Wildland Fire Management Plan
Rodgers Creek Area 6

May 20, 2016

Submitted to:

British Pacific Properties Limited
#1001 - 100 Park Royal
West Vancouver, British Columbia

Submitted by:

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The following Diamond Head Consulting staff performed the site visit and prepared the report. All general and professional liability insurance and individual accreditations have been provided below for reference.

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Insurance Information

WCB:	# 657906 AQ (003)
General Liability:	Northbridge General Insurance Corporation - Policy #CBC1935506, $5,000,000 (Mar 2015 to Mar 2016)
Errors & Omissions:	Lloyds Underwriters – Policy #1010615D, $1,000,000 (June 2015 to June 2017)

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1 Introduction

Diamond Head Consulting Ltd. (DHC) was retained by British Pacific Properties Limited to complete a wildland fire management plan for the proposed subdivision at Rodgers Creek Area 6 in West Vancouver. In accordance with the 2007 Community Wildfire Protection Plan, the District requires that such a plan be submitted for the subdivision approval. The overall objective of this report is to assess the potential wildfire threat and provide recommendations and tools to reduce this threat to the development site. Specific goals for this project are:

- To assess interface fuel hazards using an accepted fuel hazard assessment procedure and present a summary of results;
- To map the location of hazardous fuel types relative to the planned development area;
- Recommend site-specific fuel treatments for adjacent high fuel hazards that will reduce the risk to structures, human lives, and critical natural features;
- Recommend improvements to suppression capabilities in and around the proposed development; and
- Make recommendations for building materials and landscaping that will minimize wildfire hazard.

1.1. Site Planning Documents Reviewed

Diamond Head Consulting was provided with the following documentation from the client that provides the basis for all comments and recommendations:

- British Pacific Properties Rodgers Creek Development - Development Concept, February 2016

Any changes to these site plans should be provided to Diamond Head Consulting so that this wildfire report can be updated accordingly.

2 Methodology

Diamond Head Consulting Ltd. completed a field assessment of the natural areas within 200m of the development site. In these areas detailed descriptions of the ecology and the fuel characteristics was collected for each polygon. Data collected at each fuel plot included:

- Biogeoclimatic classification;
- Soil and humus characteristics;
- Slope, aspect and terrain classification;
- Forest stand composition by layer (species, density, age, diameter, height, etc.);
- Vertical and horizontal stand structure;
- Quantity and distribution of ladder fuels;
- Composition and coverage of understory brush, herbs and grasses, and;
- Quantity and distribution of ground fuels by size class.

Detailed fuel hazard assessments were completed within the interface of adjacent lands using the provincial assessment system, “Rating Interface Wildfire Threats in BC” (Morrow, Johnson, Davies, 2008). This ranking system was used to help determine where fuel treatments will effectively reduce wildfire threat and to prioritize these areas for treatment. This combination of landscape and site level risk assessments provides a foundation to develop treatment strategies at a broad landscape level as well as specific treatments to address structures at risk.

3 Project Description

The planned development consists of twenty-three single family lots, eight duplex lots, eight cluster housing units, and four apartment complexes. Due to the size of the development and its associated infrastructure requirements, few mature trees are planned to be retained within the development clusters. Most of these areas are bordered by creeks and associated environmental setbacks. There are also natural areas outside the environmental setbacks within the development area. These areas are passive forested parks and will be dedicated to the District of West Vancouver. Figure 2 shows a development plan of Area 6.

