REPORT TO REGIONAL WATER SUPPLY COMMISSION
MEETING OF WEDNESDAY, 20 JUNE 2007

SUBJECT WILDFIRE RISK MANAGEMENT PLAN

ISSUE

Wildfire has been identified as a major risk to water quality in water supply reservoirs. To address this risk, a Wildfire Risk Management Plan is being developed for the Greater Victoria Water Supply Area. This plan sets our four key risk reduction strategies based on the results of a landscape-level assessment of the likelihood and consequences of a large-scale wildfire within or adjacent to the Water Supply Area.

This report provides an overview of wildfire risk issues and sets out the key risk reduction strategies proposed for the Wildfire Risk Management Plan and a recommended timetable and funding schedule. If these strategies and timetable are endorsed by the Commission, the plan will be finalized and the risk reduction program added to the 2008 budget.

BACKGROUND

Wildfire History of SE Vancouver Island

Wildfire is a natural part of the ecology of southeast Vancouver Island. Periodic wildfires have led to the dominance of Douglas-fir; an early successional, but long-lived, fire-adapted tree species. Evidence suggests that large-scale (stand replacing) wildfires have occurred every 250-300 years in the past. Most of the older trees sampled in the Greater Victoria Water Supply Area are within this age grouping.

Conditions today are very different from the 'natural' fire regime in Douglas-fir forests. Decades of active fire suppression have almost eliminated wildfire from the landscape, resulting in a considerable build up of forest fuels. The conversion of much of the remaining forest on SE Vancouver Island to managed forest stands has resulted in areas of densely stocked plantations, which, without thinning, also represent a high fuel hazard. The potential for human-caused fires have increased with the expansion of recreation and rural residential development. These factors, in combination with the observed trend to hotter drier summers, increase the potential for a large-scale, catastrophic wildfire. This situation is common to many forest types in North America.

Impacts of Wildfire on Water Quality

The *Strategic Plan for Water Management* identifies wildfire as a major risk to water quality in drinking water supply reservoirs. Wildfires can:

- shut down, damage or destroy water supply facilities and infrastructure;
- lead to erosion, debris flows and landslides that can introduce ash, sediment, and debris into the drinking water supply and, in extreme cases, affect reservoir capacity or require additional treatment to maintain water quality (sample images provided in **Attachment 1**);
- greatly increase nutrients and alter nutrient ratios in water supply reservoirs that can lead to blooms of toxin-producing green/blue algae, taste and odour problems, reduced effectiveness of water disinfection and filter clogging; and
- negatively affect 'secondary values' such as fish habitat and biodiversity.

Wildfire Risk Management Plan

Water Services has retained BA Blackwell and Associates to prepare a plan for reducing the risk of a large-scale fire affecting the Water Supply Area. This consultant has developed a methodology for a wildfire risk management plan that includes a risk assessment model (**Attachment 2**). The risk assessment model and

planning framework have been used in the Greater Vancouver Water District, national and provincial parks, and the municipalities of Cranbrook, Valemount and Whistler.

The Wildfire Risk Management Plan has three main elements:

1. A wildfire risk assessment for the Greater Victoria Water Supply Area and adjacent lands
2. Strategies for reducing identified risks
3. An implementation schedule for risk reduction activities

1. Risk Assessment

The first element of the Wildfire Risk Management Plan is a wildfire risk assessment. This risk assessment has been conducted in two phases: 1) the Water Supply Area, and 2) expanding the assessment to include adjacent lands of concern (**Attachment 3**). The risk assessment is based on the best available science and professional judgment and produces maps on the potential for a wildfire to start, spread and be difficult to control in relation to the consequences to water quality, infrastructure, adjacent lands, air quality and biodiversity. Water quality has been given the highest weighting (75%) in the application of the model to the Water Supply Area.

The results of Phase 1 of the risk assessment were presented to the Regional Water Supply Commission in October 2006. Virtually the entire Water Supply Area is at risk from wildfire during periods of extreme fire hazard. Forested ridges immediately adjacent to the south and mid basins of Sooke Reservoir (**Attachment 4**) are of particular concern due to the high potential for negative effects on water quality from a fire in these areas.

Phase 2 of the risk assessment is now complete. Key findings include: a high fuel hazard on a large proportion of adjacent lands, constraints to detecting and suppressing a fire in some of these areas, and the increase in risk with the expansion of residential and recreational areas adjacent to the Water Supply Area.

During Phase 2 of the risk assessment, Water Services staff consulted with local Fire Departments, Protection staff at the Ministry of Forests and Range, staff from Regional Parks and Planning and Protection Services, and staff from the Cowichan Valley Regional District. Water Services will continue to work with the agencies in the implementation of the Wildfire Risk Management Plan.

