Community Wildfire Protection Plan

Dashwood Fire Protection Area

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COMMUNITY WILDFIRE PROTECTION PLAN –

DASHWOOD FIRE PROTECTION AREA

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2 Executive Summary

Risk analysis reports have identified wildland urban interface (WUI) fire as the second highest risk to residents (after flooding) throughout the Regional District of Nanaimo (RDN). In order to better assess and manage the risk of wildland fire within its boundaries, the RDN commissioned the Strategic Group to prepare a Community Wildfire Protection Plan (CWPP) for the Dashwood Fire Protection Area.

A Community Wildfire Protection Plan (CWPP) is a plan developed by a community that:

1. Defines risk areas within the community for interface fires,
2. Identifies measures necessary to mitigate those risks, and
3. Outlines a plan of action to implement the measures.

The CWPP for the Dashwood Fire Protection Area identifies and analyzes the risk of WUI fire and proposes both landscape level and strategic solutions to mitigate those risks. The plan includes a detailed analysis of WUI fire hazards and consequence to spatially identify and stratify areas at risk into categories of Low, Moderate, High and Extreme risk of WUI fire. The total area of Dashwood is 2389 hectares of which 1489 hectares (62%) rates as high or extreme risk to wildland fire. Site investigations and observations throughout the Dashwood area have allowed us to generally conclude that the primary areas of concern, with respect to mitigating fire hazard in the WUI, are:

1. access constraints to WUI sites by fire fighting personnel and response units,
2. lack of FireSmart landscaping/engineering on residential properties and heavy forest fuel accumulations in close proximity to structures, and
3. shortage of detailed information on WUI fire recovery plan.

Recommendations and risk reduction measures presented in section 8 are categorized into three broad areas referred to as the 3 E's Approach: Education, Engineering and Enforcement. Broadly, these recommendations fall into one of the following:

1. Education: Increase community awareness of FireSmart principles using effective communication and training. Include more detail to WUI fire events within RDN emergency plans.
2. Engineering: Physically apply mitigation techniques to reduce the chance of a wildland fire occurring, but also reduce the severity should one occur.
3. Enforcement: Review existing bylaws and create new bylaws that empower officials to ensure safe use of fire and compliance with FireSmart guidelines. Further develop relationships with other agencies or employ a fire prevention officer to patrol high risk areas.

The intent of these recommendations is to present the RDN with achievable, coordinated options which serve to leverage existing capacity and initiatives in order to reduce the threat of wildland Sfire within the community (while respecting the time, cost and political constraints which may be present).

Fire suppression personnel, resources and infrastructure in Dashwood are very proficient. Nevertheless, by incorporating both the strategic and tactical recommendations contained within this report, it is anticipated

that the likelihood of significant wildland fire events within the community will be reduced and that the effectiveness of any response by fire suppression personnel will be greatly increased.

The Province of British Columbia recently released the British Columbia Wildland Fire Management Strategy (Province of British Columbia 2010e) of which the first goal is to “reduce the hazards and risks associated with wildland fire in and around communities and other high-value areas.” Under this goal, CWPPs are mentioned as a first strategic priority and the adoption of community development plans and enforcement regimes that emphasize risk mitigation and FireSmart principles are also a priority.

2.1 A Successful WUI Fire Prevention Program

The following guiding principles to a successful WUI fire prevention program were obtained from the Symposium 2004 WUI – Working Towards a Fire Safe Community manual presented by the Thompson Okanagan Inter-Agency Committee. We encourage the RDN, the Dashwood Volunteer Fire Department and the residents of Dashwood to consider adopting the following principles:

- "We, as agencies working in partnership toward a common goal, must be prepared to act upon and assist in the resolution of identified issues";
- "We must realize that it may require stepping outside our traditional roles and taking on new challenges";
- "We must respond to the people of the community in a manner that meets their needs";
- "No single agency or group can solve the problem"; and
- "We must work as a team with the people of the community and develop solutions to the issues most important to them in the WUI."

3 Acknowledgements

The authors of this report would like to thank and acknowledge the following people for their assistance and participation in preparing the Dashwood Community Wildfire Prevention Plan.

Jani Drew, Emergency Coordinator, RDN

Nick Acciavatti, Fire Chief, Dashwood Volunteer Fire Department

Jennifer Naylor, Fuel Management Generalist, Ministry of Natural Resource Operations, Coastal Fire Centre

Brian McIntosh, Fuel Management Specialist, Ministry of Natural Resource Operations, Coastal Fire Centre

Rob Templeman, Fire Protection Technician, Ministry of Natural Resource Operations, Mid Island Fire Zone

4 Introduction and Background

Wildland fires that occur on BC's forested lands are a natural part of forest ecology, life cycle and seral stage development. Although wildland fires are more commonly associated with interior sites and coastal sites that transition the interior, many coastal communities have attributes similar to those found in the interior of BC that can have the same catastrophic effect on lives, homes, public infrastructure, private improvements, resource values and wildlife. Understanding the hazards and risks associated with wildland fire helps land managers to identify areas that require hazard mitigation and to prepare for an emergency in the event a disaster does occur.

Areas where human development and wildland or forests mix or abut each other are known as the wildland urban interface (WUI) (see Appendix 1). The WUI poses a special set of challenges to emergency management personnel as well as the residents living in these areas. Emergency management personnel can be challenged with fast moving wildland fires spreading amongst homes and other structures, thereby threatening residents and their homes. The 2003 fire season in BC stands out as a disastrous event where several major WUI fires destroyed over 300 homes and tens of thousands of residents were evacuated. Following the 2003 fire season, the provincial government released the report "Firestorm 2003 Provincial Review" (Filmon 2003) which, among other recommendations, called for the Province to expedite strategies to improve fire prevention in communities having WUI areas. In addition, the Auditor General produced reports in 2001 and 2005 concluding that the provincial government needed to do more to be better prepared for major interface fires (Office of the Auditor General 2001, 2005). A significant problem identified was the lack of complete and reliable information about this issue – number of fires, locations, and the costs and losses associated with interface fires. As a result of the Filmon Report, the Community Wildfire Prevention Plan (CWPP) process was introduced in order to help communities identify the hazards and risks in their area.

In 2006 the Regional District of Nanaimo (RDN) commissioned EmergeX Planning to conduct a Hazard, Risk and Vulnerability Assessment of all types of emergencies and/or disasters relevant to the area (EmergeX Planning 2006). Forest fires and WUI fires were identified as high risk, second only to floods. A majority of the Dashwood was, at the time and continues to be, classified as high and extreme WUI fire hazards.

> *… a significant hazard exists in Electoral Area F south of Highway 19 beginning down Corcan Road and extending down Meadowood Way into the Little Qualicum [River] Estates that straddle Spider Lake. The northern shores of Cameron Lake have also been designated as an "Extreme" WUI (WUI) fire hazard.*
> (Hazard Risk and Vulnerability Assessment, RDN, EmergeX Planning 2006)

Provincial Strategic Threat Analysis Data (PSTAD) (Province of British Columbia 2010d) is a data set that analyzes wildland fire incidence, forest fuels and their proximity to human development and rates the threat that a wildland fire poses to the developed areas. A review of PSTAD indicates that most of Dashwood is rated high to extreme WUI fire threat rating (Regional District of Nanaimo 2010). The WUI presents a unique challenge throughout BC and is discussed in Section 5.9.

> *British Columbia has the highest risk of injury and property losses from interface fires in Canada because the climate and topography of the province make it particularly susceptible to wildfires.*
> (Office of the Auditor General 2005)

Strategic Group was retained in June 2010 to complete a CWPP for the Dashwood Fire Protection Area (referenced as "Dashwood" in this document) which is located within the RDN. This project has been funded by the RDN and the Union of BC Municipalities (UBCM).

> *Wildland forest fires are capable of spreading at an astonishing rate. Crowning forest fires often spread at up to 5.5 kilometres per hour, with spotting as far as 2 kilometres ahead. Wind blown grass fires can spread at speeds up to 8.5 kilometres per hour.*
> (FireSmart Manual, Partners in Protection 2003)

4.1 Scope

This CWPP has been written to identify various hazards and risks at a landscape level in order to guide site level wildland fire prevention and provide recommendations of hazard reduction measures within the Dashwood area. Furthermore this CWPP will identify natural and human created physical attributes which are the basis for determining hazards, consequences and resulting wildland fire risks. This report is presented in four sections and five appendices, including a description of Dashwood, wildland fire risk assessment methodology and analysis, conclusions and recommendations, as well as definitions and key concepts, maps, fuel type explanations, biogeoclimatic zone descriptions and WUI threat rating results. The recommendations within this CWPP are intended to assist the Dashwood Fire Department, the RDN, private land owners and residents in reducing community wildland fire risks.

5 Dashwood Description

5.1 Location and Study Area

The Dashwood is located 48 kilometres northwest of Nanaimo on Vancouver Island within the RDN (figure 1 and Appendix 2). It lies between Qualicum Beach and Bowser as well as extending south along the Qualicum River to the community of Meadowood. The total area of Dashwood is 2,389 hectares. The area contains the strip of semi-rural lands along the east coast, including the village of Dashwood and extends south and uphill to the settlements of Meadwood and Little Qualicum River Estates.

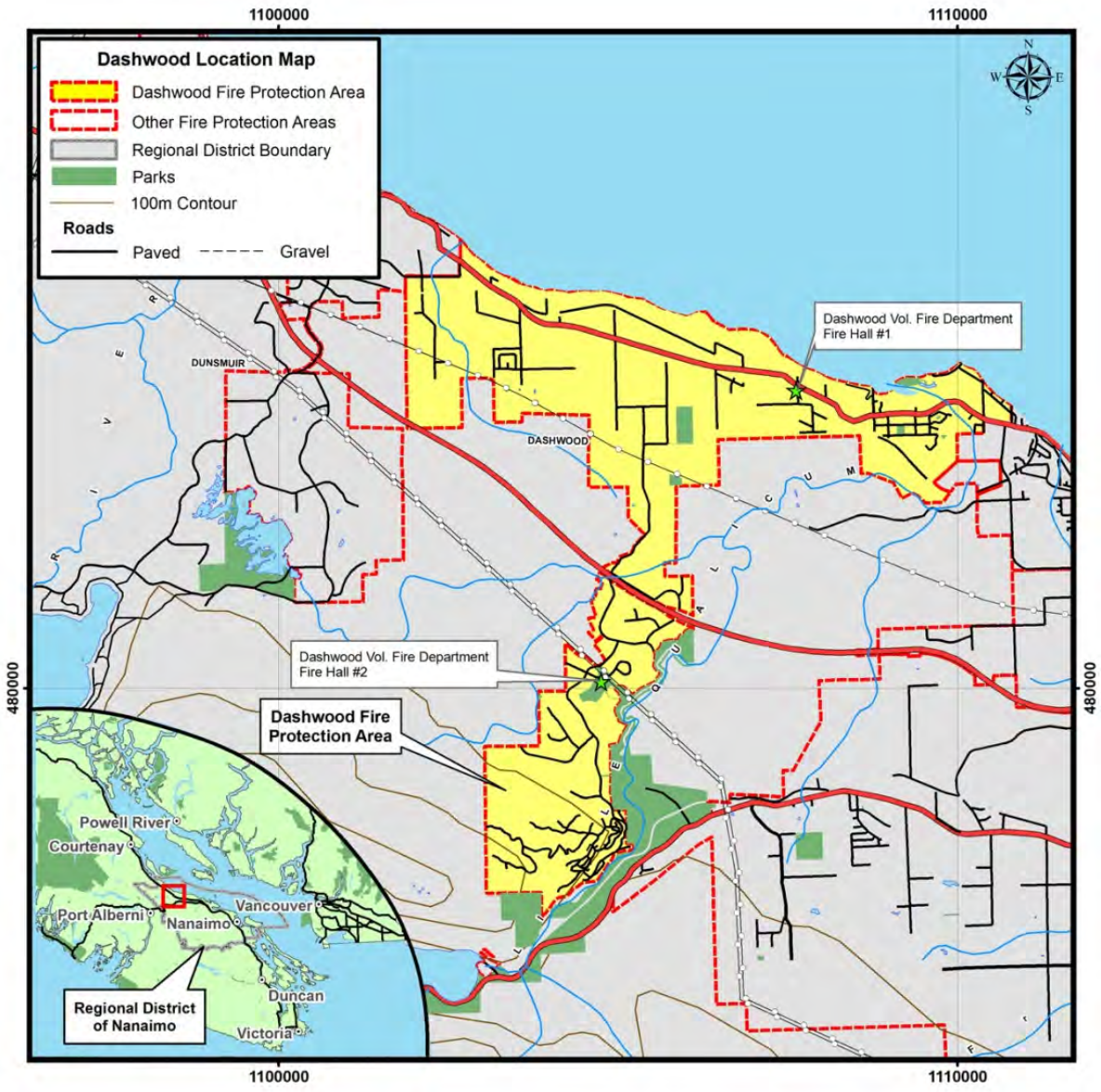

Figure 1 Location map, Dashwood Fire Protection Area (see Appendix 2 for full size map).

5.2 Topography

Dashwood lies within the geographical area known as the Georgia Basin with its northeast boundary bordering the marine waters of Georgia Strait, the Little Qualicum River to the east, and nearly to Cameron Lake in the southwest. Dashwood is on the east side, or rain shadow, of the Beaufort Range from ridge tops (Wesley Ridge) down to bottom slopes. Elevation ranges from sea level to 600m. Drainages and major creeks in the area include Little Qualicum River, Kinkade Creek, Annie Creek and Dolly Varden Creek. A variety of terrain exists with gently undulating ground on the northern portion of the area to steeper ground with some open bluffs in the south. A northeasterly aspect is prominent on the slopes, with the exception of an easterly aspect in a small area of Meadowood Estates closest to the Little Qualicum River. In general the soils are well-drained, sandy to gravelly with large amounts of cobble.

Areas of thin, well-drained soils, such as the upper slopes and ridge tops in Dashwood are more prone to drought conditions during summer months.

5.3 Fire Weather

Weather and climate are two very significant aspects affecting wildfire hazards. Understanding the history of weather patterns can influence how fire control and prevention is carried out. Typical frontal weather patterns in the Dashwood area include:

Southeast Weather Patterns – These are normally wet and windy weather cells that bring moisture during the winter, spring and fall months (low pressure).

Northwest Weather Patterns – These weather fronts are associated with drier weather from BC's interior that result in warm to hot temperatures and extreme fire weather during the summer months (high pressure).

The largest controlling element to weather systems in this area is the Beaufort Range. Precipitation is typically expressed through orographic lift where the west side of the range experiences significant precipitation which results in a drier rain-shadow environment on the eastern slopes of Vancouver Island, where Dashwood is.

Two weather phenomena in the Dashwood area that are important in terms of wildland fires are outflow winds and "Qualicum winds" (pers. comm. Dan Morrison 2010). Outflow winds here are generated from a ridge of high pressure over mainland BC and winds flow out of major valleys and drainages, notably Bute Inlet, Toba Inlet, Jervis Inlet, Howe Sound and the Fraser Valley. These outflow winds keep the relative humidity low overnight and can make for very low relative humidities in the afternoon (at times less than 10%). Qualicum winds are a "gap" wind where air is channelled through an opening due to topography (in this case, the Alberni Inlet and Cameron Lake). They occur in the summer when there is a ridge of high pressure offshore and very strong, warm winds blow up Barkley Sound, over the pass near Port Alberni and out to Georgia Strait. They are associated with very warm and dry conditions and can reach speeds of up to 50-60km/hr.

Weather stations provide hourly observations and are supplemented with data from other agency stations to support fire weather forecasting and the Canadian Forest Fire Danger Rating System (CFFDRS) (see Appendix 1). Two weather stations were selected as being representative of the Dashwood area (see table 1 and figure 2) (Province of British Columbia 2010c):

- ***Beaver Creek (Ministry of Natural Resource Operations – Wildfire Management Branch)*** – This station is indicative of Dashwoods upland areas (middle and upper slopes) like Meadowood.
- ***Qualicum Airport (Environment Canada)*** – This station best represents Dashwoods foreshore and slightly inland areas (lower slopes).

Table 1 Ministry of Natural Resource Operations - Wildfire Management Branch and Environment Canada representative weather stations.

