Community Wildfire Protection Plan

Community of Otter Point
Considerations for Wildland Urban Interface Management

OTTER POINT

COMMUNITY WILDFIRE PROTECTION PLAN

Considerations for Wildland Urban Interface Management for Otter Point, British Columbia

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1.0 Introduction

In 2010 B.A. Blackwell & Associates Ltd. were retained by the Capital Regional District (CRD) and the District of Sooke to develop Community Wildfire Protection Plans (CWPPs) for Sooke, the Juan de Fuca Electoral Area communities and Piers Island. 'FireSmart – Protecting Your Community from Wildfire'[1] was used to guide the protection planning process. For Otter Point, the assessment considered important elements of community wildfire protection including communication and education, structure protection, emergency response and vegetation management.

The social, economic and environmental losses associated with the 2003 and 2009 fire seasons emphasized the need for greater consideration and due diligence in regard to wildfire risk in the wildland urban interface (WUI). In considering wildfire risk in the WUI, it is important to understand the specific risk profile of a given community, which can be defined by the probability and the associated consequence of wildfire to the community. While the probability of fire in coastal communities is substantially lower when compared to the interior of British Columbia (BC), the consequences of a large fire are likely to be very significant in communities given access and evacuation constraints, population size (especially during summer months), values at risk, topography and environmental considerations.

This CWPP will provide Otter Point with a framework to assess the Fire Protection Area's fire risk. Additionally, the information contained in this report will help to guide the mitigation strategies that will best address wildfire risk in the community.

The scope of this project included three distinct phases of work:

- **Phase I** –Assess fire risk and develop a Wildfire Risk Management System (WRMS) to spatially quantify the probability and consequence of fire.
- **Phase II –** Conduct a structured decision making workshop to define each community's most important objectives for wildfire protection, and to develop the mitigation strategy alternatives that would best meet community needs.
- **Phase III –** Develop the Plan, which outlines measures to mitigate the identified risk through communication and education, structure protection, emergency response and vegetation management.

[1] Partners in Protection. 2004. FireSmart Protecting your Community from Wildfire. http://www.partnersinprotection.ab.ca/downloads/index.php

2.0 Otter Point

2.1 Study Area

Otter Point is located along the Strait of Juan de Fuca, between the District of Sooke and Shirley, and is approximately 30 km^2 in area. Otter Point is bounded to the north by forest land reserves. The community is approximately 45 km west of Victoria, accessed via Highway 14 (Figure 1). The shoreline of Otter Point varies from rocky headlands and cliffs to small cobble beaches. The community is predominantly rural with small hobby farms and parcels of undeveloped forest[2]. The northern boundary of the study area is adjacent to forest lands managed by Western Forest Products (TFL 61).

Figure 1. Google Map image of Otter Point and surrounding areas.

2.2 Population

Otter Point in is one of several unincorporated communities that make-up the Juan de Fuca Electoral Area, which is under the jurisdiction of the CRD. The Juan de Fuca Electoral Area covers over 1,500 km^2 and is home to approximately 4,500 residents. The population of Otter Point is approximately 1,600 and the community has a low population density. Many residents run small, home-based businesses and the Sooke Business Park, currently under development, will consist of 53 industrial lots.

[2] http://www.crd.bc.ca/jdf/about.htm

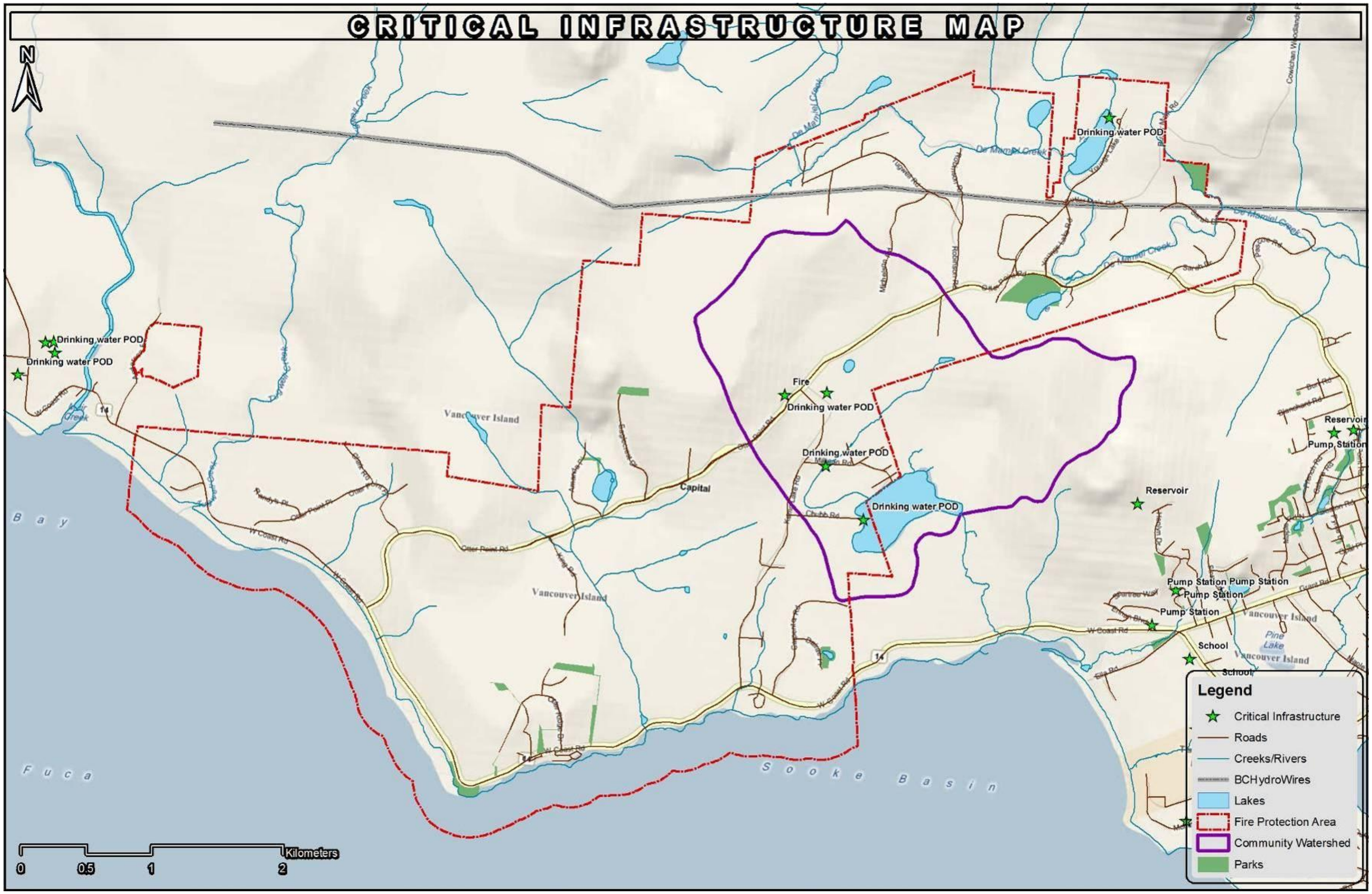
2.3 Infrastructure

Infrastructure within Otter Point is limited. The nearest hospital is in Victoria (45 km) and the nearest schools are in the District of Sooke. The only public building is the Otter Point Fire Department (Figure 2 and Map 1), which is located off of Otter Point Road.

Figure 2. Otter Point Fire Department (left) and Kemp Lake (right).

Otter Point water is sourced either from the Kemp Lake Waterworks Improvement District watershed (Map 1) or from potable well water. Kemp Lake (Figure 2) and Young Lake are both within the Fire Protection Area and approximately one third of the district has hydrants (Kemp Lake Road and Carpenter Road areas). Water supply is adequate for the current population but the ongoing Official Community Planning process has identified community concerns regarding long-term water supply with the growth of commercial and residential development in Otter Point.

Electrical service is received through a network of metal and wood pole transmission infrastructure supplied by BC Hydro/BC Transmission Corporation. Southern Vancouver Island west of Victoria is supplied power by a single 138 kV circuit that connects Colwood Substation, Sooke Substation and Jordan River Generating Station. The Jordan River Generating Station has traditionally been able to supply the combined load of Colwood, Sooke and Jordan River when power has been out on this line. The ability to supply power from either Jordan River or from the north means that, while fire could cause a disruption in power services either due to heat from the flames or fallen trees associated with a fire event, an extended power disruption is unlikely. Wood pole distribution lines connecting homes would be vulnerable to fire, which could disrupt service to portions of the community.



Map 1. Critical Infrastructure within the Otter Point Fire Protection Service Area.

2.4 Environmental Values

The Biogeoclimatic Ecosystem Classification (BEC) system describes zones by vegetation, soils and climate. Regional subzones are derived from relative precipitation and temperature. The study area is defined by the regional climate of the Coastal Western Hemlock very dry maritime (CWHxm). The CWH is the most productive forest region in Canada and in the drier portion of this zone many conifers exhibit their best growth.

Sensitive ecosystem data is not complete for rare species or species of concern however there are two blue listed species documented within the study area (Ermine and common bluecup). Environmental values include the Strait of Juan de Fuca, which is important fish habitat (Chinook, chum, coho, halibut, cutthroat trout, steelhead and rainbow trout), plus there are nearby salmon spawning streams and two large lakes within the study area. Future urban development and invasive species such as Scotch broom are threats to biodiversity within Otter Point (Figure 3).

Figure 3. Invasive Scotch Broom

3.0 Fire Environment

3.1 Fire Weather

The Canadian Forestry Service developed the Canadian Forest Fire Danger Rating System (CFFDRS) to assess fire danger and potential fire behaviour. A network of fire weather stations during the fire season are maintained by the Ministry of Forests and Range (MOFR) and are used to determine fire danger on forestlands within a community. The information can be obtained from the MOFR Protection Branch and is most commonly utilized by municipalities and regional districts to monitor fire weather, and to determine hazard ratings, associated fire bans and closures. Fifteen years of data from the now archived Chemainus, Barnard and Mesachie fire weather stations were used to summarize fire weather for Otter Point. The key fire weather parameters summarized are:

- Drought Code: The Drought Code represents the moisture in deep, compact organic matter with a nominal depth of about 18 cm and a dry fuel load of 25 kg/m^2. It is a measure of long-term drought as it relates to fire behaviour.

- Danger Class: The Danger Class Rating is derived from fire weather indices and has 5 classes: 1) Very Low Danger; 2) Low Danger; 3) Moderate Danger; 4) High Danger; and 5) Extreme Danger.

The drought code provides some indication of seasonal drought effects on forest fuels. The higher the drought code, the drier the duff (layer of decomposing organic materials below the litter layer), indicating a prolonged period without adequate moisture input to wet the duff layer. This code also provides some indication of potential fire severity in terms of duff consumption; the drier the duff is, the more it will be consumed by fire. The depth of burn can result in greater tree mortality and seed bank consumption due to soil heating. Soil heating can also result in soil hydrophobicity, meaning the soil repels water, and this has been linked with increased erosion post-fire due to increased water run-off. Figure 4 shows that the drought code tends to shift over the summer months and in to the fall from being predominantly low in June, to high in July and then extreme in August and September.

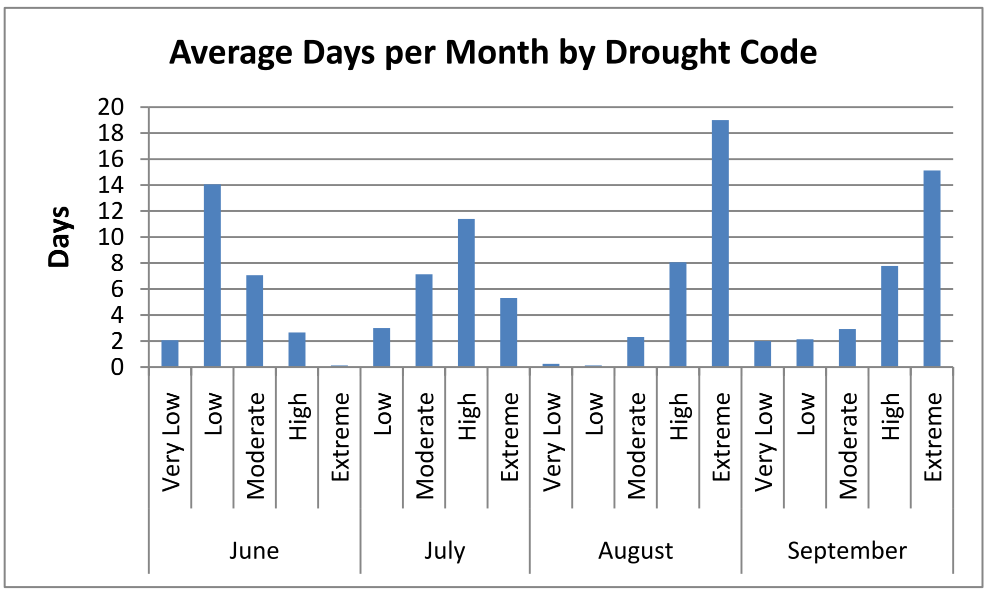


Figure 4. Drought code averaged for each month over a 15 year period from the Chemainus, Barnard and Mesachie weather stations (Very low = 0-79; Low = 80-189; Moderate = 190-299; High = 300-424, Extreme = >425).

The Fire Danger classes provide a relative index of how easy it is to ignite a fire and how difficult control is likely to be. The BC *Wildfire Act* [SBC 2004] and *Wildfire Regulation* [B.C. Reg. 38/2005], which specify responsibilities and obligations with respect to fire use, prevention, control and rehabilitation, restrict high risk activities based on these classes. Fire Danger Classes are defined as follows:

Class 1 (Low) – Fires likely to be self-extinguishing and new ignitions unlikely. Any existing fires limited to smouldering in deep, drier layers.

Class 2 (Moderate) – Creeping or gentle surface fires. Fires easily contained by ground crews with pumps and hand tools.

Class 3 (High) – Moderate to vigorous surface fire with intermittent crown involvement. Challenging for ground crews to handle; heavy equipment (bulldozers, tanker trucks, aircraft) often required to contain fire.

Class 4 (Very High) – High-intensity fire with partial to full crown involvement. Head fire conditions beyond the ability of ground crews; air attack with retardant required to effectively attack fire's head.

Class 5 (Extreme) – Fast-spreading, high-intensity crown fire. Very difficult to control. Suppression actions limited to flanks, with only indirect actions possible against the fire's head.

Figure 5 shows that the number of danger class days on average for each month of the fire season is highly variable but that the number of high, very high and extreme danger class days tends to be highest from July through to September. August has the highest number of extreme danger class days.

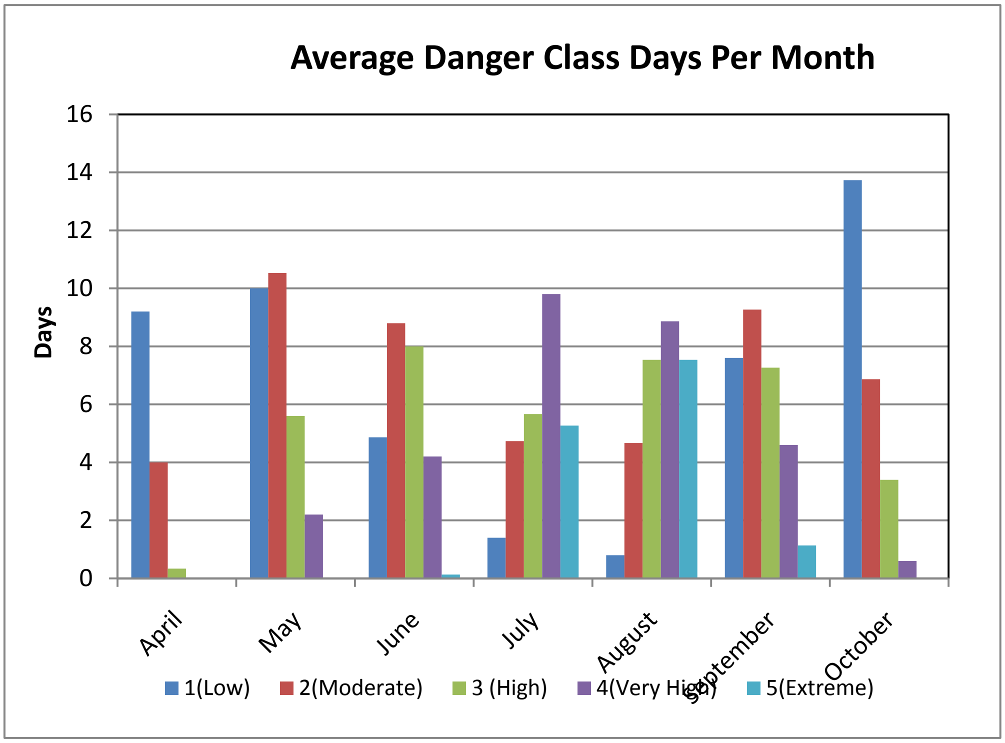


Figure 5. Fire Danger Class averaged for each month from 15 years of data from the Chemainus, Barnard and Mesachie weather stations.