2. Risk Reduction Strategies

The second element of the Wildfire Risk Management Plan is the development of risk reduction strategies. The consultants and Water Services staff have reviewed the results of the risk assessments and identified risk reduction options. The risk assessment model has been used to test the effectiveness of these options in reducing the likelihood of a large-scale wildfire.

Four key strategies for risk reduction have been identified:

1. Complete fuel reduction measures around key water supply facilities using Fire Smart principles;
2. Continue to improve the Water Services capability for preventing, detecting, and suppressing wildfires and rehabilitating burned areas (prevention is focused on outreach to adjacent landowners);
3. Identify wildfire containment zones in high risk areas and expand existing fuel breaks around these areas; and
4. Identify priority areas within the Water Supply Area for forest fuel reduction treatments to increase the protection of the wildfire containment zones and reduce fuels in these areas.

Strategies 1 and 2 build on initiatives currently underway or recommended in the *Strategic Plan for Water Management*. However, these two strategies do not address hazardous forest fuels on lands within and adjacent to the Water Supply Area that increase the potential for a large-scale wildfire and extreme fire behaviour. Strategies 3 and 4 have been developed to reduce the risk associated with these fuels.
Strategy 3 involves the delineation of fire containment zones in high priority areas within the Water Supply Area (**Attachment 5**) and the enhancement of the existing fuel breaks bordering these zones. These fuel breaks are roads and a major power line corridor.

To improve the effectiveness of roads as fuel breaks, it is proposed that fuel reduction be carried out within a strip 50 m on either side of the road. This fuel reduction will focus on the removal of woody debris and small trees that could enable a ground fire to spread to the forest canopy. This type of treatment is illustrated on **Attachment 6** and would be carried out on approximately 80 km (22%) of the 367 km of roads managed by Water Services.

To improve the effectiveness of the power line corridor as a fuel break, Water Services will work cooperatively with BC Transmission Corporation to modify existing vegetation management practices and assess the feasibility of replacing high hazard vegetation with more desirable species. This work would focus on about 14 km of the power line corridor.

Enhancing existing fuel breaks is considered the most effective way of managing the risk associated with areas of high fuel hazard on lands adjacent to the Water Supply Area. Portions of these adjacent lands are open to public access, further increasing the potential for fire. If a fire were to start in these lands, a fuel-reduced barrier may be the only effective means of preventing a wildfire from spreading to the Water Supply Area.

Strategy 4, the reduction of fuels in forest stands within the Water Supply Area, will focus on priority areas of high fuel hazard in and around the wildfire containment zones. As with the fuel breaks, the fuel reduction methodology will focus on removing surface and ladder fuels, with the goal of retaining large, well-spaced trees. Detailed fire behaviour analyses will be conducted to identify the areas where fuel reduction would be most effective. Approximately 17% (1,900 ha) of the Water Supply Area contains fuels of concern. Not all of these areas would require treatment.

The effects of risk reduction with the four proposed strategies are cumulative. If all of these options are implemented, it is estimated the risk of a catastrophic wildfire will be reduced by about 50%. It is unlikely that the risk of a large-scale wildfire can be reduced much lower as long as there are standing forests and fire starts in hot dry summers.

3. Implementation Timetable

If all four risk reduction strategies are endorsed by the Commission, the Wildfire Risk Management Plan will set out a 10 year implementation program. Strategies 1 and 2 are already in process. It is proposed that Strategy 3, the expansion of existing fuel breaks, be initiated in 2008 with completion within six years. Strategy 4, fuel reduction in priority forest fuel types within the Water Supply Area, would begin in 2012.

ALTERNATIVES

1. Complete Fire Smart fuel reduction around key facilities and continue to improve prevention, detection, suppression and rehabilitation capability, but do not enhance fuel breaks and carry out fuel reduction work. Some risk reduction (about 20%) will be achieved, but fuel hazard will remain and continue to increase.

2. Carry out all four risk reduction strategies within a 10 year implementation period.

FINANCIAL IMPLICATIONS

It is estimated that a budget of $500,000 per year for the next 10 years will lead to a major reduction in the risk of a large scale wildfire affecting the Greater Victoria Water Supply Area. Approximately $100,000 (20%) of these funds will be reallocated to this program from Watershed Protection operational budgets. Additional funds from operational accounts will be spent on risk reduction in the first two years of the program to complete existing initiatives.

A request for new funds required will brought forward in the 2008 budget. Once risk reduction targets are achieved, it is estimated that the annual cost of the program will drop by 50% for maintenance of fuel breaks and other forest fuel treatments.

RECOMMENDATION

That the Regional Water Supply Commission endorse the four risk reduction strategies and direct staff to include a request for funding in the 2008 Budget.