	Latitude	Longitude	Elevation (m)	Start Year
Beaver Creek	49 22 38	124 55 59	100	1987
Qualicum Airport	49 20 00	124 23 00	58	2008

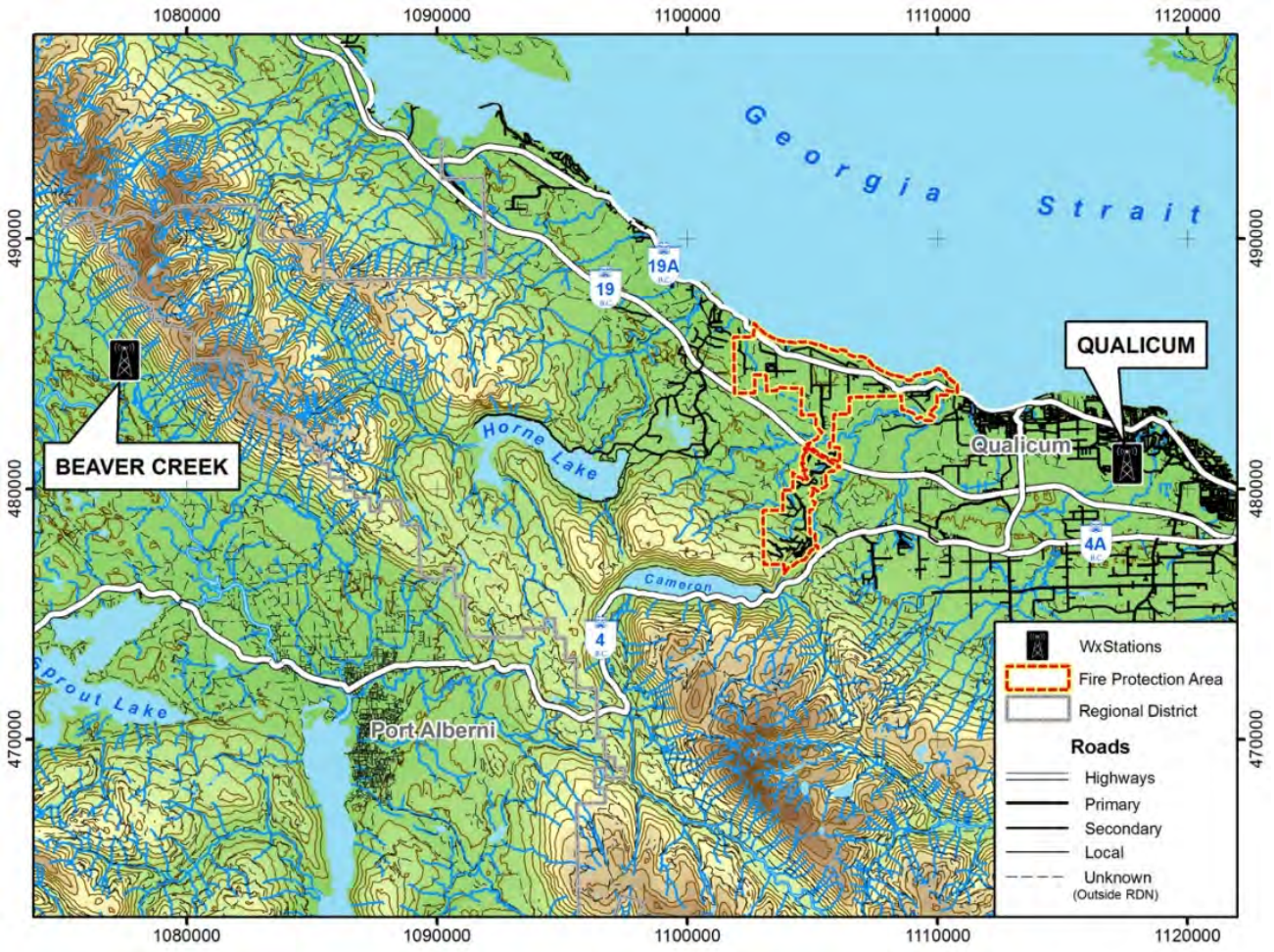

Figure 2 Ministry of Natural Resource Operations weather stations at Beaver Creek and Qualicum (see Appendix 2 for full size map)

Weather readings from these stations and fuel condition information contribute to the identification of fire Danger Classes through the CFFDRS and give a general indication of the ease of ignition and potential fire intensity. The risk to lives and property increase when conditions are at Danger Class 3 (Moderate), 4 (High) and 5 (Extreme). Figures 3 through 6 indicate when and how often these conditions occur for both the Beaver Creek and Qualicum weather stations during the fire season (April 1 – October 31) through the life of each weather station. Green represents Very Low to Low fire danger (Danger Class 1 and 2), yellow represents Moderate fire danger (Danger Class 3), orange represents High fire danger (Danger Class 4) and red represents Extreme fire danger (Danger Class 5).

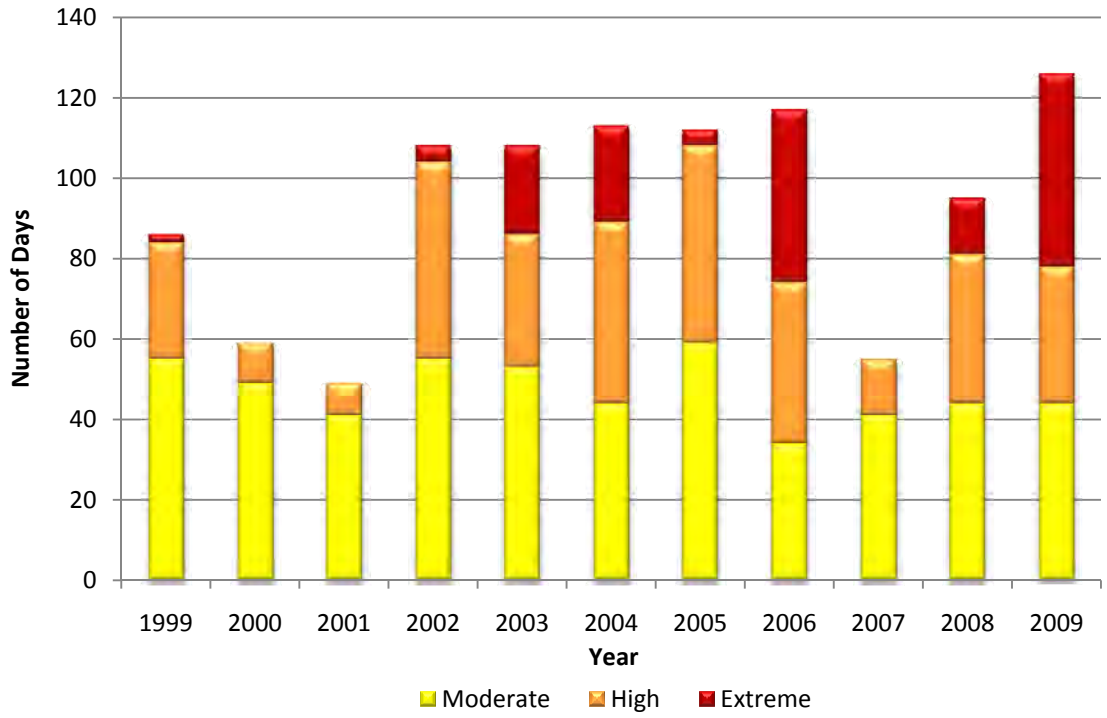

Figure 3 Number of fire season days (April 1 to October 31) (Beaver Creek) at Danger Class 3 and above (1999-2009)

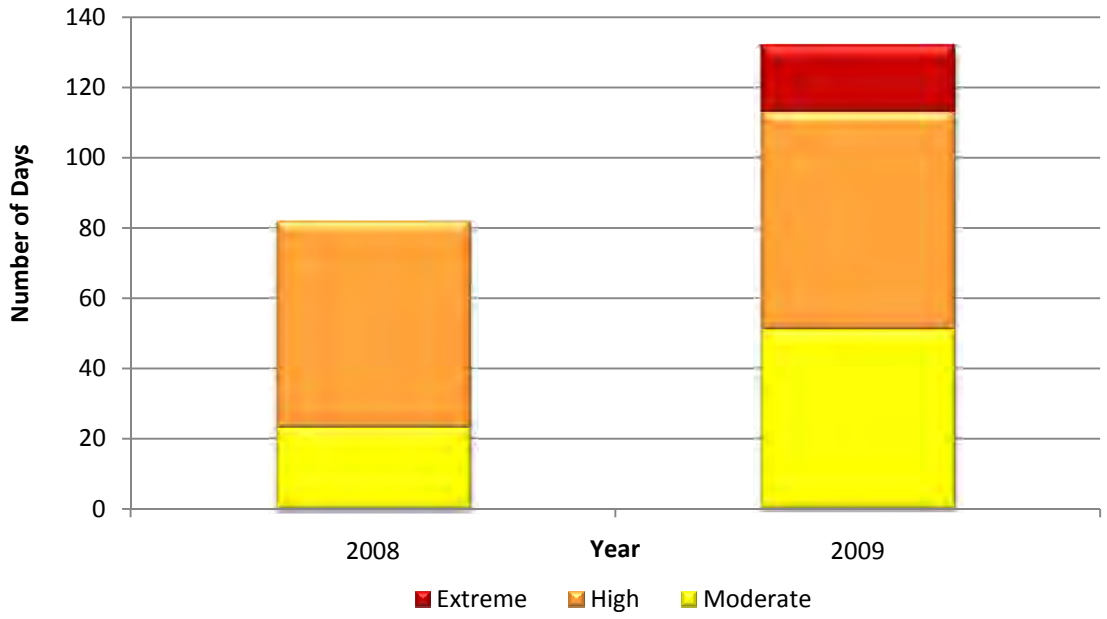

Figure 4 Number of fire season days (April 1 to October 31) (Qualicum) at Danger Class 3 and above (2008-2009)

Comparing data within the two geographic areas of Dashwood indicate that a higher number of days of extreme fire weather occur in the upper slopes (Meadowood and Qualicum Estates).

Some of the environmental conditions that are used in the danger class determinations include temperature and relative humidity. Figures 5 and 6 present these observations for 2009 for Beaver Creek and Qualicum. Specific attention to these figures should be directed to the proximity of the temperature line to the relative humidity line. As these two values approach each other, fire danger increases to the point where a temperature and relative humidity "crossover" occurs (when relative humidity is lower than the temperature) indicating the potential for extreme fire behaviour. Analysis of these graphs show that high and extreme fire weather occurs in the Dashwood area from mid May until the end of September.

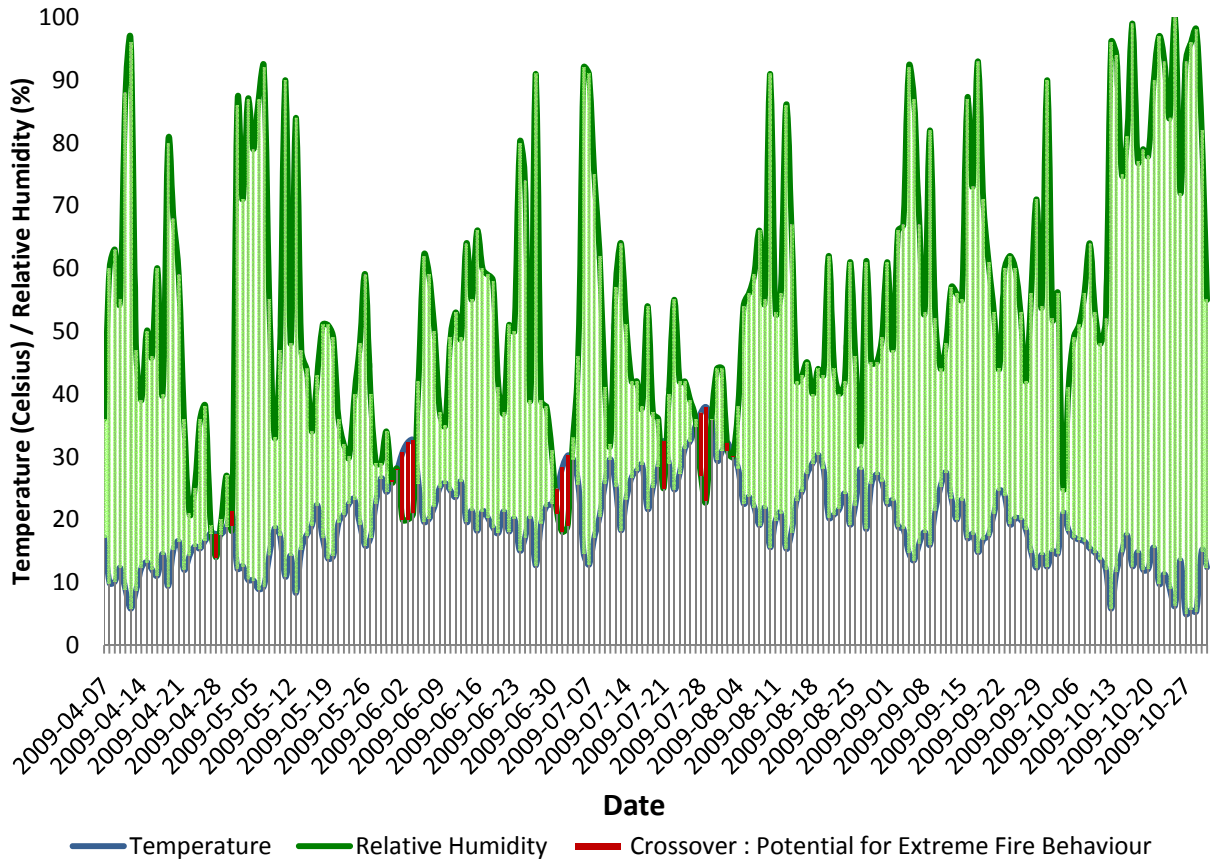

Figure 5 Potential extreme fire behaviour ("crossover") days at Beaver Creek (2009)

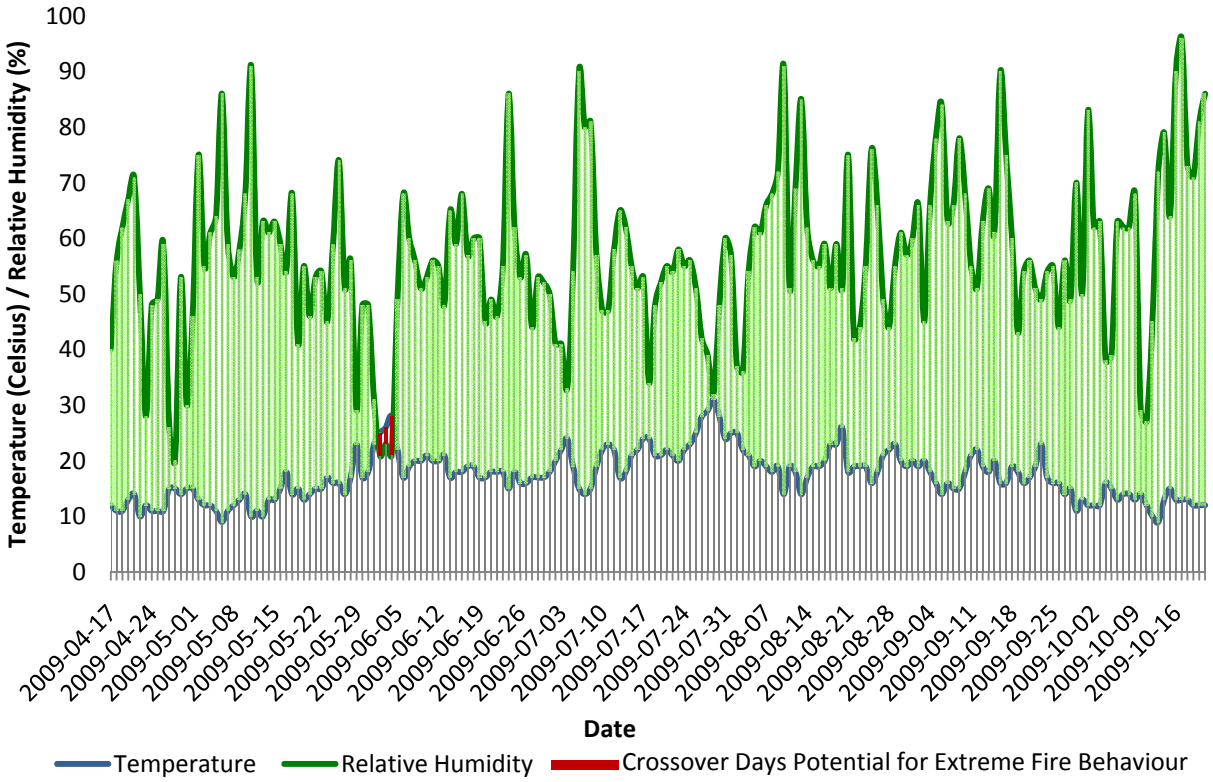

Figure 6 Potential extreme fire behaviour ("crossover") days at Qualicum (2009)

5.4 Fuel Types

5.4.1 Definition and Description

Another important aspect of understanding wildland fire hazard relates to the fuels available for combustion. Most forest ecosystems grow more biomass every year than what decomposes so there is a build-up of organic material over time. All organic material, live, dead or in various stages of decomposition, is combustible and is considered “fuel” by wildland fire managers. The combination of this vegetative build-up, dry weather conditions and ignition sources indicates the potential for wildland fires. The forests along the southwest coast of BC are classified as a temperate rain forest and not generally recognized as a wildland fire-prone regime; however a review of the conditions and statistics reveals that wildland fire is a common element in coastal forest ecosystems. Generally the coastal region is characterized by very wet winters and warm summers with persistent high pressure ridges through July and August. The extended warm and dry air masses, coupled with the well-drained, low-moisture retention soils in the area, produce drought conditions particularly along the east side of Vancouver Island. All three of the factors required for wildland fire occurrence (fuels, weather and ignition sources) exist in abundance in Dashwood.

