SECTION 6: APPENDICES

6.1 APPENDIX A: LOCAL WILDFIRE RISK PROCESS

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

1. Fuel type attribute assessment, ground truthing/verification and updating as required to develop a local fuel type map (Appendix A-1: Fire Risk Threat Assessment Methodology).
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: Proximity of Fuel to the Community).
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: Fire Spread Patterns). Wind speed, wind direction, and fine fuel moisture condition influence wildfire trajectory and rate of spread.
4. Consideration of topography in relation to values. 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 risk, considering all 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 Appendix F: Fire Risk Threat Assessment Methodology Wildfire Risk Assessment plot worksheets are provided in Appendix B: Wildfire Threat Assessment Plots – Worksheets and Photos (under separate cover), plot locations are summarized in Appendix D: Wildfire Threat Assessment Plot Locations, and the field data collection and spatial analysis methodology is detailed in Appendix F: Fire Risk Threat Assessment Methodology.

6.1.1 APPENDIX A-1: FIRE RISK THREAT ASSESSMENT METHODOLOGY

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.[43] 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.[44] It should be noted that there are significant limitations with the fuel typing system which should be recognized. Major limitations include: a fuel

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

[44] 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.

typing system designed to describe fuels which sometimes 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.[44] Details regarding fuel typing methodology and limitations are found in Appendix E: Fuel Typing Methodology and Limitations. 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 starting point for more detailed assessments and as an indicator of overall wildfire risk, not as an operational, or site-level, assessment.

Table 29 summarizes the fuel types by general fire behaviour (crown fire and spotting potential). In general, the fuel type that may be considered most hazardous in terms of fire behaviour and spotting potential in the WUI is C-3. C-5 fuel types have a moderate potential for active crown fire when wind-driven.[44] 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. 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 risk assessment should occur every 5 – 10 years to determine the need for threat assessment updates and the timing for their implementation.

Table 29. Fuel Type Categories and Crown Fire Spot Potential. Only summaries of fuel types encountered within the WUI are provided (as such, other fuel types, i.e., (as such, other fuel types, i.e., C-1, C-2, C-4, C-7, O-1 a/b, S-2, and S-3 are not summarized below)

Fuel Type	FBP / CFDDRS Description	AOI 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 (Douglas fir, hemlock, cedar), 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
M-1/2	Boreal mixedwood (leafless and green)	Moderately well-stocked mixed stand of conifers and deciduous species, low to moderate dead, down woody fuels; areas harvested 10-20 years ago	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
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
M-1/2	Boreal mixedwood (leafless and green)	Moderately well-stocked mixed stand of conifers and deciduous species, low to moderate dead, down woody fuels; areas harvested 10-20 years ago	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)

**C-3 fuel type is considered to have a high crown fire and spotting potential within the WUI due to the presence of moderate to high fuel loading (dead standing and partially or fully down woody material), and continuous conifer ladder fuels.*

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

- C-5 fuel types being incorrectly identified by the PSTA as D-1/2, M-1/2, or C-3
- C-5 fuel types being incorrectly identified by the PSTA as C-3, and
- C-3 fuel types being incorrectly identified by the PSTA as O1-a/b.

The resulting updated fuel types were shown earlier on Map 4.

6.1.2 APPENDIX A-2: PROXIMITY OF FUEL TO THE COMMUNITY

Home and Critical Infrastructure Ignition Zones

Multiple studies have shown that the principal factors regarding home and structure loss to wildfire are the structure's characteristics and immediate surroundings. The area that determines the ignition potential of a structure to wildfire is referred to as (for residences) the Home Ignition Zone (HIZ) or (for critical infrastructure) the Critical Infrastructure Ignition Zone (CIIZ).[45,46] Both the HIZ and CIIZ include the structure itself and four concentric, progressively wider Priority Zones out to 100 m from the structure (Figure 5 below). More details on priority zones can be found in the FireSmart Manual.[47]

