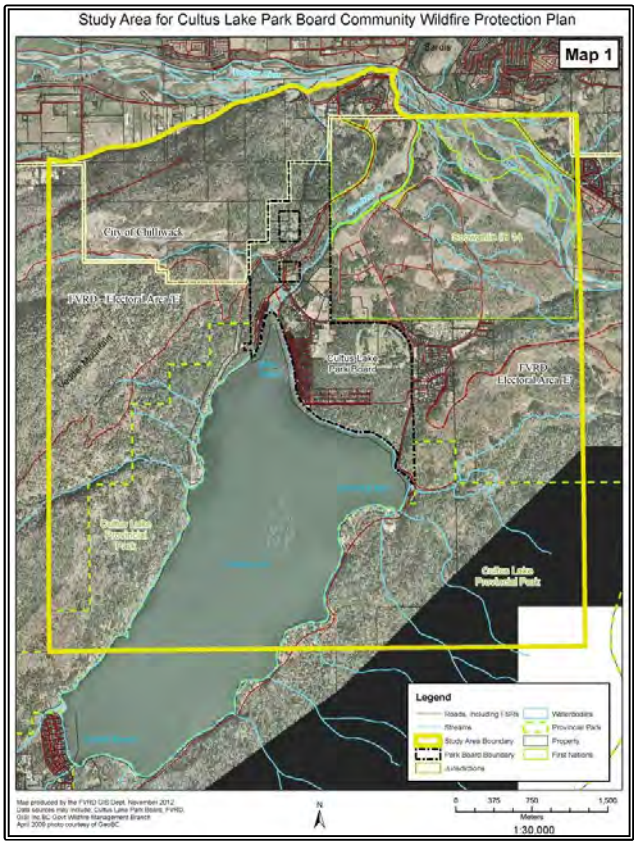
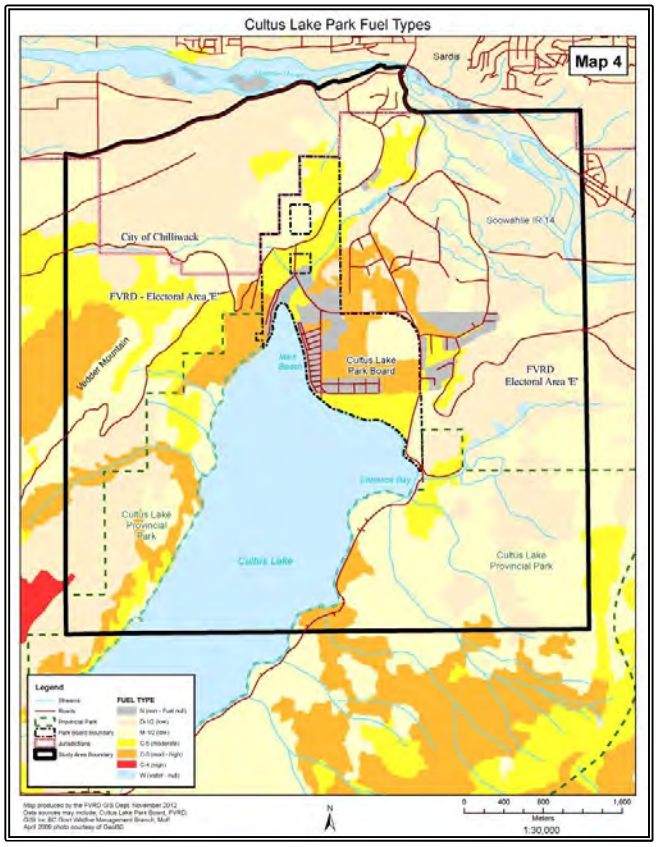




Cultus Lake Park

Community Wildfire Protection Plan

February 2013

FIRE LINE
CONSULTING · INSTRUCTION

Table of Contents

LIST OF FIGURES

LIST OF MAPS

LIST OF TABLES

Acknowledgements

We wish to extend our thanks to the staff of Cultus Lake Park including:

-Chief Administrative Officer - Ronald Campbell

-Manager Community Services - David Stelmack

-Fire Chief - Warren Mazuren

Many thanks also to:

-Shannon Sigurdson - GIS Supervisor Fraser Valley Regional District,

-Rick Kimmerly – Forest Protection Officer - Fraser Fire Zone - BC Ministry of Forests and Range

…for their kind assistance and guidance in the completion of this CWPP.

Section 1.0: Executive Summary

1.1.1 Background

In October of 2011, Fireline Consulting was engaged to assist Cultus Lake Park (CLP) in developing a Community Wildfire Protection Plan (CWPP) in consultation with CLP staff. The CWPP project is jointly funded by CLP and the Union of B.C. Municipalities.

1.1.2 Project Scope: The purpose of this project is to:

i) conduct a detailed assessment and mapping of the hazard, defining the risk from wildland urban interface (WUI) fire to Cultus Lake Park,

ii) recommend mitigation activities necessary to improve community safety, and;

iii) use the assessment data and recommended mitigations to develop a comprehensive 'Community Wildfire Protection Plan' for Cultus Lake Park.

1.1.3 CWPP Overview: The CWPP planning process reviews the following items:

Section 2: Community Profile – a general overview of the community, infrastructure and previous wildfire related projects.

Section 3: Wildland/Urban Interface Issues – FireSmart Solutions – Full background information on WUI issues, structural ignition factors, WUI fire suppression challenges, community impacts and responsibilities, FireSmart principles and guidelines with respect to structure protection and vegetation management.

Section 4: Fire Environment – a discussion of the 3 fire environment factors – weather, terrain and fuels. Weather analysis in terms of high fire danger class days, wind patterns, historic ignitions and terrain is provided. Forest fuels are reviewed with respect to standard fuel types, biogeoclimatic zones and natural disturbance units. A fuel management overview and strategy is provided in this section.

Section 5: Wildfire Risk Reduction Recommendations – a full range of wildfire prevention, preparedness and response, legislative and fuel treatment issues were investigated with a variety of initiatives proposed to mitigate potential wildfire impacts on CLP. Five key areas where changes can be made to address community wildfire risk are identified:

1) Wildfire Prevention
2) Wildfire Preparedness
3) Wildfire Response
4) Legislation
5) Fuel Treatment

Wildfires in the CLP area are infrequent (averaging 2/year since 1980) and small (<0.2 ha average size). However the community is subject to periods of hot dry weather (averaging 23 and up to 53 high fire dangers days per year) and ignition potential is increasing with settlement and recreational use trends. Reducing wildfire ignitions through the use of targeted WUI fire prevention materials and public education initiatives is an effective way of safeguarding the community.

Wildfire preparedness is a concern for the Cultus Lake community which remains a busy tourist and recreational destination during the summer season. Methodologies to monitor and communicate information on local wildfire danger levels or activity are provided. These are important considerations and assist the community in dealing efficiently with wildfire related issues as they arise.

Service infrastructure must continue to operate and be adequately protected during an interface fire. Most critical infrastructure buildings in CLP are structurally FireSmart but require additional fuel treatment to comply with FireSmart vegetation management guidelines.

Residential, commercial and institutional infrastructure and structures vary in compliance with FireSmart guidelines. Some advantages are provided by roadway design with respect to the community interface with adjacent forested areas. Many of the structures in the core CLP residential areas do not comply with FireSmart guidelines with respect to structural options. Structural density is high and the community is thus more vulnerable to an urban conflagration. Compliance with all FireSmart recommended guidelines is recommended. Improving setbacks, landscaping choices, and building materials to build a more FireSmart community is a long-term process that will realize significant risk reduction benefits as the housing inventory changes over time.

Wildfire evacuation planning is in place and has been exercised with regular plan review/updating recommended. The fire department is well resourced and trained although recommendations for additional wildfire training and equipment/water supply upgrades are provided.

Local government can reduce the potential for interface fire disasters and wildfire damage through both public education and the use of legislative tools. Community leaders must continue to support 'FireSmart community' public education initiatives as well as seeking opportunities to mitigate interface fire hazard through the use of FireSmart planning guidelines backed with legislative authority. The adoption of development permit areas and bylaws is occurring across the province to push this change. A full review of CLP bylaws was undertaken with recommendations for improvements to wildfire risk mitigation legislation provided.

Fuel treatment can be an effective method of preventing high intensity wildfire from developing and for reducing destructive wildfire behavior. Fire risk assessments in the CLP study area were conducted using the provincial Wildfire Threat Rating worksheet – the 45 plots surveyed had either moderate or low risk ratings.

Cultus Lake Park is situated within an encircling network of fuel types that range from higher hazard fuel types such as continuous coniferous to lower hazard fuel types such as deciduous, mixed / open fuel types, non-fuel types and fuel modified areas. An assessment of existing and proposed landscape fuelbreak units is provided. Fuelbreaks are only one component of a multi-faceted fire protection strategy.

FireSmart fuel management guidelines recommend that fuel treatments be applied first to those fuels adjacent values at risk. Significant wildfire hazard mitigation can be realized by the application of site level fuel treatments adjacent specific structures or structure groups in the CLP study area. CLP's overarching fuel treatment program will need to merge any fuelbreak strategy with other strategic initiatives such as site level fuel treatments, FireSmart modifications to structures and implementation of wildfire prevention, preparedness and response recommendations.

It is recognized that CLP has limited resources to implement these recommendations. The recommendations are all significant and many can be implemented with little direct cost to CLP. Given the reality that not all recommendations will be acted on, CLP should review the recommendations and address the ones that are within their resources to act on. To address the remaining recommendations, CLP should put together a plan that identifies the resources required and develop an implementation timeline.

1.1.4 Recommendation Summaries

While there are no strategies providing fail safe wildfire protection to municipal areas located in forested areas - the FireSmart recommended guidelines are the current national standard and provide an established and reasonable benchmark based primarily on National Fire Protection Association standards that are published as a code: NFPA 1144 - Standard for Protection of Life and Property from Wildfire.

The FireSmart program manual 'FireSmart – Protecting Your Community from Wildfire' (Partners in Protection – July 2003) was referenced extensively in the development of the CLP CWPP.

Wildfire protection of interface values at risk located adjacent forested areas is attained through compliance with FireSmart recommended guidelines in the categories of vegetation (fuel) management, structural and infrastructural design, installation or modification. Effective wildfire protection also requires strong fire prevention, preparedness and response planning.

In total, 32 recommendations were developed for implementation by CLP.

Section 5.0: Wildfire Risk Reduction Recommendation Summary

1. Wildfire Prevention

Recommendation 5.1.1.1 CLP fire officials should seek to develop and distribute targeted WUI fire prevention materials at CLP recreational facilities (sites where human caused fire ignitions are likely to occur.) Water Park, recreational trail and golf course users are a prime audience for delivery of fire prevention messages.

Recommendation 5.1.2.1 CLP planning and fire officials should commit to provision of regularly scheduled public education presentations augmented with additional presentation series following periods of heavy wildfire activity. One methodology would be to establish different target groups – schools, residents and business leaders – and ensure each group received a customized presentation on a multi-year rotation basis.

Recommendation 5.1.2.2 CLP planning and fire officials should work to develop a CLP specific Powerpoint presentation product. Developed in consultation with interface fire protection specialists, the presentation would address FireSmart structural fire protection issues - 'Understanding Structural Ignitions'- why structures ignite during wildland interface fire events with an overview coverage of the three part FireSmart mitigation strategy (vegetation management, structural options and infrastructural modifications) specific to the CLP area.

Recommendation 5.1.2.3 CLP planning and fire officials should work in consultation with both interface fire protection, planning and media development specialists to develop CLP wildland urban interface specific fire prevention messages for use with CLP website, public education displays, fire danger signs and FireSmart demonstration properties.

Recommendation 5.1.2.4 CLP should develop an ancillary wildfire prevention program for use during periods of high fire danger (when provincial fire bans or fire advisories are in place for the CLP area). Such restrictions would be determined by an appointed staff representative via consultation with the BC Ministry of Forests and Range - Wildfire Management Branch website which features a 'Fire Prohibitions'
link - http://bcwildfire.ca/hprScripts/WildfireNews/Bans.asp

2. Wildfire Preparedness

Recommendation 5.2.1.1 During periods of high wildfire activity in the CLP area - CLP should monitor (via appointed staff representative) the BC Ministry of Forests and Range - Wildfire Management Branch website which features a 'Current Wildfire Situation' link - http://bcwildfire.ca/Situation/ providing details on any active wildfires in the CLP area. The CLP staff representative should contact the Wildfire Management Branch - Coastal Fire Centre fire management staff for the latest information on any fires adjacent to or affecting CLP.

Recommendation 5.2.1.2 In the event that significant wildfire activity is occurring in the CLP area, a 'Daily Wildfire Update' should be provided by an appointed CLP Media / Communications person. Wildfire updates should be accessible on the CLP website and available to assist all front line service staff in providing responses to resident and visitor inquiries regarding wildfire activity.

Recommendation 5.2.2.1 CLP fire officials should ensure FireSmart recommended guidelines for critical electrical infrastructure hazard reduction are followed to reduce vulnerability of electrical lines to wildfire. CLP fire officials should meet with BC Hydro officials to discuss powerline right of way vegetation clearing procedures and standards along the Columbia Valley Road / highway access route to CLP.

Recommendation 5.2.2.2 CLP fire officials should ensure FireSmart recommended guidelines for vegetation management are applied to all CLP water supply structures.

Recommendation 5.2.2.3 CLP fire officials should ensure FireSmart recommended guidelines for vegetation management and structural modifications are applied to all CLP sewage structures.

Recommendation 5.2.2.4 CLP fire officials should ensure FireSmart recommended guidelines for vegetation management and structural modifications are applied to all CLP communications structures. CLP fire officials should meet with communications officials to discuss FireSmart guideline compliance at communication structures.

Recommendation 5.2.2.5 CLP fire officials should ensure FireSmart recommended guidelines for vegetation management, structural and infrastructural modifications are applied to all CLP structures and infrastructure.

Recommendation 5.2.3.1 A written wildfire evacuation procedure should be included as part of the CLP Emergency Response Plan – a component of the CLP Emergency Program. CLP fire and emergency response officials should meet with BC Ministry of Forests and Range Wildfire Management Branch, BC Parks, Provincial Emergency Program (PEP) and Regional District emergency planning representatives to review and update the wildfire evacuation plan on a regular basis.

The CLP wildfire evacuation procedure should:

-Identify primary or secondary evacuation routes for all areas of CLP;

-Identify reception centre, marshalling points, safe zones;

-Identify all resources required to implement the evacuation plan;

-Develop a communications – public awareness strategy to inform the public.

Recommendation 5.2.4.1 CLP planning officials should develop post-wildfire rehabilitation plans that address the full range of rehabilitation activities that may be required on a large burn area (500 – 4,000 ha's). Initially, rehabilitation work will focus on stabilization of slopes and protection of infrastructure.

Recommendation 5.2.4.2 CLP planning officials should prepare a list of contractors that are qualified and capable of providing post-wildfire assessments and emergency stabilization/rehabilitation of damaged areas.

3. Wildfire Response

Recommendation 5.3.1.1 CLP fire and emergency response officials should review wildfire reporting and initial response procedures with BC Ministry of Forests and Range - Wildfire Management Branch - Fraser Fire Zone representatives annually.

Recommendation 5.3.2.1 All CLPVFD members should be provided with a basic wildland fire suppression training course on an annual basis. CLPVFD members should also be provided with interface fire operations and Incident Command System training with reviews provided on an annual basis.

Recommendation 5.3.3.1 Additional wildfire suppression equipment would improve CLPVFD wildfire suppression effectiveness. The following items should be purchased:

-pressure pump (Wildfire Striker II Plus, Wildfire Ultra-Striker or Wildfire Mark 3) complete (suction hose, fuel can, tool kit with valves + nozzles etc.);

-volume pump (Honda WH30X or equivalent) complete (suction hose, fuel can, tool kit with valves + nozzles etc.);

-1,000’ x 1 ½” wildland lined fire hose lengths;

-500' x ¾" econoflow hose lengths;

-sufficient quantity of wildland personal protective equipment to outfit 20 firefighters with Nomex coveralls, helmets, wildland boots, gloves, goggles, ear protection.

Recommendation 5.3.3.2 CLPVFD should purchase a basic structural sprinkler protection system. A basic sprinkler kit package would include sufficient equipment (sprinkler heads, hoses, valves and adapters, mounting poles and brackets) to provide rooftop sprinklers for 10 - 15 structures and Priority Zone 1 and 2 sprinkler coverage for 250 metres of sprinkler line. CLPVFD members should be trained and exercise in the rapid assembly and activation of the sprinkler system.

Recommendation 5.3.3.3 CLP fire and emergency response officials should conduct a needs analysis and assess options for acquiring a CLVFD fire/rescue boat. The boat if equipped with adequate pumping capability and other equipment would provide significant advantage to Fire Dept. response effectiveness during responses to structure or wildland fires adjacent the lakeshore.

Recommendation 5.3.4.1 CLPVFD fire officials should commence a formal tactical response planning process for all foreseeable wildfire tactical response situations. Tactical response access as well as resource and water requirements for both planned sprinkler systems and tactical engine needs should be included in the tactical response plan. This process should include an evaluation of requirements for dry hydrant, engine accessible reservoir or gravity standpipe installations for use during a wildland fire response.

Recommendation 5.3.4.2 CLPVFD fire officials should work with CLP Works personnel to ensure adequate hydrant water supply in all foreseeable wildfire tactical response situations. Exercises to test the effectiveness of emergency firefighting water supplies during wildfire tactical response are recommended.

4. Legislation

Recommendation 5.4.1.1 Cultus Lake Park planning and fire officials should ensure that guidelines for development permit issuance in any Development Permit Area – Wildfire Hazard Area require that all new development or addition/retrofitting to existing structures takes place in accordance with FireSmart recommended guidelines applying to vegetation management, structural design and construction and infrastructural design or modification.

Recommendation 5.4.2.1 Cultus Lake Park planning and fire officials should consider opportunities to ensure that any regulatory approach to wildfire risk mitigation be coordinated with neighbouring jurisdictions.

Recommendation 5.4.3.1 Cultus Lake Park planning and fire officials should review and compare both existing CLP bylaws and examples of successful interface fire legislation in consultation with an interface fire protection specialist. Development of viable interface fire legislation may be most effectively facilitated by implementing an Official Community Plan or equivalent legislative vehicle with a Development Permit section that incorporates a schedule designated Development Permit Area – Wildfire Hazard Area.

5. Fuel Treatment

Recommendation 5.5.3 CLP should commence an area specific fuel treatment program (implemented over 5 years on a priority basis) that targets progressive fuel reduction in higher hazard fuel type areas identified by the CWPP planning process (section 5.5.4 – Existing and Proposed Landscape Fuelbreak Units and section 5.5.6 – CLP Hazard Reduction Fuel Treatments). The goal of fuel treatment is to reduce both crown and surface fire potential in priority areas. Fuel treatment programs will require that fuel treatment plans and site specific prescriptions be developed in consultation with qualified interface fire protection professionals.

Recommendation 5.5.4.1: CLP fire officials should meet with BC Ministry of Forests, Lands & Natural Resource Operations officials to request the opportunity to provide input on all harvesting plans proposed in the vicinity of CLP.

Recommendation 5.5.4.2: CLP should meet with BC Ministry of Transportation & Highway officials to discuss highway right of way vegetation clearing procedures and standards along those sections of highway adjacent CLP that could function as a strategic fuel break.

Recommendation 5.5.4.3: CLP should develop vegetation clearing procedures and standards for recreational trail maintenance in areas identified as strategic fuelbreaks – thinning with understory fuels removed over a 5m area on each side of the trail is proposed. Use of trails to facilitate access by fire suppression crews should also be considered in the development of any trail maintenance standard.

Recommendation 5.5.4.4: CLP should meet with BC Hydro officials to discuss powerline right of way vegetation clearing procedures and standards along those sections of transmission or distribution line that could function as a fuel break. CLP should work with utility companies to establish critical electrical infrastructure hazard reduction guidelines and cooperative arrangements for maintenance of low wildfire hazard conditions on and adjacent transmission or distribution line right of ways.

Recommendation 5.5.5.1 CLP should commit to performing required maintenance on fuel treated areas within its jurisdiction. CLP should implement a program to encourage residents to maintain leasehold properties in compliance with FireSmart vegetation management guidelines. Implementation of an ancillary program to assist residents in disposing of vegetative yard debris safely is also recommended. Cooperative arrangements in support of required maintenance should also be considered for fuel treated areas outside CLP jurisdiction.

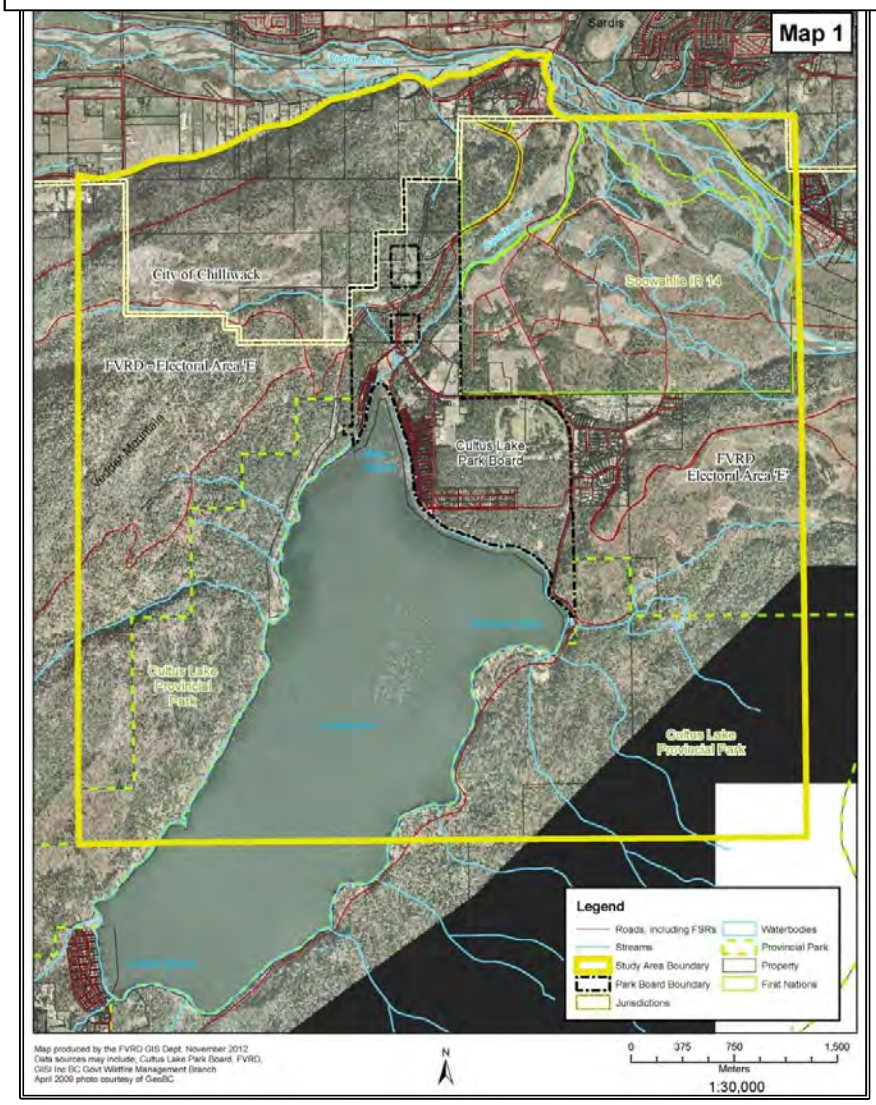
Section 2.0 Community Profile

2.1 The Community

Cultus Lake Park (CLP) is located in the Fraser Valley on the Columbia Valley Road at the north end of Cultus Lake approx. 3.5 km's south of the Vedder River. CLP is located approximately 10 km's south of the City of Chilliwack and 23 km's east of the City of Abbotsford. The study area for the CLP CWPP includes a 2 kilometre buffer around the community.

Cultus Lake is the source of the Sweltzer River. Cultus Lake itself is warm, and the area has become a popular tourist recreation destination with ample opportunities for fishing, water skiing, wind surfing, and hiking. Cultus Lake Park is distributed on both the west and east shorelines at the north end of Cultus Lake with over 465 full time residences, 21 commercial businesses, and Sunnyside campground with 586 camp sites.

Map 1: Study area for the Cultus Lake Park Community Wildfire Protection Plan



2.1.2 Population & Settlement

Cultus Lake Park has a summer population of approx. 2,500 persons – winter 1,000 persons. Situated near Cultus Lake Provincial Park - tourism has been an important economic driver for the community.

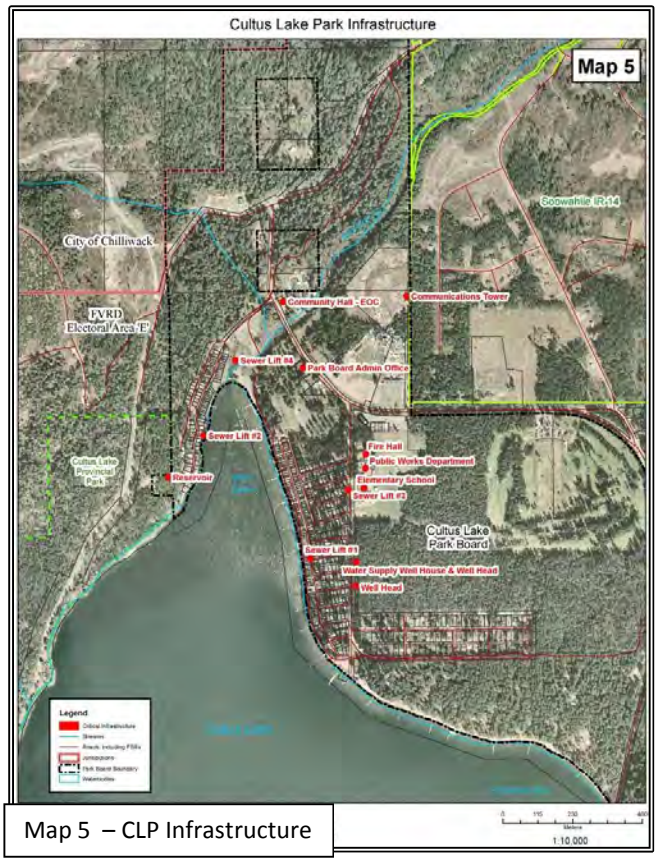
Many of the jobs in the community are in the industries of accommodation and food services or retail trade.

2.1.3 Infrastructure

Table 2-1: Key Infrastructure in the Cultus Lake Park CWPP Area

Facility	
CLP Admin Park Office – Park Patrol HQ	Reservoir
Works Dept shop and office	Sewage Treatment
Firehall	Community Hall – EOC
Elementary School	BC Hydro – transmission lines
Water Intake	Helipad - schoolyard
Water Treatment	Transfer Station

Key infrastructure that may be involved during emergency response to a wildfire.



Map 5 – CLP Infrastructure

Protection of infrastructure during a wildfire event is important to ensure that emergency response is as effective as possible.

Key infrastructure in CLP is located in the core downtown area which helps to ensure access and egress (to important infrastructure) and provides some protection from a fire.

Figure 2-1 – Roadside Electrical Infrastructure

2.1.4 Electrical Infrastructure

BC Hydro transmission and distribution lines are located on the Columbia Valley Road / highway access route to CLP and supply CLP with electrical power. Transformers and telecommunications lines are also located on the pole infrastructure. The pole infrastructure is predominantly wooden poles – the location of the lines - often adjacent forests vulnerable to wildfire and tree strikes on the conductors – is problematic.

There are no backup diesel generators for power in the event of power outage.