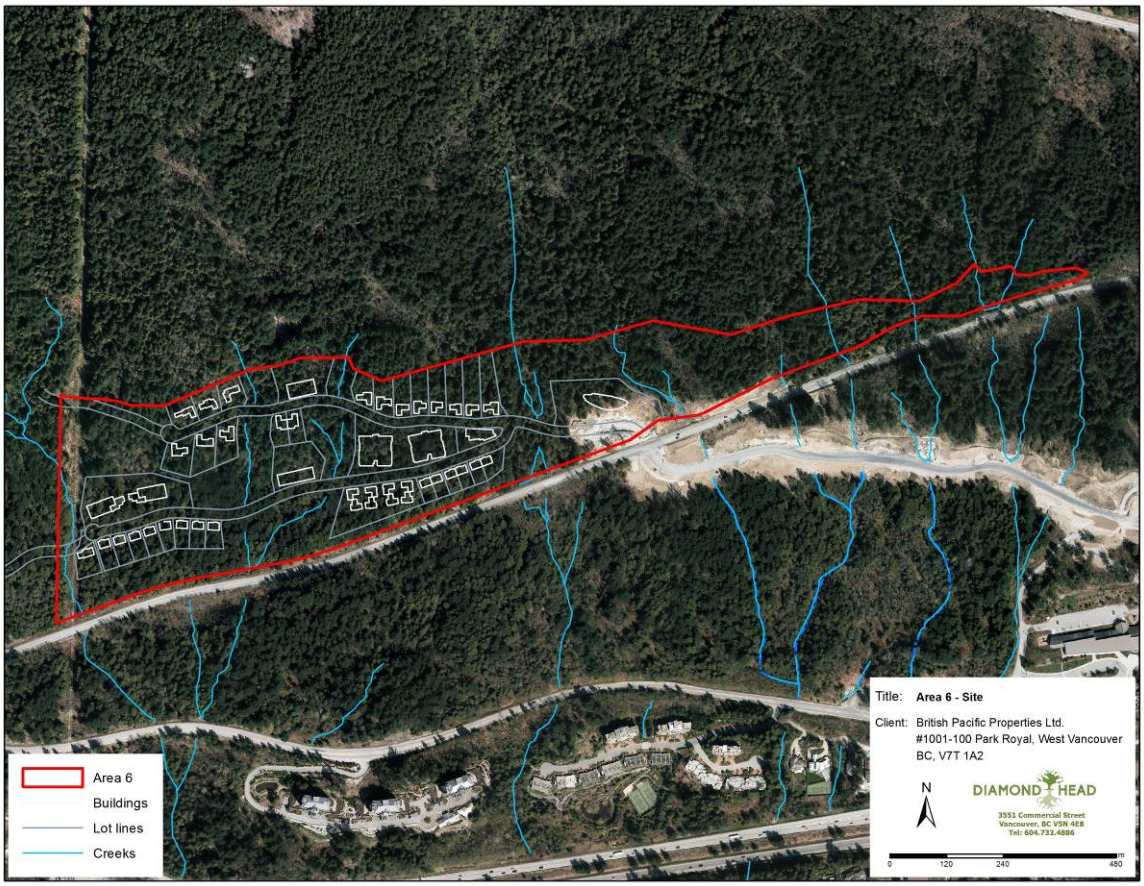

Figure 1. Site location of Area 6

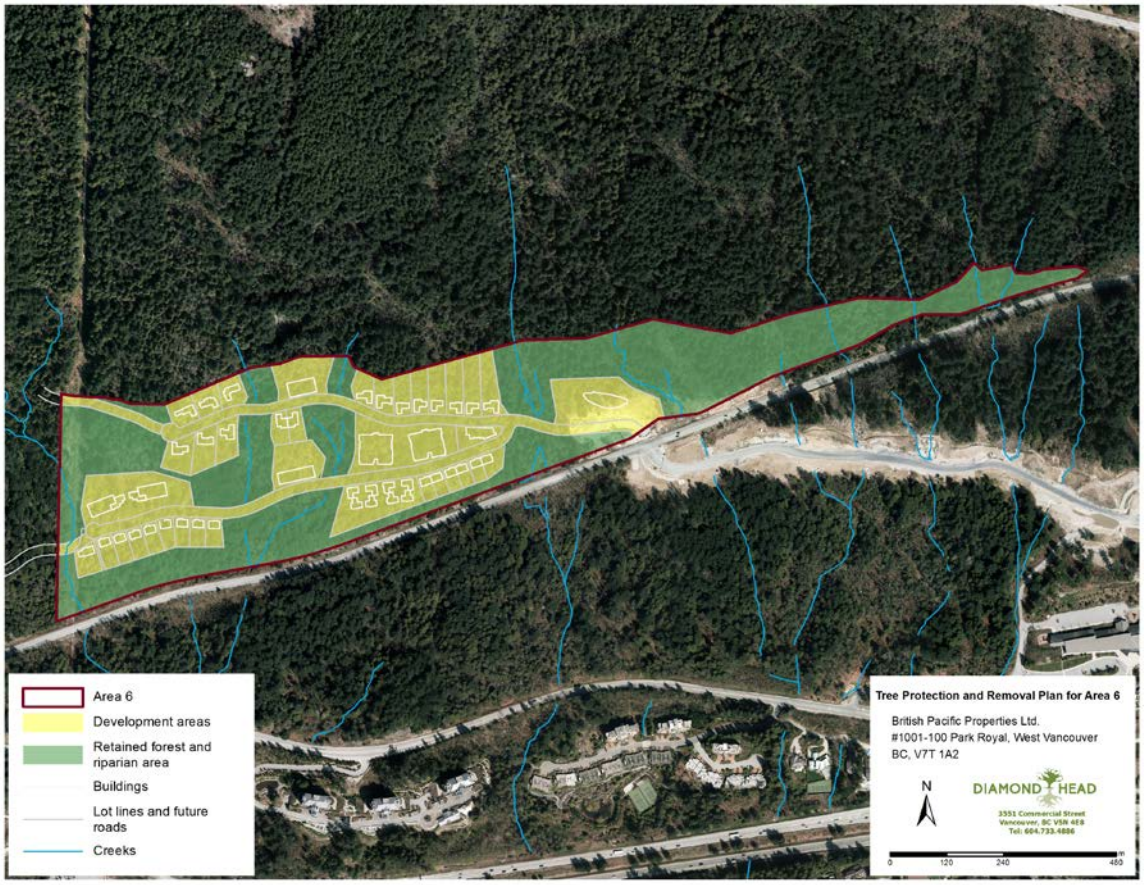

Figure 2. Area 6 development areas and tree retention areas

View of planned access to Area 6

3.1 Terrestrial Ecology

The assessment area is located on a south facing, moderately steep slope. The parent material is a mix of morainal and colluvial consisting of deep sandy loam soils with a moderate to high coarse fragment content. This area is located within the Dry Maritime Coastal western hemlock Subzone (CWHdm) of the Biogeoclimatic Ecosystem Classification System (BEC) of BC. This subzone is characterized by warm, relatively dry summers and moist, mild winters with little snowfall. Generally, the areas assessed have a slightly dry to moist soil moisture regime and is nutrient medium to rich. These are identified as mostly Site Series 01 and 05 and minor components of 07 according to the BEC classification system.

4 Fuel Descriptions

All forested areas within 100m of the proposed development site were visited on the ground. Most areas consist of moderately dense mature stands of native species that regenerated naturally following logging operations about 80 years ago. Detailed fuel types were delineated and mapped. The fuels have been divided into classifications based on the sixteen national benchmark fuel types that are used by the Canadian Fire Behaviour Prediction System. There are no fuel classifications specific to the coastal region in the Canadian Fire Behaviour Prediction System; instead the site has been classified into the fuels types that represent the fire behaviour potential of the forests types most accurately. Four fuel types were identified. The following are general descriptions of each fuel type. The following map shows the fuel type layout of the area.

