trunk Rd and 216 St
Ridge Meadows Recycling Society/ Maple Ridge Recycling Depot	10092 236 St, Maple Ridge
BC Hydro Transmission Lines	
5L082 – 500 V	NIC - Nicola -> MDN - Meridian
60L009 – 69 V	RUS - Ruskin -> WNK - Whonnock
60L003 - 69 V	SFL - Stave Falls -> COK - Como Lake
60L003MRG – 69 V	60L003MRG Tap -> Maple Ridge
60L002 – 69 V	SFL - Stave Falls -> COK - Como Lake
60L018 – 69 V	SFL - Stave Falls -> COK - Como Lake
60L018MRG – 69 V	60L002MRG Tap -> Maple Ridge
60L002MRG – 69 V	60L002MRG Tap -> Maple Ridge
60L007 – 69 V	RUS - Ruskin -> 19-8
60L008 – 69 V	RUS - Ruskin -> 19-11

SECTION 4: WILDFIRE THREAT AND RISK

This section summarizes the factors that contribute to and were assessed in the determination of wildfire threat around the community. These factors include the natural fire regime and ecology, the Provincial Strategic Threat Analysis, and the local wildfire risk analysis completed for the AOI.

The relationship between wildfire hazard, threat and risk can be demonstrated in the following example. If a fire (the hazard) ignites and spreads towards a community, the wildfire can become a threat to life and property, with an associated risk of loss, where:

$$Wildfire\ risk\ =\ Probability\ x\ Consequence$$

and:

- ***Wildfire risk*** is defined as the potential losses incurred to human life, property and critical infrastructure within a community in the event of a wildfire;

- ***Probability*** is the likelihood of fire occurring in an area and is related to the susceptibility of an area to fire (fuel type, climate, probability of ignition etc.); and
- ***Consequences*** refers to the repercussions associated with fire occurrence in an area (higher consequences are associated with densely populated areas, or areas of high biodiversity).

4.1 FIRE REGIME, FIRE WEATHER AND CLIMATE CHANGE

The ecological context of wildfire and the role of fire in the local ecosystem under historical conditions is an important basis for understanding current conditions and the potential implications of future scenarios on wildfire threat to the community. Historical conditions may be altered by the interruption of the natural fire cycle (i.e., due to fire exclusion, forest health issues, human development) and/or climate change.

4.1.1 Fire Regime and Fire Weather

Historic Fire Regime

The Biogeoclimatic Ecosystem Classification (BEC) system describes zones by vegetation, soils, and climate. Regional subzones are derived from relative precipitation and temperature. Subzones may be further divided into variants based upon climatic variation and the resulting changes in the vegetative communities; variants are generally slightly drier, wetter, snowier, warmer, or colder than the climate of the regional subzone.[40] Biogeoclimatic subzones are categorized into five Natural Disturbance Types (NDTs) occurring in BC NDTs are based on the size and frequency of natural disturbances (largely fire) that historically occur within the subzone. NDTs have influenced the vegetation dynamics and ecological functions and pathways that determine many of the characteristics of natural systems. The physical and temporal patterns, structural complexity, vegetation communities, and other resultant attributes should be used to help design fuel treatments, and where possible, to help ensure that treatments are ecologically and socially acceptable.[41] The AOI is characterized by the BEC subzones and associated NDTs as outlined in Table 7 and illustrated in Map 3.

Table 7. BEC zones and natural disturbance types found within the AOI[42].

Biogeoclimatic Zone	Natural Disturbance Type	Area (ha)	Percent (%)
CMAunp: Coastal Mountain-heather Alpine, Undifferentiated and Parkland	NDT5	89.7	0.3%
CWHdm: Coastal Western Hemlock, Dry Maritime	NDT2	19,069.6	68%
CWHvm1: Coastal Western Hemlock, Very Wet Maritime, Submontane variant	NDT1	1,352.1	5%

[40] Retrieved from Province of BC BECWeb: https://www.for.gov.bc.ca/HRE/becweb/resources/classificationreports/subzones/index.html

[41] Province of British Columbia, 1995. Biodiversity Guidebook, s.l.: s.n.

[42]Source: MFLNRORD BEC Map (DataBC)

CWHvm2: Coastal Western Hemlock, Very Wet Maritime, Montane variant	NDT1	4,748.3	17%
CWHxm1: Coastal Western Hemlock, Very Dry Maritime, Eastern variant	NDT2	2,186.1	8%
MHmm1: Mountain Hemlock, Moist Maritime, Windward variant	NDT1	618.8	2%

The AOI is predominated by the Coastal Western Hemlock, dry maritime (CWHdm) BEC Zone which makes up 68% of the total area of interest. This BEC Zone is characterized by a type 2 natural disturbance type (NDT2) which is defined by forest ecosystems historically having infrequent stand initiating events.

Natural Disturbance Type 1 24% of the AOI is represented by CWHvm1, CWHvm2, MHmm1 forest ecosystems. These ecosystems are characterized by rare stand-initiating events. These are forest ecosystems that experience relatively small disturbances in terms of spatial extent. They have historically resulted in uneven-aged, heterogeneous stand structures from rare and small disturbances caused by fire, wind and/or landslides. The mean return interval for these disturbances has generally been 250 years for the CWH and 350 years for the MH.

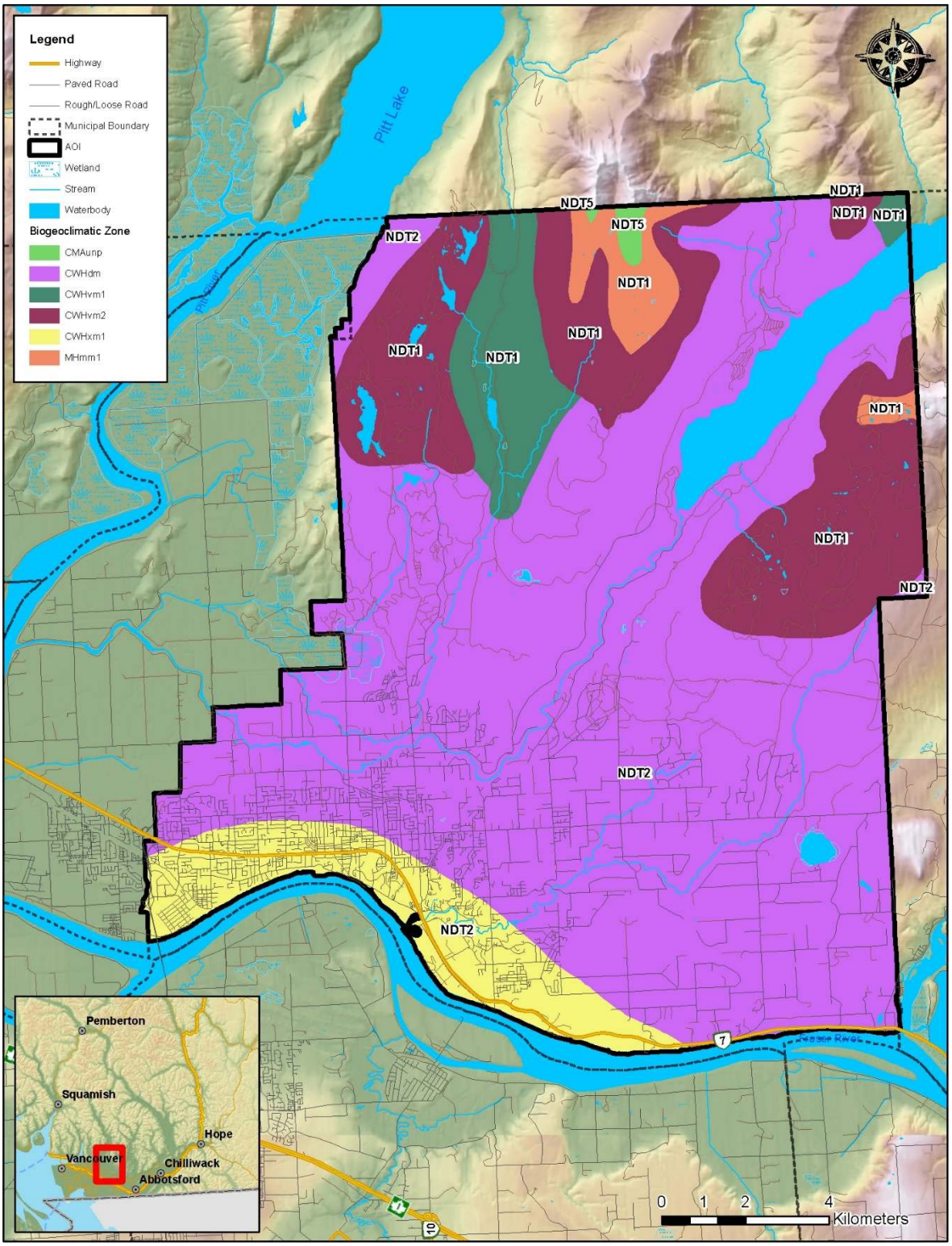
Natural Disturbance Type 2 is the dominant type in the AOI and is represented by the forest ecosystems (CWHdm, and CWHxm1) and cover 76% of the AOI. NDT 2 is historically characterized by infrequent stand initiating events where fires were often of moderate size (20 to 1,000 ha) with a mean return interval of fire of approximately 200 years. Many of these fires occur after periods of extended drought and produce a forested landscape characterized by extensive areas of mature forest with intermixed patches of younger forests. Although the fire frequency is not high and fires are generally not large, pre-planning and preparation are essential to reduce the negative impacts of a wildfire.

Natural Disturbance Type 5 less than 1% of the AOI is represented by CMAunp forest ecosystems. These ecosystems are characterized by Alpine Tundra and Subalpine Parkland ecosystems. These are forest ecosystems in which major stand initiating events are infrequent. They have historically resulted in late to seral climax vegetation and uneven aged heterogeneous stand structures patterned by variations in local topography and from rare disturbances caused by fire. [43]

While natural disturbance regimes are useful for describing the historical disturbance pattern typical for an area, fire history is complex and highly variable across space and time for many ecosystems[44]. Furthermore, forest health issues, human development and natural events contribute to changes in the fire regime, forest attributes and fuel hazard around the community.

[43] Province of British Columbia. 1995. Biodiversity Guidebook. Retrieved from: https://www.for.gov.bc.ca/ftp/hfp/external/!publish/FPC%20archive/old%20web%20site%20contents/fpc/fpcguide/BIODIV/chap2d.htm#nur

[44]Hall, E. 2010. Maintaining Fire in British Columbia's Ecosystems: An Ecological Perspective. Report submitted to the Wildfire Management Branch, Ministry of Forests and Range.



Map 3. Biogeoclimatic Zones and natural disturbance regimes within the AOI.

Forest Health Issues

The Coast Forest Health Overview outlines forest health issues present within the Fraser TSA.[45]This overview and forest health strategy (2015-2017) outlines several forest health issues that are most prevalent within the Fraser Timber Supply Area which encompasses the AOI. Abiotic factors of concern are drought and windthrow. Pests of particular concern are the Douglas-fir beetle (*Dendroctonus pseudotsugae*), forest tent caterpillar (*Malacosoma disstria*), and the parasitic plant western hemlock dwarf mistletoe (*Arceuthobium tsugense*). Ranging from minimal amounts to high-severity patches, western hemlock dwarf mistletoe-infected trees have the potential to significantly impact fuel loading throughout the AOI as mortality and tree failure occurs. Diseases of particular concern include laminated root disease (*Phellinus sulphurescens*) and Armillaria root disease (*Armallaria ostoyae*). Both laminated and armillaria root rot can also result in high levels of windthrow due to the destabilization of infected trees' root systems. Sporadic outbreaks of western hemlock looper (*Lambdina fiscellaria*) have occurred in the south coast; however, occurrences of this pest have declined in recent years, although forest land managers are noting a greater incidence of the foliar disease Swiss needle cast (*Rhabdocline pseudotsugae*) on Douglas-fir. These forest health factors may have implications for the level of surface fuel accumulation in affected stands, as well as access and working conditions for fire fighters in the event of wildfire.

The occurrence of invasive plant species such as Himalayan blackberry (*Rubus armeniacus*), English holly (*Ilex aquifolium*) and English ivy (*Hedera helix*) were noted in low-disturbance interface forest stands (WUI) within 200 m from the nearest road or establishment. If deemed necessary, and in conjunction with work completed by the Development Planning & Environmental Planning department to address the challenges posed by invasive plants, the removal of invasive species should occur concurrently with fuel treatments to ensure cost efficiencies and improve the success of ecosystem restoration work. Site monitoring should occur post-treatment to evaluate treatment efficacy and assess further mitigation requirements. The Invasive Species Council of BC recommends Himalayan blackberry treatment may be done manually, individual stems less than 1 cm in diameter can be pulled or dug out by root crowns and larger patches should be brushed or mowed twice seasonally. For the most effective results, the first treatment should be done in May and the second removal should be completed by the end of June once all the stored carbohydrates in the roots have been deployed into the foliage. English holly treatment may be in the form of manual removal, with small plants being pulled to remove the roots and large plants cut at the root collar to suppress the growth of future sprouts. English ivy mitigation can occur via manual pruning or pulling of the plant at the root and removal of resulting plant material from the site, avoiding cuttings, as those can sprout. Areas treated for English ivy removal should be mulched or covered in chips produced during the fuel treatment (not exceeding a depth of 4 cm above mineral soil), and should be frequently monitored and managed post-treatment.

[45] 2015-17 Coastal Timber Supply Areas Forest Health Overview. 2015.

RECOMMENDATION #17: The City's Environment Planning section should implement findings from its invasive plant management pilot studies to Identify potential fuel loading issues along with forest structure attributes to determine future invasive plant maintenance strategies or management requirements. If fuel treatments will occur, address invasive species management during implementation in the WUI, in order to improve forest resilience and promote ecological restoration of degraded sites.

Human Development and Natural Events

Since the establishment of urban and rural development in the AOI, there have been numerous anthropogenic and natural changes that have occurred on the landscape. Most of these changes can be described as agricultural, residential, infrastructure/institutional, and commercial development. This process entails land clearing and road building. Forest harvesting occurs on provincial Crown land as well as on private land within the AOI. Abiotic and biotic natural events occur at small geographic scales. The overall implication of human development is an increase in human ignition potential with a decrease in hazardous fuels cover, as land clearing for human development generally increases the non-fuel and O 1a/b fuel types (see Appendix 0 for a description of fuel types).

The following is a list of notable changes observed within the AOI and a description of associated implications regarding wildfire behaviour.

- Residential land development has occurred across the AOI since the mid-19th century following wide-spread settlement by early pioneers engaging in resource-based activities. This has generally resulted in the creation and expansion of the wildland-urban interface in particular areas (see Section 5.2.3) and an increase in fire suppression to protect people, homes and property in an ecosystem that had a historic fire interval of 200 years. Population growth is expected to continue in the WUI especially in the Silver Valley, Webster's Corners, and Whonnock neighbourhoods. In the eastern portion of the AOI neighbourhoods in the WUI often have only with one access/evacuation route. With the CMR's favourable climate, high recreational and landscape values, and proximity to Vancouver make it a desirable place to live, work or retire.
- With an increasing population, front-country and back-country use of trails within the CMR has increased in recent years. Increased recreational use of forested areas has implications for human caused ignitions, particularly when these activities are undertaken during the hot and dry summer months. Back-country activities have the added complication of being areas with poor access for suppression efforts.
- Forest industry activities –forest harvesting is common on provincial Crown land as well as on private land within the AOI. Poor slash hazard abatement practices can lead to high fuel loading along roadsides.
- Agricultural development – as of 2011, approximately 22% of the land base is characterized as Agricultural Land Reserve (ALR) but a portion of the CMR land used for agricultural endeavors is not contained within the ALR. This area is dominated by vegetable and fruit production, horses

and pasture, dairy farms, nurseries and greenhouses, and poultry where the potential wildfire behaviour is greatly reduced due to removal of forest vegetation and the year-round irrigation, resulting in lower potential for curing during the wildfire season.

Fire Weather Rating

Fire Weather refers to weather conditions that are conducive to fire. These conditions determine the fire season, which is the annual period(s) of the year during which fires are likely to start, spread, and cause sufficient damage to warrant organized fire suppression.

The Canadian Forestry Service developed the Canadian Forest Fire Danger Rating System (CFFDRS) to assess fire danger and potential fire behaviour. Fire Danger Classes provide a relative index of the ease of ignition and the difficulty of suppression. A network of fire weather stations is maintained during the fire season by MFLNRORD and the recorded data are used to determine fire danger, represented by Fire Danger Classes, on forestlands within a community. The information can be obtained from the BCWS and is most commonly utilized by municipalities and regional districts to monitor fire weather, restrict high risk activities when appropriate, and to determine hazard ratings associated with bans and closures.

The BC *Wildfire Act* [BC 2004] and *Wildfire Regulation* [BC Reg. 38/2005], which specify responsibilities and obligations with respect to fire use, prevention, control and rehabilitation, and restrict high risk activities based on these classes. Fire Danger Classes are defined as follows:

- **Class 1 (Very Low)**: Fires are likely to be self-extinguishing and new ignitions are unlikely. Any existing fires are limited to smoldering in deep, drier layers.
- **Class 2 (Low)**: Creeping or gentle surface fires. Ground crews easily contain fires with pumps and hand tools.
- **Class 3 (Moderate)**: Moderate to vigorous surface fires with intermittent crown involvement. They are challenging for ground crews to handle; heavy equipment (bulldozers, tanker trucks, and aircraft) are often required to contain these fires.
- **Class 4 (High)**: High-intensity fires with partial to full crown involvement. Head fire conditions are beyond the ability of ground crews; air attack with retardant is required to effectively attack the fire's head.
- **Class 5 (Extreme)**: Fires with fast spreading, high-intensity crown fire. These fires are very difficult to control. Suppression actions are limited to flanks, with only indirect actions possible against the fire's head.

It is important for the development of appropriate prevention programs that the average exposure to periods of high fire danger is determined. 'High fire danger' is considered as Danger Class ratings of 4 (High) and 5 (Extreme). Danger class days were summarized to provide an indication of the fire weather in the AOI. Considering fire danger varies from year to year, historical weather data can provide information on the number and distribution of days when the AOI is typically subject to high fire danger conditions, which is useful information in assessing fire risk.

Figure 1 displays the average frequency of Fire Danger Class days between the months of April and October. The data is summarized from the UBC Research fire weather station (years 2010 – 2019) located in UBC's Malcolm Knapp Research Forest According to Figure 1, months with the highest average number of 'high' fire danger class days are July, August and September. July and September are comparable while August has the highest overall average number of 'high' fire danger class days followed by July. Although the highest fire danger is within these three months, it should be noted that there are 'high' danger class days which extend from June to October (Figure 1).

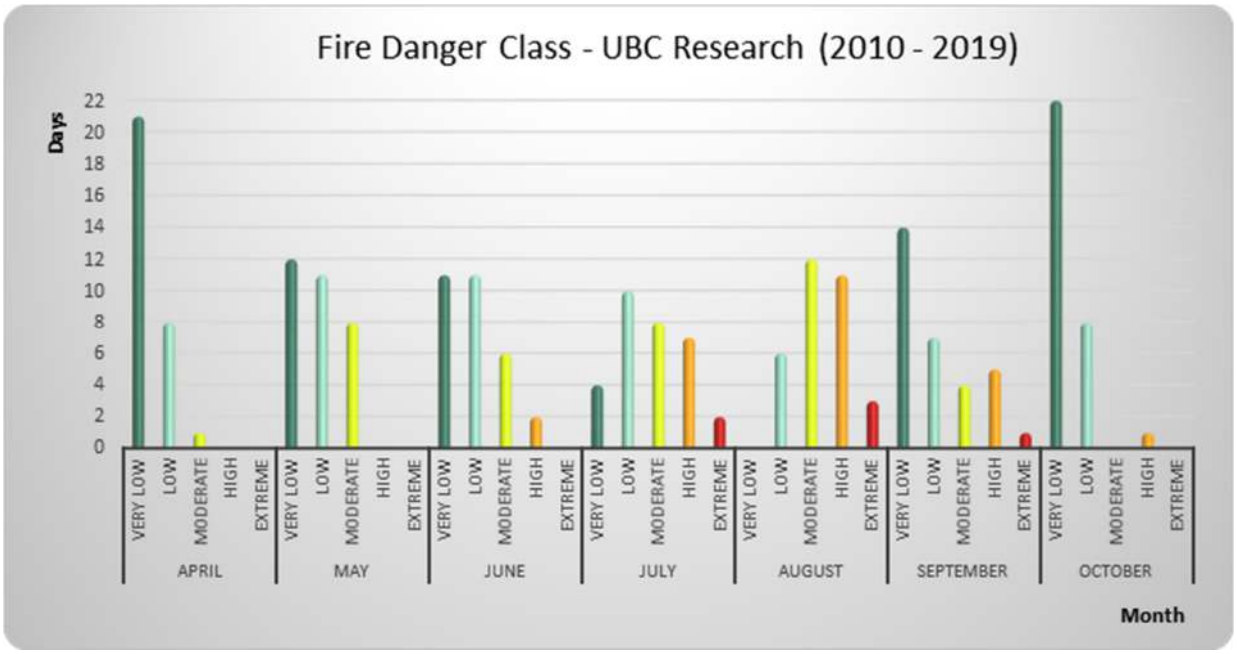


Figure 1. Average number of danger class days for the UBC Research fire weather station. Summary of fire weather data for the years 2010 - 2019.

4.1.2 Climate Change

Climate change is a complex aspect to consider in wildfire management planning. Numerous studies outline the nature of climate change impacts on wildland fire across Canada, and globally.[46] Current climate change projections point to a warmer and drier environment and shifts in vegetation with the following implications in some areas of the province:

- Increased disturbances due to insects and disease
- Increased forest fire frequency
- Longer and more intense wildfire seasons
- Increased number of high and extreme fire danger days for an average year.

[46]Flannigan, M.D et al. 2009. Implications of changing climate for global wildland fire. International Journal of Wildland Fire 18, 483-507.

As a result, some existing forests have an increased probability of more frequent, intense and more difficult to control wildfires that are likely to result in increased tree mortality, detrimental impacts to soils and hydrology, and increased threat to the community and interface areas. Although there are uncertainties regarding the extent of these impacts on wildfire, it is clear that the frequency, intensity, severity, duration and timing of wildfire and other natural disturbances is expected to be altered significantly with the changing climate.[47]Despite the uncertainties, trends within the data are visible.

As outlined *in Climate 2050 Strategic Framework – Metro Vancouver*[48], the following climate projections for the CMR are made:

- Year round increases in temperature, with the greatest increases occurring in the summer months (daytime and nighttime temperatures) and fewer winter days with frost and ice;
- Decline in summer precipitation, with longer dry spells, and extended drought periods;
- Increase in winter precipitation by 5%, with the majority of the rainfall occurring in the fall and winter;
- More extreme precipitation events, with increased rainfall during the wettest days of the year and increased frequency in extreme rainfall events; and
- Decreasing snowpack, as increasing temperatures may cause deep spring snow-packs to melt sooner and faster, resulting in a 50% reduction compared to the present day.

An increased frequency of natural disturbance events is also expected to occur as a result of climate change with coincident impacts to ecosystems. These include: storm events, including catastrophic blowdown and damage to trees from snow and ice; wildfire events and drought. Furthermore, an Increase in winter precipitation may result in slope instability, mass wasting, and increased peak flows (loss of forest cover from fire or other disturbance may increase the chance of mass wasting).