2.1.5 Water Infrastructure

A piped aquifer is the sole source of water for CLP. A 100,000 IG (Imperial gallon) reservoir is located between the south end of Monroe Ave and Parmenter Road. The reservoir is supplied by an intake pumping station located at the CLP water supply well house (located at Sunnyside Ave. and Cedar Ave.) with two independent well heads located on Sunnyside Ave in concrete pumphouses with backup diesel generator power supply. One well head is located behind the water supply well house and the other is located at Sunnyside Ave. and Alder St.

Figure 2-2b – CLP Well house

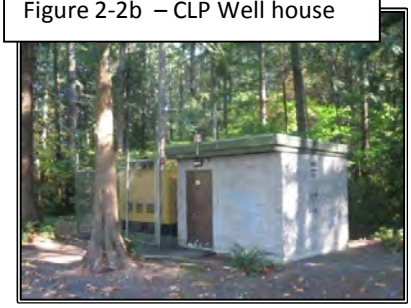


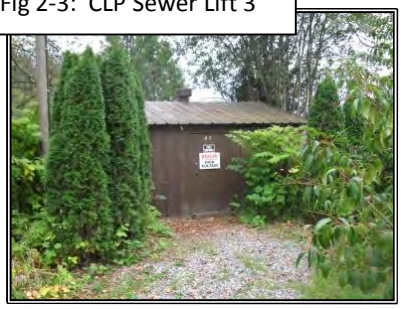
Figure 2-2a – CLP Reservoir

The CLP water supply well house is a critical infrastructure facility where CLP has installed a backup generator. The generator is vulnerable to wildfire due to proximity to forest vegetation.

2.1.6 Sewage Infrastructure

There are 4 pumping stations or sewer lifts that pump sewage to effluent fields located north of the Water Park or behind the CLP school. There are no backup diesel generators for power to the sewer lifts in the event of power outage.

Fig 2-3: CLP Sewer Lift 3



2.1.7 Communications Infrastructure

There is a telecommunications tower in the overflow parking / compostables landfill area adjacent the Cultus Lake Water Park. A Telus telecommunication sub-station is located on the east side of the Water Park adjacent Soowahlie Indian Reserve 14.

Figure 2-4 – Comm. Tower

2.1.8 Previous Wildfire Related Projects

With the exception of a minor MFNLRO Wildfire Management Branch project conducted on public lands in CLP - there have been no previous wildfire related projects in the CLP jurisdiction.
There is no community forest in the CLP jurisdiction.
CLP works crew responds to resident requests or reports and typically dedicates approximately 30 person days per year to rudimentary fuel reduction work (felling, bucking and chipping – landfilling) dead and diseased or wind felled tree stems and branches as required around CLP. Rim Tree Services is occasionally engaged and has additional capacity with a 55 foot bucket truck.

Section 3.0: Wildland/Urban Interface Issues – FireSmart Solutions

3.1 The Wildland/Urban Interface

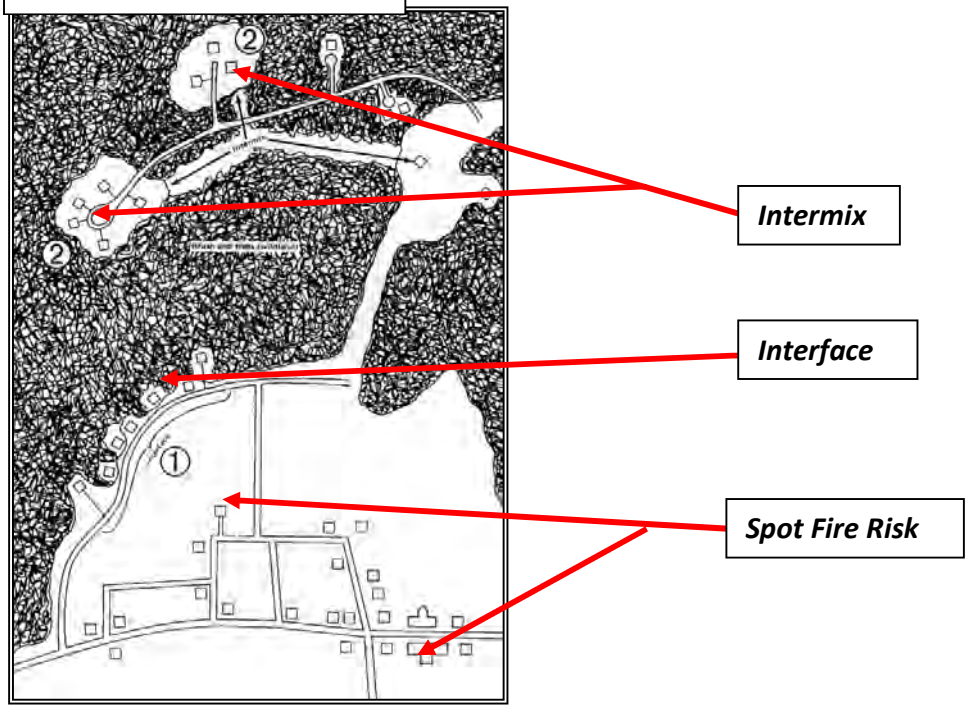
The wildland/urban interface (WUI) is defined simply as the area where the "forest meets the community" or "any area where combustible wildland fuels are found adjacent homes, farm structures and other outbuildings".

This may occur at the **interface** – where wildland fuels meet community developments at a well-defined boundary or in the **intermix** where development and wildland fuels intermingle with no clearly defined boundary. (See Figure 3-1 – Interface vs Intermix)

The wildland/urban interface fire problem stems from two different sources of fire and their impact on the community. Fires can move from wildland (forest, bush or grassland fire) areas into the community. Wildland fires spreading through communities can endanger residents and damage or destroy structures and infrastructure. Conversely, fires can move from the community (structure or infrastructure fire) into the adjacent wildlands. Fire spreading from communities can damage forests and threaten resource-based industries and parks. Even in urban areas some distance from the interface, structures can be at risk when wind carries showers of embers from wildfires and ignites structures located a long way from the actual wildfire.

In Cultus Lake Park, the likelihood of a fire spreading out of the community into the adjacent forested area is just as much of a concern as fire spreading from the forest into the community. In either fire spread scenario, community impacts can be significant and it is important for the Cultus Lake Park community to plan and prepare for interface fires.

Figure 3-1 – Interface vs Intermix

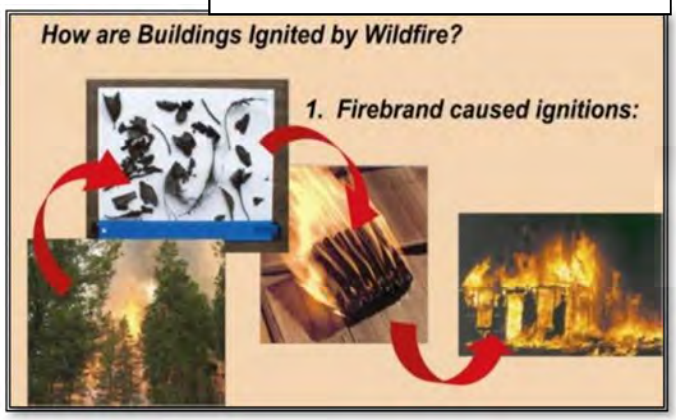


3.1.2 How are Buildings Ignited by Wildfire?

Fires spreading into the wildland/urban interface from the forest can impact community structures in two distinct ways:

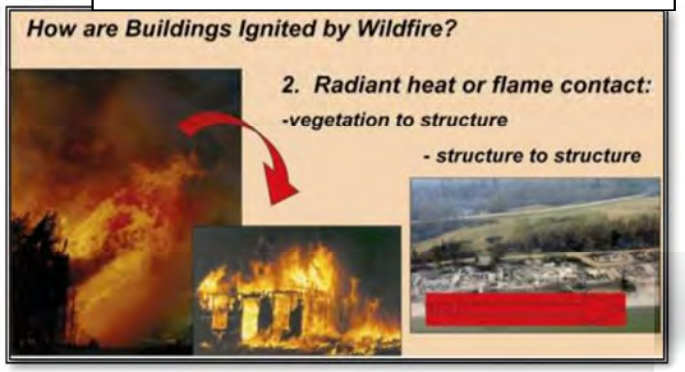
First, wildland fires produce firebrands that are lofted into the air and travel great distances, often igniting spot fires ahead of the main fire. Firebrands that land on a combustible roof will usually start a fire that will consume the building if the fire is not suppressed. The reality of firebrand-caused ignitions is that buildings located in relatively urban settings, some distance inside the community interface boundary, are still vulnerable to wildland fire.

Figure 3-2 – Firebrand Caused Ignitions



Second, direct flame contact or radiant heat can ignite vulnerable buildings. Ignitions can result from both vegetation-to-structure spread and structure-to-structure spread. Fire can ignite a vulnerable structure when the structure is in close proximity (within 10 meters of the flame) of either the flaming forest edge or a burning house.

Figure 3-3 – Radiant Heat / Flame Caused Ignitions



Structural fires also have the potential to move from a house into the adjacent forest. FireSmart principles not only address fire coming from the WUI to a structure but they also reduce the probability of a structural fire igniting the forest interface.

3.1.3 Interface Fire Suppression Challenges

Another reason buildings are so rapidly ignited during interface fires is that all available firefighting resources are often rapidly overwhelmed. Wildland/urban interface fires are complex incidents that typically involve both wildland and structural fires. They often demand a joint response by wildland and structural firefighting agencies with specialized operating procedures and tactics. Even so, unless interface stakeholders have applied FireSmart principles and standards, these fires frequently overwhelm all available firefighting resources. There are not enough engines, equipment, or firefighters to protect a large number of threatened homes at the same time.

3.1.4 Interface Fire Community Impacts

Typically, wildland/urban interface fires do tremendous damage, result in large, economic losses and have severe social impacts. Even the best case scenario involves suppression costs, loss of forest resources and some level of inconvenience.

The worst case scenario impacts a community in many ways:

-there is always the potential for death or serious injury,

-loss of or damage to homes and irreplaceable items,

-inconvenience, emotional trauma and costs of evacuating,

-site aesthetics/viewscape loss,

-water supply/slope stability affected,

Financial costs can include building and infrastructure loss or damage, business interruptions, and the cost of environmental rehabilitation, as well as the direct suppression/evacuation costs.

3.1.5 Interface Fire Risk Reduction - Community Responsibility

Solutions to the interface fire protection challenges facing Canadians are beyond the mandate or capabilities of any one agency or group. Ownership of the interface fire problem rests with interface community members. The key to resolving the problem is working together.

For successful control of interface fires, community members must work with emergency response agencies to implement solutions within the following risk reduction categories:

-Communication & education
-Community Planning
-Structure Protection
-Emergency response, training, and equipment
-Fuel management

3.2 FireSmart

FireSmart: Protecting Your Community from Wildfire[1] is a comprehensive interface fire protection manual developed by Partners in Protection. The FireSmart program has been adopted by a variety of government agencies charged with interface fire protection responsibilities.

FireSmart provides individuals and agency personnel with a structured and practical approach for assessing wildfire site and structure hazard, selecting viable solutions or mitigative approaches to reduce the hazard posed by interface fire to communities or homes.

The principal aspects and recommended guidelines for interface fire hazard mitigation are discussed in three sections - vegetation management, structural modification and infrastructural modification. A FireSmart structure or community meets or exceeds these guidelines.

3.2.1 FireSmart Structure Protection

In the interface, FireSmart buildings are the result of owners' efforts. FireSmart structure protection focuses on structural modification and vegetation management – the application of mitigative actions on the structure or on vegetation close to the structure.

Structures located in interface zones are frequently inadequate with respect to their ability to withstand an interface fire event. Structures need to be able to withstand the radiant and convective heat generated by adjacent forests during wildfires and also must be constructed to minimize the chance of ember ignitions on the structure as spot fires carried surprisingly long distances from nearby wildfires ignite structures.

Roofing

Roofs that catch fire are the main cause of building losses in the interface. The roof is the most vulnerable component of the building. It is a more-or-less horizontal surface that catches and holds much of what falls on it. Firebrands and flaming debris generated by large fires can travel great distances. Once airborne, these brands are pushed by prevailing winds or driven aloft great distances by the fire's convection column. The firebrands respect no boundaries and jump over built and natural fuel breaks to ignite spot fires.

Firebrands landing on a combustible roof surface will often start a new fire. This new fire, in turn, may produce more airborne firebrands (particularly if the roof is built of untreated wooden shakes).

Many jurisdictions have no legislation requiring the use of fire rated roofing in interface areas. Legislation fails to deal with existing combustible roofs.

[1] For further information on the FireSmart Canada see: https://www.firesmartcanada.ca/

Building Exterior – Siding Material

After the roof, siding material is the structural component most vulnerable to fire. An interface fire will produce intense heat that can result in exterior ignitions. Airborne firebrands can lodge in and against the structural exterior and are a major source of building ignitions. Building survival depends on how easily the building exterior can be ignited. Vegetation or combustibles close to the building exterior or exterior wall features that can trap accumulations of embers increase the ignition hazard to structures during a fire passage.

Any material used for siding purposes should be fire resistant such as stucco, metal siding, brick, cement shingles, concrete block, poured concrete and rock. Siding material should be at least 12 mm thick and extend from ground level to the roofline. Materials such as stucco, metal siding, brick, cement shingles, concrete block, poured concrete and rock offer superior fire resistance. Logs or heavy timbers provide a more fire-resistant building exterior than board siding. Vinyl siding may melt, exposing flammable sheathing.

Wooden siding, offers very little fire resistance yet is commonly used in interface areas. Untreated wooden shakes or tar paper used as siding material provide no fire protection and actually increase the hazard. Residents can increase the fire resistance of a wood-sided building by eliminating areas on the siding surface where sparks and embers will lodge. Exterior vertical walls should be sheathed from ground level to roof line with material that is at least 12 mm thick.

Building Exterior – Window + Door Glazing

Glass shattered by fire creates an opening in a building exterior that allows firebrands to enter the building so that it burns from the inside. Clear concentrations of fuels within 10 metres of windows and glass doors. Small or multiple-pane windows are less vulnerable to breakage than large panes. Single-pane windows fracture and collapse more easily than double or triple-pane windows. Tempered glass provides more safety than plate glass does.

Building Exterior – Eaves, Vents, and Openings

Eaves and vents are ready-made openings that can allow heat and embers to enter a building and ignite it. To prevent entry of windblown embers, eaves should be closed in with fascia + screened soffits.

Building Exterior – Balconies, Decks and Porches

Stilt construction and overhangs are often used in the assembly of decks and balconies, despite the fire danger they create by trapping heat rising along exterior siding. If vegetation, debris or stored combustibles are allowed to accumulate under the overhang, the fire danger is further increased.

Build balcony and deck surfaces of non-combustible or fire-resistant materials. Sheath in decks, balconies and undersides of overhangs with 12 mm sheathing. Use non-combustible material. Encase or build stilts of non-combustible materials. Use heavy timbers instead of 2 x 4's to increase fire resistance. Provide access to areas below slotted deck surfaces so debris can be removed on a regular basis.

Building Exterior – Adjacent Combustibles

Firewood, building material (and other combustible debris piles), neighbouring buildings and wooden storage shacks are all serious fire dangers. These items will ignite and burn intensely. Homeowners often do not consider the potential fire danger of these items and must be encouraged to clean up or relocate such accumulations of fuel farther from the building. Locate firewood, building material (and other combustible debris piles), neighbouring buildings and wooden storage shacks >10 m from structure. Where combustibles are located downslope from structure, the hazard to buildings is increased.

3.2.2 FireSmart Vegetation Management

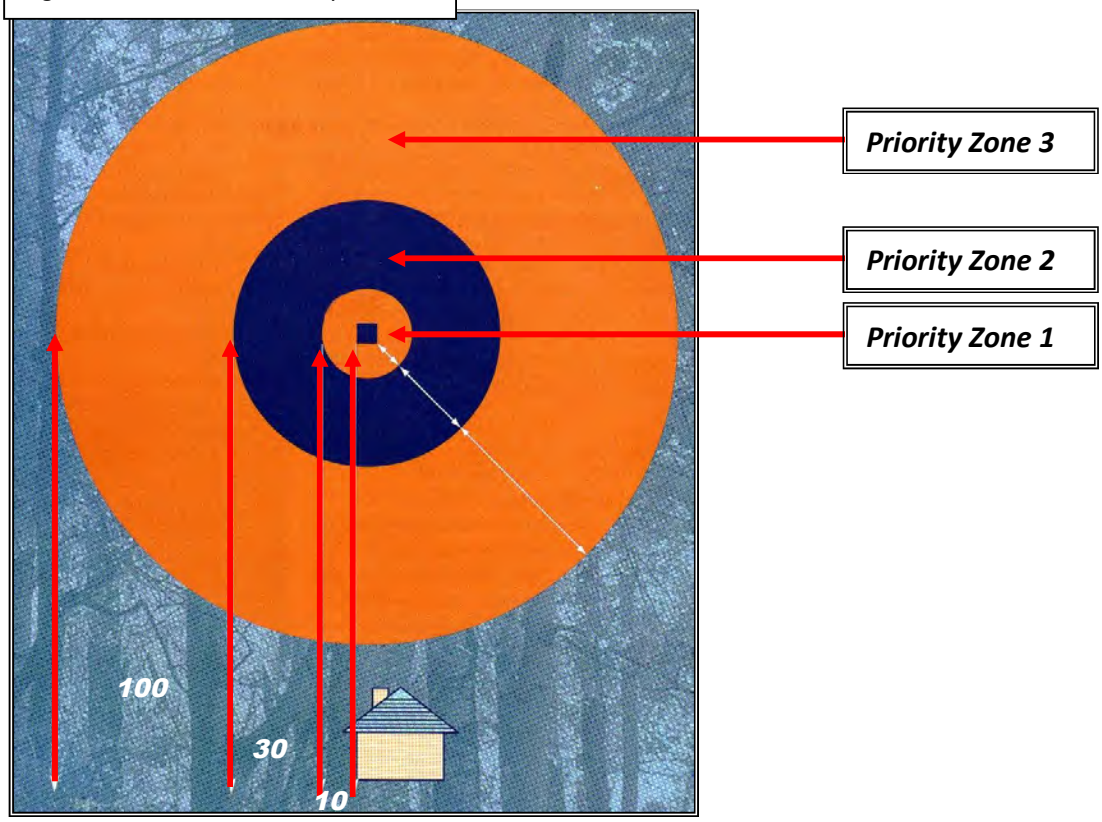
Reduction of fire danger in fuels capable of supporting fast-spreading, high-intensity fires often requires significant intervention – removal, reduction or conversion of on-site fuels. Vegetation management results in the creation of fuel modified areas between a building and a potential wildland fire.

Fuel modified areas have combustible materials and vegetation removed, reduced or converted to reduce fire spread potential and prevent wildland fires from spreading to buildings (or structural fires spreading to wildland fuels). Without fuel modified areas, fire intensity and rate of spread can make firefighting difficult or impossible.

Establishing Priority Zones

Vegetation management is typically conducted within three priority zones established around each building. There are unique vegetation management activities recommended for each priority zone. The general strategy involves starting vegetation management in Priority Zone 1 and as effective hazard mitigation is accomplished there, moving out to perform similar activities in Priority Zone 2 and 3.

Figure 3-4 – FireSmart Priority Zones



Priority Zone 1 is located < 10 metres from the structure. The objective of Priority Zone 1 vegetation management is to create an environment that will not support fire of any kind. In some situations, this may be the only zone or area that homeowners need to manage.

Priority Zone 2 is located between 10 and 30 metres from the structure. The objective of Priority Zone 2 vegetation management is to create an environment that will only support fires of lower intensity and rate of spread. Fuel reduction (rather than removal) is the principal strategy in Priority Zone 2.

Priority Zone 3 is located between 30 and 100 metres from the structure. The objective of Priority Zone 3 vegetation management is similar to Priority Zone 2 - to create an environment that will only support fires of lower intensity and rate of spread. Vegetation management in Priority Zone 3 may only be needed in specific cases when high hazard levels resulting from heavy continuous forest vegetation and steep topography are not reduced enough by fuel management in Priority Zone 2.

Maintenance - Firebreak effectiveness tends to decrease over time. After the initial vegetation management, trees will continue to grow, usually at a faster rate. The increased light on the forest floor encourages heavy grass and brush growth where, in many cases, nothing grew before. Some species of trees are easily felled by winds that penetrate the forest cover more easily after the original clearing and thinning has been done. An interface structure or community will not stay FireSmart without occasional maintenance of previously treated areas.

Section 4: Fire Environment

Wildfires respond to three distinct fire environment factors – weather, terrain and fuels.

4.1 Weather

Analysis of weather is important in determining fire danger and potential for high intensity fire behaviour. The BC Forest Service Wildfire Management Branch fire weather stations provide data that can be interpreted to determine fire danger in the forested areas surrounding CLP. The Canadian Forest Fire Danger Rating System (CFFDRS) uses the terms - Danger Class 4 (high) and - Danger Class 5 (extreme) to describe periods of critically high fire danger. Fire danger class conditions are used to impose fire prevention restrictions on industrial and recreational forest users and also assist fire management agencies in complying with fire preparedness and response standards.

While fire danger affecting Cultus Lake Park (CLP)) varies from year to year, analysis of historical weather station data can provide information on the number and distribution of days that CLP is typically subject to high fire danger conditions – useful information in assessing fire risk to CLP.

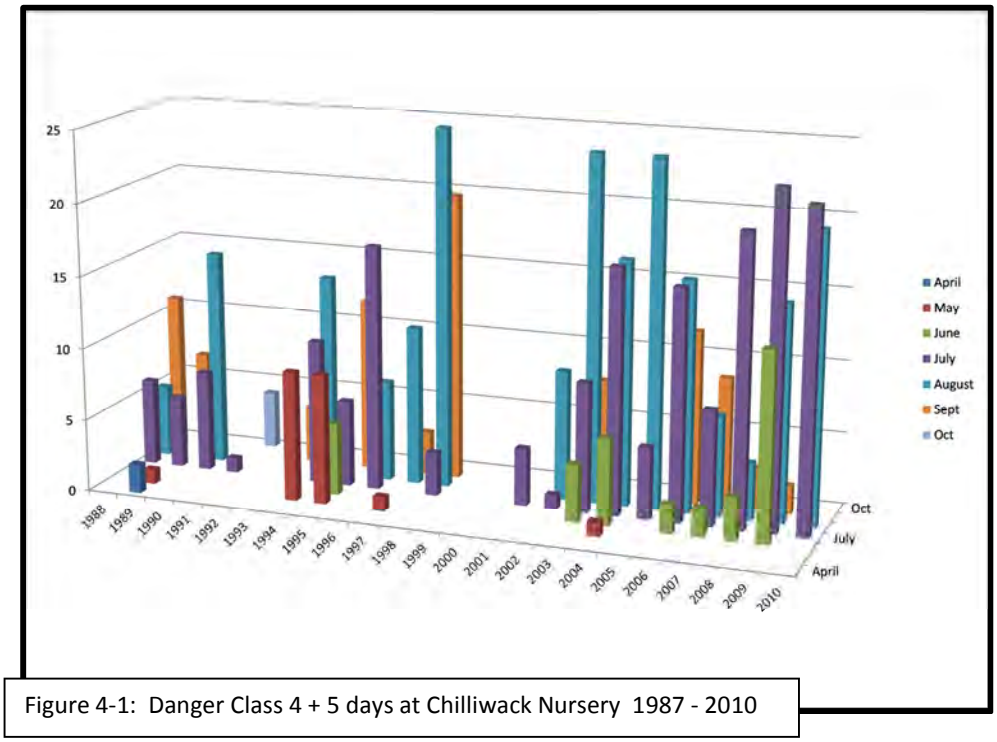


Figure 4-1: Danger Class 4 + 5 days at Chilliwack Nursery 1987 - 2010

Figure 4-1 provides a summary of BC Forest Service Wildfire Management Branch Chilliwack Nursery weather station data dating back to 1987. The graph provides a summary of Danger Class 4 + 5 days occurring between April and October for each year 1987 to 2010.

Chilliwack Nursery data shows that the average number of Danger Class 4 + 5 days per fire season is 23, with the range varying from 0 to 53 days. The data shows that there have been 12 years (out of 23) when fire danger in CLP has been high or extreme for an extended period of days (above the average of 23 days). Typically, the most extreme fire weather occurs in five to six weeks spread between July and August. However in April of 1951, a period of significant fire activity occurred with numerous large fires burning in the CLP area.

4.1.1 Wind Patterns

There is no weather station with windspeed and wind direction monitoring capability located at Cultus Lake. CLP fire officials report that a brisk (20 – 30 km/hr) south wind develops between early and late afternoon on most summer days. Such a wind would be a significant influence on any wildfire ignition in the CLP area with wind coming off Cultus Lake driving fire spread north. One scenario of concern would be fire spreading north on the west shore of Cultus Lake to impinge on CLP interface values in the Monroe / Lakeshore area of CLP.

4.1.2 Historic Ignitions:

The BC Ministry of Forests and Range (MoFR) fire reporting system was used to compile an historical database of fires[2]. Figure 2-2 summarizes CLP area fires (within 10 km's) occurring by decade between 1970 and 2012. Fires are broken down by size class and cause (lightning, human and industrial causes).

Analysis of Table 4-1 - Fire history summary within the study area from 1970 – 2012 yields the following:

The average number of fires per year by decade is:

1970-1979 – 5 1980-1989 – 3 1990-1999 – 2 2000-2012 – 2

The total number of fires 1970 - 2012 was 114, of which 54% were human caused, 33% were lightning caused and 8% were industrial caused. Most fires (97%) burning between 1970 and 2012 were smaller than 4 ha's with only 2 fires greater than 10 ha's.

The four largest fires in the CLP area since 1970 included 2 lightning fires occurring in 1970 and 1990 and burning 4.0 ha's and 5.0 ha's respectively as and 2 human caused (smoker/hiker/hunter) fires occurring in 1987 and 1988 - burning 60 ha's and 11 ha's respectively.

The average fire size since 2000 has been well below 1.0 hectare (0.2 ha's) this despite the fact that the number of Danger Class 4 + 5 days occurring between April and October has been significantly greater since 2000.

Typically, perceived fire risk decreases following a period of relatively low fire danger years and complacency with regard to fire prevention and preparedness can set in. Fire management agencies must work continuously to maintain effective and well-supported fire prevention, hazard mitigation and response capabilities.