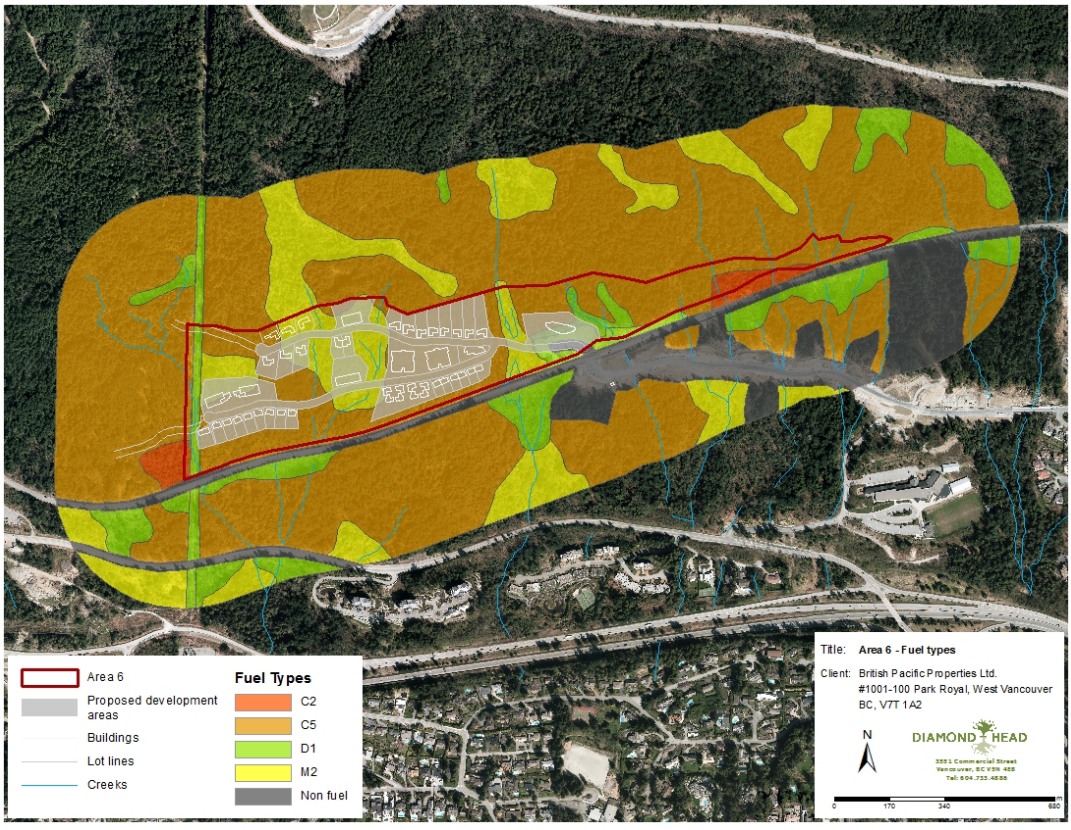

Figure 3. Fuel Type Map

4.1 Fuel Type C5- Coniferous Dominated Stands

A large portion of the stands found within and adjacent to the development sites are classified as C5 fuel type. These stands are about 80 years old and consists of a mature second growth canopy of even aged, moderately stocked (500 – 800 stems per hectare) conifers. The stands are dominated by Douglas-fir (*Psuedutsuga menziesii*), western hemlock (*Tsuga heterphylla*), and western redcedar (*Thuja plicata*). The stand has a high crown to base height with few ladder fuels. There are scattered ladder fuels, mostly consisting of western redcedar and western hemlock. Ground fuel loading is moderate and there is a patchy distribution of flammable ground vegetation.

These areas pose a high wildfire risk. The slopes are moderately steep (30-60%) and there is relatively continuous ground and crown fuels that could support a high intensity wildfire under dry weather conditions. Although there are limited ladder fuels, a high intensity fire could create a crown fire that would move quickly and would be difficult to suppress. Table 1 outlines the general stand characteristics of a C5 stand.

Table 1 C5 general stand characteristics

Characteristic	Risk Level	Description
Surface fuel continuity (% cover)	Moderate	24-60 % cover
Vegetation fuel composition	Low	Herbs and deciduous shrubs
Fine woody debris continuity (<=7cm) (% cover)	Moderate	10-25% coverage
Large woody debris Continuity (>=7cm) (% cover)	Moderate	10-25% coverage
Live conifer canopy closure (%)	Med	41-60% crown closure
Live deciduous canopy closure (%)	High	<20% crown closure
Live and dead conifer crown height (m)	Low	>5m
Live and dead suppressed and understory conifer (stems/ha)	Low	<500 stems/ha

Fuel type C5 photos

4.2 Fuel Type C2 - Coniferous Dominated Stands

There are some stands of trees that are denser with lower and more compact crowns. These are generally growing on rocky drier sites and many are directly above Cypress Bowl Road. The trees in these stands are generally young to mature and have an even aged stand structure. They are dense with 500-700 stems per hectare. Western redcedar and Douglas-fir are the dominant species with lesser components of western hemlock. There are moderate to high amounts of ladder fuels present consisting of lower branches of mature conifers and suppressed western redcedar and western hemlock. Ground fuel loading is moderate and there is a patchy distribution of flammable ground vegetation.

These areas pose a high wildfire risk. The slopes are moderately steep (30-60%) and there is continuous ground, ladder and crown fuels that could support a high intensity wildfire under dry weather conditions. The greatest risk from these conifer stands is their potential to support a crown fire, which has the potential to carry quickly, is difficult to suppress and can produce significant spotting. Table 2 outlines the general stand characteristics of a C2 stand.

Table 2 | C2 general stand characteristics

Characteristic	Risk Level	Description
Surface fuel continuity (% cover)	Moderate	24-60 % cover
Vegetation fuel composition	Low	Herbs and deciduous shrubs
Fine woody debris continuity (<=7cm) (% cover)	Moderate	10-25% coverage
Large woody debris Continuity (>=7cm) (% cover)	Moderate	10-25% coverage
Live conifer canopy closure (%)	High	61-80% crown closure
Live deciduous canopy closure (%)	High	<20% crown closure
Live and dead conifer crown height (m)	Moderate	2-3m
Live and dead suppressed and understory conifer (stems/ha)	Moderate	500-1000 stems/ha

Photos of C2 fuel type

4.3 Fuel Type D1 - Deciduous Dominated Stands

There are fragmented pockets of stands dominated by deciduous species. These grow mainly in wetter areas and adjacent to existing creeks. They are classified as a D1 fuel type which typically have less than 20% coniferous component. These stands are even aged with a density between 500 and 1000 stems per hectare. Dominant trees species include mainly red alder (*Alnus rubra*) and bigleaf maple (*Acer macrophyllum*). These areas generally have a high moisture regime. Ground fuel loadings are low and the ground vegetation is moderately dense consisting of mostly species with low flammability. Areas that are dominated by deciduous shrub species and regenerating deciduous trees are also classified as D1 fuel type. These include the hydro right of way the extends up through the west edge of Area 6 as well as the area previously cleared adjacent to the planned access road.

D1 fuel types have a low flammability and would not support a fast spreading, high intensity wildfire. If a ground fire did start it would not have a high intensity and would be very unlikely to spread into the crown of the stand. D1 stands pose a low wildfire risk and are expected to act as fuel breaks decreasing the overall wildfire threat to the site. Table 3 outlines general characteristics of D1 stands.

Table 3 | D1 general stand characteristics

Characteristic	Risk Level	Description
Surface fuel continuity (% cover):	Low	20-40 % cover
Vegetation fuel composition	Low	Herbs and deciduous shrubs
Fine woody debris continuity (<=7cm) (% cover)	Low	Scattered, <10% coverage
Large woody debris Continuity (>=7cm) (% cover)	Low-Med	10-25% coverage
Live conifer canopy closure (%)	Very low	< 20% crown closure
Live deciduous canopy closure (%)	Very low	>80% crown closure
Live and dead conifer crown height (m)	Very low	5m+ or <20% conifer crown closure
Live and dead suppressed and understory conifer (stems/ha)	Very Low	0-500 stems/ha

Photos of D1 fuel type

4.4 Fuel Type M2 – Mixed stand of coniferous and deciduous species

There are pockets of stands in and adjacent to Area 6 that have mixed components of deciduous and conifer species. Stand density is between 200 and 600 stems per hectare. Tree species include an inconsistent mix of bigleaf maple, red alder, western redcedar, western hemlock and Douglas-fir. The coniferous trees in these stands are generally discontinuous and there are scattered canopy gaps which breaks horizontal fuel continuity. Pockets of ladders fuel are present, and consist mainly of the lower branches of conifers. Ground fuels in these areas are generally moderate and discontinuous. Understory vegetation is moderately dense consisting of mostly species with low flammability.