Dashwood is almost entirely covered with predominantly pure coniferous forest with areas of mixed deciduous and coniferous located adjacent to major drainage areas and more recently disturbed areas.

Most of the forest is second growth resulting from the forest harvesting which began in the early 1900's. The forest cover surrounds and intermixes with all the settled areas.

The size, amount and arrangement of forest fuel, coupled with weather and topography, influences how a wildland fire will burn. The Canadian Forest Service has developed the Canadian Forest Fire Behaviour Prediction (FBP) System (Forestry Canada Fire Danger Group 1992; Taylor et al. 1997) which classifies forest fuels into 16 sub-categories based on species composition, surface fuels and stand structure. Although based mostly on boreal vegetation, fuel characteristics (such as species composition, density, arrangement and size) have been used to identify "equivalent" fuel types in the Dashwood area from the 16 national benchmark fuel types (see Appendix 3). This is standard practice by fire behaviour analysts and fire managers in coastal BC.

In addition to the FBP fuel types, forest vegetation types and their related climate and topography have been extensively researched and inventoried by the MNRO on Crown land for the purpose of forest ecosystem management. One system of classification is called the Biogeoclimatic Ecosystem Classification (BEC) system (see Appendix 4). The BEC system provides an accurate description of vegetation associations and site moisture content.

A combination of FBP fuel types and BEC zones/subzones better define the Dashwood area and are used in determining hazard ratings. Furthermore, fuel types for the Dashwood area have been combined with interface occurrence and historic ignitions to produce a landscape level risk assessment to guide further site level fire prevention plans and activities.

5.4.2 Fuel Typing Methodology

PSTAD produced by the MNRO was acquired for the Dashwood area. PSTAD mainly covers areas of Crown land. Due to the predominance of private land within Dashwood, PSTAD does not cover all areas within the Fire Protection Area.

The RDN Hazard Risk and Vulnerability Assessment (HRVA) (EmergX Planning 2006) used the FireSmart hazard ratings system to rate areas. The polygons are assessed at a high level and indicate the relative risk of WUI fire within the whole of the RDN. HRVA does not cover all ground within the Dashwood area.

As PSTAD and the HRVA were not comprehensive enough in the identification of hazardous areas, fuel type mapping was completed by interpretation of high resolution orthophotos by the Strategic Group GIS Department. The orthophoto interpretation of forest fuels was ground-truthed to verify and adjust, where necessary, the fuel typing within the subject area. Figure 7 is an overview map of the FBP fuel types in the Dashwood WUI, including an additional 2 km buffer from the Fire Protection Area boundary.

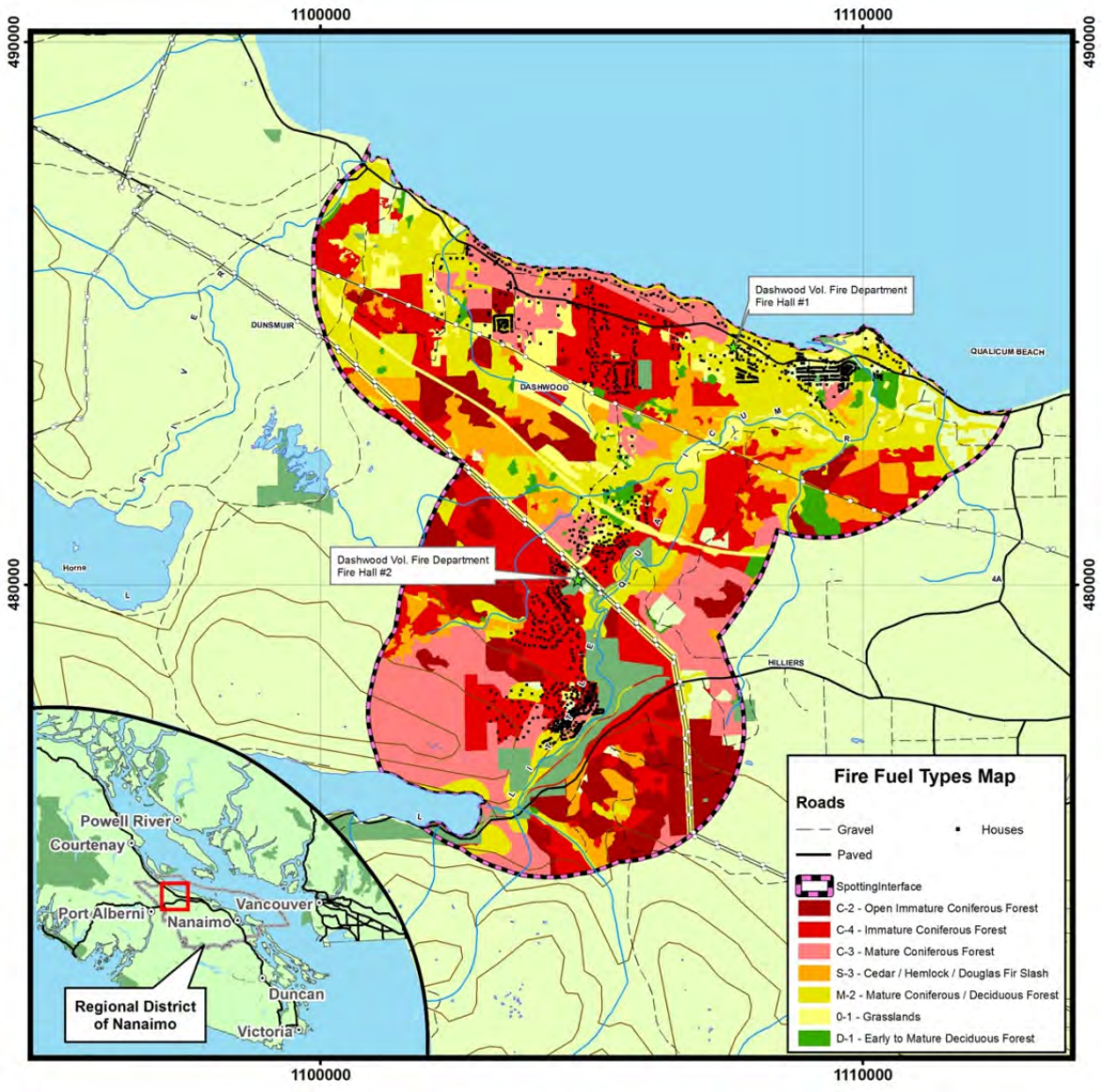

Figure 7 Fuel types in the Dashwood Area and surrounding WUI (2km from residences and developments)

5.5 Historical Fire Information

Historical fire knowledge provides insight into what is possible in the future and provides land managers and planners with a guide to (1) plan when education, engineering and enforcement activities are most critical to fire prevention and suppression, and (2) indicate what geographic areas require the greatest attention or priority of resources. This section includes details of fire occurrences in the Dashwood area.

Historic wildland fire occurrences help to understand and analyze the hazard or probability of future events. Wildland fires happen when there is a convergence of certain conditions. When multiple fires happen over time in a given area one can draw the conclusion that these convergences of conditions that result in a wildland fire are more probable. Historical fire data was obtained from the MNRO fire

reporting system and from the GeoBC interactive map website (Province of BC 2010a). Information from these sources dates back to 1919 and was collected as part of the British Columbia Natural Disturbance Database (Canadian Forest Service 2007). Data has been analysed for the Dashwood area to show historical fire ignitions by cause, location, date and size.

Wildland fire ignition is classified in two main causes: lightning and human. Lightning is usually produced by strong convective activity. Due to the moderating effect of the ocean, weather patterns on mid Vancouver Island do not commonly produce the high day time heating required to initiate the strong convective activity that produces lightning. However, lightning does occasionally occur in the region and is generally produced by convective activity that is initiated orographically (that is, by the upward deflection of air masses by topography). Human-caused fires are those caused by human carelessness or malicious use of fire. These can be intentional and malicious, such as arson, or they can be unintentional, completely accidental or through carelessness. A large and growing population imbedded within extensive semi-rural areas and various industrial activities within the forest are the main human ignition sources. Humans cause 80-90% of the wildland fires on Vancouver Island.

For the Province of British Columbia fire cause data shows that 43% of fires were human caused and 57% of fires were lightning caused (figure 8). For the Dashwood area fire cause data shows that 90% of fires were human related, 0% of fires were lightning related and 10% of fires were other (figure 9). The marked increase in human related fires in the Dashwood area compared to the provincial average indicates a need for education and enforcement activities to address the high probability of a person caused WUI fire.

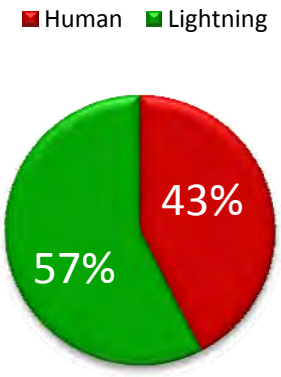

Figure 8 Wildland fires by cause (1998-2008) – British Columbia

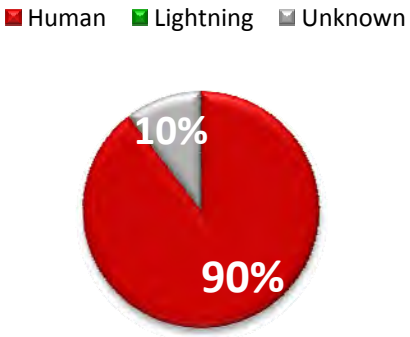

Figure 9 Wildland fires by cause (1998-2008) - Dashwood Protection Area

Locations of previous wildland fire ignitions can assist in determining where to concentrate fire prevention efforts in the Dashwood area. Figure 10 (see also Appendix 2 for full size map) shows the location of fires in the Dashwood area from 1919 to 2009. The hatched polygons represent the extents of previous fires and the points represent small spot fires that have been recorded over this time period.

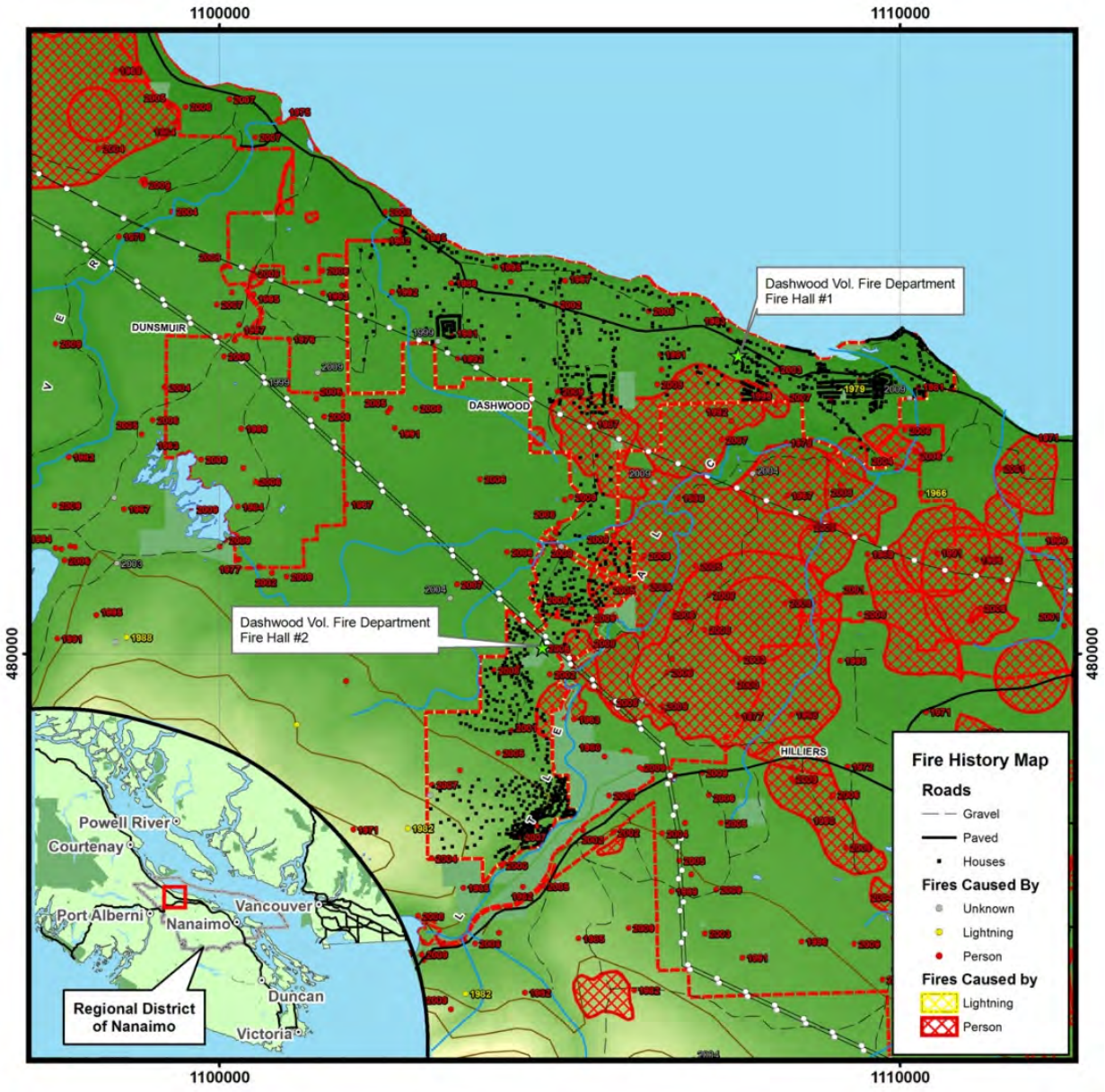

Figure 10 Historic wildland fires in the Dashwood area, 1919-2009 (see also Appendix 2 for full size map).

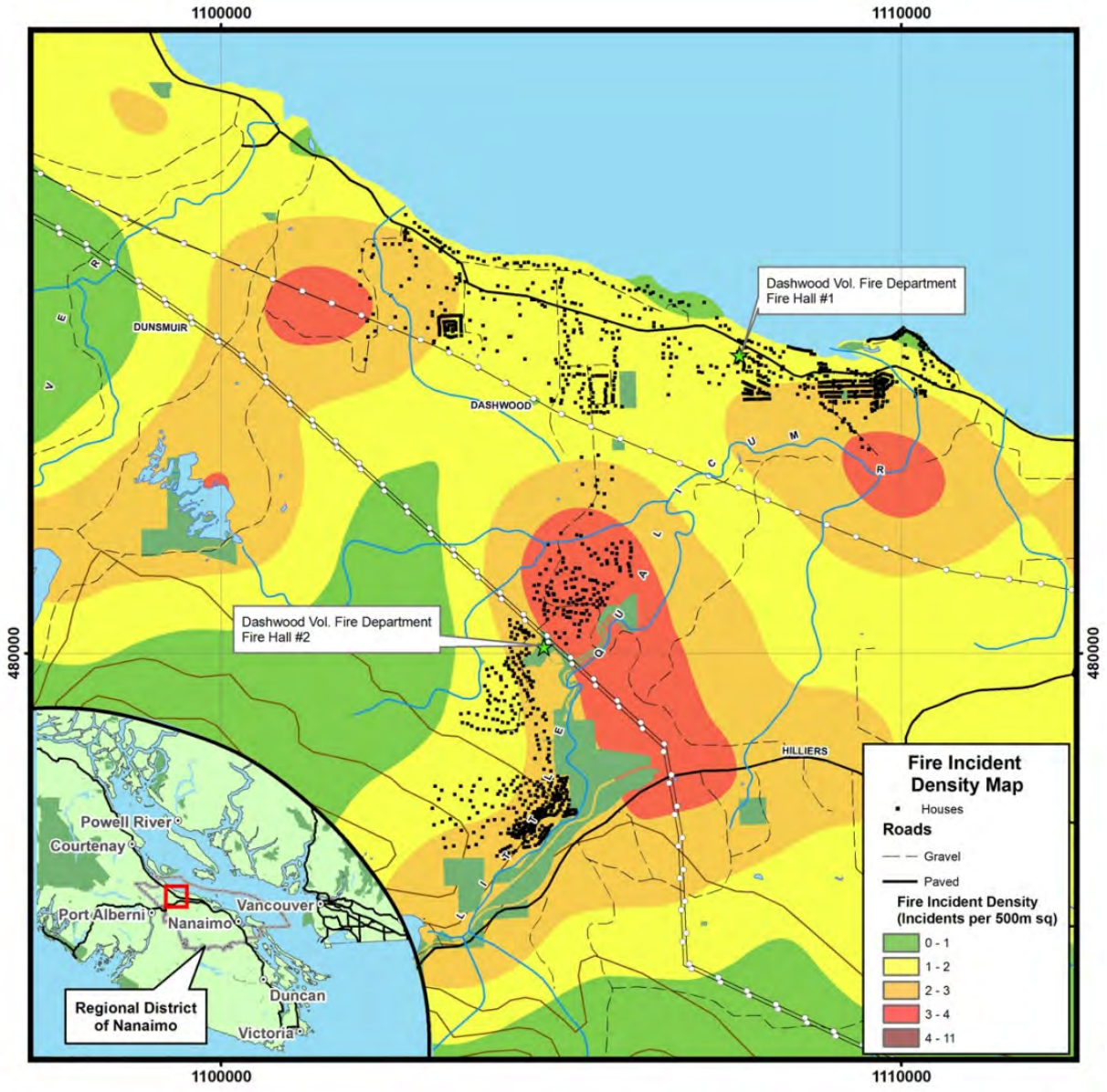

Figure 11 Fire occurrence density analysis, 1919-2009 (see also Appendix 2 for full size map)

Further grouping of the historical fire locations displays the density of fire incidents to further reinforce and locate where human caused fires are concentrated and prevention activities can be prioritized. Figure 12 graphically presents the total number of recorded fires annually since 1952 in the Dashwood area within a 2 km buffer. The most notable increase in number of fires can be seen in the early part of the 21st century.