Insects and disease occurrence of Douglas-fir beetle (*Dendroctonus pseudotsugae*), spruce beetle (*Dendroctonus rufipennis*) and Swiss needle cast (*Phaeocryptopus gaeumannii*) may increase; outbreaks of western hemlock looper *(Lambdina fiscellaria lugubrosa*) may also increase.[49] Other research regarding the intricacies of climate change and potential impacts on wildfire threats to Canadian forests has found that: firstly, fuel moisture is highly sensitive to temperature change and projected precipitation increases will be insufficient to counteract the impacts of the projected increase in temperature. Results conclude that future conditions will include drier fuels and a higher frequency of extreme fire weather days.[50] Secondly, the future daily fire severity rating (a seasonally cumulative

[47]Dale, V., L. Joyce. S. McNulty, R. Neilson, M. Ayres, M. Flannigan, P. Hanson, L. Irland, A. Lugo. C. Peterson, D. Simberloff, F. Swanson, B. Stocks, B. Wotton. *Climate Change and Forest Disturbances*. BioScience 2001 51 (9), 723-734.

[48]Metro Vancouver, 2019. Climate 2050 Strategic Framework. Retrieved From: http://www.metrovancouver.org/services/air-quality/AirQualityPublications/AQ_C2050-StrategicFramework.pdf

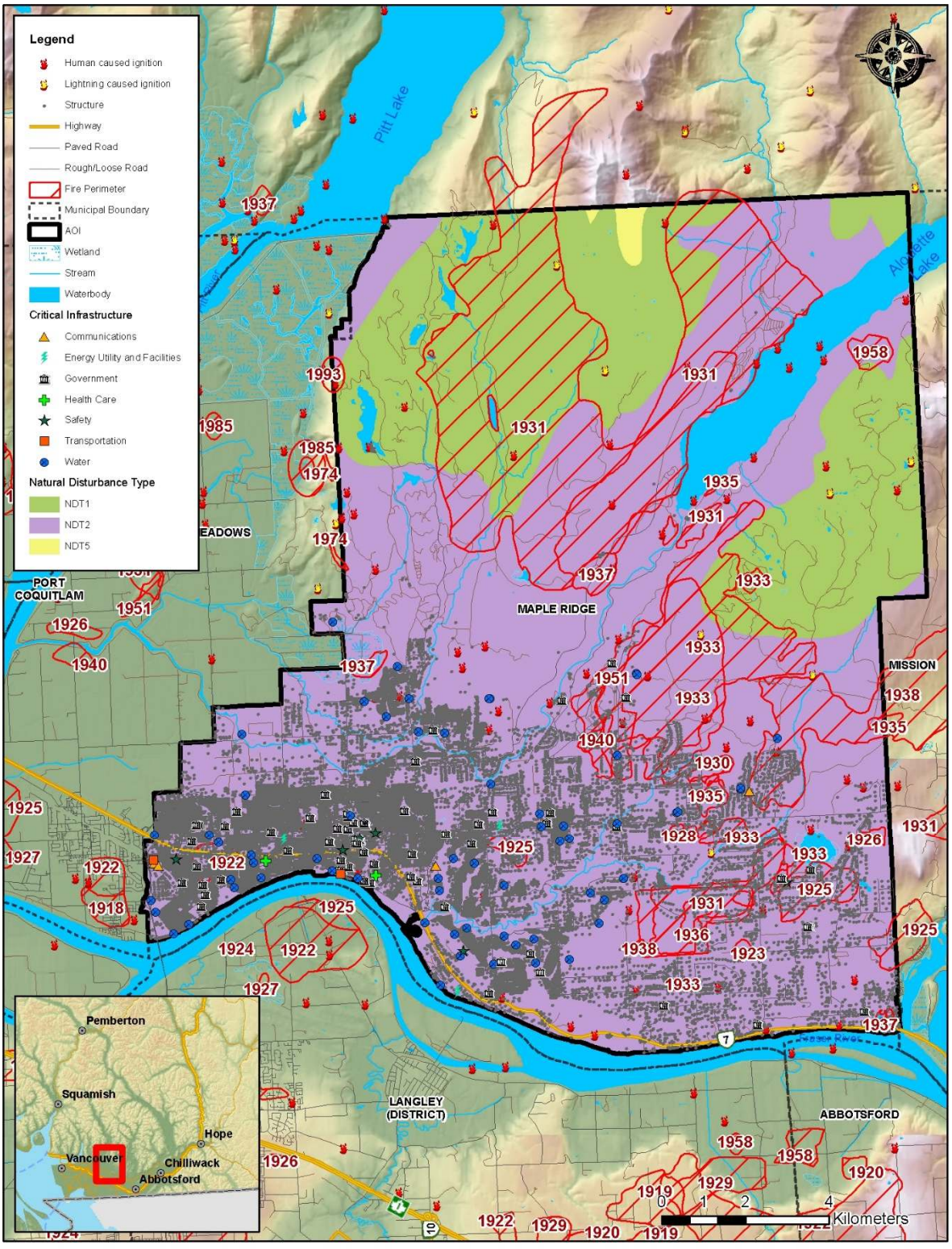
[49] MFLNRO, 2016. BC Provincial Government extension note '*Adapting natural resource management to climate change in the West and South Coast Regions*'. Accessed online at: https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/nrs-climate-change/regional-extension-notes/coasten160222.pdf

[50] Flannigan, M.D., B.M. Wotton, G.A. Marshall, W.J. deGroot, J. Johnston, N. Jurko, A.S. Cantin. 2016. *Fuel moisture sensitivity to temperature and precipitation: climate change implications*. Climatic Change (2016) 134: 59 -71. Accessed online at https://link.springer.com/content/pdf/10.1007%2Fs10584-015-1521-0.pdf.

value) is expected to have higher peak levels and head fire intensity is expected to increase significantly in Western Canada. A bi-modal (spring-late summer) pattern of peak values may evolve to replace the historical late summer peak which is the current norm.[51] Fire season severity seems to be sensitive to increasing global temperatures; larger and more intense fires are expected and fire management will become more challenging. [52] Thirdly, Future climatic conditions may be more suitable for, or give competitive advantage to, new species of plants, including invasive species[53].

In summary, climate scientists expect that the warming global climate will trend towards wildfires that are increasingly larger, more intense and difficult to control. Furthermore, it is likely that these fires will be more threatening to WUI communities due to increased potential fire behaviour, fire season length, and fire severity.

[51]deGroot, W. J., M. D. Flannigan, A.S. Cantin. 2013. *Climate change impacts on future boreal fire regimes*. Forest Ecology and Management. 294: 35 -44.
[52] Price, D.T. et al. 2013
[53] PCIC, 2017.



Map 4. Fire Regime, Ecology and Climate Change.

4.2 PROVINCIAL STRATEGIC THREAT ANALYSIS

The Provincial Strategic Threat Analysis (PSTA) evaluates multiple data sets to provide a coarse (high-level) spatial representation of approximate relative wildfire threats across BC. It provides a starting point to assess the local wildfire threat. Three inputs are combined to create the PSTA wildfire threat analysis component[54]:

1) **Historic fire density**: represents the ignition and fire spread potential based upon historic patterns and fire density weighted by fire size (larger fire perimeters were given a higher weight in order to reflect the greater cost and damage usually associated with larger fires).
2) **Spotting impact**: represents the ability of embers or firebrands from a burning fire to be sent aloft and start new fires in advance of the firefront, or outside of the fire perimeter. Spotting is most associated with high intensity crown fires in coniferous fuels and structure losses. For the wildfire threat analysis, the spotting analysis is based on estimating the threat to a given point on the landscape from the fuels surrounding it, up to a distance of 2 km. Spotting distances greater than 2 km are rare and unpredictable.
3) **Head fire intensity (HFI)**: represents the intensity (kW/m) of the fire front. HFI is correlated with flame length and fire behaviour. The greater the fire intensity (kW/m), or HFI and fire intensity class, the more extreme the fire behaviour is likely to be and the more difficult the fire will likely be to suppress. The HFI used in the wildfire threat analysis was developed using the 90th percentile fire weather index value.

The final wildfire threat analysis value was developed through an average weighting process of the aforementioned three layers.[55] The values were then separated into 10 classes (1 – 10) which represent increasing levels of overall fire threat (the higher the number, the greater the fire threat); threat class 7 is considered the threshold. Threat classes of 7 and higher are locations where the threat is severe enough to potentially cause catastrophic losses in any given fire season, when overlapping with values at risk. Classes were grouped into the following general threat class descriptions: low (1 – 3); moderate (4 – 6); high (7 – 8); and, extreme (9 – 10).

There are considerable limitations associated with the PSTA wildfire threat analysis component based upon the accuracy of the source data and the modelling tools, the most notable being:

- Limited accuracy and variability of the fire history point data;
- Sensitivity to fuel type and the associated limitations of using fuel type approximations for fire behaviour modelling; and,

[54]BC Wildfire Service. 2015. *Provincial Strategic Threat Analysis 2015 Wildfire Threat Analysis Component*. Retrieved from: https://www.for.gov.bc.ca/ftp/!Project/WildfireNews/PSTA/Provincial_Strategic_Threat_Analysis_PSTA_2015_REPORT.pdf. Accessed January 9, 2018.

[55]Weighting of the three PSTA wildfire threat analysis components: Fire density 30%; HFI 60%; spotting impact 10% (water bodies were automatically given a value of 'no threat' [-1])

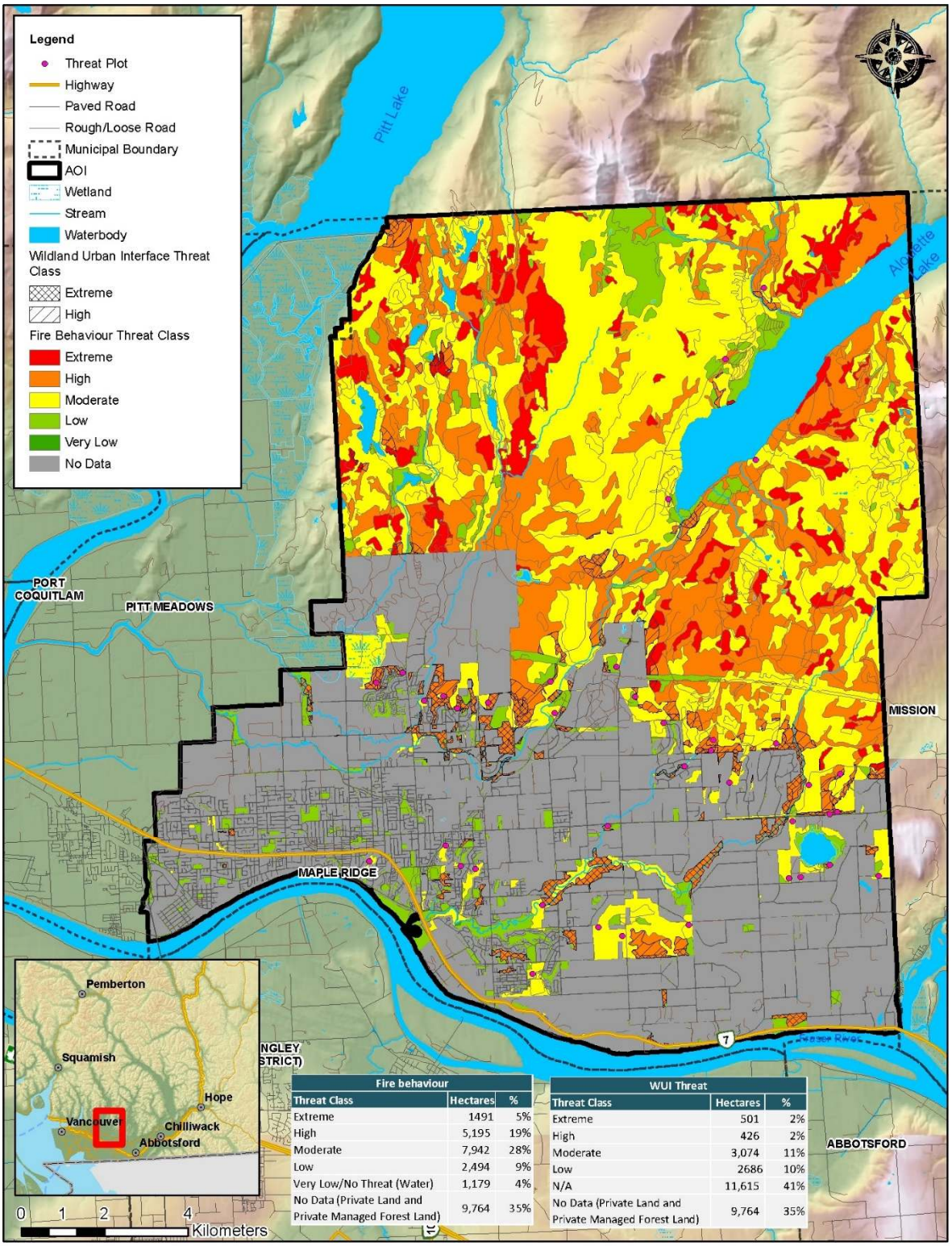
- 90th percentile rating for HFI, which represents a near worst-case scenario which may be artificial in some circumstances.

Consequently, the PSTA is complemented by a finer scale local wildfire threat analysis considering local factors to improve the wildfire threat assessment. The key steps to completing the local wildfire threat analysis and a detailed assessment of the local wildfire threat are described in Section 4.3 and Appendix A – Local Wildfire Threat Process.

The fire threat ratings from the 2019 PSTA are summarized in Table 8 and spatially illustrated in Map 5. Just under half of the AOI (46%) is categorized as either private land or private managed forest land and has no data for wildfire threat in the PSTA dataset. Low threat areas cover 13% of the AOI and water covers 4%. Approximately 34% of the AOI is categorized as having a moderate wildfire threat rating in the provincial Wildfire Threat Analysis. High and extreme threat rating covers less than 5% of the study area, with the most notable high-threat areas being scattered in the northern portion of the AOI which overlaps Golden Ears Provincial Park and concentrated along the north-west portion, along Silver Valley, and central portion, near the Justice Institute of British Columbia, of the WUI.

Table 8. Overall PSTA Wildfire Threat Analysis for the study area (rounded to the nearest hectare).

Threat Class	Area (ha)	Threat Class Description	Percent of AOI
-3	12,784	No Data (Private Land)	46%
-2	2	No Data (Private Managed Forest Land)	0%
-1	1,224	Water	4%
1	15	Low	13%
2	280		
3	3,254		
4	4,767	Moderate	34%
5	3,927		
6	748		
7	964	High	4%
8	57		
9	-	Extreme	0%
10	42		
Total	28,064	-	**100%**



Fire behaviour		
Threat Class	Hectares	%
Extreme	1491	5%
High	5,195	19%
Moderate	7,942	28%
Low	2,494	9%
Very Low/No Threat (Water)	1,179	4%
No Data (Private Land and Private Managed Forest Land)	9,764	35%

WUI Threat		
Threat Class	Hectares	%
Extreme	501	2%
High	426	2%
Moderate	3,074	11%
Low	2686	10%
N/A	11,615	41%
No Data (Private Land and Private Managed Forest Land)	9,764	35%

Map 5. Provincial Strategic Threat Rating.

4.2.1 Fire History

Fire ignition and perimeter data are depicted in Map 6. The following PSTA fire ignition data is available from 1950-2018 and fire perimeter data is available from 1919-2018 for the area. It was reported from BCWS (personal communication) that most fire activity in the City has occurred after the lifting of fire bans (the fire bans are effective and change human behaviour). Locally, BCWS prevention activity is focused on open fires and mechanical ignition sources, while smoking and lightning caused ignitions are of lower concern.

As shown in Map 6 small to large historical wildfires have burned within the AOI. ***Fire ignition data*** for the AOI is available for 1950-2016. The data shows that there have been 124 fire incidents within the AOI; and approximately 94 or 76% of these ignitions were human-caused.

Fire perimeter data for the AOI is available from 1919 to 2016, and reveals that the top ten fires burning the greatest number of hectares within the AOI occurred between 1931 and 1938 with the largest fire burning 3,643 ha and the smallest of the ten covering 108 ha (average of 273 ha). The majority (79%) of fire events took place between 1920 and 1940, with the remainder occurring in the 1950s-1970s (2 fires), and the 1990s (1 fire). All were defined as human-caused. The majority (75%) of the fires that either overlapped or occurred exclusively within the AOI were under 100 ha in total fire size and 40% were under 20 ha in size.

4.3 LOCAL WILDFIRE THREAT ASSESSMENT

The local wildfire threat assessment process includes several key steps as outlined in Appendix A – Local Wildfire Threat Process and summarized as follows:

- Fuel type attribute assessment, ground truthing/verification and updating as required to develop a local fuel type map (Appendix 0).
- Consideration of the proximity of fuel to the community, recognizing that fuel closest to the community usually represents the highest hazard (Appendix A-2).
- Analysis of predominant summer fire spread patterns using wind speed and wind direction during the peak burning period using ISI Rose(s) from BCWS weather station(s) (Appendix A-3). Wind speed, wind direction, and fine fuel moisture condition influence wildfire trajectory and rate of spread.
- Consideration of topography in relation to values (Appendix A-4). Slope percentage and slope position of the value are considered, where slope percentage influences the fire's trajectory and rate of spread and slope position relates to the ability of a fire to gain momentum uphill.
- Stratification of the WUI according to relative wildfire threat based on the above considerations, other local factors and field assessment of priority wildfire risk areas.

WUI Threat Assessments were completed over nine field days in January and February of 2020, in conjunction with verification of fuel types (see Appendix C for WUI Threat Assessment worksheets and photos). WUI Threat Assessments were completed in interface (i.e., abrupt change from forest to urban

development) and intermix (i.e., where forest and structures are intermingled) areas of the study area to support development of priority treatment areas, and in order to confidently ascribe threat to polygons which may not have been visited or plotted, but which have similar fuel, topographic, and proximity to structure characteristics to those that were.

Field assessment locations were prioritized based upon:

- PSTA wildfire threat analysis class - Field assessments were clustered in those areas with wildfire threat analysis classes of 6 or higher.
- Proximity to values at risk – Field assessments were clustered in the intermix and interface, as well as around critical infrastructure.
- Prevailing fire season winds – More field time was spent assessing areas upwind of values at risk.
- Slope position of value – More field time was spent assessing areas downslope of values at risk. Similarly, values at top of slope or upper third of the slope were identified as particularly vulnerable.
- Land ownership – Crown and municipal land was the main focus of field assessments.
- Local knowledge – Areas identified as hazardous, potentially hazardous, with limited access / egress, or otherwise of particular concern as vulnerable to wildfire, as communicated by local fire officials and BCWS zone staff.
- Observations – Additional areas potentially not recognized prior to field work were visually identified as hazardous and assessed during the week.

A total of 39 WUI threat plots were completed and over 700 other field stops (e.g., qualitative notes, fuel type verification, and/or photograph documentation) were made across the AOI (see Appendix F for WUI threat plot locations).

Using the verified and updated fuel types (Appendix 0, Map 8) combined with field wildfire threat assessments and office-based analysis (Appendix 0 to A-4), local wildfire threat for the study area was updated. Using the Wildfire Threat Assessment methodology[56], there are two main components of the threat rating system: the wildfire behaviour threat class (fuels, weather and topography sub-components) and the WUI threat class (structural sub-component).

The result of the analysis shows that the study area is composed of a mosaic of low, moderate and high threat class stands; the variability in wildfire threat is dictated primarily by the level of natural and anthropogenic disturbances that have historically occurred and persist on the land base. The study area is made up of 5% extreme threat class rating, 19% high, 28% moderate, 9% low and 4% very low/water

[56]Using the 2012 WUI Wildfire Threat Assessments in B.C. Guide(https://www.ubcm.ca/assets/Funding~Programs/LGPS/SWPI/Resources/swpi-WUI-WTA-Guide-2012-Update.pdf)

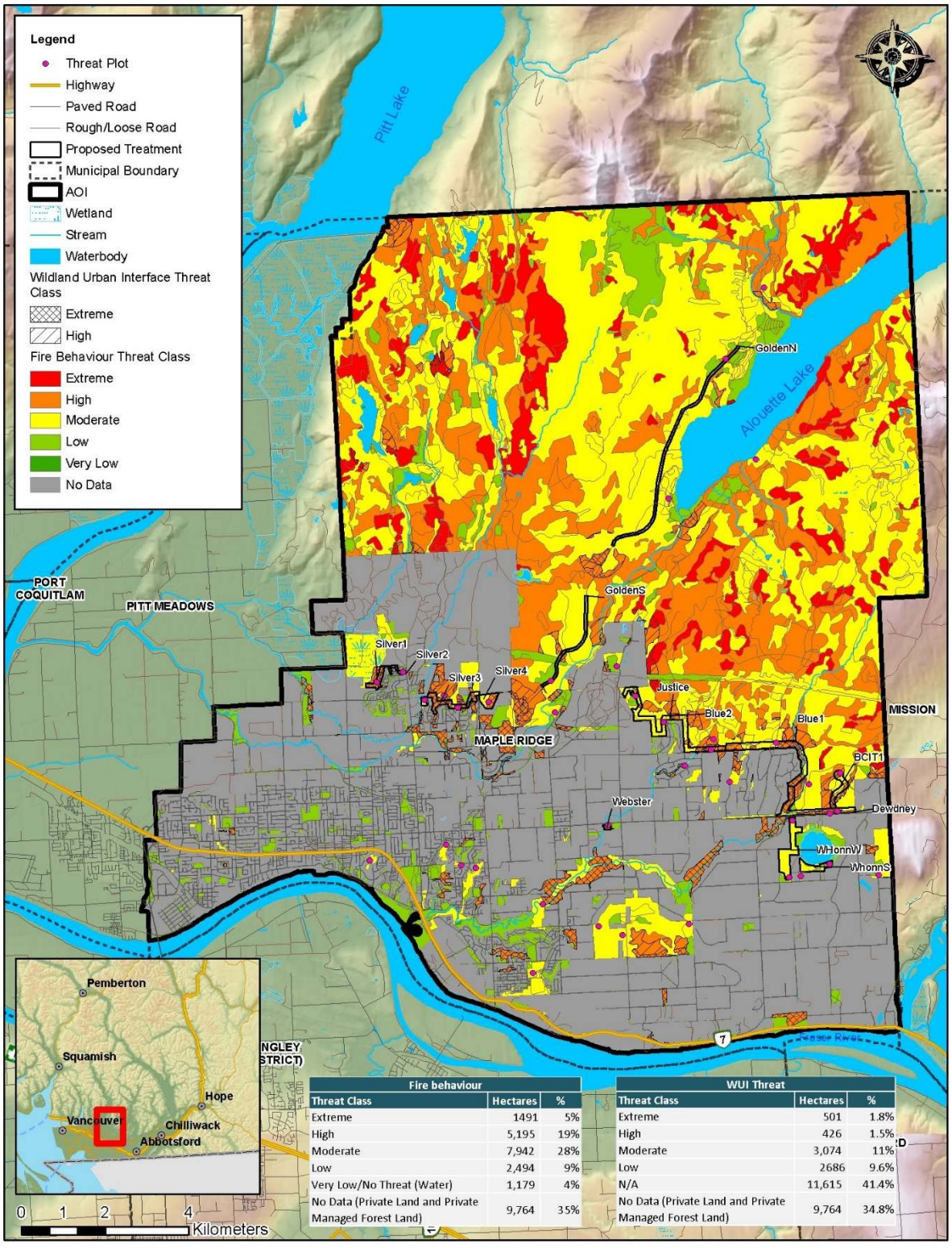
(Table 9). The remaining 35% of the AOI is classified as private land and as such has not been allocated fire threat data. Assessment of fire threat on private land is outside the scope of this CWPP.

The areas that represent the highest wildfire behavior potential and greatest risk to values within the CMR are areas of high and extreme threat class surrounding the development of Silver Valley, north of Mike Lake and near the eastern border of the Justice Institute of British Columbia.

For detailed field data collection and spatial analysis methodology for the local threat assessment and classification, see Appendix H – WUI Threat Assessment Methodology.

Table 9. Fire behaviour threat summary for the study area.