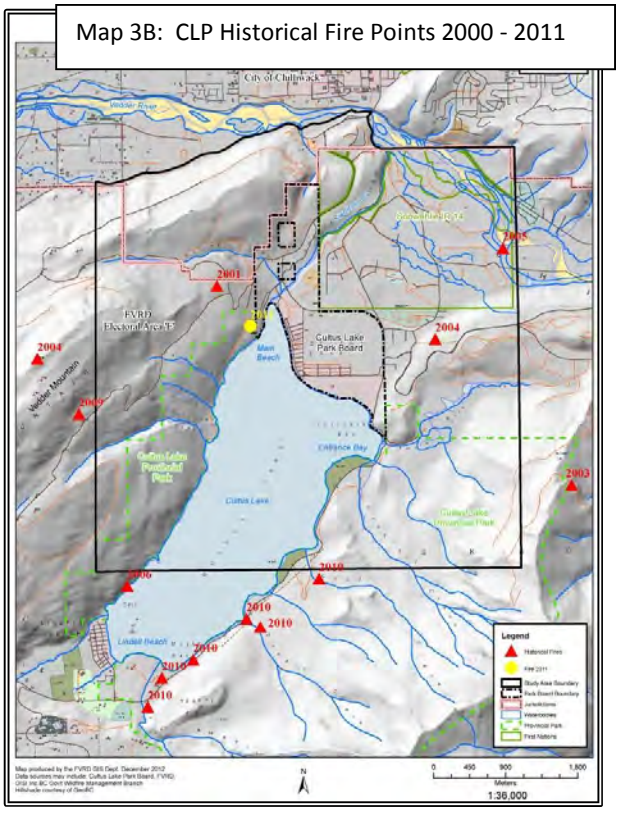
[2] Personal communication – data – Oct. 12, 2012 - Eric Meyer, Supt. Fire Weather, BC Wildfire Management Branch

Table 4-1: Fire history summary within and adjacent (10 km's) the CLP study area from 1970 – 2012

1970 – 2012	*Lightning*	*% of Total*	*Human*	*% of Total*	*Industrial*	*% of Total*	*TOTAL 46 fires*
< 4.0 ha's	24	52%	20	43%	1	2.5%	45
4.0 – 10.0 ha's	1	2.5%					1
> 10.0 ha's							
1980 – 1989	*Lightning*	*% of Total*	*Human*	*% of Total*	*Industrial*	*% of Total*	*TOTAL 30 fires*
< 4.0 ha's	3	10%	16	53%	8	27%	27
4.0 – 10.0 ha's			1	4%			1
> 10.0 ha's					2	6%	2
1990 – 1999	*Lightning*	*% of Total*	*Human*	*% of Total*	*Industrial*	*% of Total*	*TOTAL 14 fires*
< 4.0 ha's	6	43%	6	43%	1	7%	13
4.0 – 10.0 ha's	1	7%					1
> 10.0 ha's							
2000 – 2012	*Lightning*	*% of Total*	*Human*	*% of Total*	*Industrial*	*% of Total*	*TOTAL 24 fires*
< 4.0 ha's	3	12%	19	80%	2	8%	24
4.0 – 10.0 ha's							
> 10.0 ha's							

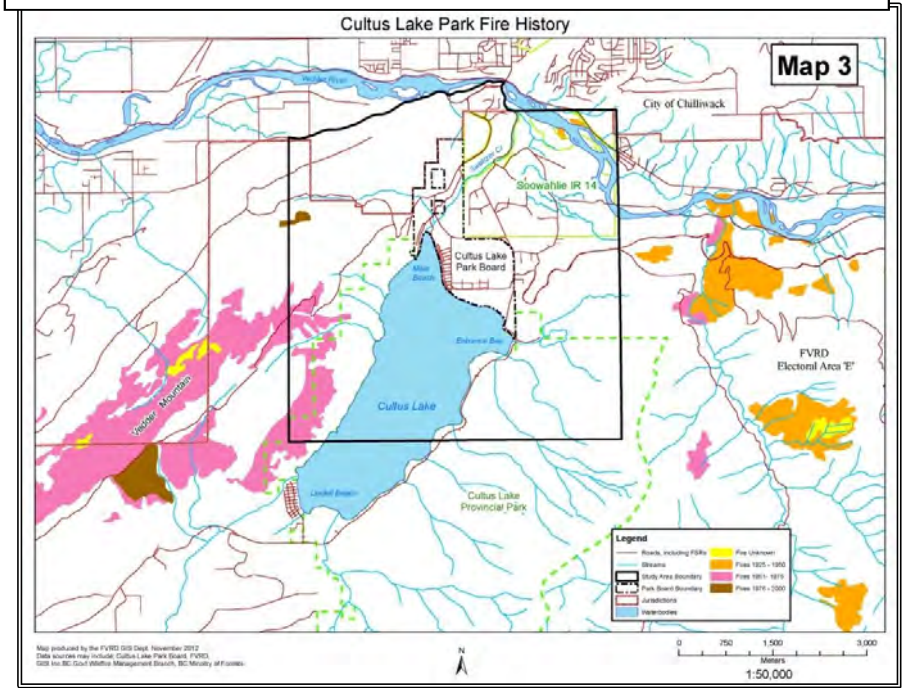
Map 3B shows CLP Historical Fire Points from 2000 - 2011.

Map 3B: CLP Historical Fire Points 2000 - 2011

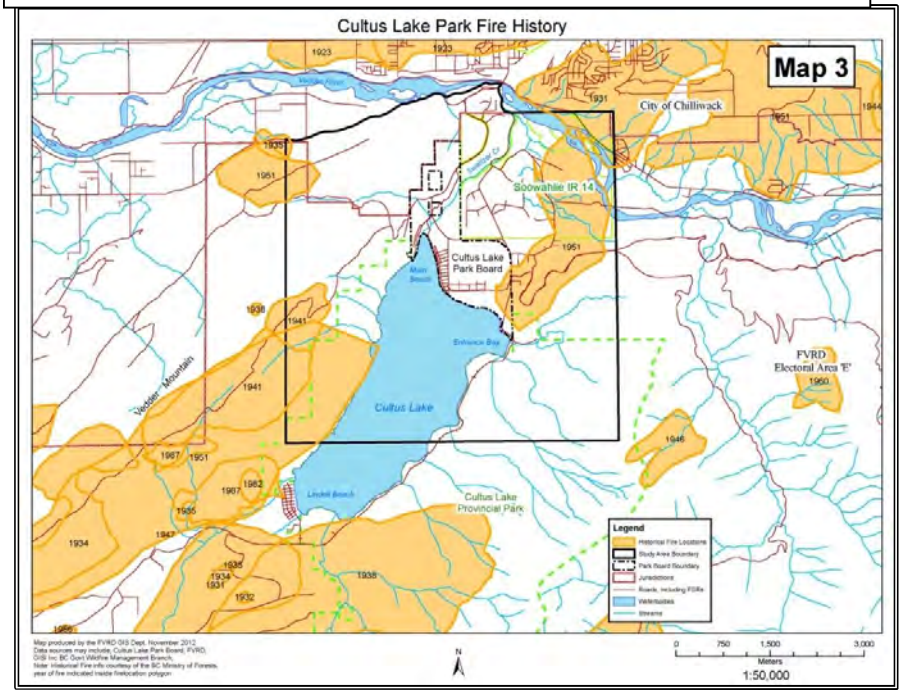


Map 3-1 shows the CLP Fire History with fire boundaries and fire year, from 1925-2000.
Not all fire boundaries are visible due to overlapping fire extents. Map 3-2 shows CLP Fire History with ignition points and fire years, from 2000 to present.

Map 3-1: CLP Fire History with fire boundaries and fire year, from 1925-2000



Map 3-2: CLP Historical Fire Locations & Extents, from 1923-1982



4.2 Terrain

The CLP community is located at the end of a lake in a wide valley bottom. Topographic influences on fire behaviour are somewhat complex although the community and lake are located between Vedder Mountain to the west and Mt Amadus to the east - features which can be expected to channel winds and affect upslope and downslope fire behavior. In general, forested terrain rises away from the majority of the CLP interface perimeter and there are few CLP values that are located in intermix situations with forest fuels on a slope below the value.

4.3 Fuels

Fuel type classification in the CLP area uses the CFFDRS (Canadian Forest Fire Danger Rating System). Provincial Strategic Threat Assessment data for the CLP study area was provided to CLP by MFR and fuel typing data was confirmed and updated during fieldwork. A total of 45 field checks were made in the CLP Study Area to perform Wildfire Threat Assessments and complete Wildfire Threat Worksheets on representative plots. Fuel types were assigned to each plot and the MFR fuel typing provided was updated and refined to reflect local variations.

4.3.1 CLP Fuel Type Summary

Generally speaking, the CFFDRS fuel types considered most dangerous with respect to supporting dangerous fire behavior and spotting (transport of fire embers on wind or fire convection) are C4 and C3. Fuel type M2 although a mix of deciduous and coniferous fuels, becomes more hazardous as the ratio of coniferous trees to deciduous trees increases within the stand. Examples of the predominant CLP CFFDRS fuel types are provided below:

C3 fuel type

There is a moderate amount of C3 fuel type in the study area (24% of total area). This fuel type is comprised of young to mature forests with few ladder fuels but generally good crown connectivity. The C3 forests in the study area are often dominated by second growth cedar and Douglas fir with reduced separation of surface fuels and live crown. Suppression difficulty is moderate and increases with downed and dead surface fuel loading and ladder fuels on younger regen specimens.

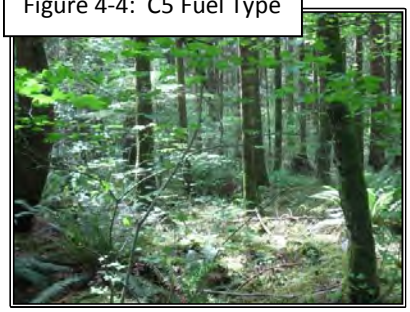
Figure 4-2: C3 Fuel Type

C4 fuel type

There is only a small portion of C4 fuel type located in the study area (0.5%). The C4 fuel types are comprised of denser stands of second growth cedar and Douglas fir with ladder fuels closer to surface. This fuel type was located in Cultus Lake Provincial Park further from the CLP interface. Suppression in this fuel type is more difficult due to the tendency for crown fire behavior in the fuel type.

Figure 4-3: C4 Fuel Type

Figure 4-4: C5 Fuel Type



C5 Fuel Type

There is a moderate amount of C5 fuel type in the study area (12 %). The C5 fuel types are comprised of more widely spaced mature stands of cedar and Douglas fir with ladder fuels occurring sporadically or not at all. Understory growth is often limited to minimal deciduous brush or ferns. Suppression in this fuel type is generally limited to suppression of surface fire – crown fire potential is limited to wind-driven crown fire.

Figure 4-5: M2 Fuel Type

Figure 4-6: D1 Fuel Type

M2, D1 and O1b Fuel Types

The remaining fuel types are lower hazard but comprise 74% of the study area.

M2 (mixed coniferous with high deciduous %), D1 (deciduous forests), can provide excellent fire breaks that support only low intensity fires. While spread rates can be high in the M2 fuel type – the higher proportion of deciduous trees in CLP M2 stands generally assist control efforts in this fuel type.

Figure 4-7: O1b Fuel Type

The O1b fuel type is characterized by tall grasses and shrubs. This fuel type has the potential for high spread rates and fire in this type can be more difficult for suppression crews to fight due to the amount of fuel present. The O1b fuel type is limited in the CLP study area and is present in an area dominated by D1 and M2 fuel types and suppression difficulty should be somewhat easier as a result.

NF Fuel Type

About 7% of the study area was classified as NF or non-fuel and constitutes the residential and commercial footprint within the CLP settled area core.

These areas are classified as non-fuel as there are limited quantities of forest vegetation within the urban area. Structures in CLP are often situated in dense rows or clusters and structure to structure fire spread is a strong possibility, particularly on windy days.

Figure 4-8: NF Fuel Type

Map 4: CLP Fuel Types

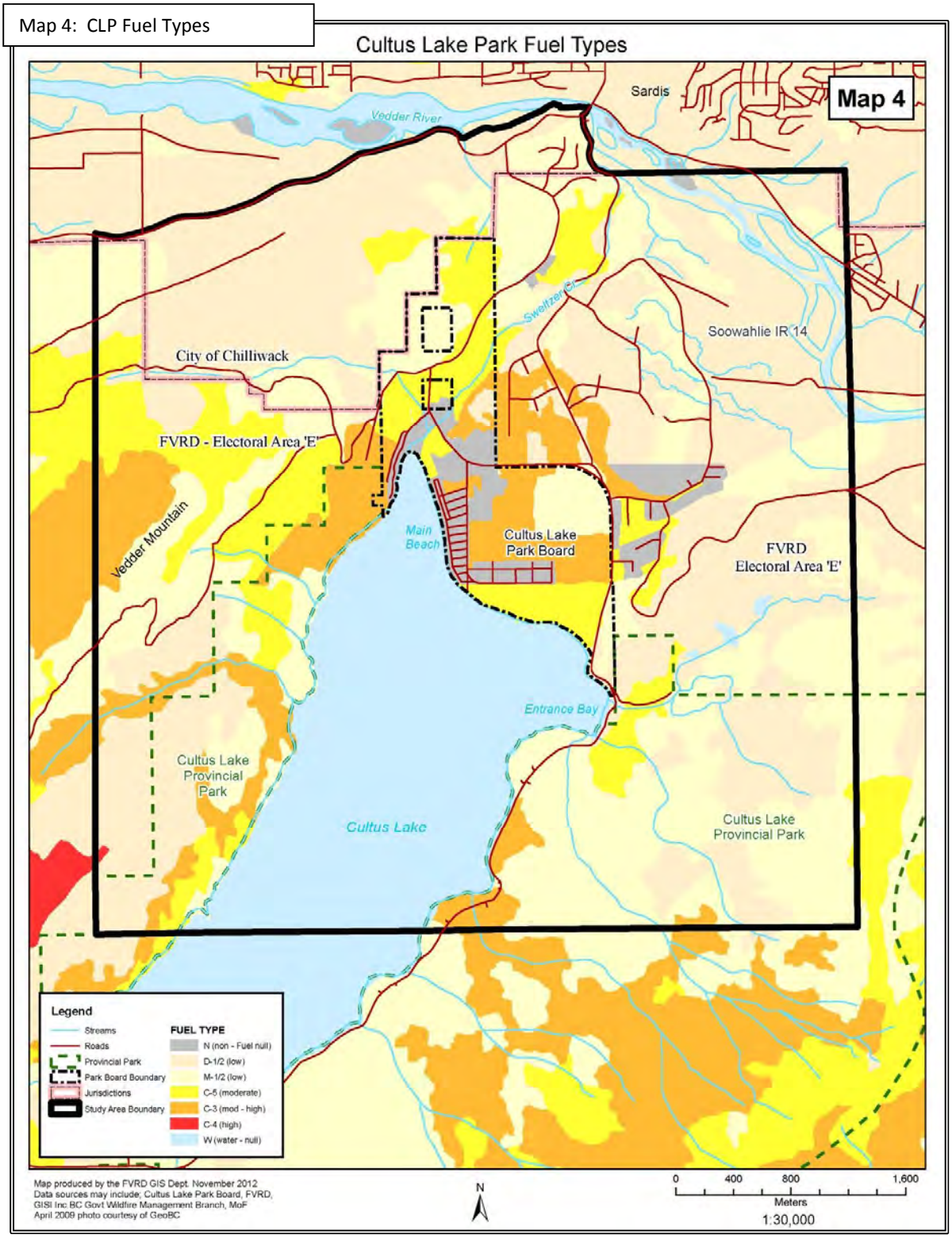


Table 6 below summarizes the CFFDRS fuel types found in the CLP study area by percentage representation within the study area and general fire behaviour.

Table 4-2: A summary of fuel types, associated hazard and areas within the CLP study area

Fuel Type	*Description*	*Wildfire Behaviour under Danger Class 4/5*	*Wildfire Hazard*	*Area (ha)*	*%*
C3	Fully stocked mature forest, crowns separated from the ground.	Surface and crown fire, low to very high fire intensity and rate of spread.	Moderate to High	234	10
C4	Dense, pole sapling forest, heavy standing dead and down, dead woody fuel, continuous vertical crown continuity.	Almost always crown fire, high to very high fire intensity and rate of spread.	High	1	0
C5	Well stocked mature forest, crowns well separated from the ground.	Low to moderately fast spreading, low to moderate intensity surface fire.	Moderate	284	12
D1	Moderately well stocked deciduous stands.	Always a surface fire, low to moderate rate of spread and fire intensity.	Low	967	42
M2	Moderately well stocked mixed stand of conifers and deciduous species, low to moderate dead, down woody fuels, crowns nearly to the ground.	Surface torching and crowning moderate to very high intensity and spread rate (depending on slope and percent conifers).	Low to Moderate	738	32
01b	Shrub type with volatile species.	Rapid spreading with low to moderate surface fire intensity.	Moderate	5	0
NF	Residential and commercial footprint within the CLP settled area core. Classified as non-fuel as there are limited quantities of forest vegetation within the urban area.	Structures in CLP are often situated in dense rows or clusters and structure to structure fire spread is a strong possibility, particularly on windy days.	Nil	81	4

4.3.2 Biogeoclimatic Units

In British Columbia, the Biogeoclimatic Ecosystem Classification (BEC) system describes different zones by vegetation, soils, and climate. Variant zones within the principal BEC classification are established from rainfall and temperature. The principal ecosystem in the Cultus Lake area is the Coastal Western Hemlock Dry Maritime subzone (CWHdm[3]). Two other variant zone ecosystems are found in the Cultus Lake area - Coastal Western Hemlock Very Dry Maritime subzone (CWHxm1) and Coastal Western Hemlock Very Wet Maritime subzone (CWHvm2). A brief description of all the ecosystems in the study area is provided below.

In addition, a summary is provided of the Natural Disturbance Units (NDU[4]) associated with this area.

Coastal Western Hemlock Dry Maritime Subzone (CWHdm)

CWHdm occurs at low elevations on the mainland and immediately adjacent islands. It extends from Hardwicke Island in the north to the Chilliwack River in the southeast. Along the Sunshine Coast and lower Fraser Valley it occurs above and adjacent to the CWHxm, respectively. Elevational limits range from sea level (or above CWHxm if present) to approximately 650 m (lower in wetter valleys).

The CWHdm has warm, relatively dry summers and moist, mild winters with little snowfall. Growing seasons are long, and feature only minor water deficits on zonal sites.

Coastal Western Hemlock Very Dry Maritime Subzone (CWHxm1)

The CWHxm extends up the south side of the Fraser River as far as Chilliwack. Elevational limits range from sea level (or above the CDFmm where present) to approximately 700 m. Near the wetter parts of its distribution, the upper limit is lower (e.g., 150 m in the Fraser Valley).

The CWHxm has warm, dry summers and moist, mild winters with relatively little snowfall. Growing seasons are long, and feature water deficits on zonal sites.

Coastal Western Hemlock Very Wet Maritime Subzone (CWHvm2)

The CWHvm2 occurs at higher elevations, above the CWHvm1. Elevational limits range from approximately 650-1000 m in the south to 450-800 m in the north. It grades into the MH zone above.

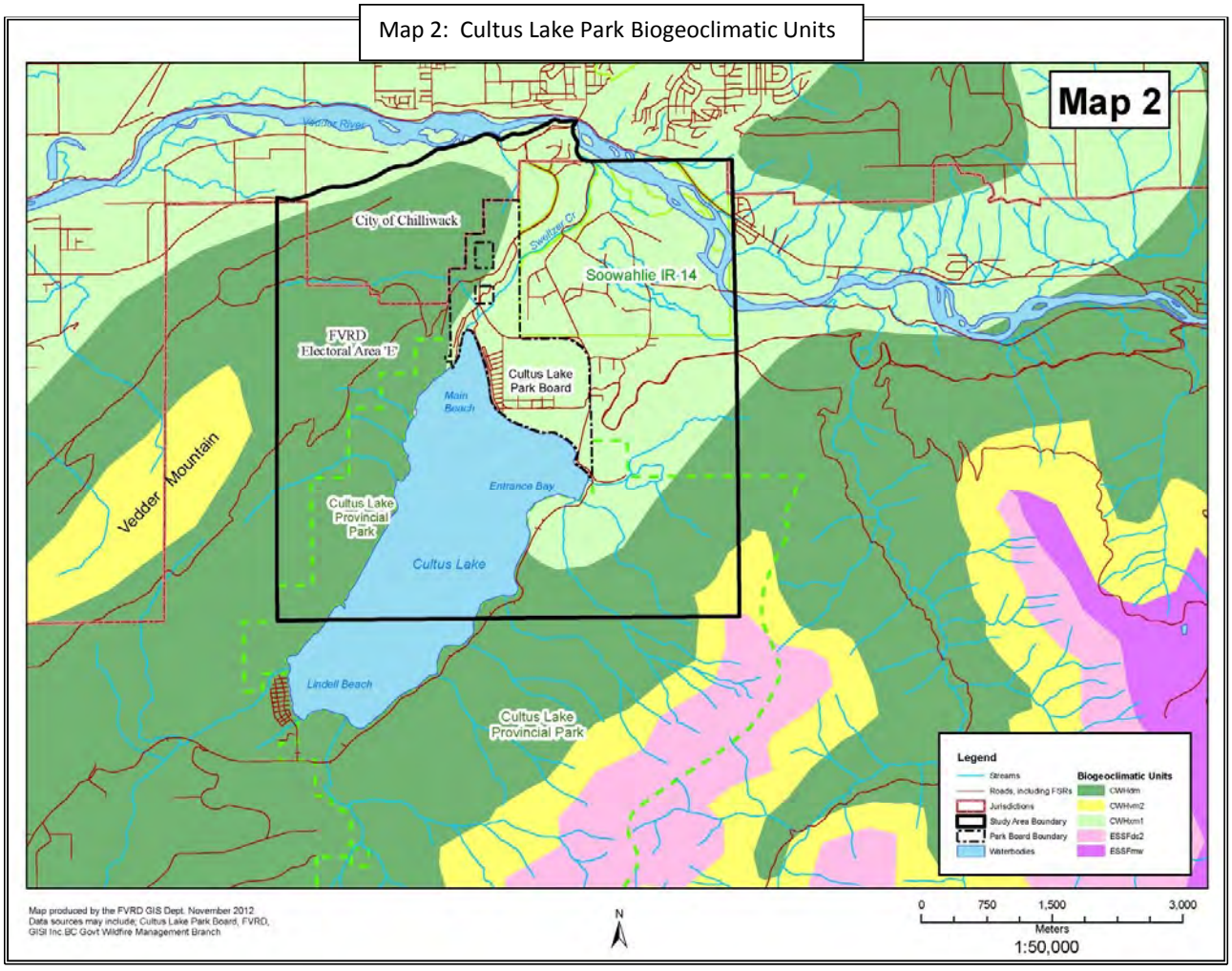
The CWHvm2 has a wet, humid climate with cool, short summers and cool winters featuring substantial snowfall. Compared with the submontane variant, the CWHvm2 has cooler temperatures, shorter growing seasons, and heavier snowfall, with snowpacks persisting throughout the winter.

---

[3] Subzone descriptions come from the Biogeoclimatic Ecosystem Classification Program:
http://www.for.gov.bc.ca/hre/becweb/resources/classificationreports/subzones/index.html

[4] B. Dorner and C. Wong, Natural Disturbance Dynamics in Coastal BC May 15, 2003

Map 2: Cultus Lake Park Biogeoclimatic Units



4.3.3 Natural Disturbance Units

Natural Disturbance types characterize ecosystems that have evolved within different natural disturbance regimes. Stand-initiating disturbances are those processes that largely terminate the existing forest stand and initiate secondary succession in order to produce a new stand. The disturbance agents are mostly wildfires, windstorms and, to a lesser extent, insects and landslides.

The CWH biogeoclimatic zone is associated with Natural Disturbance Type 1 and 2 (NDT1 + 2) – Ecosystems with rare or infrequent stand-initiating events. According to recent field research[5], historical fires were very infrequent in wet coastal temperate rain forests and were more likely low- and mixed-severity events, rather than stand-initiating fires. Information relevant to the natural disturbance regimes in the CLP study area has been extracted from this report (see Appendix 2).

[5] Daniels, L.D. and R.W. Gray. 2006. Disturbance regimes in coastal British Columbia. *BC Journal of Ecosystems and Management* 7(2):44–56. URL: ***http://www.forrex.org/publications/jem/ISS35/vol7_no2_art6.pdf***

Essentially, the research noted in Appendix 2 indicates that the flammability ratings of the wet coastal temperate rain forest are low with moisture content of fuels retarding ignition and spread of fire even during years of extreme drought. Stand-initiating fires have burned coastal forests in the past century, but under unusual circumstances. The spread of fire is influenced by the flammability of fuels, which in turn varies with topography and climate:

Topography: Fuels on steep, southwest-facing slopes will be more flammable than forests on steep, northwest-facing slopes or flat ground in the bottom of valleys. This CWPP proposes hazard reduction fuel treatments for two east / south-east facing slope areas on the west side of Cultus Lake - Unit 2 Lakeshore Munroe West – South and Unit 3 Unit 2 Lakeshore Munroe West – North.

Climate: Historically, years of high fire activity were most likely to occur when persistent high pressure ridges formed along the west coast, blocking westerly winds, reducing precipitation, and allowing fuels to dry for extended periods. Even during extended droughts – factors such as lightning ignitions and the availability of sufficiently flammable fuels were sufficiently rare that stand-initiating fire occurrence remained a 'very rare' event in wet coastal temperate rain forests.

Notwithstanding this historical condition, current ignition factors include:

i) An increased risk of human ignition (CLP is densely populated and sees high levels of recreational use during periods of high fire danger weather). Most of the recent, large-scale fires in coastal forests were ignited by humans. This CWPP notes a number of fire prevention recommendations that proactively reduce ignition potential.

ii) An increased possibility of fuel flammability if pure coniferous stands are opened up by a rogue wind event, clear cut harvest or development clearing. The resulting slash accumulations and sun-exposed surface fuels on the forest floor will present a significant fire hazard that can remain for a number of years. Timber harvest was a precursor to the Chilliwack Valley fires in the early 1900s. Logging created large fuel loads and microclimatic conditions that allowed the fuels to dry, making these sites conducive to burning. This CWPP notes that a re-evaluation of crown fire potential should be conducted in the event that fuel structures change.

iii) Forecast climate change trends may increase the threat of crown fire. This CWPP notes that CLP recorded its longest drought since 1998 in August of 2012 – 28 days with no rain. Temperature records were similarly broken during this period. This CWPP notes that should extended periods of drought become more common in the future, the CLP community may wish to re-evaluate its level of fire preparedness and establish fire prevention or hazard mitigation interventions appropriate to the existing situation.

4.3.4 Fuel Management Overview

Fuel Management is the process of modifying forest fuels (trees, low branches, needles, and woody debris) to reduce the potential for devastating wildfires. Fuel management is an important component of any strategy to reduce wildfire danger adjacent interface values at risk. Benefits of fuel management for wildfire hazard reduction include:

-Protection of public safety and property within and adjacent the community.

-Reduction of accidental wildfire ignition risk within and adjacent the community.

-Reduction of high intensity fire potential – minimizes fire impacts on viewscape, soil quality, slope stability / erosion, watershed, air quality and wildlife.

-Improved wildfire detection and suppression capabilities within and adjacent the community.

-Improved forest health and maintenance of diverse wildlife habitat.

Figure 4-9: WUI site before fuel management

Figure 4-10: WUI site after fuel management

The amount, type and arrangement of forest vegetation or fuel adjacent interface communities or structures is an important determinant of wildfire hazard. Properly managed vegetation increases structural protection from approaching wildfires and also reduces the chance that a building fire will spread to the adjacent wildlands. Vegetation management is one of several FireSmart mitigations – structural and infrastructural modifications can also mitigate the interface fire hazard that a community or structure faces. Before commencing wildfire hazard reduction fuel treatments it is important that a number of factors including cost benefit, treatment aesthetic and ecological impact as well as the degree and duration of effectiveness all be considered.

Forest fuel accumulations result when a forest produces more vegetation or biomass than the forest ecosystem can decompose. The amount of biomass produced varies with site productivity and climate. The amount of biomass that is decomposed varies with temperature and moisture. Biomass decomposition is favored in the wet, warm coastal rainforest climates as opposed to the drier, cooler interior climates.

Problematic fuel accumulations are described by high levels or loadings of surface fuels – particularly problematic are high proportions of fine fuels versus larger fuels and strong continuity between surface and aerial fuels in the forest overstory. High stand densities are typically associated with these conditions.

Surface fuels - include all of the forest floor combustibles. Understory vegetation such as grass, shrubs, and small trees and coarse woody debris in contact with the forest floor. Forest fuel loading describes the relative mass of fuels in an area of forest floor and will vary with many factors.

Fine fuels (<12 cm diameter) dry quickly and ignite easily – fuel treatments will typically prioritize removal and reduction of these fuels.

Larger fuels (>12 cm diameter) dry more slowly and are less flammable however their role in sustaining higher duration fires is problematic - fuel treatments will also target reduction of high surface fuel loadings in this size category.

