

# Ntityix Resources Ltd. Wildfire Risk Management Plan

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Project 1321- 5

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## Executive Summary

Wildfire is a key natural disturbance agent in British Columbia that poses considerable risks to values across the province. Recent unprecedented fire seasons (2017 & 2018) have elevated the need for wildfire risk management planning across administrative boundaries as a form of disaster preparedness and mitigation. Through assessing the likelihood and associated impacts of an event, wildfire risk management planning supports an understanding of the threats and opportunities associated with wildfire and informs mitigation strategies that balance social, economic, and ecological values.

The Ntityx Resource LP Wildfire Risk Management Plan (hereby referred to as the “Ntityx WRMP”) was initiated in June 2019 in response to the need for enhanced wildfire risk management across the forest tenures held by Westbank First Nation, including a Community Forest Agreement and First Nation Woodland License. The Ntityx WRMP consisted of the following key phases:

- ▶ Development of a Terms of Reference;
- ▶ Documentation of the internal and external context within which wildfire risk management is being carried out;
- ▶ Risk assessment, including risk identification, analysis, and evaluation;
- ▶ Development of management strategies in response to the risks identified; and
- ▶ Development of the project report.

The risk management process was directed by a Planning Team that included: local fire chiefs; wildlife biologists; representatives from Westbank First Nation, Big White Ski Resort, and the Central Okanagan Regional District; as well as internal BC government specialists from MFLNRORD and the BC Wildfire Service. The Planning Team was led by Ntityx Resources LP and Forsite Consultants Ltd.

To represent the likelihood of a wildfire event occurring, a modified burn probability was developed for the Plan Area and combined with a strategic review of values on the landscape that may be impacted from fire. The BCWS Resource Strategic Wildfire Allocation Protocol (RSWAP) framework was used to help identify and classify values at risk into four (4) categories: (1) Human Life and Safety; (2) Critical Infrastructure, (3) High Environmental and Cultural Values, and (4) Resource Values.

Collectively, wildfire risk for the Plan Area was assessed through the combination of a modified burn probability and values at risk to wildfire. Key areas of higher wildfire risk included communities and evacuation/major travel corridors, as well as areas with a higher burn probability due to a combination of ignition probability and intensity. Management strategies were developed that respond to high risk areas where current controls or measures do not sufficiently address the associated level of wildfire risk. An exposure analysis was conducted to provide further insight into priority fuel treatment areas to reduce wildfire risk. This analysis was based on the assessment of the level of potential exposure of individual structures to wildfire. A summary of the applicable area, forest management context, risk reduction objectives, actions, responsibilities, and partners were identified for each management strategy.

Management strategies for the Ntityx WRMP include recommendations tied to specific locations that are related to the following categories:

1. Fuel Management Treatments;
2. Evacuation Planning;
3. Engagement with Utilities;
4. Communication, Education, and Enforcement; and
5. Watershed Resiliency

The Ntityx WRMP is a current assessment of the wildfire-related risks throughout the Plan Area. An annual progress report is recommended to document progress against the plan. This plan was developed with a term of (5) years, with a plan renewal process recommended in 2025. Although wildfire risk can never be eliminated, the information and strategies communicated in this WRMP are intended to provide a roadmap for Ntityx Resources and Westbank First Nation to enhance the resiliency of their tenure and surrounding values at risk to wildfire.

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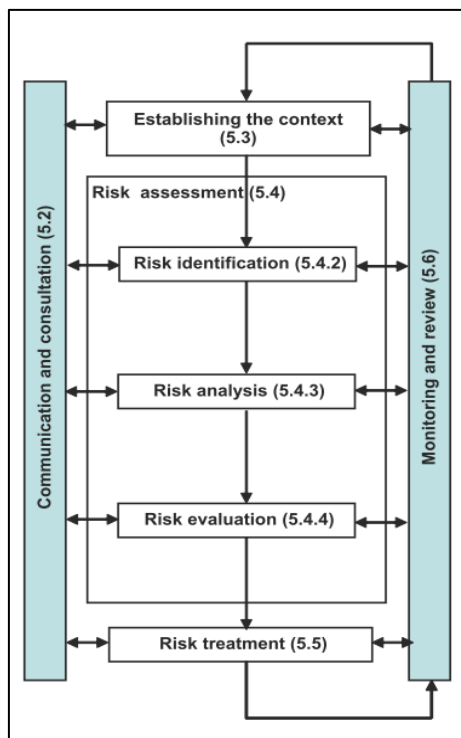
# 1 Introduction

The management of wildfire risk is of significant importance in BC, as wildfire is an essential natural disturbance process and a key driver of landscape resilience. Over the past century, effective fire suppression, forest management practices, and displacement of indigenous communities and practices have altered the fuels landscape.

This report represents the implementation of a risk management process in Westbank First Nation’s area-based tenure, including a Community Forest Agreement (CFA) and First Nation Woodland License (FNWL), and the surrounding area. These tenures are managed by Ntityx Resources LP (hereby referred to as “Ntityx”). This process is referred to as the Ntityx Wildfire Risk Management Plan (WRMP).

High-level direction and context for this WRMP and Plan Area came from the mandate of Ntityx, the strategic initiatives of the BC Wildfire Service (BCWS), and from recommendations in provincial guiding documents such as the *BC Wildland Fire Management Strategy* (2010).

The Ntityx WRMP is based on the *CAN/CSA-ISO 31000-Risk Management – Principles and Guidelines* as summarized in Figure 1. The risk management process involves the following key steps:



- ▶ Development of a **Terms of Reference**;
- ▶ Document the **Context** to wildfire risk management;
- ▶ Conduct a **Risk Assessment**, including risk identification, identification, analysis and evaluation with a focus on spatial representation of fire probability and values in support of the risk assessment;
- ▶ Develop **Management Strategies** in response to the risks identified, including the threats and opportunities associated with wildfire; and
- ▶ Develop a **Final Report** for endorsement by the Ntityx WRMP Planning Team.

The Ntityx WRMP intends to work alongside the working BCWS risk management framework.

**Figure 1:** CAN/CSA-ISO 31000-10 Risk Management Process.



## 1.1 PLAN OBJECTIVES

The objectives of the Ntityx WRMP objectives are:

### **OBJECTIVE 1- DEFINE STRATEGIES AND PRIORITIES FOR WILDFIRE PREVENTION AND MITIGATION**

- ▶ Use the planning process to generate priority areas with a high risk of wildfire, and strategies to support wildfire risk response;
- ▶ Support the development of resilient communities through fire mitigation and preparedness;
- ▶ Support landscape-level mitigation in areas susceptible to catastrophic wildfire;
- ▶ Identify where the use of managed fire can support both the prevention and mitigation of a catastrophic event, and where it can be used for ecological restoration;
- ▶ Coordinate with forest tenure-holders, municipalities and other jurisdictions to foster collaborative partnerships in wildfire risk management;
- ▶ Integrate industrial activities where appropriate (including harvest operations and prescribed fire); and
- ▶ Inform and be informed by other forest, land and resource planning and management processes.

### **OBJECTIVE 2 – SUPPORT INFORMED WILDFIRE MANAGEMENT DECISIONS AND PLANNING**

- ▶ Build on the history, planning, and implementation of wildfire management in the Plan Area;
- ▶ Provide support for informed decisions, which further support due diligence and justification for response tactics;
- ▶ Provide detailed information on the values at risk on the landbase to provide general support for BCWS Incident Command decisions; and
- ▶ Support the coordination of wildfire operations with First Nations, appropriate regulatory agencies, governments, and stakeholders.

### **OBJECTIVE 3 – SUPPORT AN OPEN AND TRANSPARENT UNDERSTANDING OF WILDFIRE RISKS AND RESPONSE**

- ▶ Engage with First Nations, appropriate agencies, and major stakeholders in the planning process;
- ▶ Inform involved parties about risks, including public and shared risks; and
- ▶ Develop materials that can be used to support ongoing engagement with the public, landowners, and communities.

## 1.2 SCOPE AND DELIVERABLES

The key deliverables of this risk management process include the WRMP and supporting documents that identify, analyze, and evaluate wildfire risk across the Plan Area, and outlined key management strategies in response to those risks.

The scope of the Ntityx WRMP includes:

- ▶ Review of pertinent legislation, regulation, reports and plans in order to capture relevant objectives and values that should be incorporated into the risk management process
- ▶ Engagement with a range of stakeholders to identify and/or confirm overall objectives and values
- ▶ Use of an integrated risk management approach to ensure all risks are identified, analyzed, and evaluated
- ▶ Description of key management strategies that should be considered in response to the risks identified
- ▶ Development of a series of reports, including the *Terms of Reference*, *Context*, *Wildfire Risk Management Plan*, and *Management Strategies*, that collectively comprise the Ntityx WRMP
- ▶ A range of appropriate risk management methodologies and tools for identifying, assessing, evaluating, and responding to wildfire-related risk
- ▶ Consideration of both wildfire threats (values negatively impacted by wildfire) and opportunities (values positively influenced by wildfire)
- ▶ Spatial distribution of wildfire threats, opportunities and associated values
- ▶ A general discussion of the management strategies in response to identified risks. Detailed plans associated with the management strategies will not be a part of the Ntityx WRMP but will be addressed through other programs and processes.
- ▶ Results including maps, data background, and methods used

### 1.3 TIMELINES

The development of the Ntityx WRMP process began in June 2019 with completion of the final report in June of 2020.

The plan was developed with a five (5) year term, with progress against recommended management strategies reported annually. A detailed review of the plan is recommended after five (5) years to support a risk assessment update led by Ntityx Resources. In the interim period, updates to the plan may be needed if significant changes take place, including either changes to the landbase (significant wildfire event, for example) or significant changes in the understanding of or presence of values on the landbase.

### 1.4 PLANNING TEAM

In support of the overall risk management process, a Planning Team was established for the Ntityx WRMP that included the following representatives:

- ▶ **David Gill** – *General Manager of Forestry*, Ntityx Resources LP
- ▶ **Jason Brolund** – *Fire Chief*, City of West Kelowna
- ▶ **Dennis Craig** – *Fire Chief*, District of Peachland
- ▶ **Brent Lipinski & Ian Peterson** – *Stewardship Forester*, Okanagan Shuswap Natural Resource District (MFLNRD)
- ▶ **Jeremy Hopkinson** – *Vice President of Operations*, Big White Ski Resort
- ▶ **Todd Cashin** – *Community Services*, Central Okanagan Regional District
- ▶ **Cailyn Glasser & Aaron Deans** – *Wildlife Biologist*, Okanagan Nation Alliance

- ▶ **Stephanie Paul** – Referrals Officer, Westbank First Nation
- ▶ **Michael Aldred** – Prevention Officer (Kamloops Fire Centre), BC Wildfire Service
- ▶ **Rob Osioy** – Prevention Officer (Penticton Fire Centre), BC Wildfire Service
- ▶ **Ed Korpela** – Fire Management Planning Specialist, BC Wildfire Service
- ▶ **Dana Hicks** – Wildfire Prevention Specialist, BC Wildfire Service

The Planning Team met on a regular basis to provide expertise and guidance for the project.

## 2 Context

Key to the implementation of the risk management process is the establishment of “the context.” The context identifies the current environment and situation within which wildfire risk management will be implemented. There are conditions and dynamics that are both internal and external to the Ntityx and the BCWS that influences wildfire risk management in the Plan Area, and ultimately influences how each organization would collaboratively respond to wildfire risks. The Planning Team supported the analysis and planning process through ongoing discussions that helped develop the overall context for the risk management process. A *Context Document* was developed that captures the environment within which the Ntityx WRMP was completed. A summary of this context is provided below.