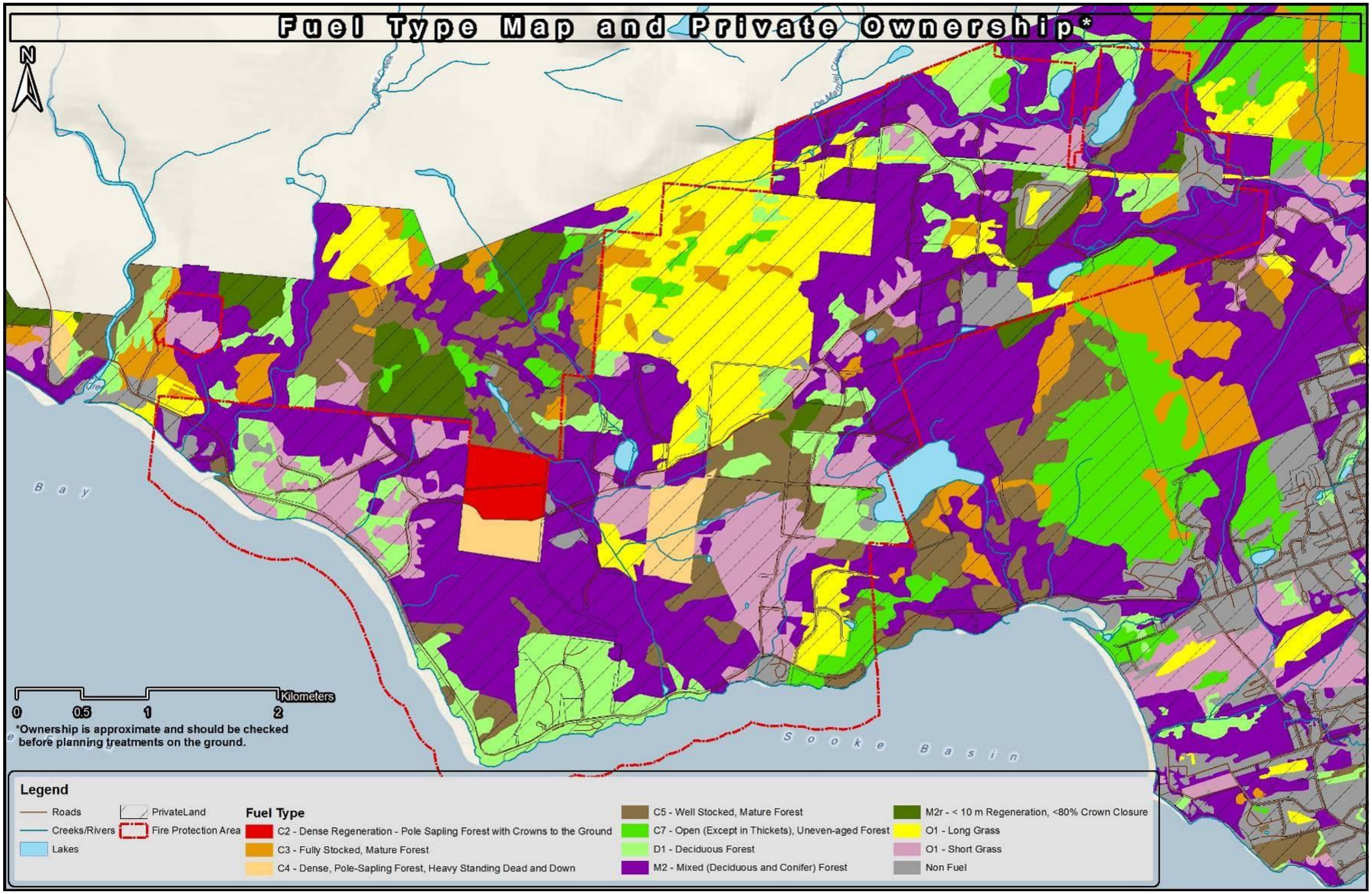
3.2 Fuels

The fuel typing used to develop the Provincial Strategic Threat analysis is not accurate at a local scale, therefore fuel types are generated spatially for the study area using an algorithm that assigns CFFDRS fuel types based on Vegetation Resource Inventory (VRI) data. The fuel types within the study area and the composition for each fuel type are outlined in Table 1. The algorithm uses BEC, species mix, crown closure, age, and non-forest descriptors to assign fuel type. Typically, the outputs require refinement and do not adequately describe the variation in fuels present within a given area, due to errors in VRI and adjustments required in the algorithm. For this reason, it is important to ground-truth fuel types in order to modify the algorithm and improve fuel type accuracy. The VRI-based fuel typing was improved upon and adjusted to incorporate local variation and is illustrated in Map 2.

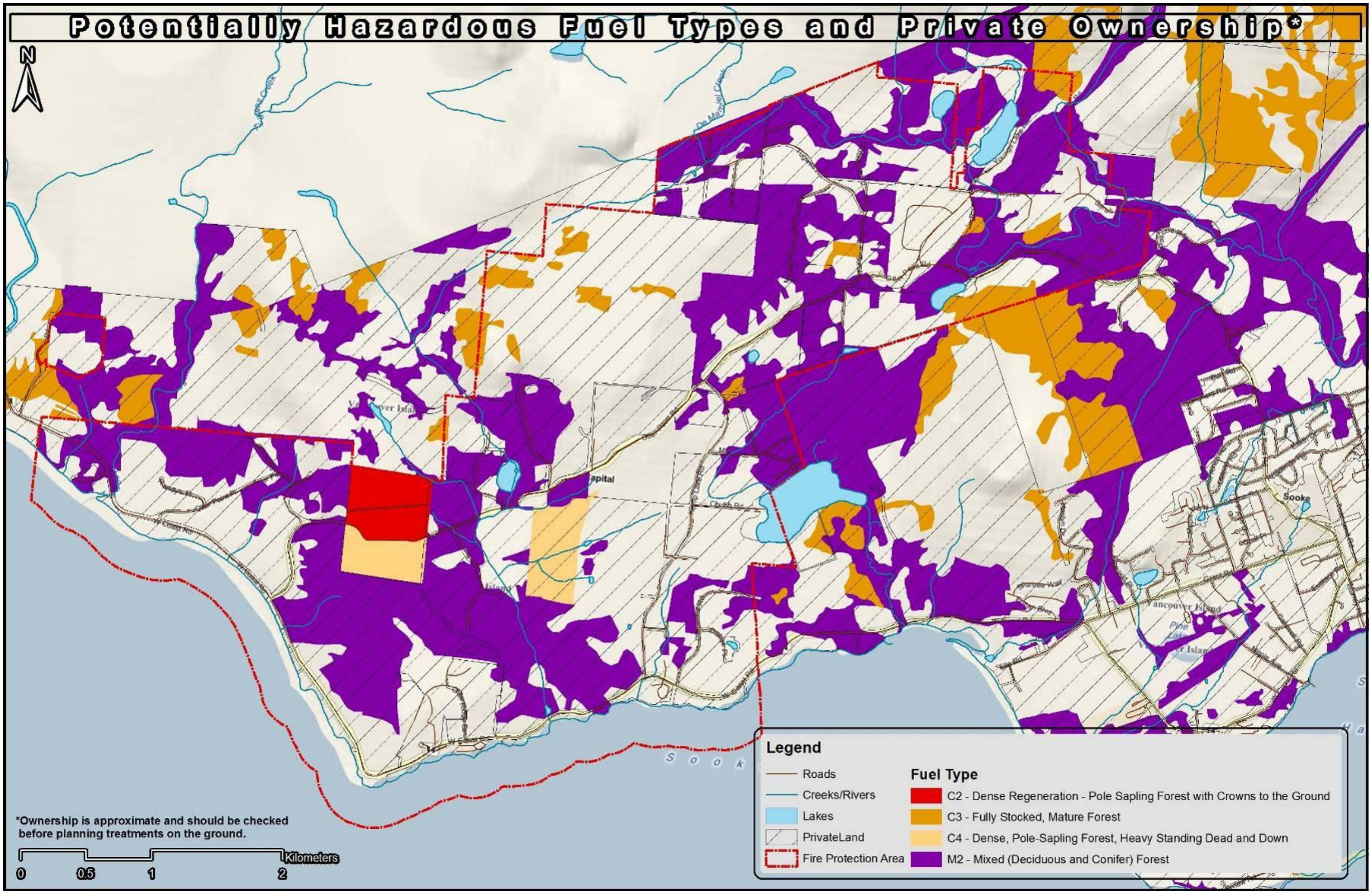
Table 1 summarizes the fuel types by general fire behaviour and total area for Otter Point. In general the fuel types considered hazardous in terms of dangerous fire behavior and spotting (lofting burning embers) are C2, C4, and C3. Fuel type M2 can sometimes be hazardous depending on the proportion of conifers within the forest stand. Hazardous fuel types are shown in Map 3.

Table 1. A summary of fuel types, associated hazard and areas within the Otter Point study area.

Fuel Type	Description	Wildfire Behaviour under High Wildfire Danger Level	Area (ha)	Percent (%)
C2	Dense regeneration to pole-sapling forest with crowns almost to the ground	Almost always **crown fire**, high to very high fire intensity and rate of spread	30.8	2
C3	Fully stocked, mature forest, crowns separated from ground	**Surface and crown fire**, low to very high fire intensity and rate of spread	46.3	3
C4	Dense, pole-sapling forest, heavy standing dead and down, dead woody fuel, continuous vertical crown fuel continuity	Almost always **crown fire**, high to very high fire intensity and rate of spread	47.4	3
C5	Well stocked, mature forest, crowns well separated from ground	Low to moderately fast spreading, low to moderate intensity **surface fire**	112.6	6
C7	Open, uneven-aged forest, crowns separated from ground except in conifer thickets, understory of discontinuous grasses, herbs	**Surface, torching, rarely crowning** (slopes > 30%), moderate to high intensity and rate of spread	40.7	2
D1	Moderately well-stocked deciduous stands	Always a **surface fire**, low to moderate rate of spread and fire intensity	255.7	14
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 conifer)	719.9	40
M2r	Moderately well-stocked mixed stand of conifers and deciduous species regeneration, crowns nearly to the ground	**Surface, torching and crowning**, moderate to very high intensity and spread rate(depending on slope and percent conifer)	27.6	2
O1 – Long	Continuous standing grass, fuel loading is 0.3 kg/m2, 90% cured	Rapid spreading, moderate to high intensity **surface fire**	287.0	16
O1 – Short	Continuous human modified short grass, fuel loading is 0.17 kg/m2, 90% cured	Rapid spreading, low to moderate intensity **surface fire**	220.5	12
		Total:	1,788.5	



Map 2. Fuel typing and private ownership for the Otter Point Fire Protection Service Area.



Map 3. Potentially hazardous fuel types within the Otter Point Fire Protection Service Area.

3.3 Historic Ignitions

Fire data are summarized by fire cause for the period of 1919 to 2009 with some gaps between years. Within the Otter Point Fire Protection Service Area, all historic ignitions have been human caused (Figure 6). The number of fires per year is quite low, though data pre-1951 may underestimate the number of fire starts as it only records fire extent for fires that contributed to an area burned, whereas data after that date includes all fires reported to the Ministry of Forests, Lands and Natural Resource Operation's (MFLNRO) Wildfire Protection Branch.

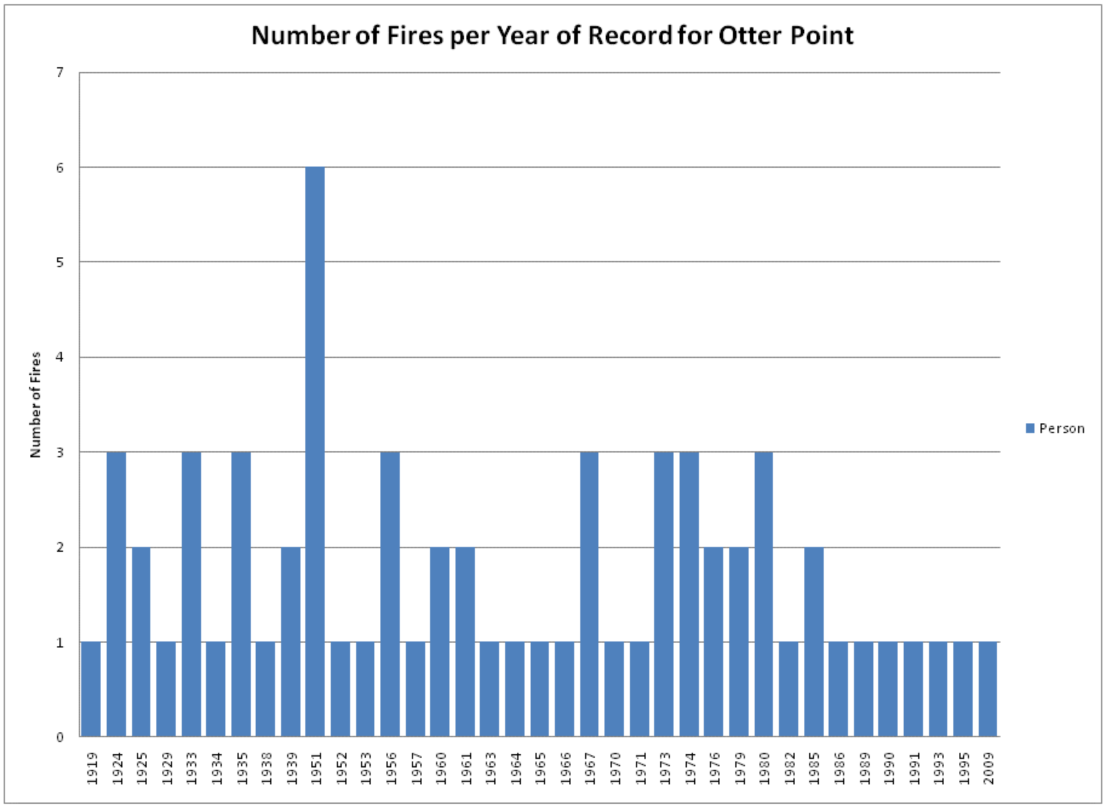


Figure 6. Number of fires per year between 1919 and 2009 within the Otter Point Fire Protection Service Area.

The number of hectares burned per year (Figure 7) shows that there were large areas burned in the 1920s and 1930s (due to just a few fires) and that area burned has been consistently small since the 1950s, which likely coincides with effective fire suppression. Though there were a relatively high number of ignitions in the 1950s and 1970s, these did not result in an increase in the area burned within the District.

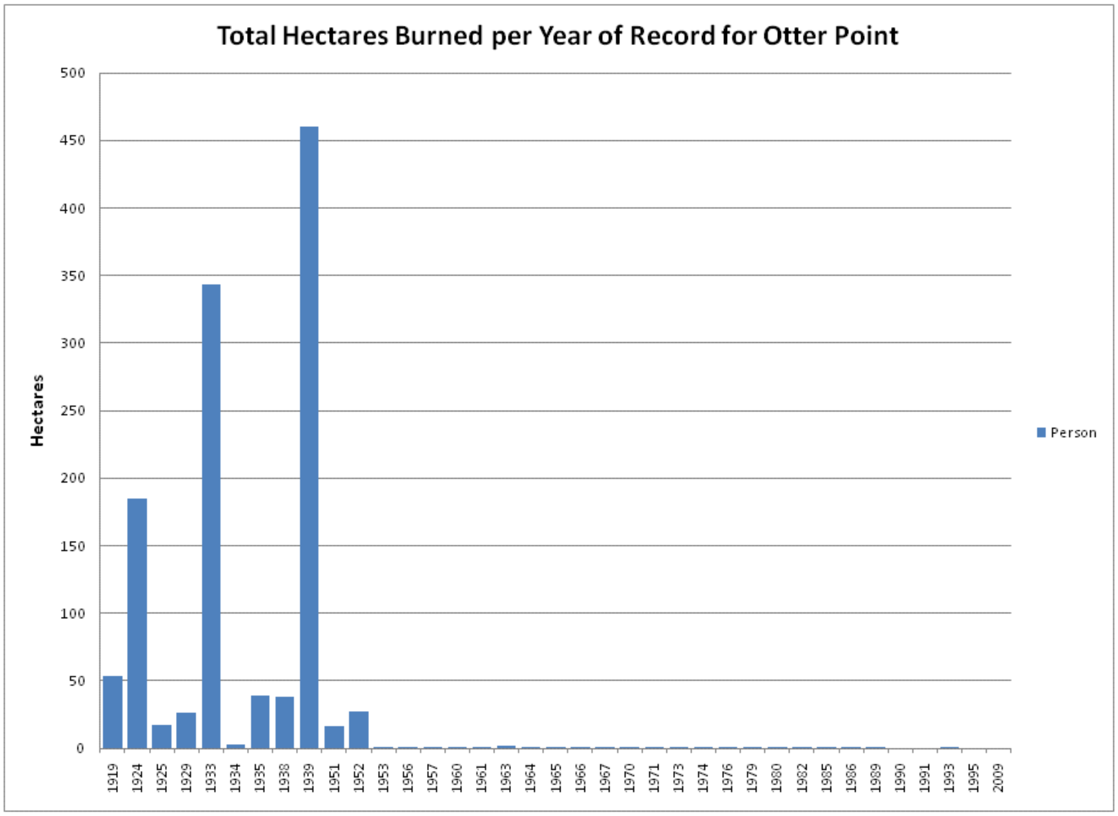
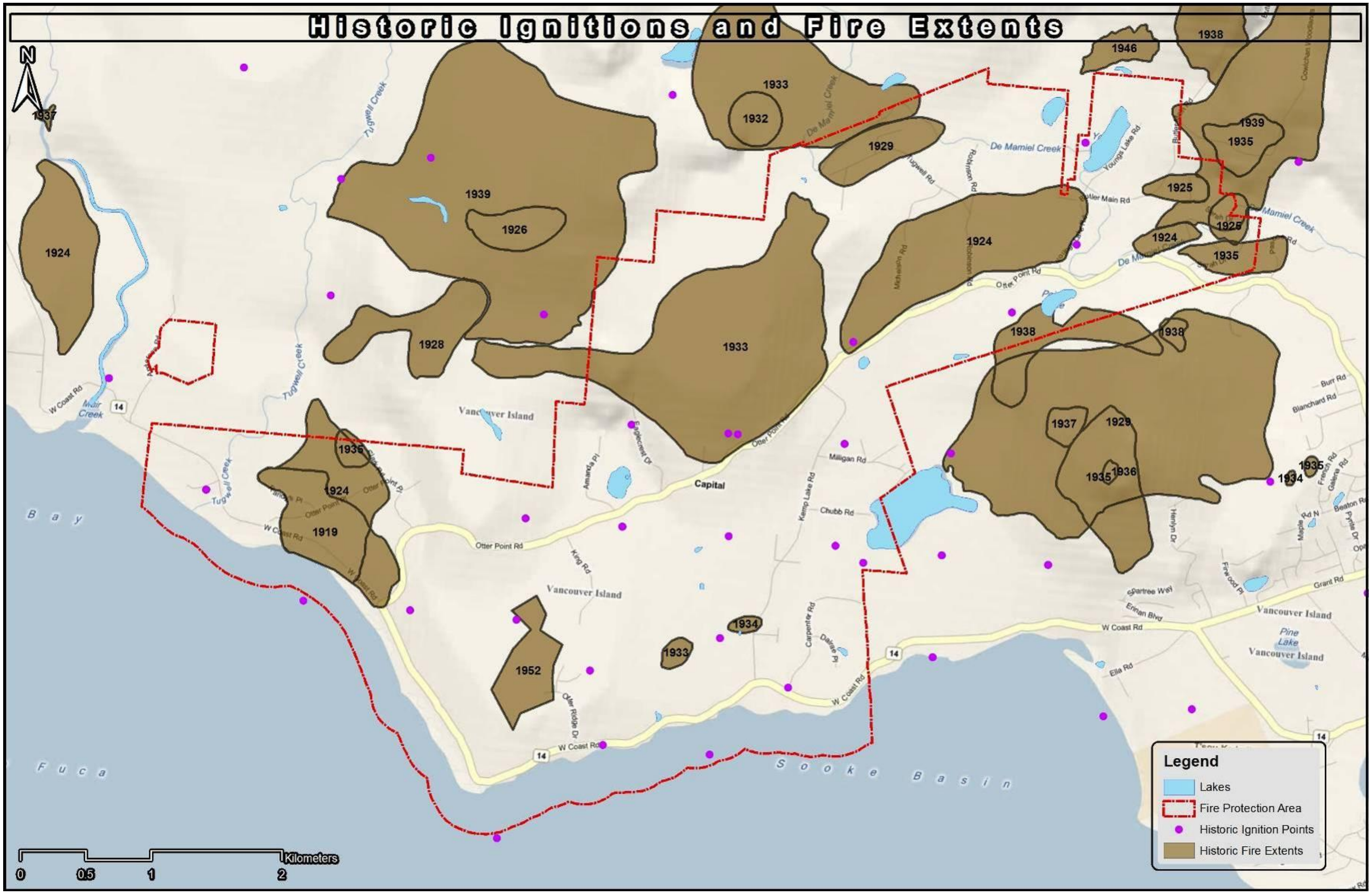


Figure 7. Number of hectares burned per year between 1919 and 2009 within the Otter Point Fire Protection Service Area.