The fire behavior potential in these stands is low to moderate and highly dependent on the percentage content and distribution of coniferous species. Most of these stands have a 40-60% coniferous component which is discontinuous in the stand. If a ground fire did start in these areas, it could move into the crowns of the scattered conifers. However, an M2 crown fire would be isolated and unlikely to spread quickly. Table 4 outlines general characteristics of M2.

Table 2 | M2 general stand characteristics

Characteristic	Risk Level	Description
Surface fuel continuity (% cover)	Low	20-40 % cover
Vegetation fuel composition	Low	Herbs and deciduous shrubs
Fine woody debris continuity (<=7cm) (% cover)	Low	Scattered, <10% coverage
Large woody debris Continuity (>=7cm) (% cover)	Low-Med	10-25% coverage
Live conifer canopy closure (%)	Med	40-60% crown closure
Live deciduous closure (%)	Med	20-40% crown closure
Live and dead conifer crown height (m)	Med	2-<3 m
Live and dead suppressed and understory conifer (stems/ha)	Very Low	0-500 stems/ha

Photos of M2 fuel type

5 Summary of Wildfire Threat

Areas 6 is located within a densely forested area with few natural fuel breaks. The majority of the forested areas have a high and continuous conifer component, and are moderately steep. These include areas classified as C5 and C2 fuel types. In these areas, ground fuels are moderate and there are enough ladder fuels to carry a ground fire to the crown of the trees. Under dry and hot weather conditions, there is potential to produce a relatively high intensity crown fire that would be difficult to suppress, posing an interface and spotting hazard to the development.

There are also pockets of mixed stand conditions classified as M2. These stands include a discontinuous distribution of conifers that could support isolated crown fires. Fuels breaks that would help to slow a wildfire include pockets of deciduous dominated stands, roadways and openings created for development lots. However, these areas are relatively small in comparison to the surrounding continuous forested areas.

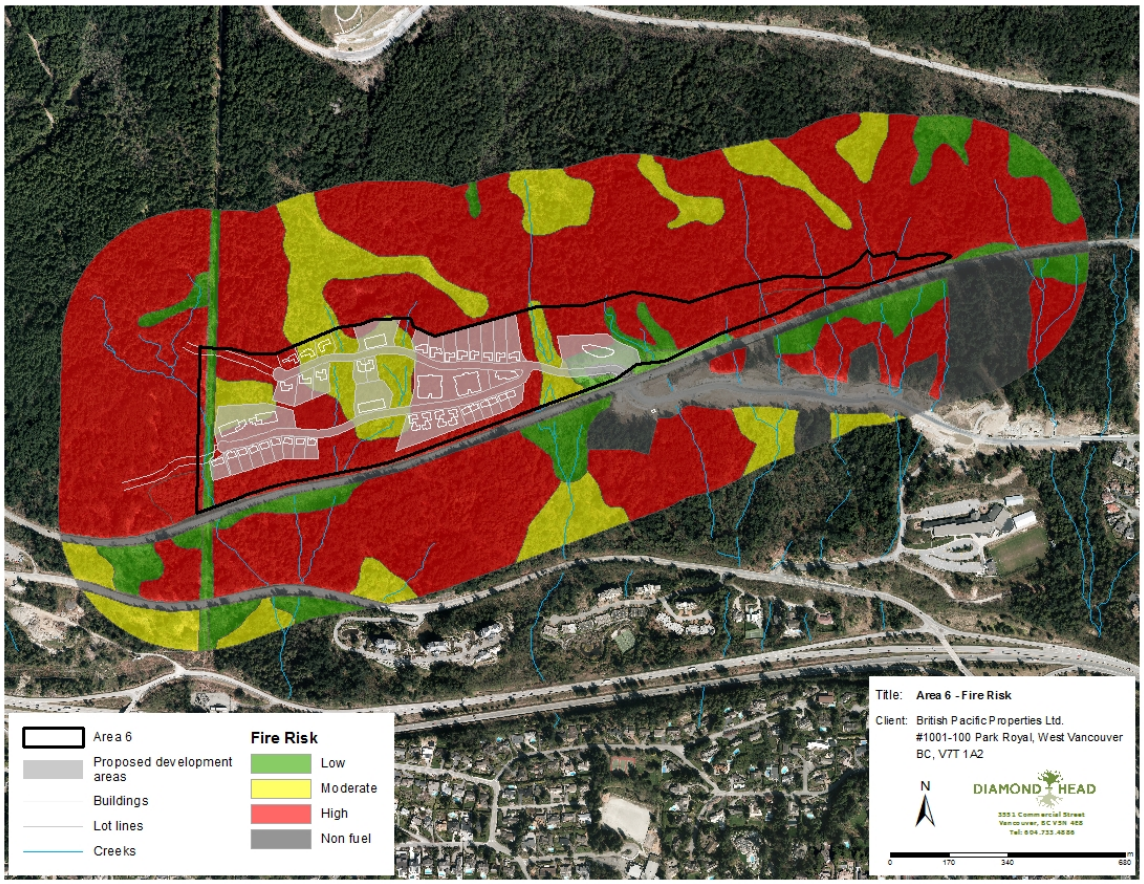

Figure 4. Wildfire threat mapping

6 FireSmart Wildfire Threat Mitigation Recommendations

This section provides recommendations to mitigate the risk of wildfire to the proposed development areas based on the current condition of hazardous fuels and wildfire threat, site planning documents, and FireSmart standards within the prioritized zones defined in the FireSmart Homeowners Manual (Partners in Protection and Province of BC, 2016) (Figure 6).

During a wildfire homes are ignited as a result of:

- Sparks or embers landing and accumulating on vulnerable surfaces such as roofs, verandas, eaves and openings. Embers can also land on or in nearby flammable materials such as bushes, trees or woodpiles causing a fire close to a structure.
- Extreme radiant heat from flames within 30 m of a structure that melts or ignites siding, or breaks windows.
- Direct flame from nearby flammable materials such as bushes, trees or woodpiles.