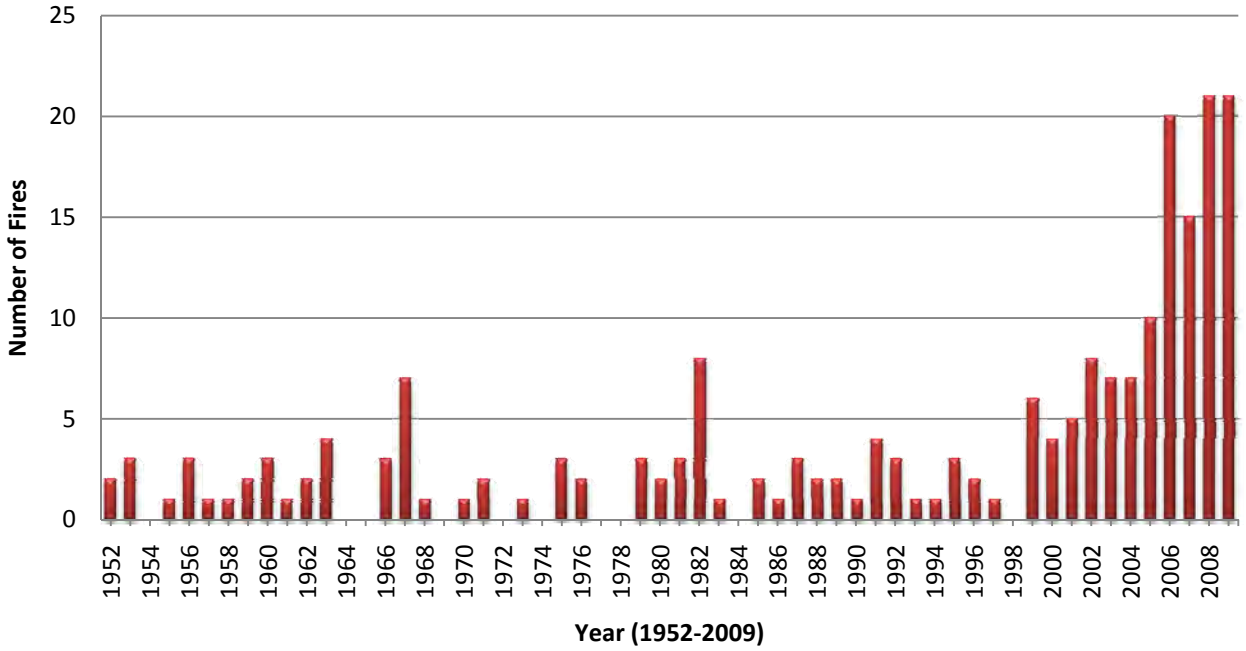

Figure 12 Total number of recorded fires within 2 km of the Dashwood (1952-2009)

Figure 13 and 14 show total hectares burned between 1919 and 2009 (note the scale change between figures). Between 1919 and 1939 there are some years where a substantial area burned within Dashwood, notably 1925 and 1935. As recording methods improved from the 1950s onward there were a higher number of smaller fires recorded in the fire reporting system.

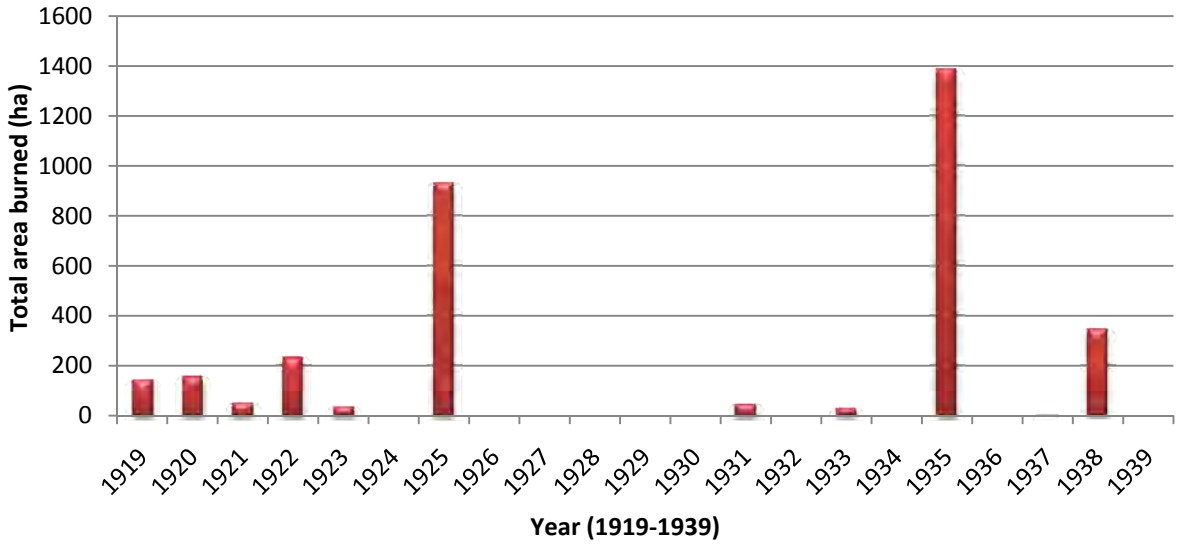

Figure 13 Total area burned by year for recorded fires in the Dashwood area, 1919-1939

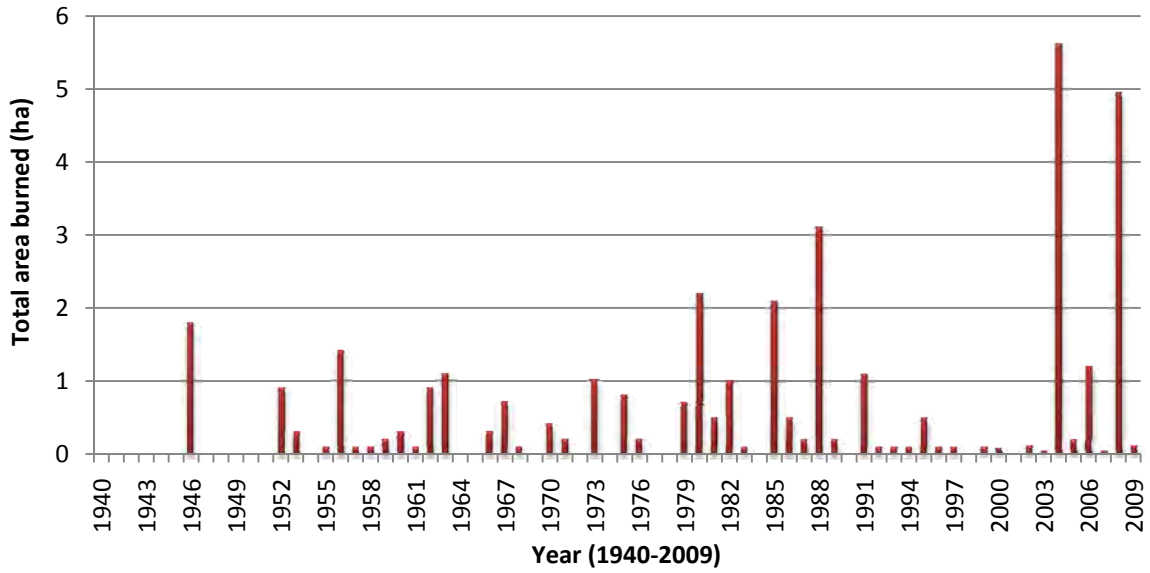

Figure 14 Total area burned by year for recorded fires in the Dashwood area, 1940-2009

To further reinforce the time of year that most fires occur in the Dashwood area, figure 15 has been included to assist in WUI fire prevention planning. The graph illustrates that the core period of wildland fire occurrence is from the last two weeks of April to mid-September.

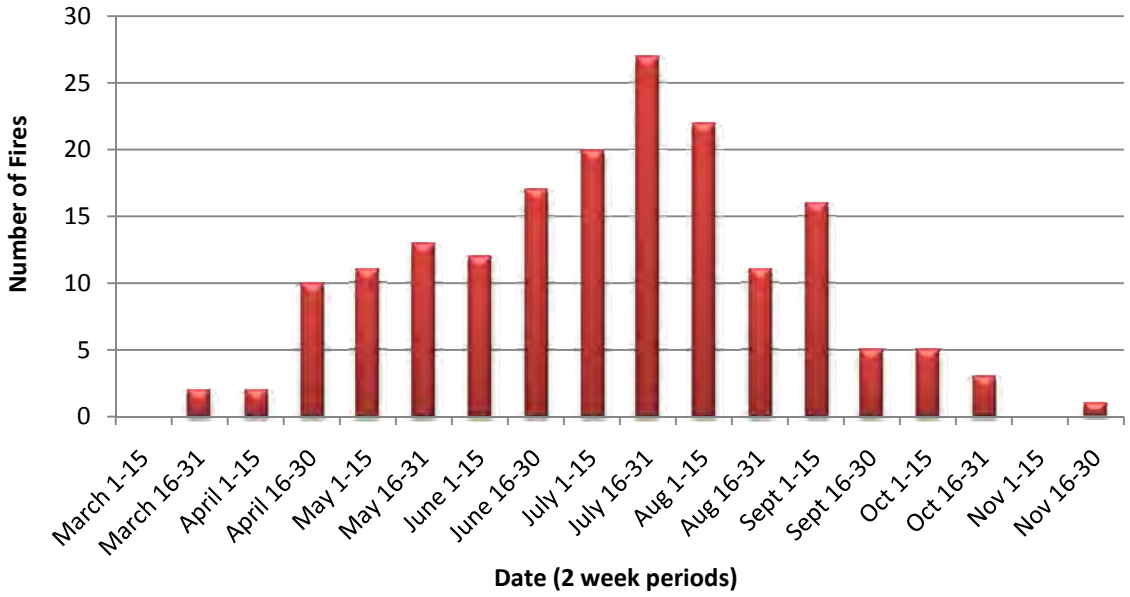

Figure 15 Number of wildland fire occurrences, bi-weekly intervals of recorded fires (1952-2009)

5.6 Existing Fire Suppression and Emergency Response Infrastructure

Emergency response infrastructure is located throughout the Protection Area and varies with demographics and geographic coverage. When wildland fires do occur within the Dashwood, the Dashwood Volunteer Fire Department is responsible for fire suppression and must assume a lead role in

control operations. If requested, and if resources are available, the MNRO may support the Fire Department. However, MNRO support will be limited to wildland fire suppression and support to the Office of the Fire Commissioner structural specialist for structural or values protection, not actual structural firefighting (Ministry of Forests and Range et al. 2008).

The MNRO has two fire bases located near the Dashwood area, both of which are in the Mid Island Zone of the Coastal Fire Centre. The Errington fire base is located in Parksville and has two three-person initial attack crews and the Port Alberni fire base is home to a 20-person unit crew.

The Dashwood Volunteer Fire Department is a committed department that was established in 1983 with the passing of RDN Bylaw 612. Community growth in the last decade has encouraged expansion of the department to increase coverage of the Meadowood/Corcan Road area. In 2007 the Dashwood Volunteer Fire Department undertook a long term project to achieve Superior Shuttle Accreditation in areas where these is no fire hydrant service (Dashwood Volunteer Fire Department 2008). Water storage supply tanks have been installed at selected locations and the department will eventually be able to supply the minimum required 220 Imperial gallons per minute for at least two hours. In 2008 the Meadowood area gained improved fire ratings through the Fire Underwriters Survey (FUS) and as a result most properties in the community are no longer considered unprotected and homeowners can approach their insurers for an adjustment in their premiums (Dashwood Volunteer Fire Department 2009). A new fire hall was completed in mid-2009 and the community was instrumental in purchasing the new equipment required for the facility. Details of suppression infrastructure can be found in table 2 below.

Table 2 Dashwood Volunteer Fire Department equipment and personnel.

Infrastructure/Personnel/Equipment	Quantity	Details
Fire Halls	2	
Engines	Command (1)	
	Engines (2)	1000 gallon pumper top mounted Hale 1050 pump with Foam Pro 2001 system; 1000 gallon pumper top mounted Waterous 1050 pump with Foam Pro 2008 system
	Tankers (2)	1500 gallon tanker with pumper facilities; 1500 gallon poly tank, no pumper facilities
	Rescue (2)	Rescue equipment, crew and equipment transportation; 350 gallon water tank, 5 gallon foam tank, 350 gallon per minute pump, first responder and wildland fire apparatus
Hydrants	~ 40	Various locations
Water tanks	4	1 on Corcan Rd (6000 gallon); 1 at Station 62 (17 000 gallon); 2 within Little Qualicum River Estates (15 000 gallons each)
Personnel	35 total	20 with S-100
Wildland firefighting equipment	Various	300 ft of hose; various nozzles and tools; 2 apparatus set up for wildland operations

Photo 1 Dashwood Volunteer Fire Department wildland fire truck (2001 Ford F550: 350 gallon water tank, 5 gallon foam tank). This is a specialised unit to deal with wildland fires

Photo 2 Dashwood Volunteer Fire Department hydrant and strata hose reel, Country Road in Little Qualicum River Estates.

5.7 Demographics

The Dashwood itself is covered by three electoral areas (F, G and H) so exact population information is not available. For comparative purposes however, this report will present population trends over these three electoral areas which is overall a larger area. Figure 16 graphically presents population growth from 2001 to 2006. In 2001 the population of electoral areas F, G and H was 17,696 and by 2006 this population grew by 1,487 residents to a total of 19,183. This increase marked an 8.4% growth rate in just five years or 1.7% annually. With population growth and development in the wildland urban interface there comes a

greatly increased risk of human-caused wildland fires and threat to human life and safety, homes, businesses and infrastructure (Province of British Columbia 2010e).

The distribution of residents (both permanent and seasonal) and improvements in the Dashwood area is primarily concentrated along the foreshore areas. The secondary concentration of population is located from the foreshore to Highway 19 and inland near the Meadowood area with tertiary developments scattered throughout lots and acreages. Population growth is mainly persons moving from a more urban setting to a more rural setting. This can bring with it a general lack of understanding of wildland fire risk.

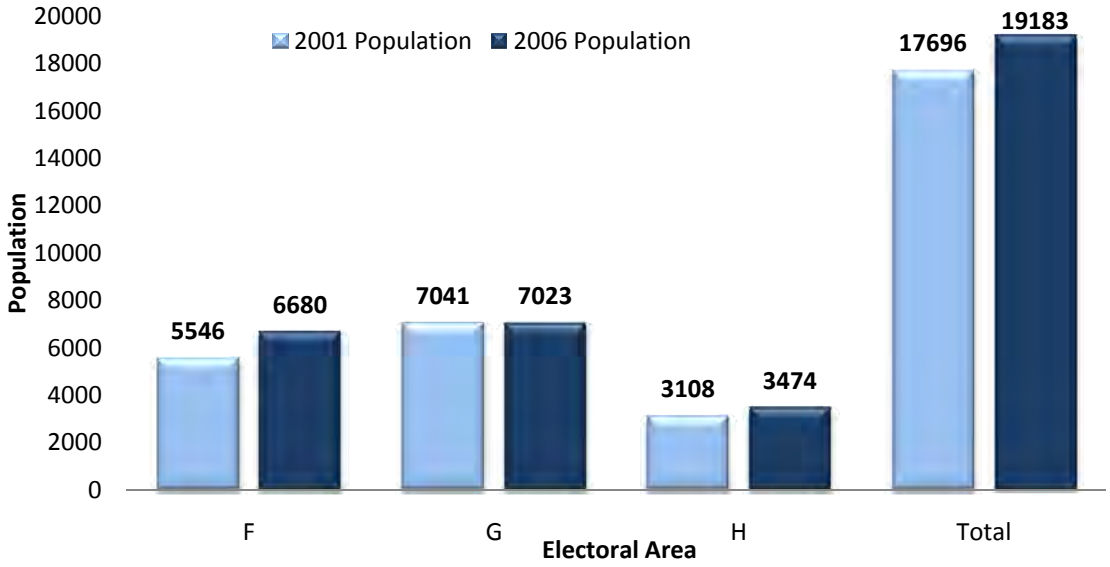

Figure 16 Electoral areas F, G and H population trends (2001 and 2006). The Dashwood falls within all three electoral areas.