### 2.1 PLAN AREA

The Ntityx WRMP Plan Area includes the Westbank First Nation Community Forest Agreement (CFA K1P) (47,455 ha), First Nation Woodland Licence (FNWL N2B) (17,867 ha), and surrounding area. The lands immediately adjacent to the tenured area are included in the planning process due to the potential influence of wildfires originating outside of the CFA and FNWL, and the potential of values adjacent to the tenured area influencing risk response activities within the tenure. To incorporate these adjacent risks and values, a 10km buffer was applied to Westbank First Nation’s tenure to comprise the total Plan Area (~ 324,700 ha) (Figure 2). Such a substantial buffer was applied due to the highly diverse land-use environment and overwhelming presence of critical infrastructure and other values at risk that will influence wildfire risk management decisions within the tenured area.

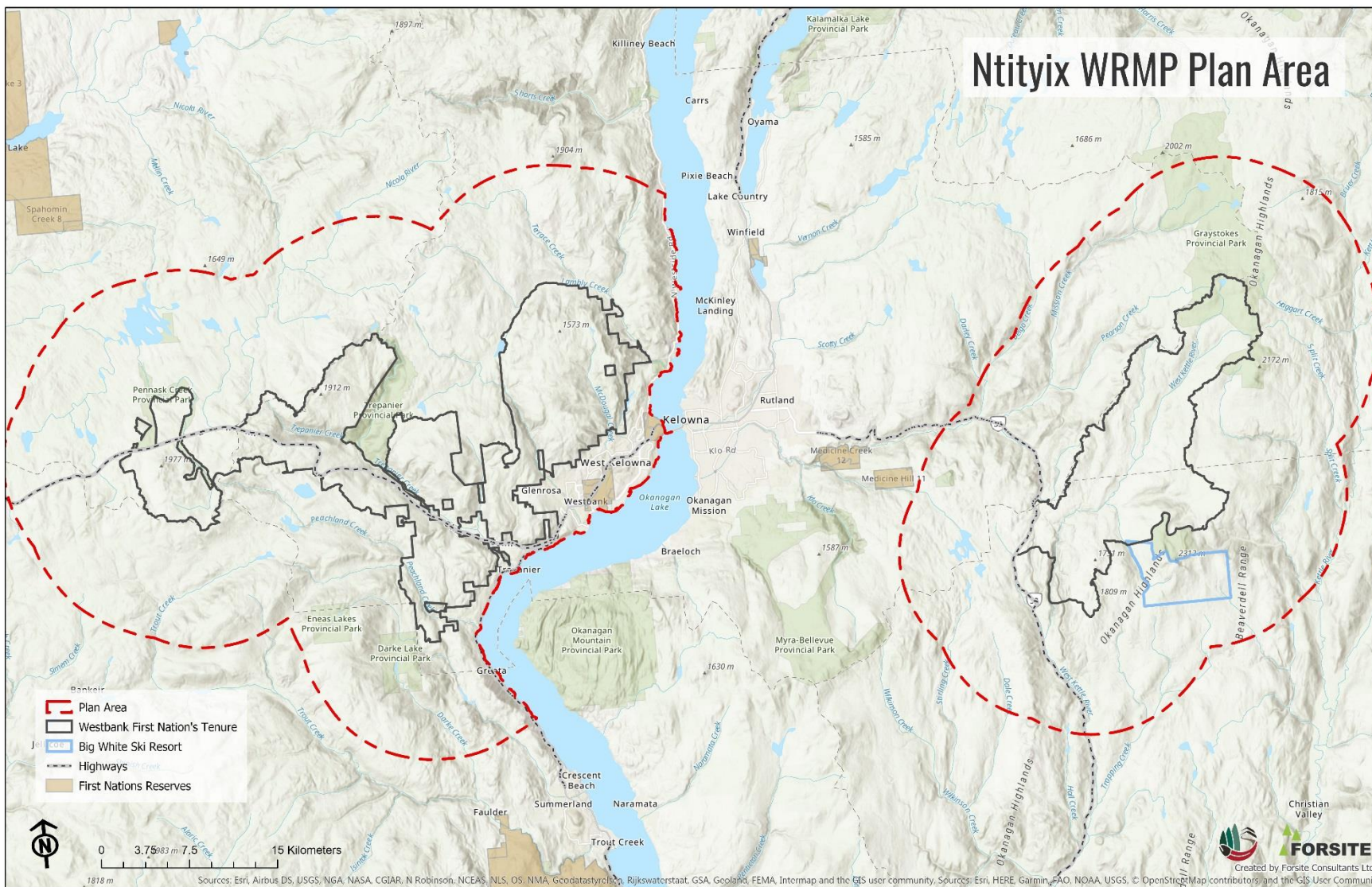


Figure 2. Ntityx WRMP Plan Area

## 2.2 ADMINISTRATIVE CONTEXT

Within the Plan Area there are additional land uses and jurisdictions that influence the wildfire risk management planning process, including:

- ▶ **Regional Districts:** Central Okanagan, Thompson-Nicola, North Okanagan, Kootenay Boundary, and Okanagan-Similkameen Regional Districts.<sup>1</sup>
- ▶ **Natural Resource Districts:** Okanagan-Shuswap, Cascades, and Selkirk Natural Resource Districts.
- ▶ **Timber Supply Areas (TSAs):** Okanagan, Merritt, and Boundary TSAs.
- ▶ **BC Wildfire Service Fire Centres:** Kamloops and Southeast Fire Centres.
- ▶ **Municipalities:** District of West Kelowna, Corporation of the District of Peachland, and Corporation of the District of Summerland.
- ▶ **Provincial Parks:** Trepanier, Pennask Lake, Pennask Creek, Eneas Lakes, Darke Lake, Okanagan Mountain, Graystokes Provincial Parks.
- ▶ **Ecological Reserves:** Browne Lake and Big White Mountain Ecological Reserves.
- ▶ **Controlled Recreation Areas:** Big White and Crystal Mountain Ski Areas.
- ▶ **Westbank First Nation** and Tsinstikeptum Reserves No 9 and 10; and
- ▶ Private Land<sup>2</sup>, and Forest and Range Tenure Holders.

Within this diverse land-use environment, a collaborative approach is being fostered in the development of Ntityx WRMP.

## 2.3 LEGISLATION AND POLICY CONTEXT

The BCWS has the authority to manage wildfire on provincial lands across the province. A series of strategic plans and guidance documents (i.e. policies) are in place that provide direction as to how the BCWS operates. These documents provide guidance to everyday operations as well as more strategic-level planning exercises such as this WRMP. The key legislative and policy context include the following:

- ▶ The BC Wildfire Act<sup>3</sup> and BC Wildfire Regulations;
- ▶ Wildfire Management Branch Strategic Plan (2012-2017)<sup>4</sup> ;
- ▶ BC Wildfire Service Wildfire Risk Reduction Planning Standard (2018)<sup>5</sup>;

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<sup>1</sup> The Central Okanagan Regional District is the regional government that makes up a majority of the project area and given this, had a seat on the Planning Team.

<sup>2</sup> Although the presence of private land and associated development may influence the risk assessment process, the WRMP will not identify management strategies or responses specific to private land.

<sup>3</sup> [http://www.bclaws.ca/civix/document/id/complete/statreg/04031\\_01](http://www.bclaws.ca/civix/document/id/complete/statreg/04031_01)

<sup>4</sup> [http://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/wildfire-management/governance/bcws\\_strategic\\_plan\\_2012\\_17.pdf](http://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/wildfire-management/governance/bcws_strategic_plan_2012_17.pdf)

<sup>5</sup> [https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/wildfire-status/prevention/fire-fuel-management/wildfire\\_risk\\_reduction\\_planning\\_standard.pdf](https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/wildfire-status/prevention/fire-fuel-management/wildfire_risk_reduction_planning_standard.pdf)

- ▶ BC Wildland Fire Management Strategy<sup>6</sup> (2010); and
- ▶ Canadian Wildland Fire Strategy<sup>7</sup> (2016).

## 2.4 PLANNING CONTEXT

In addition to the legislative and policy context, direction and expectations are also realized through other BC land-use and planning processes. The planning context includes the following:

- ▶ Okanagan-Shuswap Land and Resource Management Plan<sup>8</sup>
- ▶ Westbank First Nation Forest Stewardship Plan<sup>9</sup>
- ▶ Westbank First Nation Community Plan<sup>10</sup>
- ▶ Regional District Okanagan Similkameen Community Wildfire Protection Plan<sup>11</sup>
- ▶ City of West Kelowna Community Wildfire Protection Plan<sup>12</sup>
- ▶ District of Peachland Community Wildfire Protection Plan<sup>13</sup>
- ▶ Big White Ski Resort Wildfire Protection Plan<sup>14</sup>
- ▶ City of West Kelowna Official Community Plan<sup>15</sup>
- ▶ Climate Change and Fire Management Research Study<sup>16</sup>
- ▶ Fire Management Stocking Standards Guidance Document<sup>17</sup>
- ▶ Addressing the New Normal: 21<sup>st</sup> Century Disaster Management in British Columbia<sup>18</sup>

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<sup>6</sup> [http://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/wildfire-management/governance/bcws\\_wildland\\_fire\\_mngmt\\_strategy.pdf](http://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/wildfire-management/governance/bcws_wildland_fire_mngmt_strategy.pdf)

<sup>7</sup> <http://cfs.nrcan.gc.ca/pubwarehouse/pdfs/37108.pdf>

<sup>8</sup> [https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/thompsonokanagan-region/okanaganshuswap-lrmp/okanagan\\_shuswap\\_lrmp.pdf](https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/thompsonokanagan-region/okanaganshuswap-lrmp/okanagan_shuswap_lrmp.pdf)

<sup>9</sup> <https://static1.squarespace.com/static/56bf60ec0442623c14dea094/t/5b730d4103ce645179ff0173/1534266701265/2018-2023+FSP.pdf>

<sup>10</sup> <https://www.wfn.ca/docs/wfn-community-plan.pdf>

<sup>11</sup> [http://www.rdosmaps.bc.ca/min\\_bylaws/Community\\_Services/Wildfire\\_Protection\\_Program/RDOSCWPPFINAL2011.pdf](http://www.rdosmaps.bc.ca/min_bylaws/Community_Services/Wildfire_Protection_Program/RDOSCWPPFINAL2011.pdf)

<sup>12</sup> <https://www.westkelownacity.ca/en/city-hall/resources/Documents/CWPPUpdate-26OCT2018.pdf>

<sup>13</sup> <https://www.peachland.ca/cms/wpattachments/wpID683atID1935.pdf>

<sup>14</sup> <https://www.rdkb.com/LinkClick.aspx?fileticket=0gtVU2h8yAo%3d&tabid=280>

<sup>15</sup> <https://www.westkelownacity.ca/en/city-hall/resources/Documents/0100-Official-Community-Plan.pdf>

<sup>16</sup> [http://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/wildfire-management/governance/bcws\\_climate\\_change\\_research\\_strategy.pdf](http://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/wildfire-management/governance/bcws_climate_change_research_strategy.pdf)

<sup>17</sup> [http://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/land-based-investment/forests-for-tomorrow/fire\\_management\\_stocking\\_standards\\_guidance\\_document\\_march\\_2016.pdf](http://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/land-based-investment/forests-for-tomorrow/fire_management_stocking_standards_guidance_document_march_2016.pdf)

<sup>18</sup> <https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/embc/bc-flood-and-wildfire-review-addressing-the-new-normal-21st-century-disaster-management-in-bc-web.pdf>

- ▶ A Submission to the BC Flood and Wildfire Review – Association of BC Forest Professionals<sup>19</sup>
- ▶ Risk Management Guidelines for the BC Public Sector<sup>20</sup>
- ▶ Provincial Government Core Policy & Procedure Manual, Chapter 14: Risk Management<sup>21</sup>
- ▶ Sendai Framework for Disaster Reduction<sup>22</sup>
- ▶ BC Wildfire Service Tools for Fuel Management<sup>23</sup>

The BCWS mandate, structure, and challenges it faces are all a part of the context that influences the approach to wildfire risk and wildfire risk management. The development of a provincial risk framework for the BCWS is currently ongoing. The risk management process will follow the principles identified within the ISO-31000 standard. The Planning Team will continue to work with BCWS to integrate into the provincial risk framework, which may involve updates to the Ntityx WRMP in future iterations.