The figures above and the fire history data presented in Map 3 indicate that Otter Point and surrounding areas have experienced large fires in the last 100 years. Effective fire suppression since the 1950s has likely reduced the extent of fires within the Fire Protection Area.

The point ignition data shown in Map 4 represents ignitions located, as per MFLNRO methodology, on a grid rather than the exact ignition location; therefore, some points are located in water and multiple points are often located on top of one another.



Map 4. Historic ignitions and fire extents from 1919 to 2009.

4.0 The Wildland Urban Interface

The classical definition of wildland urban interface (WUI) is the place where the forest meets the community. Other configurations of the WUI can be described as intermixed. Intermixed areas include smaller, more isolated developments that are embedded within the forest. An example of an intermixed interface is shown in Figure 8.

In each of these cases, fire has the ability to spread from the forest into the community or from the community out into the forest. Although these two scenarios are quite different, they are of equal importance when considering interface fire risk. Within the Fire Protection Area, the probability of a fire moving out of the community and into the forest is equal or greater to the probability of fire moving from the forest into the community. Regardless of which scenario occurs, there will be consequences for the community and this will have an impact on the way in which the community plans and prepares for interface fires.

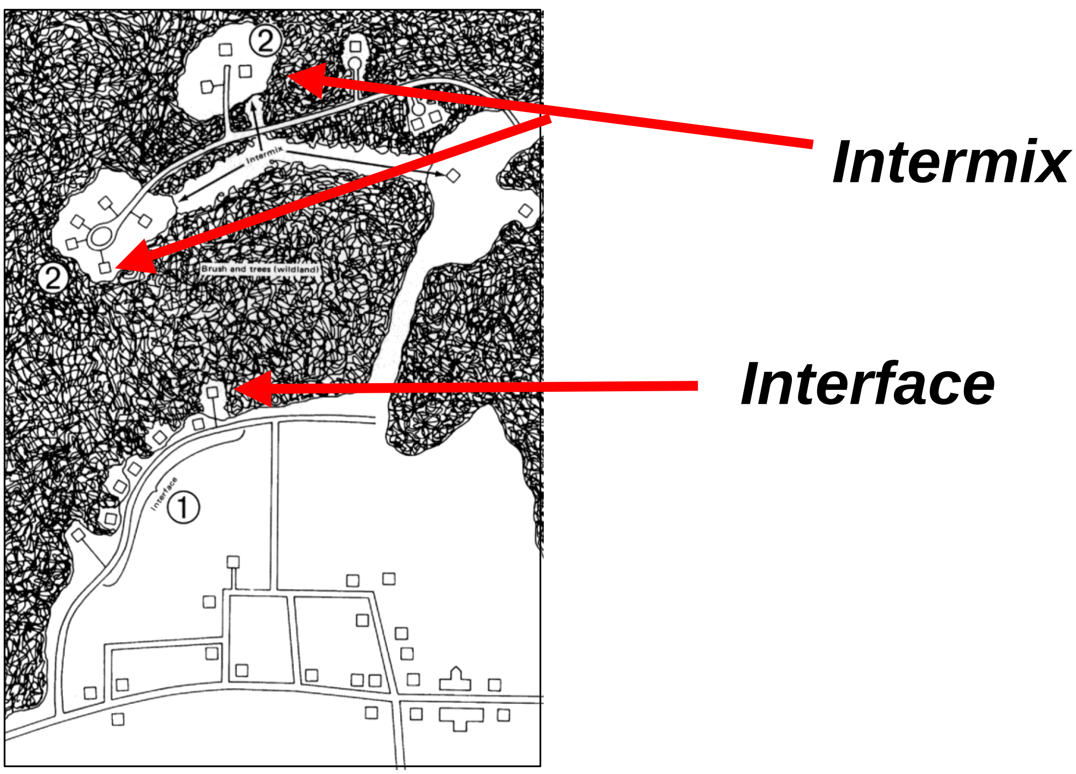
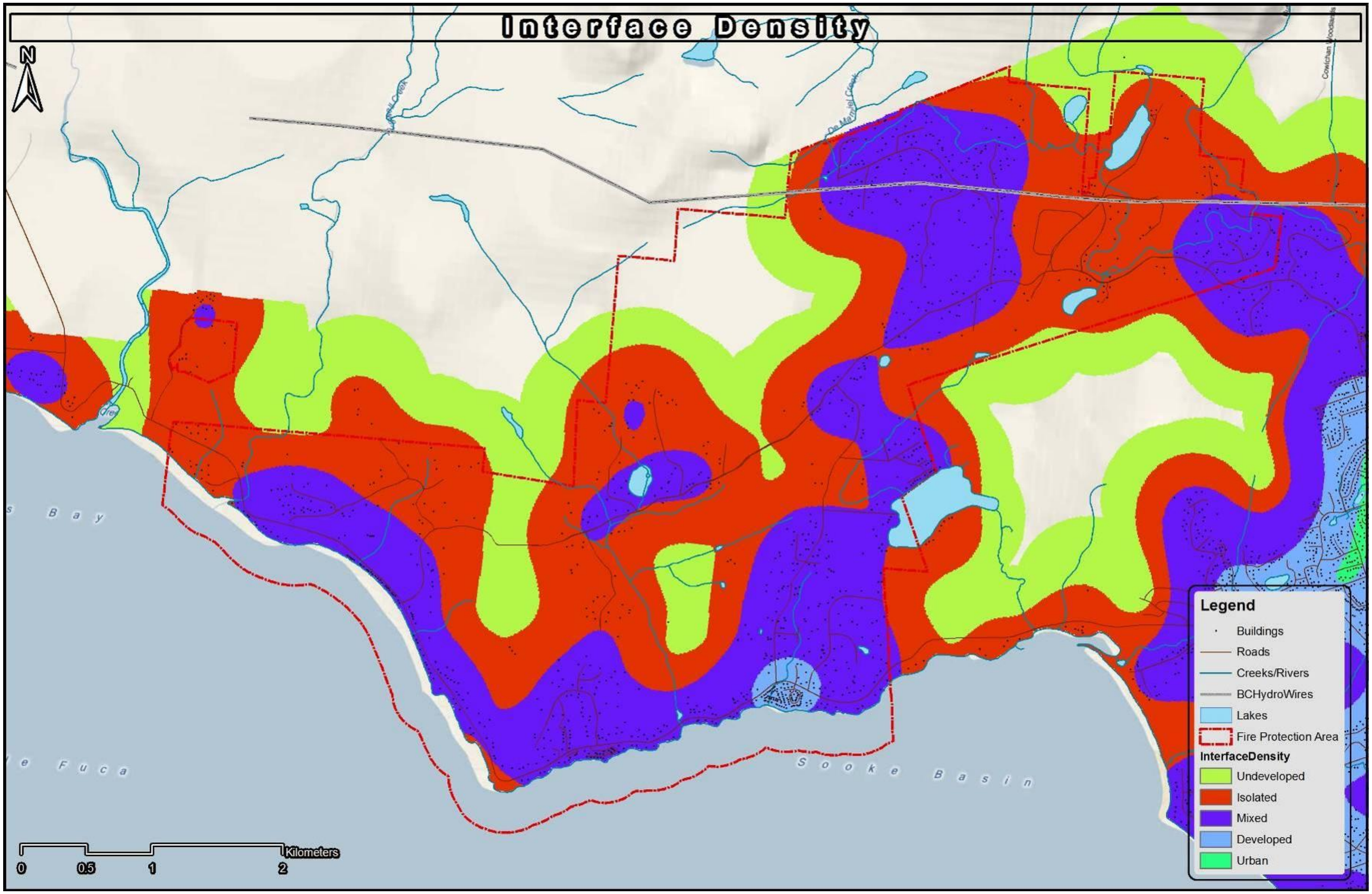


Figure 8. Graphical example showing variation in the definition of interface.

Map 5 shows the interface density classes mapped for the Fire Protection Area. Otter Point contains a small area classed as 'Developed' interface density (Olympic View Mobile Home Park) but the majority of the area is 'Mixed' and 'Isolated', which predominantly look 'intermix' as defined in Figure 8.



Map 5. Interface density classes within the Otter Point Fire Protection Area and surrounding areas.

4.1 Vulnerability of the Wildland Urban Interface to Fire

Fires spreading into the WUI from the forest can impact homes in two distinct ways:

1) From sparks or burning embers getting carried by the wind, or convection that starts new fires beyond the zone of direct ignition (main advancing fire front), and alight on vulnerable construction materials (*i.e.* roofing, siding, decks etc.) (Figure 9).

2) From direct flame contact, convective heating, conductive heating or radiant heating along the edge of a burning fire front (burning forest), or through structure-to-structure contact. Fire can ignite a vulnerable structure when the structure is in close proximity (within 10 meters of the flame) to either the forest edge or a burning house (Figure 10).

Figure 9. Firebrand caused ignitions: burning embers are carried ahead of the fire front and alight on vulnerable building surfaces.

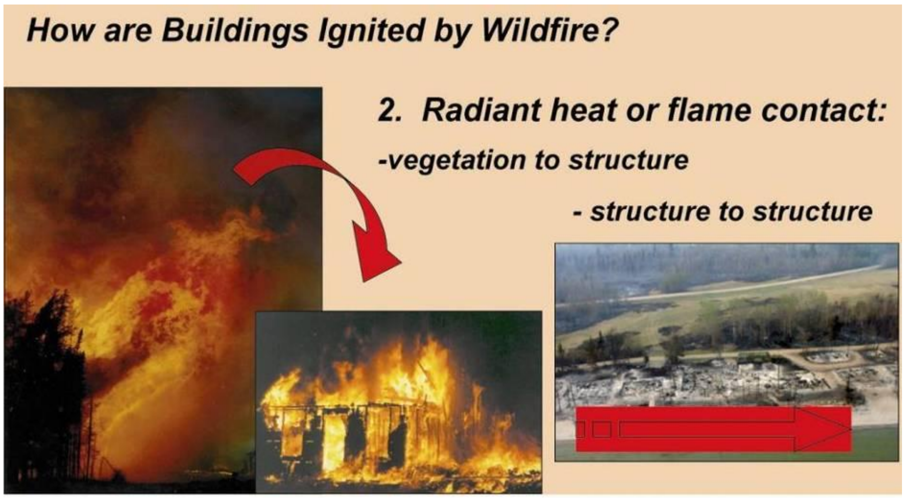


Figure 10. Radiant heat and flame contact allows fire to spread from vegetation to structure or from structure to structure.

5.0 Community Wildfire Protection Planning Process

The WUI continuum summarizes the main options available for addressing WUI fire risk in the CWPP process (Figure 11).

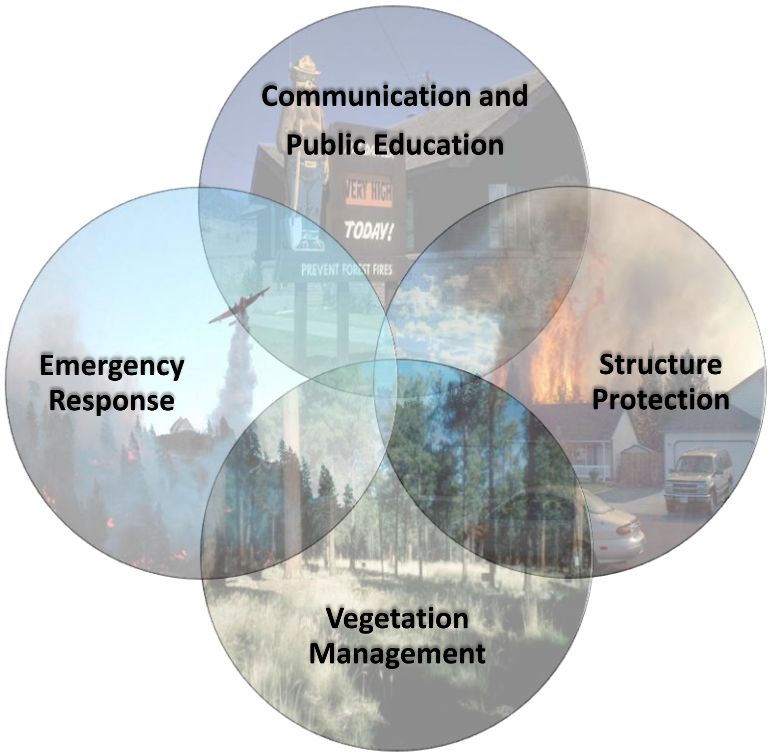


Figure 11. Wildland urban interface continuum summarizing the different options for addressing fire risk during the Community Wildfire Protection Plan process.

The recommended management response to a given wildfire risk profile is based on determining the appropriate combination and level of emphasis of the key elements shown in Figure 11:

- Communication and public education (e.g., signage, websites, advertising, communication planning, private owner structure protection and vegetation management)
- Structure protection (e.g., FireSmart principles for construction and vegetation management, National Fire Protection Association [NFPA] standards, subdivision design)
- Vegetation management (e.g., identifying hazardous fuel types, reducing crown and ladder fuels, landscape level fuel breaks)
- Emergency response (e.g., evacuation and access routes, firefighting capability, training, emergency response planning, post-fire rehabilitation planning)

Determining where effort for wildfire mitigation should be focused is based on an assessment of risk, defined as the factors that contribute to the probability of fire and the values at risk (consequence) in the community. A variety of management responses are appropriate within a given community based on the Community Risk Profile presented in Section 6.0.

6.0 Community Risk Profile

Two parallel approaches were used to develop the risk profile for each community within the study area.

6.1 Stakeholder Workshop

The first part of the approach involved a workshop with participation from Fire Chiefs, emergency program coordinators and representatives, regional and municipal staff (planning, engineering, parks, water and building) and a representative from the MFLNRO (formerly the Ministry of Forests and Range) Protection Branch . The workshop used a Structured Decision Making approach as defined in Hammond *et al.* (1999)[3]. The decision problem was defined as:

> **In order to adequately improve community protection against a large wildfire event, which mitigation strategies make the most sense for implementation in CRD communities and Sooke?**

Prior to the workshop, key objectives were elicited from participants via an email questionnaire. At the workshops, participants went through a process of weighting those objectives and defining the 'best' alternatives for each community. We then used this information to look at the consequences and tradeoffs of each alternative on the defined objectives. This process enabled us to determine which mitigation strategies had the biggest impact on the objectives that matter to communities. Those objectives that we could not influence through our mitigation alternatives were removed from the analysis because they do not affect our decision.

Across all stakeholders, regardless of community representation, means objectives that supported the fundamental objective of protecting human life and well-being were consistently rated at the top. There was a lot more variability across the group on the fundamental objectives of protecting economic values and protecting environmental values. It is our interpretation that this variation is explained both by the stakeholder's perception of:

1. The impacts of wildfire on these objectives in the context of these specific communities; and,
2. The stakeholder's ability to influence the impact on objectives through their decision.

[3] Hammond, J., Keeney, R. And H. Raffia. 1999. Smart Choices: A Practical Guide to Making Better Decisions. Harvard Business School Press, Boston, Ma, USA.

In other words, the ranking of objectives is not necessarily a reflection of the objective's inherent value or importance, but a reflection of the objective's importance in relation to this specific decision.

Representatives of Otter Point generally agreed with the consistently moderate and high objectives shown in Table 2. However, drinking water was ranked more highly as an objective than in other communities. This is likely due to Otter Point's reliance on the Kemp Lake water improvement district for supplying water to most of its area. Kemp Lake is a surface water source and its watershed is all within private lands.

Objectives were assigned measurable metrics and this was used to compare alternatives relative to the status-quo (i.e., current practices) and gauge their impacts on objectives. For Otter Point, a comparison of possible mitigation alternatives against objectives determined that the objectives most benefited by mitigation strategies were:

1. Improved public understanding of fire risk and personal responsibility;
2. Reducing ignitions;
3. Improving evacuation ease;
4. Protecting homes/structures; and,
5. Protecting critical infrastructure.