5.8 Industrial and Economic Activity

Although the main land use of the Dashwood area is residential, industrial/ agricultural operations are located throughout. Some activities pose a greater fire risk than others and are listed in table 3 below.

Table 3 Fire risks associated with industrial activities in the Dashwood area.

Activity	Associated Risk
Agriculture	Welding*, mechanical land clearing*, clearing and maintaining rights of way, including grass mowing*, piling and burning
Forestry	Pile burning, mechanical brushing* and spacing, disk trenching*, preparation or use of explosives*, operating a power saw*, rock drilling*, tree processing*, portable wood chipping, milling, processing or manufacturing*, log forwarding*, skidding logs*, yarding logs using cable systems*, operating a vehicle equipped with metal tracks, chains or studs (other than operating it for road construction/maintenance/deactivation or on a road/landing/log sort)

Construction/Land Clearing	Debris burning, Use of fire- or spark-producing tools or cutting tools*, grinding*, mechanical land clearing*, rock drilling*
Recreation and Tourism	Increase in number of visitors to wildland areas (and in some cases poor fire awareness)
Mining (Gravel)	Brush disposal

* Defined as a High Risk Activity by the Ministry of Forests and Range (Province of BC 2010b)

5.9 The Wildland Urban Interface in Dashwood

The WUI is a term used to describe an area where various structures (most notably private homes) and other human developments meet (*interface*; photos 3 and 4) or are intermingled (*intermix*; photos 5 through 8) with forest and other vegetative fuel types (CIFFC 2003). Figure 7 in section 5.4 displays the boundaries of the WUI in Dashwood and includes a 2 km buffer. The main ignition source for structures in a WUI fire is from airborne firebrands landing on combustible roofing materials, some distance away from the main fire front, (this is termed spotting). Spotting potential is greatly increased when aerial fuels are involved in a wildland fire. Some fuel types are more susceptible to crown fire than others. The 2 km buffer is to reflect observed maximum spotting distances as used in the Beck and Simpson (2007) report and depicts those fuel types that readily support crown fire and are able to threaten structures and communities within Dashwood. Wildland fire threats within this WUI pose a direct hazard to the following values listed in order of priority:

- Public safety/human life
- Property and structures
- Critical infrastructure (telecommunications, transmission lines/towers, power infrastructure, water infrastructure)
- Water and air quality
- Fisheries and wildlife
- Soils and biodiversity

All of Dashwood is classed as WUI and intermix. As the population increases (see section 5.7) in the WUI so will the chance of human caused fires that could threaten residents and visitors. The presence of people near the WUI has also led to aggressive fire suppression activities to protect life and limit property damage; this has disrupted the historical occurrence of more frequent low intensity fires that removed flammable undergrowth without significantly damaging larger trees (Office of the Auditor General 2005). The resulting accumulated vegetation and hot, dry weather can combine to present an elevated risk of wildland fire.

Photo 3 An example of the interface, at the junction of Huckleberry Lane and Dewberry Way.

Photo 4 An example of the interface, Pady Place.

Photo 5 Koskimo Road house in the intermix (C4)

Photo 6 Galvin Place homes in the intermix (C3)

Photo 7 Abbey Road intermix house overlooking Pady Place (C3)

Photo 8 Whistler Way house in intermix (C4)

6 WILDLAND FIRE RISK ASSESSMENT METHODOLOGY AND ANALYSIS

Wildland fire risk assessment for the Dashwood CWPP was developed using the following publications and information:

- Hazard Risk and Vulnerability Assessment – RDN (EmergeX Planning 2006) – which uses the Provincial Emergency Program HRVA toolkit (Provincial Emergency Program 2004)
- Rating Interface Wildfire Threats in British Columbia (Morrow, Johnston & Davies 2008)
- Wildfire Threat Analysis and the Development of a Fuel Management Strategy for British Columbia (Beck and Simpson 2007)
- Canadian Forest Fire Behaviour Prediction (FBP) System, including standard and coastal equivalent fuel types (Forestry Canada Fire Danger Group 1992; Taylor et at. 1997)
- WUI (including intermix) areas
- Historical fire occurrence and weather data (Province of BC 2010a)

Three basic elements are integral in a risk assessment. These elements are *hazard*, *consequence* and the resulting *risk*. A hazard is defined as a source of potential harm, or a situation with a potential for causing harm, in terms of human injury; damage to health, property, the environment, and other things of value; or some combination of these (Provincial Emergency Program 2004). Consequence is defined as a result or effect of an occurrence (Dictionary.com 2009). In the case of wildland fire it represents the elements or values that could be negatively affected by a WUI fire. Risk is then defined as the product of hazard and consequence. In terms of WUI fires, it is all the factors that contribute to the likelihood of a fire occurring times the negative consequence should a fire occur. Simply:

HAZARD X CONSEQUENCE = RISK

Using this formula we can compare the risk in two different potential wildland fire situations: a large wildland fire in an uninhabited forest area versus a large wildland fire in an area with residential homes. Both scenarios might have identical hazards (fuels, ignition sources), but the fire in the uninhabited region has less consequence (potential timber loss, air and water quality) compared to the more settled area (in addition to the same potential losses as the uninhabited area there may be loss of homes and potential for injury). Therefore a much higher risk is associated with a fire in a settled area due to the greater potential for negative consequences.

The basis for assessing and locating hazards within the Dashwood area involved fuel type identification, historical fire occurrence data and extracting locations where forest land is intermixed with structures thereby providing additional hazard (the WUI). Interface areas have been buffered by 2 km and intersected with the spotting and interface breach potential coverage to develop a final coverage that depicts those stands that are able to threaten communities (Beck and Simpson 2007). The criteria used were based on those used in Beck and Simpson (2007) and Morrow, Johnston and Davies (2008) (Table 4).

Table 4 Hazard determination table

		HAZARD		
		Fuel Type*	**WUI***	**Historic Ignitions (per 0.78km^2)***
RATING	**Low** (1 point)	S3	< 1 structure/0.78km^2 (isolated)	0
	Moderate (2 points)	O1, C3	1-10 structures/0.78km^2 (undeveloped)	1-2
	High (3 points)	M2	10-100 structures/0.78km^2 (mixed)	2-4
	Extreme (4 points)	C4, C2	100-1000 structures/0.78km^2 (developed)	>4

***based on Beck and Simpson (2007). The "urban" structure density (>1000 structures per 0.78 km^2) was removed as none exists within Dashwood.**

The basis for assessing the consequences within the Dashwood area involved identifying the values at risk as determined in Section 5.8. With regard to wildland fire public safety is rated the highest and environmental impacts are rated lowest. The structure density analysis was also used for identifying the consequences (for example, higher structure density results in an equally higher risk class due to the larger number of residents and structure values) (See Appendix 2 for structure density map) . Critical infrastructure was identified as:

- Two major power lines running northwest – southeast
- Highway 19 ("Inland Island Highway")
- Highway 19A ("Old Island Highway")
- Corcan/Meadowood Roads
- Little Qualicum River Estates water supply
- Dashwood Fire Halls #1 and #2

ArcMap (version 9.3) was used to spatially generate the above hazards and consequences. Once overlaid the components result in an overall risk map, or wildland urban risk rating (Figure 17, see also Appendix 2).

Table 5 Overall risk rating – total combined points.

		OVERALL RISK RATING (Total points)
RATING	**Low**	3-4
	Moderate	5-7
	High	8-10
	Extreme	11-12

As in the Hazard, Risk and Vulnerability Assessments (Provincial Emergency Program 2004) "risk-based" choices help communities address vulnerabilities, mitigate hazards and prepare for response to and recovery from hazard events. "Risk-based" means based on informed choices of alternate unwanted

outcomes; in other words, communities make risk reduction choices based on the acceptability of consequences and the frequency of hazards (Provincial Emergency Program 2004).

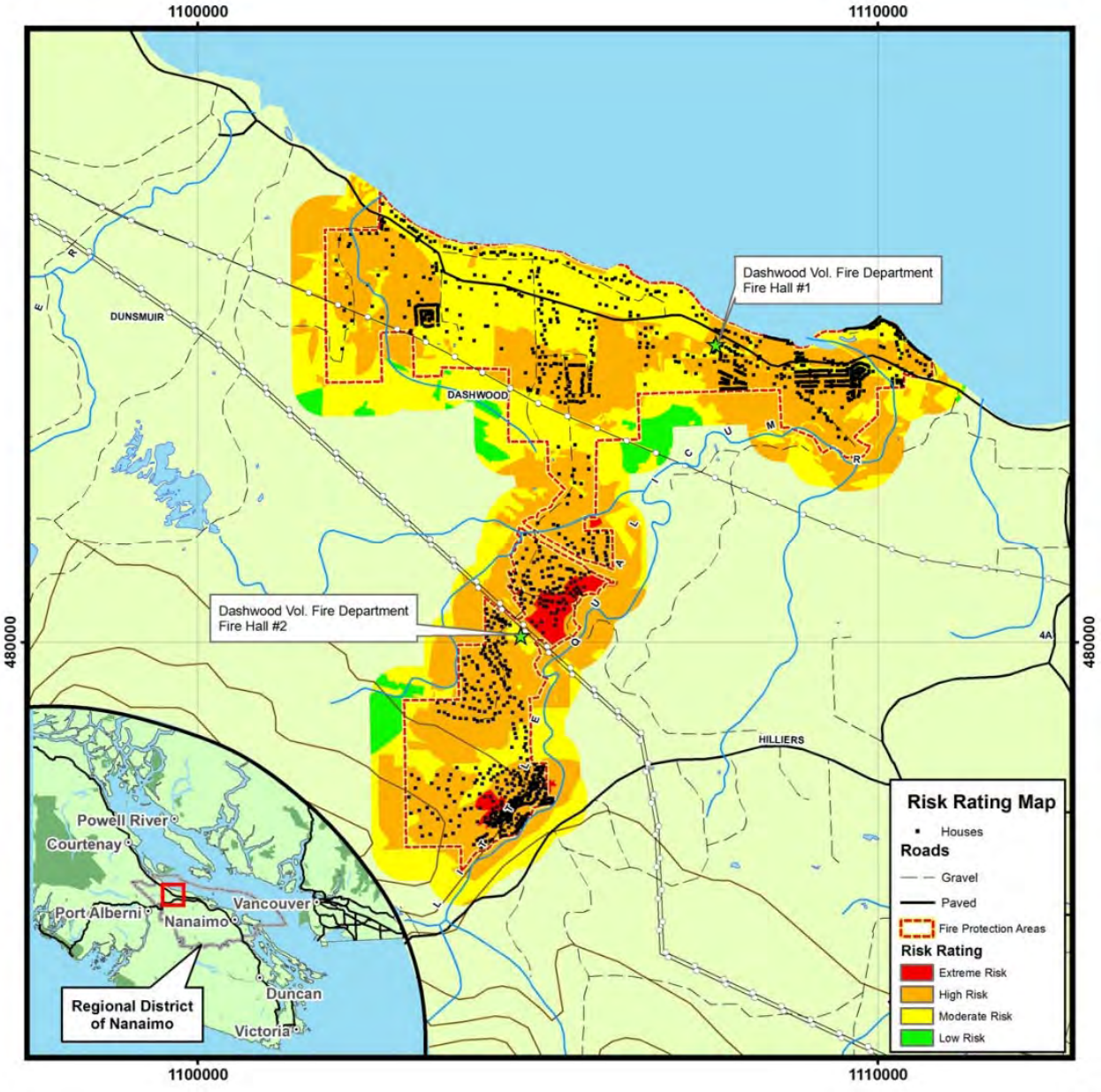

Figure 17 Overall risk rating, Dashwood Fire Protection Area.

7 CONCLUSIONS

Examination of the issues surrounding the Dashwood area show that a significant WUI hazard exists. Vegetative fuel build-up near residential structures and access restrictions in specific areas contribute to the hazard and need to be managed accordingly.

Education

Due to the large amount and complexity of wildland urban interface and intermix areas within Dashwood, an effective education program that provides community members with knowledge of the why and how of FireSmart principles should be initiated. Communication between all members of the community is vital to the commencement and continued development of such a program. Wildland fire suppression capability within Dashwood would benefit from additional training of fire department volunteers, RDN staff and even residents. Establishing emergency plans specific to WUI fire in this area will help reduce the chance of negative consequences to public safety in the event of a WUI fire.

Engineering

The physical applications of mitigation techniques including fuel management are critical to the success of a FireSmart community within Dashwood. A strong prevention plan should aim to reduce the chance of a fire starting while confirming knowledge of existing facilities can expedite the process should one occur.

Enforcement

A review of existing bylaws and the creation of new bylaws are critical to the enforcement of community standards that govern the use of fire. There must be effective sanctions on people who do not use fire safely and hence community officials need to be empowered to enforce those laws.

8 RECOMMENDATIONS

Wildland fire prevention initiatives fall under three broad categories: Education, Engineering and Enforcement, also known as the 3 E's approach.

Education involves raising the awareness level of the public and stakeholders about various fire and fire prevention related principles. One of the first steps in the education process is for residents within the WUI to gain an understanding that fire is a constant and recurrent process in most forest and grassland ecosystems and that it cannot be fully eliminated. This fact does not change when houses and other developments are built within forest areas. Once this is accepted, planning for the inevitable presence of fire can begin. Education can range from raising the awareness of the role fire has historically played in forest ecosystems (the effects of fire – both good and bad – on the landscape) and the safe use of fire, to the methods of making our residences and living areas safer from fire. Education can also mean training of structural fire suppression personnel and residents in the specialized tactics and the acquisition of specialized equipment used for wildland fire suppression.

Engineering involves processes that modify our surroundings with an eye towards managing for fire or to reduce the potential damage caused by fire. This could be the design of residential developments near forest areas that take into account factors that recognize and manage for the presence of fire. This could include the design of infrastructure such as water delivery systems, ingress and egress routes, the use of building materials that provide greater resistance to fire, and the modification of forest fuels in and around interface areas. Fuel modification can be at the landscape level, such as sequencing forest harvesting activities to minimize fire risks as well as at the more specific level by the creation of defensible space adjacent to structures in the interface and intermix. Other soft engineering can take the form of risk analysis and rate indexing by, for example, insurance companies who might provide inducements for property owners to conduct FireSmart engineering around their forest properties.

Enforcement is the final category in a well-rounded fire prevention strategy. There must be rules and guidelines for the safe and responsible use of fire as there can be serious consequences for its misuse. To be effective and credible there also must be a consequence for failure to use fire safely and responsibly. Enforcement initiatives can take the form of having simple and comprehensive legislation governing the safe and effective use of fire and the management of issues that create a fire hazard; for example, legislation that enables the imposition of fire bans, orders to reduce a fire hazard, orders to extinguish a fire that is potentially dangerous, rules on adequate equipment to manage fire, ability to close areas off if the hazard becomes too unsafe and legislation that enables forced cost recovery for an agency burdened with suppressing a wildland fire started by someone else. Agency personnel must be trained and empowered to act on the legislative non-compliance at the lowest operational level possible. There must also be dissemination of the rules so the public knows exactly what is expected and what the consequences are.

The following recommendations are divided into each of the above categories based on our conclusions in the previous section.

8.1 EDUCATION

8.1.1 Community Awareness and Communication

We recommend undertaking a community public education program that builds on material already available in various BC government departments and agencies, as well as from external sources. FireSmart materials contain all the technical aspects; however, delivering and getting buy-in to the message is the challenge. Undertake a regional approach and foster communication between all players:

- Community planners/staff
- Homeowners/residents
- Business/industry
- Fire departments
- Developers/builders
- Non-governmental Organizations

The homeowner who chooses to live in the intermix has an important role. The choice of the construction design and building materials can significantly affect a residence's fire safety. Maintaining the defensible space, reducing naturally occurring hazards, and preventing unwanted fires are all responsibilities of the homeowner (Mangan 2000).