## 2.5 ENVIRONMENTAL, SOCIAL, AND ECONOMIC CONTEXT

The environmental, social and economic context for the Ntityx WRMP refers to the factors or conditions outside of the administrative or jurisdictional direction of Ntityx or the BCWS that will, regardless, significantly influence wildfire risk response.

**Environmental Context** - Natural disturbance regimes, species at risk (SAR), and biodiversity management will be key drivers influencing the use and response to wildfire on the landscape.

**Social Context**- The Plan Area is topological and ecological diverse, with complex and relatively intensive human use and development, including residential, industrial, and recreational development present throughout. Wildfire risk management will involve different approaches in response to this diversity, with specific attention being given to First Nations and stakeholders with interests in the land and how it is managed, as well as the need for more partnerships and collaboration in order to implement meaningful wildfire risk management.

**Economic Context** – Diversity in the land use and designation within the Plan Area is reflected in the economic context. Significant industry presence exists in the following sectors:

- ▶ *Tourism*
- ▶ *Agriculture* – orchards, vineyards, and traditional agriculture
- ▶ *Forestry/Timber*- forest tenure holders and additional crown forested lands
- ▶ *Grazing/Ranching* –crown land integrated with adjacent private lands
- ▶ *Recreation* – dispersed and concentrated, controlled recreation areas, regional and provincial parks
- ▶ *Transportation* – provincially significant highways
- ▶ *Utilities* – electricity transmission, pipelines

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<sup>19</sup> [https://abcfp.ca/web/ABCFFP/About\\_Us/Advocacy-Activities.aspx](https://abcfp.ca/web/ABCFFP/About_Us/Advocacy-Activities.aspx)

<sup>20</sup> [http://www.bcucipp.org/sites/bcucipp.civicwebcms.com/files/media/ERM\\_Guideline.pdf](http://www.bcucipp.org/sites/bcucipp.civicwebcms.com/files/media/ERM_Guideline.pdf)

<sup>21</sup> <https://www2.gov.bc.ca/gov/content/governments/policies-for-government/core-policy/policies/risk-management>

<sup>22</sup> <https://www.unisdr.org/we/coordinate/sendai-framework>

<sup>23</sup> <https://www2.gov.bc.ca/gov/content/safety/wildfire-status/prevention/fire-fuel-management/fuel-management>

## 2.6 KEY TRENDS

A series of key trends are expected to influence wildfire risk management within the Plan Area in the next 5 years:

- ▶ Forest fuels supporting increased probability of larger wildfire events due in part to recent fire exclusion across the landscape and a range of forest health issues, including mountain pine beetle;
- ▶ Climate change influences on wildfire incidence, wildfire behaviour and fuel conditions, including warming and drying trends, and a potential reduction in fire return intervals;
- ▶ Wildland fire as a strategic tool in the management of landscape-level wildfire risk;
- ▶ Land-use and population may continue to increase across the Plan Area both within and outside of existing communities. Ongoing forest management activities will continue to have a significant impact on landscape-level fuels within portions of the Plan Area; and
- ▶ Collaboration and partnerships will be increasingly required to deal with complex landscape-level wildfire risk conditions.

# 3 Risk Identification

The Ntityx WRMP follows the principles of risk management found in the *CAN/CSA-ISO 31000 Risk Management-Principles and Guidelines*. Risk identification is a component of the risk assessment, which considers both the likelihood and impact of wildfire through modeling.

The following key risk management principles were identified as priorities for the Ntityx WRMP risk management process. Risk management:

- ▶ Identifies and protects values;
- ▶ Is a part of a decision-making;
- ▶ Explicitly addresses uncertainty;
- ▶ Is based on the best available information;
- ▶ Is transparent and inclusive; and
- ▶ Is dynamic, iterative, and responsive to change.

## 3.1 MODIFIED BURN PROBABILITY

The Ntityx WRMP process utilized a modified burn probability methodology to support the analysis of wildfire risk. This approach combined an ignition probability analysis with headfire intensity (HFI), provided by the Provincial Strategic Threat Analysis (PSTA) dataset<sup>24</sup> to determine the modified burn probability for the Plan Area.

A kernel density analysis of fire history data was used to determine ignition probability. This distance-dependent tool is limited in its ability to account for other independent variables and relationships<sup>25</sup>, and does not account for temporal scale. In addition, a robust fire behaviour probability model differs from historical fire data analysis due to

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<sup>24</sup> Provided by BCWS.

<sup>25</sup> <https://koreauniv.pure.elsevier.com/en/publications/estimating-the-spatial-pattern-of-human-caused-forest-fires-using>



its dependence on spatial and temporal factors<sup>26</sup>. For this reason, this analysis and its output is referred to as “modified” burn probability.

### 3.1.1 Ignition Probability

Ignition probability was determined by completing a 20 x 20 meter (0.4 ha) raster analysis in a GIS environment. Ignition probability was analyzed using the following three inputs, or sub-components of the ignition probability (Table 1):

1. Lightning-Caused Historical Fire Starts – provided in the Provincial Historic Fire Starts dataset, lightning-caused fire starts from 1950 to 2018 were analyzed with a kernel density analysis.
2. Human-Caused Historical Fire Starts – provided in the Provincial Historic Fire Starts dataset, human-caused fire starts from 1950 to 2018 were analyzed with a kernel density analysis.

Both human and lightning – caused wildfire ignition layers were normalized to values ranging from 1 to 10. Normalization does not change the results, but allows for the more simplified combination of many GIS layers in subsequent phases of the analysis.

3. Proximity to Roads and Motorized Trails – this was analyzed using a series of distance-based classes from the spatial indicator of potential ignitions (Table 2).

The ignition probability was determined by calculating the weighted sum of these sub-components (fire starts and proximity to roads). Each of these sub-components have a different influence on ignition probability and therefore were weighted based on this relationship.

Ignition potential based on fuel type was not incorporated into the analysis. For the Plan Area, it can be assumed that the vast majority of the forest types have a high probability of ignition based on data for fire weather days from representative weather stations and historical fire patterns.

**Table 1** Ignition Probability – Proximity to Roads and Trails

Data Source	Category Rating by Proximity Class				Subcomponent Weight
	0-100 m	100-250 m	250-500 m	500 + m	
<i>MOTI Roads</i>	10	8	6	4	<b>40</b>
<i>Permitted Roads</i>	8	8	6	4	<b>30</b>
<i>Other Roads</i>	8	8	6	4	<b>20</b>
<i>Trails</i>	6	6	6	2	<b>10</b>

### 3.1.2 Headfire Intensity (HFI)

Headfire intensity (HFI) is a component of the PSTA data provided by the BCWS<sup>27</sup>. This layer incorporates provincial weather station data, fire weather index, elevation, and Fire Behaviour Prediction (FPB) fuel types to determine the intensity of a fire during peak burning season weather conditions.

<sup>26</sup> <https://www.sciencedirect.com/science/article/pii/S0378112705000563>

<sup>27</sup> For more information on the headfire intensity layer see the BCWS PSTA overview at: <https://www2.gov.bc.ca/gov/content/safety/wildfire-status/prevention/fire-fuel-management/psta>

HFI can be defined as the predicted energy output at the fire front measured in kilowatts per meter (kw/m) that describes the potential difficulty of controlling a fire. At 2,000 kw/m fire intensity generally surpasses the capabilities of ground crews, with 4,000 kw/m being the general threshold for air attack effectiveness. At 10,000 kw/m, heavy water bombers become inactive for fire suppression<sup>28</sup>.

The HFI was normalized to 10 distinct classes in order to be combined with the ignition probability. The PSTA datasets defined HFI into classes, however some classes were not present within the Plan Area. Therefore, the source HFI dataset was reclassified into 10 distinct classes and as a result, the HFI classes used in this analysis are not reflective of the PSTA data classes. This resulting HFI layer was used as a measure of fire behavior, with the assumption that a more intense fire front would have a greater negative impact on values at risk.

### 3.1.3 Modified Burn Probability

Modified burn probability is the combination of HFI and ignition probability (60% ignition, 40% HFI), where the presence of ignitions on the landbase are often a more significant factor in burn probability and therefore is weighted more than HFI (Table 2). To support this approach, additional model runs were completed that weighted ignition probability and HFI equally (50% ignition, 50% HFI), however the dominant weighting towards ignition probability was determined to be the most representative of conditions on the ground, and was therefore selected to represent wildfire risk in this assessment.

**Table 2.** Modified Burn Probability Analysis Components and Weightings

Component (Weight %)	Subcomponent (Weight %)	Description	Source
<b>Ignition Probability (60)</b>	Human Caused Fires (50)	Kernel density of lightning caused fire ignition points	BC Wildfire Ignition points (BCWS)
	Lightning Caused Fires (30)		
	Proximity to Roads and Trails (20)	Buffered distance from roads and trails based on proximity classes	See <b>Error! Reference source not found.</b>
<b>Headfire Intensity (40)</b>	Headfire Intensity (100)	Headfire Intensity Classes	Provincial Strategic Threat Analysis (BCWS)

### 3.1.4 Data Limitations

The PSTA dataset utilizes the 2018 Vegetation Resources Inventory (VRI) that accounts for harvesting to 2017, meaning that harvest activities from 2016 to present are not included in the PSTA analysis. As a result, several locations within the Plan Area could be classified as having a higher modified burn probability than what may be the reality on the ground. Additionally, stand density does not impact the fuel classification included in the PSTA which will result in recent treatments potentially registering as a higher modified burn probability since this aspect of the stand is not taken into account but will impact the spread and intensity of wildfire.

<sup>28</sup> <http://iopscience.iop.org/article/10.1088/1748-9326/aa7e6e/pdf>

### **3.1.5 Result**

The result of the modified burn probability analysis for the Ntityx WRMP is shown in Figure 3. These results represent relative burn probability within the Plan Area.

Several key locations receive a relatively high modified partial burn probability for the Plan Area, including the stretch of land and WUI along Westside Road down to just north of Summerland, Big White Ski Resort, Joe Ritch, and the area just south of Highway 33.