Figure 4-11: Surface fuel before fuel treatment

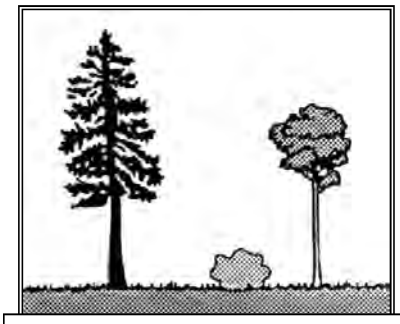


Figure 4-12: Surface fuel after fuel treatment

Aerial fuels - include all forest combustibles not in contact with the forest floor. Fire intensity in these fuels varies with many factors including type (deciduous – which will not usually support crown fire spread vs coniferious), size and arrangement. Aerial fuels that permit fire to move from tree to tree – dense, heavily branched or laddered forests (especially in dead or diseased condition) are the most problematic and are described as having high crown fire potential.

Crown fire potential is reduced by increasing the height to live crown (the proximity of surface fuels to lower canopy branches) and decreasing the crown closure (the proximity of individual tree crowns that determines the ease with which fire spreads in the forest canopy). Dense forest canopies will spread a crown fire once it develops however the dense canopy can also contribute to a substantial reduction of surface fuels and lower branches – a condition that reduces the likelihood of crown fire development.

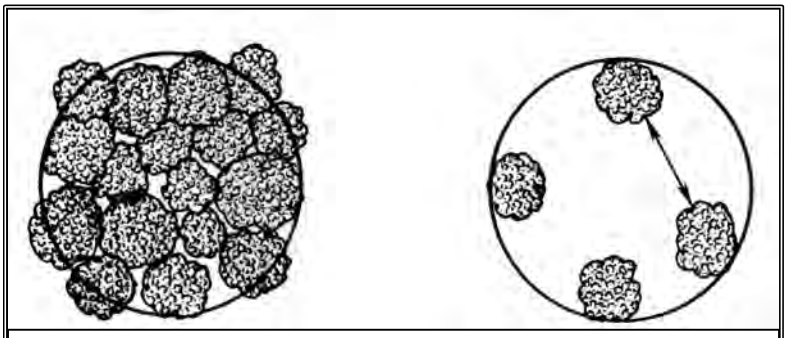


Figure 4-13: High crown closure vs Low crown closure

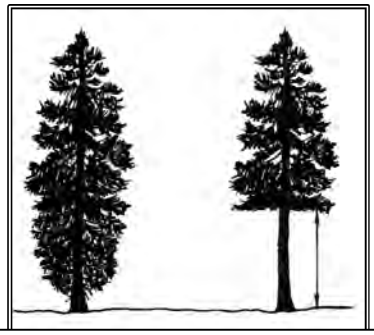


Figure 4-14: Height to live crown reduction

4.3.5 Fuel Management Strategy

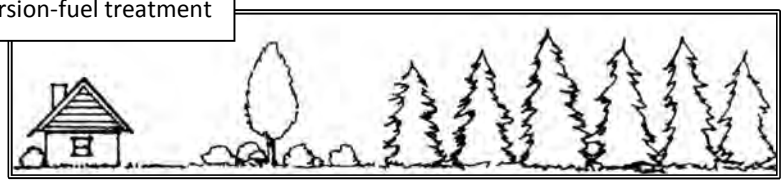
The general fuel management strategy for provision of wildfire protection to WUI communities involves using:

1. Existing fuelbreaks (areas featuring deciduous or low flammability fuels, green space or access/utility infrastructure corridors). There are a number of opportunities to improve the wildfire protection afforded by existing landscape fuelbreaks. Recommendations on fuel treatments in specific fuelled areas adjacent fuelbreaks are included in this plan.
2. Stand level fuel treatments involving fuel removal, fuel reduction or fuel conversion in strategic locations (adjacent values at risk - structural, utility, watershed or other resources). Stand level fuel treatments are applied in Priority Zone 2 + 3 or beyond - depending on the level of wildfire hazard protection required.

Figure 4-15: Pre-fuel treatment

Figure 4-16: Reduction-fuel treatment

Figure 4-17: Conversion-fuel treatment



Section 5: Wildfire Risk Reduction Recommendations

Preventing, preparing for and responding to wildfire emergencies are important priorities for Cultus Lake Park (CLP). CLP is located in an area subject to wildfire ignition and - under high fire danger conditions - wildfire impingements on several areas within or adjacent to CLP. Local fire and forestry officials are attempting to mitigate the potential impacts of wildfire on interface communities with a variety of wildfire prevention, preparedness and response initiatives.

5.1 Wildfire Prevention

Programs and initiatives that encourage residents in areas vulnerable to wildfire to implement FireSmart recommended guidelines and increase wildfire preparedness are important in preventing or minimizing interface fire risk. Even highly effective wildfire prevention programs cannot prevent all wildfires and interface wildfire prevention initiatives that focus on prevention of interface fire disasters in addition to conventional fire prevention messages can be highly effective.

Local government can reduce the potential for interface fire disasters and wildfire damage through both public education and the use of legislative tools. Community leaders must continue to support 'FireSmart community' public education initiatives as well as seeking opportunities to mitigate interface fire hazard through the use of FireSmart planning guidelines backed with legislative authority.

5.1.1: Interface Fire Ignitions Human caused fire ignitions are one of the most preventable fire ignition causes. Wildland fire response agencies have always sought to change behaviours that lead to wildland fire ignitions. Wildfire cause statistics in the CLP study area show that over the ten years (2002 – 2012) 22 wildfire starts were recorded with a variety of cause assignations. With the exception of lightning all fire causes detailed on the list are preventable. This knowledge can assist fire officials in targeting wildland urban interface fire prevention messages.

The CLP community features a number of heavily used trails and a golf course with forested perimeter. The CLP Water Park attracts numerous visitors and is located adjacent forested areas. While these frequently used areas present fire prevention challenges they also offer opportunities to develop and distribute targeted WUI fire prevention materials.

Table 5-1: CLP Wildfire Cause Statistics

Wildfire Cause Statistics (2002 – 2012)	
Cause	***# of Fires***
Incendiary	8
Campers	3
Juvenile fire setter	3
Lightning	3
Smoker	2
Equipment	1
Fire Use	1
Miscellaneous	1
TOTAL	**22**

Recommendation 5.1.1.1 CLP fire officials should seek to develop and distribute targeted WUI fire prevention materials at CLP recreational facilities (sites where human caused fire ignitions are likely to occur.) Water Park, recreational trail and golf course users are a prime audience for delivery of fire prevention messages.

5.1.2 Public Education **-** Effective public education is important in preventing or minimizing fire risk in the wildland / urban interface (WUI). Political leaders, community planners and fire officials need to work together to present a consistent interface fire risk reduction message to the public.

Development of a public education program is a priority item in CLP's CWPP planning process. The goal of the public education program will be to refocus public awareness on wildfire hazard to interface areas in the context of CWPP recommendations.

Over time, a number of public education opportunities will present themselves with respect to preventing or minimizing fire risk in the WUI. Following a period of heavy wildfire activity, particularly when interface areas are involved, public interest in wildfire hazard mitigation will be very high (e.g. B.C.'s 2003 wildfire season). Presentations on minimizing fire risk in the will typically draw a large interested public and local resident audience. Other events - such as Fire Prevention Week, Fire Dept. open houses and school or youth group presentations also provide public education opportunities.

Fire officials should consider the benefits of delivering a number of short presentations to service club or business organizations at their respective meetings or dinners. Membership of these groups is comprised of influential and committed community members that will be interested in what is being provided by the CWPP initiative. Fire officials should expect a special level of interest from this group as catastrophic wildfire events during peak tourist season months are a significant issue in terms of business continuity.

Public Education Presentations **-** All public education presentations should be based on recommendations provided by the **FireSmart – Protecting Your Community from Wildfire** manual. The FireSmart Manual is very comprehensive (173 pages) and contains a great deal of information which can be used to encourage community-based prevention plans or initiatives to reduce the risk of fire losses and enhance safety in the wildland/urban interface.

School or Youth Group Presentations **-** Presentations that target important behavior modifying or guideline compliance messaging at children and youth via school programs have proven to be highly effective in structural fire prevention initiatives as children and youth take the message home and foster adoption by parents and relatives. FireSmart education programs, often developed jointly by BC Ministry of Forests and Range – Wildfire Management Branch staff and local Fire Dept. members, can range in complexity from communication of age appropriate FireSmart interface fire hazard mitigation messages to the involvement of students in fuel treatment programs in priority areas of the community. There are numerous resources available to assist in the implementation of such programs.

Media Communications **–** Media outlets are normally very receptive and eager to assist with fire prevention initiatives and will assist in the development of print or film pieces on FireSmart – hazard reduction – public safety programs. As with all media relations – consistency and accuracy are best assured through the use of a single media communications person liaising with media outlets on behalf of the FireSmart program. Use of the **FireSmart – Protecting Your Community from Wildfire** manual can assist in preparing news articles or interview content for submission to media outlets.

FireSmart Powerpoint Presentation: This presentation binder / CD package was developed by the Kootenay Interface Steering Team and was distributed by the BC Office of the Fire Commissioner in 2004. The FireSmart Powerpoint Presentation is very flexible and is designed to assist local planning or fire officials that may be requested to deliver a presentation on standard FireSmart manual content to various audiences.

The package consists of a series of slides and speakers notes prepared for each of the principal FireSmart manual chapters. The slides can be customized to allow presenters to address a wide variety of audiences, each with its own issues and information requirements. Full details on presentation structure and delivery are contained in the presentation package.

Public Education Display: Use of a three-panel display by planning and fire officials at scheduled events is a highly effective public education methodology. Orthophoto maps and sign panels are used to graphically convey information specific to the CLP CWPP and generic FireSmart hazard mitigation information. While highly useful for public education displays the three panel display will also be referenced by CLP fire officials during CWPP orientations provided to Board members and other officials.

Fire Danger Signs - The use of a large, roadside wildfire danger sign is an another highly effective public education tool. A Fire danger sign has been positioned in a prominent location (entry to CLP on Columbia Valley Rd.) that assures residents and visitors alike will view the sign information. The sign is changed with increases or reduction to fire danger by a BC Ministry of Forests and Range – Wildfire Management Branch – Fraser Fire Zone – Cultus Lake Base staff member.

FireSmart Demonstration Properties - CLP should work to establish FireSmart demonstration properties in selected high hazard level areas. FireSmart demonstration properties will feature both FireSmart building materials and construction techniques as well as FireSmart vegetation management techniques. Demonstration properties are especially viable in high visibility locations in areas where CLP fire officials especially wish to encourage compliance with FireSmart recommended guidelines. Signs can be prepared and positioned to show before and after views, explain general FireSmart hazard mitigation strategies and assist in conveying fire prevention messages to the interface public.

Website – Wildfire prevention / interface fire hazard mitigation information can be easily included on the CLP website. Wildfire related information such as fire danger, fire restrictions, and interface fire hazard assessment / mitigation recommendations should be included on the website. Generic FireSmart hazard mitigation information can be posted to the website with specific pictures and maps used to customize the information for the CLP audience.

Recommendation 5.1.2.1 CLP planning and fire officials should commit to provision of regularly scheduled public education presentations augmented with additional presentation series following periods of heavy wildfire activity. One methodology would be to establish different target groups – schools, residents and business leaders – and ensure each group received a customized presentation on a multi-year rotation basis.

Recommendation 5.1.2.2 CLP planning and fire officials should work to develop a CLP specific Powerpoint presentation product. Developed in consultation with interface fire protection specialists the presentation would address FireSmart structural fire protection issues - 'Understanding Structural Ignitions'- why structures ignite during wildland interface fire events with an overview coverage of the three part FireSmart mitigation strategy (vegetation management, structural options and infrastructural modifications) specific to the CLP area.

Recommendation 5.1.2.3 CLP planning and fire officials should work to develop a CLP wildland urban interface specific fire prevention messages for use with: CLP website, public education displays, fire danger signs and FireSmart demonstration properties in consultation with both interface fire protection, planning and media development specialists.

Recommendation 5.1.2.4 CLP should develop an ancillary wildfire prevention program for use during periods of high fire danger (when provincial fire bans or fire advisories are in place for the CLP area). Such restrictions would be determined by an appointed staff representative via consultation with the BC Ministry of Forests and Range - Wildfire Management Branch website which features a 'Fire Prohibitions' link - http://bcwildfire.ca/hprScripts/WildfireNews/Bans.asp

5.2 Wildfire Preparedness

Cultus Lake Park (CLP) fire and emergency response officials must be prepared for both the possibility and the effects of periods of high wildfire activity in the vicinity of CLP.

- Large wildfires burning anywhere in the Fraser Valley region can affect CLP businesses, particularly if tourists and the travelling public alter travel plans.
- Protection of values including critical infrastructure, residences, commercial and non-critical infrastructural values requires that FireSmart recommended guidelines for hazard mitigation be implemented as required for optimum value protection.
- Wildfire ignitions or spread into forests adjacent CLP may require evacuation of residents and visitors to safe areas.
- Post wildfire rehabilitation planning to minimize long term impacts due to wildfire adjacent the CLP community is another responsibility that fire and emergency response officials must plan for.

5.2.1 Fire Danger Monitoring and Communications: CLP can be affected by wildfire danger and wildfire activity however the traveling public or tourist perception of wildfire conditions in the CLP area can also have a significant effect on CLP and CLP businesses. Media reportage of fire incidents is often brief, sometimes inaccurate, and can influence the vacation plans of the traveling public and tourists with scheduled reservations – it is important that accurate and up to date information on wildfire status be conveyed to these groups.

Recommendation 5.2.1.1 During periods of high wildfire activity in the CLP area - CLP should monitor (via appointed staff representative) the BC Ministry of Forests and Range - Wildfire Management Branch website which features a 'Current Wildfire Situation' link - - http://bcwildfire.ca/Situation/ providing details on any active wildfires in the CLP area. The CLP staff representative should contact the Wildfire Management Branch - Coastal Fire Centre fire management staff for the latest information on any fires adjacent to or affecting CLP.

Recommendation 5.2.1.2 In the event that significant wildfire activity is occurring in the CLP area, a 'Daily Wildfire Update' should be provided by an appointed CLP Media / Communications person. Wildfire updates should be accessible on the CLP website and available to assist all front line service staff in providing responses to resident and visitor inquiries regarding wildfire activity.

5.2.2 Structure Protection: FireSmart is a program developed to provide users with solutions or mitigative approaches to reduce the hazard posed by wildfire to interface communities or homes. The principal aspects and recommended guidelines for interface fire hazard mitigation are discussed in three sections: vegetation fuel management, structural options and infrastructure. Recommendations are provided to assist property owners with protecting their buildings from wildfire. FireSmart recommended guidelines also apply to critical infrastructure. Maintenance of a serviceable critical infrastructure which might include the community Emergency Operations Centre, health and emergency services and the water distribution and treatment infrastructure is important and will assist with safe and effective incident management.

Both critical infrastructure and residential - commercial – institutional infrastructure installations and areas were visited during the development of the CLP CWPP document. Preparation of detailed hazard assessment forms for each structure or installation was not done however a general analysis of compliance with FireSmart recommended guidelines is submitted for CLP critical infrastructure and residential - commercial – institutional infrastructure installations.

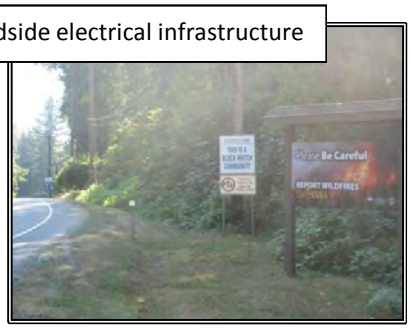
Critical Infrastructure

Key infrastructure that may be involved during emergency response to a wildfire includes:

Table 5-2: Critical Infrastructure in the Cultus Lake Park CWPP Area

Critical Infrastructure – Cultus Lake Park	
CLP Administration Office – Park Patrol HQ	Reservoir
Works Dept. shop and office	Sewage Treatment
Firehall	Community Hall – EOC
Elementary School	BC Hydro – transmission & distribution lines
Water Intake	Communications Towers
Water Treatment	Helipad - schoolyard

Fig 5-1: Roadside electrical infrastructure



Electrical Infrastructure

BC Hydro transmission and distribution lines are located on the Columbia Valley Road / highway access route to CLP and supply CLP with electrical power. Transformers and telecommunications lines are also located on the pole infrastructure. The pole infrastructure is predominantly wooden poles – the location of the lines - often adjacent forests vulnerable to wildfire and tree strikes on the conductors – is problematic.

There are no backup diesel generators for power in the event of power outage. Power loss to the community occurs two or three times in ten years - this is due to tree strikes on conductors.

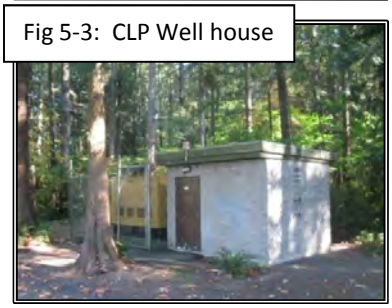
Recommendation 5.2.2.1 CLP fire officials should ensure FireSmart recommended guidelines for critical electrical infrastructure hazard reduction are followed to reduce vulnerability of electrical lines to wildfire. CLP fire officials should meet with BC Hydro officials to discuss powerline right-of-way vegetation clearing procedures and standards along the Columbia Valley Road / highway access route to CLP.

Water Infrastructure

Fig 5-2: CLP Reservoir

A piped aquifer is the sole source of water for CLP. A 100,000 IG (Imperial gallon) reservoir is located between the south end of Monroe Ave and Parmenter Road. The reservoir is supplied by an intake pumping station located at the CLP water supply well house (located at Sunnyside Ave. and Cedar Ave.) with two independent well heads located on Sunnyside Ave in concrete pumphouses with backup diesel generator power supply. One well head is located behind the water supply well house and the other is located at Sunnyside Ave. and Alder St.

Fig 5-3: CLP Well house



The CLP water supply well house is a critical infrastructure facility where CLP has installed a backup generator. The generator is vulnerable to wildfire due to proximity to forest vegetation.

Structures do not comply with FireSmart recommended guidelines with respect to vegetation management but are generally compliant with FireSmart recommended guidelines with respect to structural modifications.

Water is directed via service and supply lines (single line) that cross under the lake (at the footbridge) – the line is buried up to the footbridge approximately 1 to 1.5 m below surface.

While severe fire can change the hydrologic characteristics of an affected watershed – changing flow volumes, turbidity and timing of traditional surface water flows – fire is unlikely to affect the supply aquifer. Similarly, concern with possible contamination of the CLP water supply by fire retardants used in wildfire suppression is minimized by the existence of the supply aquifer. Nonetheless fire suppression tactics used in the vicinity of CLP should attempt to use water over chemical retardants or suppressants wherever possible.

Recommendation 5.2.2.2 CLP fire officials should ensure FireSmart recommended guidelines for vegetation management are applied to all CLP water supply structures.

Fig 5-4: CLP Sewer Lift

Sewage Infrastructure

There are 4 pumping stations or sewer lifts that pump sewage to effluent fields located north of the Water Park or behind the CLP school.

Fig 5-5: CLP Sewer Lift

East Side Cultus Lake Sewer Lifts – Sewer lift 1 (attached to house at 150 First Ave.) receives sewage via gravity flow and pumps sewage to Sewer lift 3 (adjacent the CLP Works Yard) where sewage is pumped and gravity flowed into effluent fields.

Fig 5-6: CLP Sewer Lift

Fig 5-7: CLP Sewer Lift

West Side Cultus Lake Sewer Lifts - The sewer lifts on the west side of the lake are pumped – Sewer lift 2 (adjacent house at 32 Lakeshore Rd.) gravity flows sewage to Sewer lift 4 (adjacent the parking lot near the west side park on Lakeshore Rd.) where sewage is pumped and gravity flowed into effluent fields.

There are no backup diesel generators for power to the sewer lifts in the event of power outage.

Structures are not entirely compliant with FireSmart recommended guidelines with respect to vegetation management or structural options.

Recommendation 5.2.2.3 CLP fire officials should ensure FireSmart recommended guidelines for vegetation management and structural modifications are applied to all CLP sewage structures.

Communications Infrastructure

There is a telecommunications tower in the over flow parking / compostables landfill area adjacent the Cultus Lake Water Park. A Telus telecommunication sub-station is located on the east side of the Water Park adjacent Soowahlie Indian Reserve 14. Facilities do not comply with FireSmart recommended guidelines with respect to vegetation management.

Fig 5-8: CLP Communications Tower

Recommendation 5.2.2.4 CLP fire officials should ensure FireSmart recommended guidelines for vegetation management and structural modifications are applied to all CLP communications structures. CLP fire officials should meet with communications officials to discuss FireSmart guideline compliance at communication structures.

Residential - Commercial – Institutional Infrastructure

Residential - The community of CLP has developed along and inland from the east and west shorelines at the north end of Cultus Lake. Residential development is dense and the community features a well-defined interface with the coniferous forested areas located adjacent the community. With the exception of one 75 metre strip (7 lot) section on the west side of Munroe Avenue and two private developments in the north end of CLP – all residential lots that interface with the forested area are separated from that forested area by a paved roadway. There are no intermix residential developments with the exception of the two private developments in the north end of CLP – located on a non-CLP owned island of land (within the CLP boundary) west of Columbia Valley Road.

Commercial - A commercial core has been established to service the residential community and a number of businesses occupy a strip mall and other commercial lots adjacent the centrally located intersection of Sunnyside Blvd. and Columbia Valley Road. A large park facility with marina and beach is co-located with commercial facilities. None of these commercial facilities feature a direct interface with the forested areas located adjacent the community.

The two largest commercial developments are the Cultus Lake Water Park and Cultus Lake Golf Club. The Cultus Lake Water Park features a well-defined interface with the forested area adjacent the development perimeter and is separated from that forested area by a paved / gravel roadway. The Cultus Lake Golf Club features a well-defined interface with the forested area adjacent the development perimeter – values are separated from that forested area by either a paved roadway or an irrigated fairway.

Institutional – The community of CLP features several administrative buildings adjacent the centrally located intersection of Sunnyside Blvd. and Columbia Valley Road. The CLP Works Yard and Office, as well as the Fire Dept. and Elementary School are located on the east side of Sunnyside Blvd. None of these administrative or institutional facilities feature a direct interface with the forested areas located adjacent the community.

The Cultus Lake Salmon Research Laboratory operated by Fisheries and Ocean Canada is a hatchery/research facility located on a non-CLP owned island of land (within the CLP boundary) along Columbia Valley Road adjacent Sweltzer Creek. The Ministry of Forests and Range Wildfire Management Branch Fraser Zone operates the Cultus Lake Base on a parcel of land adjacent the intersection of Parmenter Road and Columbia Valley Road. Both of these institutional facilities feature a direct interface with the forested areas surrounding them and are not separated from that forested area by a paved roadway to any significant degree.

General FireSmart Status of CLP Residential - Commercial – Institutional Infrastructure

Vegetation Management - Most structures in the core CLP residential areas that interface with a forested area are separated from that forested area by a paved roadway which provides a significant measure of compliance with FireSmart recommended guidelines with respect to Priority Zone 1 and 2 vegetation management for those structures. Forest vegetation within the core CLP residential areas is frequently coniferous and of the single or small cluster specimen tree and hedge variety within a backyard landscaped environment. Some CLP residential areas have accumulations of slash, garden and forest debris piles (Fig 5-12) adjacent the community forest interface. These fuel accumulations will increase wildfire intensity and spread rates in the area and should be removed.

Structures - Many of the structures located in the core CLP residential areas do not comply with all FireSmart recommended guidelines with respect to structural options. There is no legislated or regulatory requirement for newly constructed or retrofitted structures to comply with FireSmart recommended guidelines with respect to structural options. While most structures feature rated roofs – many roof surfaces have accumulated forest debris and structural features such as open decks, combustible outbuildings, fences and wood / building material piles adjacent structures are common. Structural density is high (Fig 5-13) and the community is thus more vulnerable to an urban conflagration (structure to structure fire spread – frequently wind driven – i.e. Slake Lake, May 2011) type of fire. Urban conflagrations can be initiated by wildfire adjacent the community or an unsuppressed structural ignition within the community.

Infrastructure – Access routes are congested due to structural density and parking along access routes. Parked vehicles often exacerbate access route congestion during the peak summer visitor season – with congestion factored in, access route minimum width does not meet FireSmart recommended guidelines. Access routes are looped providing two way access to most residential locations – the exception is the residential area on the west side of Cultus Lake where both Munroe Ave. and Lakeshore Drive dead end with cul-de-sac turnarounds that do not meet FireSmart recommended guidelines. Fire Department responders do not report significant access challenges for residential fire response within CLP with grades and bridge limitations adequate. Responses to other parts of the CLP Fire Dept. Fire Protection Area (Soowahlie IR 14 – speed bumps, Vedder Mountain Forest Service Rd.) are more problematic due to engine clearance limitations. Responses to FVRD Electoral Area E portions of the CLP Fire Dept. Fire Protection Area do feature non-looped access routes with cul-de-sac turnarounds.

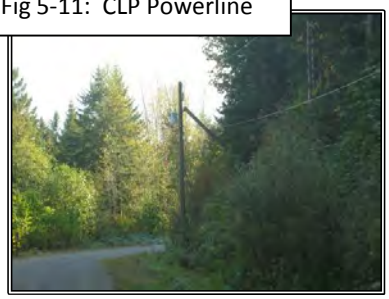
Fig 5-9: CLP Golf Course

Open spaces and greenbelt areas are numerous adjacent the CLP residential core and, where they exist, are effective in moving the edge of the forested area interface away from structures and facilities.

Fig 5-10: CLP Hydrant

Water supply to the community is from a piped aquifer that supplies a large reservoir via an intake pumping station with two independent well heads located on Sunnyside Ave in concrete pumphouses with backup diesel generator power supply. CLP hydrant infrastructure is described as adequate by fire officials with 23 hydrants featuring an average pressure of 50 psi and 200 gpm flow (exception is hydrants in the Lakeshore Rd area with lower pressure). No structure in CLP is located further than 300 metres from a hydrant. There are a total of 51 hydrants in the CLP Fire Protection Area – hydrants outside of CLP vary in with respect to pressure and flow adequacy.

Fig 5-11: CLP Powerline



Electrical utilities are above ground and vulnerable to both tree strike (with attendant ignition possibilities) and wildfire threat. Both transmission and distribution lines feature sections of powerline that do not meet FireSmart recommended guidelines. Gas utilities are provided via underground service – above ground LPG tanks are not an issue.

Recommendation 5.2.2.5 CLP fire officials should ensure FireSmart recommended guidelines for vegetation management, structural and infrastructural modifications are applied to all CLP structures and infrastructure.

Fig 5-12: Garden + forest debris piles adjacent CLP residential interface

Fig 5-13: High structural density in CLP residential core

5.2.3 Wildfire Evacuation Planning: An evacuation plan recognizes the potential requirement for evacuation of CLP residents and visitors during wildfire emergencies at or near CLP.

Significant tourist populations frequent the CLP area during wildfire season. Principal concerns with respect to evacuation issues on a peak summer day are i) CL Water Park with up to 5,000 visitors on peak days and ii) CLP campground with 500 sites and up to 3,000 visitors.

Livestock evacuation issues in CLP are limited to several sheep maintained at one property in the north end of CLP.

An evacuation exercise was conducted in May of 2010, one week before the long weekend when CLP occupancy was estimated at approximately 60%. Mock evacuation notices were delivered to all residences by 6 – 7 teams (composed of RCMP, Fire Dept. and Park Patrol members) in 2.5 hours.

An evacuation procedure would be triggered by:

i) a major wildfire or fires starting or advancing to within a pre-determined distance of CLP or;

ii) a fire ignition immediately adjacent or within CLP that spreads aggressively and threatens CLP or access to CLP by direct fire impingement or ember transport / spot fire ignition within CLP.