The order of the objectives in the list above reflects how much the mitigation alternatives defined in the workshop were able to impact our objective (i.e., 1. on the list was the objective most impacted by the mitigation alternative).

Interestingly, though the following objectives were important, our available alternatives did not impact the metrics we used to measure them in relation to the status-quo:

- Suppression response – this was measured in terms of response time, which is currently quite good across the fire protection area and will not be changed by our alternatives.
- Drinking water – because intakes and the Kemp Lake watershed are on private land, there is a limited ability to control land management in and around that infrastructure.

The metrics used to measure impacts on objectives were not exhaustive and so were not the sole factor used to determine recommendations for each community. For example, there is more to improving suppression response than just improving response time and so we still consider other elements of suppression response. Additionally, while we cannot recommend that the CRD pursue fuel treatments on private land (for example, within the Kemp Lake watershed), landowners may be influenced through education and communication; therefore recommendations to that end are still relevant. What this analysis does is provide direction on where we should focus our efforts in wildfire mitigation by highlighting what is most important to consider and where we can likely make the biggest improvements.

Table 2. Fundamental and means objectives considered in the workshop, and colour coded objectives that were ranked consistently across groups. The objectives in unshaded cells were ranked low to moderate but varied between groups.

Fundamental Objectives	Means Objectives #1	Means Objectives #2
Human Life and Social Benefit/Well-Being	**Reduce Wildfire Threat**	**Ignitions**
		Suppression Response
		Fire Behaviour
	Protect Community Infrastructure	**Critical infrastructure**
		Homes /Structures
	Maximize Safety	**Evacuation Ease (Egress)**
	Minimize Health Impacts	Drinking water
		Air quality
	Maintain Recreation Quality/ Opportunity	**Maintain Park/Trail Recreation**
	Enable Effective Implementation	Cost of Implementation (incl. additional res.)
		Maximize Public Understanding of Fire Risk and Personal Responsibility
		Political acceptability
Economic	Commercial Assets	Timber Assets
	Residential Land Value	Visual Quality
Natural Environment	Biodiversity	Minimize Invasive Species Spread
		Minimize Habitat Loss for Fire Vulnerable Species
[red] Consistently High	[blue] Consistently Moderate	

6.2 Modelling Wildfire Risk

The second approach to developing the community risk profile was to use a geospatial wildfire risk model called the 'Wildfire Risk Management System' (WRMS). Individual polygons are weighted for each subcomponent (Figure 12). Using algorithms, the subcomponents are combined to produce component weightings which are then further processed to derive probability and consequence ratings.

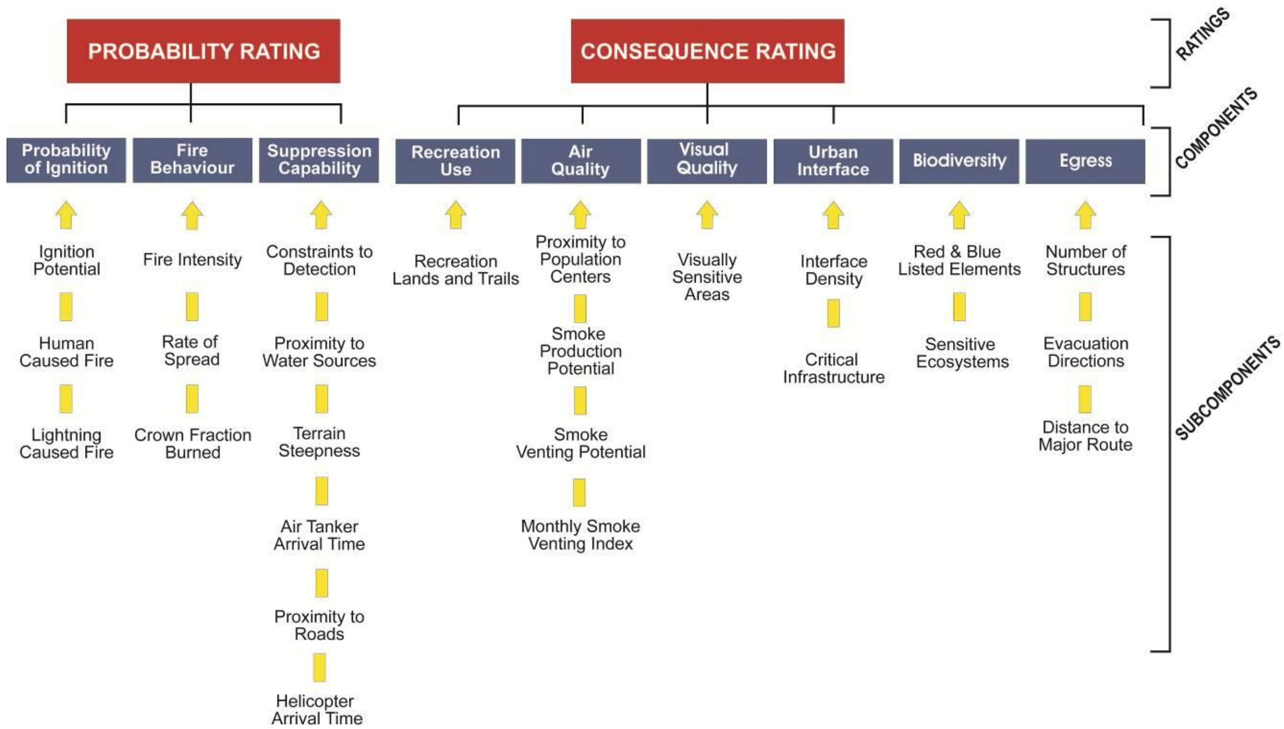


Figure 12. Illustration of the sub-components and components used to calculate the final probability and consequence ratings within the Wildfire Risk Management Structure for the CRD and Sooke. Note: Sensitive Ecosystems was excluded for Otter Point because there is no inventory.

The weightings used for the CRD and Sooke communities WRMS were determined using the ranking of objectives derived during the stakeholder workshop. Component weightings were as follows:

- Probability Rating
    - Probability of Ignition: 35%
    - Potential Fire Behaviour: 30%
    - Suppression Capability: 35%
- Consequence Rating
    - Urban Interface: 49%
    - Egress (Evacuation Ease): 20%
    - Recreation: 10%
    - Biodiversity: 7%
    - Visual Quality: 7%
    - Air Quality: 7%

6.2.1 The Base Case

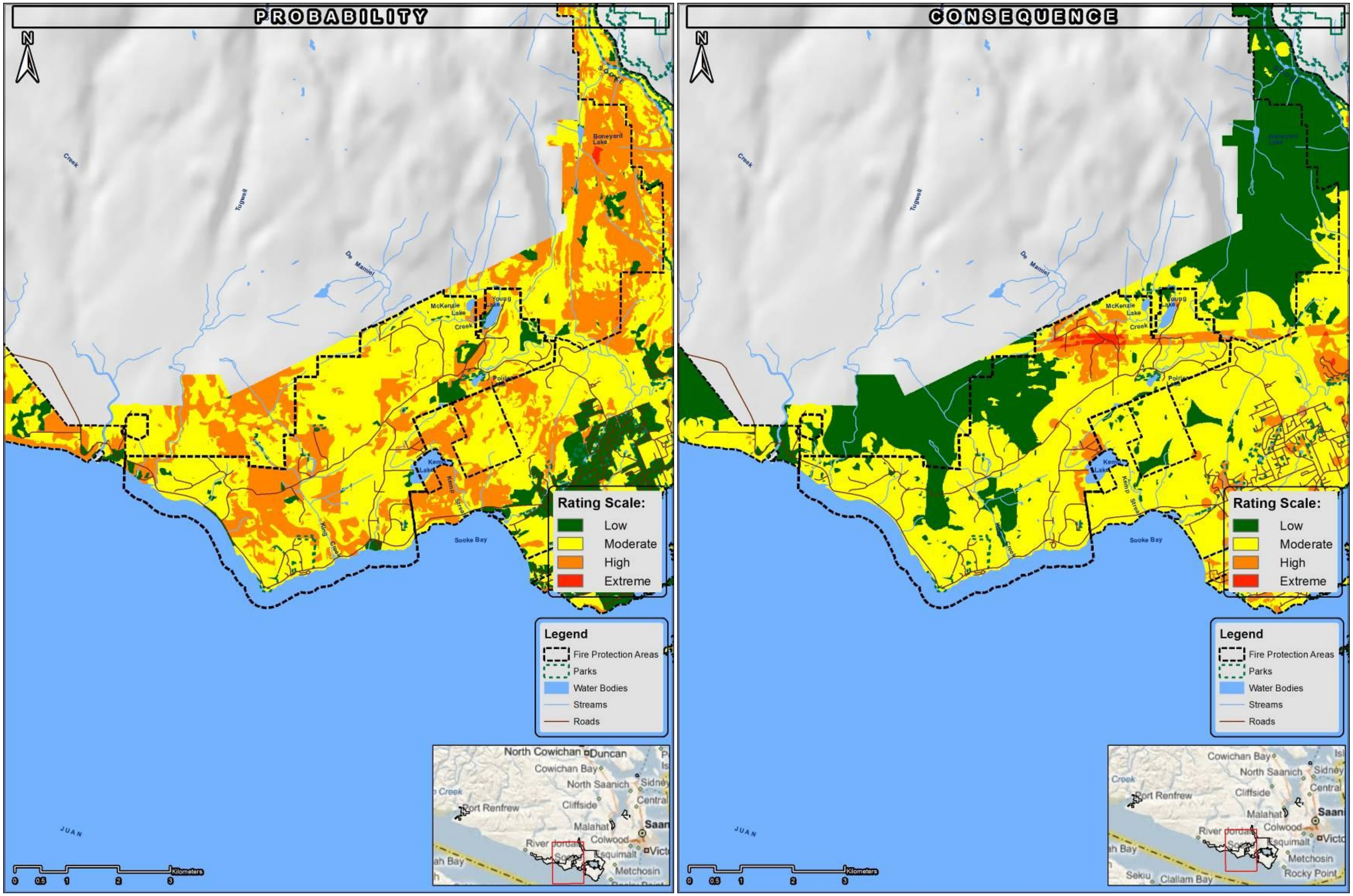
The base case WRMS reflects current conditions for each of the subcomponents, components and ratings shown in Figure 12 according using data available from the Province, the CRD and data collected in the field. All map outputs for the WRMS are provided in Appendix 1.

The probability of fire within Otter Point is predominantly moderate to high based on expected fire behaviour, ignition and suppression capability (Map 6). The consequence of wildfire is predominantly moderate with areas of high and extreme (Map 6) driven primarily by critical infrastructure, interface density and evacuation. The area of extreme consequence is a location with mixed urban interface, a BC Hydro transmission line and limited access/egress for evacuation.

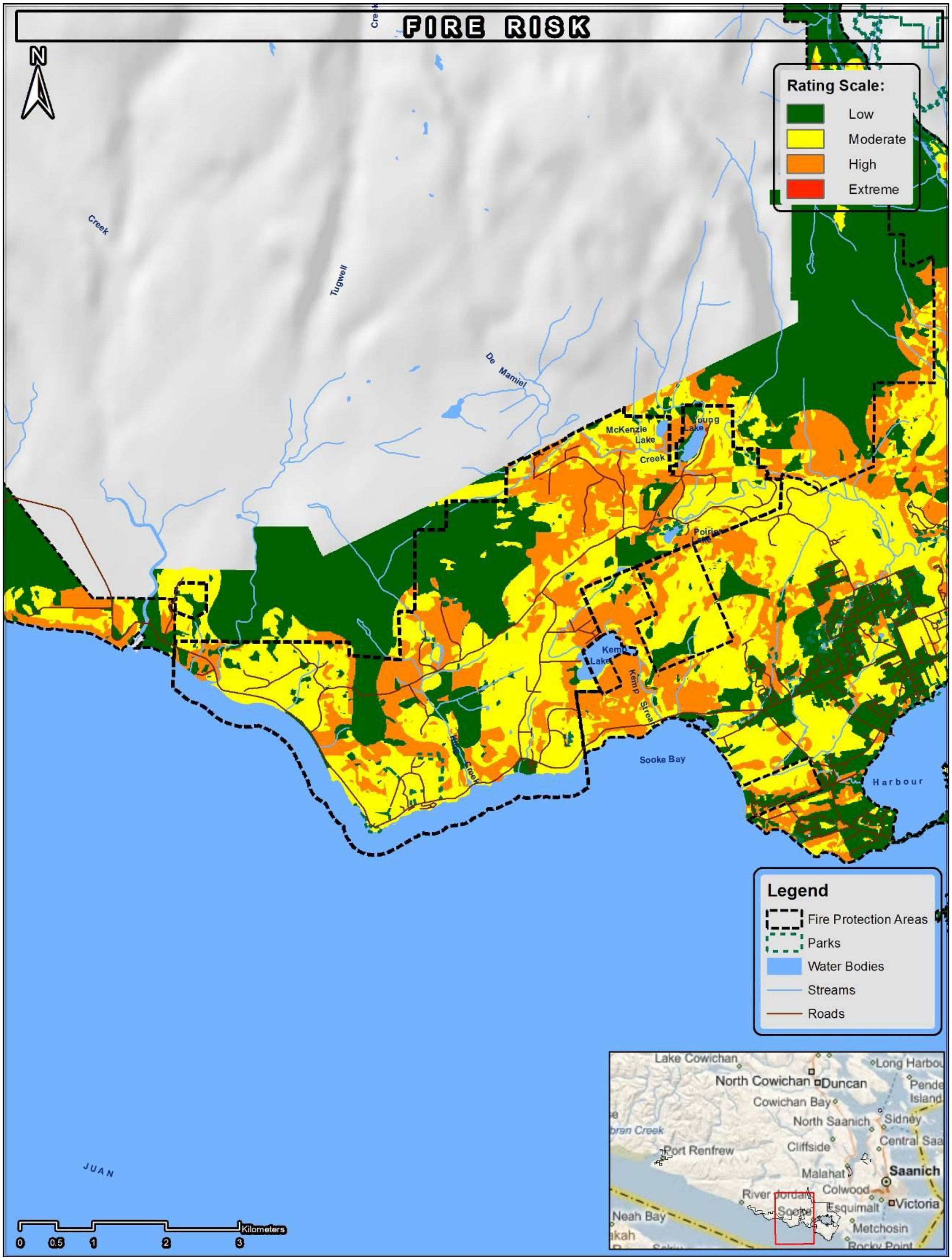
Fire risk (Map 7) represents the overall fire risk as a combination of probability and consequence defined as follows:

Fire Risk Matrix

		PROBABILITY>>>>			
		Low	**Moderate**	**High**	**Extreme**
CONSEQUENCE>>>>	**Low**	Low	Low	Low	Moderate
	Moderate	Low	Moderate	High	High
	High	Moderate	High	High	Extreme
	Extreme	Moderate	High	Extreme	Extreme



Map 6. Probability of wildfire (left) and consequence of wildfire (right) from the Wildfire Risk Management System.



Map 7. Otter Point Fire Risk from the Wildfire Risk Management System.

6.2.2 WRMS Re-Runs

Based on the objectives rated as consistently high from the stakeholder workshop, we identified four hypothetical mitigation scenarios. These were used to re-run the WRMS in order to see their impact spatially on overall wildfire risk. The four scenarios were:

1. Reducing human ignitions by 50% (reducing ignitions objective).
2. Improving suppression capability by adding water sources in locations that were poorly serviced (improving suppression response objective).
3. Modifying fuels in priority areas across the study area (i.e., 100 m around homes, critical infrastructure and several select fuel treatment areas on Crown land adjacent to structures) (reducing fire behavior, protecting critical infrastructure and homes/structures).
4. Improving egress (evacuation ease) by adding 2-way access in specific subdivisions across the study area (evacuation ease objective).

The following maps show the comparison of the relevant component of the WRMS from the base-case to the re-runs described in points 1 - 4 above.

Map 8 shows the comparison from the base case to re-run 1, a 50% reduction in ignition. Though there is a noticeable change in the ignition maps, there is very little change in the probability component overall. This is because of the localized impact of reducing human ignitions based on historic data. The Wildfire Ignition Probability Predictor and lighting ignitions still contribute to a predominantly moderate ignition probability. The limited sensitivity of the model to a change in human ignition supports our professional judgment that reducing human ignitions, while an important objective, is only part of the answer for improving wildfire protection across the landscape. Ignitions across the Fire Protection Area are low annually (less than 10) probably due to enforcement and public education already in place. A further reduction would be beneficial and would further reduce the probability of a wildfire occurring but it is not possible to prevent all ignitions, or fires burning into the Fire Protection Area, and it only takes one ignition under extreme weather conditions and delayed suppression to create a wildfire emergency.