Wildfire Behaviour Threat Class	2019 PSTA Data	2019 CWPP
	Percent of AOI	Percent of AOI
Extreme	<1%	5%
High	4%	19%
Moderate	13%	28%
Low	34%	9%
Very Low/ No Threat (Water)	46%	4%
No Data (Private Land and Private Managed Forest Land)	4%	34.8%



Fire behaviour		
Threat Class	Hectares	%
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No Data (Private Land and Private Managed Forest Land)	9,764	35%

WUI Threat		
Threat Class	Hectares	%
Extreme	501	1.8%
High	426	1.5%
Moderate	3,074	11%
Low	2686	9.6%
N/A	11,615	41.4%
No Data (Private Land and Private Managed Forest Land)	9,764	34.8%

Map 6. Local Fire Behaviour Threat Rating and WUI Threat Rating.

SECTION 5: RISK MANAGEMENT AND MITIGATION FACTORS

This section outlines a wildfire risk management and mitigation strategy that accounts for fuel types present within the community, local ecology, hazard, terrain factors, land ownership, and capacity of local government and First Nations. Wildfire risk mitigation is a complex approach that requires cooperation from applicable land managers/owners, which includes all level of governments (local, provincial, federal and First nations), and private landowners. The cooperative effort of the aforementioned parties is crucial in order to develop and proactively implement a wildfire risk mitigation program. Development of a successful wildfire risk mitigation strategy is dependent on hazard identification within the community, which accounts for forest fuels, high risk activities, frequency and type of human use, and other important environmental factors. The resulting wildfire risk management and mitigation strategy aims to build more resilient communities and produces strategic recommendations or actionable items that can be categorized as follows:

1. Fuel management opportunities to reduce fire behaviour potential in the WUI;
2. Applications of FireSmart approaches to reduce fire risk and impacts within the community; and,
3. Implementation of communication and education programs to inform and remind the public of the important role it plays in reducing fire occurrence and impacts within its community.

5.1 FUEL MANAGEMENT

Fuel management, also referred to as vegetation management or fuel treatment, is a key element of wildfire risk reduction. For the purpose of this discussion, fuel management generally refers to native vegetation/fuel modifications in forested areas greater than 30 m from homes and structures (priority Zone 3 and beyond).

The objectives for fuel management are to:

- Reduce wildfire threat on private and public lands nearest to values at risk; and,
- Reduce fire intensity, rate of spread, and ember/spot fire activity such that the probability of fire containment increases and the impacts on the forested landscape and the watershed are reduced (create more fire resilient landscapes).

Ideally, these objectives will enhance protection to homes and critical infrastructure. Caveats associated with the statement include: 1) wildfire behaviour will only be reduced if the fire burns in the same location as treatments occurred, and 2) protection of homes and critical infrastructure is highly dependent upon the vulnerability to ignition by embers (ignition potential) directly around the value at risk. In summary, fuel treatments alone should not be expected to protect a community from the effects of wildfire, namely structure loss.

Fuel treatments are designed to reduce the possibility of uncontrollable crown fire through the reduction of surface fuels, ladder fuels and crown fuels. However, the degree of fire behaviour reduction achieved by fuel management varies by ecosystem type, current fuel type, fire weather, slope and other variables and it is important to note that it does not stop wildfire. It should also be noted that although

fuel treatments have the potential to decrease potential fire intensity and the likelihood of extreme fire behaviour, they can also increase surface wind speeds and potentially reduce fuel moisture content by opening up the canopy and therefore have the potential to increase the speed at which a fire may spread across the landscape. Those undertaking the planning and implementation of fuel treatments should acknowledge this and plan accordingly.

Fuel management on Crown lands may be funded by the Union of BC Municipalities (UBCM), through the Community Resiliency Investment (CRI) Program). Fuel management on provincial Crown land only, may be funded by the new Crown Land Wildfire Risk Reduction (WRR) funding category[57] under the CRI Program. The CRI Program (formerly the Strategic Wildfire Prevention Initiative or SWPI) also provides funding for selected FireSmart activities and planning on private land.[58] The best approach to mitigate fuels on private lands is to urge private landowners to comply with FireSmart guidelines (as described below in Section 5.2) and to conduct appropriate fuel modifications using their own resources (CRI program funding may be available). In general, when considering fuel management to reduce fire risk, the following steps should be followed:

- Carefully anticipate the likely wildfire scenarios to properly locate fuel modification areas;
- Acquire an understanding of local ecological, archaeological, and societal values of the site;
- Prescriptions should be developed by a qualified professional forester working within their field of competence;
- Public consultation should be conducted during the process to ensure community support;
- Potential treatment areas and draft prescriptions should be referred to First Nations with sufficient time for meaningful review and input;
- Treatment implementation should weigh the most financially and ecologically beneficial methods of fulfilling the prescription's goals;
- Pre- and post-treatment plots should be established to monitor treatment effectiveness; and
- A long-term maintenance program should be in place or developed to ensure that the fuel treatment is maintained in a functional state.

The fuel treatment opportunities identified in this CWPP include the use of fuel breaks and fuel treatments as defined in Section 5.1.1, to reduce the wildfire potential around the AOI. Potential treatment activities include fuel removal, thinning, stand conversion, pruning, and chipping, or a combination of two or more of these activities. Stand conversion encourages forests with a higher proportion of deciduous trees, and has been shown to be effective at reducing wildfire potential in mixed-wood or conifer dominated stands. This approach generally involves a thin-from-below to reduce

[57] Crown Land WRR is a recently introduced category of CRI Program funding for risk reduction activities on provincial Crown Land effective 2020 that will be led by MFLNRORD (in partnership with local government and others) for wildfire risk reduction activities targeting provincially identified critical infrastructure, and treatment activities on provincial Crown land around communities.

[58] CRI FireSmart Community Funding & Supports – Program & Application Guide. 2020. Retrieved from: https://www.ubcm.ca/assets/Funding~Programs/LGPS/CRI/cri-2020-program-guide.pdf

ladder fuels and crown fuels continuity, targeting the removal of conifer species and the retention of broadleaf species.

5.1.1 Proposed Treatment Units

Funding opportunities from UBCM under the CRI Program will consider fire prevention activities on provincial Crown land, local government and reserve land.[59] Fire prevention activities on private land that may be funded under this program are related to FireSmart activities (including FireSmart planning and assessments, local rebate programs for completion of eligible FireSmart activities, and provision of off-site disposal of vegetation management debris).

The potential treatment areas represent moderate, high or extreme fire hazard areas which are close to values at risk (structures, infrastructure, or areas of high use during the fire season) or have been identified as landscape level fuel treatments and are located on provincial Crown or municipal land. *It should be noted that the location of proposed treatment units on these land ownership types does not imply that high and extreme hazard areas do not exist on private land within the AOI.* As stated in Section 5.1, mitigation approaches should also be pursued on private land where hazard exists, bearing in mind the different funding resources and objectives on this land type. Although the potential treatment areas have been ground-truthed during field work, additional refinement of these sites will be required when prescriptions are developed. Detailed site-level assessment to stratify treatment areas (including areas in the polygon that do not require treatment), must identify values and constraints, engage all appropriate provincial agencies and stakeholders, and furthermore must identify, consult and involve all affected First Nations. Fourteen recommended potential fuel treatments are outlined in Table 10 and displayed in **Error! Reference source not found.**. These fuel treatment opportunities include the use of interface fuel treatments and primary fuel breaks as defined below.

Fuel Treatment Types

The intent of establishing a fuel treatment is to modify fire behaviour and create a fire suppression option that is part of a multi-barrier approach to reduce the risk to values (e.g. structures). A fuel break in and of itself, is unlikely to stop a fire under most conditions. The application of appropriate suppression tactics in a timely manner with sufficient resources, is essential for a fuel break to be effective. Lofting of embers (*i.e.*, "spotting") over and across a fuel break is a possibility (increasing with more volatile fuel types and fire weather) and has the potential to create spot fires beyond the fuel break that can expand in size and threaten values at risk. Spotting should be evaluated and treated to create conditions where extinguishment of spot fires is possible and FireSmart standards should be

[59]This new funding program (up to $50 million over three years) was initiated in 2018 as per recommendations from the 2017 BC Flood and Wildfire Review Report by Abbott and Chapman (https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/embc/bc-flood-and-wildfire-review-addressing-the-new-normal-21st-century-disaster-management-in-bc-web.pdf). Program details are available on the UBCM's website: https://www.ubcm.ca/EN/main/funding/lgps/community-resiliency-investment.html

applied to structures and associated vegetation and other fuel to reduce the risk of structures igniting. Fuel treatments require periodic maintenance to retain their effectiveness.

Interface Fuel Breaks

Fuel breaks on Crown or municipal land immediately adjacent to values are termed interface fuel breaks. These are designed to modify fire behaviour, create fire suppression options, and improve suppression outcomes. Interface fuel breaks are relatively small (approximately 100 meters wide) and when treated with appropriate fuel reduction measures can break the crown fire threshold and reduce the risk of a crown fire reaching values at risk. Treatment widths can be varied to allow for alignment and to take advantage of natural and human-constructed fire resilient features that enhance effectiveness. Surface fire spread across the fuel treatment and spotting across the fuel treatment, are both concerns and rely on suppression actions to be effective. In order to reduce potential fire intensity and spotting, fuel on private land between the interface fuel break and structures should be treated according to FireSmart vegetation management standards. Structures in interface areas should be constructed or retrofitted to FireSmart design standards. All of the proposed fuel treatments for the CMR are interface fuel breaks.

Primary Fuel Break

Primary fuel breaks are located in strategic locations beyond the interface fuel treatments. Primary fuel breaks are designed to modify fire behaviour and create fire suppression options that reduce the risk of a crown fire reaching a community and/or adjacent private lands. Primary fuel breaks may be located to completely surround a community or be strategically placed upwind of communities and perpendicular to fire season winds. Primary fuel breaks have sufficient width and appropriate fuel reduction measures to break the crown fire threshold and reduce fire intensity such that overstory fire moves to the ground surface and spread rates are reduced. While there are no absolute standards for fuel break width or fuel manipulation in the literature, distances will vary based on fuel type, topography, and expected fire behaviour. [60] A 300-metre fuel break width is generally recommended. The spotting and fire suppression concerns with regards to primary fuel breaks are the same as the ones described for interface fuel breaks. No primary fuel breaks have been recommended as part of this CWPP, but the east-west BC Hydro transmission line alignment across the north central part of the AOI can be considered a primary fuel break. During field assessments the fuel types noted in the right-of-way included N (non-fuel), D-1/2 (deciduous), and M-1/2 (a mix of deciduous and coniferous with the coniferous component comprising 25% or 50%). These fuel types are considered low hazard.

RECOMMENDATION #18: Proceed with detailed assessment, prescription development and treatment of hazardous fuel units and FireSmart fuel treatment demonstration treatment areas identified and prioritized in this CWPP. Prescriptions must be developed within the context of the City's OCP Chapter 5-Natural Features and Metro Vancouver's Sensitive Ecosystem Inventory (SEI). Consult with a qualified biologist and First Nations during prescription development to address all concerns.

[60] Agee, J.K., Bahro, B., Finney, M.A., Omi, P.N., Sapsis, D.B., Skinner, C.N., van Wagtendonk, J.W., Weatherspoon, C.P. The use of shaded fuelbreaks in landscape fire management. Forest Ecology and Management, 127 (2000), 55-66.

Table 10. Proposed Treatment Area Summary Table.

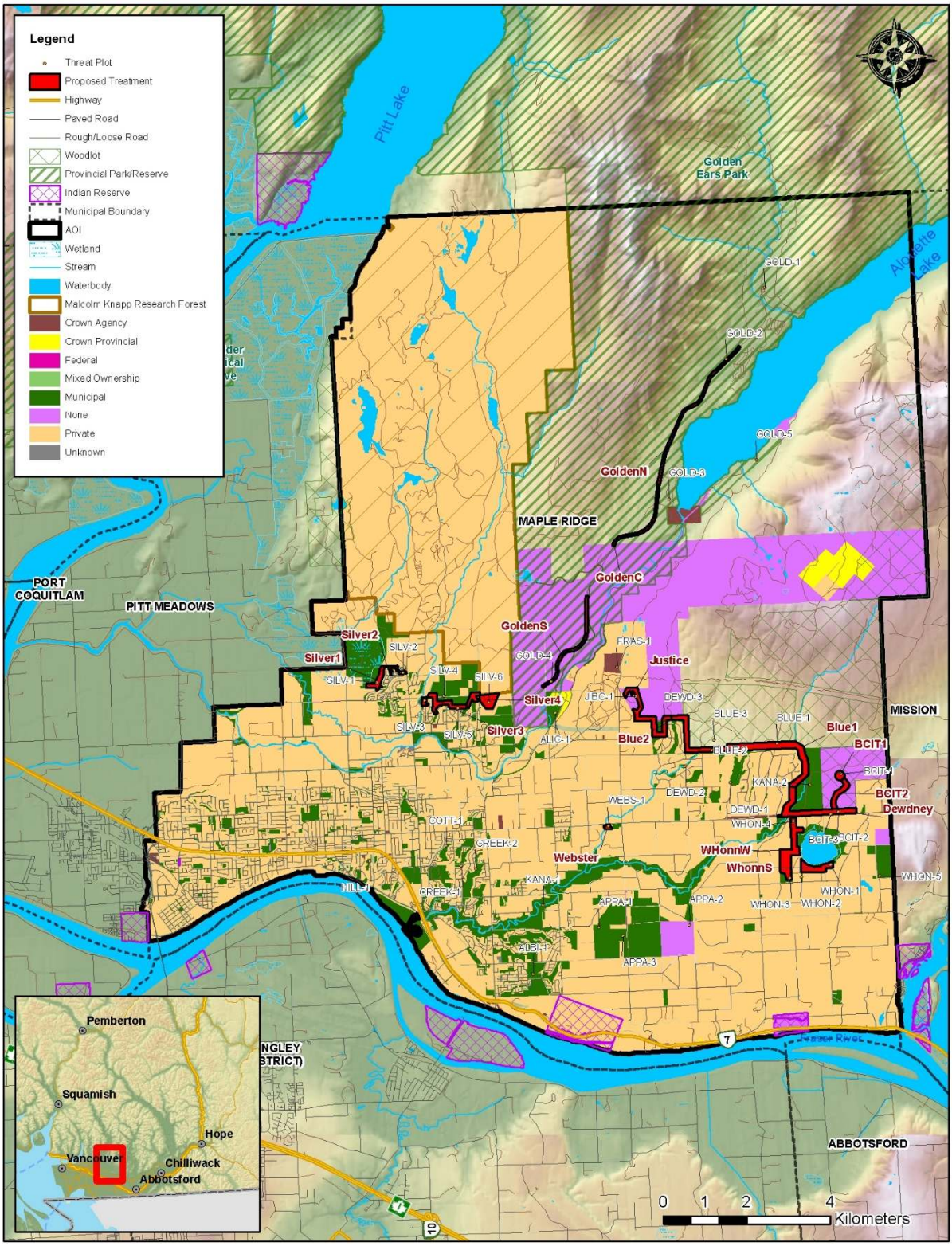
FTU # and Stratum	Geographic Area	Priority	Total Area (ha)	Treatment Unit Type/ Objective	Local Fire Threat (ha)			Overlapping Values / Treatment Constraints	Treatment Rationale
					Extreme / High	Mod	Low		
1	Silver Valley (Silver1)	Moderate (priority #12)	8.6	**Interface Fuel Break:** Fuel treatment will result in residual stands with characteristics that will reduce continuity of fuel loads, crown and surface fire behaviour, and wildfire risk.	8.5	0.1	0.0	This PTU falls within the Fraser TSA and is entirely overlapped by the Widgeon landscape unit which is a part of the Chilliwack Natural Resource District and is guided by the Lower Fraser Sustainable Resource Management Plan. It is also almost entirely overlapped by an agriculture land reserve (ALR) polygon (4312399). There is partial overlap with critical habitat for federally listed species at risk, specifically pertaining to marbled murellet populations (*Brachyramphus marmoratus*) in the southern mainland coast. Private land parcels border the PTU. Consultation with tenure holders, private land holders, and a qualified ecosystem biologist must occur during prescription development and prior to implementation to ensure all concerns are addressed.	This PTU is located adjacent (<100 m) to private residences in the western portion of the Silver Valley neighbourhood, and near Foreman Drive and Vista Ridge Drive. Due to the proximity to Blaney Bog soils are fresh to moist. There is significant blowdown and high surface fuel loading, especially fine fuels (<7cm diam). Conifer regeneration in gaps has created variable age classes resulting in a low fuel strata gap patch vertical and horizontal fuel continuity which can contribute to surface fires transitioning to crown fires. This area is recommended for treatment due to its proximity to private residences, and the high hazard fuel type (C-3) and is intended to provide separation between the homes and flammable vegetation. Recommended treatments include removal of understory conifers, pruning to increase crown base height, and removal of excess surface fuels. When implemented, this fuel break will improve resident safety.
2	Silver Valley (Silver2)	Moderate (priority #11)	3.6	**Interface Fuel Break:** Fuel treatment will result in residual stands with characteristics that will reduce continuity of fuel loads, crown and surface fire behaviour, and wildfire risk.	3.6	0.0	0.0	This PTU falls within the Fraser TSA and is entirely overlapped by the Widgeon landscape unit which is a part of the Chilliwack Natural Resource District and is guided by the Lower Fraser Sustainable Resource Management Plan. There is partial overlap with critical habitat for federally listed species at risk, specifically pertaining to marbled murellet populations (*Brachyramphus marmoratus*) in the southern mainland coast. Private land parcels border the PTU. Consultation with tenure holders, private land holders, and a qualified ecosystem biologist must occur during prescription development and prior to implementation to ensure all concerns are addressed.	This PTU is located between Anderson Creek Drive to the north and Foreman Drive to the south in the Silver Valley area, and occupies a patch of forest land sandwiched between new residential development. Cedar hedging is commonly planted within the home ignition zone (HIZ) to mark private property adjacent to the greenbelt where this PTU is situated. It is a Hw dominated stand, infected with dwarf mistletoe, resulting in tree failure and accumulations of MWD and FWD on the forest floor and contributing to overall fuel loading. Standing dead Hw present within and surrounding the assessment area, will contribute to surface fuel loading to increase into the future. Recommended treatments include removal of understory conifers, pruning to increase crown base height, and removal of surface fuels.

FTU # and Stratum	Geographic Area	Priority	Total Area (ha)	Treatment Unit Type/ Objective	Local Fire Threat (ha)			Overlapping Values / Treatment Constraints	Treatment Rationale
					Extreme / High	Mod	Low		
3	Silver Valley (Silver3)	High (priority #5)	16.7	**Interface Fuel Break:** Fuel treatment will result in residual stands with characteristics that will reduce continuity of fuel loads, crown and surface fire behaviour, and wildfire risk.	12.6	3.5	0.6	This PTU falls within the Fraser TSA and is partially overlapped by the Widgeon landscape unit and partially overlapped by the Alouette landscape unit which is a part of the Chilliwack Natural Resource District and is guided by the Lower Fraser Sustainable Resource Management Plan. It partially overlaps with the Alouette FDU which is regulated by the BCTS TCH Chilliwack District FSP. Private land parcels border the PTU. Consultation with tenure holders and private land holders must occur during prescription development and prior to implementation to ensure all concerns are addressed.	This treatment unit extends between Balsam St. on the west and McCauley Crescent on the east in the Silver Valley. Fuel types are M-1/2 50%, C-5, and higher hazard M-1/2 75%. Horizontal and ladder fuels are patchy; fine, medium, and coarse woody debris fuel loading is high in portions of the PTU due to standing dead Hw resulting from mistletoe and drought-stressed Cw. Dense Cw and Hw regeneration fringes private property. The greatest concern in this PTU is excess surface fuel loading and dense stands of young conifers. Recommended treatments include removal of understory conifers, removal of excess surface woody debris accumulations, including a 3 m strip along either side of the Shoesmith and Maple Ridge trails to reduce the likelihood of fire starts from human ignitions. This PTU is contiguous with the SILVER4 treatment unit to the east.
4	Silver Valley (Silver4)	High (priority #4)	17.4	**Interface Fuel Break:** Fuel treatment will result in residual stands with characteristics that will reduce continuity of fuel loads, crown and surface fire behaviour, and wildfire risk.	9.6	6.4	1.5	This PTU falls within the Fraser TSA and is entirely overlapped by the Alouette landscape unit which is a part of the Chilliwack Natural Resource District and is guided by the Lower Fraser Sustainable Resource Management Plan. It completely overlaps with the Alouette FDU which is regulated by the BCTS TCH Chilliwack District FSP. Private land parcels are within and border the PTU. Consultation with tenure holders and private land holders must occur during prescription development and prior to implementation to ensure all concerns are addressed.	Contiguous with SILVER3 to the west, this PTU forms a continuous 100m buffer around new residential development along 240th St. as well as the water reservoir. The Malcolm Knapp Research Forest lies immediately to the north and contains a mix of mature forest, and cutblocks in various stages of regeneration. Surface fuel loading, steep slopes (>40%), and a south aspect with a water reservoir above, characterizes the treatment unit. The stand is second-growth, even-aged with both high crown closure and height to diameter ratios. Mortality from drought-stressed CW on thin soils is expected to contribute to FWD, MWD, and CWD surface fuel loading. It is recommended that thinning treatments remove these dead and dying trees in order to reduce future fuel loading, and to remove flammable vegetation around the water reservoir facility.
5	Justice Institute of BC (Justice)	High (priority #7)	28.3	**Interface Fuel Break:** Fuel treatment will result in residual stands with characteristics that will reduce continuity of fuel loads, crown and surface fire behaviour, and wildfire risk.	2.1	25.3	0.9	This PTU falls within the Fraser TSA and is entirely overlapped by the Alouette landscape unit which is a part of the Chilliwack Natural Resource District and is guided by the Lower Fraser Sustainable Resource Management Plan. The western portion of the PTU overlaps with an institutional tenure used for a school/outdoor education facility; and two reserve/notation, sand/gravel quarrying tenures. It completely overlaps with the Alouette FDU, which is managed by the BCTS TCH Chilliwack District FSP. It partially overlaps with an active license to cut that will expire on 4/25/2020. Private land parcels border the PTU. Consultation with tenure holders and private land holders must occur during prescription development and prior to implementation to ensure all concerns are addressed.	This PTU wraps around the east side of the Justice Institute of BC, and follows the Blue Mountain Forest Service Rd, to Katonien St. Fringes of C-3 vegetation surround the yard of the Justice Institute which contains combustible materials for training purpose and the business park. Vertical and horizontal ladder fuels are continuous along these edges and the crown base height (CBH) is low. Surface fuel loading is moderate; ladder fuels are uniform in the C-3 fringes; and crown closure is high. This fuel break will provide separation between structures and flammable vegetation. Recommended treatments include thinning to reduce density of conifers and removal of surface fuels. When implemented, this fuel break will increase safety and improve access for firefighters. This PTU is contiguous with the BLUE2 treatment unit to the east.