CLP fire and emergency response personnel will monitor any wildfire activity in the vicinity of CLP via regular communication with BC Ministry of Forests and Range fire officials. Evacuation procedures should establish evacuation triggers for specific areas and identify primary / secondary evacuation routes and safety zones for evacuee marshalling.

While a complete evacuation of CLP due to wildfire threat is unlikely, evacuation of specific CLP areas or resident groups (those vulnerable to high smoke concentrations and poor air quality) may be required.

CLP features a number of evacuation route possibilities. The primary evacuation route for all CLP residents is the Columbia Valley Highway (Cultus Lake Rd.) north to Chilliwack's Heritage Park. The secondary evacuation route for all CLP residents is the Soowahlie Rd. to Sweltzer Creek Cres. (Sleepy Hollow Rd.) and north to Chilliwack's Heritage Park. Emergency officials have planned for two-lane egress (one way north) from CLP to Chilliwack to be established if required.

In the event that primary or secondary evacuation routes to the north are lost it would be necessary to marshal evacuees in pre-identified central safe zones until evacuation routes are cleared. CLP features a number of fuel-free areas (parks, parking lots, large fields and the lakeshore / beach area) within and adjacent most areas of CLP. There is no viable evacuation route to the south.

The CLP Emergency Operations Centre (EOC) is located in the CLP Community Hall, a centrally located FireSmart structure. The EOC functions to coordinate planning, logistical and administrative support to a wildfire incident. Chilliwack is the backup location should the CLP EOC location need to be evacuated.

Fraser Valley Regional District (FVRD) Community Emergency Response Program has developed an Emergency Plan for Electoral Area E which encompasses CLP. The plan is comprehensive and contains responsibilities, procedures and contact information in the event of an emergency. The plan also identifies media contact details and lists the organization and volunteers that will provide door to door evacuation procedure notification. Wildfire is identified in the Plan as the primary natural hazard concern of CLP.

Recommendation 5.2.3.1 A written wildfire evacuation procedure should be included as part of the CLP Emergency Response Plan – a component of the CLP Emergency Program. CLP fire and emergency response officials should meet with BC Ministry of Forests and Range Wildfire Management Branch, BC Parks, Provincial Emergency Program (PEP) and Regional District emergency planning representatives to review and update the wildfire evacuation plan on a regular basis.

The CLP wildfire evacuation procedure should:

-Identify primary or secondary evacuation routes for all areas of CLP;

-Identify reception centre, marshalling points, safe zones;

-Identify all resources required to implement the evacuation plan;

-Develop a communications – public awareness strategy to inform the public.

5.2.4 Post-Wildfire Rehabilitation Planning: Watershed stability is dependent on intact standing and surface vegetation and soil that resists erosion and sedimentation. Any significant wildfire disturbance could seriously affect watershed stability. There are some areas in CLP where wildfire impacts on steep, burned slopes with erosive soils could, with sudden storm events, result in a variety of slope stability issues.

Post wildfire rehabilitation planning is important and helps to avoid long term damage to slopes, soils or storm drain infrastructure by designating restoration activities that will mitigate damage caused by fire suppression activity or high intensity fire. Provision of timely post wildfire damage assessments and mitigation recommendations will assist CLP officials to obtain contractors for required rehabilitation work. It is important that the work is completed before any major storm events occur with the potential to trigger undesirable post-wildfire effects. Sudden, high intensity rainfall events, on areas with post wildfire water repelling soils are often linked to flooding and increased erosion.

Recommendation 5.2.4.1 CLP planning officials should develop post wildfire rehabilitation plans that address the full range of rehabilitation activities that may be required on a large burn area (500 – 4,000 ha's). Initially, rehabilitation work will focus on stabilization of slopes and protection of infrastructure.

Recommendation 5.2.4.2 CLP planning officials should prepare a list of contractors that are qualified and capable of providing post-wildfire assessments and emergency stabilization/rehabilitation of damaged areas.

5.3 Wildfire Response

The CLP Fire Department is responsible for fire and emergency response in the CLP Fire Protection Area. The Fraser Valley Regional District (FVRD) operates the Cultus Lake Volunteer Fire Department (CLVFD). The CLFVD serves the CLP jurisdiction as well as certain areas within the Fraser Valley Regional District – Electoral Area E, the Soowahlie Indian Reserve 14 and Cultus Lake Provincial Park. Mutual aid is provided by Columbia Valley FD and Chilliwack FD.

Fig 5-14: CLP Fire Hall

The CLVFD responds to structural fire, wildfire and other emergency incidents with 19 trained volunteers with a minimum of 15 members available within 30 minutes.

Use of safe and effective wildfire response procedures by trained members of the CLVFD can contain small wildfire ignitions before they escape control and become larger wildfire incidents. The CLVFD currently responds to wildfires and is compensated at prescribed rates for that action in accordance with the conditions outlined in the B.C. Ministry of Forests and Range (MoFR), Wildfire Management Branch, Coastal Fire Centre Operating Guidelines.

5.3.1 Wildfire Reporting and Response: Detection and reporting of wildfire ignitions during periods of high and extreme wildfire hazard is critical to the success of wildfire initial attack efforts. All wildfires detected within the CLP Fire Protection Area are reported to the CLVFD and / or the MoFR Wildfire Reporting line - 1-800-663-5555 (or *5555 cellular). Changes to the Wildfire Act restrict MoFR wildfire response on fires within CLP jurisdiction to provision of suppression assistance subject to resource availability and on an as requested / required basis. MoFR resource availability may be limited prior to May 15 and after September 1 during any fire season.

Recommendation 5.3.1.1 CLP fire and emergency response officials should review wildfire reporting and initial response procedures with BC Ministry of Forests and Range - Wildfire Management Branch - Fraser Fire Zone representatives annually.

5.3.2 Training: Wildland fire suppression training is provided to CLVFD members with approximately half (10 out of 19) having completed S-100 training which is provided over two days every other year in a joint training session with Columbia Valley Fire Dept.). ICS 100 training has been undertaken via self-study by approximately half (10 out of 19) of the CLVFD members. No S-115 or S-215 (WUI operations) training has been provided to CLVFD members.

CLVFD members occasionally cross train and engage in joint responses with MoFR Wildfire Management Branch, Fraser Fire Zone wildland fire suppression crews stationed at Cultus Lake Base.

Recommendation 5.3.2.1 All CLPVFD members should be provided with a basic wildland fire suppression training course on an annual basis. CLPVFD members should also be provided with interface fire operations and Incident Command System training with review/refresher training provided on an annual basis.

***5.3.3 Wildland Equipment*:** The CLVFD responds with a 2007 Freightliner pumper truck, a 1980 pumper truck, and a 1992 cube van emergency vehicle.

CLVFD does not have a complete set of personal protective equipment required for wildland fire response. CLVFD maintains a complement of ~12 wildland hand tools (pulaskis, shovels) and backpack pumps.

CLVFD Water delivery equipment includes:

-1 x Wildfire Mark 3 portable pump (unserviceable)

-1 x Honda WX15 portable pump

-1 x Honda GXV 340 11 HP Floto pump

-1 x 1,500 Imp. Gal self-supporting porta-tank

-2 ½ inch hydrant gate valves

CLVFD equipment is compatible with equipment used by MoFR Wildfire Management Branch, Fraser Fire Zone fire crews via use of 1 ½ inch quick-connect wildland hose adapters.

CLVFD requires the following water delivery equipment:

-portable wildland pressure pump and volume pump;

-1½ inch quick-connect wildland hose;

-¾ inch econoflow hose;

-structure protection sprinklers and accessories

A CLVFD fire/rescue boat with adequate pumping capability would provide significant advantage to Fire Dept. response effectiveness during responses to structure or wildland fires adjacent the lakeshore.

Recommendation 5.3.3.1 Additional wildfire suppression equipment would improve CLPVFD wildfire suppression effectiveness. The following items should be purchased:

-pressure pump (Wildfire Striker II Plus, Wildfire Ultra-Striker or Wildfire Mark 3) complete (suction hose, fuel can, tool kit with valves + nozzles etc.);

-volume pump (Honda WH30X or equivalent) complete (suction hose, fuel can, tool kit with valves + nozzles etc.);

-1,000' x 1 ½" wildland lined fire hose lengths;

-500' x ¾" econoflow hose lengths;

-sufficient quantity of wildland personal protective equipment to outfit 20 firefighters with Nomex coveralls, helmets, wildland boots, gloves, goggles, ear protection.

Recommendation 5.3.3.2 CLPVFD should purchase a basic structural sprinkler protection system. A basic sprinkler kit package would include sufficient equipment (sprinkler heads, hoses, valves and adapters, mounting poles and brackets) to provide rooftop sprinklers for 10 - 15 structures and Priority Zone 1 and 2 sprinkler coverage for 250 metres of sprinkler line. CLPVFD members should be trained and exercise in the rapid assembly and activation of the sprinkler system.

Recommendation 5.3.3.3 CLP fire and emergency response officials should conduct a needs analysis and assess options for acquiring a CLVFD fire/rescue boat. The boat if equipped with adequate pumping capability and other equipment would provide significant advantage to Fire Dept. response effectiveness during responses to structure or wildland fires adjacent the lakeshore.

5.3.4 Water Supply

Water supply to the community is from a piped aquifer that supplies a large reservoir via an intake pumping station with two independent well heads located on Sunnyside Ave in concrete pumphouses with backup diesel generator power supply.

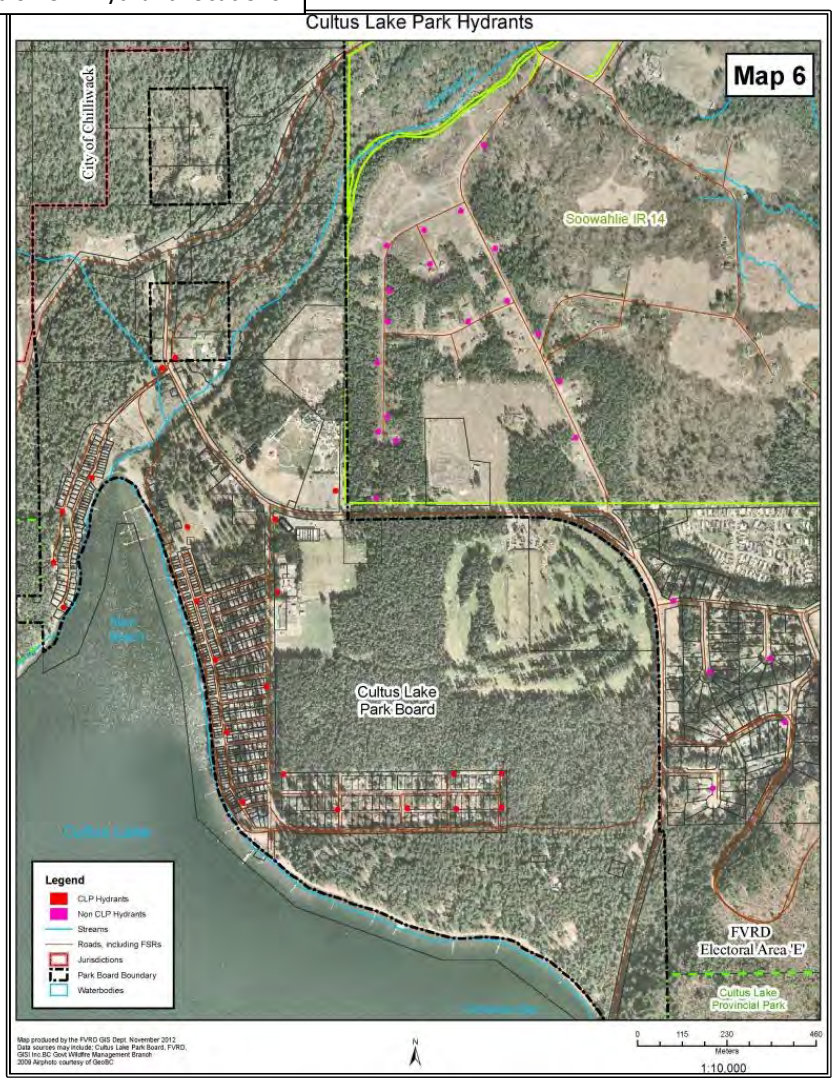
CLP hydrant infrastructure is described as adequate by fire officials with 23 hydrants featuring an average pressure of 50 psi and 200 gpm flow (exception is hydrants in the Lakeshore Rd area with lower pressure). No structure in CLP is located further than 300 metres from a hydrant. There are a total of 51 hydrants in the CLP Fire Protection Area – hydrants outside of CLP vary with respect to pressure and flow adequacy.

No formal needs analysis or evaluation of potential interface wildfire suppression water delivery sites has been conducted. This would involve identifying the requirement for and potential location of dry hydrant, engine accessible reservoir or gravity standpipe installations for use during a wildland fire response.

Recommendation 5.3.4.1 CLPVFD fire officials should commence a formal tactical response planning process for all foreseeable wildfire tactical response situations. Tactical response access as well as resource and water requirements for both planned sprinkler systems and tactical engine needs should be included in the tactical response plan. This process should include an evaluation of requirements for dry hydrant, engine accessible reservoir or gravity standpipe installations for use during a wildland fire response.

Recommendation 5.3.4.2 CLPVFD fire officials should work with City Works personnel to ensure adequate hydrant water supply in all foreseeable wildfire tactical response situations. Exercises to test the effectiveness of emergency firefighting water supplies during wildfire tactical response are recommended.

Map 6: CLP Hydrant Locations



5.4 Legislation

While fire and land management agencies can influence the possibility that wildfire will impact communities in the wildland urban interface through fire prevention, suppression and fuel management it is local government that can reduce the potential for interface fire disasters and wildfire damage through both public education and the use of legislative tools.

It is important that, in areas vulnerable to wildfire hazard, all new development or addition / retrofitting to existing structures takes place in accordance with FireSmart recommended guidelines applying to vegetation management, structural design and construction and infrastructural design or modification.

Community leaders must continue to support 'FireSmart community' public education initiatives as well as seeking opportunities to mitigate interface fire hazard through the use of FireSmart planning guidelines backed with legislative authority.

5.4.1 Interface Fire Legislation and the Community Planning Process

Many local governments (with or without wildfire hazard issues) have implemented fire use and fire protection bylaws. Communities with wildfire hazard issues require more specialized legislation that targets specific wildfire hazard mitigations by requiring the use of specific building materials and vegetation to structure clearance distances and treatment standards. This type of legislation is not as common across provincial municipalities but is being steadily implemented as community leaders look for proactive solutions to their community's wildfire hazard mitigation challenges.

A variety of specific legislative tools can be used to control development in communities in wildfire hazardous area. Two of the most common are Official Community Plans (OCPs) that use development permit areas (DPAs), and covenants.

Official Community Plans (OCP's)

Official Community Plan's provide a statement of objectives and policies to guide decisions on planning and land use management and can be an effective tool in mitigating any interface fire threat.

The Local Government Act provides specific powers to address "wildfire hazard" and states that OCP's must include "...restrictions on the use of land that is subject to hazardous conditions..."

Communities with interface wildfire hazard issues should use the OCP to set out policies to mitigate that hazard. Stating such a policy necessitates employing a means of influencing the nature of any subsequent development.

Example: A policy could be entered in the OCP noting a concern regarding development in interface areas and stating that a higher level of planning and impact analysis will be required prior to development approval.

Development Permits

Official Community Plan's using development permits options may be employed by a municipality or for designated areas of regional districts covered by an OCP. Development permits as a component of an OCP can provide the basis for influencing development in areas with interface fire risk.

Development Permits:

-apply only to new subdivisions and have no effect on existing development.

-are attached to the title of the property.

-are the responsibility of the property owner to carry out.

-can be required:

-as a condition of subdivision or;

-at the time a building permit is required.

OCP's can designate Development Permit Area's (DPA's) for the protection of development from wildfire hazard. DPA's must be accurately defined and justified, a requirement that is often met through the provision of Wildfire Hazard Reports by private consultants or provincial agency expertise. The Local Government Act requires the conditions or objectives justifying the designation to be prescribed and to specify guidelines respecting the manner by which these will be addressed. DPA's may include requirements on development character and landscaping (in relation to wildfire hazard) such as:

-siting, form, exterior design and finish of structures;

-type and proximity of vegetation to the development.

Covenants

Covenants are the most direct method of mitigating interface fire hazard on private land.

The basis for requiring covenants may be lodged in either the OCP or in a subdivision control bylaw. Covenants registered on the title of property are an effective method for addressing a wide range of interface fire hazard issues with one approach. Covenants can address structural and landscaping issues (landscaping and yard storage can contribute to the interface fire hazard and are difficult to address with the other legislative tools). Covenants are only as effective as the will of the Grantor to take on the role of enforcer. In most cases this is local government through bylaw enforcement provisions.

The B.C. Land Title Act - Section 219 allows for the placement of a restrictive covenant against the title of a property requiring that certain restrictions apply to that land.

Restrictive covenants are placed by virtue of the jurisdiction of the Approving Officer and are a commonly utilized method of wildfire hazard reduction in B.C.

Covenants place specific conditions on the use of a property and can be required for lot development within "existing subdivisions" via the building permit system. Covenants may also be a requirement for new subdivisions where the need is based in the respective bylaw.

The following examples pertain to registration of covenants to ensure the following outcomes:

-Potential purchasers are made aware of interface issues and property owner role in protecting their housing investment.

-All roofing installations and materials meet class "B" fire rating requirements contained within the B.C. Building Code.

-Municipality is "saved harmless" in the event of damage to homes as a result of interface fire spread.

-Fuel modified areas maintained from home to property boundary, or 10 m distance, whichever is less.

-All eaves, attics, decks and under floor openings are screened to prevent the accumulation of flammable material, and;

-All wood burning appliances are installed with approved spark arrestors.

Recommendation 5.4.1.1 Cultus Lake Park planning and fire officials should ensure that guidelines for development permit issuance in any Development Permit Area – Wildfire Hazard Area require that all new development or addition/retrofitting to existing structures takes place in accordance with FireSmart recommended guidelines applying to vegetation management, structural design and construction and infrastructural design or modification.

5.4.2 Regional and Local Cooperation

The community of CLP is surrounded by land and developments governed by other jurisdictions. While CLP can seek opportunities to mitigate interface fire hazard through the use of FireSmart planning guidelines backed with legislative authority it will be important that any regulatory approach to wildfire risk mitigation be coordinated with neighbouring jurisdictions.

Specifically, CLP shares jurisdictional boundaries with:

- Soowahlie Indian Reserve 14
- FVRD Electorial Area E
- Cultus Lake Provincial Park
- City of Chilliwack

Recommendation 5.4.2.1 Cultus Lake Park planning and fire officials should consider opportunities to ensure that any regulatory approach to wildfire risk mitigation be coordinated with neighbouring jurisdictions.

5.4.3 Status of Interface Fire Legislation – Cultus Lake Park

The CLP community is experiencing increasing redevelopment pressure with continued growth forecast for the foreseeable future. The physical layout of CLP is such that most future development will be required to occur on and adjacent the community perimeter – an area potentially subject to various degrees of wildfire hazard. FireSmart development can occur in this or any area but will require proactive imposition of planning or development controls tailored to wildfire hazard mitigation.

This report uses the following classifications to describe the legislative potency of the various categories of interface fire legislation.

> ***Strong:*** Legislation refers directly to wildfire hazard and i) provides specific direction on abatement or mitigation of wildfire hazard and ii) further imposes restrictions on development on land that is subject to wildfire hazard.
>
> ***Moderate:*** Legislation discusses or refers indirectly to wildfire hazard but i) lacks specific direction on abatement or mitigation of wildfire hazard and ii) does not impose restrictions on development of land that is subject to wildfire hazard.
>
> ***Pending:*** Legislation does not discuss or refer to wildfire hazard.

The following legislative items were reviewed for their current and potential capacity to mitigate interface fire hazard through the use of FireSmart planning guidelines backed with legislative authority.

On the basis of this review CLP interface legislation would be classified as 'pending / moderate'.

> **General Regulations Bylaw Item 27** – Burning Conditions and Restrictions – prohibits all unpermitted open fires, discusses some details on obtaining an open fire permit and requires that permitted open fires be lit only in designated areas. No other parameters for the use of open fire are provided eg. Size, fuel type, attendance and required suppression equipment, prevailing environmental conditions or open fire use during fire ban.
>
> **General Regulations Bylaw Item 6** – Tree Cutting or Removal – regulates a number of activities relevant to wildfire hazard reduction with respect to vegetation management and requires cleanup of any debris resulting from tree cutting or removal. No specific mention of wildfire hazard reduction intent or FireSmart recommended guidelines is made and there are a number of additions or clarifications that could better support implementation of FireSmart vegetation management guidelines.
>
> **Fire Department Bylaw Item 14** – General Provision empowering the Fire Chief to cause removal of a hazard to persons or property – discusses structural fire hazard issues. No specific mention of wildfire hazard reduction or application of FireSmart recommended guidelines is made.

Park Plan – General Policies section discusses a number of issues relevant to wildfire hazard reduction and adoption of FireSmart recommended guidelines. No specific mention of wildfire hazard reduction or application of FireSmart recommended guidelines is made.

Specified Area Bylaw – discusses a number of issues relevant to wildfire hazard reduction and adoption of FireSmart recommended guidelines. No specific mention of wildfire hazard reduction or application of FireSmart recommended guidelines is made. CLP officials are currently working with FVRD staff to update this Bylaw – inclusion of Development Permit Areas is under consideration and provides further opportunity for application of FireSmart planning guidelines.

Building Bylaw #5 – addresses a number of issues relevant to wildfire hazard reduction and adoption of FireSmart recommended guidelines. No specific mention of wildfire hazard reduction or application of FireSmart recommended guidelines is made.

Recommendation 5.4.3.1 Cultus Lake Park planning and fire officials should review and compare both existing CLP bylaws and examples of successful interface fire legislation in consultation with an interface fire protection specialist. Development of viable interface fire legislation may be most effectively facilitated by implementing an Official Community Plan or equivalent legislative vehicle with a Development Permit section that incorporates a schedule designated Development Permit Area – Wildfire Hazard Area.

5.5 Fuel Treatment

Fuel treatment can be an effective method of preventing high intensity wildfire from developing and for reducing destructive wildfire behaviour. Fuel treatments can limit fire spread towards or away from the WUI community interface.

5.5.1 Fuel Treatment Goals

The goal of fuel treatment is to reduce crown fire behaviour through the reduction in surface fuels, ladder fuels, and crown fuels in priority areas. This threshold of reduction varies by ecosystem type, fuel type present, fire weather, slope, and other variables. However, as a rule of thumb, tree crown continuity must be discontinuous (<400 sph depending on tree size), surface fuels must be below 1kg/m^2, and ladder fuels must be at least 3 m above surface fuels.

Fuel treatments are applied first to those fuels adjacent values at risk – fuel removal within Priority Zone 1 and subsequently, to fuels further from values at risk - fuel reduction in Priority Zones 2 + 3. Fuel conversion strategies can be used in Priority Zones 1 - 3 and reduce wildfire danger by retaining deciduous or low flammability species over the more combustible coniferous trees or plants. Fuel treatment goals address two priorities:

1. Reduce the chance of structural ignition from direct wildfire impingement by implementing FireSmart fuel reduction recommended guidelines wherever fuels are located within 30 m of residential values at risk. A secondary benefit will be realized in the reduction of accidental wildfire ignition risk within or adjacent interface areas.
2. Reduce the chance of structural ignition from heavy firebrand accumulation and resulting spot fire ignitions by minimizing high intensity and crown fire potential within or up to 100 m from interface areas or within strategically located fuel treatment sites.

5.5.2 Fuel Treatment Application

Fuel treatments are typically applied under prescriptions that accomplish hazard reduction and as much as possible provide a degree of ecosystem restoration. Fuel treatment prescriptions will attempt to mimic the effects provided by natural disturbances historically present in an area. When prescribed fuel treatments duplicate natural disturbances - fundamental ecosystem processes are maintained and the result is a long lasting, ecologically superior and more fire resistant landscape.

Fuel treatments vary in complexity and scale from those undertaken on a landscape scale for community protection to those accomplished immediately adjacent values at risk on a site specific basis.

Fuel treatments are done for 3 reasons

-Reduce fire intensity at impingement with interface or intermix values at risk

-Reduce spotting potential in fuels < 2km from community or values.

-Provide an example of FireSmart fuel treatments conducted on public lands to motivate residents to accomplish similar fuel treatments on private land.

In general, the following steps should be followed to conduct fuel treatments:

-A qualified professional forester should develop the prescription;

-Public consultation should be conducted during the process to ensure community support;

-Treatment implementation must weigh the most financially and ecologically beneficial methods of fulfilling the prescription goals;

-An environmental monitor should be involved in ensuring that the treatments are correctly implemented;

-Pre- and post-treatment plots should be established to monitor treatment effectiveness;

-A long term maintenance program should be in place to ensure that the fuel treatment is maintained in a functional state.

5.5.3. Fuel Treatment Recommendations

Fuel treatment recommendations are based on FireSmart fuel management guidelines and incorporate the following general principles:

1. Removal of selected whole trees to leave a forest of more separated and fire resistive trees – removal of trees to reduce stem density to <40% crown cover with 3 – 6 metres between tree crowns will minimize the potential for crown fire spread.
2. Pruning of trees to increase the height to live crown to a minimum of 2 meters, this reduces the potential for surface fire to spread into tree crowns.
3. Removal of surface fuels or slash created by spacing and pruning.

Fuel treatment recommendations provide for shaded and open fuel breaks by varying whole tree spacing criteria.

Shaded fuel break - Fuel treatment recommendations for smaller, non-continuous blocks of fuels located within the community interface. These areas are subject to accidental or spot fire ignitions and fuel treatments focus on preventing ignitions from developing into high intensity crown or surface fire. This treatment will focus on surface/ladder fuel removal with less aggressive whole conifer thinning. This treatment can also be applied wherever site aesthetic issues exist.

Open fuel break - Fuel treatment recommendations for continuous fuels located on or adjacent the community interface. These areas are subject to crown fire impingement and fuel treatments focus on preventing crown fire spread. This treatment will focus on surface/ladder fuel removal with more aggressive whole conifer thinning to reduce crown closure.

Fuels are managed by:

-Mechanical means – removal and reduction of fuels with machinery or hand tools, salvage opportunities are maximized and the remainder burned.

-Controlled fire application – prescribed burning – often following a mechanical thinning or treatment – especially when untreated fuels are immediately adjacent values at risk.

-Structural modifications – structures are potential fuel for a fire – structure combustibility is reduced with the application of FireSmart structural modifications.

Recommendation 5.5.3 CLP should commence an area specific fuel treatment program (implemented over 5 years on a priority basis) that targets progressive fuel reduction in higher hazard fuel type areas identified by the CWPP planning process (section 5.5.6 – CLP Hazard Reduction Fuel Treatments). The goal of fuel treatment is to reduce both crown and surface fire potential in priority areas. Fuel treatment programs will require that fuel treatment plans and site specific prescriptions be developed in consultation with qualified interface fire protection professionals.

5.5.4. Existing and Proposed Landscape Fuelbreak Units

As described in Section 4.3, Cultus Lake Park is situated within an encircling network of fuel types that range from higher hazard fuel types such as continuous coniferous to lower hazard fuel types such as deciduous, mixed / open fuel types, non-fuel types and fuel modified areas (highways, golf course or open fields and transmission line right-of-ways).

Fuel Type fuelbreaks - A number of lower wildfire hazard areas featuring deciduous / mixed or open fuel types (D1/2, M1/2, O1) have been identified by the CWPP planning process. (Map 4 – CLP Fuel Types). Fuel type polygons can comprise landscape fuelbreak units and the relative positioning of these areas is of interest for strategic planning purposes.