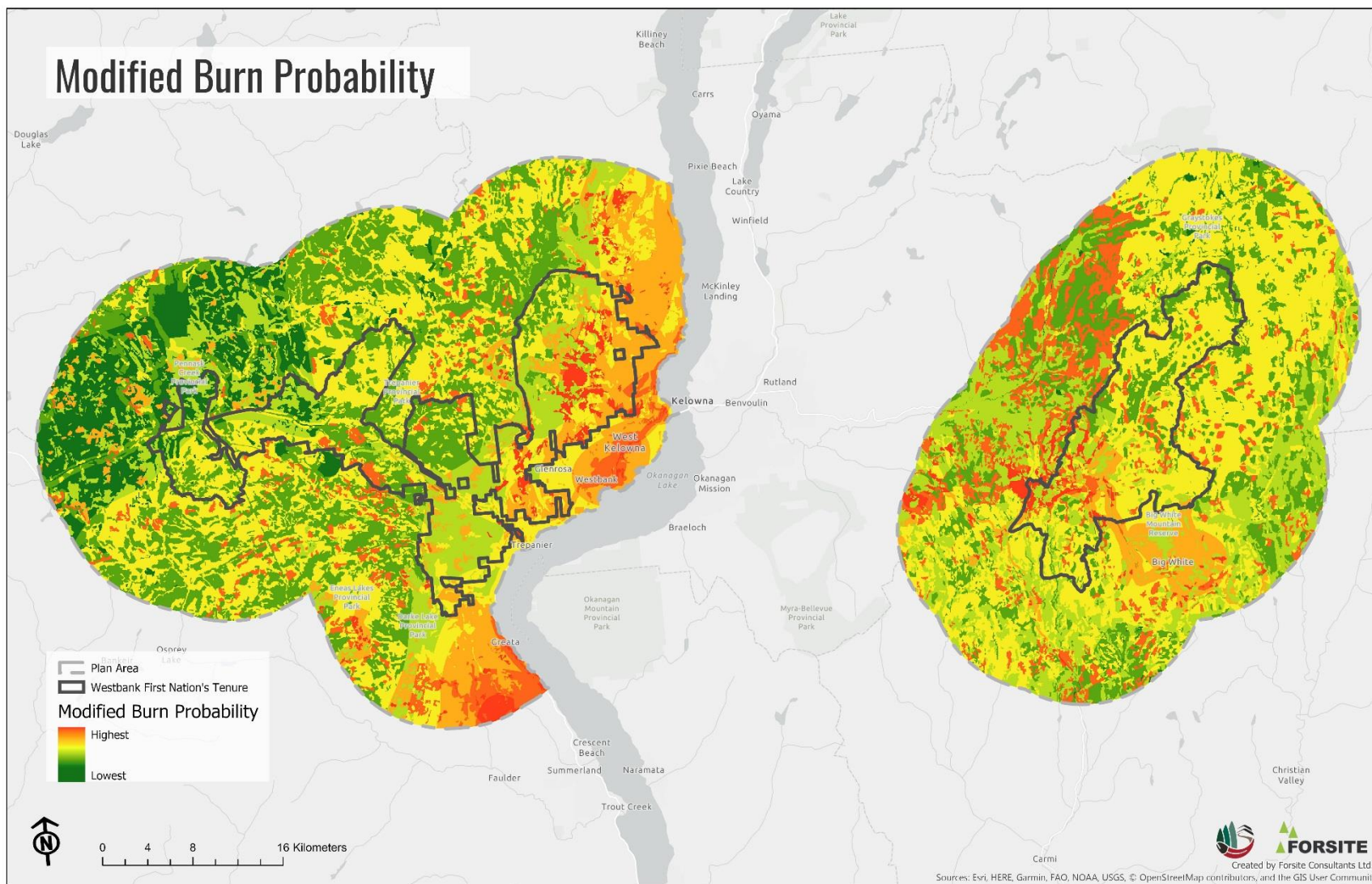


Figure 3. Modified Burn Probability

### 3.2 IMPACT TO VALUES AT RISK

Consequences or impacts to values were evaluated for the BCWS RSWAP categories. Spatial indicators of each of these value components were identified where feasible given data availability. Impact criteria were then applied to spatial indicators to estimate the cumulative impact that could be realized across the Plan Area, in relation to the presence of these values in the event of a wildfire.

Impact weightings for *High Environmental and Cultural Values* as well as *Resource Values* RSWAP categories were developed through a Values Workshop that gathered Planning Team members and other relevant stakeholders to review and rank the associated spatial indicators. Rankings were based on the description of and, in some cases, the quantification of environmental, social, and operational impacts or consequences. The ranking of *Human Life and Safety* and *Critical Infrastructure* RSWAP categories was provided by the BCWS to ensure alignments with their allocation framework.

#### 3.2.1 Impact Criteria

The outcome of a wildfire event on values across the landbase can be described as the impact or consequence of the event. The following impact criteria was developed in conjunction with the BCWS to determine the relative impact of a wildfire on a spatial indicator. The Ntityx WRMP and associated management strategies focus on areas of “Moderate”, “Higher”, and “Highest” impacts (see Table 3). This impact criteria table supported attendees of the Values Workshop in identifying and analyzing values at risk across the Plan Area and applying a spatial indicator to each identified value in the analysis.

**Table 3.** Impact Criteria

<i>Level</i>	<i>Temporal Modifier</i>	<i>Spatial Scale</i>	<i>Spatial Indicator Rating (SIR)</i>	<i>Key Words</i>
<b>Highest</b>	Permanent	Provincial	<b>10</b>	Irreversible; critical; permanent; extreme social, environmental, economic impacts; substantial losses; large scale
	Long/Moderate	Regional/Local	<b>9</b>	
	Short	Local	<b>8</b>	
<b>Higher</b>	Long	Regional/Local	<b>7</b>	Extensive; threatened; long term; requires urgent intervention; disruption; major social, environmental, economic impacts
	Moderate	Regional/Local	<b>6</b>	
	Short	Local	<b>5</b>	
<b>Moderate</b>	Long	Regional/Local	<b>4</b>	Reversible; manageable with time/effort; localized; significant social, environmental, economic impacts.
	Moderate	Regional/Local	<b>3</b>	
	Short	Local	<b>2</b>	
<b>Lower</b>	NA	Local	<b>1</b>	Short term; reversible; temporary
<b>Lowest</b>	Immediate	Local	<b>0</b>	Insignificant; temporary

### 3.2.2 Values at Risk Identification

Consequences or potential impacts to values at risk were identified through conversations with the Ntityx WRMP Planning Team and other stakeholders. The potential impacts to threatened values (i.e. those potentially negatively impacted by wildfire) were ranked as shown in Table 4.

The ranking of values was facilitated by a Values Workshop that brought together local specialists in the areas of wildfire, biodiversity, range, ecology, forestry, First Nations, and land management. The workshop session identified subcategories for each of the four RSWAP categories, and within these, identified spatial indicators that could be used to represent these values. The importance of each of the indicators and corresponding subcategories was then identified through a consensus-based rating process for two of the RSWAP categories (*High Environmental and Cultural Values* and *Resource Values*) that was generally based on the following factors:

- ▶ Perceived importance of the value to the public;
- ▶ Susceptibility of the threatened value to wildfire;
- ▶ Likelihood that the value or indicator would influence wildfire risk response; and
- ▶ Availability and scale of the spatial data being used to represent the value.

Spatial datasets that were represented by point data (i.e. structures) or line data (i.e. evacuation route) were buffered by 500 meters in the analysis to support interaction of the impact data with the modified burn probability layer as this is used to reflect the wildfire risk.

Values Workshop attendees rated each indicator’s significance with a relative value between 0 and 10. This rating assigned to the individual indicators allowed for the recognition of the relative significance of one indicator when compared to another. Ratings for *Human Life and Safety Values* and *Critical Infrastructure Values* RSWAP categories were provided by BCWS to ensure alignment with their developing framework and risk management processes.

**Table 4:** Values at Risk and Rankings

<b>Category</b>	<b>Subcategory</b>	<b>Indicators</b>	<b>SIR</b>
<b>Human Life and Safety</b>	<b>People</b>	Residences/Cabins	10
		Campgrounds/Recreation Sites	10
		Facilities	10
		Controlled Recreation Areas	10
		Major Travel Corridors	10
		Trails	10
	<b>Community</b>	Designated Communities	10
		Westbank First Nation	10
		Other Communities	10
	<b>Evacuation</b>	Evacuation Routes & Critical Evacuation Corridors	10
Egress Routes		10	
<b>Property &amp; Critical Infrastructure</b>	<b>Critical Infrastructure</b>	Transmission Lines & Primary Distribution	9
		Windfarm	9
		Pipeline Distribution Stations	9
		Communications Towers	9
		Ministry Repeaters	9

		BCWS Weather Stations	9
		First Responder Facilities	9
	<b>Public &amp; Private Infrastructure/Property</b>	Major Community Businesses/Facilities	7
		Minor Community Businesses/Facilities	7
<b>High Environmental &amp; Cultural Values</b>	<b>Water</b>	Community Watersheds	7
		Domestic Points of Diversion	4
		Non-Domestic Points of Diversion	3
	<b>Range</b>	Range Infrastructure	3
	<b>Fish &amp; Aquatic</b>	Fisheries Sensitive Watersheds	7
		Known Fish-bearing streams	4
	<b>Wildlife</b>	Species at Risk Occurrences	5
<b>Resource Values</b>	<b>Timber</b>	High-Value Forest	7
		Area-based Tenures	7
		Volume-based Tenures	4
		Permanent Sample Plots	1
	<b>Recreation</b>	Trails	2
		Controlled Recreation Areas	7
		Provincial & Regional Parks/Reserves	4
		Recreation Sites	4
	<b>Visuals</b>	Visually Sensitive Areas	2
		Recreation Viewpoints	1
	<b>Wildlife Habitat</b>	Mule Deer Winter Range	3
		Moose Winter Range	4
		Goat Winter Range	3
		Wildlife Habitat Areas	5

### 3.2.3 Analysis

The ranking of individual impacts, or values at risk, was used to estimate the consequence of a wildfire occurring in a particular area. Values potentially threatened by wildfire across the landbase were incorporated into a “values roll-up” produced from a GIS overlay of the individual spatial indicators. Maximum and cumulative values roll-ups were generated for the Plan Area to represent potential impacts to values at risk and were leveraged in the wildfire risk analysis to support decision making within the Planning Team.

The maximum values roll-up depicts the maximum of all potentially overlapping values on the landbase. For example, if a residence with a rank of 10 existed within the same recreational trail corridor with a rank of 3, the area (i.e. pixel) would be assigned a total rank of 10. The cumulative roll-up, on the other hand, combines all values rankings in an area. In the previous example, the cumulative roll-up would produce the rank of 13. Both values roll-ups were included in the wildfire risk analysis, as different reflections of those risks. Alternative views of the risks supported the Planning Team in evaluating risk and risk response.

### 3.2.4 Results

The results of the values roll-ups are shown in Figure 4 (maximum) and Figure 5 (cumulative). Both values at risk roll-ups highlight population centers and presence of people, including residences/structures, facilities, travel/evacuation corridors, recreation areas, and trails. The relative rankings between critical infrastructure and other environmental and cultural values differentiate more clearly in cumulative rankings, showing the combined 'value' associated with an area.