The fire resistance of homes in the interface can be improved by achieving FireSmart standards for subdivision design, building materials, ignition sources and combustible fuels. In the event that a wildfire does threaten the area, suppression capability is improved with good access, defensible space and water supply. The following recommendations address:

- Building construction and site layout;
- Suppression and Emergency Access Planning;
- Fuel hazard mitigation on any wildland/green spaces;
- FireSmart landscaping; and,
- Ongoing maintenance.

6.1 Building Construction and Site Layout

Generally, during a wildfire, homes are ignited as a result of embers landing and accumulating on vulnerable surfaces such as roofs, verandas, eaves and openings. Embers can also land on or in nearby flammable materials such as bushes, trees or woodpiles and, if the resulting fire is near the home, create enough radiant heat to ignite the walls of the home. Small fires in the yard can also spread towards the structures, beneath porches or under homes. Therefore, the building material and construction techniques are a paramount concern for homes in the interface. The following construction guidelines are recommended for this development:

Roofs

- Use only fire retardant material (Class A or B rated) on roofs; and
- Clear and maintain roofs free of combustible material.

Siding

- Siding should be predominantly fire resistant or non-combustible material, particularly within 30 m of a mixed or coniferous forest edge; and,
- Siding should extend from the ground level to the roofline.

Wood Chimneys

- Wood burning fireplaces are not permitted as per the Development Permit and a Section 219 Covenant to be registered on the lots in the subdivision.

Balcony, Decks and Porches

- Deck surface and sheathing materials should be made of predominantly non-combustible of fire-resistant materials (Class A or B rated) such as wood composite products.
- Decks should be sheathed in and, if deck surfaces are slotted, provide access below for cleaning out litter accumulations.

Vents, openings, eaves, attics, overhanging projections, soffits

- Eaves, attics, overhanging projections and underfloor openings should be protected with non-combustible covers.
- Any intake or exhaust vents that open into insulated attic space or are attached to combustible duct systems must be non-combustible and screened using 3mm, non-combustible wire mesh.
- Soffits must be non-combustible or made of ignition resistant materials.

Guidelines during Construction

- During construction of houses, all waste construction materials including brush and land clearing debris; needs to be cleaned up on a regular basis to minimize the potential risk. No combustible materials should be left at the completion of construction.
- Prior to construction of any wood frame buildings, there must be fire hydrants within operating range.
- All construction operations should be conducted according to the Wildfire Act and the regulations. Contractors should have certified S-100 workers on-site.

6.2 Suppression and Emergency Access Planning

In BC, the *Wildfire Act* specifies responsibilities and obligations with respect to fire use, prevention, control, and rehabilitation. The expected outcome of the *Wildfire Act* is that fire starts are prevented through appropriate fire prevention planning and hazard mitigation. The concept of "due diligence" is central to the *Act*, meaning that all reasonable care commensurate with the fire hazard is exercised.

Under the Act, land clearing and the use of heavy machinery for construction are considered "High risk industrial activities" under the Wildfire Act and Regulation and must conform to the statutory requirements:

- Between March 1 and November 1, the Wildfire Regulation requires that the Fire Danger Class be determined for the location of the activity.
- High risk activities are required to have a functioning fire suppression system at the activity site. The system may involve the delivery of water, the addition of a surfactant, the application of a suppressant, or a combination of all three. The fire suppression system should be practicable and reasonable for the specific high risk activity being carried out. The system should be nearby, operational and capable of being deployed in a reasonable length of time to suppress a fire, taking the Fire Danger Class into consideration.
- Firefighting hand tools are required on site during the fire season (on or after March 1 and before November 1). Firefighting hand tools must be available at that site in a combination and type to properly equip each person who works at the site with a minimum of one firefighting hand tool per person.
- Operation of engines must be done safely. A person must not operate an engine at a time when there is a risk of fire starting or spreading unless precautions are taken to ensure that the engine does not cause a fire.
- Sufficient fuel breaks are required so that there is no reasonable chance of a fire spreading. A fuel break may also be created using a sprinkler system that increases the moisture content of fuel above its ignition point.

Hand Tools

Fire suppression hand tools and water back packs will be placed at each of the water tanks and on every machine that is working on site. Each worker should have access to a tool with which to carry out fire suppression work. "Fire fighting hand tools" are defined in the Regulation to include shovels, mattocks, pulaskis, fire extinguishers and hand tank pumps.

Water for Suppression

During construction, emergency water storage tanks will be placed in strategic locations accessible along Fern Fire Access Road. These tanks will be maintained from March through to November. The District of West Vancouver Fire Department and North Shore Emergency Management Office (NSEMO) have been provided with the locations and access information for these tanks. In addition, a mobile water tank will be on site with a pump delivery system.

Emergency water tanks will be made ready with hose connections placed in locations accessible to the clearing site. The mobile water tanker will be used to irrigate the work site prior to clearing activities if required.

Work Restrictions and Fire Watch

Restrictions on high risk activities apply depending on the Fire Danger Class. Restrictions must be followed when the rating is moderate, high and extreme. These may include ceasing activity altogether or for periods of the day and maintaining fire watcher and communication requirements. Requirements for work restrictions are provided in Schedule 3 of the Wildfire Regulation.

Table 3. Schedule 3 of the Wildfire Regulation (restrictions on high risk activities)

Column 1 Fire Danger Class (DGR)	Column 2 Restriction	Column 3 Duration
III (moderate)	After 3 consecutive days of DGR III or greater, maintain a fire watcher after work for a minimum of one hour	Until after the fire danger class falls below DGR III
IV (high)	Maintain a fire watcher after work for a minimum of 2 hours	Until after the fire danger class falls below DGR III
	After 3 consecutive days of DGR IV, cease activity between 1 p.m. PDT (Pacific Daylight Saving Time) and sunset each day	Until after the fire danger class falls to DGR III for 2 consecutive days, or falls below DGR III
V (extreme)	Cease activity between 1 p.m. PDT (Pacific Daylight Saving Time) and sunset each day and maintain a fire watcher after work for a minimum of 2 hours	Until after the fire danger class falls below DGR IV for 2 or more consecutive days
	After 3 consecutive days of DGR V, cease activity all day	Until after the danger class falls below DGR V for 3 or more consecutive days, or falls below DGR IV

Access Planning

An emergency response access strategy (May 2016) has been developed for Area 6. This document provides an explanation and discussion of the various routes planned for accessing the subdivision. It also specifies road design requirements as it relates to an Emergency Response Strategy (ERS).