Recommendation 1: Enhance Regional District of Nanaimo website to include FireSmart information/PowerPoint presentation, current Fire Danger Rating during fire season, safe fire use and burning guidelines and related fire bylaws.

Recommendation 2: Enhance Corcan/Meadowood Residents Association website to include FireSmart information/PowerPoint presentation, current Fire Danger rating during fire season, and safe fire use and burning guidelines.

Recommendation 3: Engage the media. Make the wildland urban interface issue known by utilizing local print media, radio and television.

Recommendation 4: Hold public presentations/community awareness seminars at least once a year. Choose the right type of community engagement (inform, consult, involve, collaborate or empower). The types of engagement are not mutually exclusive and any combination of engagement types may be used over time.

Recommendation 5: Distribute FireSmart and local fire information via brochures, CDs, DVDs and/or the internet. Bulk supplies of FireSmart materials are available from the Office of the Fire Commissioner or the Provincial Emergency Program.

Recommendation 6: Consider identifying or establishing a FireSmart show home. This could be a public building, identified private home or business. This would increase local knowledge and acceptance by showing what FireSmart treatments on a property would look like.

Recommendation 7: Initiate a FireSmart auditor service for private WUI areas. Retain a qualified wildfire consultant to conduct audits on residential properties for the homeowner. The result would be an easy-to-understand list of items to address on the property to incorporate FireSmart principles. This would ideally be provided by the RDN and offered to residents as a service, at no cost or with a cost recovery aspect. This would promote homeowner involvement and increase the likelihood they take action. This initiative would apply to WUI areas throughout RDN.

Recommendation 8: Consider forming a WUI fire protection committee(s) at the local level to address concerns. The committee should be made of members from all relevant agencies and groups. For example the Corcan/ Meadowood Residents Association could have a wildfire prevention sub-committee.

Recommendation 9: Adopt FireSmart guidelines through bylaws for new developments. Require developers to adhere to strict standards for building materials, clearing limits and fire resistant plant species for landscaping.

Recommendation 10: Recognize outstanding resident/corporate involvement in the FireSmart program. Create an award or form of recognition for persons or businesses that become involved in FireSmart initiatives: recognition could be for a resident taking the initiative on their own property and/or for the promotion of FireSmart principles through group/committee membership.

8.1.2 Training

We recommend ensuring that training needs are recognized and are reasonable and attainable for all fire fighters and managers.

Recommendation 11: Centralize and formalize wildland fire suppression training and suppliers. Individual fire departments currently manage finding a training supplier and setting up training sessions. Efficiencies and cost-savings can be gained by centrally organizing training delivery.

Recommendation 12: Review existing wildland training material. Develop wildland fire training that is more appropriate for rural structural departments. Identify areas requiring updating, replacement with more recent research information, or new ones for development.

Recommendation 13: Ensure there is information exchange between agencies. Structural and wildland fire suppression agencies could set up greater information exchange on resource readiness levels, sharing of fire weather forecasts, etc.

Recommendation 14: Train building inspectors/development officers/bylaw officers in FireSmart and wildland urban interface issues.

Recommendation 15: Continue basic wildland fire suppression training and strive for advanced training for fire department personnel. Identify basic training for selected residents and RDN Staff (i.e. wardens, bylaw officers, parks staff). Training provides for greater understanding of wildland fire safety and concepts in general. Senior fire department personnel should receive more advanced levels of wildfire suppression and safety training (i.e. S-290 – Introduction to Fire Behaviour, S-390 – Fire Behaviour for Firefighters, S-590 – Advanced Fire Behaviour series of wildland fire behaviour training).

Recommendation 16: Ensure recurrency material/ standards for structural fire department. Develop custom standards to maintain structural firefighters knowledge level in wildland fire suppression.

Recommendation 17: Establish cross-training between structural and wildland firefighters. Ensure British Columbia Emergency Response Management System (BCERMS) is understood and the roles understood. Ensure training standards and needs are reasonable and attainable for all fire fighters and managers.

Recommendation 18: Establish simulation exercises. A simulated WUI fire scenario exercise should be developed and carried out at least once per year in critical areas, such as Meadowood/ Little Qualicum River Estates. This exercise should involve emergency management agencies and residents both in the planning and the execution to test knowledge and ability to respond. Separate observers should be used for debriefing and critique of exercise.

8.1.3 Emergency / Evacuation / Recovery Plans

8.1.3.1 Emergency Plans

Recommendation 19: Ensure Emergency Plans are kept current and include detailed plans for critical areas like Little Qualicum River Estates.

8.1.3.2 Response Plans

It is beyond the scope of this CWPP to develop detailed response plans; however, during field observations areas such as Little Qualicum River Estates have high density residential areas and extremely narrow access roads coupled with only one way in or out of the area. Further detail to emergency response planning in this area which integrates wildland fire and other emergency events is recommended.

Recommendation 20: Improve access and egress for emergency services and residents. Narrow roads and single route ingress/egress in Little Qualicum River Estates, for example, will cause restrictions in emergency evacuations unless there is a coordinated, pre-planned response plan. Marshalling areas should be pre-designated. Several safe zones for residents and vehicles should be identified for various situations and made known to residents and emergency services. Identify evacuation corridors. Develop livestock/pet evacuation plans (consider transport/storage/holding areas/care/feeding). Recognize alternatives.

8.1.3.3 Recovery Plans

Recommendation 21: Further develop a Recovery Plan with detail to the wildland urban interface. Provide remediation options available after the incident, including potential funding agencies. Address the physical and social consequences of wildland fire incidents.

8.2 ENGINEERING

Access is a critical component of suppressing any fire and becomes even more critical in wildland urban intermix fires. Road width, traffic flow, curve radius, and bridge weight limits all impact on the timeliness and ability of fire apparatus to reach a fire, or to gain access to a structure (Mangan 2000).

8.2.1 Assessment of Existing Infrastructure

Recommendation 22: Increase knowledge by conducting a review of all water sources and options. Map and assess all access routes and any issues associated with them.

8.2.2 Physical Improvements

Recommendation 23: Consider using a wildland fire suppression crew on a Standing Offer/ Retainer basis during the high and extreme periods of the fire season. A wildland fire suppression crew could relieve first-responders from most wildland situations once stabilized, freeing them up for structural fire and other higher-order emergency calls. This crew could span the whole RDN.

Recommendation 24: Install signage and keep them current. Examples of signs are:

- Fire danger
- Evacuation routes
- Fire reporting information
- Interpretive (i.e. fire ecology, FireSmart)
- Campfire information

Recommendation 25: Establish equipment caches and a structural protection unit for the Dashwood Fire Protection Area. Particularly in the higher density areas, consideration should be given to establishing small caches of firefighting tools. A self-contained trailer with sprinklers, pumps and hose located in Dashwood would lessen the reliance on other fire departments for this specialized equipment. Could be set-up as a mutual-aide resource with associated cost sharing.

Recommendation 26: Consider developing and/or enhancing strategic fuel breaks. New developments and future adjacent private land logging should be planned to maximize the defensible space near developed areas.

Recommendation 27: Restrict and/or block motorized access to areas of concern. Install/close gates, install barriers, and/or build ditches to restrict access to back-country areas during periods of high fire danger.

Recommendation 28: Improve access to and from the Corcan/Meadowood area. Alternate ingress/egress would significantly increase safety and improve response time of mutual aide resources such as MNRO fire crews and neighbouring fire departments. At minimum an emergency access point should be created at the junction of Corcan Road and Highway 19; with an interchange as a future goal. Emergency access within Little Qualicum River Estates is severely restricted and alternative ingress/egress would require a feasibility study.

8.2.3 Fuel Management

Carrying out fuel management projects on Crown land adjacent to a wooded acreage with a residence is not as effective as creating a defensible space closer to the residence. The most effective locations for creating defensible space and conducting fuel management in Dashwood are, for the most part, located on private property. The majority of the land within Dashwood is privately owned, creating a challenge in getting fuel management operations completed.

Recommendation 29: Conduct fuel management treatments on public/Crown lands (via UBCM funding). As most of Dashwood is private land (see Appendix 2), areas where publicly-funded fuel management projects can be proposed are severely limited. There are large areas where large wooded private lots adjoin areas of public land. Although fuel management could be carried out on the public land area, this would not be the best strategic location or prudent use of funds for fuel management options when the private land contains significant fuel. Strategically-speaking, fuel management should emanate from the structure outwards.

Recommendation 30: Encourage land owners to adopt FireSmart principles and conduct fuel management where necessary. The challenge here is convincing private land owners that fuel reduction measures are prudent, although expensive (roughly 300 person-hours per hectare plus vehicles/ fuel/ machinery costs).

Recommendation 31: Consider a Fuel Management Pilot Project. Funded by the MNRO and administered by the UBCM, Fuel Management Pilot Projects are a good way explore fuel treatment options and demonstrating or showcasing these to the community.

Recommendation 32: Explore alternative funding support for private land fuel treatments. Greater buy-in or participation for fuel management treatments on private land would be achieved if there were some publicly-funded incentives. This could take the form of rebates or grants to encourage WUI residents to take action.

Recommendation 33: Develop Fuel Management Prescriptions. Proper fuel management prescriptions by qualified forest professionals are key for effective fuel management. Provision of a regional- or Provincial-funded service where fuel management prescriptions can be delivered might be another means of inducing private landowner participation.

8.3 ENFORCEMENT

8.3.1 Bylaws

Recommendation 34: Review existing and/or create new fire bylaws. Ensure provisions exist for fire safety and dealing with fire, as well as the incorporation of FireSmart principles when guiding new subdivision developments and building codes. Fire bylaws should incorporate statutes that authorize a bylaw officer to:

-order the removal of a fire hazard
-order the extinguishment of a fire
-prescribe the requirements to control a fire
-prescribe the requirements when using fire
-prohibit the use of fire except under certain circumstances
-prohibit causing a wildfire
-prohibit allowing a fire to get out of control
-authorize the billing of fire suppression costs to a responsible party
-authorize the billing of fire damages/ losses to RDN property, (structures, timber)
-authorize the closure of areas to public access, due to fire danger.
-authorize sanctions upon a person who contravenes fire bylaws.
-confers enforcement authority powers on key staff.

Recommendation 35: Empower key staff (i.e. wardens, fire chiefs, bylaw officers) to carry out enforcement of applicable bylaws.

8.3.2 Monitoring and Patrol

Recommendation 36: Cooperate with other agencies (MNRO, Conservation Officer Service, RCMP, BC Parks). Open up dialogue with enforcement agencies that are on the land and convey problem areas or areas of concern so other agencies can cover these areas during patrols.

Recommendation 37: Consider assigning an in-house Fire Prevention Officer for the RDN. This position could be a seasonal position that would patrol the RDN, including RDN park properties for fire-related issues during the summer.

8.3.3 Strata Development Considerations

Recommendation 38: Develop in-house fire use and prevention rules.

Recommendation 39: Consider a fire prevention officer as part of strata councils. This ensures that someone is making sure fire prevention issues are being discussed and addressed.

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APPENDIX 1 Definitions and Key Concepts

A majority of these definitions are extracted from the Canadian Interagency Forest Fire Centre (CIFFC) glossary of fire management terms (CIFFC 2003).

A

Air Mass -A meteorological term referring to an extensive body of air within which the conditions of temperature and moisture in a horizontal plane are essentially uniform.

Atmospheric Stability -A meteorological term referring to the resistance of the atmosphere to turbulence and vertical motion (upward). With reference to fire management activities the atmosphere is usually described as neutral, stable, or unstable with respect to the dry adiabatic lapse rate (DALR):

> *Stable Atmosphere* -The temperature decrease with altitude is less than the DALR (the atmosphere tends to suppress large-scale vertical motion).
>
> *Unstable Atmosphere* - The temperature decrease with altitude is greater than the DALR (the atmosphere tends to support large-scale vertical motion).

Available Fuel - The quantity of fuel in a particular fuel type that would actually be consumed under specified burning conditions.

B

Biogeoclimatic Zones – Areas classified by their vegetation coverage, geologic features and climate characteristics. In wildfire management are useful in delineating various fuel types and moisture regimes which can assist in interpreting the fire ecology of an area.

Buildup Index - Note Canadian Forest Fire Weather Index System.

C

Canadian Forest Fire Behaviour Prediction (FBP) System –Developed by the Canadian Forest Service the FBP System is a subsystem of the Canadian Forest Fire Danger Rating System. The FBP System provides quantitative outputs of selected fire behaviour characteristics by combining the effects of the three things that affect wildland fire behavior, (fuels, weather and topography). Fuels are classified in 5 broad types subdivided into 16 sub-types, based mainly on species composition and fuel arrangement, (structure). Weather effects are captured by the CFFWI System and are input directly into the FBP System. Topography is factored in by inputting slope. The outputs of the system are Rate of Spread, (ROS, in metres/ min, both backing fire and frontal fire), Head Fire Intensity, (HFI in kw/m) and fire type, (crown or surface). Based on the main outputs fire growth, area and perimeter are calculated using elliptical formulae.

The FBP System is based on a large volume of empirical field data acquired over several dacades and numerous test burns.

Canadian Forest Fire Danger Rating System (CFFDRS) –Developed by the Canadian Forest Service, CFFDRS is the national system of rating fire danger in Canada. The CFFDRS includes all guides to the evaluation of fire danger and the prediction of fire behaviour such as the Canadian Forest Fire Weather Index System and Canadian Forest Fire Behaviour Prediction System.

Canadian Forest Fire Weather Index (FWI) System - A subsystem of the Canadian Forest Fire Danger Rating System; referred to previously by a variety of names (e.g. Canadian Forest Fire Weather Index, Canadian Fire Weather Index, Canadian Forest Fire Weather Index Tables). The components of the FWI System provide numerical ratings of relative fire potential in a standard fuel type (i.e. a mature pine stand) on level terrain, based solely on consecutive observations of four fire weather elements measured daily at noon (1200 hours local standard time or 1300 hours daylight saving time) at a suitable fire weather station; the elements are dry-bulb temperature, relative humidity, wind speed, and precipitation. The system provides a uniform method of rating fire danger across Canada. This rating is most commonly seen posted at fire departments and Forest Service fire bases and is expressed as: Very Low, Low, Moderate, High or Extreme.

The FWI System consists of six components. The first three are fuel moisture codes that follow daily changes in the moisture contents of three size classes of forest fuels; higher values represent lower moisture contents and hence greater flammability. The three classes of fuel sizes are used to reflect the rate of drying and wetting each fuel size class exhibits. The final three components are fire behaviour indices representing rate of spread, amount of available fuel, and overall fire danger; their values increase as fire weather severity worsens.

The six standard codes and indexes of the FWI System are:

Fine Fuel Moisture Code (FFMC) -A numerical rating of the moisture content of litter and other cured fine fuels . This code indicates the relative ease of ignition and flammability of fine fuels.

Duff Moisture Code (DMC) -A numerical rating of the average moisture content of loosely compacted organic layers of moderate depth. This code indicates fuel consumption in moderate duff layers and medium-sized woody material.

Drought Code (DC) - A numerical rating of the average moisture content of deep, comp act, organic layers. This code indicates seasonal drought effects on forest fuels, and the amount of smouldering in deep duff layers and large logs.

Initial Spread Index (ISI) -A numerical rating of the expected rate of fire spread. It combines the effects of wind and FFMC on rate of spread but excludes the influence of variable quantities of fuel.

Buildup Index (BUI) - A numerical rating of the total amount of fuel available for combustion that combines DMC and DC. (Referred to as the Adjusted Duff Moisture Code or ADMC between 1969 and 1975).

Fire weather Index (FWI) - A numerical rating of fire intensity that combines ISIand BUI. It is suitable as a general index of fire danger throughout the forested areas of Canada.

Control Line -A comprehensive term for all constructed or natural fire barriers (i.e. road rights of way, rivers) and treated fire perimeter used to control a fire.

Cost Sharing Agreements -Agreements between agencies or jurisdictions to share designated costs related to incidents. Cost sharing agreements are normally written but may also be oral between authorized agency and jurisdictional representatives at the incident.

Crossover – Term used to describe the point at which the relative humidity is less than, or equal to, the ambient air temperature. May be used as an indicator of extreme burning conditions.

Crown Fire - A fire that burns in the upper portion of a forest or stand of trees. Occurs during high and extreme fire conditions and is considered to be one of the most dangerous wildfire conditions due to it's fast spread rate and high rate of energy release.

Crown Fuels -The standing and supported forest combustibles not in direct contact with the ground that are generally only consumed in crown fires (e.g. foliage, twigs, branches, cones). Synonym -Aerial Fuels.

D

Drought - A period of relatively long duration with substantially less than normal precipitation, occurring usually over a wide area.

Duff -The layer of partially and fully decomposed organic materials lying below the litter and immediately above the mineral soil. It corresponds to the fermentation (F) and humus (H) layers of the forest floor. When moss is present, the top of the duff is just below the green portion of the moss.