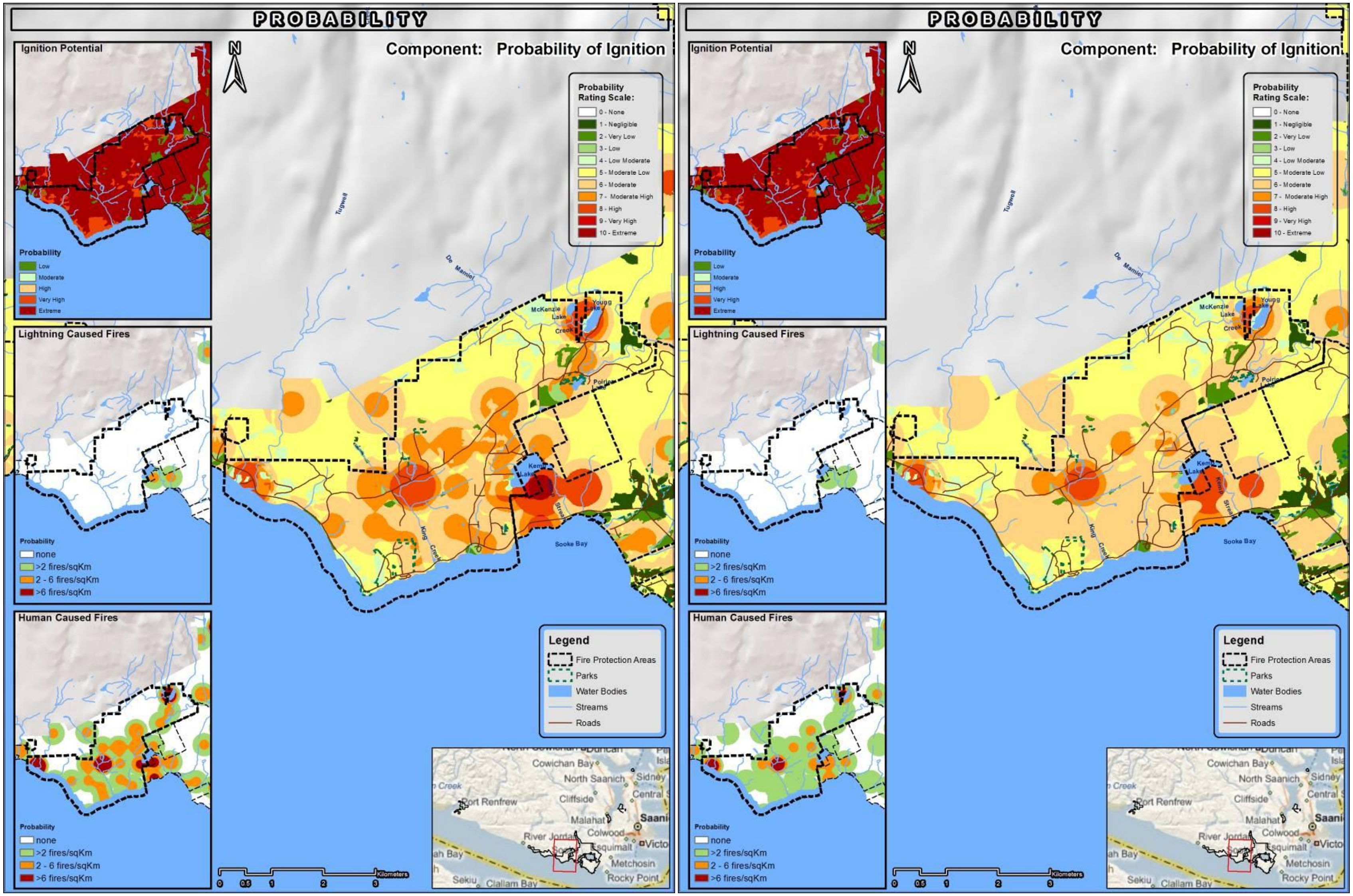
Map 9 shows the comparison from the base case to re-run 2, additional water sources to improve suppression capability. There is localized change to suppression capability from strategically adding water sources within the Fire Protection Area. However, the change is small because Otter Point already has quite good suppression capability in accessible areas.

Map 10 shows the comparison from the base case to re-run 3, FireSmarting around homes and critical infrastructure to reduce fire behaviour. While the differences in fire probability due to fuel treatments are localized around homes, there is a notable reduction in the probability of extreme fire behaviour (from high to moderate) around important areas such as Kemp Lake and the portion of Otter Point road that is treated. There are also other impacts of FireSmarting, including improved protection of homes and critical infrastructure that would provide substantial value not captured in the WRMS model. Within Otter Point it is not appropriate to implement the very large fuel treatments necessary to show widespread change in the fire behavior layer of the model. This is primarily because ecosystems in the CWH biogeoclimatic zone do not generally require restoration due to fire exclusion and forests are adapted to infrequent, stand-replacing or mixed severity fire so fuel treatments would have limited effectiveness over time and would not usually meet broader ecosystem management objectives. Therefore, the focus of any fuel modification should be to improve structure or infrastructure protection and to reduce fire severity in developed areas.

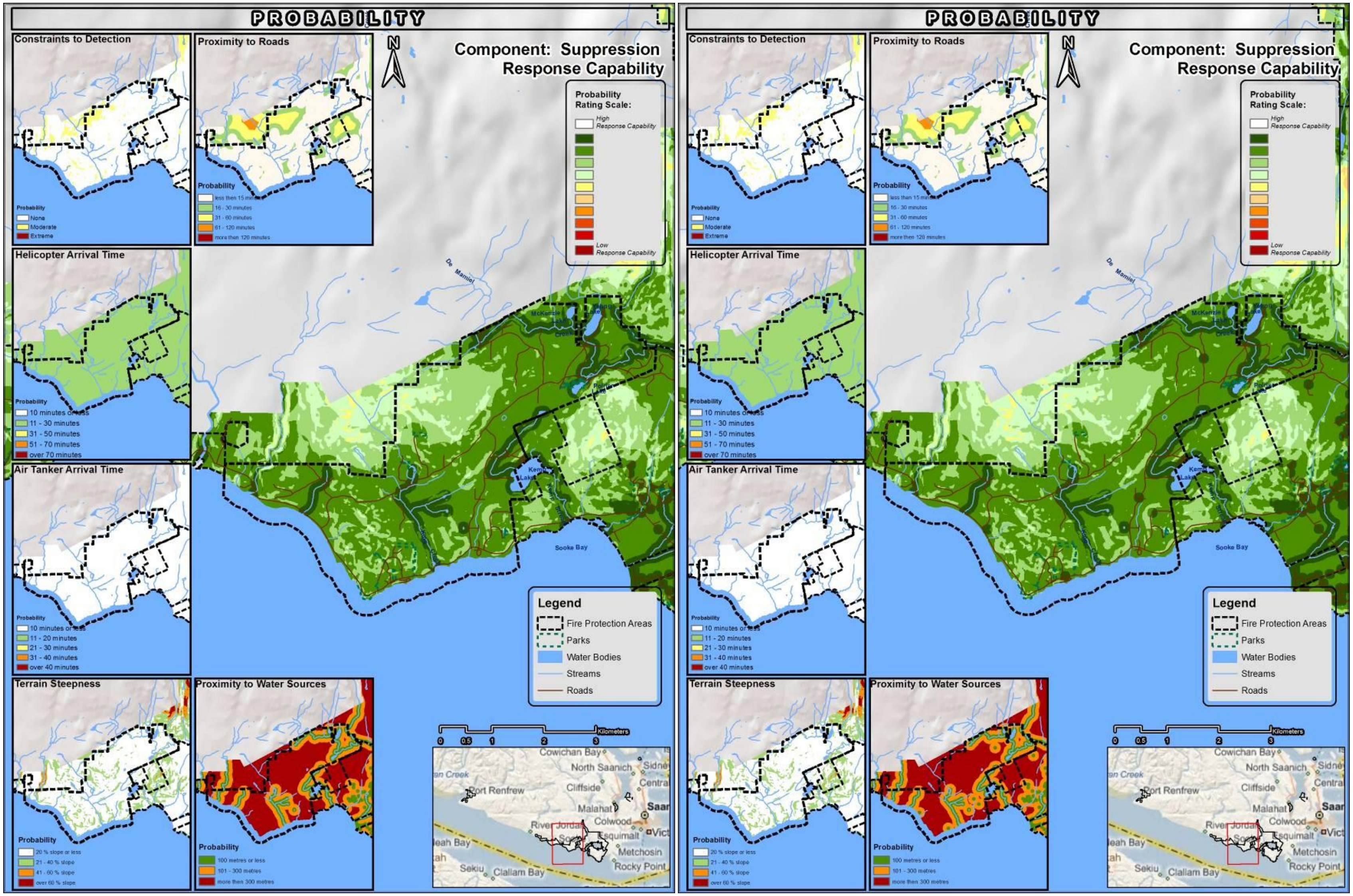
Map 11 shows a comparison of the base case to re-run 4, adding 2-way access routes to selected areas that are currently 1-way. This change has a notable impact on the evacuation ease layer and on the consequence of wildfire component.

In summary, the mitigation alternatives modeled in the WRMS show that the largest spatial impact is achieved by implementing a mitigation alternative that improves access where it is currently limited and results in FireSmart treatments around homes and critical infrastructure. Localized impacts are seen by reducing human ignitions and improving water access.

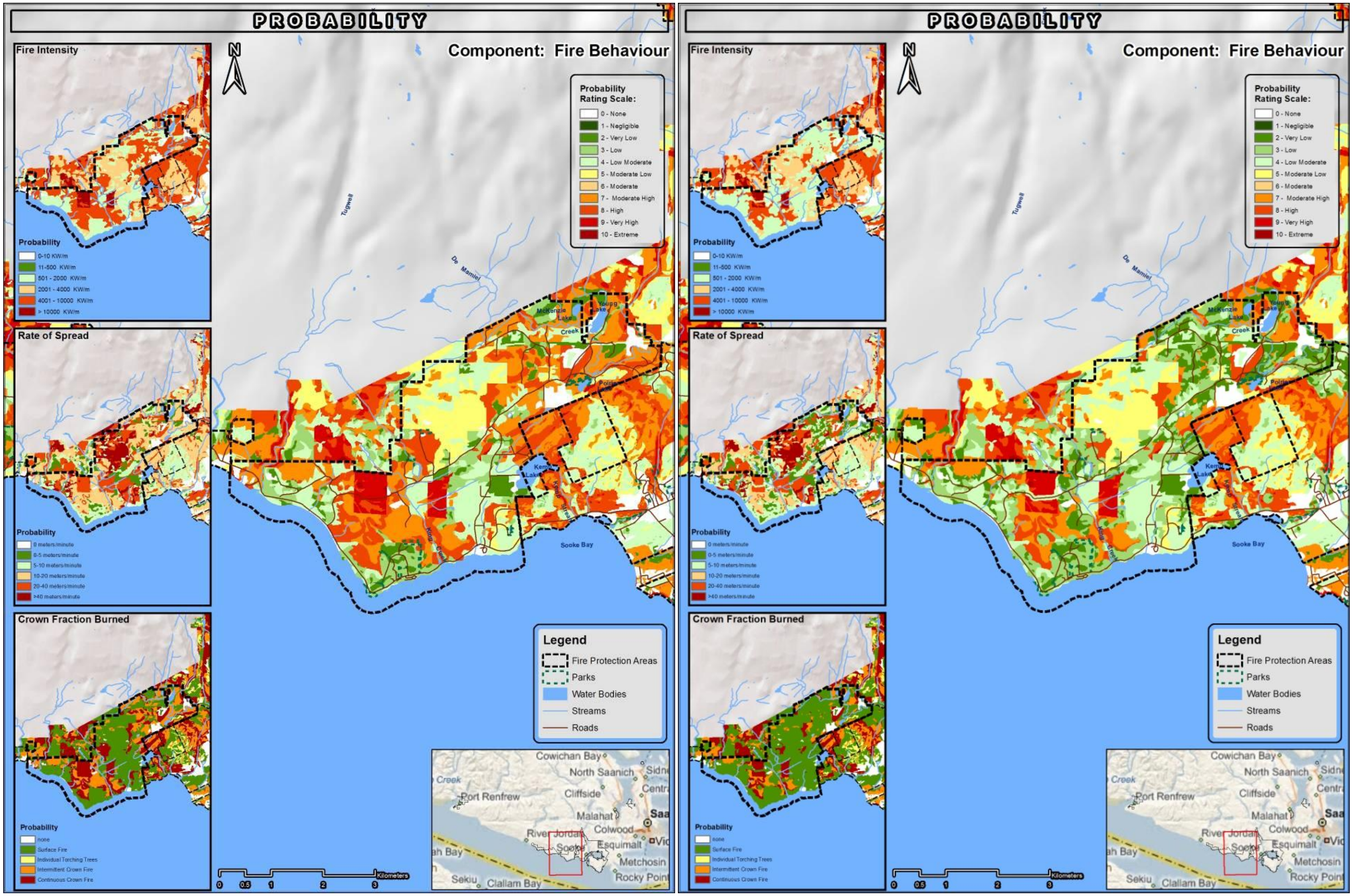
As with the stakeholder workshop analysis, the metrics used to measure changes in these alternatives are not exhaustive and so are not the sole factors we use when determining recommendations for each community. The WRMS does show which of our alternatives has the largest spatial impact. We can use this information to further prioritize objectives and to explicitly identify the locations where changes would be most beneficial.



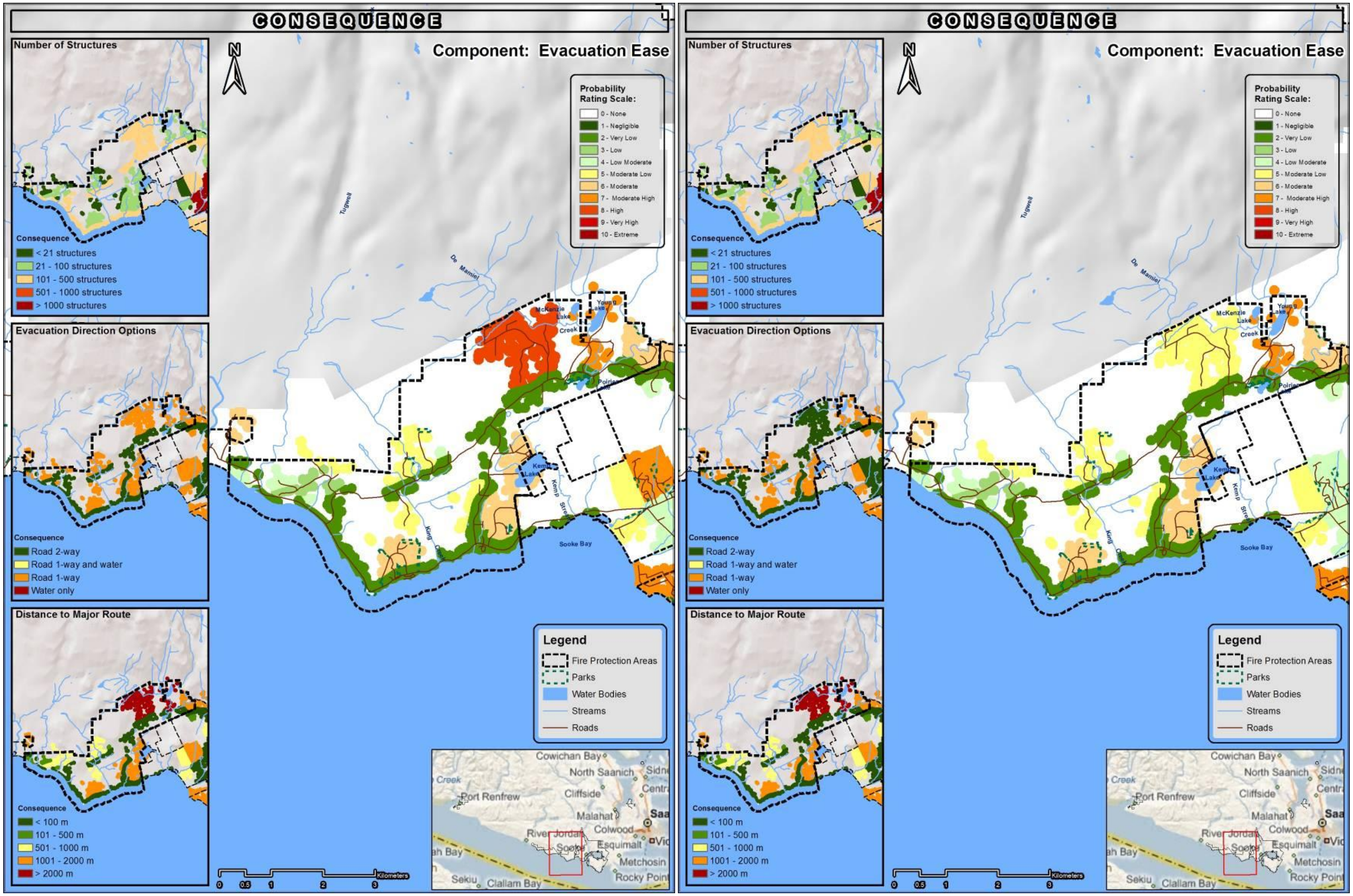
Map 8. Comparison of probability ignition from WRMS base case (left) to reducing ignitions by 50% (Re-Run 1).



Map 9. Comparison of suppression response capability from WRMS base case (left) to improving water access (Re-Run 2).



Map 10. Comparison of fire behaviour from WRMS base case (left) to FireSmarting around homes and critical infrastructure (Re-Run 3).



Map 11. Comparison of evacuation ease from WRMS base case (left) to improving 2-way access in select areas (Re-Run 4).

7.0 Action Plan

The Action Plan consists of the key elements of the WUI continuum and provides recommendations to address each element. In general, recommendations have relevance to more than one key CWPP element (e.g., education recommendations have relevance to structure protection and vegetation management) but we discuss them here under the most applicable topic.

7.1 Communication and Education

7.1.1 Objectives

The objectives for communication and education are:

- To improve public understanding of fire risk and personal responsibility by making residents aware that their communities are interface communities and by educating them on actions they can take to reduce fire risk on private property.
- To establish a sense of homeowner responsibility for reducing fire hazards.
- To raise the awareness of elected officials to the resources required and the risk that wildfires pose to communities.
- To continue to work diligently to prevent ignitions during periods of high fire danger.
- To educate residents outside Fire Protection Areas about their level of fire protection and, where appropriate, to encourage their participation in Fire Protection Areas.

7.1.2 Current Status

The community within Otter Point has some awareness of fire risk, burn bans and local regulations through educational outreach undertaken by the Fire Department and the Otter Point Volunteer Fire Department website. Signage on major routes and at the Fire Departments is very good. The community is FireSmart for the most part due to the development style and personal choices but in some parts of the mixed and isolated interface density areas, individual homeowners could do more to limit the possibility of fire spreading to or from their homes to the forest.

The Juan de Fuca Electoral Area has an emergency program that plans and manages emergency response for the entire Electoral Area. This plan was created in response to the Emergency Program Act. Program activities include the coordination of communication among area response agencies, and direct the Emergency Coordinator.

7.1.3 Recommendations

Recommendation 1: The CRD should consider implementing a multi-media education program that maximizes efforts during the wildfire season, and during and after high profile wildfire events, in order to take advantage of heightened public interest during those periods. In addition to those methods already used, the CRD could:
- Upgrade the Juan de Fuca Electoral Areas website to display or link wildfire prevention information more prominently and to display real time information on fire bans and high fire danger (http://www.bcforestfireinfo.gov.bc.ca/).
- Review and update wildfire preparedness education in primary schools.
- Utilize social media such as Facebook and Twitter to communicate fire bans, high fire danger days, wildfire prevention initiatives and other real time information.
- Provide FireSmart education materials at the point of issuing building permits so that people know the fire hazard where they are building and what they can do to reduce those hazards.
- Use fridge magnet lists to communicate evacuation tips and the essentials needed.