As part of the ERS, BPP has committed to maintaining secondary access from the end of each of the cul-de-sac roads. The northern road will connect to the Fern Fire Access road while the south road will connect south west to the Upper Mountain path which will be constructed immediately north of Cypress Bowl Road. Fern Access road will be upgraded and maintained to provide access for suppression resources as needed and to be used for evacuation if necessary.

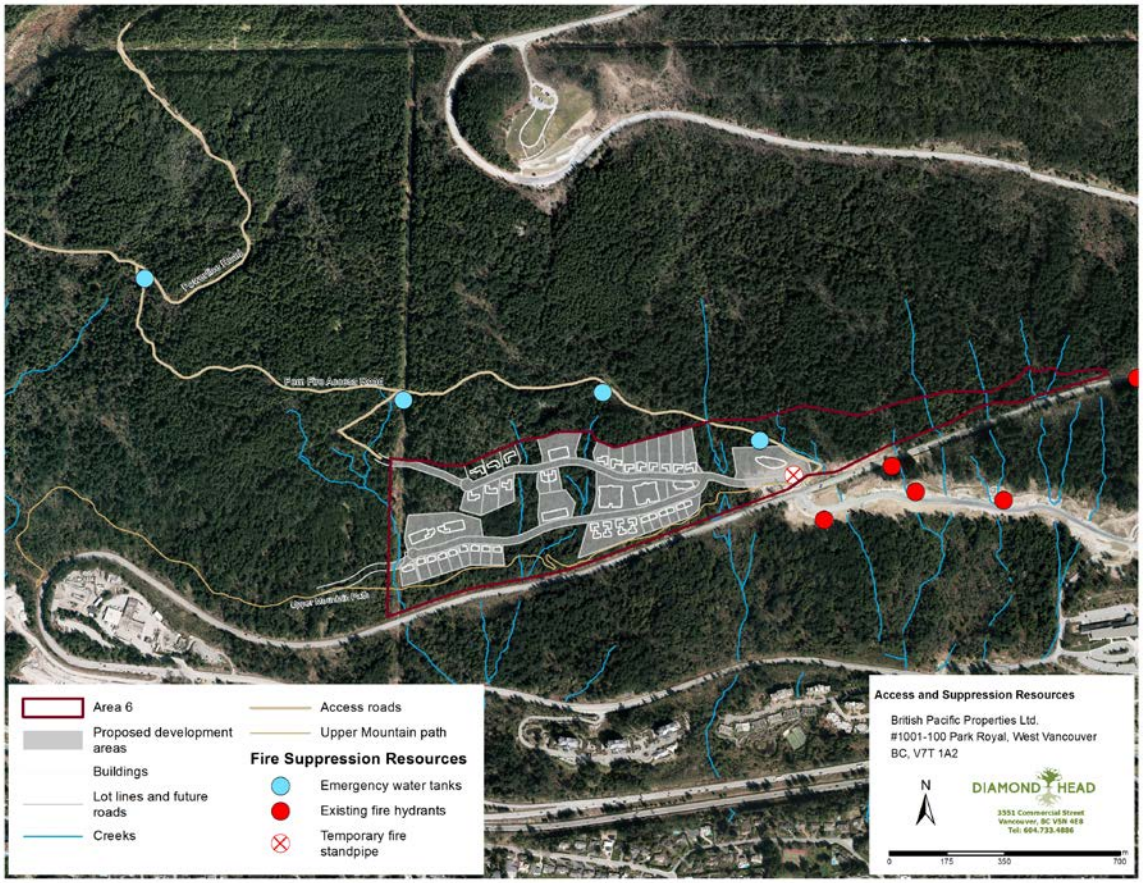

Figure 5. Access for Emergency Response and Water Availability

6.3 Fuel Hazard Mitigation in Adjacent Forested Areas

The FireSmart Program outlines three priority areas when mitigating fuels adjacent to structures. General recommendations for the creation and maintenance of FireSmart zones 1 and 2 are provided. Recommended objectives of these strategies that will reduce wildfire threat include:

- Reduce surface fuels;
- Increase the height to the base of tree crowns;
- Increase spacing between tree crowns; and,
- Promote fire-resistant deciduous trees.

Priority zone 1 is within 10m of any structures. The goal in this zone is to remove hazardous fuels and convert vegetation to fire resistance species to produce an environment that does not support combustion. Priority zone 2 is from 10 to 30m from any structures. These areas are found mostly within the proposed park areas. These areas support sensitive environmental conditions and fuel treatments must be prescribed in a sensitive manner. The goal in this zone is to reduce flammable vegetation through thinning, pruning and clean-up of ground fuels to produce an environment that will only support low-intensity surface fires.

Priority zone 3 includes the natural areas between 30 and 100m from structures. Due to the moderate wildfire risk to the site from fuels at this distance, and due to the complexities of environmental sensitivities treatments in this area have not generally been recommended.

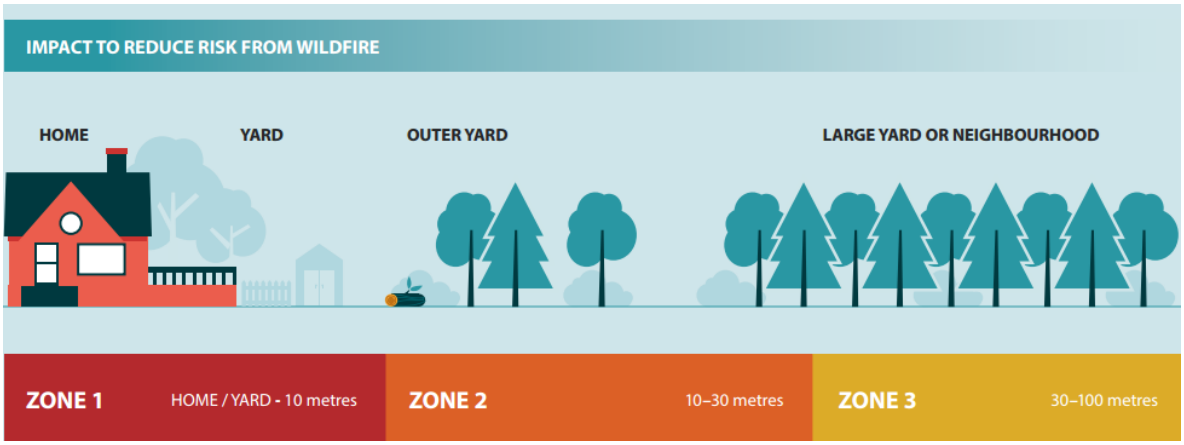

Figure 6. FireSmart Priority Zones defined in the FireSmart Homeowners Manual (Partners in Protection and Province of BC, 2016).