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Attachment 1

Overview of the area burned by a large-scale wildfire in the Denver Colorado Water Supply Area.
Photo from Denver Water

Erosion on a burned hillslope after the Buffalo Creek Fire in the Denver Water Supply Area.
Photo by John A. Moody of the US Geological Survey

Result of erosion and flooding from a severely burned area.
The peeled bark indicates the highest level of water and debris during a flash flood after the fire.
Photo by John A. Moody, USGS

Debris in Denver's Strontia Springs Reservoir on July 12,1996
as a result of the Buffalo Creek fire and subsequent flash flood.
Photo from Denver Water

CAPITAL REGIONAL DISTRICT
Water Services

Watershed Protection Division
Project Overview

Overview of the Wildfire Risk Assessment Model

Greater Victoria Water Supply Area and Adjacent Lands

Introduction

CRD Water Services is working with a consultant (BA Blackwell and Associates) is carrying out a two phase landscape level risk assessment to assess the probability and consequences of a large scale wildfire on lands within and adjacent to the Greater Victoria Water Supply Area. Phase 1 of the model looked at wildfire probability and consequences within the Greater Victoria Water Supply Area. Phase 2 of the model will do this risk assessment for both the Water Supply Area and an expanded study area incorporating adjacent lands (Map 1).

There are two primary elements in the spatial model:

1. Determining the probability of a fire starting, spreading and being difficult to control

2. Identifying and ranking the consequences of a wildfire (i.e., values at risk) in the study area

The interaction between wildfire probability and consequences is used to determine the level of management intervention that may be required to reduce risk in areas of higher probability and consequences (Figure 1).

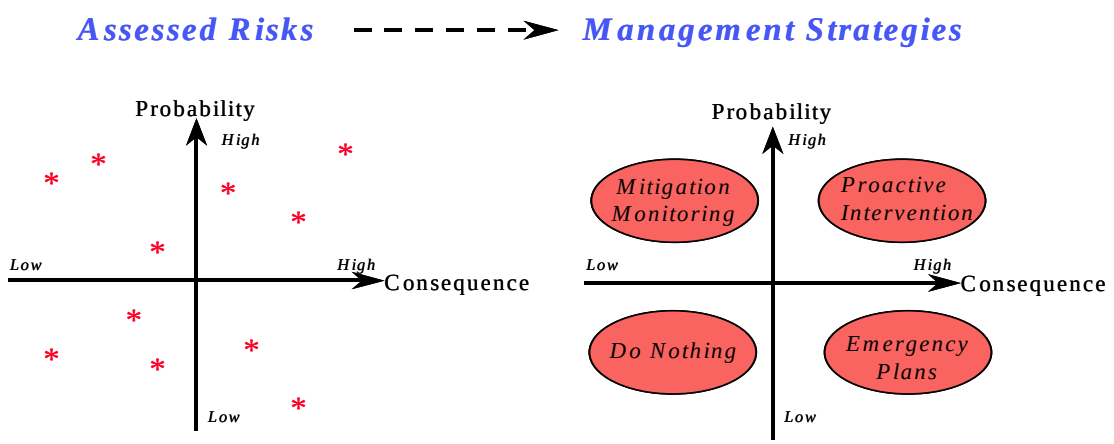
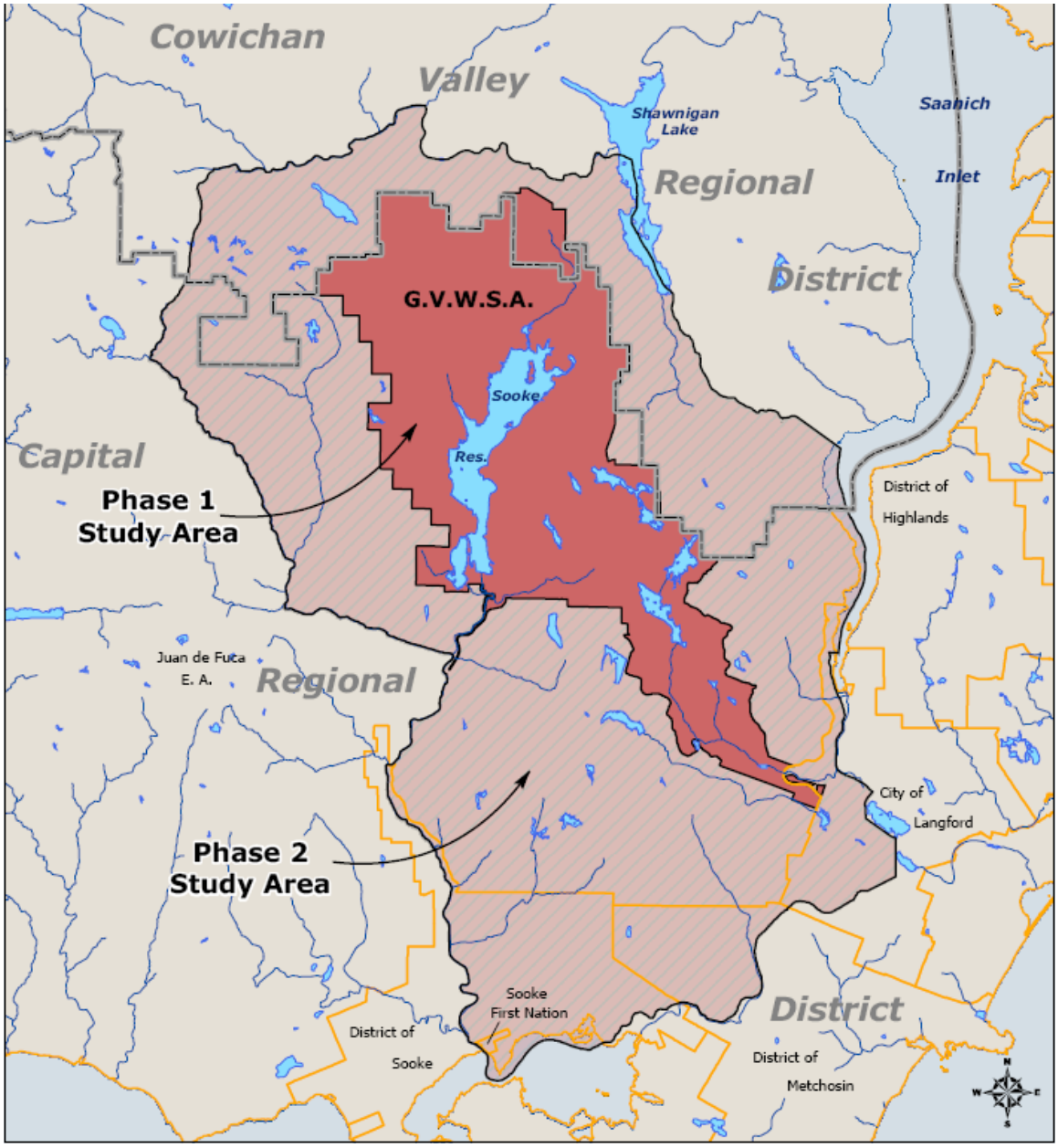