E

Emergency Operations Plan -The plan that each jurisdiction has and maintains for responding to appropriate hazards.

Extreme Fire Behaviour -A level of fire behaviour that often precludes any fire suppression action. It usually involves one or more of the following characteristics: high rate of spread and frontal fire intensity, crowning, prolific spotting, presence of large fire whirls, and a well-established convection column. Fires exhibiting such phenomena often behave in an erratic, sometimes dangerous, manner.

F

Fine Fuel Moisture Code - Note Canadian Forest Fire Weather Index System.

Fine Fuels - Fuels that ignite readily and are consumed rapidly by fire (e.g. cured grass, fallen leaves, needles, small twigs). Dead fine fuels also dry very quickly. Synonym -Flash Fuels.

Fire Behaviour - The manner in which fuel ignites, flame develops, and fire spreads and exhibits other related phenomena as determined by the interaction of fuels, weather, and topography. Some common terms used to describe fire behaviour include the following:

Smouldering - A fire burning without flame and barely spreading.

Creeping - A fire spreading slowly over the ground, generally with a low flame.

Running - A fire rapidly spreading and with a well-defined head.

Torch or Torching - A single tree or a small clump of trees is said to "torch" when its foliage ignites and flares up, usually from bottom to top. Synonym -Candle or Candling.

Spotting - A fire producing firebrands carried by the surface wind, a fire whirl, and/or convection column that fall beyond the main fire perimeter and result in spot fires.

Crowning - A fire ascending into the crowns of trees and spreading from crown to crown.

Fire Behaviour Triangle - An instructional aid in which the sides of an equilateral triangle represent the three interacting components of the fire environment that are responsible for fire behaviour (i.e. fire weather, fuels, and topography). Synonym -Fire Environment Triangle.

Firebrand- A piece of flaming or smouldering material carried aloft by convection or winds and capable of acting as an ignition source when it lands.

Fire Cause Class - The assignment of a wildfire to a category according to the causative agent responsible for starting the fire. The following classifications, adopted in 1980, are used for reporting national wildland fire statistics:

Lightning -A wildland fire caused directly or indirectly by lightning.

Recreation - A wildland fire caused by people or equipment engaged in a recreational activity (e.g. vacationing, fishing, picnicking, non-commercial berry picking, hiking).

Resident - A wildland fire resulting from activity performed by people or machines for the purpose of agriculture or an accidental fire caused by activity associated with normal living in a forested area.

Forest Industry - A wildland fire caused by people or machines engaged in any activity associated with forest products production.

Other Industry -A wildland fire caused by industrial operations other than forest industry or railroads. Includes municipal, provincial, or federal works projects whether employees, agents, or contractors.

Railroads - A wildland fire caused by any machine, employee, agent, or contractor performing work associated with a railway operation, or a passenger on a train.

Incendiary- A wildland fire willfully started for the purpose of mischief, grudge, or gain.

Miscellaneous - A wildland fire of known cause that cannot be properly classified under any of the other standard classes listed above.

Fire Climate - The composite pattern or integration over time of the fire weather elements that affect fire occurrence and fire behaviour in a given area.

Fire Danger -A general term used to express an assessment of both fixed and variable factors of the fire environment that determine the ease of ignition, rate of spread, difficulty of control, and fire impact.

Fire Danger Class - A segment of a fire danger index scale identified by a descriptive term (e.g. Nil or Very Low, Low, Moderate, High, Very High, or Extreme), numerical value (e.g. I, II, III, IV, or V), and/or a colour code (e.g. green, blue, yellow, orange, or red). The classification system may be based on more than one fire danger index (e.g. the Buildup Index is sometimes used in addition to the Fire Weather Index). Facilitates easy communication of fire danger to the general public. In BC the following is used:

FIRE DANGER CLASS					
	FWI				
BUI	0	1-7	8-16	17-30	31+
0-19	1	2	2	3	3
20-42	2	2	3	3	4
43-69	2	3	3	4	4
70-118	2	3	4	4	5
119+	3	3	4	5	5

1	Very Low
2	Low
3	Moderate
4	High
5	Extreme

Fire Danger Rating - The process of systematically evaluating and integrating the individual and combined factors influencing fire danger represented in the form of fire danger indexes.

Low (Danger Class 1 and 2 - green) - Conduct standard industrial, private and public activities.

Moderate (Danger Class 3- yellow) - Carry out any activities in the wildland urban interface with caution.

High (Danger Class 4 - orange) - Fire Hazard is serious. Extreme caution must be used in any forested environment. Burning permits may be restricted and industrial activities limited. Controlled open fires may be banned (camp fires). Fire control resources are on stand- by alert.

Extreme (Danger Class 5 - red) - Some industrial activities within the Wildland Urban Interface may be banned, as well as full woods closure on public lands (including recreational access). Fire behaviour likely to be extreme and ignition is easy. Fire control resources on 24 hr stand-by and public information campaign is launched.

Fire Ecology - The study of the relationships between fire, the physical environment, and living organisms.

Fire Effect(s) - Any change(s) on an area attributable to a fire, whether immediate or long-term, and on-site or off-site. May be detrimental, beneficial, or benign from the standpoint of forest management and other land use objectives.

Fire Environment -The surrounding conditions, influences, and modifying forces of topography, fuel, and fire weather that determine fire behaviour.

Fire Equipment Cache - A supply of fire fighting tools and equipment in planned quantities or standard units at a strategic point for exclusive use in fire suppression.

Fire Frequency - The average number of fires that occur per unit time at a given point.

Fireguard -A strategically planned barrier, either manually or mechanically constructed, intended to stop or retard the rate of spread of a fire, and from which suppression action is carried out to control a fire. The constructed portion of a control line.

Fire Hazard - A general term to describe the potential fire behaviour, without regard to the state of weather-influenced fuel moisture content, and/or resistance to fireguard construction for a givenfuel type. This may be expressed in either the absolute (e.g. "cured grass is a fire hazard") or comparative (e.g. "clear-cut logging slash is a greater fire hazard than a deciduous cover type") sense. Such an assessment is based on physical fuel characteristics (e.g. fuel arrangement, fuel load, condition of herbaceous vegetation, presence of ladder fuels).

Fire History -The study and/or compilation of evidence (e.g. historical documents, fire reports, fire scars, tree growth rings, charcoal deposits) that records the occurrence and effects of past wildland fires for an area. Note Fire Cycle, Fire Frequency, Fire Incidence, Fire Interval, and Fire Occurrence.

Fire Impact(s) - The immediately evident effect of fire on the ecosystem in terms of biophysical alterations (e.g. crown scorch, mineral soil exposure, depth of burn, fuel consumption).

Fire Interval - The average number of years between the occurrence of fires at a given point.

Fireline -

(1) That portion of the fire upon which resources are deployed and are actively engaged in suppression action. In a general sense, the working area around a fire.

(2) Any cleared strip used to control a fire. Loosely synonymous with fireguard.

Fire Management - The activities concerned with the protection of people, property, and forest areas from wildland fire and the use of prescribed burning for the attainment of forest management and other land use objectives, all conducted in a manner that considers environmental, social, and economic criteria. Note: Fire management represents both a land management philosophy and a land management activity. It involves the strategic integration of such factors as knowledge of fire regimes , probable fire effects, values -at-risk, level of forest protection required, cost of fire-related activities, and prescribed fire technology into multiple-use planning, decision making, and day-to-day activities to accomplish stated resource management objectives. Successful fire management depends on effective fire prevention, detection, and presuppression, having an adequate fire suppression capability, and consideration of fire ecology relationships.

Fire Management Plan - A statement of policy and prescribed actions with respect to forest fires (prescribed fires and wildland fires) for a specific area (may include maps, charts, and statistical data).

Fire Management Planning -The systematic, technological, and administrative management process of determining the organization, facilities, resources, and procedures required to protect people, property, and forest areas from fire and to use fire to accomplish forest management and other land use objectives.

Fire Occurrence - The number of fires started in a given area over a given period of time.

Fire Prevention - Activities directed at reducing fire occurrence; includes public education, law enforcement, personal contact, and reduction of fire hazards and risks.

Fire Rank - A rating guide used to describe fire intensity from 1 to 6.

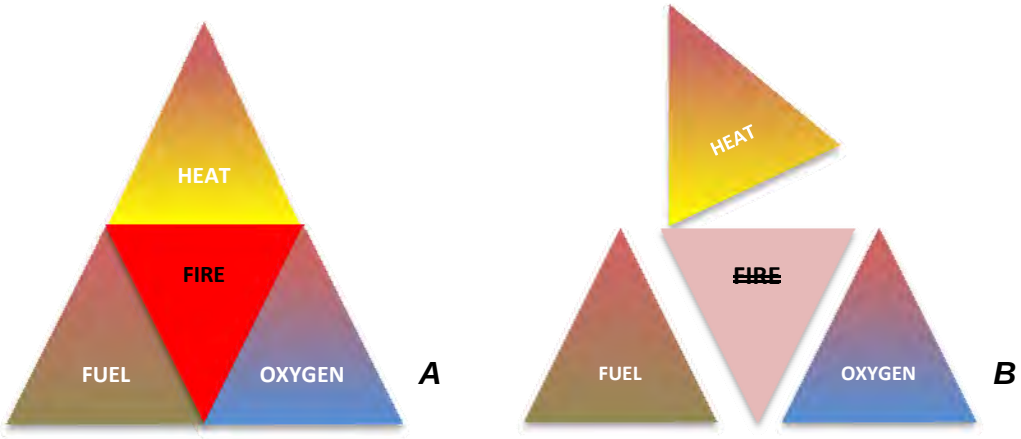
Fire Regime - The kind of fire activity or pattern of fires that generally characterize a given area. Some important elements of the characteristic pattern include fire cycle or fire interval , fire season, and the number, type, and intensity of fires.

Fire Season - The period(s) of the year during which fires are likely to start, spread, and do damage to values -at-risk sufficient to warrant organized fire suppression; a period of the year set out and commonly referred to in fire prevention legislation. The seasonal period where fire is likely and preparedness is required under the *Wildfire Act* and is April 1st to October 31st.

Fire Severity -A general term most commonly describe the combined effects of both flaming combustion and smouldering combustion on either a wildland fire or prescribed fire site as manifested in various fire behaviour characteristics (e.g. fire intensity, flame height and length, residence and burn-out times, etc.); this is quite inferred after-the-fact from the fire impact(s). *Ecosystems* (flora and fauna) - Disturbance characteristics such as percent of plants killed, effects on soil organisms, post-fire regeneration, fire return period, etc. *Fire Management* -Fire business such as supplemental resource requirements, mobilization logistics, organizational workload, emergency budget supplements, etc. *Geosystems* (soil and water) - Off-site movement of material such as loss of soil nutrients, increase in peak water run-off, soil erosion, decreased water quality, etc. *Society* - Social change such as injuries and fatalities, extent of damages to homes and improved property, net resources value changes, losses due to activity interruptions, etc.

Fire Suppression - All activities concerned with controlling and extinguishing a fire following its detection.

Fire Triangle - An instructional aide in which the sides of an equilateral triangle represent the three factors necessary for combustion and flame production (i.e. oxygen, heat, and fuel) (image *A* below). When any one of these factors is removed, flame production is not possible or ceases (image *B* below).



Fire Weather - Collectively, those weather parameters that influence fire occurrence and subsequent fire behaviour (e.g. dry-bulb temperature, relative humidity, wind speed and direction, precipitation, atmospheric stability, winds aloft).

Fire Weather Index - Note Canadian Forest Fire Weather Index System.

Fire Weather Station -A meteorological station equipped to measure fire weather elements. A primary weather station is one at which sufficient weather observations are taken to compute fire danger indexes. A secondary weather station does not provide this level of information, but rather provides supplementary data on weather conditions.

Forest Fire - Any wildland fire or prescribed fire that is burning in forested areas, grass, or alpine/tundra vegetation. The main types of forest fire are:

Ground Fire - A fire that burns in the ground fuel layer.

Surface Fire - A fire that burns in the surface fuel layer, excluding the crowns of the trees, as either a head fire, flank fire, or backfire.

Crown Fire - A fire that advances through the crown fuel layer, usually in conjunction with the surface fire. Crown fires can be classified according to the degree of dependence on the surface fire phase:

(i) *Intermittent Crown Fire* - A fire in which trees discontinuously torch, but rate of spread is controlled by the surface fire phase.

(ii) *Active Crown Fire* - A fire that advances with a well-defined wall of flame extending from the ground surface to above the crown fuel layer. Probably most crown fires are of this class. Development of an active crown fire requires a substantial surface fire, and thereafter the surface and crown phases spread as a linked unit.

(iii*) Independent Crown Fire* -A fire that advances in the crown fuel layer only.

Forest Floor - The organic surface component of the soil supporting forest vegetation; the combined duff (if present) and litter layers.

Front - In meteorology, the boundary between two air masses of different density. A cold front represents the leading edge of colder air replacing warmer air; the reverse of this is a warm front.

Fuel - An element of fire, mostly referring to carbon based materials like wood and vegetation. Land clearing and logging operations refer to as, slash.

Fuel Arrangement - A general term referring to the horizontal and vertical distribution of all combustible materials within a particular fuel type.

Fuel Break - An existing barrier or change in fuel type (to one that is less flammable than that surrounding it), or a wide strip of land on which the native vegetation has been modified or cleared, that act as a buffer to fire spread so that fires burning into them can be more readily controlled. Often selected or constructed to protect a high value area from fire. In the event of fire, may serve as a control line from which to carry out suppression operations.

Fuel Description - A description of the fuel properties that are important for assessing potential fire behaviour (e.g. fuel arrangement, fuel load, fuel moisture content).

Fuel Load- The dry weight of combustible materials per unit area. Recommended SI units are kilograms per square metre (kg/m2) and tonnes per hectare (t/ha) (1.0 kg/m2 is equivalent to 10 t/ha). Often classified as light, medium or heavy.

Fuel Management - The planned manipulation and/or reduction of living or dead forest fuels for forest management and other land use objectives (e.g. hazard reduction, silvicultural purposes, wildlife habitat improvement) by: prescribed fire; mechanical, chemical, or biological means; and/or changing stand structure and species composition.

Fuel Moisture Content -The amount of water present in fuel generally expressed as a percentage of the substance's weight when thoroughly dried at 100 degrees Celsius (DC).

Fuel Type -An identifiable association of fuel elements of distinctive species, form, size, arrangement, and continuity that will exhibit characteristic fire behaviour under defined burning conditions.

G

Geographic Information System (GIS) -A computer software system (often including hardware) with which spatial information may be captured, stored, analyzed, displayed, and retrieved.

Global Positioning System (GPS) -Employs a constellation of 24 high-orbiting satellites that provides (depending on the receiver used) three dimensional positioning (latitude, longitude, altitude), velocity, track, and time transfer information worldwide.

Ground Fuels - All combustible materials below the litter layer of the forest floor that normally support smouldering or glowing combustion associated with ground fires (e.g. duff, roots, buried punky wood, peat).

H

Hazard Reduction - Treatment of living or dead forest fuels to diminish the likelihood of a fire starting, and to lessen the potential rate of spread and resistance to control.

Heavy Fuels - Large diameter woody or deep organic materials that are difficult to ignite and burn more slowly than fine or medium fuels.

Human-caused Fire - A forest fire or wildland fire caused by human carelessness or malicious use of fire.

I

Incident -An occurrence either human caused or by natural phenomena, that requires action by emergency service personnel to prevent or minimize loss of life or damage to property and/or natural resources.

Incident Command System (ICS) -A standardized on-scene emergency management concept specifically designed to allow its user(s) to adopt an integrated organizational structure equal to the complexity and demands of single or multiple incidents, without being hindered by jurisdictional boundaries.

Initial Attack - The action taken to halt the spread or potential spread of a fire by the first fire fighting force to arrive at the fire.

Initial Attack Base - Any place where initial attack capability has been positioned in readiness for probable fire action. The forces must have air and/or ground transport capability on site.

Initial Attack Crew - Personnel trained, equipped and deployed to conduct suppression action to halt the spread or potential spread of a wildland fire within the first burning period.

Initial Spread Index - Note Canadian Forest Fire Weather Index System.

Interface - See Wildland Urban Interface

Intermix – see Wildland Urban Interface

L

Ladder Fuels - Fuels that provide vertical continuity between the surface fuels and crown fuels in a forest stand, thus contributing to the ease of torching and crowning (e.g. tall shrubs, small-sized trees, bark flakes, tree lichens). Synonym -Bridge Fuels . Note Ground Fuels.

Lightning Fire - A wildland fire caused directly or indirectly by lightning.

Litter -The uppermost part of the forest floor consisting of freshly cast or slightly decomposed organic materials (i.e. the L layer).

M

Mutual Aid Agreement -Written agreement between participating agencies and/or jurisdictions in which they agree to assist one another upon request, by furnishing resources.