FTU # and Stratum	Geographic Area	Priority	Total Area (ha)	Treatment Unit Type/ Objective	Local Fire Threat (ha)			Overlapping Values / Treatment Constraints	Treatment Rationale
					Extreme / High	Mod	Low		
6	Blue Mountain Woodlot (Blue1)	High (priority #1)	45.8	**Interface Fuel Break:** Fuel treatment will result in residual stands with characteristics that will reduce continuity of fuel loads, crown and surface fire behaviour, and wildfire risk.	28.0	17.8	0.0	This PTU falls within the Fraser TSA and is entirely overlapped by the Alouette landscape unit which is a part of the Chilliwack Natural Resource District and is guided by the Lower Fraser Sustainable Resource Management Plan. The northeastern portion of the PTU overlaps with a statutory right of way for a utility waterline; and a reserve/notation tenure for a watershed reserve. It completely overlaps the Alouette FDU, managed by the BCTS TCH Chilliwack District FSP. The Kathryn community watershed, fed by Kathryn Creek overlaps the northeast PTU corner. It partially overlaps with Blue Mountain Woodlot (W0038) and partially Seyem'Qwantlen Resources Ltd. (W0086). There is partial overlap with critical habitat for federally listed species at risk, specifically marbled murellet (*Brachyramphus marmoratus*) habitat. Private land parcels border the PTU. Consultation with tenure holders and private land holders must occur during prescription development and prior to implementation to ensure all concerns are addressed.	This PTU is within 100m of rural lots at McNutt, Garibaldi St., and Sayers Cr. To the north, Blue Mountain woodlot has a patchwork of recent and older cutblocks. C-3 stands border the private properties, some with a stand density >3000 SPH, though open patches do exist. Crown closure is >80%. Ladder and horizontal fuels are continuous. The greatest concern in this PTU is dense stands of young conifers. The PTU width is 150m to account for regenerating cutblocks. Recommended treatments include removal of understory conifers, pruning to increase crown base height, and removal of surface fuels. This type of stand is likely to exhibit potential for crown fire behavior during periods of high or extreme fire danger. This PTU forms an interconnected fuel break with BLUE2 and DEWDNEY.
7	Blue Mountain Woodlot (Blue2)	High (priority #2)	22.6	**Interface Fuel Break:** Fuel treatment will result in residual stands with characteristics that will reduce continuity of fuel loads, crown and surface fire behaviour, and wildfire risk.	11.2	11.3	0.1	This PTU falls within the Fraser TSA and is entirely overlapped by the Alouette landscape unit which is a part of the Chilliwack Natural Resource District and is guided by the Lower Fraser Sustainable Resource Management Plan. It completely overlaps with the Alouette FDU, which is managed by the BCTS TCH Chilliwack District FSP. It partially overlaps with the Blue Mountain Woodlot (W0038). Private land parcels border the PTU. Consultation with tenure holders and private land holders must occur during prescription development and prior to implementation to ensure all concerns are addressed.	This PTU is a 100m buffer around 1) business park; and 2) private lots between 261st and 266th Streets north of 124th Ave. Approximately 50% of this treatment unit is located on Blue Mountain Woodlot tenure immediately to the north and east. Dense C-3 stands border the private properties, though open patches exist. Crown closure is >80%. Ladder and horizontal fuels are continuous. The greatest concern in this PTU is dense stands of young conifers. Recommended treatments include thinning to reduce density, and removal of surface fuels. This PTU forms an interconnected fuel break with BLUE2 and DEWDNEY. This PTU forms a connected interface fuel break with BLUE1 and DEWDNEY treatment units to the west and south.
8	Dewdney Trunk Rd East (Dewdney)	Moderate (priority #10)	33.9	**Primary and Interface Fuel Break:** Fuel treatment will result in residual stands with characteristics that will reduce continuity of fuel loads, crown and surface fire behaviour, and wildfire risk.	20.8	9.0	4.0	This PTU falls within the Fraser TSA and is entirely overlapped by the Alouette landscape unit which is a part of the Chilliwack Natural Resource District and is guided by the Lower Fraser Sustainable Resource Management Plan. There is partial overlap with a statutory right of way tenure used for a utility electric powerline. It completely overlaps with the Alouette FDU, which is managed by the BCTS TCH Chilliwack District FSP. In the eastern portion of the PTU it partially overlaps with the BCIT Woodlot (W0007). Culturally modified trees (CMT) exist. Private land parcels border the PTU. Consultation with tenure holders, First Nations and private land holders must occur during prescription development and prior to implementation to ensure all concerns are addressed.	This PTU is located along Dewdney Trunk road which is a major arterial connecting with Lougheed Highway and Mission. It is an important access and evacuation route in the north and east portions of the AOI. The stand is mainly mature Cw with a C-3 strip between Dewdney Trunk Rd and the Hydro ROW. Fuel loading is mod/high due to windthrow. This area was identified for roadside treatment (50 m on either side of the road) due to the C-3 fuel type fringing the road which can cause evacuation issues and compounded with poor visibility from smoke. Recommended treatments include removal of understory conifers <12.5 cm dbh, pruning to increase crown base heights, and removal of surface fuels. This PTU connects with BLUE2.

FTU # and Stratum	Geographic Area	Priority	Total Area (ha)	Treatment Unit Type/ Objective	Local Fire Threat (ha)			Overlapping Values / Treatment Constraints	Treatment Rationale
					Extreme / High	Mod	Low		
9	BCIT Woodlot 0007 BCIT1	High (priority #3)	13.7	**Primary and Interface Fuel Break:** Fuel treatment will result in residual stands with characteristics that will reduce continuity of fuel loads, crown and surface fire behaviour, and wildfire risk.	7.3	6.4	0.0	This PTU falls within the Fraser TSA and is entirely overlapped by the Alouette landscape unit which is a part of the Chilliwack Natural Resource District and is guided by the Lower Fraser Sustainable Resource Management Plan. It completely overlaps with the Alouette FDU, which is managed by the BCTS TCH Chilliwack District FSP. It completely overlaps with the BCIT Woodlot (W0007). Consultation with woodlot operators and tenure holders must occur during prescription development and prior to implementation to ensure all concerns are addressed.	This PTU is located along the roadway to the caretaker residence on the BCIT Woodlot. The road traverses cutblocks in variable stages of regeneration and the caretaker structure is surrounded by a young C-3 stand of Cw and Hw, roughly 20 years and an understory of regenerating conifers with a CBH < 1 m. Recommended treatments include removal of understory conifers, thinning of the C-3 stand, pruning to increase crown base height, and removal of surface fuels. The proposed treatment will help protect the residence and provide a means for safe evacuation in the event of a wildfire.
10	Whonnock West (WhonnW)	Low (priority #14)	32.7	**Interface Fuel Break:** Fuel treatment will result in residual stands with characteristics that will reduce continuity of fuel loads, crown and surface fire behaviour, and wildfire risk.	0.0	32.3	0.4	This PTU falls within the Fraser TSA and is entirely overlapped by the Alouette landscape unit which is a part of the Chilliwack Natural Resource District and is guided by the Lower Fraser Sustainable Resource Management Plan. It completely overlaps with the Alouette FDU, which is managed by the BCTS TCH Chilliwack District FSP. Private land parcels surround the PTU. Consultation with tenure holders and private land holders must occur during prescription development and prior to implementation to ensure all concerns are addressed.	This PTU is located in a C-5 stand immediately west of Whonnock Lake and the rural properties to the west. It spans the area between 112th Ave and Dewdney Trunk Rd. Fire Hall #2 is near this PTU on 112th Ave at Hynes Street. Characterized primarily by a typical C-5 stand it has moderate surface fuel loading, some partially elevated. Surface fuels are made up of some fine fuels (such as twigs and needles). The treatment unit will reduce the risk of fire spread from ignition stats within the park and campsite area. Recommended treatments include removal of understory conifers, pruning to increase crown base height, and removal of surface fuels. This PTU connects with the WHONNS fuel treatment unit.
11	Whonnock South (WhonnS)	Moderate (priority #13)	13.2	**Interface Fuel Break:** Fuel treatment will result in residual stands with characteristics that will reduce continuity of fuel loads, crown and surface fire behaviour, and wildfire risk.	1.7	8.9	2.6	This PTU falls within the Fraser TSA and is entirely overlapped by the Alouette landscape unit which is a part of the Chilliwack Natural Resource District and is guided by the Lower Fraser Sustainable Resource Management Plan. It completely overlaps with the Alouette FDU, which is managed by the BCTS TCH Chilliwack District FSP. Private land parcels border the PTU. Consultation with tenure holders and private land holders must occur during prescription development and prior to implementation to ensure all concerns are addressed.	This PTU is located adjacent to the day use in the park south of Whonnock Lake. This stand has Pl present in overstory which is affected by blight, thus dropping needles and contributing to a deep (>15cm) duff layer and surface fine fuel loading. The duff layer likely becomes quite dry and flammable during the fire season, and is especially vulnerable to ignition from recreational visitors during peak summer months. Crown closure is high and ladder fuels are continuous due to standing dead and dying lower branches. The objective of this treatment is to reduce fire spread from ignition starts to surrounding homes. Recommended treatments include removal of understory conifers, pruning to increase crown base height, and removal of surface fuels. This PTU connects with WHONNW.

FTU # and Stratum	Geographic Area	Priority	Total Area (ha)	Treatment Unit Type/ Objective	Local Fire Threat (ha)			Overlapping Values / Treatment Constraints	Treatment Rationale
					Extreme / High	Mod	Low		
12	Webster's Corners (Webster)	High (priority #6)	2.0	**Interface Fuel Break:** Fuel treatment will result in residual stands with characteristics that will reduce continuity of fuel loads, crown and surface fire behaviour, and wildfire risk.	1.8	0.0	0.2	This PTU falls within the Fraser TSA and is entirely overlapped by the Alouette landscape unit which is a part of the Chilliwack Natural Resource District and is guided by the Lower Fraser Sustainable Resource Management Plan. It completely overlaps with the Alouette FDU, which is managed by the BCTS TCH Chilliwack District FSP. Private land parcels surround the PTU. Consultation with tenure holders and private land holders must occur during prescription development and prior to implementation to ensure all concerns are addressed.	This PTU is in an isolated patch of hazardous fuels on municipal land adjacent to Webster's Corners Elementary School on Dewdney Trunk Rd. The parcel has two homes, one of which is a caretaker residence. The fuel strata gap is less than 3 m, due to Cw branches which sweep quite low to the ground, thus facilitating potential fire spread from young, suppressed and regenerating Cw into the crowns of mature Cw. Homes are not FireSmart and would benefit from removal of combustible debris, enclosing spaces where embers collect, and planning for cladding and roof replacements over time. This PTU could be an invaluable FireSmart demonstration showcase for Maple Ridge residents. Recommended treatments include removal of understory conifers, pruning to increase crown base heights, and removal of surface fuels.
13	Golden Ears Park Rd North (GoldenN)	High (priority #8)	36.3	**Primary Fuel Break:** By reducing surface, ladder, and crown fuels, the fuel treatment will result in forest stands with lower overall wildfire behaviour threat and ignition potential and will create an anchor point for firefighting suppression	2.6	30.1	3.6	This PTU falls within the Fraser TSA and is entirely overlapped by the Alouette landscape unit which is a part of the Chilliwack Natural Resource District and is guided by the Lower Fraser Sustainable Resource Management Plan. It is entirely overlapped by Golden Ears Provincial Park which is a Class A provincial park. The southwest corner of the PTU overlaps with the Service Community watershed, which is fed by Service Creek. There is partial overlap with a critical habitat for federally listed species Pacific water shrew (*Sorex bendirii*), in the southwestern most portion of the PTU. Consultation with BC Parks and all other tenure holders must occur during prescription development and prior to implementation to ensure all concerns are addressed.	This 60m wide PTU is located in a dense C3 fringe along Golden Ears Parkway Rd; the single route to and from the trails, day use and camping sites in Golden Ears Provincial park and is recommended for roadside treatment. The C3 fringe is 15 m wide on both sides of the road and then transitions into a C5 stand. There is high surface fuel loading in the fine and medium woody debris categories; CWD is low. Horizontal fuel continuity within the stand is uniform and laddering fuels are high due to layering Cw. Once implemented, the treatment will facilitate the safe and efficient evacuation of park visitors during a wildfire. Thinning of understory conifers is the highest priority, followed by pruning to raise CBH and removal of fine and medium surface fuels.
14	Golden Ears Park Rd South (GoldenS)	Moderate (priority #9)	16.2	**Primary Fuel Break**: By reducing surface, ladder, and crown fuels, the fuel treatment will result in forest stands with lower overall wildfire behaviour threat and ignition potential and will create an anchor point for firefighting suppression	4.3	10.8	1.1	This PTU falls within the Fraser TSA and is entirely overlapped by the Alouette landscape unit which is a part of the Chilliwack Natural Resource District and is guided by the Lower Fraser Sustainable Resource Management Plan. It is entirely overlapped by Golden Ears Provincial Park which is a Class A provincial park. There is slight overlap with a non-legal old growth management area (OGMA), along the south eastern boundary. Consultation with BC Parks and all other tenure holders must occur during prescription development and prior to implementation to ensure all concerns are addressed.	This plot is located in a dense C3 fringe along the southern portion of Golden Ears Parkway Rd; the single route to and from the trails, day use and camping sites in Golden Ears Provincial park. The C3 fringe is 15 m wide on both sides of the road and then transitions into a C5 stand. Ladder fuels and horizontal fuel continuity is uniform with patches of high CWD fuel loading from blowdown. This PTU is located in an area recommended for roadside treatment to facilitate the safe and efficient evacuation of park visitors during a wildfire. Treatment activities include surface fuel removal, thinning of understory conifers, and pruning to increase crown base heights.



Map 7. Proposed Fuel Treatments

5.1.2 Maintenance of Previously Treated Areas

As no fuel treatments have occurred within the CMR, maintenance activities of previously treated areas are not applicable. However, if fuel treatments occur in the CMR in the future, maintenance activities such as removing standing dead, reducing surface fuels, or additional thinning (overstorey reduction and thinning suppressed conifers or conifer regeneration) should occur as needed to maintain the effectiveness of these treatments. The return interval for maintenance activities depends upon site productivity and the type and intensity of treatment. Less productive areas can likely withstand a longer frequency between maintenance activities, while more productive areas would require treatments more often.

RECOMMENDATION #19: If and when operational fuel treatments are conducted within the AOI, treatment monitoring should be completed by a Qualified Professional in order to schedule the next set of maintenance activities (5 – 10 years out).

5.2 FIRESMART PLANNING AND ACTIVITIES

This section provides detail on: 1) the current level of FireSmart implementation and uptake within the community; 2) identified FireSmart subdivisions and/or acceptance into the FireSmart Canada Community Recognition Program (FSCCRP); and 3) recommended potential FireSmart activities that can be applied within the AOI at a future date.

5.2.1 FireSmart Goals and Objectives

FireSmart® is the comprehensive nationally accepted set of principles, practices and programs for reducing losses from wildfire.[61] FireSmart spans the disciplines of hazard/threat assessment; regional planning and collaboration; policy and regulations; public communication and education; vegetation/fuel management; training and equipment; and, emergency preparedness and response. FireSmart concepts provide a sound framework for advancing the goal of wildfire loss reduction.

The FireSmart approach and concepts, including recommended FireSmart guidelines[62], have been formally adopted by almost all Canadian provinces and territories, including British Columbia in 2000; FireSmart has become the de facto Canadian standard. FireSmart is founded in standards published by the National Fire Protection Association (NFPA). The objective of FireSmart is to help homeowners, neighbourhoods, whole communities and agencies with fire protection and public safety mandates to work together to prepare for the threat of wildfire in the WUI. Coordinated efforts between all levels of planning and action are integral to effectively and efficiently reducing the risk to communities.

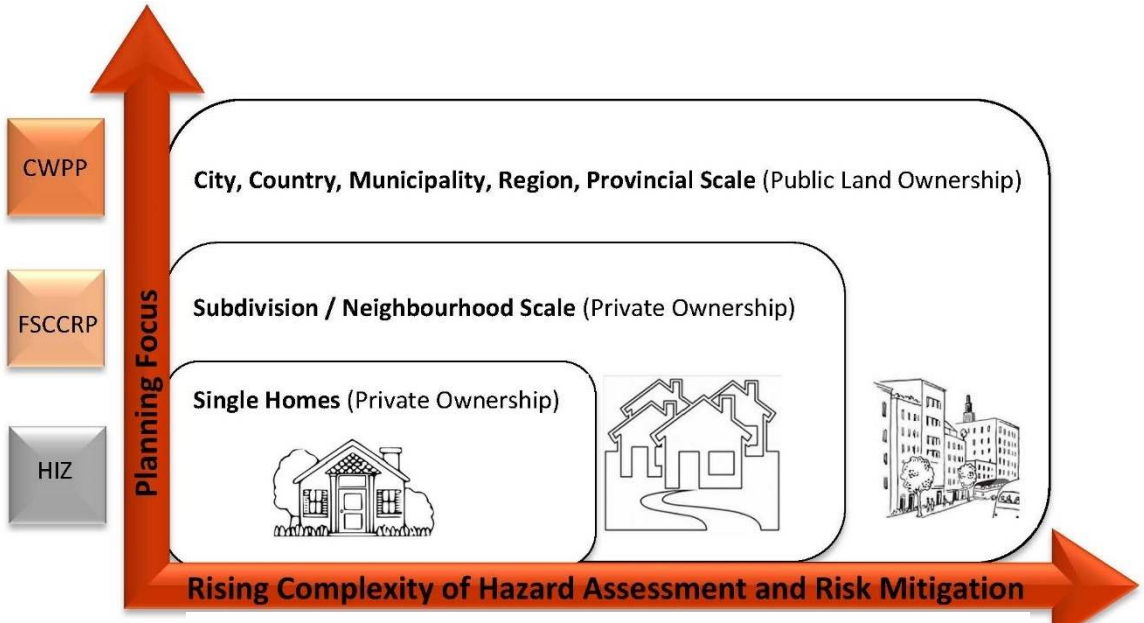
The following are key principles of FireSmart:

[61]FireSmart is the registered trademark held by the Partners in Protection Association.

[62]FireSmart guidelines first published in the 1999 manual "*FireSmart: Protecting Your Community from Wildfire*", with a second edition published in 2003.

- Wildland fires are a natural process and critical to the health of Canadian ecosystems.
- Mitigation and response efforts must be carefully coordinated through all stages of planning and implementation.
- Threats and losses due to wildfires can be reduced by working together. Responsibility for effectively mitigating hazards must be shared between many entities including homeowners, industry, businesses and governments.[63]
- There are seven broad disciplines to help address the threat of wildfire: education, vegetation management, legislation and planning, development considerations, interagency cooperation, emergency planning, and cross training.[63]
- Solutions are required at all scales from individual backyards, to communities and the wider landscape. In order to succeed, these efforts must be integrated across the mosaic of land ownership (Figure 2).
- The ultimate root of the WUI interface problem is the vulnerability of structures and homes to ignition during wildfire events, in particular vulnerability to embers (spotting). This leads to an emphasis on risk mitigations on private properties.

The highest level of planning within the FireSmart program is strategic direction, such as that provided in CWPPs.



Acronyms: ***CWPP**: Community Wildfire Protection Plan, **FSCCRP**: FireSmart Canada Community Recognition Program, **HIZ**: Home Ignition Zone*

Figure 2. The various coordinated levels of the FireSmart program.[64]

[63] https://www.firesmartcanada.ca

[64] Figure and content developed by A. Westhaver. Adapted by A. Duszynska, 2017.

The overarching goal of FireSmart is to encourage communities and citizens to adopt and conduct FireSmart practices to mitigate the negative impacts of wildfire to assets on public and private property. While responsibility for effectively mitigating hazards must be shared between many entities including homeowners, industry, businesses and governments;[65] the ultimate root of the WUI interface problem is the vulnerability of structures and homes to ignition during wildfire events, in particular vulnerability to embers. This leads to an emphasis on risk mitigations on private properties. Findings from an investigation of how homes survived and ignited during the Fort McMurray 2016 Horse River wildfire, indicate that the vast majority of initial home ignitions in the WUI were caused by embers rather than direct contact by flames or radiant heat.[66] Surviving homes in both urban and rural areas exhibited many attributes of FireSmart principles, regardless of the broader wildfire threat surrounding them.[66]

The goal of FireSmart with respect to private properties is to encourage homeowners to implement FireSmart practices to reduce damages to their property and minimize the hazards associated with wildfire. These FireSmart practices should aim to accomplish the following:

- Reduce the potential for an active crown fire to move through private land
- Reduce the potential for ember transport through private land and structures
- Create landscape conditions around properties where fire suppression efforts can be effective and safe for responders and resources
- Treat fuel adjacent and nearby to structures to reduce the probability of ignition from radiant heat, direct flame contact and ember transport
- Implement measures to structures and assets that reduce the probability of ignition and loss[67]

Home Ignition Zone

Multiple studies (including the previously referenced recent Fort McMurray WUI fire investigation) have shown that the principal factors regarding home loss to wildfire are the structure's characteristics and immediate surroundings; the area that determines the ignition potential is referred to as the Home Ignition Zone (HIZ).[68,69]The HIZ includes the structure itself and four concentric, progressively wider Priority Zones. HIZ Priority Zones are based upon distance from structure: 0 to 1.5 m (Priority Zone 1a-fuel free zone), 0 – 10 m (Priority Zone 1), 10 – 30 m (Priority Zone 2), and 30 – 100 m (Priority Zone 3). These zones help to guide risk reduction activities, with Recommended FireSmart Guidelines being most stringent closest to the structure. The likelihood of home ignition is mostly determined by the area within 30 m of the structure (Priority Zones 1a, 1 and 2). Recommended FireSmart guidelines address a multitude of hazard factors within the HIZ: building materials and design; vegetation (native or landscaped

[65]https://www.firesmartcanada.ca

[66]Westhaver, A. 2017. Why some homes survived: Learning from the Fort McMurray wildland/urban interface fire disaster. Institute for Catastrophic Loss Reduction (ICLR) research paper series – number 56.

[67]Community Resiliency Investment Program. 2018. Community Wildfire Protection Plan Template.

[68] Reinhardt, E., R. Keane, D. Calkin, J. Cohen. 2008. Objectives and considerations for wildland fuel treatment in forested ecosystems of the interior western United States. Forest Ecology and Management 256:1997 - 2006.

[69] Cohen, J. Preventing Disaster Home Ignitability in the Wildland-urban Interface. Journal of Forestry. p 15 - 21.

materials); and the presence of flammable objects, debris, and vulnerable ignition sites. More detail on priority zones can be found in the FireSmart Manual.[70]

It has been found that, during extreme wildfire events, most home destruction has been a result of low-intensity surface fire flame exposures, usually ignited by embers. Firebrands can be transported long distances ahead of the wildfire, across fire guards and fuel breaks, and accumulate within the HIZ in densities that can exceed 600 embers per square meter. Combustible materials found within the HIZ combine to provide fire pathways allowing spot surface fires ignited by embers to spread and carry flames or smoldering fire into contact with structures.

Because ignitability of the HIZ is the main factor driving structure loss, the intensity and rate of spread of wildland fires beyond the community has not been found to necessarily correspond to loss potential. For example, FireSmart homes with low ignitability may survive high-intensity fires, whereas highly ignitable homes may be destroyed during lower intensity surface fire events.[69] Increasing ignition resistance would reduce the number of homes simultaneously on fire; extreme wildfire conditions do not necessarily result in WUI fire disasters.[71] It is for this reason that the key to reducing WUI fire structure loss is to reduce home ignitability; *mitigation responsibility must be centered on homeowners*. Risk communication, education on the range of available activities, and prioritization of activities should help homeowners to feel empowered to complete simple risk reduction activities on their property.

FireSmart Canada Community Recognition Program

In the case of adjacent homes with overlapping HIZs, a neighbourhood (or subdivision) approach can be an effective method of reducing ignition potential for all homes within the neighbourhood. The FireSmart Canada Community Recognition Program (FSCCR Program) is an 8-step resident-led program facilitated by trained Local FireSmart Representatives designed for this purpose. It provides groups of residents with critical information and a means of organizing themselves to progressively alter hazardous conditions within their neighbourhood. The program also facilitates FireSmart knowledge and practices to quickly filter downwards onto the property of individual residents to further mitigate wildfire hazards at the single-home scale within the HIZ.