High Priority - Estimated cost: see Recommendation 2.

Recommendation 2: The CRD should consider employing a Fire Prevention Officer to deliver education programs to Electoral Area communities.
High Priority - Estimated cost: $70,000 annual.

Recommendation 3: The CRD should consider educating property owners who live outside Fire Protection Areas of their status and ensure they are informed of the ways in which they are and are not protected in the event of structural fire and/or wildfire. Where practical, residents should be encouraged to join existing Fire Protection Areas given the protection benefit this provides both to those residents from fighting structural fires and the greater population through preventing wildfire ignitions from structural fires.
High Priority – Estimated cost: see Recommendation 2.

Recommendation 4: The CRD should consider enhancing existing communications planning for emergency administration, community members and the media. For each Electoral Area community, the plan should identify who is responsible for delivering reliable and timely information during disasters and how this would be achieved if power and telephone communication were unavailable. The plan should also identify contacts for any local, unofficial individuals or groups that would be helpful during an emergency.
High Priority – Estimated cost to be within current operations.

7.2 Structure Protection

7.2.1 Objectives

The objectives for structure protection are:

- To improve public understanding of fire risk and personal responsibility.
- To protect homes/structures and critical infrastructure.
- To develop policy tools to adopt FireSmart standards over the next five years and to encourage private homeowners to voluntarily adopt FireSmart on their properties.

7.2.2 Current Status

Homes within Otter Point vary in terms of whether they meet FireSmart standards for construction or vegetation around homes. Most homes do have rated roofs, however a number of homes are very close to flammable vegetation or constructed with fire vulnerable siding (Figure 13). Fire research indicates that roofing, adjacent burnable materials and landscaping play the greatest role in structure ignitability. There is currently no wildfire vulnerability standard for building materials used in the CRD. In areas of concern, adjacent vegetation is sometimes in contact with roofs, roof surfaces are sometimes covered with litter fall and leaves from nearby trees, open decks are common and combustible materials are sometimes stored within 10 m of residences. There are two main avenues for FireSmarting a structure: 1) change the vegetation type, density, and setback from the structure (addressed in Section 7.4); and, 2) change the structure to reduce vulnerability to fire and reduce the potential for fire to spread to or from a structure (addressed here).

Figure 13. Home with coniferous vegetation within 10 m.

The results of fire behaviour modeling under extreme weather conditions indicated that fuel types in and around Otter Point could support fire intensities > 4,000 kw/m^2 and, potentially crown fire throwing burning embers, which we can assume would cause major damage to structures in the absence of successful fire suppression. While most homes in Otter Point are constructed from FireSmart materials, there are exceptions and, as more development occurs having FireSmart bylaws and policy in place could provide substantial benefit from a fire protection perspective. The Fire Chief does review subdivision plans prior to their approval, which is a positive step towards enhancing fire protection within new subdivisions but FireSmart and NFPA standards design could be further supported in Regional bylaw.

7.2.3 Recommendations

Recommendation 5: Consider changes to CRD policy that would improve the FireSmart conditions and suppression access for interface areas. There are several ways in which this can be achieved through different bylaws and guidelines; however it is recommended that NFPA 1142 (Water Supplies for Suburban and Rural Fire Fighting) and 1144 (Protection of Life from Wildfire) standards be used to develop specifications. Current wildfire hazard mapping delineated in OCPs (risk mapping sourced from the province) should be updated based on the protection plan fire risk mapping). An example of how such changes could be incorporated is through the:

- **Official Community Plan**: Statement of support for initiatives, Development Permit Exemptions, Wildfire Hazard Development Permit Area Guidelines (with checklist and requirement for a professional report assessing developments for FireSmart vegetation and access/egress).
- **Section 219 Covenants in Wildfire DP Areas.**
- **Subdivision Servicing Specifications:** Fire flows/water delivery system, fire protection water storage systems and access/egress. New subdivisions should be developed with multiple access points that are suitable for evacuation and the movement of emergency response equipment based on threshold densities of houses and vehicles within the subdivisions. Consideration should be given to requiring roadways to be placed adjacent to forested lands, rather than homes (e.g., ring roads).
- **Sprinkler Bylaw:** Sprinklers.
- **Zoning Bylaw:** Siting of structures in Wildfire Hazard DP Areas (including critical infrastructure).
- **Building Bylaw:** Roofing, building materials in Wildfire Hazard DP Areas.

Moderate-High Priority: Estimated cost to be within current operations.

7.3 Emergency Response

7.3.1 Objectives

The objectives for emergency response are:

- To improve emergency access and evacuation ease throughout Otter Point.
- To further develop communication and cooperation between adjacent fire departments, the Regional District and the MFLNRO.
- To maximize community resilience to a wildfire event.

7.3.2 Current Status

Otter Point is a volunteer fire department with approximately 25 volunteers. The fire department has had limited interface firefighting experience and experience with the MFLNRO incident command structure. The crew has S100 training and some have S215. The department has some interface firefighting equipment for their crew and a Compressed Air Foam (CAF) system 4x4 utility truck. Response times across Otter Point are approximately 15 minutes and mutual aid agreements are in place with adjacent fire departments. The fire hall has back-up power systems to run communications during a power outage.

Hydrants supply water for fire protection to approximately 30% of homes in Otter Point. The Fire Department can access lakes to draw water. However, there are some areas where supply is limited in the immediate vicinity. The Otter Point Fire Department, in cooperation with Sooke, East Sooke, Shirley/Jordan River and Metchosin Fire Departments, are working towards Superior Tanker Shuttle Service Accreditation, which is a recognized equivalency to hydrant protection by the Fire Underwriters Survey.

Access and evacuation ease within Otter Point is variable. Robinson Road and Tugwell Road in particular have quite a few residences and a long, 1-way in and out road. Some roads are narrow and would be difficult for emergency vehicles to access if private vehicles were evacuating at the same time. Access for firefighting is limited between Otter Point Road and West Coast Road (outside residential roads), and this area is quite heavily forested. Otter Point does not currently have an evacuation plan.

7.3.3 Recommendations

Recommendation 6: The Otter Point Fire Department, supported by the CRD, and in cooperation with local landowners should consider opportunities for developing secondary emergency access through limited access areas such as private land between Otter Point Road and West Coast Road. Where applicable to improving emergency response access, the Fire Department should acquire keys to access forestry roads or private property.
Moderate Priority: Estimated cost to be within current operations.

Recommendation 7: In those areas developed without 2-way access, the CRD and Otter Point Fire Department should consider working with developers to improve access as growth continues. The area where building 2-way access would have the greatest impact according to initial modeling results is Tugwell Road. In areas where building 2-way access is not possible, it will be critical to have adequate road widths and turnarounds to enable emergency vehicles safe access while personal vehicles evacuate (implemented through Recommendation 5).
Moderate Priority: Construction costs borne by external parties.

Recommendation 8: The Otter Point Fire Department, supported by the CRD, should consider options to improve access to existing water sources, and for adding water sources where there are none. For example, a dry hydrant at Kemp Lake would improve the speed of water refilling. Developers or homeowners should be encouraged to install water storage tanks for fire protection where current supply is inadequate, and/or where Superior Tanker Shuttle Accreditation will not apply.
Moderate Priority: Dry hydrant/s $2,000 plus.

Recommendation 9: The CRD should consider developing an Evacuation Plan for Otter Point that identifies:

- Evacuation routes to be marked.
- Safe zones.
- Responsibilities and resources for coordinating and policing evacuation.
- Individuals requiring assistance.
- The location of any large pets or livestock requiring evacuation and where they can be evacuated to.
- Potential locations of evacuation centres in adjacent communities, and where and how services would be provided to evacuees.
- Volunteers or volunteer organizations that can assist during and/or after evacuation.

Moderate-High Priority: Estimated costs to be within current operations.

Recommendation 10: The CRD should consider ensuring the existing Otter Point water systems have adequate back-up power generators to power pump stations in the event that the regular power supply is interrupted.
Moderate Priority: $20,000 plus.

Recommendation 11: The CRD should consider establishing an integrated 'Wildfire Suppression Group', consisting of representatives from each Juan de Fuca community Volunteer Fire Department, the Sooke Fire Department, mutual aid municipal departments, Wildfire Protection Branch, CRD Water and CRD Parks Suppression Crews to meet annually to establish the compatibility of equipment, identify opportunities for sharing resources, establishing equipment caches to fill gaps, and to plan joint training exercises.
Moderate Priority: Estimated cost to be within current operations.

Recommendation 12: The CRD should develop annual or biannual communications system training program for volunteer fire departments to ensure that members know how to properly use the radio system during a major emergency situation.
Moderate Priority: Estimated cost to be within current operations.

Recommendation 13: The CRD should consider establishing a sub-regional mobile cache of wildland firefighting equipment for Juan de Fuca communities. This would reduce the cost of purchasing and maintaining additional interface equipment for each Fire Department. Personal Protective Equipment and basic tools for interface fire fighting should still be maintained within each Fire Department.
Moderate Priority: Estimated cost $10,000 - $15,000.

7.4 Vegetation (Fuel) Management

Vegetation or fuel management is generally considered a key element of the FireSmart approach. Fuel management is the planned manipulation and/or reduction of living and dead forest fuels for land management objectives (*e.g.,* hazard reduction). The purpose of altering vegetation for fire protection must be evaluated against the other key CWPP elements outlined above to determine its necessity.

Within Otter Point, the outcomes of the stakeholder workshop and the WRMS modelling indicate that modifying fire behaviour through vegetation management would be worthwhile where it contributes to home and critical infrastructure protection.

Fuel management can be undertaken with a very minimal negative or even positive impact on the aesthetic or ecological quality of the surrounding forest and does not mean removing most of the trees. The focus for fuel management in the interface is not necessarily to stop fire, but to ensure that fire severity is low enough that the fire's damage is limited. For example, treating around your home may prevent structure ignition due to direct flame contact – then the home's ability to survive the fire would come down to whether construction materials can survive ember attack. Reducing surface and ladder fuels in the forest around your home may mean that some of the larger, more fire-resistant trees can survive the fire. The intent of these fuel modification treatments is not to stop the fire, but to reduce fire severity.

7.4.1 Objectives

The vegetation management objectives are:

- To proactively reduce potential fire behaviour thereby minimizing adverse impacts on structures and the community watershed.
- To FireSmart vegetation within 100 m of homes and structures.
- To encourage BC Hydro to maintain fuels beneath power lines in a low hazard state.

7.4.2 Current Status

Otter Point fuels predominantly consist of M2 (mixed forest) and O1- short grass/O1 – long grass (Map 2 and Table 1). There are scattered hazardous C2/C3/C4 fuel types (Map 3 and Table 1). As previously mentioned, landscape level fuel breaks are not likely to be ecologically appropriate or cost effective in Otter Point's Coastal Western Hemlock ecosystems. However, a FireSmart approach to vegetation management within 100 m of structures is considered beneficial in order to improve defensible space around structures, and to reduce the likelihood that a house fire could spread to adjacent forest. In addition, infestation of Scotch broom is prevalent in the area, particularly under BC hydro right-of-ways and on private cleared properties. Broom can burn very rapidly and intensely, therefore it is highly undesirable from a wildfire suppression perspective. The area of M2 and C3 fuel types around Kemp Lake has the potential for high fire severity and would benefit from FireSmart treatments.

Coniferous (and mixed) forest fuels within 100 m of structures were identified throughout Otter Point and prioritized for FireSmart or fuel treatment. The majority of area identified is on private land. All coniferous and mixed fuels were identified and prioritized regardless of current hazard condition because fuel conditions change over time and FireSmart requires ongoing maintenance. **Given that much of the C7, C5 and M2 stands (Table 1) will already be in a FireSmart condition, the actual area requiring action is likely to be much smaller than that indicated on Map 12. Ground truthing will be required prior to acting on any treatment priority areas.**

Map 12 defines five priority treatments. Each treatment is either a 'C' for Crown, or 'P' for private and priority is defined as follows:

C1: Priority 1 treatments on Crown land to FireSmart around critical infrastructure.

C2: Priority 2 treatments on Crown land to implement fuel breaks in continuous forestland adjacent to structures.

C3: Priority 3 treatments on Crown land to enhance FireSmart treatments adjacent to private land.

P1: Priority 1 treatments on private land to FireSmart around critical infrastructure.

P2: Priority 2 treatments on private land to FireSmart around private structures.

FireSmart proposes the following zones for vegetation modification (Figure 14):

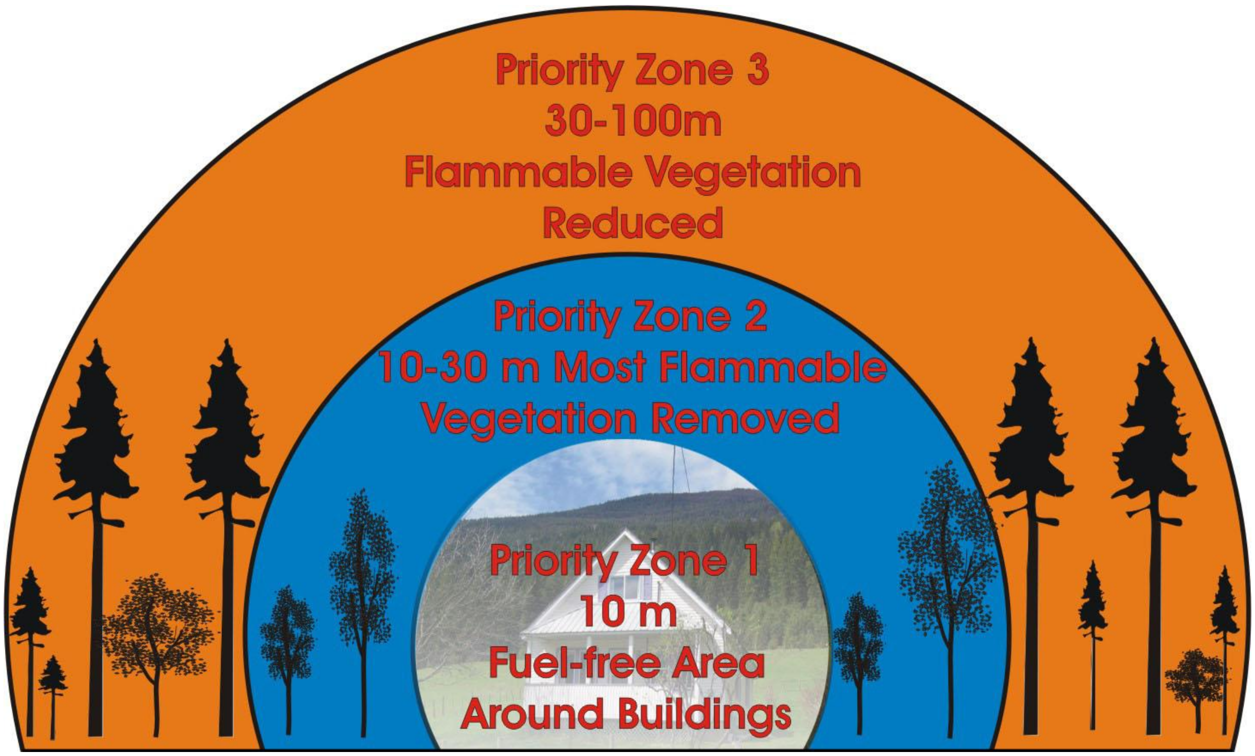
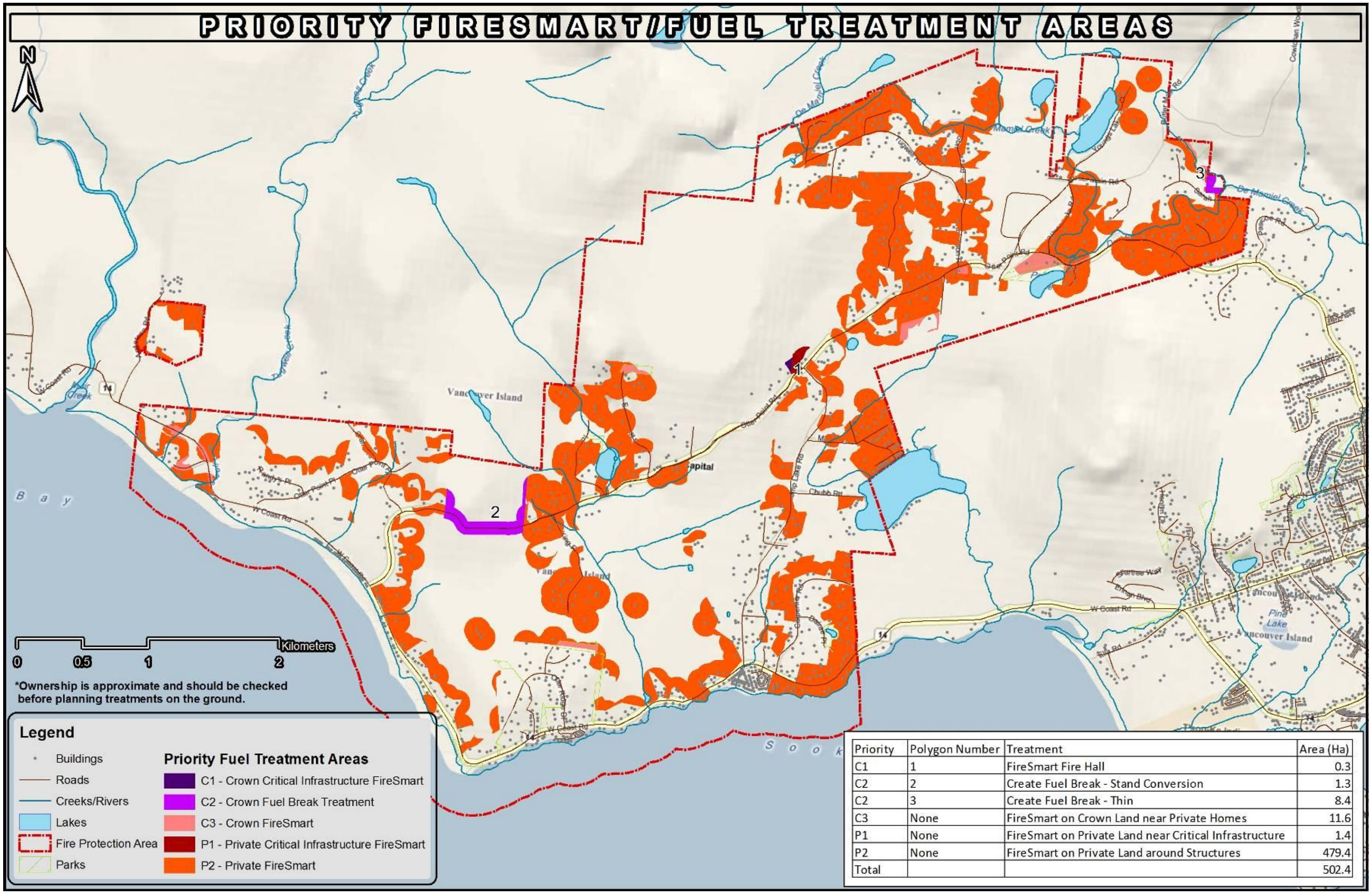


Figure 14. FireSmart Priority Zones

1. **Priority Zone 1** is a 10 m fuel free zone around structures. This ensures that direct flame contact with the building cannot occur and reduces the potential for radiant heat to ignite the building. While creating this zone is not always possible, landscaping choices should reflect the use of less flammable vegetation such as deciduous bushes, herbs and other species with low flammability. Coniferous vegetation such as juniper or cedar bushes and hedges should be avoided, as these are highly flammable. Try to keep any vegetation in this zone widely spaced and well setback from the house.