Note: Higher hazard fuel types featuring continuous coniferous fuel types are similarly identified by the CWPP planning process. While these areas feature varying degrees of wildfire hazard and do not comprise landscape fuelbreak units – planning officials must be aware of the potential for changes in forest cover on these units to increase the on-site wildfire hazard considerably. Slash remaining or juvenile ingrowth occurring on an areas following timber removal by logging or development interests can increase the wildfire hazard substantially in coniferous fuel types.

Highways and Roads - The CLP Study Area is bisected by the main Columbia Valley Road / highway access route and features a number of other paved or graveled roadways on and adjacent the CLP interface with forested areas. Roadways serve as both fuel breaks and access/egress routes.

In several locations the highway RoW and CLP roads and laneways could function, to varying extents, as strategic fuel breaks. It is therefore important to maintain these right-of-ways in a fuel reduced condition with grass and saplings cut back regularly and slash accumulations removed as

they develop. Ignition risk is higher adjacent roadways and further increases the need to regularly manage hazardous fuel conditions adjacent any roads or highways.

-Cultus Lake Provincial Park maintains a gated road from the south end of Parmenter Rd. that accesses a Group Campground on the west side of Cultus Lake. This roadway accesses a strategically important area south and (typically) downwind of CLP – vehicle access for fire crews to this area is important and the road should be maintained in the current condition. Similarly, access to the east side of Cultus Lake is afforded by the Columbia Valley Rd. and connecting Provincial Park access roads (both non-gated and gated) provide important vehicle access for fire crews to this area and the road(s) should be maintained in the current condition.

-Forest Service Roads (FSR's) accessing the eastern slopes of Vedder Mtn are also important for fire crew access and should be maintained. Currently the deactivated condition of these roads is a constraint to efficient vehicle based response by fire crews. Similarly, the Vance Rd / Liumchen Creek FSR accessing the north-western slopes of Mt. Amadis is also important for fire crew access and should be maintained in current condition.

-Soowahlie IR 14 roads also provide important access for fire service vehicles. The existence of speed bumps on these roadways slows CLP Fire Dept. response to fires in the Soowahlie IR 14 area.

Powerlines - Powerlines in the CLP study area are generally located adjacent highways and roads and also feature an elevated ignition risk due to the potential for tree strikes or vehicle accidents compromising conductor integrity. Strategic fuelbreak considerations discussed for roadways are similarly applicable to powerline right-of-ways. Maintenance of powerline right-of-way corridors to a fuel break standard will reduce the wildfire ignition risk on and adjacent powerline right-of-ways and increase the reliability of CLP's power supply.

Recreational Trails - There are a number of recreational trails (walking, mountain biking , hiking) that, if thinned to recommended fuel treatment standards, would serve to limit fire spread from or past the trail right-of-way. Thinning on trail right-of-ways would also reduce ignition potential adjacent these high traffic / high ignition risk areas.

In summary, there are a number of opportunities to improve the wildfire protection afforded by existing landscape fuelbreaks. Recommendations for site level fuel treatments in specific fuelled areas adjacent low wildfire hazard areas are included in this plan.

CLP and its cooperating agencies should recognize that fire protection strategies incorporating fuelbreak development will require a long-range commitment to completing a variety of fuel treatments. Maintenance of treated areas will also be required. Fuel treatment strategies may or may not generate revenue from sale of salvage timber removed from fuelbreak areas – market conditions and treatment costs are significant variables in this respect.

In addition, fuelbreaks are only one component of a multi-faceted fire protection strategy. CLP will need to merge any fuelbreak strategy with other strategic initiatives such as site level fuel treatments, FireSmart modifications to structures and wildfire prevention, preparedness and response issues.

Recommendation 5.5.4.1: CLP fire officials should meet with BC Ministry of Forests, Lands & Natural Resource Operations officials to request the opportunity to provide input on all harvesting plans proposed in the vicinity of CLP

Recommendation 5.5.4.2: CLP should meet with BC Ministry of Transportation & Highway officials to discuss highway right-of-way vegetation clearing procedures and standards along those sections of highway adjacent CLP that could function as a strategic fuel break.

Recommendation 5.5.4.3: CLP should develop vegetation clearing procedures and standards for recreational trail maintenance in areas identified as strategic fuelbreaks – thinning with understory fuels removed over a 5m area on each side of the trail is proposed. Use of trails to facilitate access by fire suppression crews should also be considered in the development of any trail maintenance standard.

Recommendation 5.5.4.4: CLP should meet with BC Hydro officials to discuss powerline right-of-way vegetation clearing procedures and standards along those sections of transmission or distribution line that could function as a fuel break. CLP should work with utility companies to establish critical electrical infrastructure hazard reduction guidelines and cooperative arrangements for maintenance of low wildfire hazard conditions on and adjacent transmission or distribution line right-of-ways.

5.5.5 Fuel Hazard Assessment

Fire risk assessment in the CLP study area was conducted using the provincial Wildfire Threat Rating worksheet as required by the UBCM SWPI CWPP Program.

Worksheet results are summarized in Appendix 1: Wildfire Threat Rating Worksheet Summary

The worksheet assesses 4 categories of wildfire risk:

- Fuels
- Weather
- Topography
- Structural Values at Risk

Data was collected at forty-five fuel threat rating worksheet plots (Map 7). None of the forty-five plots had high risk ratings (Table 5-3).

Table 5-3: CLP Threat Rating Worksheet Assessments

	Threat Rating Worksheet Assessments		
Fuel Type	**LOW**	**MODERATE**	**HIGH**
C3		23	
C4		1	
C5		10	
D1	1	4	
M2		5	
01b	1		
Total	**2**	**43**	

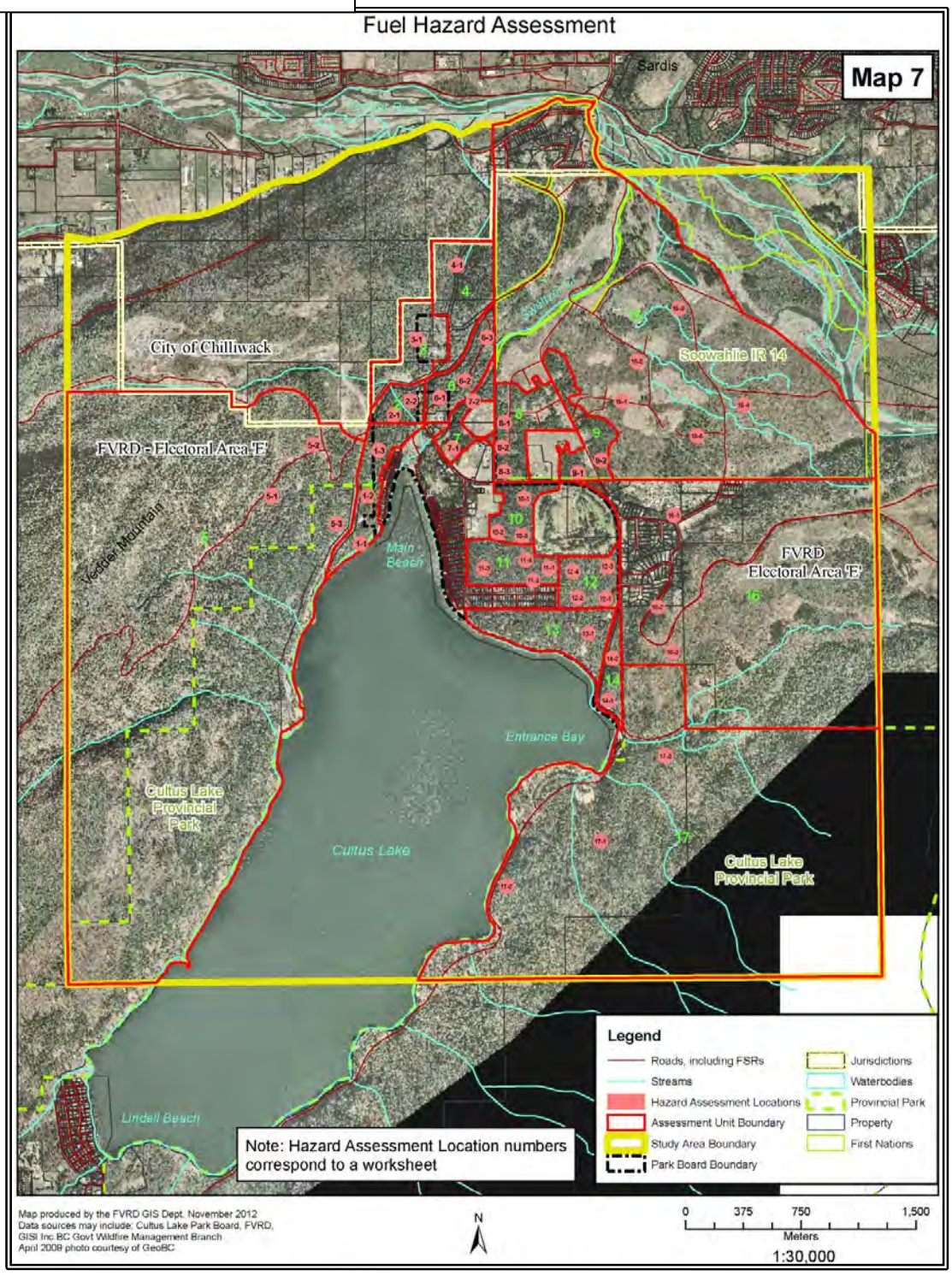
This is due to a number of factors:

- The CLP study area is largely located on flat terrain (resulting in a low risk level score under the 'Topography' category).
- The CLP study area biogeoclimatic zone and historical wildfire occurrence factors are also considered low risk (resulting in a low risk level score under the 'Weather' category). These two components account for 38% of the total possible ratings.
- Most CLP study area structural values at risk are located in interface configurations (as opposed to intermix) and are generally below or sideslope to fuel complexes (resulting in lower risk level scores under the 'Structural' category). The Structural category is only worth 14% of the total threat rating and so does not contribute substantially to the assessment.
- As well, duff and litter depth is generally only 2-5 cm and thus most sites had a low rating under that category.

Note: Assessed fire hazard is a dynamic variable and can change in relatively narrow timeframe. A wind event (resulting in significant accumulations of blowdown fuels) or other canopy altering disturbance would require a re-evaluation of crown fire potential as fuel structures change. Similarly, should forecast climate change trends increase the number of high fire danger days experienced at CLP, the threat of crown fire could increase (CLP recorded its longest drought since 1998 in August of 2012 – 28 days with no rain[6]. Temperature records were similarly broken during this period). Should extended periods of drought become more common in the future, the CLP community may wish to re-evaluate its level of fire preparedness and establish fire prevention or hazard mitigation interventions appropriate to the existing situation.

[6] Source – Chilliwack Times Aug. 20, 2012
:http://www.chilliwacktimes.com/Chilliwack+amidst+longest+drought+years/7118320/story.html#ixzz2JccqtqUe

Map 7: CLP Fuel Hazard Assessment



5.5.6 CLP Hazard Reduction Fuel Treatments

As discussed previously, forty-five Wildfire Threat Rating Worksheets were completed in the CLP Study Area - none of the forty-five plots were assessed with high risk ratings (Table 5-3).

Therefore, given the current low probability of crown fire behavior in the forest ecosystem (see note page 60) and fuel types in much of the CLP study area – landscape level hazard mitigation fuel treatments are not a particularly viable community protection option for the CLP study area. Notwithstanding the lack of assessed hazard to the facilities a variety of factors ranging from expense to ecological impact and site aesthetics all disqualify the application of standard landscape scale fuel treatments to the forested areas within and adjacent the CLP study area.

Conversely, significant wildfire hazard mitigation can be realized by the CLP community via the application of site level fuel treatments adjacent specific structures or structure groups.

FireSmart fuel management guidelines recommend that fuel treatments be applied first to those fuels adjacent values at risk – fuel removal within Priority Zone 1 and subsequently, to fuels further from values at risk - fuel reduction in Priority Zones 2 + 3.

> **Priority Zone 1 fuel treatments:** Priority Zone 1 areas within CLP are 'owned' by the leaseholders and as private land fuel treatment is not eligible for publicly funded fuel treatment program support – all fuel treatment required in these areas will have to be undertaken by the leaseholders.
>
> **Priority Zone 2 + 3 fuel treatments:** Further distant from the CLP residential interface, the responsibility for Priority Zone 2 and 3 fuel treatments will fall in most cases to the CLP Park Board. A publicly funded fuel treatment program does exist for these lands, specifically the Union of BC Municipalities (UBCM) Strategic Wildfire Prevention Initiative (SWPI) Operational Fuel Treatment Program (OFTP).

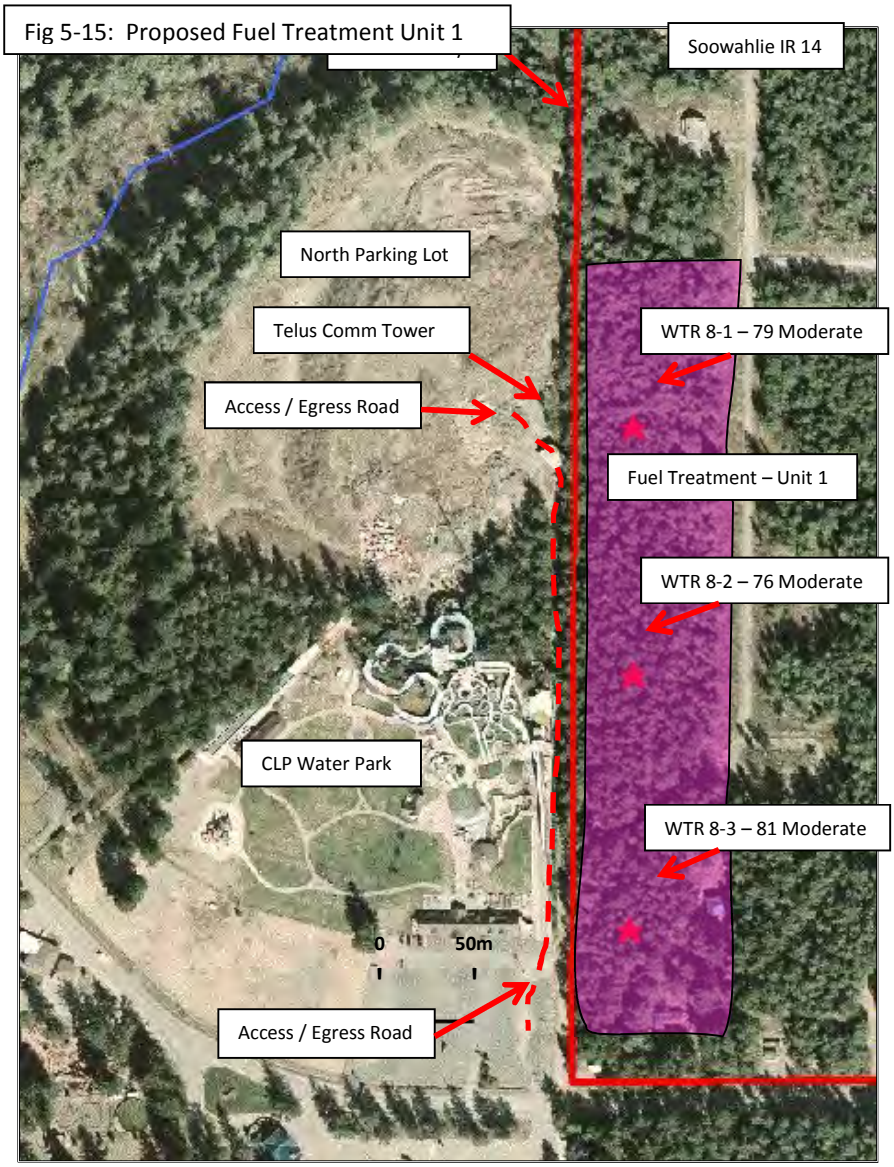
However, as described in Section 5.5.5 - Wildfire hazard assessments Levels for all assessed polygons in the CLP Study Area is moderate or less which will not qualify CLP Park Board owned lands for funding under the SWPI OFTP. Despite this, there are some areas adjacent the CLP interface that would benefit from the application of site level fuel treatments adjacent specific structures or structure groups.

A list of proposed fuel treatment areas follows on pages 63 – 67.

Fuel Treatment Unit	*Ownership*
1 - Water Park / Soowahlie 14	Soowahlie IR 14
2 - Lakeshore Munroe West - South	CLP Park Board + Cultus Lake Provincial Park
3 - Lakeshore Munroe West - North	CLP Park Board
4: Sunnyside / Mountainview	CLP Park Board
5: Sleepy Hollow	Private (631429 BC LTD).

Unit 1 - Water Park / Soowahlie 14:

Fig 5-15: Proposed Fuel Treatment Unit 1



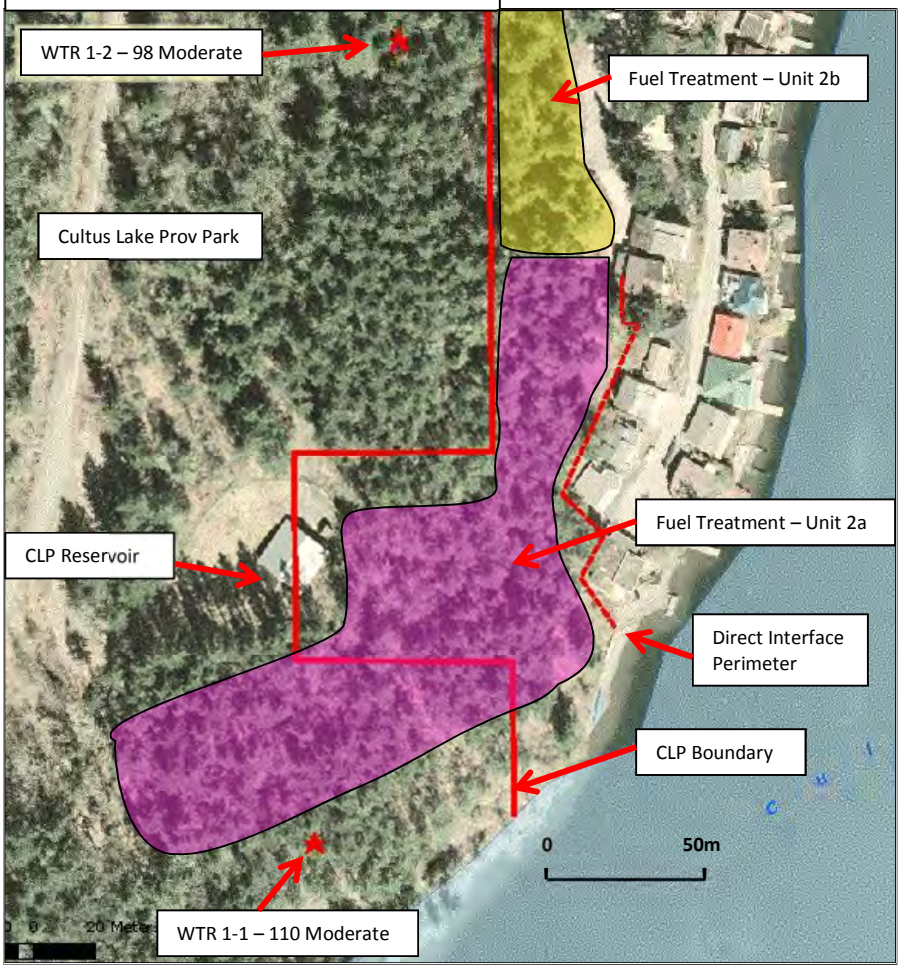
Forested strip adjacent and east of the Cultus Lake Water Park – This public / commercial facility is one of the largest water park attractions in the nation. Given the high site occupancy of the water park facility (4,500 users/day at peak attendance) coincident with the high wildfire danger conditions typically present during peak attendance periods (hot, dry weather) that increase the risk of an accidental ignition and subsequent rapid spread in the forest fuels adjacent the water park perimeter. Public safety could be endangered if fire behavior in the forested strip impinged on the water park structure. Evacuation of water park users is potentially compromised as egress from the rear parking area north of the water park facility requires vehicles to drive along a narrow roadway between the water park and the forest fuels.

There is evidence of high levels of human use within the forested strip (litter volume, trails and CLP personnel report previous accidental ignitions in this area) It is foreseeable that an ignition in this area on a hot, dry windy day could escape containment and require an evacuation of water park users under emergency conditions.

Treatment to FireSmart recommended guidelines for Priority Zone 2 within the forested strip east of the facility and parking areas, across its entire width or at least to a 30m treatment distance east of the north parking lot access / egress road is recommended. The forested strip is owned by Soowahlie IR 14 and a cooperative approach to funding application and fuel treatment coordination will be required. Installation of an alternate 'emergency use only' vehicle egress from the north parking lot is also recommended.

Unit 2 - Lakeshore Munroe West - South:

Fig 5-16: Proposed Fuel Treatment Unit 2



Forested strip adjacent
i) CLP residential properties 223 – 229 Monroe Ave. and; 44 Lakeshore Dr.

ii) CLP Reservoir

i) These eight residences are located on a direct interface perimeter of CLP. Most other CLP residential properties that interface with an adjacent forested area are separated from that forested area by a paved roadway that significantly increases the subject properties compliance with FireSmart vegetation management guidelines for Priority Zone 1 and 2.

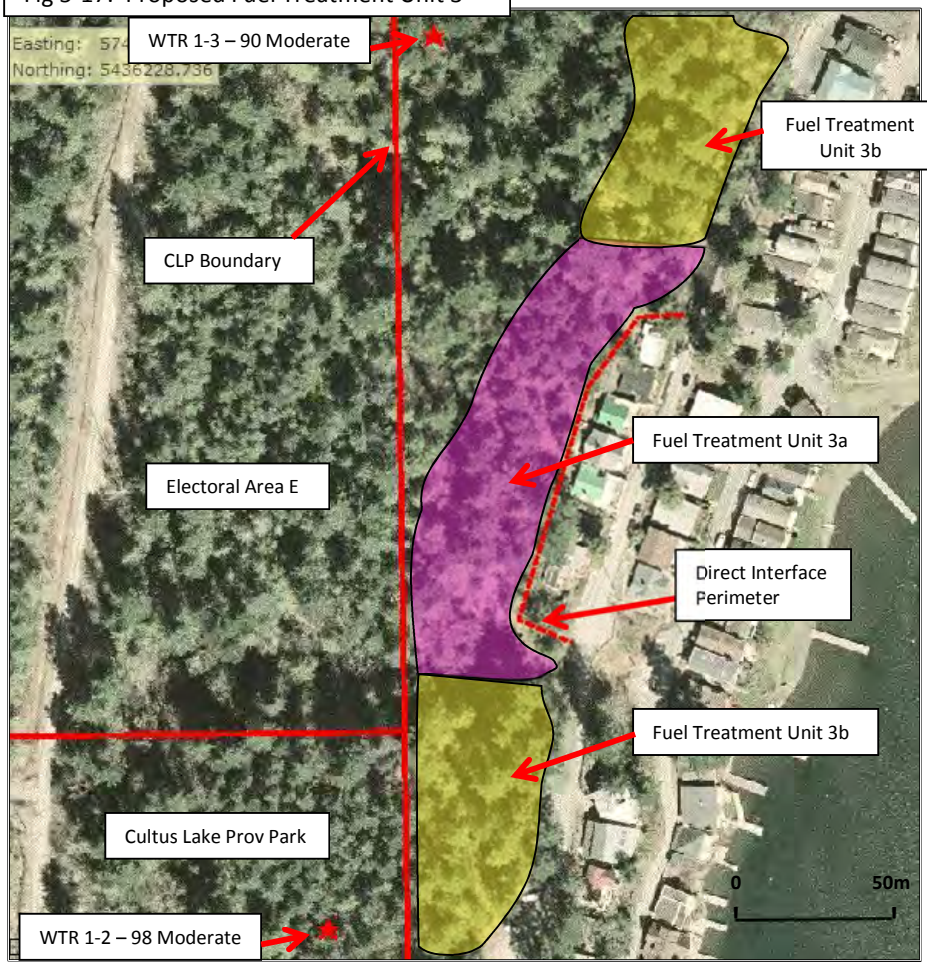
ii) The CLP Reservoir is located southwest of the Lakeshore / Monroe residential area. The reservoir is situated 125 m from the lakeshore, above and on the crest of a forested slope without adequate setback from that forested slope. While setback provisions are less critical for structures that feature an entirely non-combustible exterior and FireSmart construction - the critical infrastructure status of the reservoir and the existence of some wildfire vulnerable features on the reservoir structure provide some areas of concern.

The forested strip adjacent the subject properties is located on an east/south-east facing slope that is subject to short duration but strong diurnal wind influence. An ignition south of the Lakeshore Rd. / Monroe Ave./ CLP Reservoir properties could be expected to move north with wind influence and impinge on the interface perimeter of the subject properties.

Treatment to FireSmart recommended guidelines for Priority Zone 1 and 2 within a 30m width of forested strip adjacent i) the residential lease / public land boundary of the subject and adjacent Lakeshore Rd. / Monroe Ave properties, and; ii) the reservoir exterior, is recommended. Fuel treatment in Unit 2a is a higher priority than fuel treatment in Unit 2b. The forested area within Fuel Treatment Units 2a and 2b is owned by both CLP and Cultus Lake Provincial Park.

Unit 3 - Lakeshore Munroe West - North:

Fig 5-17: Proposed Fuel Treatment Unit 3



Forested strip adjacent CLP residential properties at: 307 – 313 Monroe Ave.

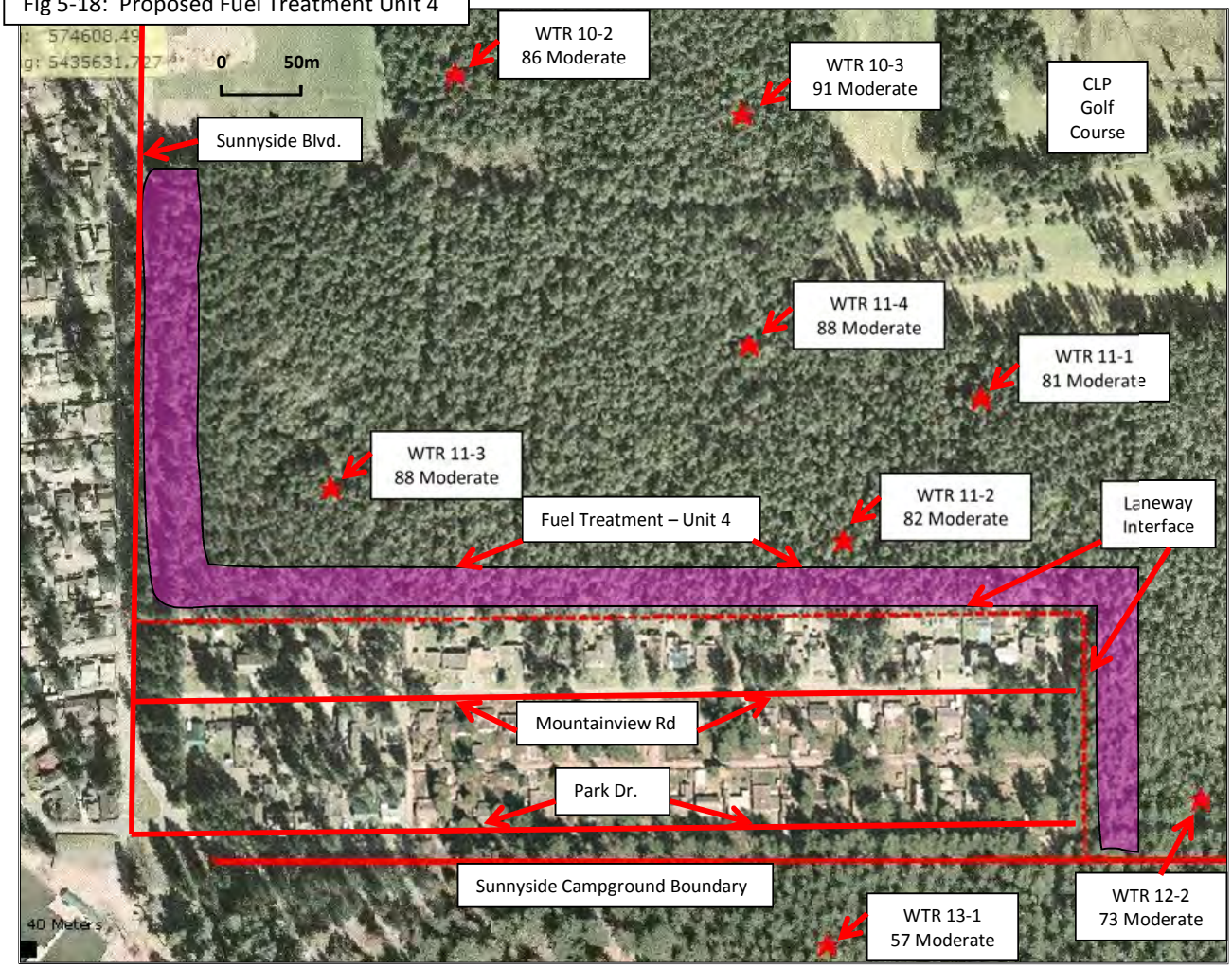
These seven residences are located on a direct interface perimeter of CLP.