WUI Disaster Sequence

Calkin et al (2014) coined the 'WUI disaster sequence', a six-step sequence which has been used to describe the situation in which the firefighting capacity of a community is overwhelmed by wildland / interface fires in highly ignitable communities: 1) extreme wildfire behaviour weather combined with, 2) a fire start, which 3) exposes numerous homes with high ignition potential, and results in numerous structures burning, 4) overwhelms suppression efforts and capabilities, and 5) leads to unprotected homes, and therefore 6) considerable structure loss. Figure 3 illustrates that it is possible to break up the

[70] https://firesmartcanada.ca/ and https://www2.gov.bc.ca/gov/content/safety/wildfire-status/prevention/firesmart

[71] Calkin, D., J. Cohen, M. Finney, M. Thompson. 2014. *How risk management can prevent future wildfire disasters in the wildland-urban interface*. Proc Natl Acad Sci U.S.A. Jan 14; 111(2): 746-751. Accessed online 1 June, 2016 at http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3896199/.

disaster sequence by decreasing the number of highly ignitable homes exposed to embers, therefore reducing the number of homes ignited and removing the consequences of multiple structures lost.

Once multiple homes are ignited in an urban area, there is increasing potential for fire to spread from structure to structure, independently of the wildland vegetation. This is known as an urban conflagration. Effective fire protection depends on ignition resistant homes and properties during extreme wildfire events.[72]

Overall, FireSmart leads to communities that are better adapted to wildfire, more resilient and able to recover following wildfires by sustaining fewer losses and disruption, and safer places to live and recreate. Action by homeowners is the number one priority for reducing structure loss in the event of a WUI fire, but the overall adaptation of the community to wildfire is multi-pronged approach.

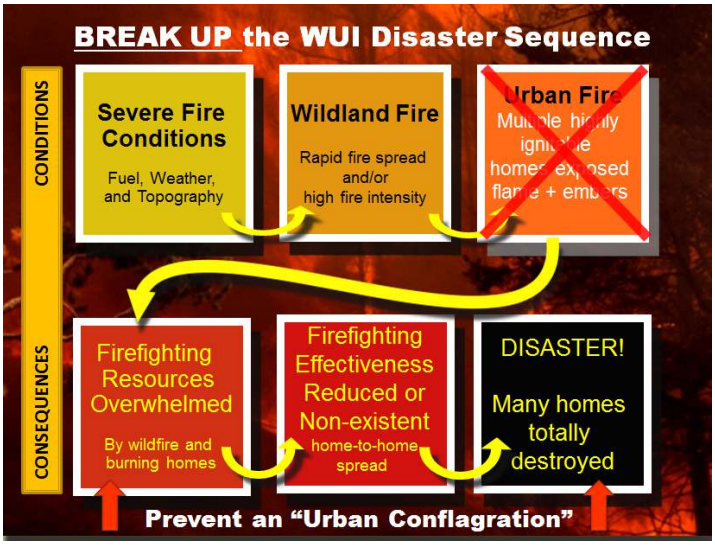


Figure 3. The wildland/urban interface disaster sequence and the possibility to break up the disaster sequence by decreasing the number of highly ignitable homes.[73]

5.2.2 Key Aspects of FireSmart for Local Governments

Reducing the fire risk profile of a community through FireSmart implementation requires coordinated action from elected officials, local government planners, developers, private land owners and industrial managers. This section presents various options of FireSmart practices, which when enacted, provide avenues for reducing fire risk within the community. The following presents an evaluation of the current level of FireSmart implementation within the CMR.

Education

Communicating effectively is a key aspect of any education strategy. Communication materials must be audience specific and delivered in a format and through mediums that reach the target audience. Audiences should include home and landowners, students, local businesses, elected officials, CMR staff,

[72]Calkin, D., J. Cohen, M. Finney, M. Thompson. "*How risk management can prevent future wildfire*"

[73]Graphic adapted from Calkin et. al, by A. Westhaver.

and local utilities providers. Education and communication messages should be simple yet comprehensive. A basic level of background information is required to enable a solid understanding of fire risk issues and the level of complexity and detail of the message should be specific to the target audience.

FireSmart information material is readily available and simple for municipalities to disseminate. It provides concise and easy-to-use guidance that allows homeowners to evaluate their homes and take measures to reduce fire risk. However, the information needs to be supported by locally relevant information that illustrates the vulnerability of individual houses to wildfire.

The CMR has undertaken some public outreach in the community and online and has entailed the delivery of FireSmart education materials and information by three MRFS members trained as Local FireSmart Representatives (three additional members were trained as Local FireSmart Representatives in the January 2020 training course). In addition, MRFRDD has communicated to CMR residents that property owners have the option to sign up for free FireSmart home assessments conducted by MRFRDD Local FireSmart Representatives; and have used the contact with residents to recruit neighbourhood leaders who can leverage the existing resident relations to assist in promoting FireSmart principles to their friends and neighbours. To date a handful of residential property assessments have been completed and MRFRDD have experienced that the proportion of residents following through from sign-up to getting the assessments done is poor.

Taking the opportunity to reach a wider audience, MRFRDD have staffed display booths to disseminate FireSmart information at events including the annual Vancouver Home Show and in conjunction with our Hot Summer Nights events. The public response has been variable and at times poor with low attendance from the public. During the fire season, MRFRDD updates fire danger messaging on the digital display sign at Fire Hall 1 and has purchased two portable flag signs that can be strategically placed at different parts of the AOI to communicate the fire danger status. The City has complemented the information on its website with FireSmart materials and website links to other resources to assist residents in conducting FireSmart activities on their home and property; and the City uses social media platforms to advertise the Community Wildfire Awareness Day held annually at Fire Hall 2. These can be expanded upon and/or adapted to further enhance wildfire preparedness and education.

A full list of recommendations pertaining to the Communication and Education strategy is presented in Section 5.3.

Planning and Development Considerations

Municipal policies and bylaws are tools available to mitigate wildfire risk to a community. It is recognized that, to be successful, all levels of government (municipal, provincial, and federal) and individual landowners need to work together to successfully reduce their risk. To that end, local government can use a range of policy tools and practices to help the community to incrementally increase FireSmart compliance over the mid-term (5 – 20 years) and therefore play a role in reducing the chance of structure loss from wildfire.

The planning objectives/considerations for the CMR are:

- To include wildfire considerations in the planning and acquisition strategy for parks and recreational areas.
- To develop policies and practices for design and maintenance of FireSmart publicly owned land such as parks and open spaces; and
- To conduct FireSmart and/or risk assessments of publicly owned lands and buildings to inform planning for prevention and mitigation activities as required.

FireSmart policies and practices can be incorporated in various aspects of development design, zoning and permitting to reduce wildfire hazard on private land and in the communities at large. The development objectives/considerations for the CMR are:

- To utilize regulatory and administrative tools to reduce wildfire hazard on private land and increase number of homes compliant with FireSmart guidelines (with low ignition potential).
- To ensure higher level planning and regulation (i.e., OCP and/or land use, engineering and public works bylaws) incorporate FireSmart policies, as applicable, to reduce wildfire hazard in vulnerable WUI neighbourhoods, and include measures that address wildfire prevention and suppression in subdivision design.
- To ensure multiple departments (including Fire Rescue Departments and/or emergency management staff) are included in the referral process for new developments.

FireSmart Vegetation Management

Some examples of actionable items for the CMR with regards to vegetation or fuel management include: 1) policy development and implementation of FireSmart maintenance for community parks and open spaces; and 2) provision of incentives (i.e., a local rebate program) and/or collection services for private landowners with a focus on pruning, yard and thinning debris (as per FireSmart activities for private land discussed below).

Depending on available funding and resources, the CMR is willing to engage in proactive vegetation management strategies (fuel treatments), targeting high-use areas near values at risk, within and immediately adjacent to developed areas. Through the Wildfire Protection Development Permit, fuel treatments adjacent to new subdivisions have been implemented at a cost to the developer. Considerations for vegetation management and maintenance scheduling are provided in Section 0.

An important component of FireSmart vegetation management is the disposal of woody debris incurred from fuel treatments or routine vegetation or landscape practices. As of March 31, 2020, the CMR has enacted, and will be enforcing an Open-Air Burning Ban. This means that permits for backyard burning will no longer be issued. With the implementation and enforcement of this initiative, some residents who are familiar with disposing woody debris and green waste through on-site burning can no longer obtain a permit for burning. This may cause an increase in illegal dumping of green waste in natural areas, or cause combustible debris to accumulate over time to hazardous levels.

RECOMMENDATION #20: Expand the chipping program to areas now subject to the Open-Air Burning Ban) in order to provide alternate woody debris and green waste disposal methods. Additional programs for the CMR to consider may include scheduled community chipping opportunities, yard waste dumpsters available by month in neighbourhoods. Programs should be available during times of greatest resident activity (likely spring and fall).

RECOMMENDATION #21: The CMR should apply for funding from the UBCM CRI Program to develop a local FireSmart rebate program. This will allow homeowners to access partial rebates for FireSmart activities on their properties, if rated as high or extreme risk in a FireSmart home and property assessment. The rebate program is described in detail in the CRI Program 2020 FireSmart Community Funding and Supports – Program & Application Guide and must adhere to the goals and objectives of FireSmart, as outlined in Section 5.2.1. Before applying for funding, Fire Prevention Public Education should review CMR resources available to execute the program.

Development Permit Areas for Wildfire Hazard

In 2013, CMR Council adopted, wrote into bylaw, and integrated into the OCP the Wildfire Protection Development Permit (WFDP) Area Guidelinesto address wildfire risk for new subdivision developments in rapidly urbanizing areas in the WUI such as Silver Valley. This CWPP Update is an opportunity to visit the successes and challenges with the WFDP and the following outlines a review of the WFDP which consisted of a field review of completed subdivisions developments in order to note compliance and the overall effectiveness of the WFDP in meeting the CMR's established goals and objectives for addressing the risk of wildfire to the community. Prior to conducting the review, the CMR provided a list of completed projects and a sample set was selected to assess. The field visit reviewed the following components:

- Use of fire-resistant exterior construction materials within the WFDP, based on the CMR's *Wildfire Development Permit Area Guidelines*;
- Inclusion of minimum setbacks from forested edge and top of slope;
- Use of FireSmart landscaping (low flammability plants, appropriate spacing and low flammability aggregates/ground cover) in parks, communal areas, and private property;
- Areas adjacent to the forest interface that have had fuel treatment activities;
- Evidence of ongoing maintenance such as thinning, or clearing accumulated debris;
- Post-development inspections and sign-offs; and.
- Enforcement and regulation (consequences of non-compliance).

A detailed description of the review is found in Appendix J, and the recommendations developed from the field review of the WFDP are included elsewhere in the body of the CWPP document in Sections 2.5.3 and 6.1.3, and referenced within Appendix J.

RECOMMENDATION #22: Provide FireSmart information to homeowners prior to occupancy for new subdivisions in the WUI. Create a FireSmart brochure that includes lists of acceptable vs. non-acceptable vegetation for home landscaping.

RECOMMENDATION #23: Consider commissioning a scenario-based cost/benefit analysis to understand the efficacy of the current security deposit system as an enforcement measure to ensure developer and builder compliance with FireSmart as per the WPDP. As an alternative to a study, update the WFDP bylaw and subject the granting of occupancy to compliance with the WFDP requirements.

RECOMMENDATION #24: Develop a landscaping standard suitable for use in Maple Ridge which lists flammable non-compliant vegetation and landscaping materials, and provides alternative substitutes that are wildfire (non-flammable) drought and pest resistant. In addition, list tips on landscape design for watering requirements, avoid wildlife attractants and reduce maintenance costs. This Standard should be included in the FireSmart information package provided to new homeowners (Recommendation #23).

RECOMMENDATION #25: Target education and outreach to promote FireSmart renovations of exterior elements to existing buildings within the Wildfire Protection Development Permit area. Incentives should target roof replacements as a first priority, followed by replacement of exterior siding and decking with fire resistant materials to increase the resiliency of homes and neighbourhoods in the WUI.

RECOMMENDATION #26: Apply for a FireSmart demonstration grant through the CRI program. Preferential sites should incorporate residential structures as they are more applicable for homeowners, and should include both exterior building material and landscaping elements to display FireSmart principles.

Subdivision Design or New Development

Subdivision design should include consideration to decrease the overall threat of wildfire. Aspects of subdivision design that influence wildfire risk are access, water pressure and hydrant locations. The number of access points and the width of streets and cul-de-sacs determine the safety and efficiency of evacuation and emergency response. In the communities and/or developed areas within the CMR, on-street parking can contribute hazards on narrow or dead-end roads, which are already unlikely to have a high capacity under heavy smoke conditions.[74] When the time for evacuation is limited, poor access has contributed to deaths associated with entrapments and vehicle collisions during wildfires.[75]Methods for access design at the subdivision level can provide tools that help manage the volume of cars that need to egress an area within a given period of time.[74]

For new development in rural settings where hydrants are limited or unavailable (or it is otherwise determined by the CMR that adequate or reliable water supply systems may not exist), the NFPA 1142

[74]Cova, T. J. 2005. Public safety in the wildland-urban interface: Should fire-prone communities have a maximum occupancy? Natural Hazards Review. 6:99-109.

[75]De Ronde, C. 2002. Wildland fire-related fatalities in South Africa – A 1994 case study and looking back at the year 2001. Forest Fire Research & Wildland Fire Safety, Viegas (ed.), http://www.fire.uni-freiburg.de/GlobalNetworks/Africa/Wildland.cdr.pdf

can be used to help determine minimum requirements for alternative water supply (natural or artificial). Alternative water sources, such as dry hydrant systems, water usage agreements for accessing water on private land, cisterns or other underground storage, etc., should be reviewed by the CMR and the Fire Rescue Departments prior to development approval.

Increasing Local Capacity–Interagency Cooperation, Emergency Planning and Cross Training

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

- Development and/or maintenance of Structural Protection Units (SPUs) which can be deployed in the event of a WUI fire;
- Conducting a comprehensive review of Emergency Management BC SPU deployment procedures for the purpose of fighting interface fires;
- Provision of sprinkler kits to community residents (at a cost);
- Continue to engage in annual cross-training exercises with adjacent Fire Rescue Departments and/or BCWS in order to increase both local and regional emergency preparedness with regards to structural fire and wildfire training;
- Participation in cross-jurisdictional tabletop exercises and seasonal readiness meetings;
- Participation in regional or multi-agency fire or fuel management tables (i.e., interface steering committee or wildfire working group) to facilitate communication and co-operation between groups and agencies responsible for wildfire preparation and response; and
- Provision of training and/or professional development for Local FireSmart Representatives to increase capacity for FireSmart activities.

Current local capacity for the CMR and recommendations to address gaps is provided in 0.

FireSmart Demonstration Projects

FireSmart demonstration projects for publicly owned buildings or public and provincially owned critical infrastructure (as identified in Section 3.2) can display the practices and principles of FireSmart to the public. This may be in the form of replacing building materials with fire resistant materials, replacing landscaping with fire-resistant plants, and demonstration HIZ fuel treatments. Appropriate/candidate FireSmart demonstration projects may be identified by the CMR in consultation with local government and based on assessment by internal and trained Local FireSmart Representatives or external Local FireSmart Representative consultant.

RECOMMENDATION #27: Post this CWPP report on the City's website and social media platforms. In addition, it should be shared with woodlots and local industry who may be interested in collaborating on fuel management treatments.

FireSmart Activities for Private Land

The best approach to mitigate fuels on private lands is to urge private landowners to comply with FireSmart guidelines and to conduct appropriate fuel modifications using their own resources (CRI program funding may be available). The CMR can facilitate uptake within the community by: 1) supporting and/or facilitating planning for private land (with property owners' consent); 2) offering local rebate

programs to homeowners on private land and First Nations land who complete eligible FireSmart activities on their properties; 3) providing off-site debris disposal for private landowners who undertake their own vegetation management (with a focus on pruning, yard and thinning debris). Off-site debris disposal options include providing a dumpster and/or chipper; providing curbside debris pick-up; and waiving tipping fees. Planning for private land may include developing FireSmart Community Plans for identified areas (i.e., a WUI neighbourhood, subdivision) and conducting FireSmart home and property assessments.

FireSmart Compliance within the AOI

As could be expected, there is a wide range of FireSmart compliance on private properties in the AOI. There are large differences in the degree to which FireSmart best practices are visible within individual HIZs, and in neighbourhoods throughout the CMR. Landscaping in the AOI is also in a range of FireSmart compliance. Generally speaking, most homes in interface WUI areas (except for new subdivisions in Silver Valley) are generally undeveloped and may be large rural lots with remnant forest vegetation and include portions of Silver Valley, Webster's Corners, Whonnock, and properties adjacent to the Malcolm Knapp research Forest, do not maintain 10 m defensible space. The main concern in the aforementioned areas is the ubiquity of flammable landscaping options (i.e., cedar hedging) in proximity to residences, as well as the lack of defensible space between property footprints and adjacent forested areas. Bark mulch is commonly used as a landscaping material within the HIZ. Accumulations of conifer foliage in roof corners and gutters was not uncommon. Storage of combustible items under decks, carports, and other horizontal surfaces was common. On the other hand, many residences are surrounded by lawn, agricultural fields, 10 m defensible space, and/or hardscaping (rocks), all of which are FireSmart compliant. New subdivisions developed and constructed with the WFDP guidelines are the most compliant and are concentrated in the Silver Valley planning area.

Aside from differing levels of awareness, understanding and acceptance of recommended FireSmart guidelines by residential and commercial property owners, there are a number of other factors that add variability to the level of FireSmart compliance within the AOI. Ultimately, these also impact the vulnerability of structures and the amount of effort required to achieve a FireSmart rating for individual homes, neighbourhoods or the communities as a whole. These factors include but are not limited to: the age of homes or subdivision; prevailing design features and favored building materials of the era; proximity to forested area (on private land, Provincial Park or City land); density, lot size and lay-out of the subdivision; positioning of the home or neighbourhood in relation to slope, aspect and prevailing winds; and the stage and maturity of landscaping.

Neighbourhoods in the CMR were unofficially surveyed during field work. The following observations were made:

- Wildfire hazard levels range from low to high across neighbourhoods within the AOI;
- The bulk of hazards are associated with conditions of natural and landscaped vegetation immediately surrounding residential properties;

- For new development, where landscaping is not yet completed, educational approaches may aid in promoting fire resistant landscaping options and achieving defensible space in the HIZ;
- Hazards are magnified in some neighbourhoods due to poor access (i.e., presence of private and gated roads) and distance from nearest water supply or fire hydrant location; and,
- All neighbourhoods have opportunities to mitigate risk through individual and collective action.

5.2.3 Priority Areas within the AOI for FireSmart

This section identifies priority areas within the AOI that would benefit from FireSmart planning and activities. These priorities are based on general field observations and input from the CMR and are not based on a scientific sample or formal data collection. Recommended FireSmart activities are essentially the same for each neighbourhood or area; however, it is recommended that the CMR prioritize the neighbourhoods in Table 11.

Table 11. Summary of FireSmart Priority Areas.

Area	FireSmart Y/N	FireSmart Canada Recognition Received Y/N	Recommended FireSmart Activities
Priority Area #1: Webster's Corner	N	N	The following is a non-extensive list of FireSmart activities for which the CMR can engage suggested neighbourhood residents: 1) Provide guidance to ensure landscaping is to an established FireSmart standard; 2) Incentivise private landowners to engage in retrofitting homes with building materials and design based on NFPA 1144 or FireSmart standards; 3) Encourage prompt removal of combustible construction materials or yard waste from private properties; and 4) Coordinate monthly or bi-monthly yard waste removal days prior to and during the fire season to reduce WUI fire hazard.
Priority Area #2: BCIT Woodlot Structure and Road	N	N	
Priority Area #3: Blue Mountain Woodlot	N	N	
Priority Area #4: Justice Institute of British Columbia			
Priority Area #5: South Whonnock	N	N	
Priority Area #6: West Whonnock	N	N	
Priority Area #7: East Dewdney Trunk Road	N	N	
Priority Area #8: Silver Valley	N	N	
Priority Area #8: Critical infrastructure	Y (partially)	N/A	Based on field observations, most critical infrastructure has had some level of FireSmart setback from forested areas. Consider conducting frequent (2-3 years) maintenance treatments to ensure the wildfire risk does not reach higher than moderate. It is recommended that fuel treatments be considered for areas adjacent to critical infrastructure in order to bolster the effect of previous FireSmart treatments. FireSmart treatments may include thinning from below to reduce ladder fuels and crown fire potential, pruning of retained trees to 3 m, and reducing surface fuels. Additionally, consider adding regular brushing activities to the maintenance treatment schedule to control weeds and grasses around critical infrastructure.

5.3 COMMUNICATION AND EDUCATION

Establishing effective communications and actively engaging key stakeholders in risk reduction activities are keystones to building a FireSmart community. Without the support and involvement of residents, businesses, public officials, industry, the efforts of public officials, Fire Rescue Departments, and others to reduce wildfire losses will be hindered. In many communities, there is a general lack of understanding about interface fire, the relationship between ignition potential and loss of homes, and the simple steps that can be taken to minimize risk on private land. In addition, public perceptions regarding responsibility

for risk reduction and the ability of firefighters to safely intervene to protect homes during a wildfire are often underdeveloped or inaccurate.

Based on the consultation completed during the development of this Plan, it is evident that CMR staff and some residents have a good level of awareness of interface fire risk and the CMR is committed to build upon past FireSmart education initiatives through continued public engagement and outreach. The public outreach initiatives the CMR has undertaken have been previously described in Section 5.2.2. However, field observations highlighted the need to further educate the community at large on what private land owners can do to take personal responsibility for the ignition potential of their homes and neighbourhoods. Often, the risk of wildfire is at the forefront of public awareness during or after major wildfire events, whether close to home or further afield. The challenge is to retain this level of awareness beyond these times. The communication and education objectives for the CMR are:

- To improve public understanding of fire risk and personal responsibility by increasing resident and property owner awareness of the wildfire threat in their community, to establish a sense of responsibility for risk mitigation among property owners, and to empower them to act;
- To enhance the awareness of, and participation by, elected officials and all WUI stakeholders regarding proactive WUI risk mitigation activities; and,
- To reduce or avoid ignitions from industrial sources.

Bringing organizations together to address wildfire issues that overlap physical, jurisdictional or organizational boundaries is a good way to help develop interagency structures and mechanisms to reduce wildfire risk. Engagement of various stakeholders can help with identifying valuable information about the landscape and help provide unique and local solutions to reducing wildfire risk. The CMR should consider creating an Interface Steering Committee to coordinate wildfire risk reduction efforts and could include key stakeholders such as CMR staff, BC Parks, recreational groups/representatives, industrial operators, and woodlot tenure holders.

Moving from the CWPP to implementation of specific activities requires that the community is well informed of the reasons for, and the benefits of specific mitigation activities. In order to have successful implementation, the following recommendations are made:

RECOMMENDATION #28: Encourage and facilitate WUI neighbourhoods to attain FireSmart Canada Community Recognition Program status and encourage homeowners to complete the FireSmart home assessment and that neighbourhoods hold a home hazard assessment workshop as one of their FireSmart events. In addition, the City should promote the use of the FireSmart Home Partners Program which facilitates voluntary FireSmart assessments on private property to identify hazards and provide options to reduce the risk.

RECOMMENDATION #29: Develop and work with all key stakeholders (industrial operators, MFLNRORD, BCWS, woodlots, Malcolm Knapp Research Forest, BC Parks) to formalize an Interface Steering Committee in order to identify ongoing and emerging wildfire related issues in the area and to develop

solutions to minimize wildfire risks. The following subject areas are recommended for the group to explore: 1) Public education needs; 2) fuel treatment projects/hazard abatement projects; 3) funding opportunities; and 4) right of way management.

RECOMMENDATION #30: Work towards educating homeowners within the Wildland Urban Interface (WUI), of the CMR's fire protection area to communicate potential suppression challenges and response times. It is common for them to be unaware of the lack of fire services in their area (in the event they call 911).

RECOMMENDATION #31: Continue promoting and providing information to private landowners related to exterior residential sprinklers as a FireSmart prevention measure. At FireSmart events distribute information on exterior sprinkler component parts, manufacturers, and water supply system requirements to ensure they are effective measures to wet down homes and Fire Priority Zone 1 and discourage home ignition. Develop general costs of exterior sprinkler equipment for property owners.