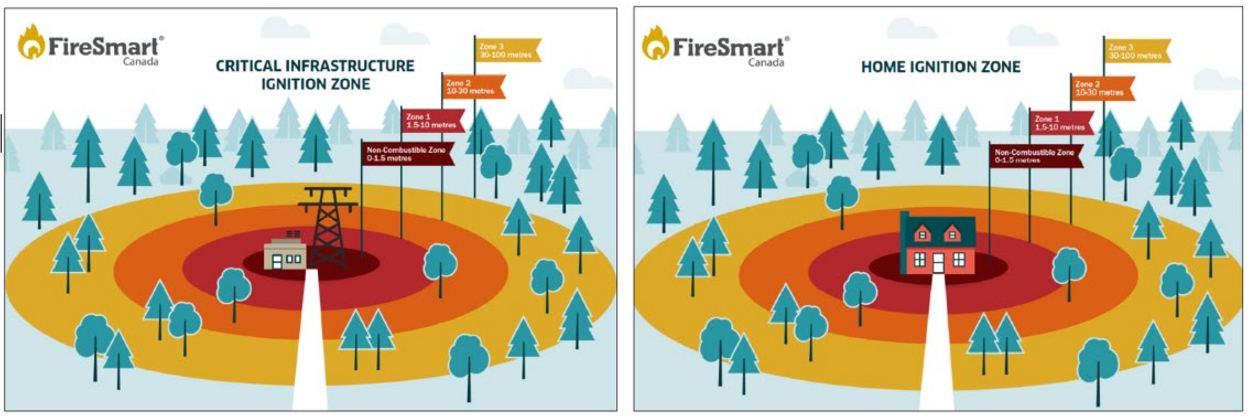

Figure 5: FireSmart Home and Critical Infrastructure Ignition Zone (HIZ, CIIZ)

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/CIIZ in densities that can exceed 600 embers per square meter. Combustible materials found within the HIZ/CIIZ 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/CIIZ 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.[46] Increasing ignition resistance would reduce the number of homes simultaneously on fire; extreme wildfire conditions do not necessarily result in WUI fire disasters.[48] It is for this reason that the key to reducing WUI fire

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[45] 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.

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

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

[48] 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/.

structure loss is to reduce structure ignitability. Mitigation responsibility must be centered on structure owners. 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.

Community Zone

Vegetation management in the Community Zone encompasses all non-provincial Crown publicly owned lands that are within Coquitlam's municipal boundary and are typically beyond 30 metres from private structures.[49] Vegetation management planning and implementation on most Community Zone lands should be directed through a formal fuel management prescription developed by a forest professional with wildfire vegetation management within their scope of practice[49]. Depending on the results of FireSmart Structure Ignition Zone assessments on individual structures, vegetation management may be required out beyond 30 metres and up to 100 metres (FireSmart Priority Zone 3) on larger private parcels.[27] Municipal parks, municipal trails, municipal outdoor event spaces and fields, etc. are all part of the Community Zone. Many Community Zone open spaces/lands are often associated with high use by the public thus increasing accidental ignition potential and the wildfire risk to properties and homes surrounding them.

Landscape Zone

The Landscape Zone encompasses provincial Crown lands that are located outside Coquitlam's municipal boundary. Vegetation (fuel) management planning and implementation is primarily the responsibility of the provincial government, working collaboratively to align landscape objectives with the CWRP objectives[49]. Vegetation management planning and implementation in the Landscape Zone and on all forested provincial Crown lands must be directed through a formal fuel management prescription developed by a forest professional with wildfire vegetation management within their scope of practice.[49]

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

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[49] Community Resiliency Investment. (2021). *FireSmart Community Funding and Supports Supplemental Instruction Guide.* Retrieved from: https://www.ubcm.ca/funding-programs/local-government-program-services/community-resiliency-investment/firesmart-0

immediately adjacent to the community are rated higher than those located further from developed areas. Table 30 describes the classes associated with proximity of fuels to the interface.

Table 30. Proximity to the Interface.

Proximity to the Interface	Descriptor*	Explanation
WUI 100 *HIZ/CIIZ and Community Zones*	(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 *Community and Landscape Zones*	(100-500m)	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 1000 *Landscape Zone*	(500-1000 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.
Landscape Zone	>1000 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.*

6.1.3 APPENDIX A-3: FIRE SPREAD PATTERNS

ISI roses can help plan the location of fuel treatments on the landscape to protect values at risk based on the predominant wind direction and frequency of higher ISI values. Potential treatment areas were identified and prioritized with the predominant wind direction in mind. Figure 6 below displays the daily average ISI values for UBC Research fire weather station, which represents wind speeds and directions in the southeast of the WUI. During the fire season (April – October) predominant winds originate from the south, east, and west.