Most other CLP residential properties that interface with an adjacent forested area are separated from that forested area by a paved roadway that significantly increases the subject properties compliance with FireSmart vegetation management guidelines for Priority Zone 1 and 2.

The forested strip adjacent the subject properties is located on an east-facing slope that is subject to short duration but strong diurnal wind influence. An ignition south of the Lakeshore Rd. / Monroe Ave. properties could be expected to move north with wind influence and impinge on the interface perimeter of the subject properties.

Treatment to FireSmart recommended guidelines for Priority Zone1 + 2 within a 30m width of forested strip adjacent the residential lease / public land boundary of the subject and adjacent Lakeshore Rd. / Monroe Ave properties is recommended. Fuel treatment in Unit 3a is a higher priority than fuel treatment in Unit 3b. The forested strip is owned by CLP.

Fig 5-18: Proposed Fuel Treatment Unit 4



Unit 4: Sunnyside / Mountainview:

Forested area adjacent CLP residential properties east of Sunnyside Blvd, north of Mountainview Rd back laneway and east of lane between Mountainview Rd and Park Dr.

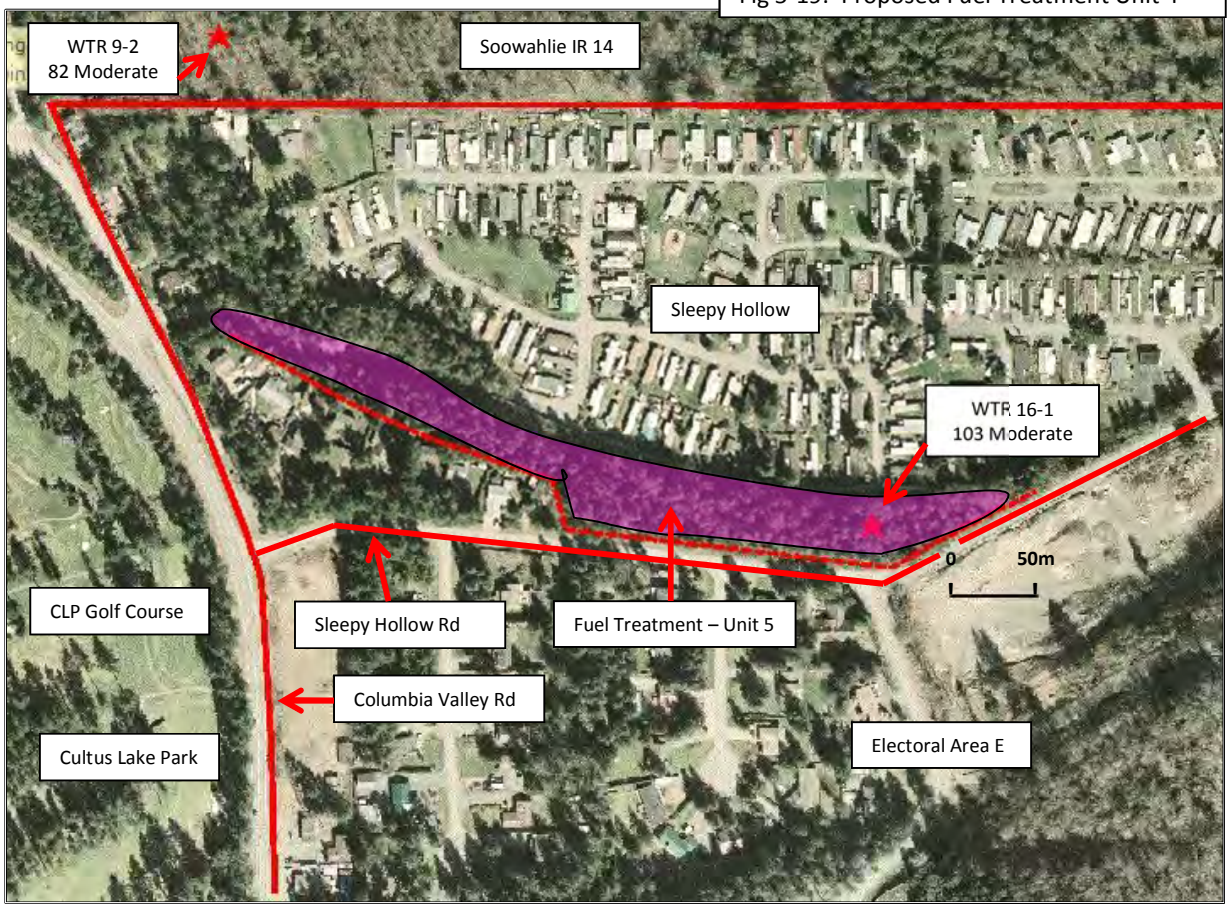
The wildfire risk to interface residential properties in this area is mitigated to some extent by the paved and/or gravel parking lots and laneways that separate the forested area from the residences.

There are a number of slash, garden and forest debris piles that have accumulated along the edge of the forested area – these fuel accumulations can be expected to increase wildfire intensity and spread rates in the area.

Treatment to FireSmart recommended guidelines for Priority Zone 2 within a 30m width of forested strip as required is recommended. The fuel treatment area is owned by CLP.

Unit 5: Sleepy Hollow:

Fig 5-19: Proposed Fuel Treatment Unit 4



Forested area north of Sleepy Hollow Rd.

The forested area is located on a steep north facing slope below residential properties north and south of Sleepy Hollow Rd. as shown.

The wildfire risk to residential properties south of Sleepy Hollow Rd. is mitigated to some extent by the paved width of Sleepy Hollow Rd. providing adequate setback between the forested area on the slope and the residences. The wildfire risk to the 8 residential properties north of Sleepy Hollow Rd. (45661, 45651, 45641, 45631 and 45621 Sleepy Hollow Rd and 3900, 3910 and 3920 Columbia Valley Rd.)is greater as no paved fuel break exists to provide setback between the forested area on the slope and the adjacent residences.

There are a number of slash, garden and forest debris piles that have accumulated across the forested area slope – these fuel accumulations can be expected to increase wildfire intensity and spread rates in the area. Treatment to FireSmart recommended guidelines for Priority Zone 1 and 2 as required is recommended. The strip of forested area is privately owned (631429 BC LTD).

5.5.7. Maintenance of Fuel Treated Areas

The effectiveness of fuel treated areas tends to decrease over time. After the initial fuel treatments, trees will continue to grow, usually at a faster rate. The increased light on the forest floor encourages heavy grass and brush growth where, in many cases, nothing grew before. Site disturbance exposes mineral soil, which creates a seed bed for new trees. This in turn leads to new opportunity for fire. Some species of trees are easily felled by winds that penetrate the forest cover more easily after the original clearing and thinning has been done.

Fuel treated areas require ongoing treatment to maintain low fuel loadings. A site specific schedule can be developed and may involve prescribed understory burning of fuels, handcrew pile and burn or mechanical treatments. Designation of fuel breaks as permitted community firewood areas can provide a low-cost maintenance alternative. A general maintenance schedule will target periodic assessments every 5-7 years and maintenance approximately every 10-15 years.

Recommendation 5.5.7.1 CLP should commit to performing required maintenance on fuel treated areas within its jurisdiction. CLP should implement a program to encourage residents to maintain leasehold properties in compliance with FireSmart vegetation management guidelines. Implementation of an ancillary program to assist residents in disposing of vegetative yard debris safely is also recommended. Cooperative arrangements in support of required maintenance should also be considered for fuel treated areas outside CLP jurisdiction.

Appendix 1: Wildfire Threat Rating Worksheet Summary

Fire risk assessment in the CLP study area was conducted using the provincial Wildfire Threat Rating worksheet as required by the UBCM SWPI CWPP Program.

Unit	Date	Fuel	Score	Threat Rating
1-1	2012-06-22	C3	110	MODERATE
1-2	2012-06-22	C3	98	MODERATE
1-3	2012-06-22	C3	90	MODERATE
2-1	2012-06-22	C5	78	MODERATE
2-2	2012-06-22	C5	74	MODERATE
3-1	2012-09-27	D1	65	MODERATE
4-1	2012-09-27	C5	98	MODERATE
5-1	2012-09-27	C5	75	MODERATE
5-2	2012-09-27	D1	55	MODERATE
5-3	2012-09-27	C3	74	MODERATE
6-1	2012-06-22	C5	76	MODERATE
6-2	2012-06-22	C5	58	MODERATE
6-3	2012-06-22	C5	65	MODERATE
7-1	2012-06-21	C3	68	MODERATE
7-2	2012-06-21	C3	75	MODERATE
8-1	2012-06-21	C3	79	MODERATE
8-2	2012-06-21	C3	76	MODERATE
8-3	2012-06-21	C3	81	MODERATE
9-1	2012-06-21	C3	78	MODERATE
9-2	2012-09-27	C3	82	MODERATE
10-1	2012-06-21	C3	87	MODERATE
10-2	2012-06-21	C3	86	MODERATE
10-3	2012-06-21	C3	91	MODERATE
11-1	2012-06-21	C3	81	MODERATE
11-2	2012-06-21	C3	82	MODERATE
11-3	2012-06-21	C3	88	MODERATE
11-4	2012-06-21	C3	88	MODERATE
12-1	2012-06-21	C3	87	MODERATE
12-2	2012-06-21	C3	73	MODERATE
12-3	2012-06-21	C3	73	MODERATE
12-4	2012-06-21	C3	63	MODERATE
13-1	2012-06-21	C5	57	MODERATE
14-1	2012-06-21	M2	108	MODERATE
14-2	2012-06-21	M2	76	MODERATE

Unit	Date	Fuel	Score	Threat Rating
15-1	2012-09-28	O1b	53	LOW
15-2	2012-09-28	D1	59	MODERATE
15-3	2012-09-28	M2	78	MODERATE
15-4	2012-09-28	D1	59	MODERATE
15-5	2012-09-28	M2	59	MODERATE
16-1	2012-09-28	C3	103	MODERATE
16-2	2012-09-28	M2	80	MODERATE
16-3	2012-09-28	D1	44	LOW
17-1	2012-09-28	C5	87	MODERATE
17-2	2012-09-28	C4	66	MODERATE
17-3	2012-09-28	C5	98	MODERATE

Appendix 2: Field Research Report Section

From: Daniels, L.D. and R.W. Gray. 2006. Disturbance regimes in coastal British Columbia. *BC Journal of Ecosystems and Management* 7(2):44–56. URL:
http://www.forrex.org/publications/jem/ISS35/vol7_no2_art6.pdf

Fuel availability and combustibility are influenced by both "bottom-up" and "topdown" controlling factors (Lertzman *et al.* 1998). Bottom-up controls include local-scale topographic influences on fuel size class distribution, fuel moisture, and fire behaviour. Top-down controls are large-scale, long-term climate regimes such as the dry climate prior to the Little Ice Age versus the current climate regime. Under the influence of a cool, wet climate, bottomup controls strongly influence fire occurrence and extent (Gavin *et al.* 2003). In wet coastal temperate rain forests, fuels accumulate in fine-scale canopy gaps that are dispersed within a stand through time. Fine fuels decompose rapidly; thus, insufficient fine fuels accumulate at any specific location to be a significant pre-cursor for a stand-initiating fire.

In general, the flammability ratings of the wet coastal temperate rain forest are low. Coarse woody debris accounts for the majority of persistent surface fuels. These fuels have high bulk density and remain moist beneath a mantle of moss and herbs in the shade of multiple layers of the canopy (Wetzel and Fonda 2000). Even during years of extreme drought, high moisture content in fuels retards ignition and spread of fire. The spread of fire is influenced by the flammability of fuels, which in turn varies with topography and climate (Huff 1995). Topography determines exposure of fuels to irradiance and wind, and indirectly influences fuel moisture, making certain parts of the landscape more susceptible to fire. For example, forests on steep, southwest-facing slopes are more flammable than forests on steep, northwest-facing slopes or flat ground in the bottom of valleys. Within stands, subtle differences in microtopography can limit the spread of fire and restrict fire size in the wet coastal temperate rain forest (Gavin *et al.* 2003b).

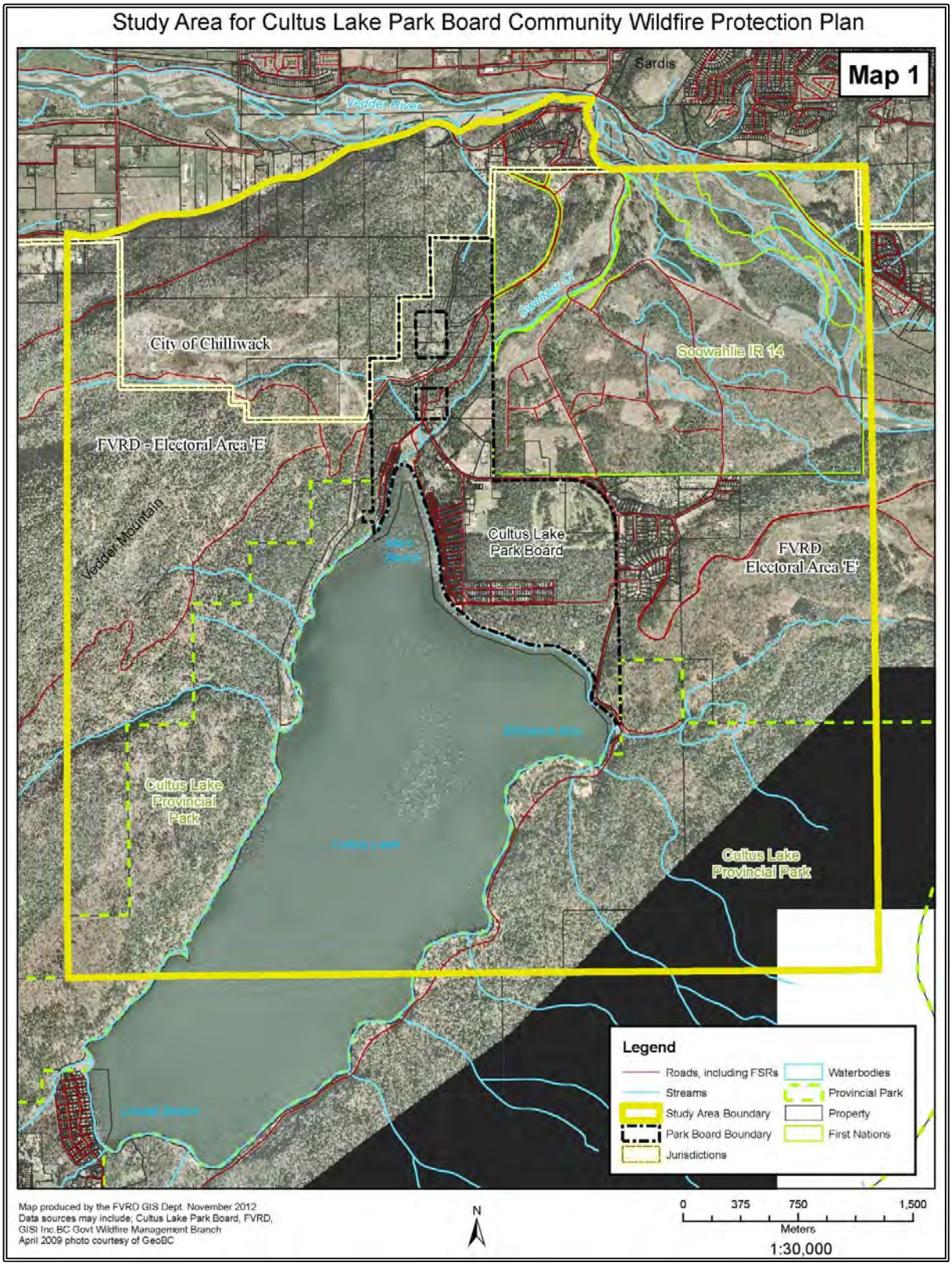
During periods of dry climate, top-down controls are more important than fuel dynamics for determining fire occurrence in the wet coastal temperate rain forests (Hemstrom and Franklin 1982; Gavin *et al.* 2003a). Historically, years of high fire activity were most likely to occur when persistent high pressure ridges formed along the west coast, blocking westerly winds, reducing precipitation, and allowing fuels to dry for extended periods (Agee 1991). Under these conditions, dry winds could spread fire, where fuels were available. This scenario depends on three essential conditions:

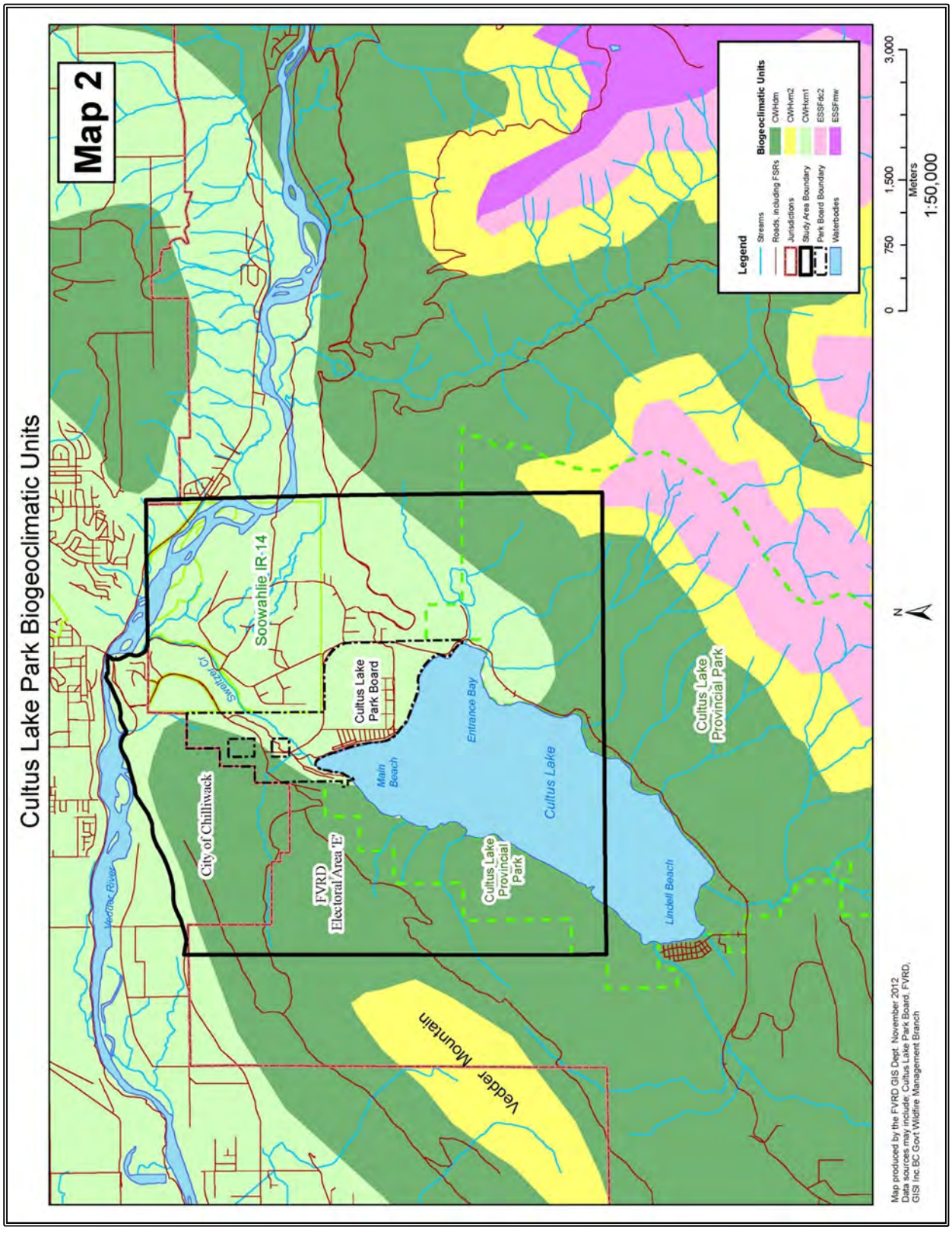
1. Ignition by lightning, and persistence of fire during precipitation and (or) high humidity associated with lightning storms;
2. Availability of fuels of appropriate size and distribution; and
3. An extended period of drought to dry surface fuels and permit the spread of fire.

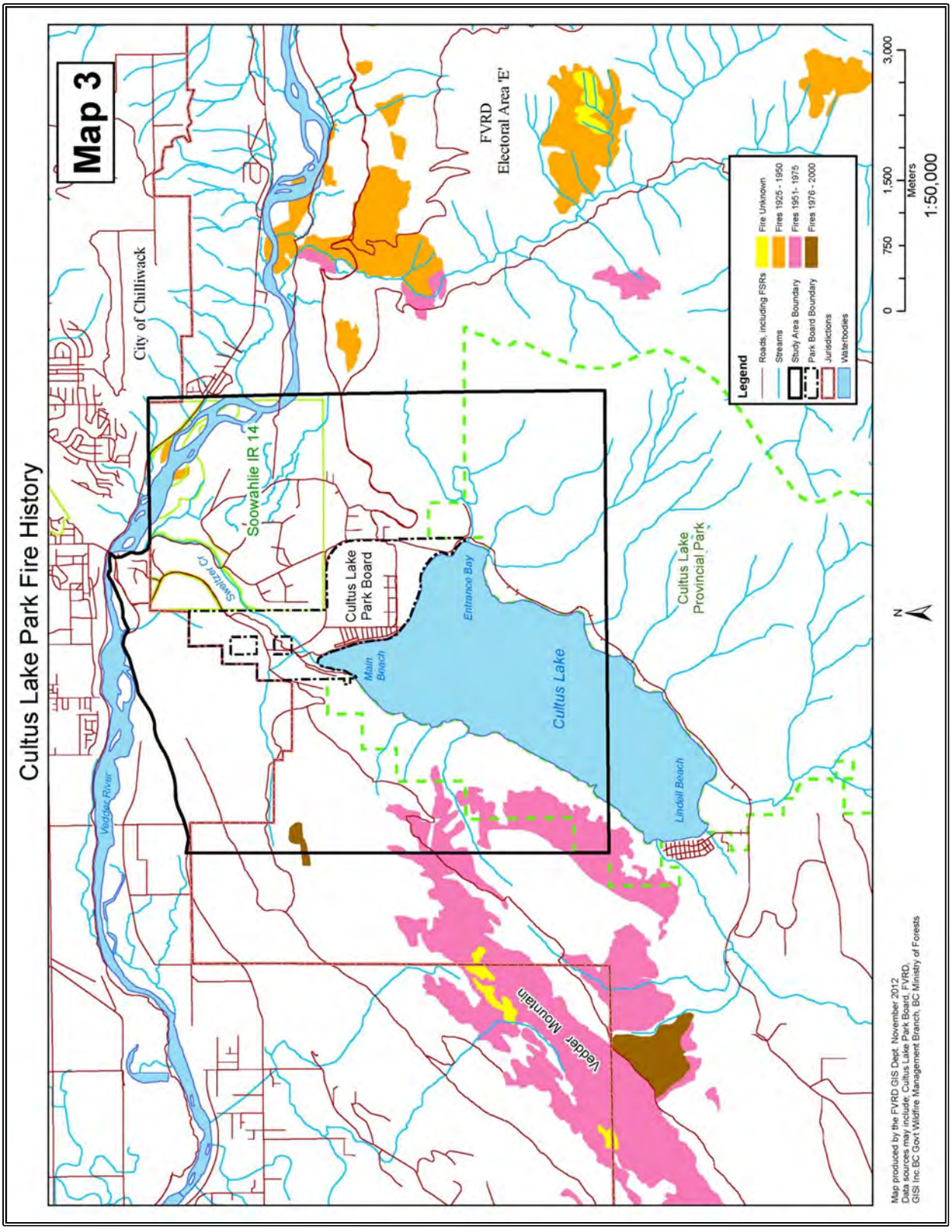
Using 20th century climate data, Agee and Flewelling (1983) modelled climate-fire scenarios for the west side of the Olympic Peninsula in Washington State and concluded that fire return intervals averaged about 900 years. Evidently, the ideal combination of lightning ignition and bottom-up (fuels) and top-down (climate) controls suitable for stand-initiating fires is very rare in wet coastal temperate rain forests.

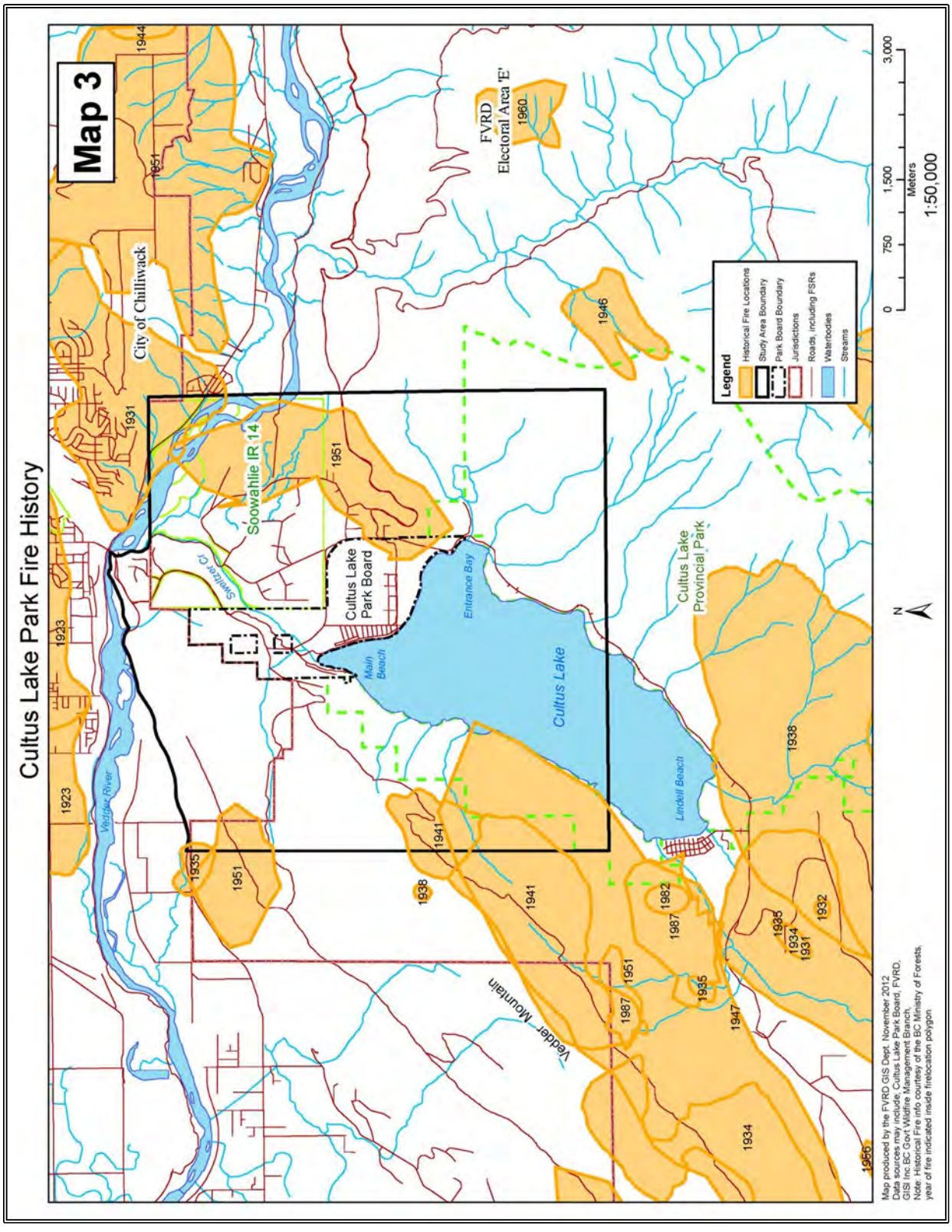
Stand-initiating fires since European settlement in the late 1800s have strongly influenced our perception of fire in coastal forests, but these fires do not represent the historic fire regime. For example, the Forks Fire on the Olympic Peninsula in 1951 was preceded by a cyclone in 1921 that created abundant fuel for the subsequent fire. Fires in the 1920s in the Capilano River watershed near Vancouver, B.C., resulted from escaped slash burns. Similarly, timber harvest was a precursor to the Tillamook Fire in Oregon, the Yacolt Fire in Washington, and the Seward and Chilliwack Valley fires in British Columbia in the early part of the 1900s. Logging created large fuel loads and microclimatic conditions that allowed the fuels to dry, making these sites conducive to burning. Moreover, most of these recent, large-scale fires in coastal forests were ignited by humans. Thus, stand-initiating fires have burned coastal forests in the past century, but under unusual circumstances.