RECOMMENDATION #32: Work with the Malcolm Knapp Research Forest, woodlots, and forest tenures to ensure that high risk activities, such as vegetation management, pile burning and harvesting do not occur during high/extreme fire danger times to reduce chance of ignitions as per the Wildfire Act. It is recommended that communications are coordinated via weekly fire calls.

RECOMMENDATION #33: Discuss options with the Malcolm Knapp Research Forest, woodlots and forest tenures adjacent to the City, to integrate future fuelbreaks with harvest planning using existing cutblocks and logging roads to address identified hazardous fuel types and spotting potential.

RECOMMENDATION #34: The City should develop a plan for post-fire rehabilitation for inclusion into the CMR Emergency Plan's Wildfire Response section. Post-fire rehabilitation would consider the procurement of seed, seedlings and materials required to regenerate an extensive burn area (1,000-5,000 ha). Target efforts on slope stabilization and infrastructure protection to stabilize and rehabilitate the burn area.

RECOMMENDATION #35: Develop a work experience program, for paid on-call firefighters, possibly in coordination with the Maple Ridge Firefighters Union Local 4449 to assist and support aspiring firefighters gain relevant training, experience and opportunities to build relationships and potential contacts within the FD.

5.4 OTHER PREVENTION MEASURES

In addition to fuel treatment and community communication and education, fire prevention in the AOI is also addressed via the following avenues: 1) public display of danger class rating signs throughout the AOI, which should updated on a weekly basis; 2) fire ban alignment with provincial fire bans; 3) potential enforcement of restricted access to back country areas similar to provincial requirements; and 4) enforcement of local bylaws such as the Fire Prevention and Unsightly Premises bylaws and the Open-Air

Burning Ban. The aforementioned activities are either currently being applied or have potential to be applied in order to reduce the potential and/or threat of wildfire ignitions.

Risk of human-caused ignition within the AOI is not limited to private property owners and individual residents. Power lines and industrial activities such as forest harvesting pose a risk of ignition, particularly in areas where cured fuels or fuel accumulations exist. Tree failures adjacent to power lines (transmission and distribution) are common occurrences and represent significant risks to ignition within the AOI. A cooperative approach for addressing the industrial area concerns must be undertaken by the CMR, BC Hydro, woodlots, forest tenures (Katzie and Kwantlen) and Malcolm Knapp Research Forest.

RECOMMENDATION #36: Continue the current practice of delivering annual training to Fire Rescue Department members so they can engage in practical wildland fire training opportunities with BCWS that covers at a minimum: pump, hose, hydrant, air tanker awareness, and employment of SPUs.

RECOMMENDATION #37: All new development in the Protected Growth and Rural response zones in the MRFRD service area should have a water system which meets or exceeds minimum standards of NFPA 1142, Standard on Water Supplies for Suburban and Rural Fire Fighting76. MRFRD should review the water supply to ensure it provides sufficient placement, flow, and reliability for suppression needs and that secondary power is available in the event of power outages.

RECOMMENDATION #38: Commission a scenario-based cost/benefit analysis to improve limitations of the water system to support domestic water needs, and structural and wildland firefighting demands. Identify resources required to upgrade the current system, costs of implementation, and develop a workplan.

RECOMMENDATION #39: Consider completing a fire flow/water vulnerability assessment to identify where upgrades to systems, flows, hydrant number or location, water storage, or secondary power is required.

SECTION 6: WILDFIRE RESPONSE RESOURCES

This section provides a high-level overview of the local government resources accessible for emergency response and preparedness use. Accordingly, in emergency situations when multiple fires are burning in different areas of the Province, resource availability may be scarce. Therefore, local government preparedness and resource availability are critical components of efficient wildfire prevention and planning. Deployment of provincial resources occurs as per the process detailed in the *Provincial Coordination Plan for Wildland Urban Interface Fires* document.[77] The aforementioned document

[76]National Fire Protection Association (NFPA).2017. Standard on Water Supplies for Suburban and Rural Fire Fighting. Retrieved online at: https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=1142

[77] Provincial Coordination Plan for Wildland Urban Interface Fires. 2016. Available online at: https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/provincial-emergency-planning/bc-provincial-coord-plan-for-wuifire_revised_july_2016.pdf

establishes a protocol for collaborative and integrated emergency management in the event of WUI fires within British Columbia.

6.1 LOCAL GOVERNMENT FIREFIGHTING RESOURCES

Firefighting efforts and effectiveness can be affected by access to secondary power sources, water pressure and supply, and by existing local government contingency plans. In the event of a wildfire emergency situation and loss of power, the CMR has access to backup diesel generators to power critical infrastructure such as the fire halls, the EOC, hospitals, sewer and water pump stations, water reservoirs, RCMP headquarters, City Hall complex, the Public Works, and some schools. However, should a wide-scale outage occur, known vulnerabilities to secondary power sources include mechanical failure and potential fuel shortages. Although the local government has not identified any issues with water pressure within areas that have fire hydrant service, there are known limitations to water supply in areas with older private water systems, or for residents located outside of water service areas, for example, rural areas in Whonnock, the eastern part of the AOI, and the norther WUI boundary. Due to the lack of hydrant protection, these fall within the Superior Tanker Shuttle water service distribution area. Specific limitations of the CMR water system with regards to wildfire suppression are detailed in Section 6.1.2.

Formal mutual aid agreements are in effect with neighbouring municipalities (more detail is provided in Section 6.1.1). In the event of a WUI fire emergency, mutual aid in the CMR is activated, as required, between adjacent municipalities with whom agreements are in place. WUI fire events may also lead to aid requests with BCWS.

6.1.1 Fire Rescue Department and Equipment

Fire protection within the AOI is primarily the responsibility of four Maple Ridge fire halls and includes Fire Hall #1 which would also act as the Emergency Operations Center (EOC) in the event of an emergency, Fire Hall #2 and, Fire Hall #3. The fourth facility, Fire Hall #4 is scheduled for construction completion April 2020 and in addition to increasing capacity the new hall will be a firefighter training ground. Table 12 provides an overview of the fire services capacity in the AOI, including Fire Rescue Department personnel and equipment. In total, the fire protection services area covers 15,766 ha (44% of the total AOI area, inclusive of water bodies); but not including First Nations Indian Reserves, which in this instance, are free from any structures. Maple Ridge Fire Rescue is the principal organization responsible for providing fire protection and fire prevention services in the AOI. At times, and when called upon MRFRD also assists in response efforts for neighbouring jurisdictions including Pitt Meadows FD and the Mission FD if they have the resources, equipment, and staff in the event of a fire. The transformation of rural acreage to actively urbanizing areas such as Silver Valley, and the Thornhill, Whonnock and North East neighbourhoods, all in the WUI, are more vulnerable as response times are typically longer (around 10 minutes, compared to four-minute response times in the core urban areas), and where water is supplied by Superior Tanker Shuttle. Organizations with values-at-risk in the AOI that have limited fire response capability include Metro Vancouver (Kanaka Creek regional park) and BC Parks (Golden Ears provincial park). The forest management and industrial operators engaged in forest harvesting and timber development on their

Crown tenures (BCIT, Blue Mountain and Seyem'Quantlen woodlot licensees, K and K Forestry First Nations Woodland License), the Malcolm Knapp Research Forest (private land) must adhere to the *Wildfire Act* and *Regulations,* and they are required to provide fire management plans and fire emergency plans during operational activities. These organizations as well as provincial parks are under BCWS jurisdiction, and response resources would be supplied via the Coastal Fire Center.

MRFRD personnel are full time, paid firefighters, in total there are about 60 (+/-) paid-on-call fire fighters (soon to be 80 with Fire Hall #4 opening in April 2020) and 7 Chief Officers that service the area. The main personnel deficiencies reported by the MRFRD are recruiting and retaining paid-on-call firefighters; achieving adequate response by paid on-call firefighters to call-outs during regular work hours before 5 pm due to other employment commitments.

Table 12. Fire Rescue Department capacity and equipment within the AOI.

Fire Protection Zones	Fire Rescue Department	Number of Stations	Number of Members	Apparatus type and number
City of Maple Ridge Municipal Boundary	Maple Ridge Fire Rescue Department (MRFRD)	4	60 (+/-) paid-on-call firefighters, soon to be 80 with Fire Hall #4 opening in April 2020, and 7 Chief Officers	• Type 2 sprinkler protection unit (SPU trailer), • Initial Attack Unit (trailer), • Ranger SXS, • Initial attack suppression equipment including; bladder, pump, hose/nozzles etc., and hand tools

Members of the MRFRD undergo significant training focused on structural firefighting and annual structure protection programs including Wildland Firefighting Level 1 (SPP-WFF 1) and SPP S-115 and S-215 training has in house S-100, S-115 and S-215 train the trainers. The MRFRD however, does not have a junior or an aspiring firefighter work experience program. With regards to relationships and training opportunities with the BCWS, operational training support exists on an as-needed basis. In consultation with MRFRD during the development of this CWPP, it was determined that there are currently no structural or wildland firefighting training and equipment deficiencies.

To broaden the scope and capacity of MRFRD's initial attack response to fire incidents beyond the AOI boundaries, formal mutual aid agreements are in place with the District of Mission FD and Metro Vancouver's fire response program – the Watershed Fire Protection Program. In addition, formal reciprocal mutual aid agreements are in place between the District of Mission, the Township of Langley and Pitt Meadows; and a formal reciprocal automatic aid agreement exists with Mission FD for scenarios where structure fires occur in areas without hydrant services. In line with other south coast municipalities with a significant WUI zone adjacent to extensive tracts of forest land, MRFRD also has a mutual aid agreement is in place with the BCWS. Mutual aid is generally utilized 10-12 times annually and typically is with the Pitt Meadows Mission FDs; and is rarely used with the BCWS. The Fire Rescue Departments maintain communication with BCWS throughout the year, as required by the fire season demands;

however, the level of engagement with the BCWS is inconsistent between Fire Rescue Departments and has generally not been very strong in recent years.

Over the previous nine years (2011-2019), MRFRD has responded to an average of 3,400 fires calls per year (averaged over all fire halls), for both structural and wildland fire incidents (this number does not represent overall calls that include medical aid and motor vehicle accidents, etc.). Of the 3400 fire calls, approximately 418 fires, or 12% were classified as wildland (bush/grass) fires with an average of 51 incidents per year. No fires occurred that were classed as interface fires – fires that were threatening enough to impact structures. Total calls fell into the categories of alarms, assistance, burning complaints, bush fires, other fires, hydro line fires, structure fires, hazardous materials, mutual aid, and rescue. From the data, wildland fire calls ranged from a low of 32 in 2011, and a high of 95 in 2015. Given the large area of the AOI and the challenges posed to MRFRD in providing fire protection services, in 2003 the CMR undertook the preparation of the *Maple Ridge Fire Rescue Department Master Plan*.[78] This document reviewed the existing fire service delivery model, and how MRFRD would need to evolve in order to continue providing fire protection and prevention services to a rapidly growing community. To overcome identified shortcomings in service delivery and improve response times, and to establish expectations around personnel deployed and response times given available resources, the AOI was stratified into three zones. Based on the attributes level of demand and high probability of spread to other structures, these zones are: 1) Urban; 2) Rural; and 3) Protected Growth.

The Protected Growth and Rural zones align primarily with the northern and eastern parts of the AOI where proximity to coniferous forest (the WUI), single access roads to rural properties exist. The *Master Plan* acknowledges that some area in these zones are in transition from a rural density to an urban density, and as a critical density is reached, response times and personnel deployment will increase and reach the level of service provided in the Urban zone.

RECOMMENDATION #40: Complete an Emergency Evacuation Plan for the AOI, operationalize the plan by completing mock evacuation exercises at night to mimic poor visibility from smoke conditions. Consult with BC Corrections to align evacuation plans and jointly conduct a desk-top evacuation planning exercise.

RECOMMENDATION #41: In collaboration with the BCWS and Metro Vancouver Watershed Protection, Maple Ridge Fire Rescue Department should consider conducting a review of response times and crew mobilization staging areas to ensure they are adequate for wildfire call outs in all new subdivision developments in the WUI. Consider installing evacuation route signage in select portions of subdivisions with circuitous local roads.

[78] Maple Ridge Fire Department Master Plan. Retrieved from: https://www.mapleridge.ca/DocumentCenter/View/1058/Master-Plan?bidId=

6.1.2 Water Availability for Wildfire Suppression

Water is the single most important suppression resource. In an emergency response scenario, it is critical that a sufficient water supply be available. The Fire Underwriters Survey summarizes their recommendations regarding water works systems fire protection requirements, in *Water Supply for Public Fire Protection* (1999).[79] Some key points from this document include the need for:

- Duplication of system parts in case of breakdowns during an emergency;
- Adequate water storage facilities;
- Distributed hydrants, including hydrants at the ends of dead-end streets;
- Piping that is correctly installed and in good condition; and
- Water works planning should always take worst-case-scenarios into consideration. The water system should be able to serve more than one major fire simultaneously, especially in larger urban centers.

Water service within the AOI is an important component of emergency response for a wildland urban interface fire in the event of a large-scale emergency, and in particular for structural fires. As previously noted in Sections 3.2.3 and 3.3.1, water service is provided by Metro Vancouver, primarily the Coquitlam watershed and reservoir. For suppression within the AOI, hydrant service is provided within the fire services area boundaries at varying levels of coverage, with the exception of the Whonnock area, and other areas near the northern WUI boundary which have no hydrant service. There are significant areas outside of these boundaries with no hydrant service such as Golden Ears Provincial Park and woodlots.

Several areas or neighbourhoods that have a lack of hydrants, water supply and/or water pressure were identified and these create suppression challenges for the CMR. The 2018 City of Maple Ridge Drinking Water Quality Report describes the structure and function of source water, the distribution system, facility maintenance and re-chlorination stations in order to ensure water quality and supply meets acceptable standards.[80] In consultation with the Wildfire Working Group, a lack of hydrants was identified in the following neighbourhoods and developments: Whonnock in the east (private system, besides lack of hydrants, also has limited capacity, not sufficient for fire suppression) and areas in the northern WUI boundary.

Water service within the CMR is an important component of emergency response for a wildland urban interface fire in the event of a large-scale emergency, and in particular for wildfires. Water supply within the CMR has the potential to become limited in summer months as shortages can/do occur during extended drought periods typical of our coastal climate. In areas where water supply is limited, MRFRD can draft water from natural and static water sources such as lakes, rivers and ponds with notable locations including Alouette Lake, Whonnock Lake, Loon Lake, the Fraser River, the North and South

[79] http://www.scm-rms.ca/docs/Fire%20Underwriters%20Survey%20-%201999%20Water%20Supply%20for%20Public%20Fire%20Protection.pdf

[80] City of Maple Ridge, 2018. Drinking Water Quality Report. Retrieved From: https://www.mapleridge.ca/DocumentCenter/View/1914/2018-Drinking-Water-Quality-Report-PDF

Alouette Rivers, and Kanaka Creek. These natural water sources are known and mapped. However, some of these sources are also at risk of drying or experiencing reduced water levels during drought events, which typically coincide with high and extreme fire danger rating days. All MRFRD engine and tender apparatus is equipped with hard suction hoses, and tender apparatus' contains portable pumps capable of drafting water from natural sources. SPU (Sprinkler Protection Unit) and IAU (Initial Attack Unit) pumps are also on hand and can be used to draft water. Firefighting personnel are trained in the deployment of this equipment.

RECOMMENDATION #42: Develop a wildfire pre-planning brochure that addresses the following: 1) locations of staging areas; 2) identifies water reservoirs, communications requirements (i.e., radio frequencies), minimum resource requirements for structure protection in the event of an interface fire, and values at risk; and 3) maps of the area of interest. This brochure would be for 1) internal CMR staff and included into the Wildfire Response section of the CMR Emergency Plan, 2) agencies that MRFRD has mutual aid agreements with, and 3) industrial operators (woodlot licensees, Malcolm Knapp Research Forest).

RECOMMENDATION #43: Develop a Total Access Plan in coordination with BC Parks, BCIT Woodlot and UBC Research Forest to map and inventory trail and road networks in natural areas for suppression planning; and to identify areas with insufficient access. Georeferenced maps with ground-truthed locations of potential optimal firebreaks should be developed as part of the Total Access Plan and shared with fire suppression personnel and BCWS to support emergency response in the event of a wildfire. The plan should be updated every five years, or more regularly, as needed to incorporate additions and/or changes.

RECOMMENDATION #44: Due to the fact that the CMR has some limited access and egress options in the WUI and areas east of Kanaka Creek Park, as part of the evacuation plan (if application funding is awarded), the CMR should assess the feasibility and available options for improving access and increasing public safety in the event of an emergency evacuation.

6.1.3 Access and Evacuation

Road networks in a community serve several purposes including providing access for emergency vehicles, providing escape/evacuation routes for residents, and creating fuel breaks. Access and evacuation during a wildfire emergency often must happen simultaneously and road networks should have the capacity to handle both. In the event of a wildfire emergency, Dewdney Trunk Road, Lougheed Highway (Highway 7) are the two most reliable, paved arterial routes east and west through the AOI. In the eastern portion of the AOI the two most reliable north-south access routes are 280th and 272nd streets, as both roads connect with Lougheed Highway and provide a relatively direct and reliable access and egress route out of the AOI. In the western portion of the AOI the main north-south access routes are 224th Street and 216th Street, both streets lead directly down to Lougheed Hwy. In the northern portion of the AOI the primary roads connecting to Lougheed Hwy are 256th St and Alouette Rd. In the southern, most developed and urbanized portion of the AOI there are minimal access and egress route concerns as most neighbourhoods

are within a few minutes' drive of Dewdney Trunk Rd and the Lougheed Hwy. If a wildfire were to block the Lougheed Highway, evacuation from the AOI would be difficult. Smoke and poor visibility, car accidents, wildlife, and other unforeseen circumstances can further complicate evacuations and hinder safe passage.

Single route neighbourhoods occur throughout Maple Ridge. Narrow streets exist in many parts in the AOI. For example, the subdivision development at 104th Ave / 240th St area which poses challenges for equipment and suppression access. Other single access routes or isolated neighbourhoods that cause suppression and/or evacuation concerns were identified by the Wildfire Working Group including: Golden Ears Park, Silver Valley planning area, along 232nd Street, new subdivision development at Rock Ridge, and areas north and east of 128th Avenue. Furthermore, other significant barrier to access and evacuation in both older and newer neighbourhoods are narrow streets, no-thru roads, and complex/windy road networks, and locked gates on private drives and service roads especially to the BC Hydro transmission line and east side of Alouette Lake, and the resource roads into woodlots. While the CMR holds copies of master keys to all or most private roads, it is critical for all agencies to have the most recent information on gate locations and ownership.

Industry and key institutional facilities embedded in the WUI are the Justice Institute of BC, the Alouette Correctional Centre for Women, and the Fraser Regional Correctional Centre. The main routes providing access are 256th St and Alouette Rd. Although the manufacturing operations and the Justice Institute primarily have day time workers, students, and staff; correctional centres are living and working spaces for people year-round making them particularly vulnerable in emergency evacuation situations. Golden Ears Parkway, the only access route into Golden Ears Provincial park is also a serious concern due to the high volumes of people who use the park in the summer during the fire season and the surrounding dense coniferous stands. In the event of an emergency, evacuation would be conducted by MRFRD first responders, RCMP, and BCWS.

With the implementation of the Wildfire Protection Development Permit Area many new developments that are located within the WFDP area are now subject to scrutiny regarding access/evacuation needs including the construction of secondary roads and access points capable of accommodating fire suppression vehicles and equipment.

Emergency access and evacuation planning is of particular importance in the event of a wildfire event or other large-scale emergency. The CMR has developed an Emergency Response Plan (ERP)[81] which includes basic contingencies in the event of a wildland/interface fire (i.e., identifies key hazards, the appropriate priority actions to be taken, key contacts and the roles and responsibilities of local government personnel). In addition to the ERP, the CMR also has hazard-specific and departmental plans which provide detailed information such as staff and volunteer callout procedures and detailed site procedures.

[81] City of Maple Ridge Emergency Plan. Information about the plan retrieved from: https://www.mapleridge.ca/1242/Emergency-Plan

In the event of a wildfire emergency within the AOI, all the fire halls, the hospital, the RCMP headquarters, schools and the City Hall complex can be designated as an EOC and potential community muster buildings.

Trails built for recreational users such as horseback riders can provide access for ground crews and act as fuel breaks for ground fires, particularly in natural areas behind homes where adequate access is not available. Strategic recreational trail development built to a standard that supports authorized ATVs (for City use only), and the installation of gates or other barriers to minimize access by unauthorized users can be used as a tool that increases the ability of MRFRD to access interface areas.

The creation of a map book or spatial file that displays the trail network available for MRFRD to access during an emergency, or for fire suppression planning should accompany any fire access trail building activities. In order to effectively use these trails during suppression efforts, it is recommended that a Total Access Plan be developed. This plan should be made available to all fire halls within the CMR, as well as BC Parks staff, woodlots managers, and the BCWS in the event that they are aiding suppression efforts on an interface fire in the AOI. The plan should include georeferenced maps with associated spatial data and ground-truthed locations of potential optimal firebreaks, identify the type of access available for each access route, identify those trails that are gated or have barriers, and provide information as to how to unlock or remove barriers. The plan should also identify those natural areas where access is insufficient so alternate plans where gaps exist can be determined. Access assessment should consider land ownership, proximity of values at risk, wildfire threat, opportunities for use as fuel break or control lines, trail and road network linkages where fuel-free areas or burn off locations can be created or used as potential sprinkler locations, and requirements for future maintenance activities such as operational access for fuel treatments and other hazard reduction activities.

RECOMMENDATION #45: MRFRD should work with BCWS to initiate and/or maintain an annual structural and interface training program. As part of the training, conduct annual reviews to ensure PPE and wildland equipment resources are complete, in working order, and the crews are trained in their use. Also engage in yearly practical wildland fire training with BCWS that covers pump, hose, hydrant, air tanker awareness, and employment of SPUs. Interface training should include completion of a joint wildfire simulation exercise and safety training.

RECOMMENDATION #46: MRFRD should engage in regular communication with the BCWS Coastal Fire Zone to foster a strong relationship and identify potential cooperative wildfire risk reduction opportunities.

RECOMMENDATION #47: Develop a wildfire pre-planning brochure that addresses the following: 1) locations of staging areas; 2) identifies water reservoirs, communications requirements (i.e., radio frequencies), minimum resource requirements for structure protection in the event of an interface fire, and values at risk; and 3) maps of the area of interest. This brochure would be for 1) internal CMR staff and included into the Wildfire Response section of the CMR Emergency Plan, 2) agencies that MRFRD has mutual aid agreements with, and 3) industrial operators (woodlot licensees, Malcolm Knapp Research Forest).

6.1.4 Training

Provision of training opportunities for structural firefighters in the realm of wildland firefighting is critical to building capacity for suppression and emergency management at the local level. It is important for Fire Rescue Departments to maintain their current level of structural firefighting and increase the focus on interface training in S-100 (introductory) and S-215 (advanced) wildfire suppression training combined with mock exercises in partnership with BCWS.