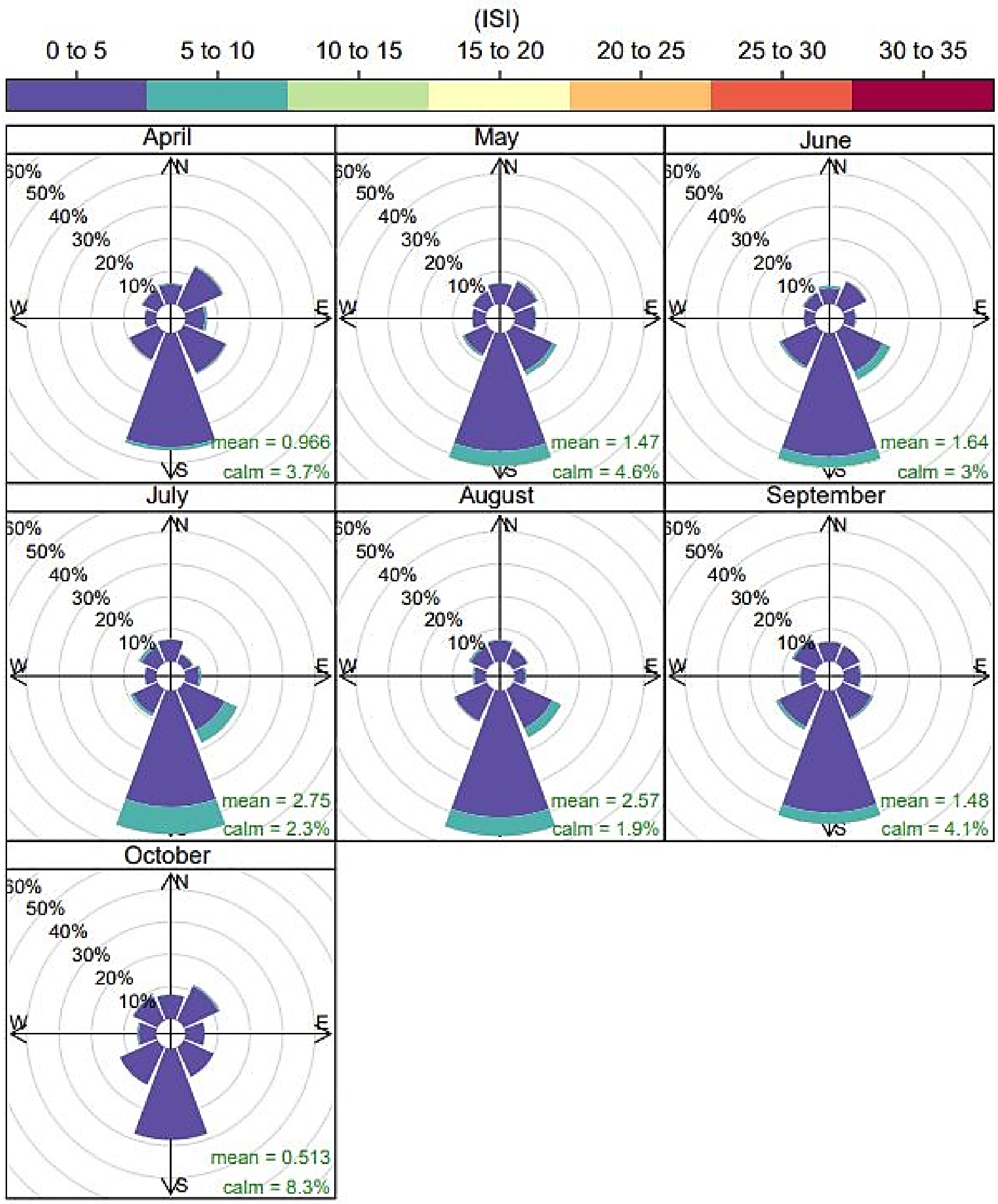

Figure 6: Initial Spread Index (ISI) roses depicting average daily wind speed and direction for each month during the fire season (April – October). Data taken from the UBC Research fire weather station 2003 – 2015.