2. **Priority Zone 2** extends from 10-30 m from the structure. In this zone, trees should be widely spaced 5-10 m apart, depending on size and species. Tree crowns should not touch or overlap. Deciduous trees have much lower volatility than coniferous trees, so where possible deciduous trees should be preferred for retention or planting. Trees in this area should be pruned as high as possible especially where long limbs extend towards buildings. This helps prevent a fire on the ground from moving up into the crown of the tree or spreading to a structure. Any downed wood or other flammable material should also be cleaned up in this zone to reduce fire moving along the ground.

3. **Priority Zone 3** extends from 30-100 meters from the home. The main threat posed by trees in this zone is spotting, the transmission of fire through embers carried aloft and deposited on the building or adjacent flammable vegetation. To reduce the threat, cleanup of surface fuels as well as pruning and spacing of trees should be completed in this zone.



Priority	Polygon Number	Treatment	Area (Ha)
C1	1	FireSmart Fire Hall	0.3
C2	2	Create Fuel Break - Stand Conversion	1.3
C2	3	Create Fuel Break - Thin	8.4
C3	None	FireSmart on Crown Land near Private Homes	11.6
P1	None	FireSmart on Private Land near Critical Infrastructure	1.4
P2	None	FireSmart on Private Land around Structures	479.4
Total			502.4

Map 12. Prioritized fuel treatment areas for Otter Point.

7.4.3 Recommendations

Recommendation 14: The CRD should consider implementing a FireSmart treatment adjacent to the Fire Hall, identified as Priority C1 on Map 12. This treatment should be repeated every 10 – 15 years unless forests are converted to a deciduous type. Ideally, the adjacent private land would also be treated for greater protection. The CRD should also review critical infrastructure not in the spatial data provided for Otter Point, such as pump stations and communication towers, and include them as a treatment priority.
Moderate Priority: Estimated cost $2,000 /ha - $12,000/ha.

Recommendation 15: The CRD should consider implementing fuel treatments in areas identified as Priority C2 on Map 12. The treatment should be repeated every 10 – 15 years for polygon 2. Polygon 3 should be converted to a deciduous type and not require retreatment.
Moderate Priority: Estimated cost $12,000 - $20,000/ha.

Recommendation 16: The CRD should consider implementing FireSmart treatments identified as Priority C3 if private landowners implement FireSmart on adjacent Priority P2 polygons. This treatment should be repeated every 10 – 15 years unless forests are converted to a deciduous type.
Moderate Priority: Estimated cost $2,000 - $12,000/ha.

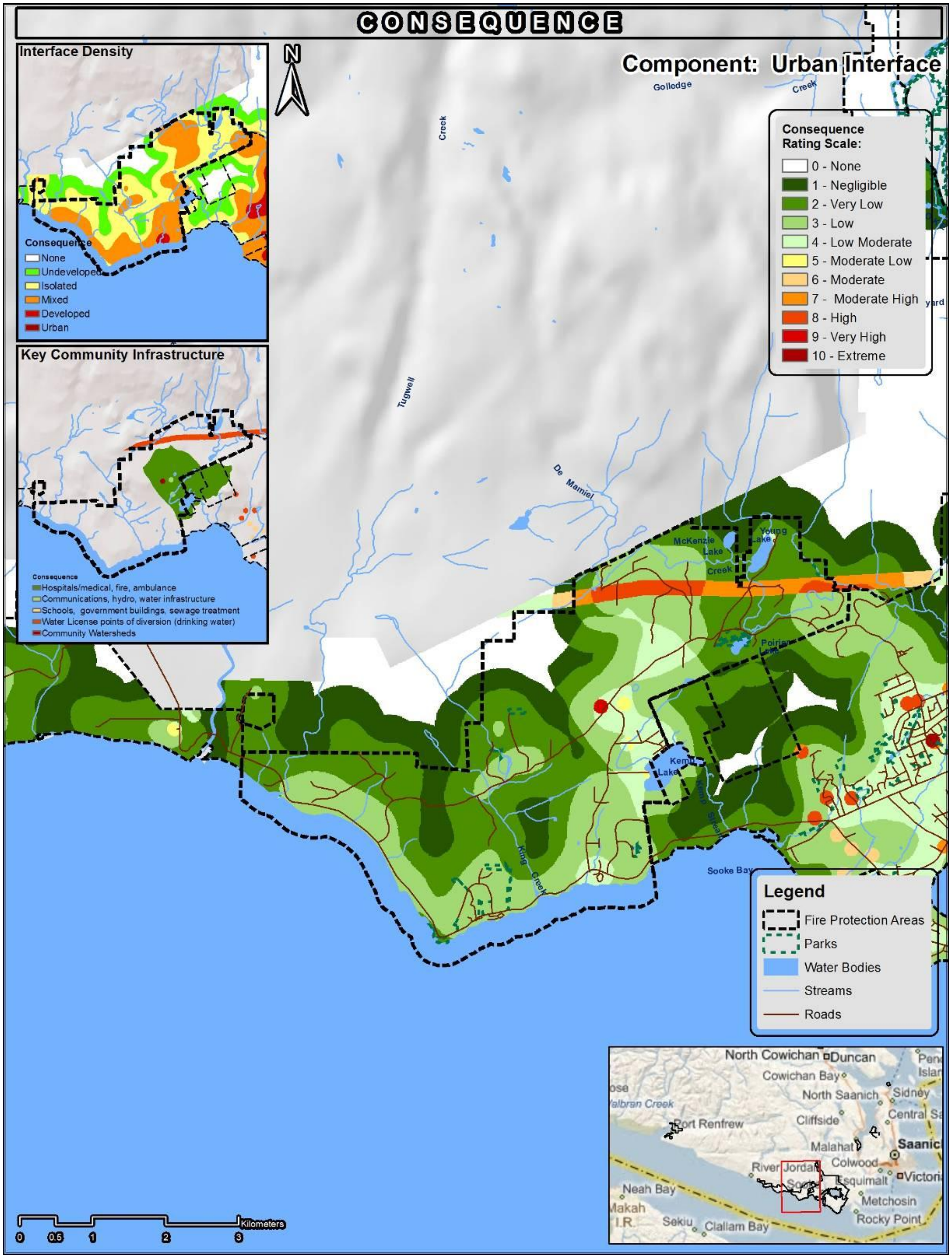
Recommendation 17: The CRD should consider encouraging residents, through education initiatives outlined in Recommendation 1, to implement FireSmart treatments identified as Priority P1 and P2. Particular focus should be given to FireSmart treatments within the community watershed; encouraging the development of a private land management plan with landowner and Kemp Lake Water District cooperation could help to improve community watershed protection.
High Priority: Costs borne by private parties.

Recommendation 18: The CRD should consider, through initiatives outlined in Recommendation 5, requiring developers to undertake FireSmart vegetation treatments of subdivisions prior to construction, including any forested parcels to be given to the CRD as park or greenspace. FireSmart should not be interpreted as cleared land by developers.
Moderate Priority: Costs borne by outside parties.

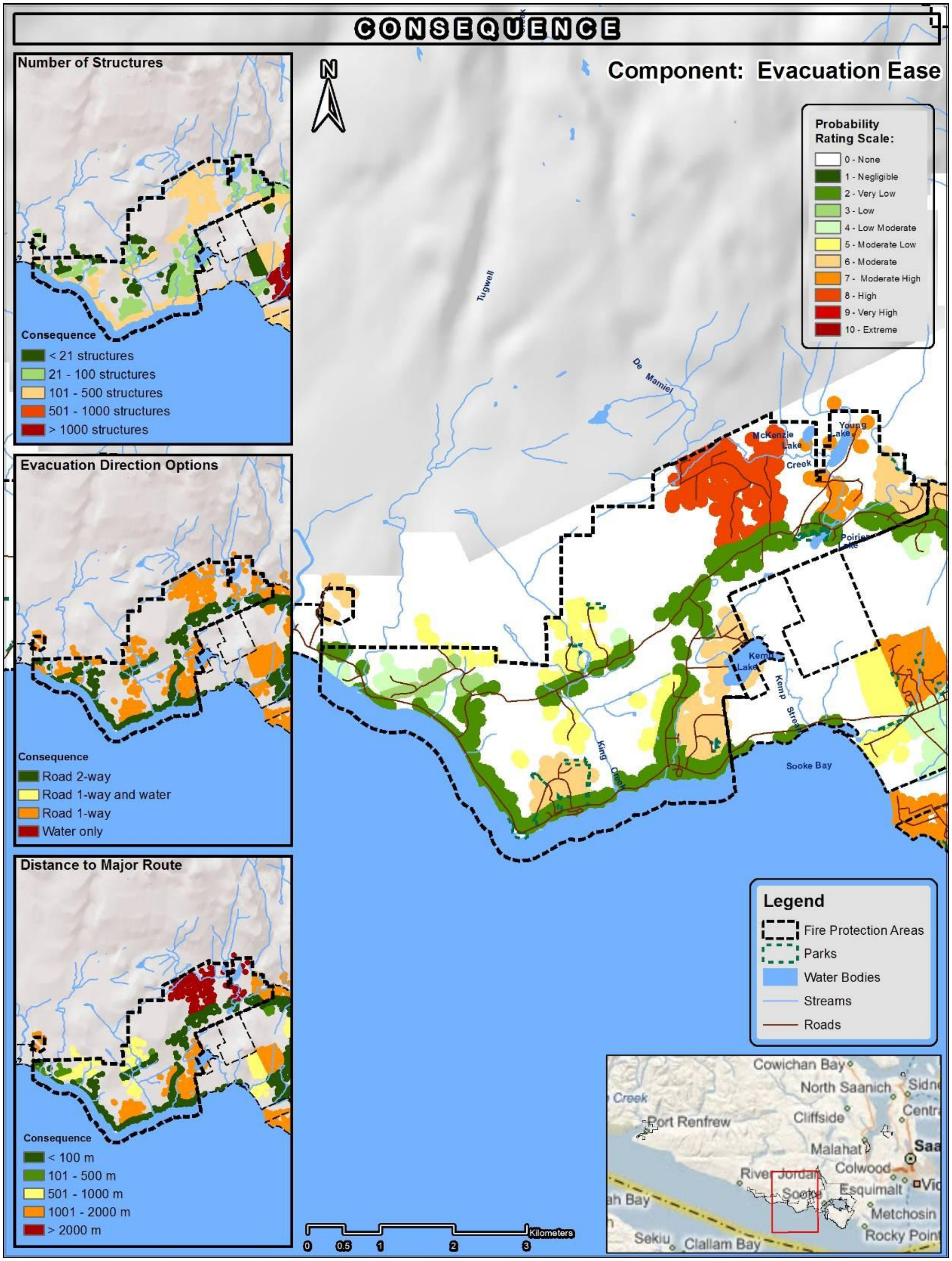
Recommendation 19: The CRD should work with BC Hydro/BC Transmission Corporation to ensure that: 1) transmission infrastructure can be maintained and managed during a wildfire event; and 2) the right-of-way vegetation management strategy considers mowing broom beneath transmission lines that contributes to unacceptable fuel loading and diminishes the ability of the right-of-way to act as a fuel break.
Moderate Priority: Costs borne by outside parties.

Appendix 1 – Wildfire Risk Management System Outputs

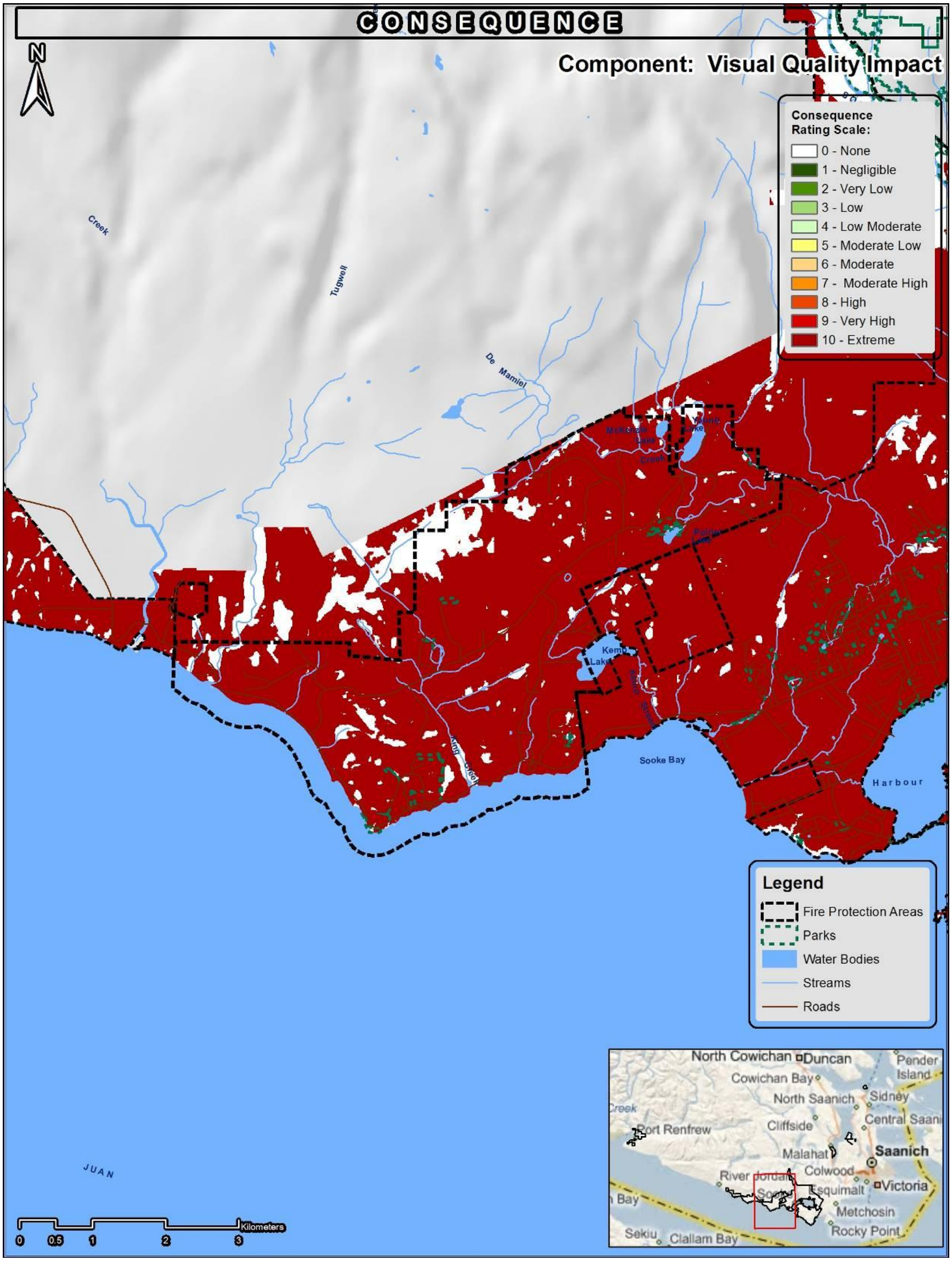
Urban Interface (Consequence)