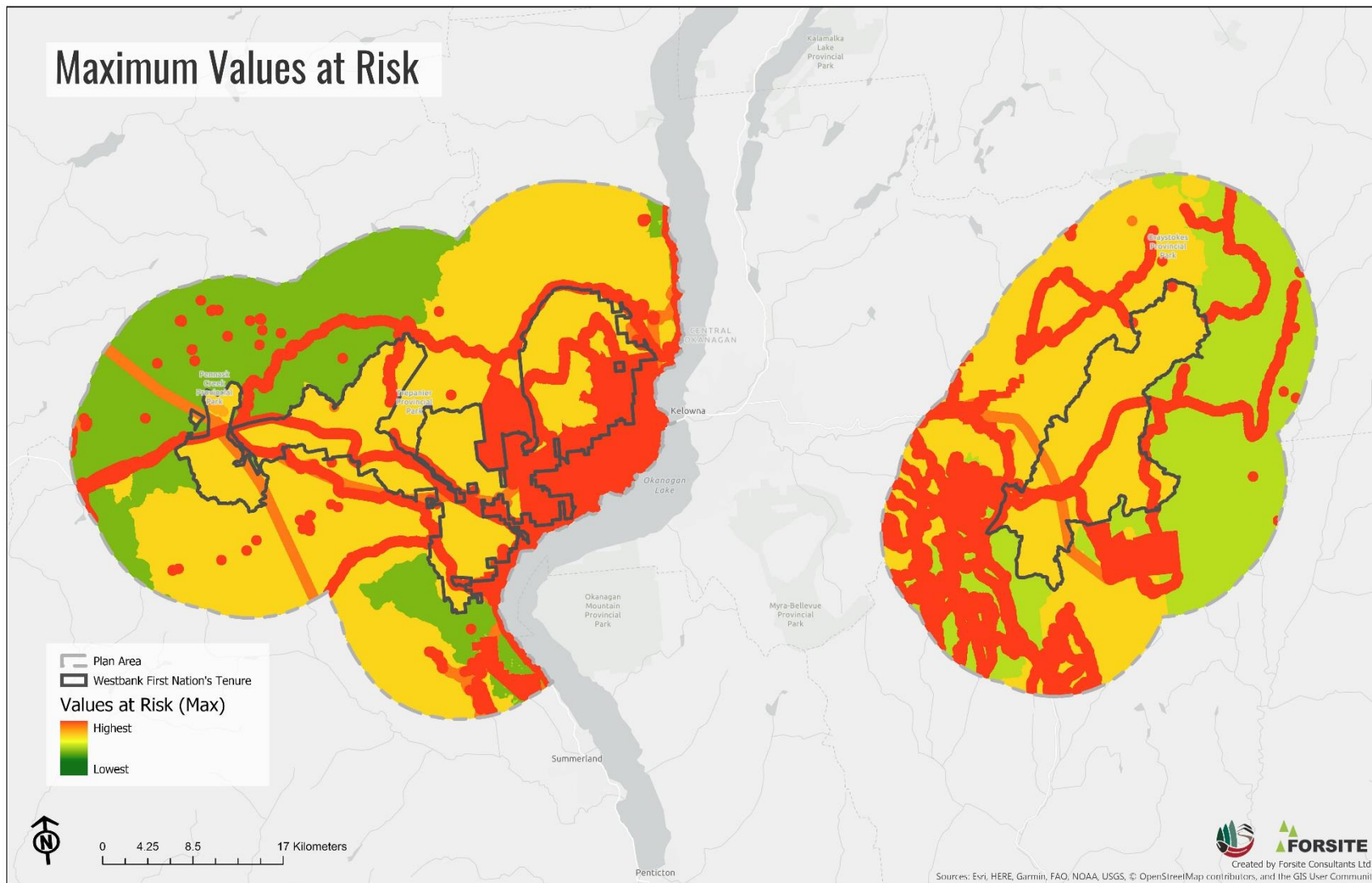


Figure 4. Values at Risk – Maximum Value

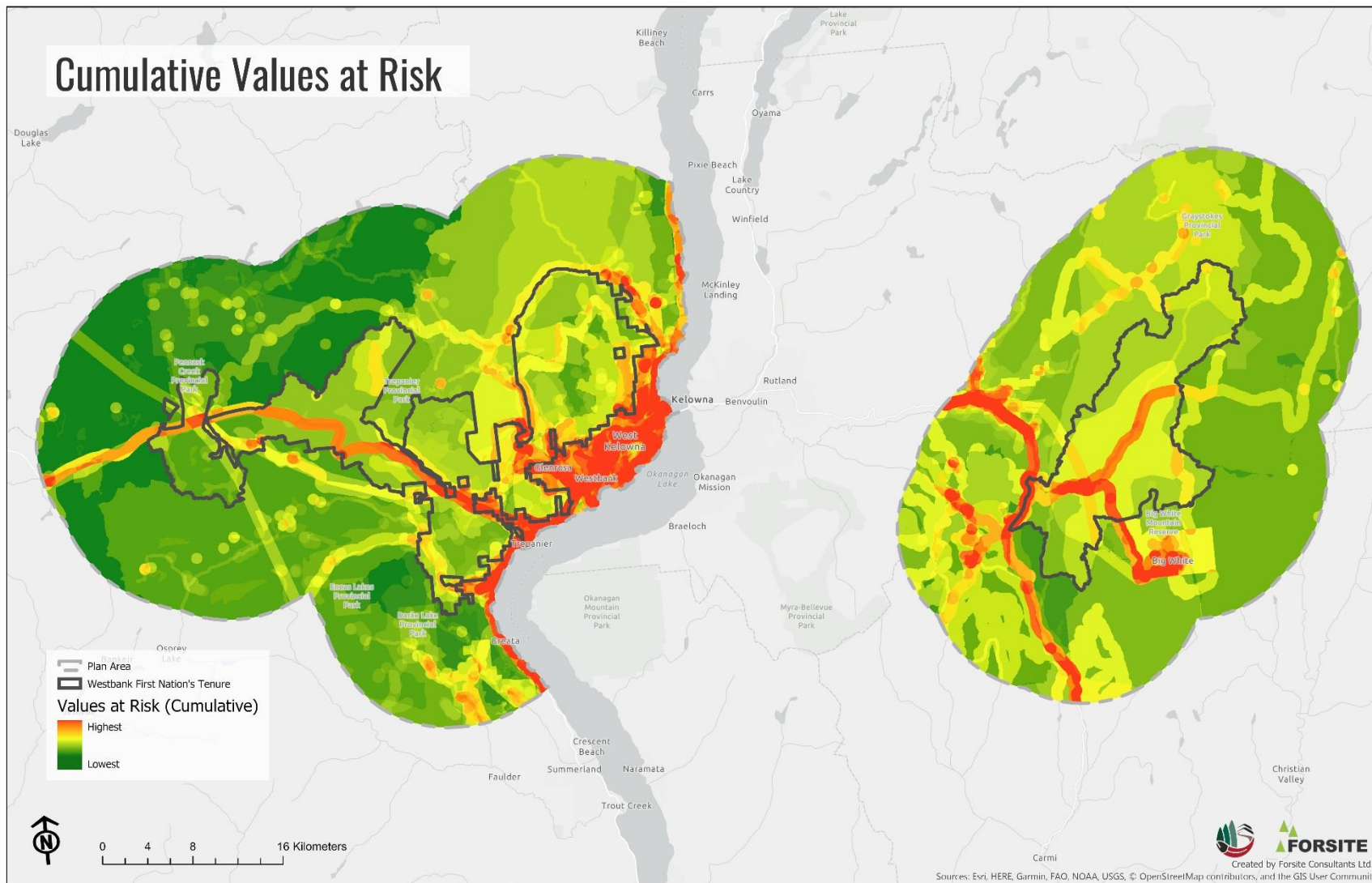


Figure 5. Values at Risk - Cumulative Value

### 3.3 WILDFIRE RISK

Wildfire risk is the combination of consequences (potential impacts) and modified burn probability in accordance with the risk matrix (Table 5). This risk matrix combines the modified burn probability with the values at risk (50/50) to identify the overall wildfire risk for the Plan Area. Predominance is given to the consequence or “values at risk” in the overall risk classification. For example, an area with “Highest” modified burn probability and the “Lowest” values at risk would result in a “Moderate” wildfire risk. The risk matrix is colour coded based on the risk classes defined in Table 6 that documents the general acceptability and proposed response to the identified risk. This approach is based on the relative risk of one area compared to another, as opposed to an absolute or numerical classification scheme.

This process was completed using both the “maximum values roll-up” as well as the “cumulative values roll-up” to produce two wildfire risk maps (maximum and cumulative) to support the Planning Team in their evaluation of wildfire risk and to inform development of responding management strategies.

**Table 5: Risk Matrix**

Values at Risk	Modified Burn Probability			
	Lowest	←-----→		Highest
Highest	Orange	Red	Red	Red
↑ ↓	Orange	Yellow	Orange	Orange
	Green	Green	Yellow	Yellow
Lowest	Green	Green	Green	Yellow

**Table 6: Risk Classification**

Colour Schema	Risk Classes
Highest	Highest – risk reduction should be considered
Higher	Higher – risk reduction should be considered
Moderate	Moderate – risk reduction may be considered
Lower	Lowest – risk may require no further treatment

#### 3.3.1 RESULTS

Wildfire risk results were produced for both maximum (Figure 6) and cumulative (Figure 7) wildfire risk. The cumulative wildfire risk was selected to identify areas of focus for the recommended management strategies. The cumulative roll-up represents all values within a particular area, adding the sum of the ranked impacts for each value at risk on the landscape and combining it values from the partial burn probability analysis. The results of this additive process shows the total impact of a wildfire occurring in an area. In contrast, the maximum wildfire risk roll-up displays the maximum rating applied to an area and does not necessarily account for the presence of multiple values.

In comparison, wildfire risk based on cumulative values (Figure 7) display greater area as moderate to higher wildfire risk, however key areas identified still include the presence of human life (i.e. communities and recreation areas), major travel corridors and evacuation routes. In contrast to the maximum wildfire risk, the cumulative wildfire risk approach allows for certain locations to become more prominent due to the presence of multiple, potentially overlapping, values. For example, when viewing maximum wildfire risk all communities, roads, and trails shows as high risk across the Plan Area, however when reviewing based on cumulative values particular stretches of evacuation routes and Wildland Urban Interface (WUI) show as higher wildfire risk due to the presence of overlapping values at risk in conjunction with higher HFI in these areas. This does not negate the importance of values at risk or the ignition probability across the Plan Area, but brings to light the importance of managing multiple values and land uses in risk reduction activities.