Figure 1 – Level of Management Intervention in Relation to Probability and Consequence Rankings

Map 1 – Expanded Study Area for Landscape-Level CRD Water Wildfire Risk Assessment



Model Components and Weighting

The probability component of the model is divided into three major components:

1. Fire starts (ignition potential and location of past fires obtained from BC Ministry of Forests and Range)

2. Fire behaviour (determined from fuel types, fire weather and terrain)

3. Suppression capability (involving water sources, roads, terrain and constraints to detection)

The values at risk are currently divided into four major components in the Phase 2 model

1. Interface Areas and Infrastructure (Urban Interface in Phase 1 of the model)

2. Water Quality in CRD Water Supply Reservoirs

3. Air Quality

4. Biodiversity

An overview of the structure of the Phase 1 model is provided in Figure 2.

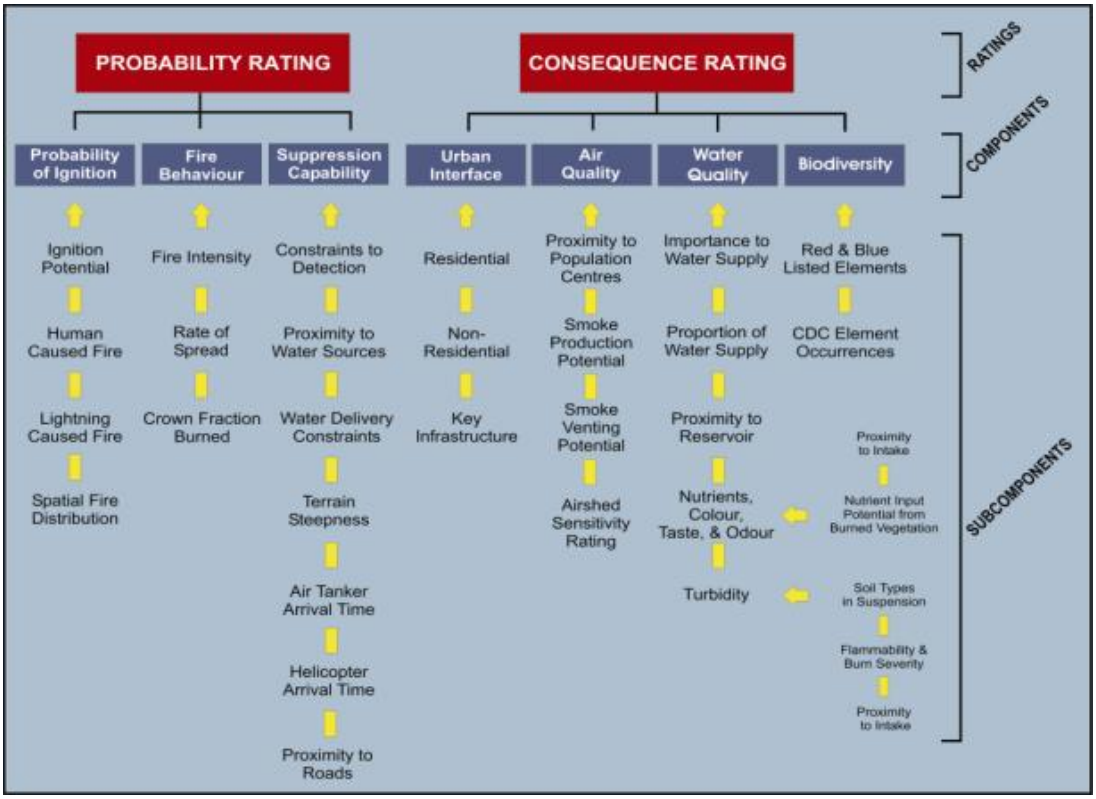


Figure 2 – Diagrammatic Overview of the Structure of Phase 1 of the Wildfire Risk Assessment Model – Greater Victoria Water Supply Area

Within each of these components are a number of subcomponents to identify specific types of consequences. For example, the Interface and Infrastructure component in Phase 2 of the model contains:

- Residential/commercial density (in four density classes)
- Forest/Recreation Lands (forestry lands, park/recreation, historic/cultural)
- Community infrastructure (with four importance rankings)
- Water supply infrastructure (with four importance rankings)

Each major component of the model has a weighting that determines its relative importance. For example, when we ran the model for the water supply area, water quality was given an overall weighting of 75%.

Within each of the ranked components, there is an internal weighting of subcomponents. For example, in the Interface and Infrastructure component, residential density is given a higher weighting than forestry/recreation lands to reflect the greater consequence of wildfire (life and property) in residential areas.

Finally, each subcomponent has several categories that are given a ranking of importance. For example, in the residential/commercial subcomponent, areas with the highest density of residences and businesses are given the highest ranking of importance.

Output of the Model

The model produces a series of maps (Figure 3). There is a map for each subcomponent. These subcomponent output maps are combined to create a summary map for each component. The information on these component maps is then combined to create overall maps of ratings for probability and consequence. These final two maps are combined to create a final map showing probability multiplied by consequence or risk.

Applications of the Model

As stated, our primary purpose for building and running the model is to get a spatial landscape-level understanding of the probability and consequences of a major fire in the area within or adjacent to the Greater Victoria Water Supply Area. The model results will be used to plan strategies for reducing/managing this risk that will be formalized in a Wildfire Risk Management Plan for the Greater Victoria Water Supply Area.

Phase 2 of the model will have the ability to change the weightings on components, subcomponents and importance rankings. This will allow us to do some simple 'gaming' with the model to better understand the effects of weightings on the results.