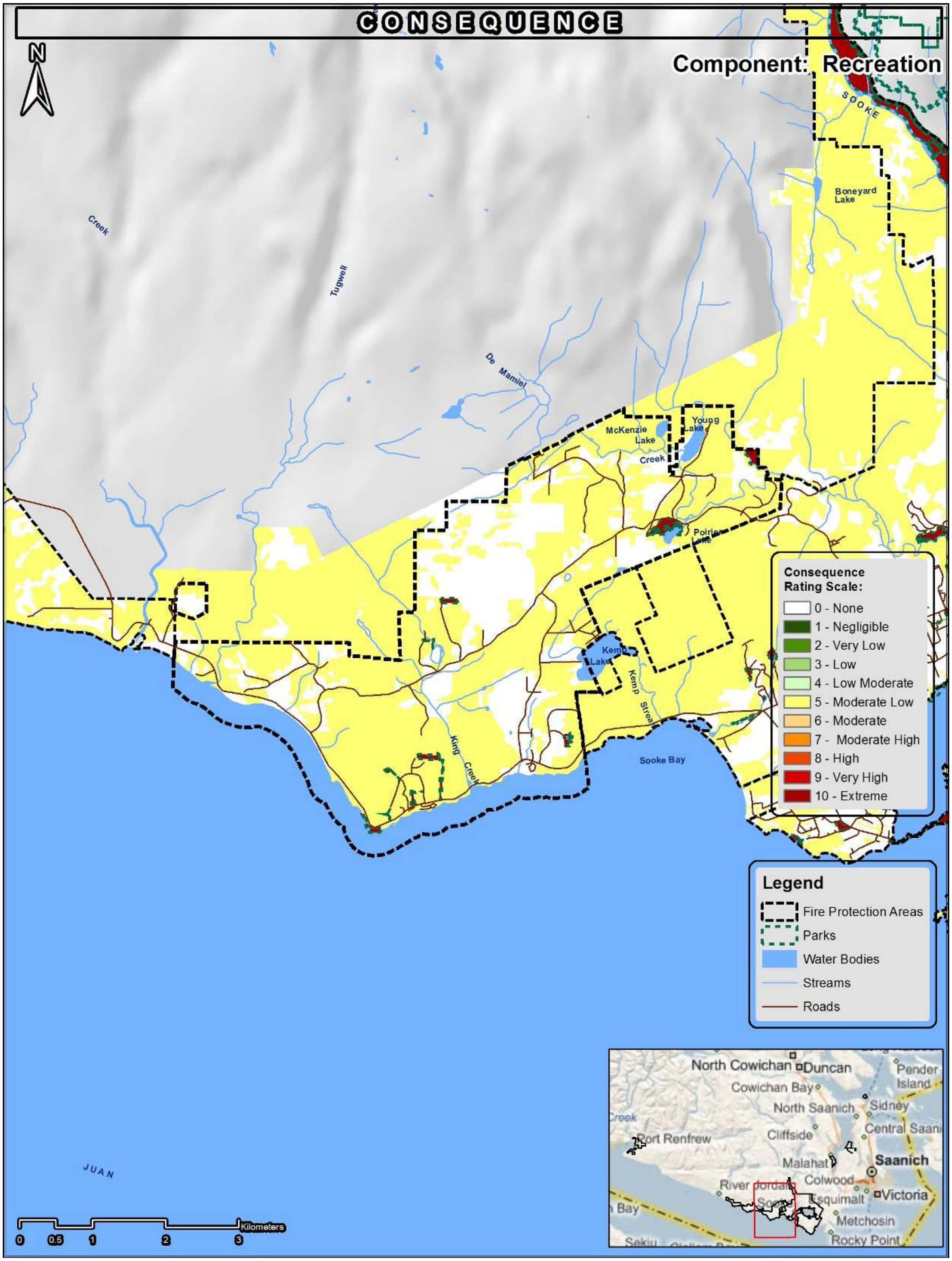
Evacuation Ease (Consequence)



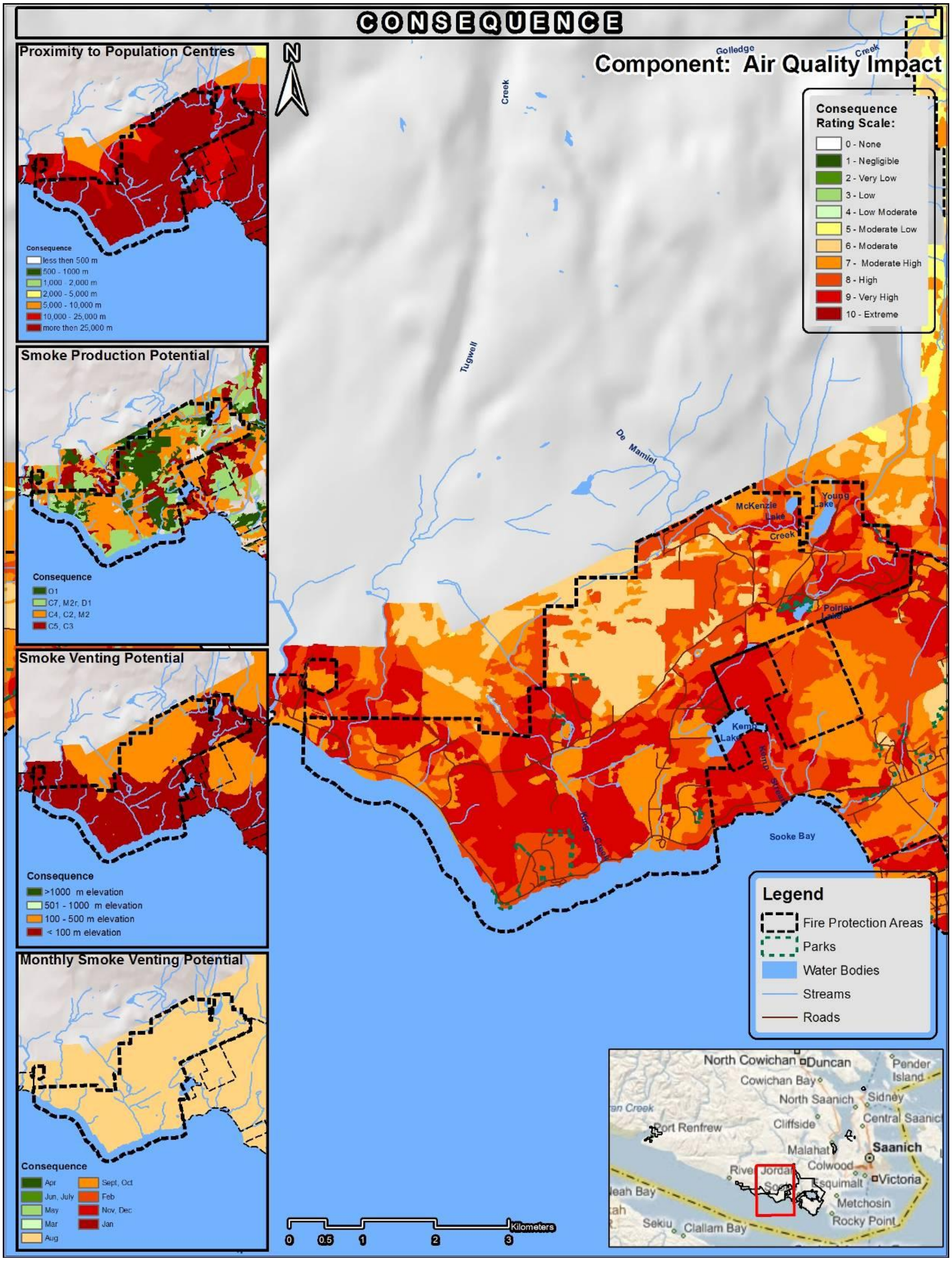
Visual Quality Impact (Consequence)



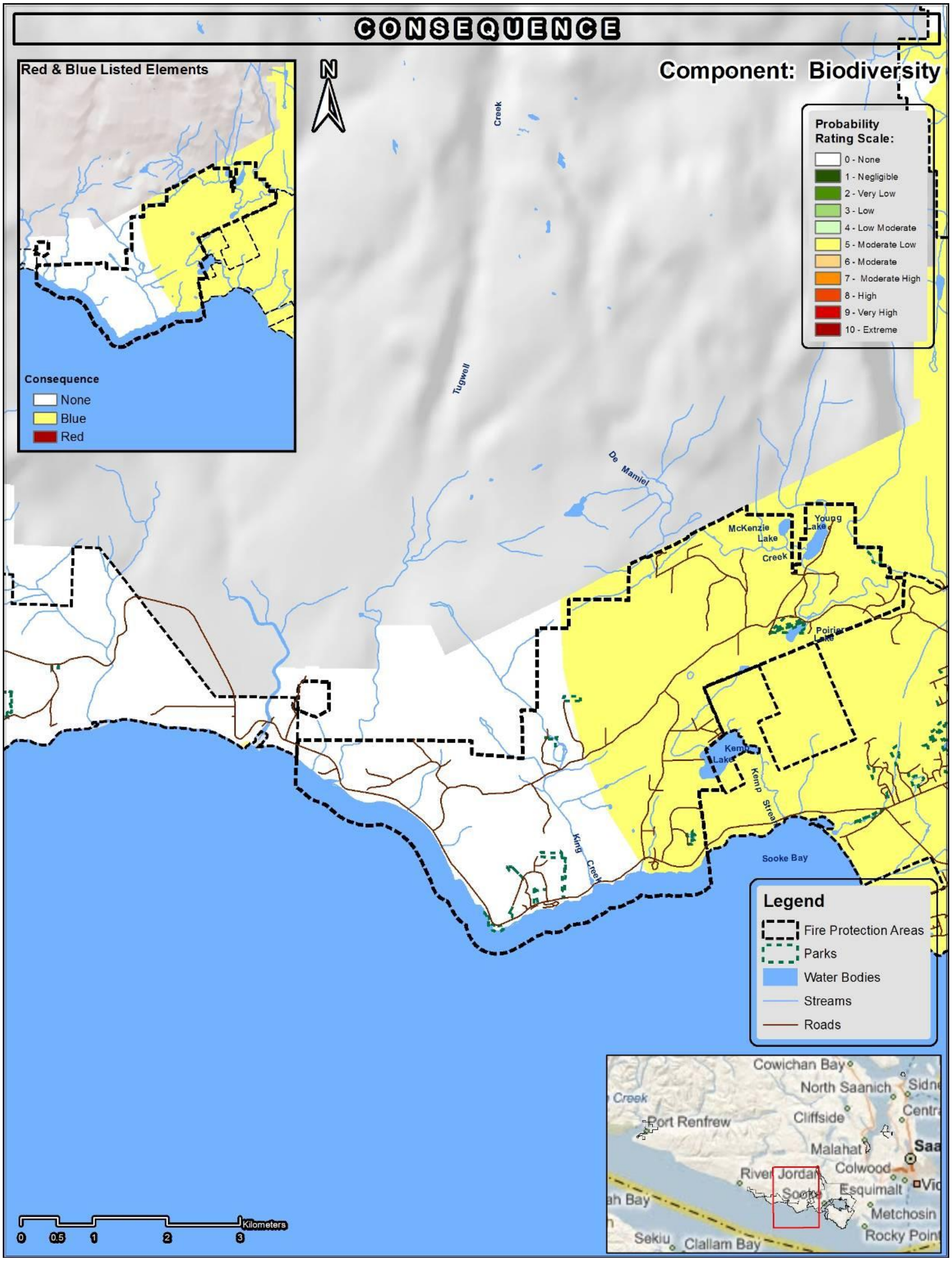
Recreation (Consequence)



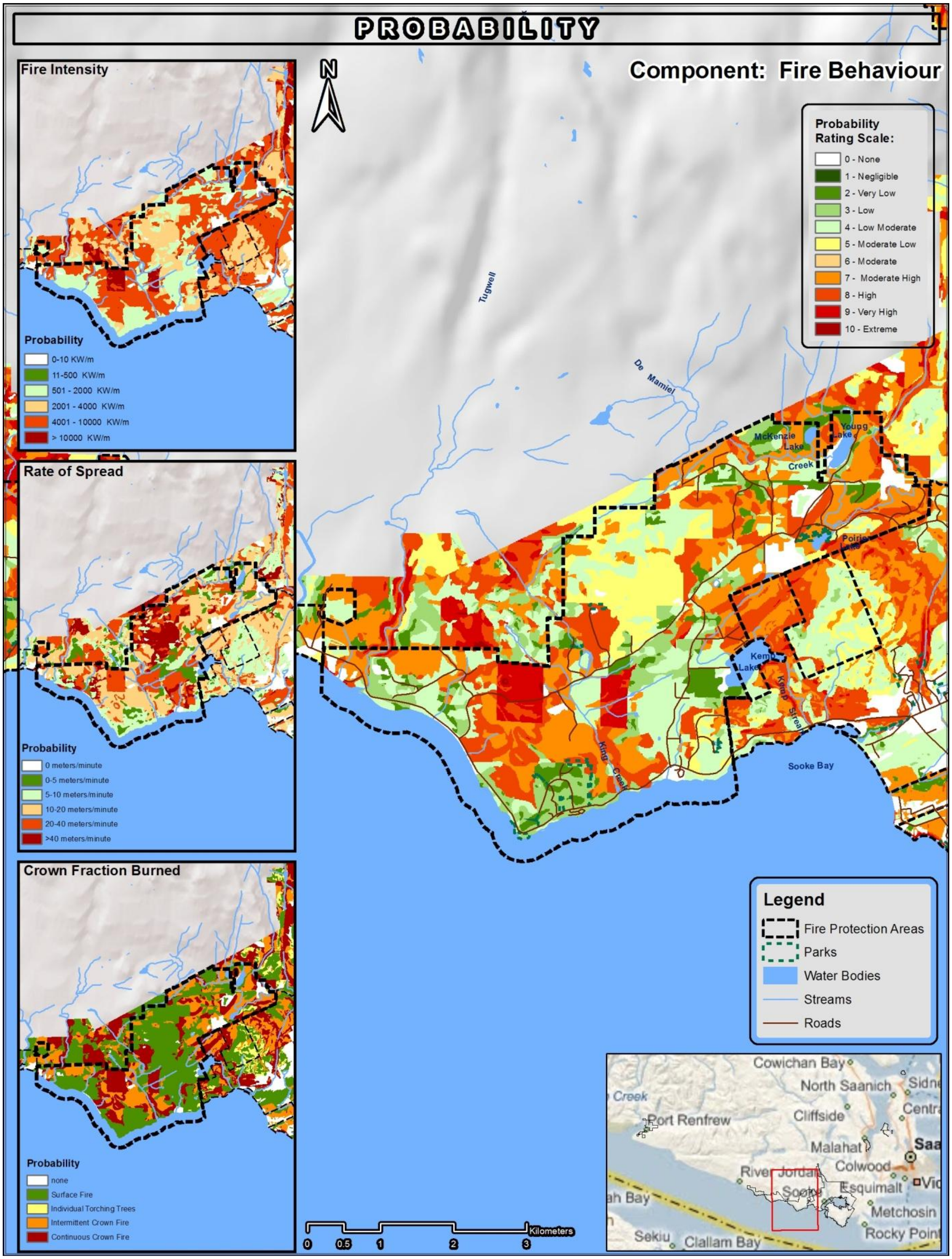
Air Quality Impact (Consequence)



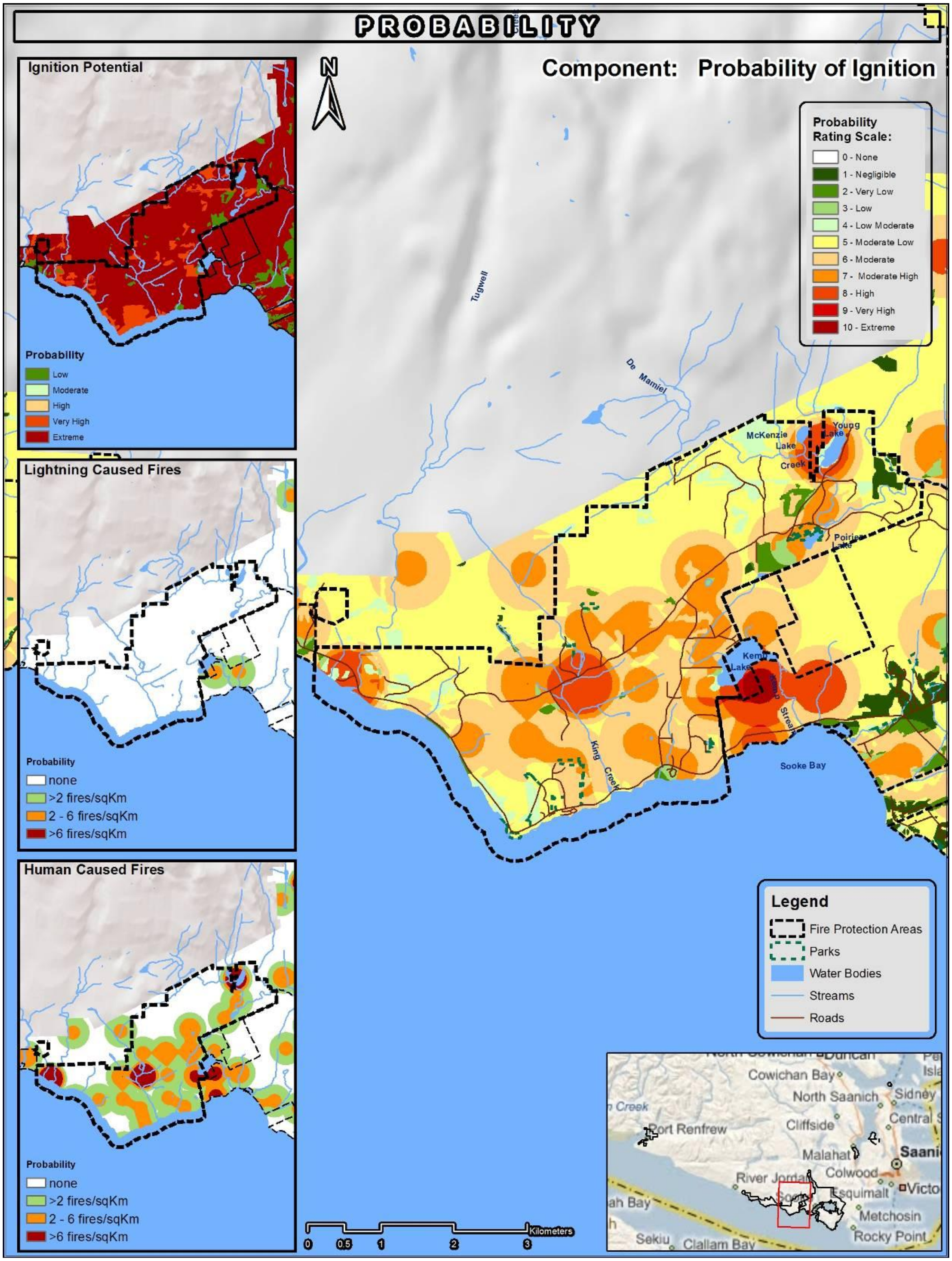
Biodiversity (Consequence)



Fire Behaviour (Probability)



Probability of Ignition (Probability)



Suppression Response Capability (Probability)