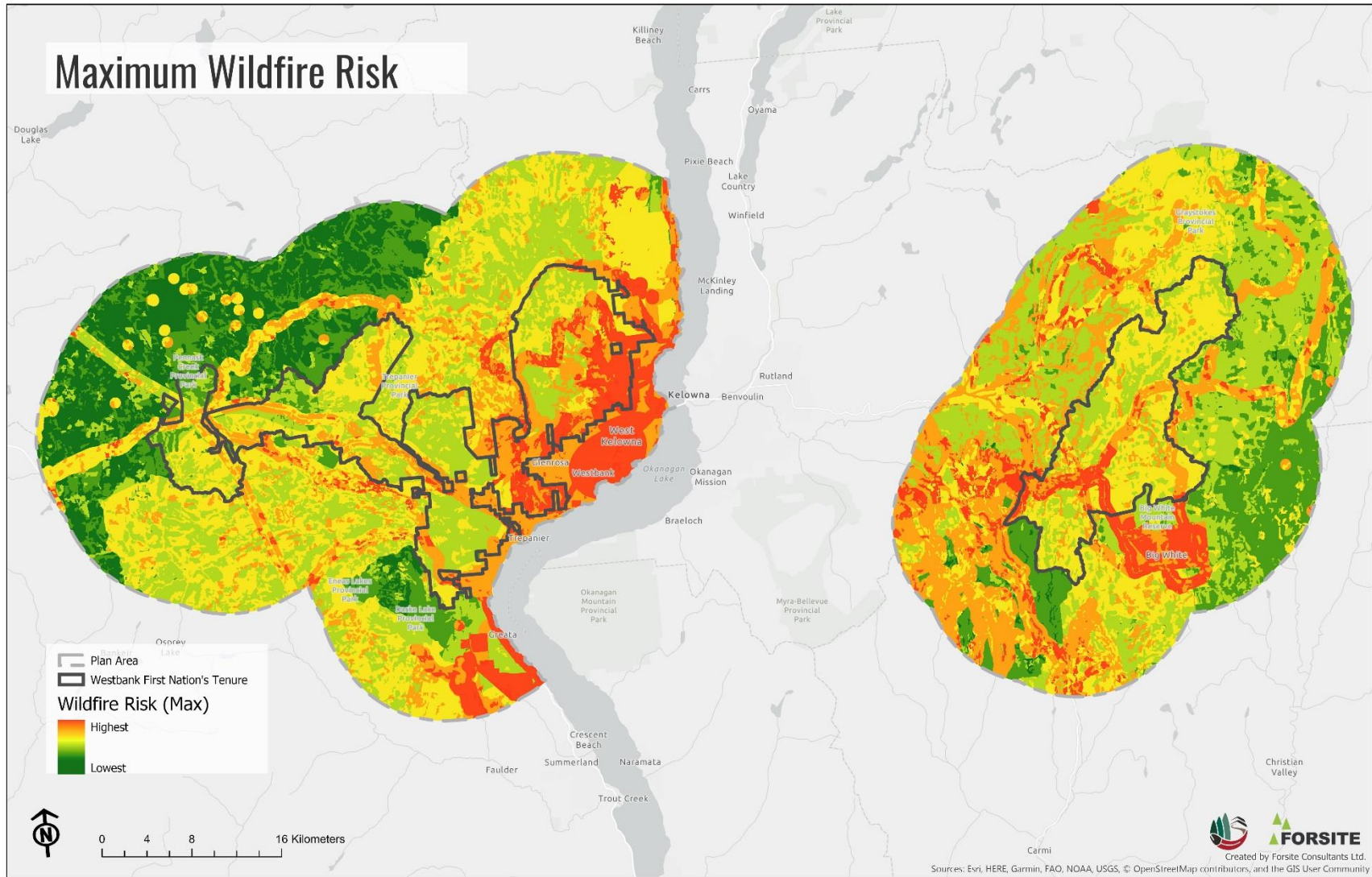


Figure 6. Wildfire Risk – Maximum Value

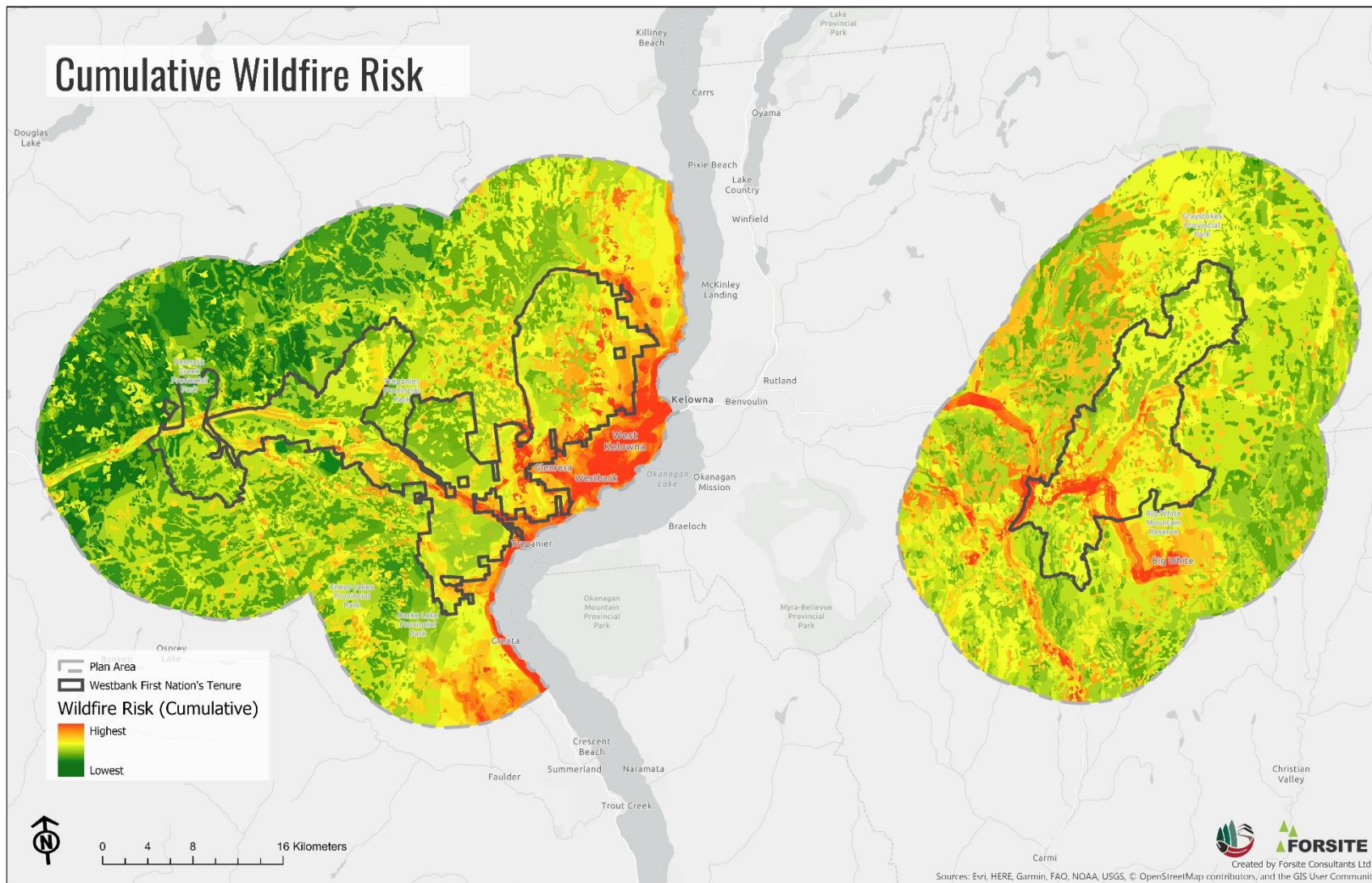


Figure 7. Wildfire Risk - Cumulative Value

### 3.3.2 Limitations

The wildfire risk analysis is meant to support discussions within the Planning Team to guide the development of the WRMP. The results of the analysis do not show the only or final answer to wildfire risk management planning. As with all models and data, there are assumptions and limitations to how data is incorporated into an analysis. For example, fuels data does not take into account thinning and the effects of other fuel management prescriptions that have been completed around the adjacent communities and therefore wildfire risk within these areas may differ in reality from the result of the model. The Ntityx WRMP analysis and resulting risk maps are best used in concert with local knowledge and professional experience – which was also considered throughout the planning process. Identified risks should be confirmed in the field prior to implementing any wildfire risk reduction activities.

Additionally, this analysis does not consider suppression capabilities of local fire departments and protection zones. These capabilities may in practice offset a portion of risk, however it is out of the scope of this project to analyze and understand the suppression resources and make inferences about capacity. Risk analysis results, however, should be interpreted in combination with other management realities.

### 3.4 OPPORTUNITY FOR WILDFIRE

As the driving natural disturbance agent on the landscape, wildfire (and/or management activities designed to emulate its effects) can provide valuable ecosystem services and enhance landscape resiliency when managed appropriately. Identifying opportunities that emulate wildfire on the landscape requires careful consideration of site-specific factors at multiple scales. Land attributes such as historical fire regimes, current forest structure and composition, expected fire behaviour, wildlife and invasive species considerations, proximity to values, cultural factors, and management objectives may all influence the decision to implement wildfire or a surrogate in a particular area.

Various known funding mechanisms exist to help implement use of prescribed fire and other fuel treatment techniques across the landscape. As of July 2020, new Community Resiliency Initiative (CRI) funding requirements have been released. WFN has already secured CRI funds for prescribed fire and fuel treatment, and should continue to pursue this funding avenue. Additionally, risk reduction burning and ecological restoration programs exist that may be pursued as an opportunity for prescribed fire on the landbase.

More detailed information on general areas and associated forest management recommendations to emulate wildfire can be found in *Appendix 1: Wildfire Management Zones*.

### 3.5 EXPOSURE ANALYSIS

Due to the proximity of Westbank First Nation's Community Forest to communities including West Kelowna, Westbank, and Peachland, an exposure analysis was conducted to provide further insight into priority fuel treatment areas to reduce wildfire risk. This analysis was based on the assessment of the level of potential exposure of individual structures to wildfire related hazards (radiant heat and embers).

Wildfire growth modeling to support the exposure analysis was conducted across the west side and east side of the Plan Area independently.

### 3.5.1 Inputs

Model inputs include the following components:

- ▶ **Structures.** Structures within the WUI intermix were the focus of the exposure analysis. Identified structures within WUI, or area within 2km of a community with a minimum density of 6 structures per square kilometer<sup>29</sup>, were buffered by 500 meters to account for long-range ember transport<sup>30</sup>. Structures within the WUI that contained at least 50% of wildland fuel (as defined by the FPB fuels) are considered the WUI intermix<sup>31</sup> and were provided as inputs to the exposure analysis.
- ▶ **Fuels.** Fire Behaviour Prediction (FBP) System fuel data was supplied by the BC Wildfire Service in the PSTA dataset.
- ▶ **Digital Elevation Model (DEM).** The 25m British Columbia TRIM DEM was resampled to a 100 meter raster to match the spatial resolution of the FPB fuels data.
- ▶ **Weather.** The WRMP Plan Area on the west side of Okanagan Lake and the east side of the lake received different weather observations due to their spatial disparity.

On the **west** side of Okanagan Lake, historical weather observations were sourced from the Brenda Mines (238) BC Wildfire Service network weather station. A single weather stream was used consisting of historical hourly weather that occurred during the nighttime burning of 2003 Okanagan Mountain Fire, during a period with strong diurnal influence. This specific weather event and timing was selected through conversations with the Planning Team, including BC Wildfire Service Prevention Officers and local Fire Chiefs to represent the local '*problem*' weather scenarios.

On the **east** side of Okanagan Lake, a total of 100 weather streams were used. These 100 weather streams were randomly selected from the Kettle2 (388) BC Wildfire Service network weather station where the Fire Weather Index (FWI) was greater than or equal to 34.5- corresponding to 95<sup>th</sup> percentile.

- ▶ **Ignitions.** The WRMP Plan Area on the west side of Okanagan Lake and the east side of the lake received different ignition grids to their spatial disparity and processing resources. The **west** side of the Plan Area utilized gridded ignition points with a 200 meter x 200 meter spacing, for a total of 23,200 ignition locations. The **east** side of the Plan Area utilized gridded ignition points with a 100 meter x 100 meter spacing, for a total of 139,384 ignition locations. The ignition points in these ignition "grids" are all treated equally and there is no attempt to quantify or infer any potential differences in ignition probability that may exist on the landscape. The goal of the analysis is to model wildfire potential from all locations to quantify the potential effects of wildfire on values on the landscape.