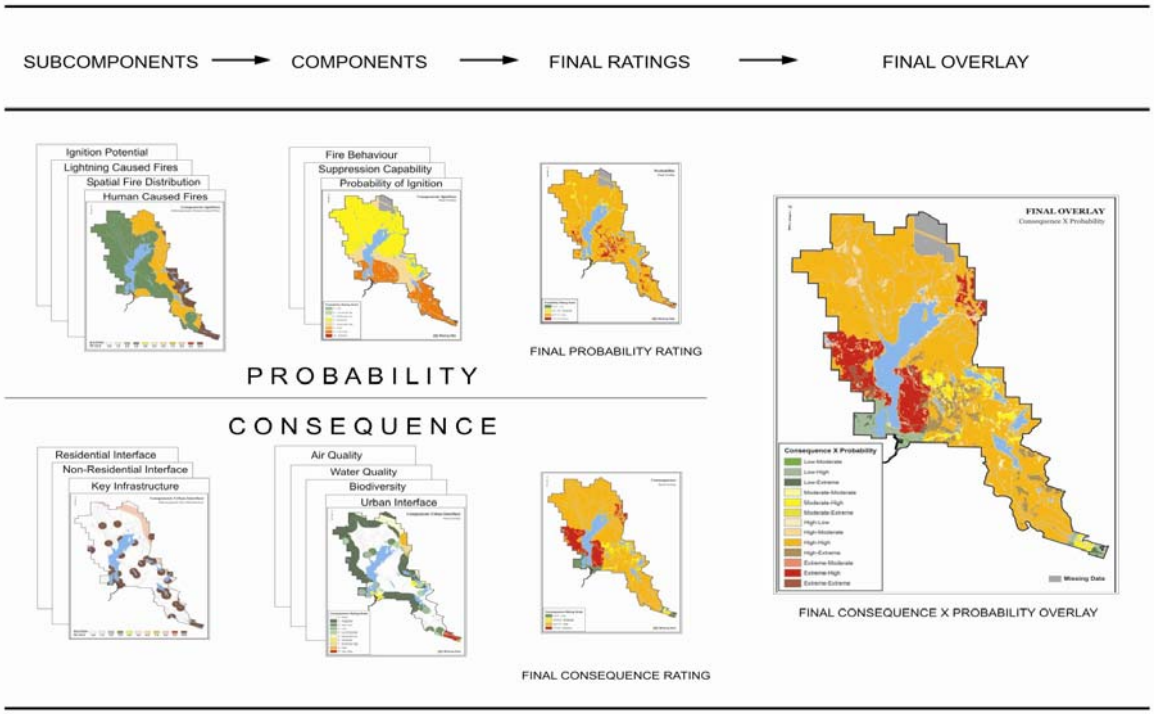


Figure 3 – Illustration of the Map Outputs of the Wildfire Risk Assessment Model

We will also have the ability to test future scenarios. For example, we could develop data sets based on projected residential development 10 years from now and run the model to see how this may affect fire starts, suppression capability, and the spatial distribution of high consequence areas.

The model may also assist with operational planning. By examining the output maps from the suppression component, we can better understand the effects of road access and water sources on suppression capability. CRD Water also has a 'pumping limits model' that uses road access to water tankers, capacity of pumps and hose lengths, proximity to water sources, and terrain to determine where it would be difficult to deliver water. We are able to use the output of the pumping limits model in the risk assessment.

Schedule

Programming and data assembly for Phase 2 of the Wildfire Risk Assessment Model is being undertaken over the winter of 2006/2007. The results of Phase 2 will be available in May, 2007. The model will then be used to develop, and test the effectiveness of, strategies for reducing the risk of a large-scale wildfire affecting the Greater Victoria Water Supply Area.