Maple Ridge Fire Rescue maintains a current level of structural protection training as described in Section 6.1.1. Additionally, all members have yearly refreshers and/or certification in WFF-1 (Wildland Firefighter Level 1) SPU training, S-215 and SPP-115. Provision of training opportunities for structural firefighters in the realm of wildland firefighting is critical to building capacity for suppression and emergency management at the local level. It is recommended that all Fire Rescue Department members continue to at minimum have S-100 and/or SPP-WFF-1 (or equivalent), and that the Fire Rescue Departments engage in yearly practical wildland fire training with BCWS. It must be noted that SPP-WFF-1 is a new S-100 equivalent course for structure firefighters only, and as such BCWS has phased out instruction of S-100 training for Fire Rescue Departments. SPP-WFF-1 also replaces S-185 (Fire Entrapment Avoidance and Safety) and takes only 6 hours to be delivered.[82]

The Fire Rescue Departments maintain communication with BCWS throughout the year, as required by the fire season demands; however, the level of engagement with the BCWS is inconsistent and has generally not been very strong in recent years. It is recommended that MRFRD work cooperatively with the BCWS (Coastal Fire Center) to conduct yearly mock exercises (or as-needed basis determined by both agencies), where information and technical/practical knowledge are shared, such as: fire line construction, Mark 3 pump operations, sprinkler protection, skid pack operations, portable water tank deployment, and wildland hose operations. These practices could also provide training to wildland crews on hydrant hookup methods, as well as provide an avenue to discuss working together on inter-agency fires. Additional training options could include engaging adjacent Fire Rescue Departments outside the AOI (i.e., District of Mission, Pitt Meadows and Township of Langley Fire Rescue Departments) to conduct joint training so as to further strengthen regional emergency response and mutual aid agreements.

6.2 STRUCTURE PROTECTION

Maple Ridge Fire Rescue is well-resourced in both structural and wildland fire suppression equipment, maintains a current level of training in both wildfire and structural firefighting (see Section 6.1.1 for additional details). MRFRD is also equipped with two sprinkler Structural Protection Units (SPU). An additional resource the department can draw on are the UBCM-owned four SPUs, each equipped to

[82] Office of the Fire Commissioner. 2013. SPP-WFF-1 (Wildland Firefighter Level 1), as per NFPA 1051 Level 1 standard, backgrounder.

protect 30 – 35 structures. The kits are deployed by the MFLNRORD/BCWS incident command structure and are placed strategically across the province during the fire season based on fire weather conditions and fire potential. When the kits are not in use, they may be utilized by Fire Rescue Departments for training exercises. SPUs can be useful tools in the protection of rural/interface homes in the event of a wildfire. An important consideration in protecting the WUI zone from fire is ensuring that homes can withstand an interface fire event. Structure protection is focused on ensuring that building materials and construction standards are appropriate to protect individual homes from interface fire. Materials and construction standards used in roofing, exterior siding, window and door glazing, eaves, vents, openings, balconies, decks, and porches are primary considerations in developing FireSmart neighbourhoods. Housing built using appropriate construction techniques and materials in combination with fire resistant landscaping are less likely to be impacted by interface fires.

While many BC communities established to date were built without significant consideration of interface fire, there are still ways to reduce home vulnerability. Changes to vegetation around homes, roofing materials, siding, and decking can be achieved over the long-term through voluntary upgrades, as well as changes in bylaws, building codes and the implementation of Wildfire Hazard Development Permit Areas. The FireSmart approach has been adopted by a wide range of governments and is a recognized process for reducing and managing fire risk in the wildland urban interface. More details on FireSmart construction can be found in the "*FireSmart Begins at Home Manual*".[83]

It is recommended that homeowners take a building envelope – out approach, that is, starting with the home and working their way out. Addressing little projects first can allow for quick, easy, and cost-effective risk reduction efforts to be completed sooner, while larger, more costly projects can be completed as resources and planning allow. For example, prior to the fire season, clearing roofs and gutters of combustible materials (leaves and needles), cleaning out any combustible accumulations or stored materials from under decks, moving large potential heat sources such as firewood, spare building materials or vehicles as far from the structure as possible, maintaining a mowed and watered lawn, removing dead vegetation, and pruning trees are actionable steps that residents can start working on immediately. The following link from the Institute of Home and Building Safety (IBHS) accesses an excellent four-minute video demonstrating the importance of FireSmart building practices during a simulated ember shower: http://www.youtube.com/watch?v=_Vh4cQdH26g.

The structure protection objectives for the CMR are to:

- Encourage private homeowners to voluntarily adopt FireSmart principles on their properties and to reduce existing barriers to action;
- Enhance protection of critical infrastructure from wildfire (and post-wildfire impacts); and,
- Enhance protection of residential / commercial structures from wildfire.

[83]Available at https://firesmartcanada.ca/resources/ (FireSmart Canada) and https://www2.gov.bc.ca/gov/content/safety/wildfire-status/prevention/firesmart (BC FireSmart)

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APPENDIX A – LOCAL WILDFIRE THREAT PROCESS

The key steps to complete the local wildfire threat assessment are outlined below:

1. Fuel type attribute assessment, ground truthing/verification and updating as required to develop a local fuel type map (Appendix 0).
2. Consideration of the proximity of fuel to the community, recognizing that fuel closest to the community usually represents the highest hazard (Appendix A-2).
3. Analysis of predominant summer fire spread patterns using wind speed and wind direction during the peak burning period using ISI Rose(s) from BCWS weather station(s) (Appendix A-3). Wind speed, wind direction, and fine fuel moisture condition influence wildfire trajectory and rate of spread.
4. Consideration of topography in relation to values (Appendix A-4). Slope percentage and slope position of the value are considered, where slope percentage influences the fire's trajectory and rate of spread and slope position relates to the ability of a fire to gain momentum uphill.
5. Stratification of the WUI based on relative wildfire threat, considering all of the above.
6. Consider other local factors (i.e., previous mitigation efforts, and local knowledge regarding hazardous or vulnerable areas)
7. Identify priority wildfire risk areas for field assessment.

The basis for the prioritization of field assessment locations is further detailed in Section 4.3. Wildfire Threat Assessment plot worksheets are provided in Appendix C (under separate cover), plot locations are summarized in Appendix F, and the field data collection and spatial analysis methodology is detailed in Appendix H.

A-1 FUEL TYPE ATTRIBUTE ASSESSMENT

The Canadian Forest Fire Behaviour Prediction (FBP) System outlines five major fuel groups and sixteen fuel types based on characteristic fire behaviour under defined conditions.[84] Fuel typing is recognized as a blend of art and science. Although a subjective process, the most appropriate fuel type was assigned based on research, experience, and practical knowledge; this system has been used within BC, with continual improvement and refinement, for 20 years.[85] It should be noted that there are significant limitations with the fuel typing system which should be recognized. Major limitations include: a fuel typing system designed to describe fuels which do not occur within the AOI, fuel types which cannot accurately capture the natural variability within a polygon, and limitations in the data used to create initial fuel types.[85] Details regarding fuel typing methodology and limitations are found in Appendix G. There are several implications of the aforementioned limitations, which include: fuel typing further from the developed areas of the study has a lower confidence, generally; and, fuel typing should be used as a

[84]Forestry Canada Fire Danger Group. 1992. Development and Structure of the Canadian Forest Fire Behavior Prediction System: Information Report ST-X-3.

[85]Perrakis, D.B., Eade G., and Hicks, D. 2018. Natural Resources Canada. Canadian Forest Service. *British Columbia Wildfire Fuel Typing and Fuel Type Layer Description* 2018 Version.

starting point for more detailed assessments and as an indicator of overall wildfire threat, not as an operational, or site-level, assessment.

Table 13 summarizes the fuel types by general fire behaviour (crown fire and spotting potential). In general, the fuel type that may be considered hazardous in terms of fire behaviour and spotting potential in the AOI is C-3, particularly if there are large amounts of woody fuel accumulations or denser understory ingrowth. C-5 fuel types have a moderate potential for active crown fire when wind-driven.[85] An M-1/2 fuel type can sometimes be considered hazardous, depending on the proportion of conifers within the forest stand; conifer fuels include those in the overstory, as well as those in the understory. An O-1b fuel type often can support a rapidly spreading grass or surface fire capable of damage or destruction of property, and jeopardizing human life, although it is recognized as a highly variable fuel type dependent upon level of curing.[86] The O-1b fuel type was also attributed to sites dominated by invasive shrubs such as Scotch Broom. These fuel types were used to guide the threat assessment.

Forested ecosystems are dynamic and change over time: fuels accumulate, stands fill in with regeneration, and forest health outbreaks occur. Regular monitoring of fuel types and wildfire threat assessment should occur every 5 – 10 years to determine the need for threat assessment updates and the timing for their implementation.

[86]Ibid.

Table 13. Fuel Type Categories and Crown Fire Spot Potential. Only summaries of fuel types encountered within the AOI are provided.

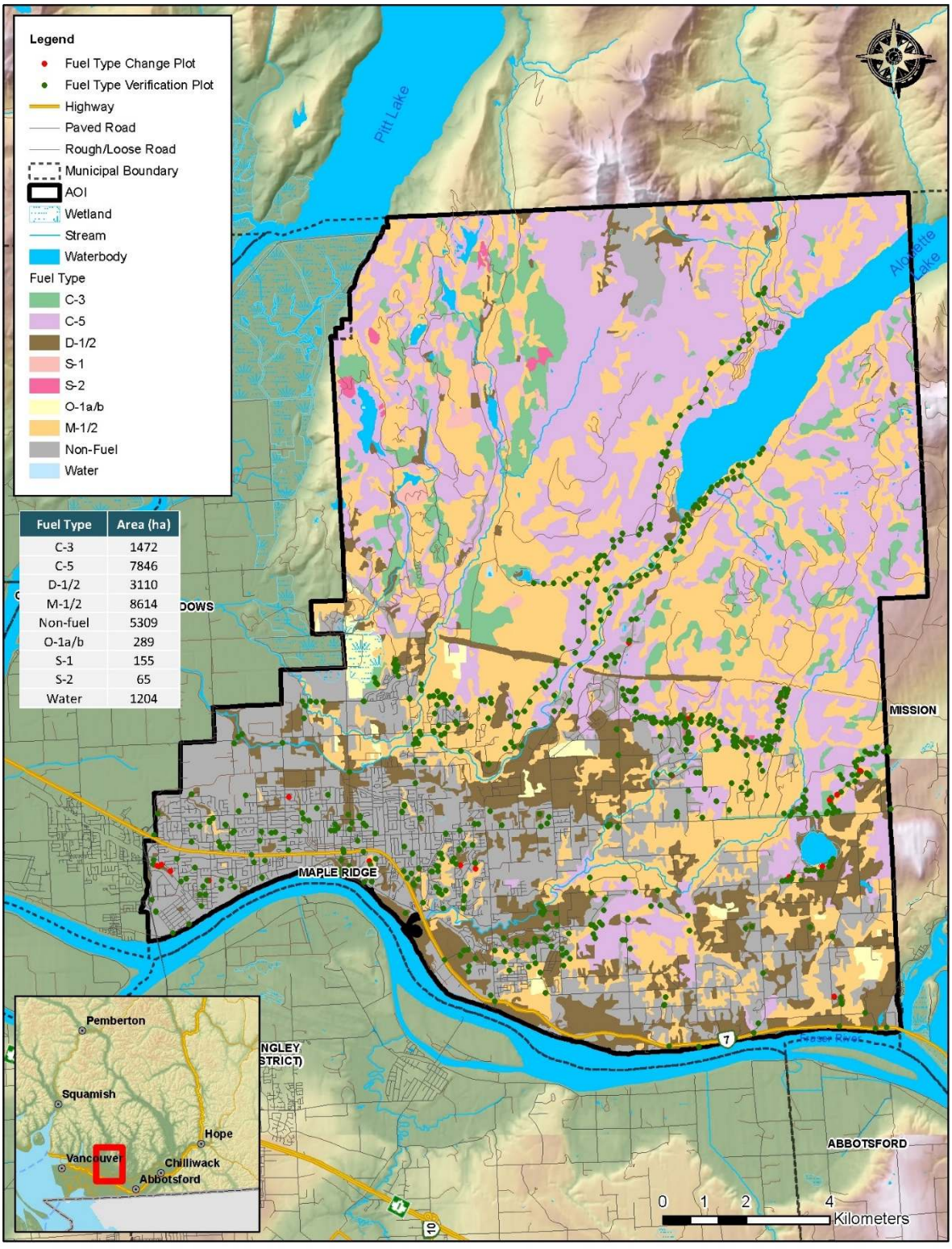
Fuel Type	FBP / CFDDRS Description	Study Area Description	Wildfire Behaviour Under High Wildfire Danger Level	Fuel Type – Crown Fire / Spotting Potential
C-3	Mature jack or lodgepole pine	Fully stocked, late young forest (western red cedar, hemlock, and/or Douglas-fir), with crowns separated from the ground	Surface and crown fire, low to very high fire intensity and rate of spread	High*
C-5	Red and white pine	Well-stocked mature forest, crowns separated from ground. Moderate understory herbs and shrubs. Often accompanied by dead woody fuel accumulations.	Moderate potential for active crown fire in wind-driven conditions. Under drought conditions, fuel consumption and fire intensity can be higher due to dead woody fuels	Low
O-1a/b	Grass	Matted and standing grass communities. Continuous standing grass with sparse or scattered shrubs and down woody debris. Vegetated, non-treed areas dominated by shrubs or herbs in dry ecosystems. Areas of very scattered trees.	Rapidly spreading, high- intensity surface fire when cured	Low
M-1/2	Boreal mixed wood (leafless and green)	Moderately well-stocked mixed stand of conifers and deciduous species, low to moderate dead, down woody fuels.	Surface fire spread, torching of individual trees and intermittent crowning, (depending on slope and percent conifer)	<26% conifer (Very Low); 26-49% Conifer (Low); >50% Conifer (Moderate)
D-1/2	Aspen (leafless and green)	Deciduous stands	Always a surface fire, low to moderate rate of spread and fire intensity	Low
S-1/2	Slash (jack / lodgepole pine, white spruce / balsam, and coastal cedar / hemlock/ Douglas-fir, respectively)	Jack or lodgepole pine slash, white pine/ balsam slash, coastal cedar/ hemlock/ Douglas-fir slash	Moderate to high rate of spread and high to very high intensity surface fire	Low
W	N/A	Water	N/A	N/A
N	N/A	Non-fuel: irrigated agricultural fields, golf courses, alpine areas void or nearly void of vegetation, urban or developed areas void or nearly void of forested vegetation.	N/A	N/A

**C-3 fuel type is considered to have a high crown fire and spotting potential within the study area due to the presence of moderate to high fuel loading (dead standing and partially or fully down woody material), and continuous conifer ladder fuels (i.e., western redcedar, Cw, and/or Douglas-fir, Fd).*

During field visits, seven recurring patterns of fuel type errors were found in the provincial dataset. They were:

- C-3 fuel types being incorrectly identified by the PSTA as C-5,
- C-5 fuel types being incorrectly as C-3,
- C-5 fuel types being incorrectly as M-1/2,
- M-1/2 fuel types identified as C-3,
- M-1/2 fuel types identified as C-5,
- M-1/2 fuel types identified as D-1/2;
- S-1 fuel types identified as C-5,
- D-1/2 fuel types identified as M-1/2, and
- N fuel types identified as D-1/2.

All fuel type updates were approved by BCWS, using stand and fuel descriptions and photo documentation for the review process (see Appendix B for submitted fuel type change rationales).



Map 8. Updated Fuel Type.

A-2 PROXIMITY OF FUEL TO THE COMMUNITY

Fire hazard classification in the WUI is partly dictated by the proximity of the fuel to developed areas within a community. More specifically, fuels closest to the community are considered to pose a higher hazard in comparison to fuels that are located at greater distances from values at risk. As a result, it is recommended that the implementation of fuel treatments prioritizes fuels closest to structures and / or developed areas, in order to reduce hazard level adjacent to the community. Continuity of fuel treatment is an important consideration, which can be ensured by reducing fuels from the edge of the community outward. Special consideration must be allocated to treatment locations to ensure continuity, as discontinuous fuel treatments in the WUI can allow wildfire to intensify, resulting in a heightened risk to values. In order to classify fuel threat levels and prioritize fuel treatments, fuels immediately adjacent to the community are rated higher than those located further from developed areas. Table 14 describes the classes associated with proximity of fuels to the interface.

Table 14. Proximity to the Interface.

Proximity to the Interface	Descriptor*	Explanation
WUI 100	(0-100 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	(101-500m)	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.
WUI 2000	(501-2000 m)	Treatment would be effective in limiting long - range spotting but short- range spotting may fall short of the value and cause a new ignition that could affect a value.
	>2 000 m	This should form part of a landscape assessment and is generally not part of the zoning process. Treatment is relatively ineffective for threat mitigation to a value, unless used to form a part of a larger fuel break / treatment.

**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.*

A-3 FIRE SPREAD PATTERNS

Wind speed, wind direction, and fine fuel moisture condition influence wildfire trajectory and rate of spread. The influence of topography on fire spread patterns is discussed in Appendix A-4. Wind plays a predominant role in fire behaviour and direction of fire spread and is summarized in the Initial Spread Index (ISI) Rose(s) from the local representative BCWS weather station – UBC Research Station (72). The wind rose data is compiled both hourly and daily and provides an estimate of prevailing wind directions and wind speed in the area of the weather station.

During the fire season (April – October) predominant winds originate from the south at speeds of 0-5 km/hour less than 40% of the time, and at speeds of 5-10 km/hour approximately 5% of the time and infrequently (<1%) occurring at speeds between 10-15 km/hr. Winds from the southeast and southwest directions occur at speeds of 0-5 km/hour less than 15% of the time and at speeds of 5-10 km/hour between 2- 5% of the time. Winds occur least frequently, from the northerly directions (northwest, north and northeast) between 5-10% of the time, and from the east and west less than 5% of the time in order of declining magnitude and frequency (Figure 4). The highest wind speeds (up to 25 km/hour) tend to occur infrequently from the north, south and southeast directions during the fire season. Potential treatment areas were identified and prioritized with the predominant wind direction in mind; wildfire that occurs upwind of a value poses a more significant threat to that value than one which occurs downwind.

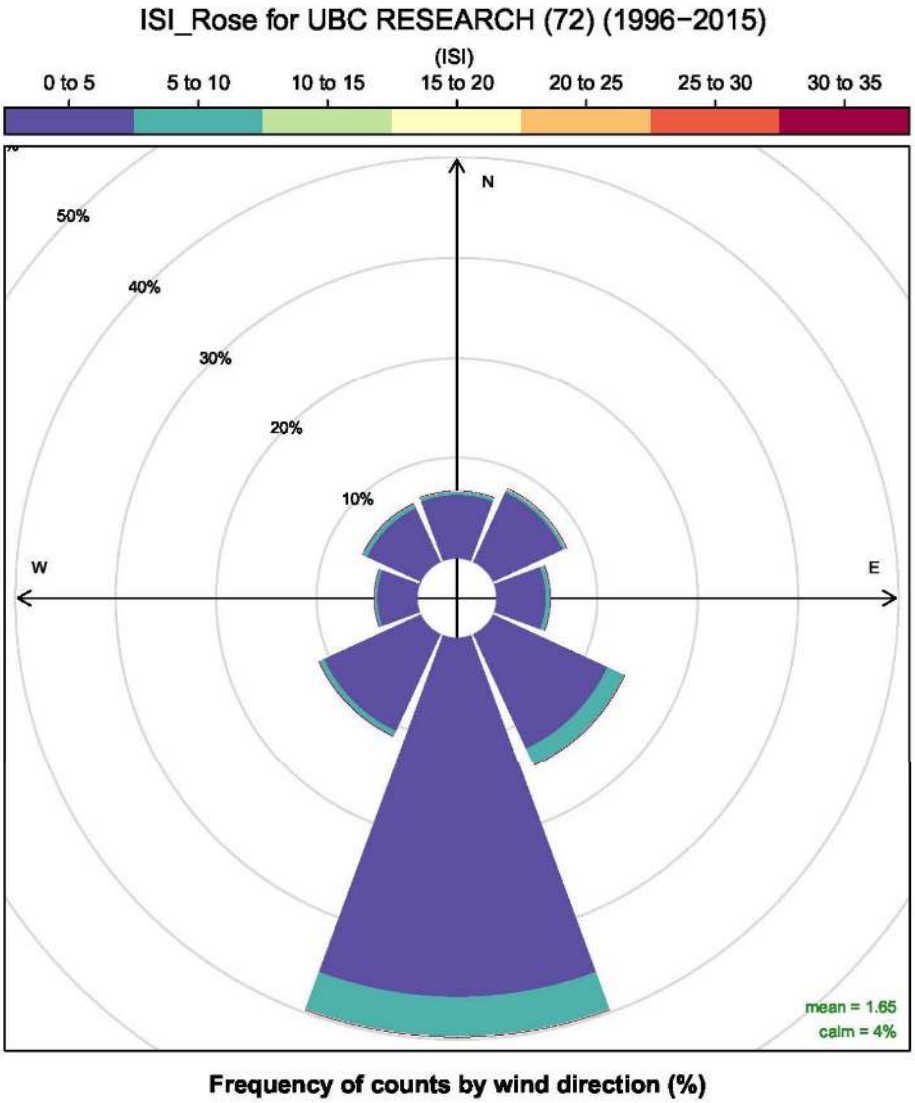


Figure 4. Windrose showing average daily wind readings during the fire season (April 1 – October 31) 1996 – 2015. Data taken from the UBC Research (72) weather station. The length of each bar represents the frequency of readings in percent and bar colour indicates the windspeed range.

A-4 TOPOGRAPHY

Topography is an important environmental component that influences fire behaviour. Considerations include slope percentage (steepness) and slope position where slope percentage influences the fire's trajectory and rate of spread and slope position relates to the ability of a fire to gain momentum uphill. Other factors of topography that influence fire behaviour include aspect and elevation.

SLOPE CLASS AND POSITION

Slope steepness affects solar radiation intensity, fuel moisture (influenced by radiation intensity) and influences flame length and rate of spread of surface fires. Table 15 summarizes the fire behaviour implications for slope percentage (the steeper the slope the faster the spread). In addition, Slope position affects temperature and relative humidity as summarized in Table 16. A value placed at the bottom of the slope is equivalent to a value on flat ground (see Table 15). A value on the upper 1/3 of the slope would be impacted by preheating and faster rates of spread (Table 16). The majority of the AOI (74%) is on less than 20% slope and will likely not experience accelerated rates of spread due to slope class. Approximately 21% percent of the study area is likely to experience an increased or high rate of spread. On the larger topographic scale, the communities in the South Zone AOI and surrounding agricultural, industrial, commercial, recreational and residential developments would be considered bottom of the slope or valley bottom.

Table 15. Slope Percentage and Fire Behaviour Implications.

Slope	Percent of AOI	Fire Behaviour Implications
<20%	74%	Little flame and fuel interaction caused by slope, normal rate of spread.
21-30%	13%	Flame tilt begins to preheat fuel, increase rate of spread.
31-45%	8%	Flame tilt preheats fuel and begins to bathe flames into fuel, high rate of spread.
46-60%	3%	Flame tilt preheats fuel and bathes flames into fuel, very high rate of spread.
>60%	2%	Flame tilt preheats fuel and bathes flames into fuel well upslope, extreme rate of spread.

Table 16. Slope Position of Value and Fire Behaviour Implications.

Slope Positionof Value	Fire Behaviour Implications
Bottom of Slope/ Valley Bottom	Impacted by normal rates of spread.
Mid Slope - Bench	Impacted by increase rates of spread. Position on a bench may reduce the preheating near the value. (Value is offset from the slope).
Mid slope – continuous	Impacted by fast rates of spread. No break in terrain features affected by preheating and flames bathing into the fuel ahead of the fire.
Upper 1/3 of slope	Impacted by extreme rates of spread. At risk to large continuous fire run, preheating and flames bathing into the fuel.

APPENDIX B – WILDFIRETHREAT ASSESSMENT – FBP FUEL TYPE CHANGE RATIONALE

Provided separately as PDF package.

APPENDIX C – WILDFIRE THREAT ASSESSMENT WORKSHEETS AND PHOTOS

Provided separately as PDF package.

APPENDIX D – MAPS

Provided separately as PDF package.