Recommendations for Zone 1 – Within 10m of buildings

- While considering environmental sensitivities, create as large a fuel free zone as possible and reduce the fire behavior potential of the forest areas that are retained.
- Overmature, dead, and dying trees with the potential to ignite and carry fire should be removed.
- All conifer trees should be removed.
- Remove all ground fuel accumulations;
- Grass should be kept mowed to 10 cm or less and watered regularly during the summer months.
- Remove all highly flammable vegetation and other combustibles from around the buildings.
- No conifer trees or shrubs should be planted within 10 m of structures.
- Litter should be removed regularly and prior to the fire season
- If including trees and shrubs in landscaping, select deciduous, fire resistant species. Ensure that vegetation will not grow to touch or overhang buildings.
- No vegetation should be placed within 10 m of glazed openings unless there are solid shutters to
- Irrigation sprinklers should be installed in landscaping

Recommendations for Zone 2 – 10m to 30 of buildings

- Conifer trees within the sub-canopy layer and understory (generally shorter than ~10m) should be removed. These are conifers that have lower branches to the ground and would act as ladder fuels to overhead conifer trees.
- Overstory conifer crown separation should generally target a spacing of 3 to 6 m, however, in natural areas the target should be refined by the prescribing forester based on site ecology.
- Canopy heights of retained overstory conifers should be pruned to a minimum height of 4 m.
- Overmature, dead, and dying trees with the potential to ignite and carry fire should be removed.
- Grass should be kept mowed to 10 cm or less and watered regularly during the summer months in landscaped areas.
- Deciduous composition in the overstory should be promoted and no thinning of live deciduous trees is necessary.
- Woody debris and downed trees should be removed. Low densities of woody debris should be retained at greater than 0.5 kg/m2 and less than 3 kg/m2. Larger decayed logs do not pose a significant wildfire risk and should be retained for ecological value;
- Dispose of all slash created by treatments off-site, or chip and retain onsite, or scatter on-site. Chips should not be a left onsite at a depth of greater than 10 cm. Low densities of woody debris should be retained at greater than 0.5 kg/m2 and less than 3 kg/m2.
- Any local accumulations of woody material should be removed from the site or scattered so that they are discontinuous. Larger decayed logs do not pose a significant wildfire risk and should be retained for ecological value.

- No roots are to be disturbed and tree removal should be done in a way that minimizes ground disturbance.
- This zone should be constructed by the developer and maintained by the individual property owner.
- Fuel treatment areas should be delineated, prescribed and supervised by a Professional Forester or Biologist.

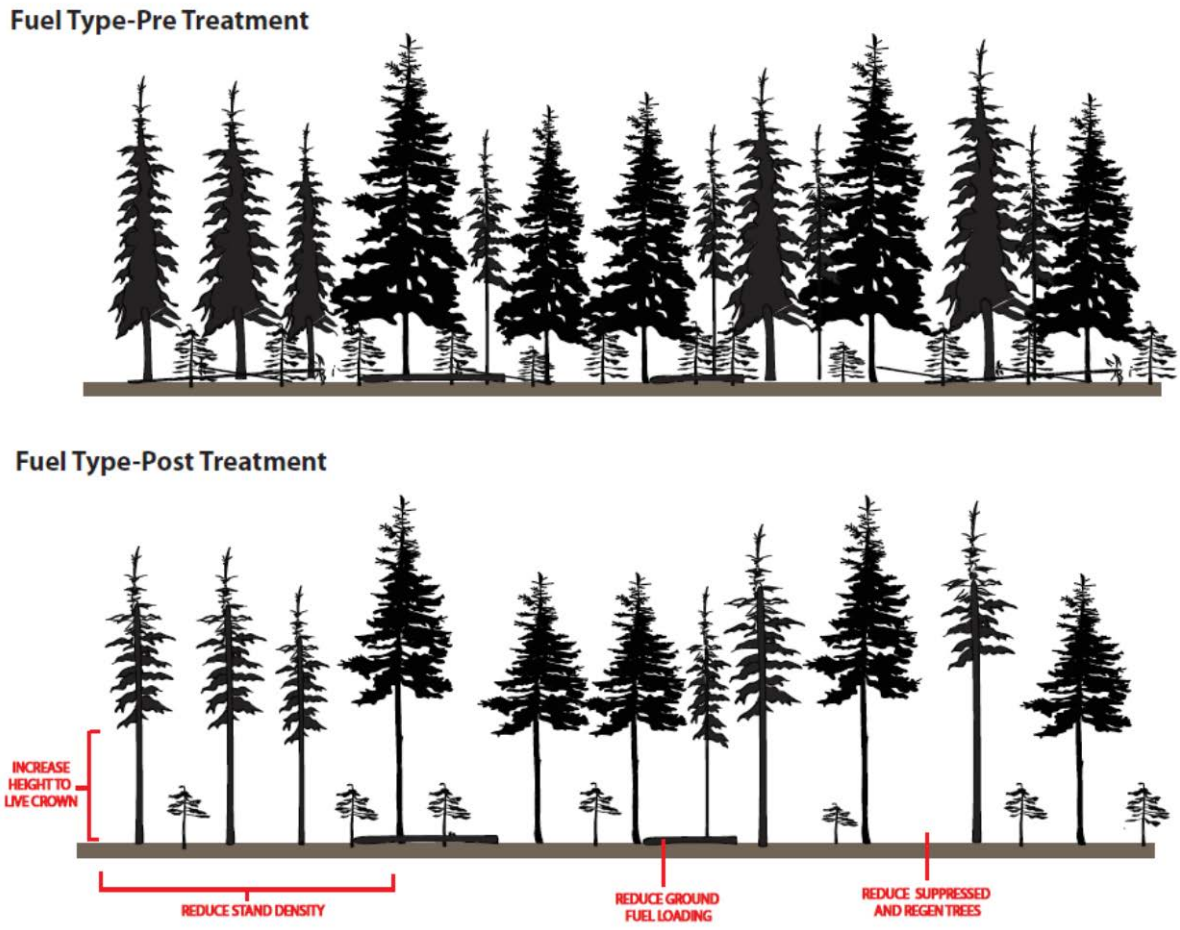

Figure 7. Illustration of fuel treatment outcomes sought to reduce horizontal and vertical fuel continuity in Priority Zones 1 and 2 with conifer fuel types.