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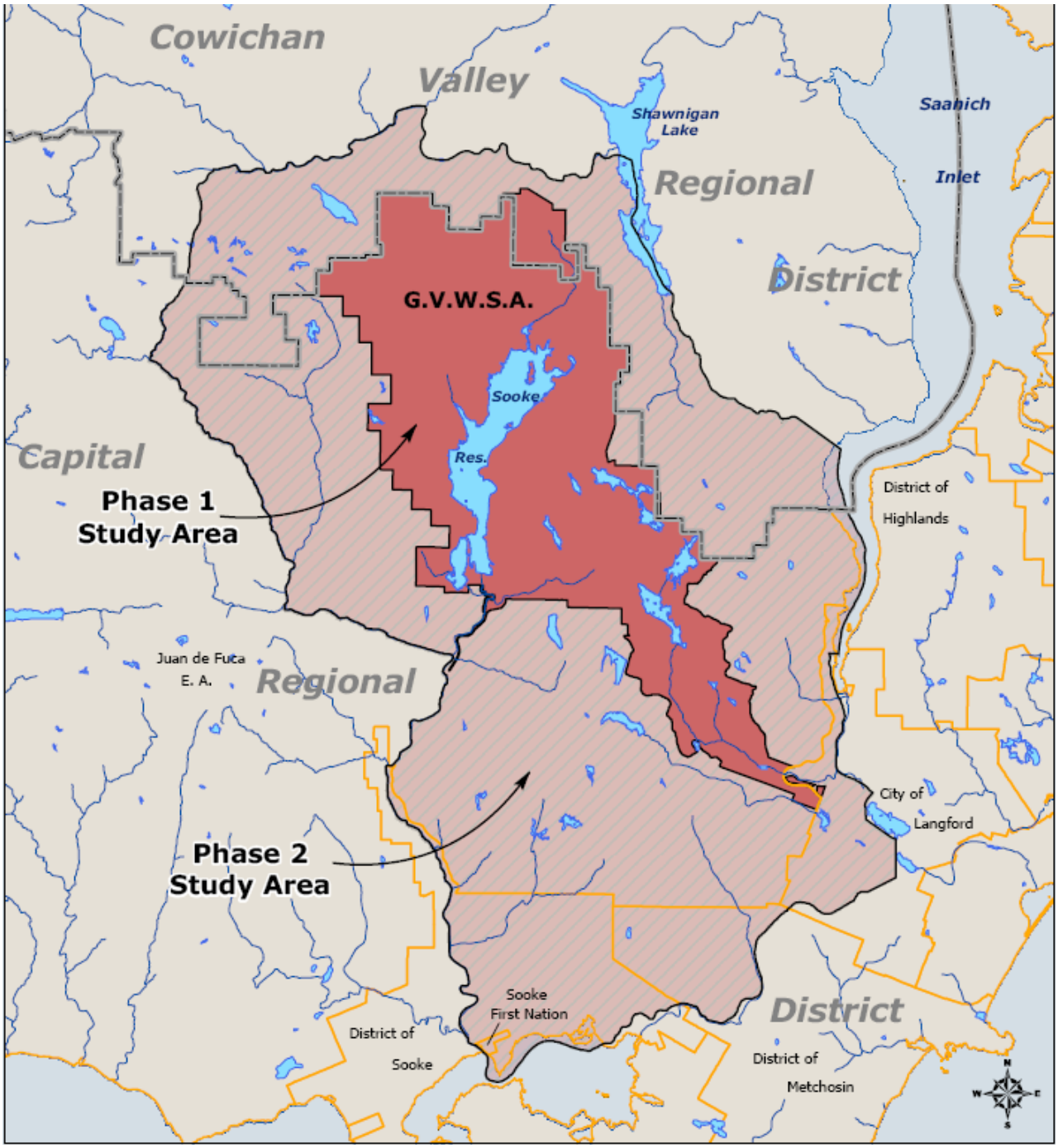