### 3.5.2 Process & Outputs

The exposure analysis utilizes the Canadian Prometheus wildfire growth model run in 'batch mode' to model fire spread across the landscape from the ignition grids. This modeling helps understand how fire will move across the landscape and expose structures to possible impact.

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<sup>29</sup> <https://www.fness.bc.ca/downloads/firesmart-planning-program-guide.pdf>

<sup>30</sup> [https://firesmartcanada.ca/wp-content/uploads/2019/10/FS\\_ExposureAssessment\\_Sept2018.pdf](https://firesmartcanada.ca/wp-content/uploads/2019/10/FS_ExposureAssessment_Sept2018.pdf)

<sup>31</sup> <https://www.sciencedirect.com/science/article/pii/S0301479713004246>



The exposure analysis is based on the spatial relationship between individual structures or buildings and the mean Fire Intensity (kW/m) and Crown Fraction Burned (%). From a building centroid, a 20 meter grid of points radiating out from the house is created to a distance of 500 meters, producing 2,000 distance values. These distance values are then intersected with the Fire Intensity and Crown Fraction Burned to facilitate calculations of relative ember exposure and radiant heat exposure using linear equations that reduce exposure with distance. These 2,000 distance values are then summarized to each of the individual building centroids to attribute the mean and maximum ember and radiant heat exposure values. Fire perimeters were overlapped with building centroids to provide the count of fires that interacted with buildings, showing potential fire pathways.

Additionally, the final metric generated through the exposure analysis includes the count of buildings exposed at each ignition point. Unlike the other outputs of this process, this value is placed on the gridded ignition points rather than the building centroids, depicting locations in the surrounding landscape where potential fuel mitigation activities could have the largest impact on nearby structures.

### 3.5.3 High-Level Planning for Exposure Reduction

To provide additional value to Ntityx Resources and Westbank First Nation, the outputs from the exposure analysis were interpreted in conjunction with a variety of other data sources to provide high-level fuel management guidance within the CFA. Due in part to the local ‘*problem*’ winds (i.e. diurnal effect) in addition to the proximity of the tenured area to structures identified in the WUI intermix, high-level planning was conducted only for the tenured area on the west side of Okanagan Lake.

In addition to exposure analysis outputs, the following information was considered to guide high-level planning:

- ▶ **Current treatment boundaries (completed, active, proposed).** Boundaries for active, completed, and proposed fuel treatments were considered. It is assumed that completed treatments are/will be sufficiently maintained.
- ▶ **Slope-based Operability.** LiDAR-derived slopes were utilized to delineate proposed fuel management treatment areas. As per client specifications, slopes equal to or less than 35% are operable for conventional harvesting operations. Slopes greater than 35% were included where slopes were not sustained (i.e. greater than 100 meters).
- ▶ **LiDAR-derived vegetation data.** LiDAR-derived single tree inventory<sup>32</sup> data was summarized by 400m<sup>2</sup> hexagons to identify stands/groups of trees that are comprised of 100% coniferous species and achieve densities greater than 500 stems per hectare.
- ▶ **Aspect.** LiDAR-derived southern (S, SW, SE) aspects were considered in delineating proposed treatment areas.
- ▶ **Access.** Areas with sufficient access/existing road networks were considered.

Recommended fuel management areas delineated by this office-based exercise are intended to provide high-level guidance for fuel management direction and prioritization within the Westbank CFA for mechanical treatments (see *Appendix 2- Detailed Management Strategies* for recommended fuel management areas). Fuel management activities in other areas identified as high risk within the tenured area should still be explored to reduce risk to the community as well as the CFA; however, it is likely hand treatments will be the most feasible form of treatment.

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<sup>32</sup> Single Tree Inventory completed by Forsite in 2019. Only trees greater than 10 meters in height were segmented and included in this product.

Prescribed burning may be considered for maintenance for any hand treated unit, potentially offering a more economically viable means for maintenance of fine fuels than hand maintenance activities.

These areas do not necessarily represent a single recommended treatment unit area, but rather identify stands with a series of features that make them relatively high risk. Other management objectives and a field reconnaissance should be considered prior to pursuing areas identified for fuel treatment.

#### 3.5.4 Limitations

Input data to the exposure analysis is the most significant limitation of the analysis. For the west side of the Plan Area, only a single weather event was leveraged to produce exposure results due to resource limitations in incorporating other known fire events and associated weather information. The addition of other weather streams to exposure analysis outputs to the west side of the plan area may be considered in future updates to provide a more robust result.

Further, building centroid data and accuracy is likely dated and may not include a complete or up-to-date representation of building centroids in the Plan Area. Due to the size of the Plan Area, only building centroids meeting the aforementioned WUI intermix definition were leveraged in the exposure analysis to reduce processing time and resources. Additionally, the FBP fuels used as an input into the exposure analysis may not capture recent harvest or treatments which have reduced stand density. This may allow areas that have previously been treated, for example, to register as an area attributing higher exposure to structures since this aspect of the stand is not taken into account but will impact the spread and intensity of wildfire.

Due to concerns around data confidentiality, results of the exposure analysis were reviewed with the Planning Team but have not been published in this Plan. Instead, the outputs of the exposure analysis have been interpreted in conjunction with other data sources to produce recommendations for mechanical fuel treatment and inform management on crown land.

## 4 Risk Analysis & Evaluation

Risk analysis and evaluation is a key component of the risk management framework. The results of the wildfire risk identification were reviewed by the Planning Team to confirm areas of moderate to high risk, as well as elevate areas of concern through local knowledge and expertise. Wildfire risk results were evaluated to determine the cause of the risk and consider appropriate controls or measures to modify risk.

The Planning Team explored the risks that were identified through guided discussions carried out over a series of Planning Team meeting. These discussions involved the following concepts and questions:

- ▶ **Assess contributing factors.** *What is causing the model to identify the level the risk? What are the contributing factors to the identified risks?*
- ▶ **Confirm risk based on local knowledge.** *Does local knowledge confirm or refute the level of risk identified in the model? Does local knowledge elevate or reduce the risk classification?*
- ▶ **Determine if the level of risk is acceptable.** *Is the level of risk significant enough to warrant a response? Are there existing measures or controls in place that adequately address the level of identified risk?*

- ▶ **Identify how we can influence the risk.** *Can we influence the risks that have been identified? Can we influence the likelihood of an event happening or interrupt the impacts from being realized? Can we share the risk? Can we avoid the risk? Should we accept or retain the risk by choice?*

The Planning Team identified locations across the Plan Area that warrant specific response, as well as several general strategies that apply to the entire Plan Area. In addition, the Planning Team identified a number of general risks (threats and opportunities) that exist across the Plan Area (not specific to a given location) that also warrant specific attention.

#### 4.1 AREAS WITH NO RECOMMENDED ACTION

While analyzing and evaluating risks, several areas were discussed as they showed as high risk in the analysis; however, through discussion with the Planning Team these areas were decreased in priority for a variety of reasons. Wildfire risks within these areas continue to exist and need to be monitored. Alternate management strategies may be needed where risks change or additional resources and opportunities for additional risk response exist. Areas reviewed where no management strategies were developed are discussed below.

##### JOE RICH

- ▶ **Values at Risk** – Residences/structures, facilities, community of Joe Ritch, evacuation routes (Hwy 33), Fortis BC transmission and primary distribution lines, communications tower, community watershed, known fish-bearing stream, range development, volume-based forest tenure, mule deer winter range, recreation areas, visually sensitive areas.
- ▶ **Additional Context** – Joe Rich is a community along Highway 33 east of Kelowna that exhibits high wildfire risk (combination of values and burn probability).
- ▶ **Rationale** - Significant fuel treatments are completed/planned for the area (conducted by Tolko Industries, and Okanagan Shuswap Natural Resource District).

##### 201 FSR

- ▶ **Values at Risk** – Evacuation route, Fortis BC transmission line, range development, known fish-bearing stream, species at risk occurrence (American badger), area-based forest tenure (Westbank), high-value forests, wildlife habitat areas (grizzly).
- ▶ **Additional Context** – The 201 Forest Service Road (FSR) connects Highway 33 and Big White Road to Highway 6 east of Vernon. This potential evacuation corridor crosses through Westbank First Nation's Tenure (Community Forest Agreement and First Nation Woodland License) north of Big White.
- ▶ **Rationale** - This evacuation corridor is not a primary evacuation route for the area and does not interact with significant values for human life and safety or critical infrastructure.

Wildfire risks exist across the landscape and should be monitored over time and actioned as needed. Priority actions are identified here, as identified by the Planning Team and within the scope of the Ntityx WRMP.

## 5 Risk Response

The Planning Team developed **nine (9) management strategies** in response to the wildfire risks identified as a priority for response. The management strategies identified below are focused on key activities identified by the Planning Team based on significance of risk, ability to influence the risk, and ability of the organizations to implement the activities given time and resources. It should be noted that additional risks exist across the Plan Area that may be significant and require response in the future. Ongoing evaluation of wildfire risk across the Plan Area will ensure that priorities and actions adapt over time with changing wildfire risk conditions.

The management strategies developed in response to the wildfire risks are summarized below, with more detailed individual management strategies provided separately (see *Appendix 2: Detailed Management Strategies*). Individual management strategies are comprised of the following components:

- ▶ **Action** – the step(s) required to implement the management strategy
- ▶ **Action Responsibility** – who is responsible to move the management strategy and associated actions forward
- ▶ **Partners** – what partners are expected to be involved in the implementation of the strategy
- ▶ **Primary Risk Goal** – the risk response goal (risk reduction, risk transfer, etc.)

A summary of these nine (9) management strategies are listed in Table 7 and shown in Figure 8.