APPENDIX E – WILDLAND URBAN INTERFACE DEFINED

The traditional and most simple definition for the wildland/urban interface (WUI) is "the place where the forest meets the community". However, this definition can be misleading. Incorrectly, it implies that neighbourhoods and structures well within the perimeter of a larger community are not at risk from wildfire. As well, it fails to recognize that developments adjacent to grassland and bush are also vulnerable.

A more accurate and helpful definition of the WUI is based on a set of conditions, rather than a geographical location: "the presence of structures in locations in which conditions result in the potential for ignition of structures from the flames, radiant heat or embers of a wildland fire." This definition was developed by the National Fire Protection Association and is used by the US Firewise program. It recognizes that all types of wildland fuel/fire can lead to structural ignition (i.e. forest, grassland, brush) and also identifies the three potential sources of structural ignition.

Two situations are differentiated. Locations where there is a clean/abrupt transition from urban development to forest lands are usually specified as the "interface" whereas locations where structures are embedded or mingled within a matrix of dense wildland vegetation are known as the "intermix". An example of interface and intermixed areas is illustrated in Figure 5.

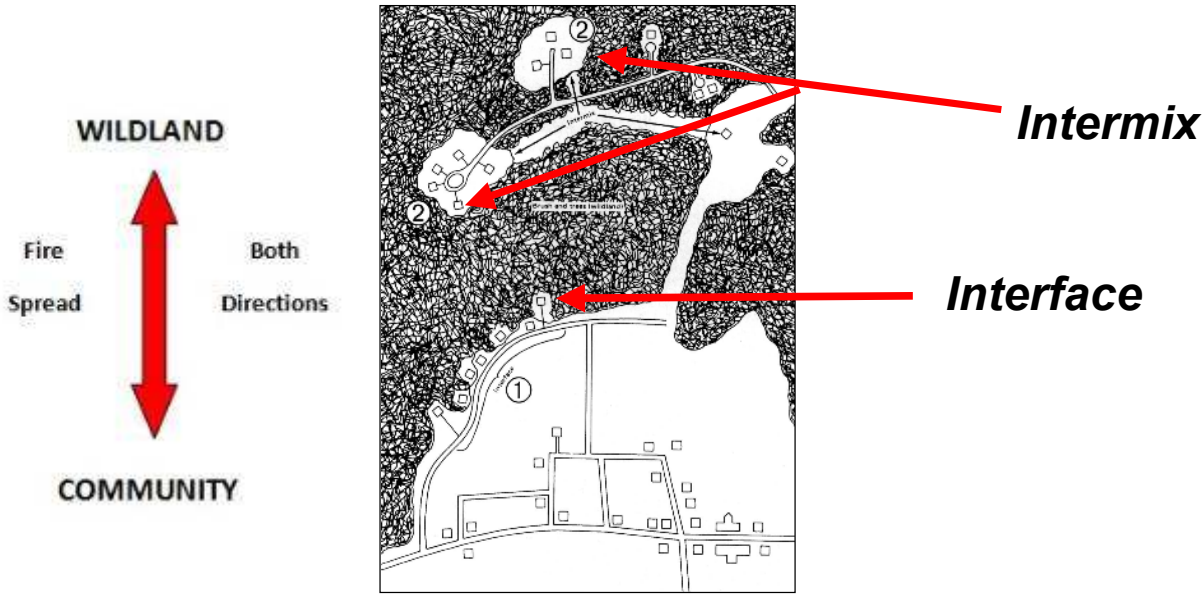


Figure 5. Illustration of intermix and interface situations.

Within the WUI, fire has the ability to spread from the forest into the community or from the community out into the forest. Although these two scenarios are quite different, they are of equal importance when considering interface fire risk. Regardless of which scenario occurs, there will be consequences for the community and this will have an impact on the way in which the community plans and prepares itself for interface fires.

Fires spreading into the WUI from the forest can impact homes in two distinct ways:

1. From sparks or burning embers carried by the wind, or convection that starts new fires beyond the zone of direct ignition (main advancing fire front), that alight on vulnerable construction materials or adjacent flammable landscaping (roofing, siding, decks, cedar hedges, bark mulch, etc.) (Figure 6).
2. From direct flame contact, convective heating, conductive heating or radiant heating along the edge of a burning fire front (burning forest), or through structure-to-structure contact. Fire can ignite a vulnerable structure when the structure is in close proximity (within 10 meters of the flame) to either the forest edge or a burning house (Figure 7).

Figure 6. Firebrand caused ignitions: burning embers are carried ahead of the fire front and alight on vulnerable building surfaces.

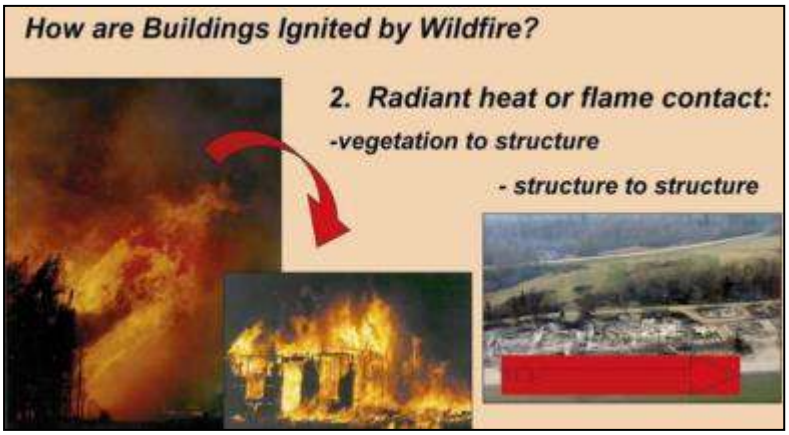


Figure 7. Radiant heat and flame contact allow fire to spread from vegetation to structure or from structure to structure.

Current research confirms that the majority of homes ignited during major WUI events trace back to embers as their cause (e.g. 50% – 80^{+} %). Firebrands can be transported long distances ahead of the wildfire, across any practicable fire guards, and accumulate on horizontal surfaces within the home ignition zone in densities that can reach 600^{+} /m^{2}. Combustible materials found within the home ignition zone combine to provide fire pathways allowing spot fires ignited by embers to spread and carry flames or smoldering fire into contact with structures.

APPENDIX F – WUI THREAT PLOT LOCATIONS

Table 17 displays a summary of all WUI threat plots completed during CWPP field work. The original WUI threat plot forms and photos will be submitted as a separate document. The following ratings are applied to applicable point ranges:

- Wildfire Behaviour Threat Score – Low (0-40); Moderate (41 – 95); High (96 – 149); Extreme (>149); and,
- WUI Threat Score – Low (0 – 13); Moderate (14 – 26); High (27 – 39); Extreme (>39).

Table 17. Summary of WUI Threat Assessment Worksheets.

WUI Plot #	Geographic Location	Wildfire Behaviour Threat Class	WUI Threat Class*
ALBI-1	Southwest corner of Albion Park	Moderate (88)	n/a
ALIC-1	Within Allco Park	Moderate (95)	n/a
APPA-1	Along the Appalachia trail, west of Grant Hill	Moderate (92)	n/a
APPA-2	North of the Thornhill Grind trail, west of Grant Hill	Moderate (93)	n/a
APPA-3	North of the Thornhill Grind trail, southeast of Grant Hill	Moderate (91)	n/a
BCIT-1	Within the BCIT woodlot, near the caretaker's home	High (111)	Extreme (47)
BCIT-2	Within the BCIT woodlot, between Dewdney Trunk Rd and BC Hydro ROW	Moderate (94)	n/a
BCIT-3	Within the BCIT woodlot, between Dewdney Trunk Rd and BC Hydro ROW	High (122)	High (28)
BLUE-1	Within the Blue Mountain woodlot, north of McNutt Rd and 128 Ave intersection	Moderate (93)	n/a
BLUE-2	Within the Blue Mountain woodlot, northeast of 127 Ave and 266 St intersection	High (127)	Moderate (25)
BLUE-3	Within the Blue Mountain woodlot	High (103)	Moderate (18)
COTT-1	Located in a greenbelt, southeast of Cottonwood Dr and 119 Ave intersection	Moderate (88)	n/a
CREEK-1	Located in a greenbelt, northwest of 116 Ave and Kanaka Mews intersection	Moderate (86)	n/a
CREEK-2	Located in a greenbelt, southeast of 116 Ave and 238A St intersection	Moderate (88)	n/a
DEWD-1	West of 248 Ave and 271 St intersection and north of 269 St	Moderate (91)	n/a

WUI Plot #	Geographic Location	Wildfire Behaviour Threat Class	WUI Threat Class*
DEWD-2	North of 264 St and 126 Ave intersection	Moderate (93)	n/a
DEWD-3	West of Lilley Dr and Katonien St intersection	Moderate (92)	n/a
FRAS-1	Adjacent to the Fraser Regional Correctional Center	Moderate (84)	n/a
GOLD-1	Located within Golden Ears Park, adjacent to the North Beach trailhead	Moderate (83)	n/a
GOLD-2	Located within Golden Ears Park, west of the Gold Creek campground	High (128)	High (34)
GOLD-3	Located within Golden Ears Park, west of the Alouette Lake South Beach day-use area	Moderate (90)	n/a
GOLD-4	Located within Golden Ears Park, along the southern portion of the access route	High (107)	Moderate (19)
GOLD-5	Located within Golden Ears Park, along the eastern side of Alouette lake and north of the dam	Moderate (90)	n/a
HILL-1	Located in a greenbelt northwest of Ritchie Ave and Giley Ave intersection	Moderate (70)	n/a
JIBC-1	Located along the eastern boundary of Justice Institute of British Columbia - Maple Ridge Campus	High (126)	High (35)
KANA-1	Located in Kanaka Creek park, northwest of 110 Ave and 246 St	Moderate (74)	n/a
KANA-2	Located in Kanaka Creek park, north of Dewdney Trunk Rd and west of the BCIT woodlot	Moderate (94)	n/a
SILV-1	Located within the Silver Valley, west of Docksteader circle	High (104)	High (33)
SILV-2	Located within the Silver Valley, northwest of Foreman Dr and 232 St intersection	High (96)	n/a
SILV-3	Located within the Silver Valley, northwest of Balsam St and Hudson Dr intersection	Moderate (89)	n/a
SILV-4	Located within the Silver Valley, north of 235 St and 236 St intersection	Moderate (88)	n/a
SILV-5	Located within the Silver Valley, north of Granite Way and Boulder Pl intersection	High (129)	High (28)

WUI Plot #	Geographic Location	Wildfire Behaviour Threat Class	WUI Threat Class*
SILV-6	Located within the Silver Valley, east of 239B St and 240 St intersection	High (110)	Extreme (50)
WEBS-1	West of Webster's Corner Elementary School, south of Dewdney Trunk Rd	High (97)	Extreme (45)
WHON-1	Southeast of Whonnock Lk	High (110)	Moderate (23)
WHON-2	Southwest of Whonnock Lk	Moderate (95)	n/a
WHON-3	Southwest of Whonnock Lk, north of Maple Ridge Fire & Rescue - Hall #2	Moderate (87)	n/a
WHON-4	Northwest of Whonnock Lk, east of Dewdney Trunk Rd and 272 St intersection	Moderate (86)	n/a
WHON-5	Southeast of Whonnock Lk, north of 286 St and 111 Ave	Moderate (80)	n/a

*Note that WUI threat scores are only collected for untreated polygons that rate high or extreme for Wildfire Behaviour Threat score. WUI threat scores are collected regardless of Wildfire Behaviour Threat score for treated polygons.

APPENDIX G – FUEL TYPING METHODOLOGY AND LIMITATIONS

The initial starting point for fuel typing for the AOI was the 2019 provincial fuel typing layer provided by BCWS as part of the *2019 Provincial Strategic Threat Analysis* (PSTA) data package. This fuel type layer is based on the FBP fuel typing system. PSTA data is limited by the accuracy and availability of information within the Vegetation Resource Inventory (VRI) provincial data; confidence in provincial fuel type data is very low on private land. The PSTA threat class for all private land within the AOI was not available. Fuel types within the AOI have been updated using ortho-imagery of the area with representative fuel type calls confirmed by field fuel type verification. Polygons not field-verified were assigned fuel types based upon similarities visible in orthophotography to areas field verified. Where polygons were available from the provincial fuel typing layer, they were utilized and updated as necessary for recent harvesting, development, etc.

It should be noted that fuel typing is intended to represent a fire behaviour pattern; a locally observed fuel type may have no exact analog within the FBP system. The FBP system was almost entirely developed for boreal and sub-boreal forest types, which do not occur within the AOI. As a result, the local fuel typing is a best approximation of the Canadian Forest Fire Danger Rating System (CFFDRS) classification, based on the fire behaviour potential of the fuel type during periods of high and extreme fire danger within the local MFLNRORD region. Additionally, provincial fuel typing depends heavily on VRI data, which is gathered and maintained in order to inform timber management objectives, not fire behaviour prediction. For this reason, VRI data often does not include important attributes which impact fuel type and hazard, but which are not integral to timber management objectives. Examples include: surface fuels and understory vegetation.

In some cases, fuel type polygons may not adequately describe the variation in the fuels present within a given polygon due to errors within the PSTA and VRI data, necessitating adjustments required to the PSTA data. In some areas, aerial imagery is not of sufficiently high resolution to make a fuel type call. Where fuel types could not be updated from imagery with a high level of confidence, the original PSTA fuel type polygon and call were retained.

For information on the provincial fuel typing process used for PSTA data as well as aiding in fuel type updates made in this document, please refer to Perrakis, Eade, and Hicks, 2018.[87]

[87]Perrakis, D.B., Eade G., and Hicks, D. 2018. Natural Resources Canada. Canadian Forest Service. *British Columbia Wildfire Fuel Typing and Fuel Type Layer Description* 2018 Version

APPENDIX H – WUI THREAT ASSESSMENT METHODOLOGY

As part of the CWPP process, spatial data submissions are required to meet the defined standards in the Program and Application Guide. As part of the program, proponents completing a CWPP or CWPP update are provided with the Provincial Strategic Threat Analysis (PSTA) dataset. This dataset includes:

- Current Fire Points
- Current Fire Polygons
- Fuel Type
- Historical Fire Points
- Historical Fire Polygons
- Mountain pine beetle polygons (sometimes not included)
- PSTA Head Fire Intensity
- PSTA Historical Fire Density
- PSTA Spotting Impact
- PSTA Threat Rating
- Structure Density
- Structures (sometimes not included)
- Wildland Urban Interface Buffer Area

The required components for the spatial data submission are detailed in the Program and Application Guide Spatial Appendix – these include:

- AOI
- Fire Threat
- Fuel Type
- Proposed Treatment
- Threat Plot

The provided PSTA data does not necessarily transfer directly into the geodatabase for submission, and several PSTA feature classes require extensive updating or correction. In addition, the Fire Threat determined in the PSTA is fundamentally different than the Fire Threat feature class that must be submitted in the spatial data package. The Fire Threat in the PSTA is based on provincial scale inputs - fire density; spotting impact; and head fire intensity, while the spatial submission Fire Threat is based on the components of the Wildland Urban Interface Threat Assessment Worksheet. For the scope of this project, completion of WUI Threat Assessment plots on the entire AOI is not possible, and therefore an analytical model has been built to assume Fire Threat based on spatially explicit variables that correspond to the WUI Threat Assessment worksheet.

Field Data Collection

The primary goals of field data collection are to confirm or correct the provincial fuel type, complete WUI Threat Assessment Plots, and assess other features of interest to the development of the CWPP update.

This is accomplished by traversing as much of the study area as possible (within time, budget and access constraints). Threat Assessment plots are completed on the 2012 version form, and as per the Wildland Urban Interface Threat Assessment Guide.

For clarity, the final threat ratings for the study area were determined through the completion of the following methodological steps:

1. Update fuel-typing using orthophotography provided by the client and field verification.
2. Update structural data using critical infrastructure information provided by the client, field visits to confirm structure additions or deletions, and orthophotography
3. Complete field work to ground-truth fuel typing and threat ratings (completed 39 WUI threat plots on a variety of fuel types, aspects, and slopes and an additional 700+ field stops with qualitative notes, fuel type verification, and/or photographs)
4. Threat assessment analysis using field data collected and rating results of WUI threat plots – see next section.

Spatial Analysis

Not all attributes on the WUI Threat Assessment form can be determined using a GIS analysis on a landscape/polygon level. To emulate as closely as possible the threat categorization that would be determined using the Threat Assessment form, the variables in Table 18 were used as the basis for building the analytical model. The features chosen are those that are spatially explicit, available from existing and reliable spatial data or field data, and able to be confidently extrapolated to large polygons.

Table 18. Description of variables used in spatial analysis for WUI wildfire threat assessment.

WUI Threat Sheet Attribute	Used in Analysis?	Comment
FUEL SUBCOMPONENT		
Duff depth and Moisture Regime	No	Many of these attributes assumed by using 'fuel type' as a component of the Fire Threat analysis. Most of these components are not easily extrapolated to a landscape or polygon scale, or the data available to estimate over large areas (VRI) is unreliable.
Surface Fuel continuity	No	
Vegetation Fuel Composition	No	
Fine Woody Debris Continuity	No	
Large Woody Debris Continuity	No	
Live and Dead Coniferous Crown Closure	No	
Live and Dead Conifer Crown Base height	No	
Live and Dead suppressed and Understory Conifers	No	
Forest health	No	
Continuous forest/slash cover within 2 km	No	
WEATHER SUBCOMPONENT		
BEC zone	Yes	
Historical weather fire occurrence	Yes	
TOPOGRAPHY SUBCOMPONENT		
Aspect	Yes	
Slope	Yes	Elevation model was used to determine slope.
Terrain	No	

WUI Threat Sheet Attribute	Used in Analysis?	Comment
Landscape/ topographic limitations to wildfire spread	No	
STRUCTURAL SUBCOMPONENT		
Position of structure/ community on slope	No	
Type of development	No	
Position of assessment area relative to values	Yes	Distance to structure is used in analysis; position on slope relative to values at risk is too difficult to analyze spatially.

The field data is used to correct the fuel type polygon attributes provided in the PSTA. The corrected fuel type layer is then used as part of the initial spatial analysis process. The other components are developed using spatial data (BEC zone, fire history zone) or spatial analysis (aspect, slope). A scoring system was developed to categorize resultant polygons as having relatively low, moderate, high or extreme Fire Threat, or Low, Moderate, High or Extreme WUI Threat.

These attributes are combined to produce polygons with a final Fire Behaviour Threat Score. To determine the Wildland Urban Interface Score, only the distance to structures is used. Buffer distances are established as per the WUI Threat Assessment worksheet (<200, 200-500 and >500) for polygons that have a 'high' or 'extreme' Fire Behaviour Threat score. Polygons with structures within 200m are rated as 'extreme', within 500m are rated as 'high', within 2km are 'moderate', and distances over that are rated 'low'.

There are obvious limitations in this method, most notably that not all components of the threat assessment worksheet are scalable to a GIS model, generalizing the Fire Behaviour Threat score. The WUI Threat Score is greatly simplified, as determining the position of structures on a slope, the type of development and the relative position are difficult in an automated GIS process. This method uses the best available information to produce the initial threat assessment across the study area in a format which is required by the UBCM CRI program.

Upon completion of the initial spatial threat assessment, individual polygon refinement was completed. In this process, the WUI threat plots completed on the ground were used in the following ways:

- fuel scores were reviewed and applied to the fuel type in which the threat plot was completed;
- conservative fuel scores were then applied to the polygons by fuel type to check the initial assessment;
- high Wildfire Behaviour Threat Class polygons were reviewed in Google Earth to confirm their position on slope relative to values at risk.

In this way, we were able to consider fuel attributes outside the fuel typing layer, as well as assessment area position on slope relative to structures, which are included in the WUI threat plot worksheet.

Limitations

The threat class ratings are based initially upon (geographic information systems) GIS analysis that best represents the WUI wildfire threat assessment worksheet and are updated with ground-truthing WUI threat plots. WUI threat plots were completed in a variety of fuel types, slopes, and aspects in order to be able to confidently refine the GIS analysis. It should be noted that there are subcomponents in the worksheet which are not able to be analyzed using spatial analysis; these are factors that do not exist in the GIS environment.

The threat assessment is based largely on fuel typing, therefore the limitations with fuel typing accuracy (as detailed in Appendix A-1 and Appendix G) impacts the threat assessment, as well.

APPENDIX I – SUMMARY OF 2007 COMMUNITY WILDFIRE PROTECTION PLAN RECOMMENDATIONS

Structure protection

Recommendation 4: Many homes and businesses are built immediately adjacent to the forest edge. In these neighbourhoods, trees and vegetation are often in direct contact with homes. The District should create building setbacks with a minimum distance of 10 m when buildings border the forest interface.

Partially completed – new development in the Wildfire Protection Development Permit Area is required to have minimum set-back distances from the forest edge

Recommendation 5: The District should begin a process to review and revise existing bylaws and building codes to be consistent with the development of a FireSmart Community. For areas that have been identified as high risk, consideration should be given to the creation of a Wildfire Bylaw that mandates fire resistant building materials, provides for good access for emergency response, and specifies fuel management on both public and private property in areas of identified high wildfire risk.

Completed

Recommendation 6: In new subdivisions within identified high risk areas of the District, roofing materials that are fire retardant with a Class A and Class B rating should be a requirement of the development permit. It is recognized that wholesale changes to existing roofing materials within high risk areas of the District are not practical, therefore a long-term replacement standard that is phased in over the roof rotation period would significantly reduce the vulnerability of the community in areas of historic development.

Completed

Recommendation 7: Given the wildfire risk profile of the community, an emergency sprinkler kit capable of protecting 30 to 50 homes should be purchased and maintained in the community. Fire rescue personnel, or a designate of the department, should be trained to mobilize and set up the equipment efficiently and effectively during a fire event.

Completed

Emergency Response

Recommendation 8: The District must work towards improving access in identified areas of the community that are considered isolated and that have inadequately developed access for evacuation and fire control.

Regular ongoing improvements

Recommendation 9: An evacuation plan should be developed for the community and the outlying road and trail networks which could be cut off or impacted by fire. A large fire may require the evacuation of heavily used trails where vehicle access is restricted.

Current plan is outdated, application has been made to UBCM for funding to update plan

Recommendation 10: During a large wildfire it is probable that the valley bottom (location of the fire hall and Health Care Centre) could be severely impacted by smoke. It is recommended that contingency plans be developed in the event that smoke causes evacuation of Maple Ridge District. The District should co-operate with Provincial and Regional governments to develop an alternate incident command location and mobile facility in the event that the District is evacuated.

Completed–CMR works closely with Provincial Regional Emergency Operations Centre (PREOC)

Recommendation 12: The Fire Rescue Department should purchase an all-terrain vehicle, trailer (both storage and pull behind unit) and related equipment to enable improved access for fire suppression in areas that are currently inaccessible.

Training

Completed

Recommendation 13: The current level of training and available equipment related to interface fire response is considered adequate, but given the risk of fire to the community, the Maple Ridge Fire Rescue Service should adopt an advanced program that fosters continuous improvement and skill renewal.

Completed

Fuel Management

Recommendation 14: The District should continue to cooperate or develop relationships with the University of British Columbia Research Forest, forest leaseholders/operators and BC Parks to develop a comprehensive fuel treatment program in the area where the District borders the Research Forest, Crown land and BC Parks land. Treatments on District lands should complement any existing treatment programs in the Research Forest, Crown land and on BC Parks land. A detailed inventory and risk assessment of the interface between the Research Forest, BC Parks land and the Community should be a serious consideration.

Completed

Recommendation 15: A number of high hazard areas immediately adjacent to or embedded in the community have been identified as part of the wildfire risk assessment. These high hazard areas should be the focus of a progressive thinning program that is implemented over the next five to ten years. Thinning should be focused on the highest priority areas: C3 and C4 fuel types. The goals of thinning are to remove hazardous fuels and to reduce the overall fire behaviour potential adjacent to the community.

Attempted / Not completed