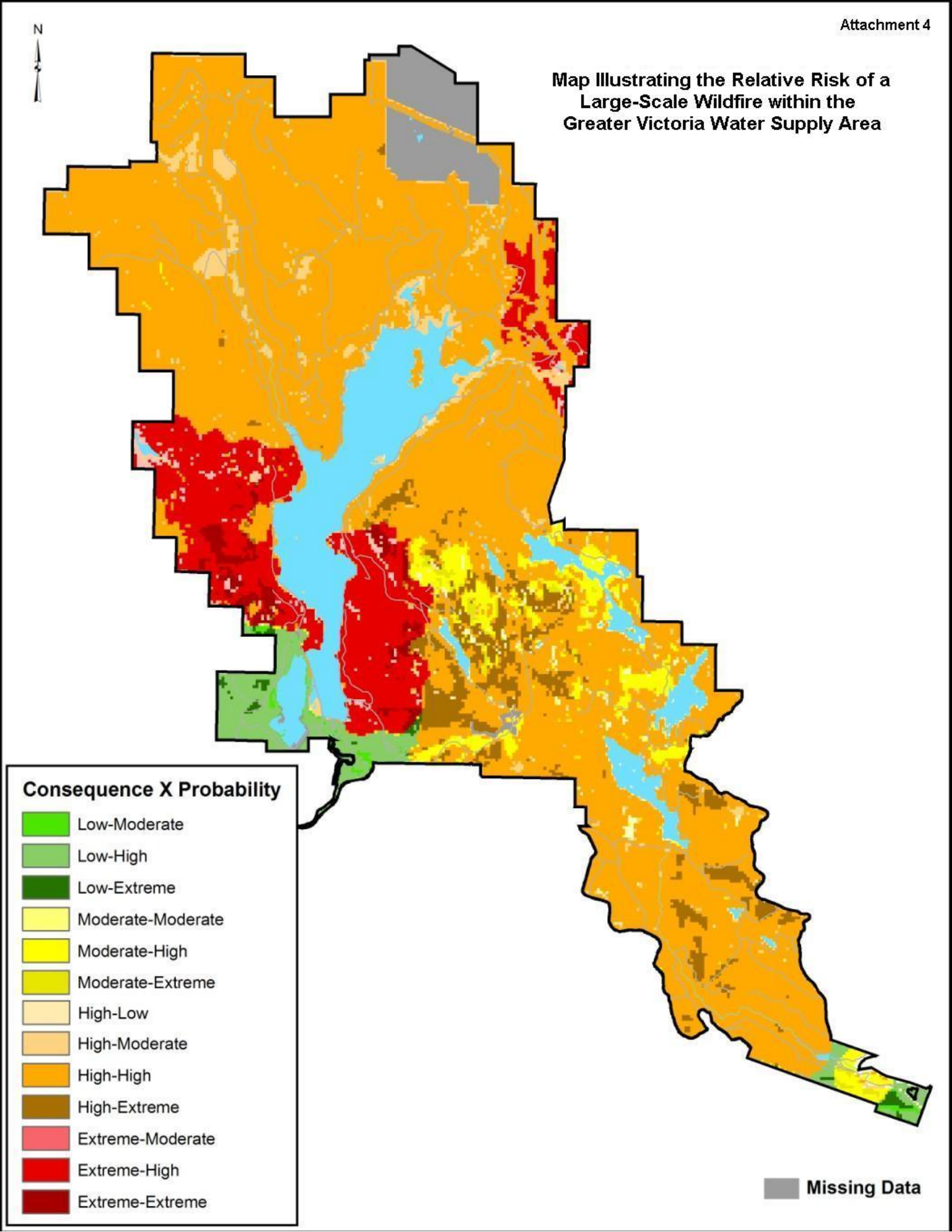
Attachment 3