6.4 Ongoing Maintenance

To ensure that FireSmart standards are maintained, periodic re-treatment or maintenance is recommended. These include:

- Regularly remove debris from roofs, gutters and beneath decks.
- Grass and landscaping should be kept mowed to 10 cm or less and watered regularly during the summer months.
- Landscape sprinkler systems should be installed and maintained by the homeowner.
- Remove any local accumulations of woody or combustible material (e.g., no woodpile or yard waste accumulations).
- Remove any over mature, dead or dying shrubs and trees.
- Plant only fire resistant trees and shrubs. A list of fire resistant plants and trees can be found at the fire smart canada website

7 Final Remarks

Planners, engineers, and landscape architects should refer to both this report and the BC FireSmart Manual during the design phase of this development. Once the subdivision layout has been finalized with the locations of structures to be built, fuel treatments should be identified in the field and carried out prior to any construction. It is recommended that fuel treatments be supervised by a qualified professional.

All construction operations should be conducted according to the Wildfire Act and the regulations. Following these regulations will help reduce liability and protect the development as an investment. Periodic inspections should be conducted during the fire season to ensure that the Act and associated regulations are being adhered to.

If the recommendations made within this report are followed, wildfire risk to life and property will be substantially reduced and the development will approach FireSmart standards to a reasonable extent within the limitations of zoning and ownership. However, the implementation of these measures does not guarantee that the site or structures are safe from wildfire, only that the risk level of the site is within acceptable standards and that fire hazards have been identified and appropriate mitigation measures taken. If there are any questions or concerns as to the contents of this report, please contact us at any time.

Sincerely,

Mike Coulthard, R.P.Bio., R.P.F.
Senior Forester, Biologist
Certified Tree Risk Assessor (46)

8 Appendix A – Fuel Descriptions

The following are stand profiles that are representative of the fuel types found around this project.

Fuel Type C5

	Dominant Trees	Co-Dominant Trees	Intermediate/Suppressed Trees
Species[1] (% by volume)	Fd100%	Fd60% Cw30%Hw10%	Cw50%Hw30% Fd20%
Density (stems/ha)	25	350	25
Tree Diameter at Breast Height (cm)	70	50	15
Tree Height (m)	45	35	8
Height to Live Crown (m)	20	15	2
Crown closure (%)	65		

[1] Species codes: Act (black cottonwood), Cw (western redcedar), Hw (western hemlock), Fd (Douglas-fir), Dr (red alder), Mb (bigleaf maple), Pr (bitter cherry), Ep (paper birch)

Fuel Type C2

	Dominant Trees	Co-Dominant Trees	Intermediate/ Suppressed Trees
Species[1] (% by volume)	Hw60% Cw40%	Cw60% Hw20%Dr20%	Cw100%
Density (stems/ha)	50	500	200
Tree Diameter at Breast Height (cm)	50	35	10
Tree Height (m)	32	25	8
Height to Live Crown (m)	7	4	2
Crown closure (%)	75		

[1] Species codes: Act (black cottonwood), Cw (western redcedar), Hw (western hemlock), Fd (Douglas-fir), Dr (red alder), Mb (bigleaf maple), Pr (bitter cherry), Ep (paper birch)

Plot 9 – Fuel Type M2

	Dominant Trees	Co-Dominant Trees	Intermediate/ Suppressed Trees
Species[1] (% by volume)	Fd100%	Dr40% Cw30%Hw10% Mb10%Fd10%	Cw50% Dr20% Hw30%
Density (stems/ha)	10	300	50
Tree Diameter at Breast Height (cm)	70	40	15
Tree Height (m)	45	25	10
Height to Live Crown (m)	20	15	5
Crown closure (%)	40		

[1] Species codes: Act (black cottonwood), Cw (western redcedar), Hw (western hemlock), Fd (Douglas-fir), Dr (red alder), Mb (bigleaf maple), Pr (bitter cherry), Ep (paper birch)

Plot 10 – Fuel Type D1

	Dominant Trees	Co-Dominant Trees	Intermediate/ Suppressed Trees
Species[1] (% by volume)	Hw40%Cw40%Fd10%	Dr90% Cw10%	Cw60% Hw40%
Density (stems/ha)	25	400	50
Tree Diameter at Breast Height (cm)	60	30	15
Tree Height (m)	35	25	5
Height to Live Crown (m)	9	15	1
Crown closure (%)	60		

[1] Species codes: Act (black cottonwood), Cw (western redcedar), Hw (western hemlock), Fd (Douglas-fir), Dr (red alder), Mb (bigleaf maple), Pr (bitter cherry), Ep (paper birch)

Appendix B – Description of Terminology

Co-dominant Trees
Defines trees with crowns forming the general level of the main canopy in even-aged groups of trees, receiving full light from above and partial light from the sides.

Crown Closure
An assessment of the degree to which the crowns of trees are nearing general contact with one another. The percentage of the ground surface that would be considered by a downward vertical projection of foliage in the crowns of trees.

Diameter at Breast Height
The diameter of a tree measured at 1.3m above the point of germination.

Dominant Trees
Defines trees with crowns extending above the general level of the main canopy of even-aged groups of trees, receiving full light from above and comparatively little from the sides.

Intermediate Trees
Defines trees with crowns extending into the lower portion of the main canopy of even-aged groups of trees, but shorter in height than the co-dominants. These receive little direct light from above and none from the sides, and usually have small crowns that are crowded on the sides.

Live Crown Ratio
Is the percentage of the total stem length covered with living branches. It provides a rough but convenient index of the ability of a tree's crown to nourish the remaining part of the tree. Trees with less than 30 percent live crown ratio are typically weak, lack vigor, and have low diameter growth, although this depends very much on the tree's age and species.

Open Grown
Defines trees with crowns receiving full light from all sides due to the openness of the canopy.

Stems Per Hectare
The number or size of a population (trees) in relation to some unit of space (one hectare). It is measured as the amount of tree biomass per unit area of land.

Suppressed Trees
Defines trees with entirely below the general level of the canopy of even-aged groups of trees, receiving no direct light either from above or from the sides.

Tree Species Codes
Fd – Douglas-fir (*Pseudotsuga menziesii*)
Hw – Western hemlock (*Tsuga heterophylla*)

Cw – Western redcedar (*Thuja plicata*)
Dr – Alder (*Alnus rubra*)
Ac – Black cottonwood (*Populus balsamifera* ssp*. trichocarpa*)
Ep – Paper birch (*Betula papyrifera)*
Pw – Western white pine (*Pinus monticola*)
Pr - Bitter cherry (*Prunus emarginata*)

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