P

Preparedness - Condition or degree of being able and ready to cope with an anticipated fire situation.

Prescribed Burning - The knowledgeable application of fire to a specific land area to accomplish predetermined forest management or other land use objectives.

R

Relative Humidity (RH) - The ratio, expressed as a percentage, of the amount of water vapour or moisture in the air to the maximum amount of moisture that the air would hold at the same dry-bulb temperature and atmospheric pressure (RH can vary from 0 to 100%). For example, 60% RH means that the air contains 60% of the moisture it is capable of holding. Popularly called humidity.

Resources -Personnel and equipment available, or potentially available, for assignment to incidents. Resources are described by kind and type, e.g., ground, water, air, etc., and may be used in tactical support or overhead capacities at an incident.

Risk - A qualitative/quantitative assessment made with two components that describes a sites overall susceptibility to wildland fire. These components are Hazard and Consequence. *Hazard* is the likelihood or probability of an event occurring (Event being an urban interface wildland fire for the purposes of this report). *Consequence* is the adverse effect (of a wildland fire) to health, property the environment, or other things of value.

S

Slash - Debris left as a result of forest and other vegetation being altered by forestry practices and other land use activities (e.g. timber harvesting, thinning and pruning, road construction, seismic line clearing). Slash includes material such as logs, splinters or chips, tree branches and tops, uprooted stumps, and broken or uprooted trees and shrubs.

Spot Fire - (1) A fire ignited by firebrands that are carried outside the main fire perimeter by air currents, gravity, and/or fire whirls. (2) A very small fire that requires little time or effort to extinguish.

Sprinkler Kit -A collection of water thieves, supply hose and water sprinkler heads used to wet the fuels along the fire perimeter or along a fireguard or in value protection.

Surface Fuels - All combustible materials lying above the duff layer between the ground and ladder fuels that are responsible for propagating surface fires (e.g. litter, herbaceous vegetation, low and medium shrubs, tree seedlings, stumps, downed-dead roundwood).

V

Values-at-Risk -The specific or collective set of natural resources and man-made improvements/ developments that have measurable or intrinsic worth and that could of may be destroyed or otherwise altered by fire in any given area.

W

Wildland Urban Interface (WUI) – The term wildland urban interface describes any area where combustible wildland fuels are found adjacent to homes, farm structures, and other outbuildings. This may occur at the interface, where development and wildland fuels (vegetation) meet at a well-defined boundary, or in the intermix where development and wildland fuels intermingle with no clearly defined boundary.

APPENDIX 2 Maps

The following maps can also be found as separate electronic files on the CD included in this report.

Map 1 Dashwood location map (*Dashwood_CWPP_Map_Location.pdf*)

Map 2 Dashwood area weather stations map (*Dashwood_CWPP_Map_Weather_Station.pdf*)

Map 3 Dashwood fire history map (*Dashwood_CWPP_Map_Fire_History.pdf*)

Map 4 Dashwood fire density map (*Dashwood_CWPP_Map_Historical_Ignition_Density.pdf*)

Map 5 Dashwood fuel type map (*Dashwood_CWPP_Map_Fuel_Types.pdf*)

Map 6 Dashwood structure density map (*Dashwood_CWPP_Structure_Density.pdf*)

Map 7 Dashwood overall risk rating map (*Dashwood_CWPP_Map_Risk_Rating.pdf*)

Map 8 Proposed fire prevention treatment map (*Dashwood_CWPP_Map_Proposed_Treatment.pdf*)

APPENDIX 3 Fire Behaviour Prediction – Fuel Types

A subsystem of the CFFDRS is the Canadian Forest Fire Behaviour Prediction (FBP) System. Weather, topography and fuel information are input into the FBP System and contributes to the CFFDRS output of fire danger. Because of this, identifying equivalent fuel types for the areas within RDN parks is a necessary input.

Technically speaking a fuel type is "an identifiable association of fuel elements of distinctive species, form, size, arrangement and continuity that will exhibit characteristic fire behaviour under defined burning conditions. More specifically, a fuel type is a fuel complex of sufficient homogeneity and extending over an area of sufficient size that equilibrium fire behaviour can be maintained over a considerable time period" (Hinton Training Centre 2003). There are five broad fuel groups developed by the CFS: coniferous (C), Deciduous (D), Mixedwood (M), Slash (S) and Open (O), further divided in 16 sub-types. Although based mostly on boreal vegetation, fuel characteristics (such as species composition (conifer/deciduous), density, arrangement and size) are used to identify "equivalent" fuel types in the RDN of the 16 national benchmark fuel types that fall within the five broad fuel groups. This is standard practice by Fire Behaviour Analysts and Fire Managers on Coastal BC. Detailed information on those found in the RDN area which was used in determining hazard ratings can be found on the following pages.

Literature Cited

Hinton Training Centre. 2003. Advanced Wildland Fire Behaviour Training Course Manual – Unit II-C Forest Fuel Types. Hinton Training Centre, Hinton, Alberta.

FBP Fuel Type C2 – Coastal Equivalent (conifer, immature, Fd, Hw, Pl, Cw)

Low to high elevation even aged or uneven aged forest stands. Majority of trees are live with a lower percentage of fine and moderate fuels and higher percentage of large fuels. Sites vary from sea level to 700m elevation with little to no snowfall, moist winters, dry summers and zonal water deficits. These fuel types can support crown fire and pose a spotting threat to WUI areas. They pose a high WUI threat.

Forest Floor and Organic Layer	Surface and Ladder Fuels	Stand Structure and Composition
continuous feather moss, lichen; moderately deep, compacted organic layer	*No understory present, surface veg. is salal, bearberry, grass, bog cranberry; sparse down woody fuels; tree crowns extend to ground*	*Open to moderately stocked juvenile stands containing sapling sized immature Douglas fir Lodgepole Pine, western hemlock, occasionally western red cedar)*

Photo 10 Example of a C2 fuel type near Dashwood Fire Hall #2

Photo 11 Example of a C2 fuel type, just off Meadowood, near Dashwood Fire Hall #2

FBP Fuel Type C3 – Coastal Equivalent (conifer, mature, Fd, Hw, Pl, Cw)

Low to high elevation even aged or uneven aged forest stands. Majority of trees are live with a lower percentage of fine and moderate fuels and higher percentage of large fuels. Sites vary from sea level to 700m elevation with little to no snowfall, moist winters, dry summers and zonal water deficits. These fuel types can support crown fire and pose a spotting threat to WUI areas. They pose a high WUI threat.

Forest Floor and Organic Layer	Surface and Ladder Fuels	Stand Structure and Composition
continuous feather moss; moderately deep, compacted organic layer	*sparse conifer understory may be present (salal, huckleberry, swordfern, oregon grape, vanilla leaf); sparse down woody fuels; tree crown separated from ground*	*fully stocked stands containing mature Douglas fir, western hemlock (occasionally western red cedar)*

Photo 12/13 Example of a C3 fuel type (l) and example of a C3 fuel type at end of Huckleberry Lane and Dewberry Way (r).

FBP Fuel Type C4 – Coastal Equivalent (conifer, immature, closed, Fd, Hw, Pl, Cw)

Low to high elevation even aged or uneven aged forest stands. Majority of trees are live with a lower percentage of fine and moderate fuels and higher percentage of large fuels. Sites vary from sea level to 700m elevation with little to no snowfall, moist winters, dry summers and zonal water deficits. These fuel types can support crown fire and pose a spotting threat to WUI areas. They pose a very high WUI threat.

Forest Floor and Organic Layer	Surface and Ladder Fuels	Stand Structure and Composition
continuous needle litter; moderately compacted organic layer	*moderate shrub/herb cover (salal, huckleberry, swordfern, vanilla leaf); ladder fuel continuity; heavy standing dead and down, clean woody fuel*	*dense stands containing immature Douglas fir, western hemlock, western red cedar and/or lodgepole pine*

Photo 14/15, C4 fuel type, approx. 300m from the beginning of Ashling Rd off Meadowood Way (l) and example of a C4 fuel type, off Koskimo Rd (r).

FBP Fuel Type M2 – Coastal Equivalent (mixed wood, green, Fd, Cw, Hw, Pl, Dr, Mb)

Low to high elevation uneven aged moist forest stands. Majority of trees are living with a high percentage of large fuels and layer of moist, fine fuel, co-dominant vegetation. Sites range between sea level and 900m elevation. Lower elecations with little to no snowfall and moist winters. Sites remain moist during majority of summer. Assumed to be leaf-on (green) stage. Typical sites include riparian zones and wetlands. These fuel types can support crown fire and pose a spotting threat to WUI areas where the coniferous component is >50%. They pose a low-moderate WUI threat.

Forest Floor and Organic Layer	Surface and Ladder Fuels	Stand Structure and Composition
continuous leaf litter in deciduous portions of stands; discontinuous feather moss and needle litter in conifer portions of stands; organic layers shallow, uncompacted to moderately compacted	*moderate shrub and continuous herb layers (upland: vanilla leaf, bracken, salmonberry; lowland: vanilla leaf, devils club, skunk cabbage, sword fern); low to moderate dead, down woody fuels; conifer crowns extend nearly to ground; scattered to moderate conifer understory*	*moderately well-stocked mixed stand of conifers (e.g. Douglas fir, western red cedar, western hemlock) and deciduous species (e.g. red alder, bigleaf maple, cottonwood). Fuel types are differentiated by season and percent conifer/deciduous sp. composition*

Photo 16 Example of an M2 fuel type at end of Abbey Road (l) and within Little Qualicum River valley (r).

FBP Fuel Type S3 – Cedar/Hemlock/Douglas fir Slash* (slash, coastal, Fd, Cw, Hw, Pl)

**Coastal equivalent not required as this fuel type is recognized by the Fire Behaviour Prediction system.*

Conifer slash that is one to two seasons old. Variations of this fuel type include sites that are harvested to varying utilization standards and those harvested, de-stumped and prepared for other non-forestry land-use purposes. These fuel types do not support crown fire and do not pose a spotting threat to WUI areas. They pose a low WUI threat.

Forest Floor and Organic Layer	Surface and Ladder Fuels	Stand Structure and Composition
continuous feather moss or compacted old needle litter below fresh needle litter from slash; moderately deep to deep, compacted organic layer	*continuous slash, high foliage retention (cedar), moderate for other species; heavy loading, deep slash; sparse to moderate shrub and herb cover*	*slash from logging, mature to overmature cedar, hemlcok or Douglas fir stands, flammability changes over time, peaking when slash is fully cured and diminishing as decomposition sets in and new vegetation greens up*

Photo 17 Example of a typical S3 fuel type, following harvesting operations.

FBP Fuel Type O1 – Grass* (open, grass)

**Coastal equivalent not required as this fuel type is recognized by the Fire Behaviour Prediction system.*

Continuous standing grass partially or fully cured. Consider fuel type modifiers such as structure (matted or standing) and degree of curing (i.e. seasonality. Curing must be >50% for fire spread). Scattered shrubs or small trees may be present. These fuel types do not support crown fire and do not pose a spotting threat to WUI areas. They pose a low WUI threat compared to other fuel types.

Forest Floor and Organic Layer	Surface and Ladder Fuels	Stand Structure and Composition
continuous dead grass litter; organic layer absent to shallow and moderately compacted/ matted	*continuous standing grass (current year crop). Standard loading is 0.3 kg/m^2, but other loading can be accommodated; percent cured or dead must be estimated. Sparse or scattered shrubs and down woody fuel. Subtypes for both early spring and matted grass and late summer standing cured grass are included*	*scattered trees, if present, do not appreciably affect fire behaviour*

Photo 18 Example of an O1 fuel type at the end of Larkdown Road.

Photo 19 Example of an O1 fuel type at end of Settler Road.

APPENDIX 4 Biogeoclimatic Zones and Subzones

In addition to the benchmark fuel types, another system of classification was used to help further define the sites: the Biogeoclimatic Ecosystem Classification (BEC). The system groups similar segments of the landscape (ecosystems) into categories of a hierarchical classification system that combine three major classifications: climate, vegetation and site (Green and Klinka 1994). BEC uses extensively researched and inventoried forest vegetation types and their related climate and topography to provide an accurate description of vegetation and site moisture content.

The BEC forest types found in RDN parks are (from Green and Klinka 1994 and Province of BC 2010):

- Coastal Douglas Fir, moist maritime (CDFmm) subzone. Located along lower elevations of the southeast rain shadow of Vancouver Island. Summers are warm and dry, and winters are mild and wet. These sites are known for water deficits and are some of the mildest climates in Canada. Forests are predominantly Douglas fir with grand fir, and on drier sites with arbutus and Garry oak.

- Coastal Western Hemlock, very dry maritime (CWHxm) subzone. Located at lower elevations along the east coast of Vancouver Island, typically just above the CDFmm zone. Summers are normally warm and dry, whereas winters are moist and mild. Some sites have water deficits. Forests are predominantly Douglas fir with hemlock and small amounts of western red cedar.

Literature Cited

Green, R.N. and K. Klinka. 1994. A Field Guide to Site Identification and Interpretation for the Vancouver Forest Region. BC Ministry of Forests. Victoria, BC, Canada.

Province of British Columbia. 2010. Coast Forest Research Section – Ecology [online]. Available from http://www.for.gov.bc.ca/rco/research/eco/bec_web/docs/MHmm1.htm [cited July 2010].

APPENDIX 5 Wildland Urban Interface Wildfire Threat Rating

The following has been extracted from the report titled "Rating Interface Wildfire Threats in British Columbia" (2008) by Morrow, Johnston, and Davies.

Expanding the fuel component of FireSmart and reducing the emphasis on the structure itself, the new system is scientifically justifiable with proven wildland fire behaviour principles and is closely tied to the Canadian Forest Fire Danger Rating System. The main focus is the fire behaviour triangle – fuels, weather, topography – and has the capacity to be used solely for fuel threat rating in the absence of a WUI. The system is considered dynamic so as scientific knowledge increases, the worksheet and manual should be reviewed and updated as required.

The system is broken down into four components and multiple sub-components within which each have a score:

1. *Fuel* – duff and litter depth, flammable surface vegetation continuity, vegetation fuel composition, fine woody debris continuity, large woody debris continuity, coniferous crown closure, deciduous crown closure, conifer crown base height, suppressed and understory conifers, continuous forest land, coniferous forest health. TOTAL score = 100
2. *Weather* – biogeoclimatic zone, historical wildfire occurrence. TOTAL score = 40
3. *Topography* – aspect, slope, terrain. TOTAL score = 40
4. *Structures* – position of structure/community to rating area, type of development. TOTAL score = 30

After rating and scoring all eighteen sub-components, the total rating score (out of 210) is tallied. This number will fit into one of the four Wildfire Threat Classes taken from the FireSmart manual:

1. *Low <55* Developed and undeveloped land that will not support significant wildfire spread.
2. *Moderate 55-115* Developed and undeveloped land that will support surface fires only. Homes and structures can be threatened.
3. *High 116-130* Forested land with continuous surface fuels that will support intermittent crown and continuous crown fires. Areas of steeper slopes, rough or broken terrain, with generally southerly aspects. Areas of high incidence of dead and downed conifers. Houses and developments down slope but immediately adjacent to forests that will support crown fires. Areas where fuel modification does not meet an established standard.
4. *Extreme >130* Forested land with continuous surface fuels that will support intermittent or continuous crown fires adjacent to and within communities, or immediately surrounding individual homes. Polygons of dead standing and downed conifers, affecting more than 40% of the area, adjacent to structures. Areas of steep slopes, difficult terrain and usually southerly aspects.

The following table provides a summary of WUI fire threat rating field work that has been completed.

Table 6 Wildland fire Threat Rating scores for sample plots.

SITE/Plot#	Location	Geographic	Date	Fuel	Wx	Topography	Structure	Rating	Class
DASH_001	N49.20.118 W124.32.705	End of Koskimo Rd	21-Sep-10	66	6	14	23	109	MOD
DASH_002	N49.19.302 W124.33.572	Across from junction of Meadowood and Ashling Roads	21-Sep-10	74	6	19	20	119	HIGH
DASH_003	N49.18.106 W124.33.827	End of Abbey Rd	21-Sep-10	51	2	9	27	89	MOD
DASH_004	N49.21.786 W124.33.369	Baylis Rd where gravel start	21-Sep-10	62	6	12	23	103	MOD
DASH_005	N49.22.295 W124.33.047	~300m south of Baylis Rd, off Hwy 19A	21-Sep-10	59	6	12	23	100	MOD
DASH_006	N49.21.429 W124.29.526	Huckleberry Lane/Dewberry Way	22-Sep-10	62	6	12	16	96	MOD

Literature Cited

Morrow, B., K. Johnston, and J. Davies. 2008. Rating Interface Wildfire Threats in British Columbia. Report submitted to the Province of British Columbia, April 22, 2008.