Map Illustrating the Areas Considered in Each of the Two Phases of the Wildfire Risk Assessment



Attachment 4



Proposed Wildfire Containment Zones and Enhanced Fuel Breaks

Attachment 5

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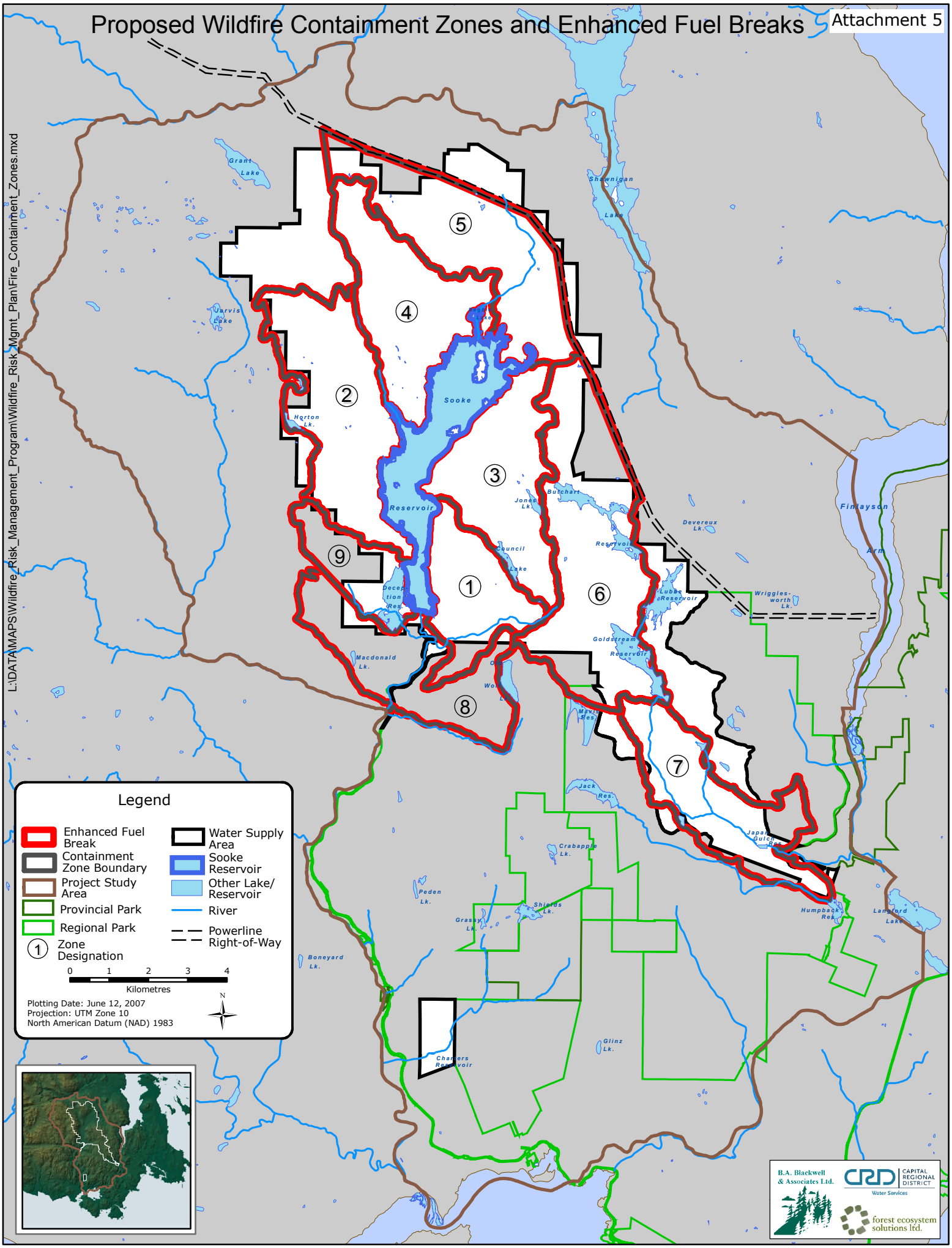

Attachment 6

Diagram Illustrating the Techniques for Reducing Forest Fuels to Enhance Road Fuel Breaks and Reduce the Fuel Hazard within Forest Stands in the Greater Victoria Water Supply Area