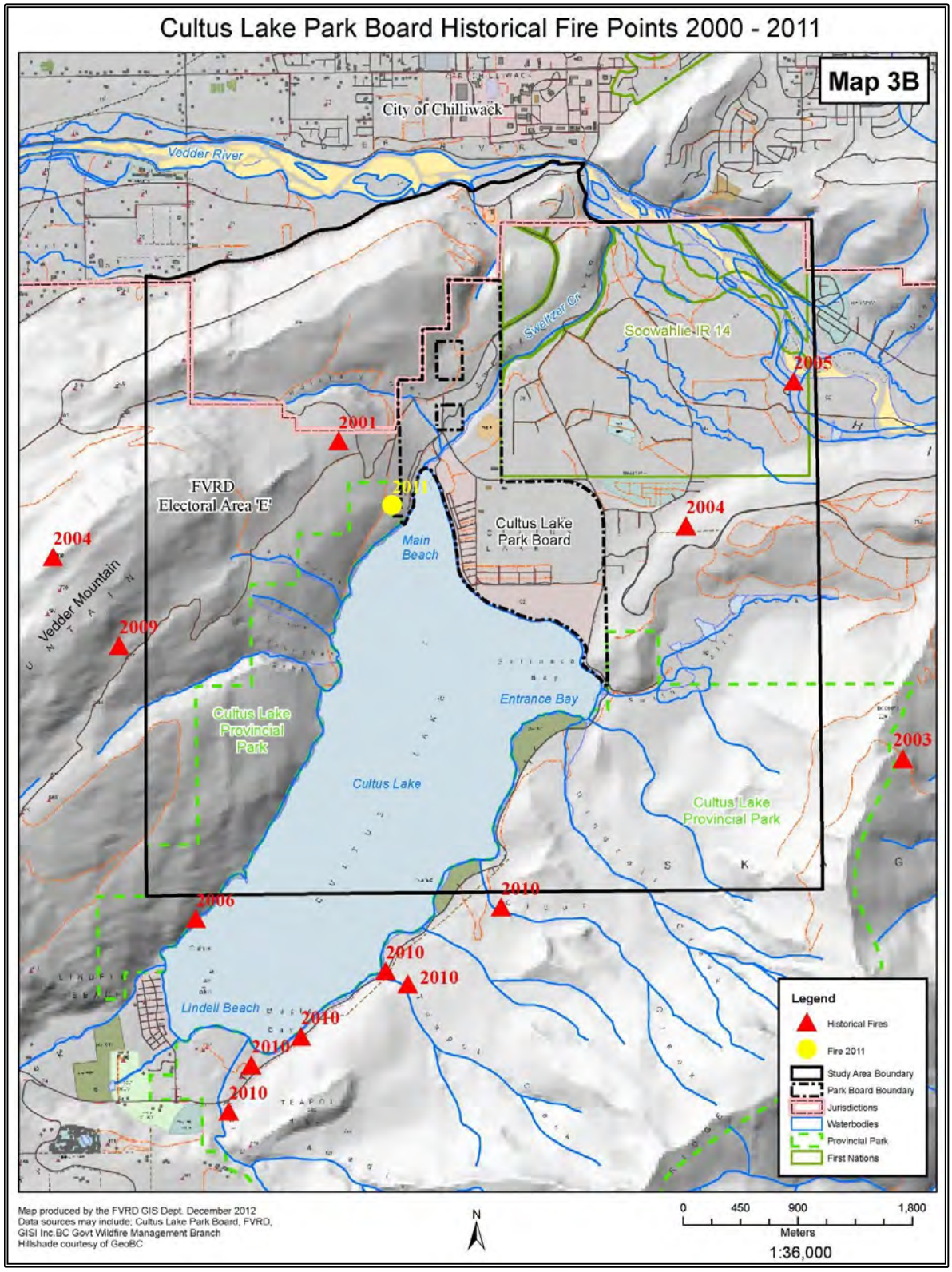
Appendix 3: Map Plates

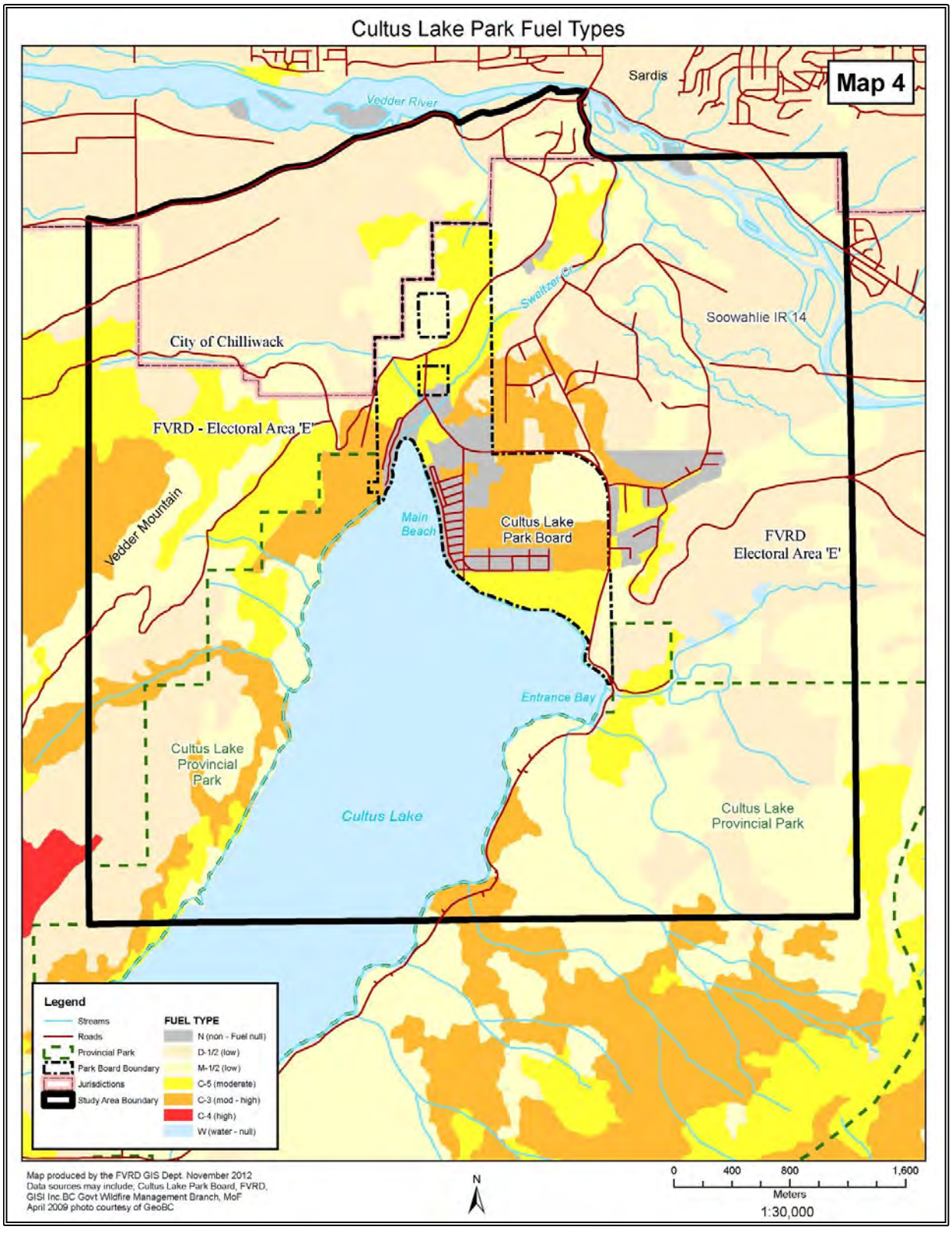


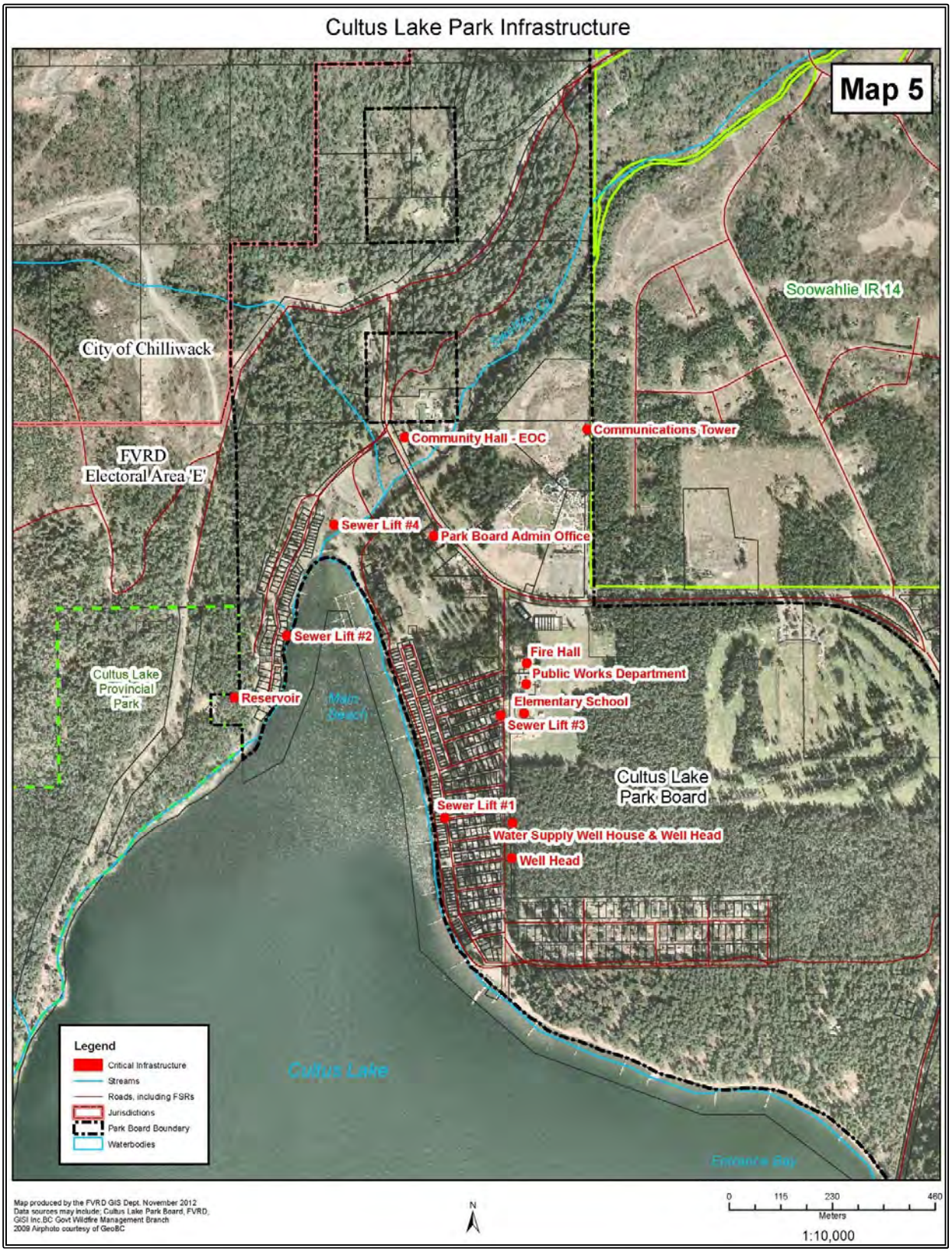

Map 2
Cultus Lake Park Biogeoclimatic Units
Legend
Streams
Roads, including FSRs
Jurisdictions
Study Area Boundary
Park Board Boundary
Waterbodies
Biogeoclimatic Units
CWHdm
CWHvm2
CWHxm1
ESSFdc2
ESSFmw
0
750
1,500
3,000
Meters
1:50,000
N
Soowahlie IR 14
Schweitzer C.
Cultus Lake Park Board
City of Chilliwack
FVRD Electoral Area 'E'
Vedder River
Entrance Bay
Main Beach
Cultus Lake
Cultus Lake Provincial Park
Cultus Lake Provincial Park
Lindell Beach
Vedder Mountain
Map produced by the FVRD GIS Dept. November 2012.
Data sources may include: Cultus Lake Park Board, FVRD, GISI Inc, BC Govt Wildfire Management Branch

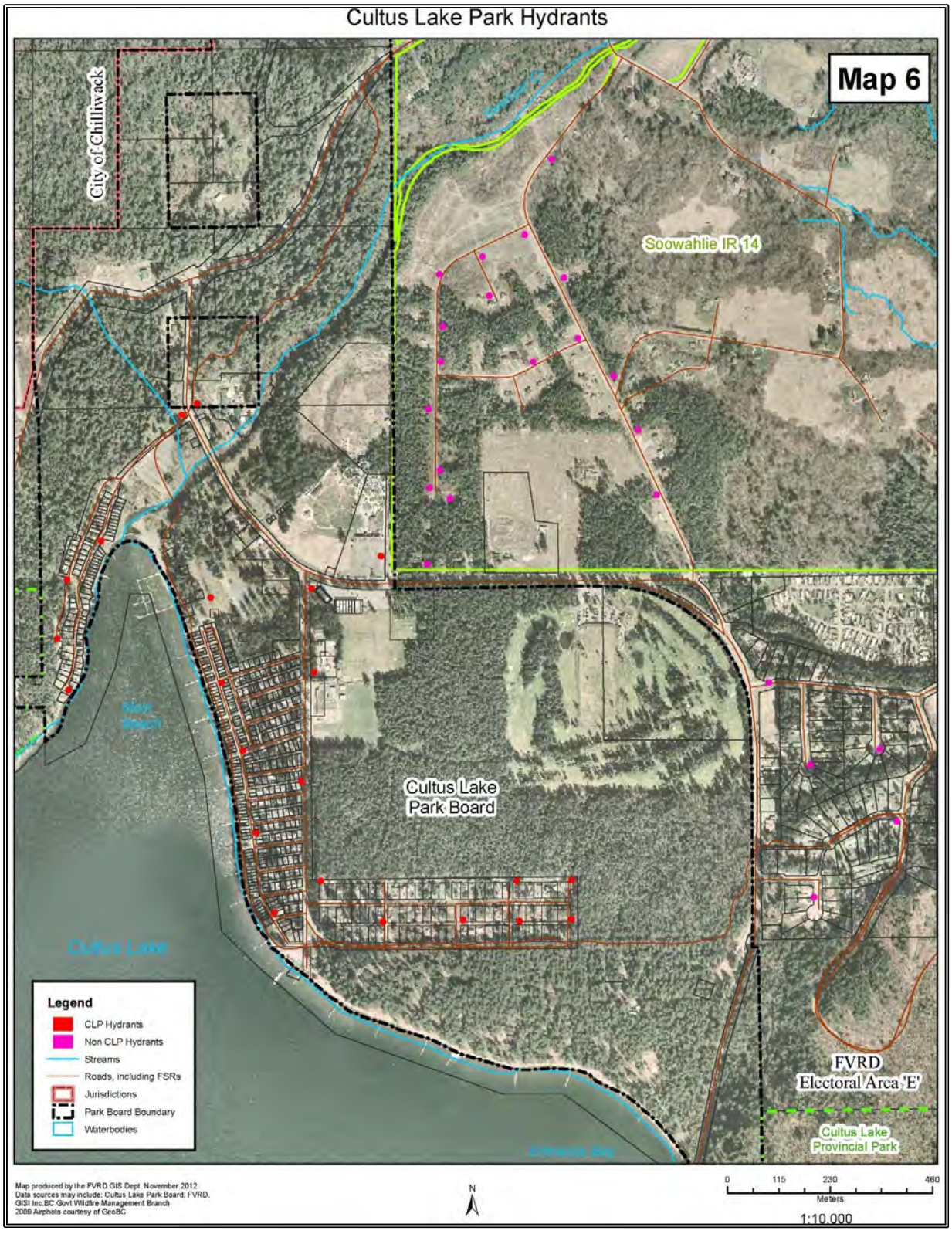

Map 3
Cultus Lake Park Fire History
City of Chilliwack
FVRD
Electoral Area 'E'
Soowahlie IR 14
Swaltzar Cr
Cultus Lake
Park Board
Entrance Bay
Main
Beach
Cultus Lake
Cultus Lake
Provincial Park
Lindell Beach
Vedder River
Vedder Mountain
Legend
Roads, including FSRs
Streams
Study Area Boundary
Park Board Boundary
Jurisdictions
Waterbodies
Fire Unknown
Fires 1926 - 1950
Fires 1951- 1975
Fires 1976 - 2000
0
750
1,500
3,000
Meters
1:50,000
N
Map produced by the FVRD GIS Dept. November 2012.
Data sources may include; Cultus Lake Park Board, FVRD,
GISi inc BC Govt Wildfire Management Branch, BC Ministry of Forests

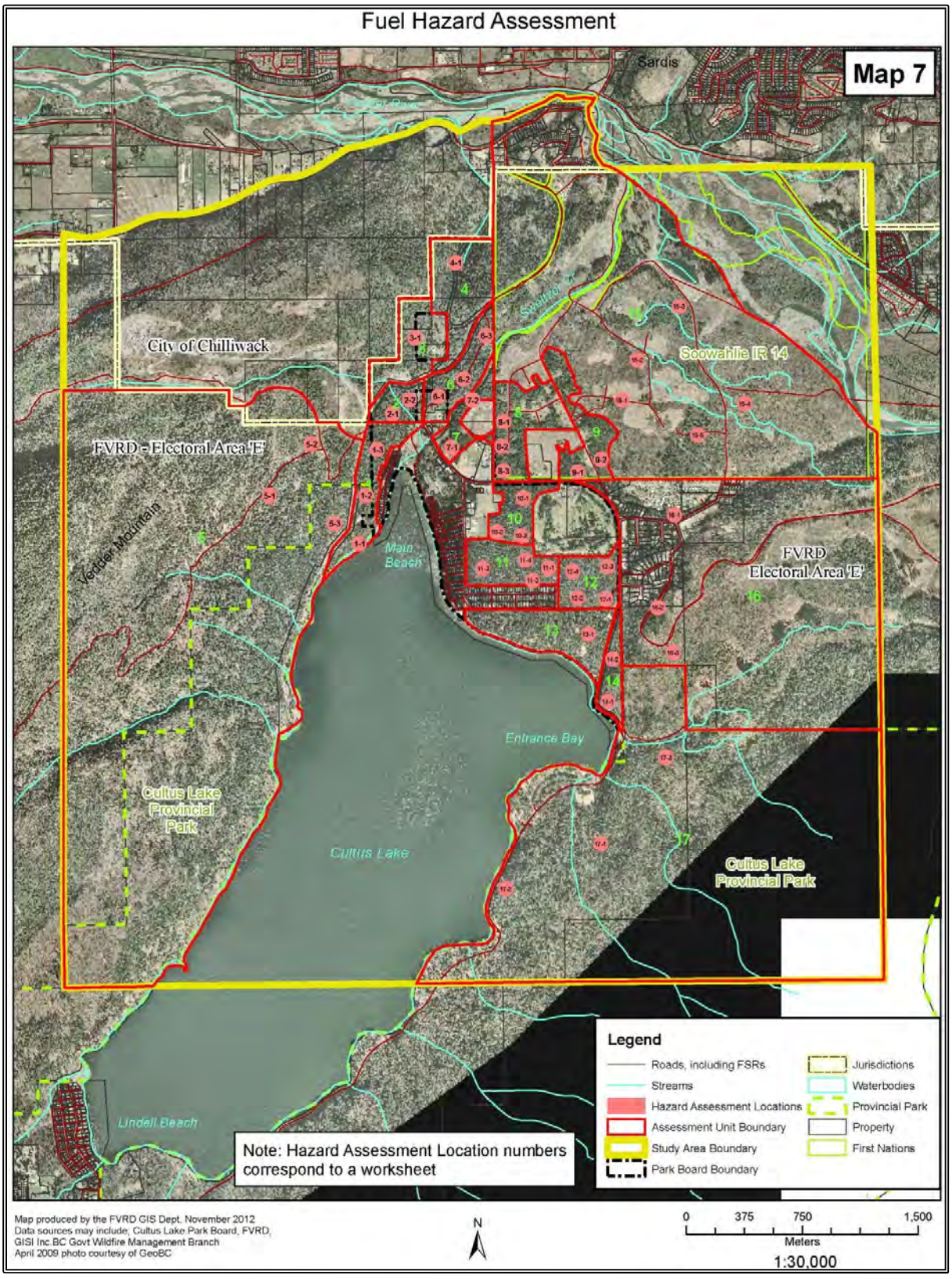

Map 3
Cultus Lake Park Fire History
City of Chilliwack
Soowahlie IR 14
Cultus Lake Park Board
Cultus Lake Provincial Park
Cultus Lake
Entrance Bay
Main Beach
Lindell Beach
Vedder River
Vedder Mountain
Sweltzer Cr
FVRD Electoral Area 'E'
Legend
Historical Fire Locations
Study Area Boundary
Park Board Boundary
Jurisdictions
Roads, including FSRs
Waterbodies
Streams
0 750 1,500 3,000
Meters
1:50,000
N
Map produced by the FVRD GIS Dept. November 2012.
Data sources may include: Cultus Lake Park Board, FVRD, GISI Inc, BC Gov't Wildfire Management Branch.
Note: Historical Fire info courtesy of the BC Ministry of Forests, year of fire indicated inside firelocation polygon


Cultus Lake Park Board Historical Fire Points 2000 - 2011
Map 3B
City of Chilliwack
Vedder River
Sweltzer Cr
Soowahlie IR 14
FVRD
Electoral Area 'E'
Cultus Lake
Park Board
Main
Beach
Vedder Mountain
Entrance Bay
Cultus Lake
Provincial
Park
Cultus Lake
Cultus Lake
Provincial Park
Lindell Beach
2001
2004
2005
2004
2004
2009
2003
2006
2010
2010
2010
2010
2010
2010
Legend
Historical Fires
Fire 2011
Study Area Boundary
Park Board Boundary
Jurisdictions
Waterbodies
Provincial Park
First Nations
Map produced by the FVRD GIS Dept. December 2012
Data sources may include; Cultus Lake Park Board, FVRD,
GISI Inc.BC Govt Wildfire Management Branch
Hillshade courtesy of GeoBC
N
0
450
900
1,800
Meters
1:36,000


Cultus Lake Park Fuel Types
Map 4
Sardis
Vedder River
Sweltzer Cr
Soowahlie IR 14
City of Chilliwack
FVRD - Electoral Area 'E'
Vedder Mountain
Main Beach
Cultus Lake Park Board
FVRD Electoral Area 'E'
Entrance Bay
Cultus Lake Provincial Park
Cultus Lake
Cultus Lake Provincial Park
Legend
Streams
Roads
Provincial Park
Park Board Boundary
Jurisdictions
Study Area Boundary
FUEL TYPE
N (non - Fuel null)
D-1/2 (low)
M-1/2 (low)
C-5 (moderate)
C-3 (mod - high)
C-4 (high)
W (water - null)
Map produced by the FVRD GIS Dept. November 2012
Data sources may include; Cultus Lake Park Board, FVRD, GISI Inc.BC Govt Wildfire Management Branch, MoF
April 2009 photo courtesy of GeoBC
N
0 400 800 1,600
Meters
1:30,000


Cultus Lake Park Infrastructure
Map 5
City of Chilliwack
FVRD
Electoral Area 'E'
Soowahlie IR 14
Community Hall - EOC
Communications Tower
Sewer Lift #4
Park Board Admin Office
Sewer Lift #2
Reservoir
Cultus Lake
Provincial
Park
Fire Hall
Public Works Department
Elementary School
Sewer Lift #3
Cultus Lake
Park Board
Sewer Lift #1
Water Supply Well House & Well Head
Well Head
Cultus Lake
Legend
Critical Infrastructure
Streams
Roads, including FSRs
Jurisdictions
Park Board Boundary
Waterbodies
Map produced by the FVRD GIS Dept. November 2012
Data sources may include: Cultus Lake Park Board, FVRD, GISI Inc.BC Govt Wildfire Management Branch
2009 Airphoto courtesy of GeoBC
N
0 115 230 460
Meters
1:10,000


Cultus Lake Park Hydrants
Map 6
City of Chilliwack
Soowahlie IR 14
Cultus Lake
Park Board
Cultus Lake
Legend
CLP Hydrants
Non CLP Hydrants
Streams
Roads, including FSRs
Jurisdictions
Park Board Boundary
Waterbodies
FVRD
Electoral Area 'E'
Cultus Lake
Provincial Park
Map produced by the FVRD GIS Dept. November 2012
Data sources may include: Cultus Lake Park Board, FVRD,
GISI Inc.BC Govt Wildfire Management Branch
2006 Airphoto courtesy of GeoBC
N
0 115 230 460
Meters
1:10,000


Fuel Hazard Assessment
Map 7
Sardis
City of Chilliwack
Soowahlie IR 14
FVRD - Electoral Area 'E'
Yeager Mountain
Main Beach
FVRD Electoral Area 'E'
Entrance Bay
Cultus Lake Provincial Park
Cultus Lake
Cultus Lake Provincial Park
Lindell Beach
Note: Hazard Assessment Location numbers correspond to a worksheet
Legend
Roads, including FSRs
Streams
Hazard Assessment Locations
Assessment Unit Boundary
Study Area Boundary
Park Board Boundary
Jurisdictions
Waterbodies
Provincial Park
Property
First Nations
Map produced by the FVRD GIS Dept. November 2012
Data sources may include; Cultus Lake Park Board, FVRD, GISI Inc.BC Govt Wildfire Management Branch
April 2009 photo courtesy of GeoBC
N
0 375 750 1,500
Meters
1:30,000