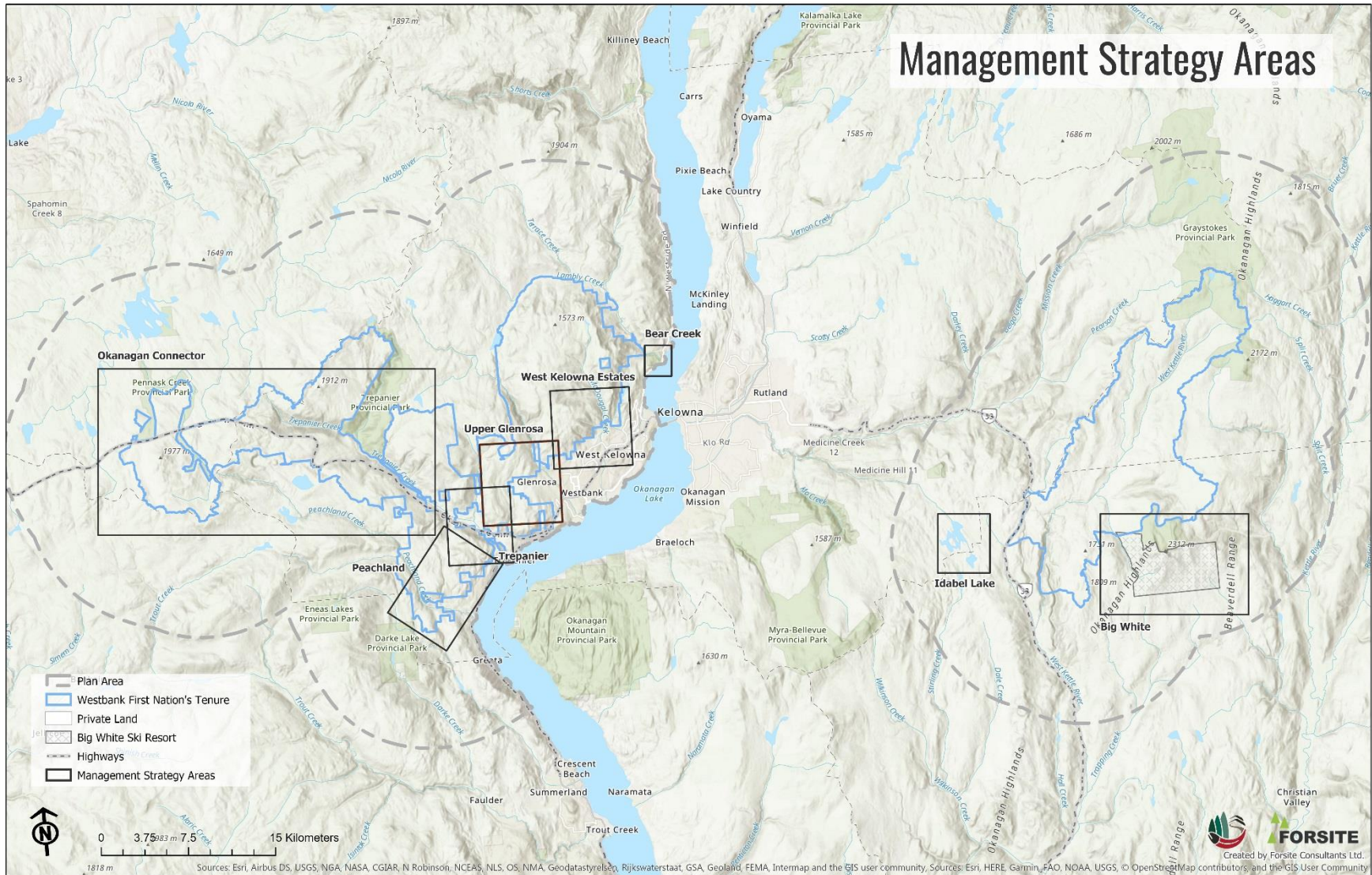


Figure 8. Management Strategy Areas

**Table 7. Management Strategy Summaries**

<b>1. UPPER GLENROSA</b>		
<b>Management Strategy</b>		<b>Description</b>
1.1	Complete and maintain fuel management treatments adjacent to and on private land.	Assess fuel loads in existing fuel management treatments in the CFA adjacent to Upper Glenrosa and maintain, if necessary. Develop and implement additional fuel hazard reduction treatments where feasible.
1.2	Evacuation planning for the Jackpine FSR.	The Jackpine FSR is an alternative evacuation route for Upper Glenrosa, however it is not a reliable evacuation route due to its current state. Conduct formal evacuation planning for the FSR – consider assigning responsibility to maintenance and signage.
1.3	Pursue emergency and evacuation planning for the community.	Emergency and evacuation planning is a critical component for preparing seamless emergency response in the event of a wildfire. Ensure that the City of West Kelowna has assessed evacuation and egress in Upper Glenrosa to ensure safety.
1.4	Educate and engage private landowners and the public.	Fuel management solely on crown land will not significantly reduce wildfire risk on private property. Without the engagement and participation of private landowners, these efforts may not be successful in reducing overall wildfire risk to Upper Glenrosa.
1.5	Consider the use of prescribed fire.	Prescribed fire can be used to achieve multiple objectives, such as modifying fuels to reduce negative consequences of wildfires, or to change site characteristics in support of ecological, economic or social objectives. Consider prescribed fire to maintain existing fuel treatments within the CFA around Upper Glenrosa.

<b>2. WEST KELOWNA &amp; WEST KELOWNA ESTATES</b>		
<b>Management Strategy</b>		<b>Description</b>
2.1	Complete and maintain fuel management treatments adjacent to and on private land.	Assess fuel loads in existing fuel management treatments in the CFA adjacent to West Kelowna Estates and maintain, if necessary. Develop and implement additional fuel hazard reduction treatments where feasible.
2.2	Manage for the resiliency of community watersheds in light of wildfire risk.	Prompt internal discussion to the City of West Kelowna and Westbank First Nation regarding the risk of catastrophic fire impacting drinking water supply.
2.3	Educate and engage private landowners and the public.	Fuel management solely on crown land will not significantly reduce wildfire risk on private property. Without the engagement and participation of private landowners, these efforts may not be successful in reducing overall wildfire risk to Upper Glenrosa.
2.4	Pursue emergency and evacuation planning for	Emergency and evacuation planning is a critical component

	the community.	for preparing seamless emergency response in the event of a wildfire. Ensure that the City of West Kelowna has assessed evacuation and egress in West Kelowna Estates to ensure safety.
2.5	Consider the use of prescribed fire.	Prescribed fire can be used to achieve multiple objectives, such as modifying fuels to reduce negative consequences of wildfires, or to change site characteristics in support of ecological, economic or social objectives.

### 3. TREPANIER CREEK

Management Strategy		Description
3.1	Engage with utilities regarding fuel management along infrastructure and right-of-way	A BC Hydro line runs perpendicular to Trepanier Creek, running immediately adjacent to stands that have been identified as high risk to wildfire. Work with BC Hydro to consider current management practices and develop additional fuel modification treatments if necessary.

### 4. PEACHLAND

Management Strategy		Description
4.1	Complete and maintain fuel management treatments adjacent to and on private land.	Develop and implement additional fuel hazard reduction treatments where feasible.
4.2	Manage for the resiliency of community watersheds in light of wildfire risk	Prompt internal discussion to the District of Peachland regarding the risk of catastrophic fire impacting drinking water supply.
4.3	Educate and engage private landowners and the public.	Fuel management solely on crown land will not significantly reduce wildfire risk on private property. Without the engagement and participation of private landowners, these efforts may not be successful in reducing overall wildfire risk to Peachland.
4.4	Pursue emergency and evacuation planning for the community.	Emergency and evacuation planning is a critical component for preparing seamless emergency response in the event of a wildfire. Ensure that the District of Peachland has assessed evacuation and egress.
4.5	Consider the use of prescribed fire.	Prescribed fire can be used to achieve multiple objectives, such as modifying fuels to reduce negative consequences of wildfires, or to change site characteristics in support of ecological, economic or social objectives.



5. BEAR CREEK PROVINCIAL PARK		
Management Strategy		Description
5.1	Enhance access to Bear Creek Provincial Park through fuel management treatments	Bear Creek Provincial Park is considered relatively high risk to a wildfire event. With poor access to the park and facilities, fuel management treatments along the access road may reduce wildfire risk.

6. BIG WHITE SKI RESORT		
Management Strategy		Description
6.1	Improve the resiliency of Big White Road corridor as an evacuation route and the resort's power supply through fuel management	Complete assessment of fuels in 500m corridor along Big White Road and main utility line. Collaborate with relevant partners to develop a corridor resiliency plan and engage in treatments if necessary.
6.2	Develop a strategy to reduce wildfire potential from the south	Forest conditions and dominant winds have elevated a significant area directly to the south of Big White in TFL 8 (Interfor). Work with Interfor to develop a risk reduction strategy to this area.

7. IDABEL LAKE		
Management Strategy		Description
7.1	Prioritize fuel management treatments adjacent to private land.	Idabel Lake is a small community situated in expansive forest. Assess and develop fuel management treatments to reduce risk to private land.
7.2	Educate and engage private landowners	Fuel management solely on crown land will not significantly reduce wildfire risk on private property. Without the engagement and participation of private landowners, these efforts may not be successful in reducing overall wildfire risk to Idabel Lake.
7.3	Consider the use of prescribed fire	Prescribed fire can be used to achieve multiple objectives, such as modifying fuels to reduce negative consequences of wildfires, or to change site characteristics in support of ecological, economic or social objectives.

8. OKANAGAN CONNECTOR		
Management Strategy		Description
8.1	Assess the resiliency of the Okanagan Connector as an evacuation route	The Okanagan Connector is a critical evacuation route and travel corridor to the Okanagan valley. Assess fuel related hazards along the corridor to consider whether wildfire risk

	along the corridor is sufficiently addressed.
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9. GENERAL	
Management Strategy	Description
9.1	<p>Reinforce and support a wildfire risk component to the Westbank First Nation Conservation Officer role/position</p> <p>WFN has established a Conservation Officer role within the organization. This role has the potential to support a range of wildfire risk related responsibilities, such as enforcement and education.</p>
9.2	<p>Ensure the resilience of communications towers to wildfire</p> <p>Communications towers and their associated power supply represent a significant component of emergency activities. Ensure all structures have been identified and work with communications towers proponents to ensure resiliency.</p>

In addition to the Management Strategies developed through guided discussions of the Planning Team, Wildfire Management Zones (WMZs) were delineated to assist Ntityx Resources in prioritizing locations within Westbank First Nation’s tenure to implement a variety of forest management practices to reduce wildfire risk. The WMZs are not intended to represent landscape fuel breaks, but rather strategic locations where the implementation of wildfire risk mitigation measures in forest practices would have particular benefit to the resiliency of the CFA and FNWL. See *Appendix 1 – Wildfire Management Zones* for more information.

## 6 Next Steps

Ntityx Resources in collaboration with partners will work to implement the management strategies. It is recommended that workplans, including potential funding applications, are created in the following months to ensure that progress is made in risk reduction efforts.

Priorities for implementation will also be confirmed with the organizations who are partnering in the individual strategies. Annual reporting against the plan goals and direction can be used to continue to build on the collaboration that was evident within the Ntityx WRMP process. Consideration of plan renewal will be made in 2025, or earlier if warranted.

In addition to the recommended management strategies (see *Appendix 2: Detailed Management Strategies*), the following next steps should be considered in implementing the WRMP.

### 6.1 FIRST NATIONS VALUES

Engagement with First Nations is a critical component to ensuring the success of management strategies and overall implementation of the Ntityx WRMP. It is recommended that Ntityx Resources relay the results of the WRMP to Westbank First Nation. Collaboration should begin prior to the implementation of any of the management strategies. It should be noted that no cultural spatial data was included into the “values at risk rollup” and subsequent wildfire risk analysis due to confidentiality concerns. Ntityx Resources and Westbank First Nation should work in

collaboration with the Regional Emergency Operations Centre to incorporate the presence of cultural values into management strategies where applicable and ensure that the necessary partners have the information they need to inform emergency management response. These efforts will ensure that cultural values can be respected in wildfire management and planning, and where possible, during suppression efforts.

## 6.2 MONITOR PROGRESS AND UPDATE AS NEEDED

Annually review the progress to implement the management strategies identified in the Ntityx WRMP, and report against the plan. Consider management strategies brought to implementation, which actions were not taken and why, changes to the landbase or processes that have influenced the implementation of the plan, and next steps. Additionally, consider changes to the modified partial burn probability analysis or values at risk that may warrant the renewal of the risk assessment process, and ultimately the WRMP. Consider the following factors:

- ▶ Fires within the Plan Area may change fire behaviour data, including HFI;
- ▶ New infrastructure and developments;
- ▶ New landbase initiatives (i.e. GAR Orders); and
- ▶ Actions as a result of the management strategies (i.e. fuel modifications).

Ntityx Resources would be responsible to move this action forward with partnership opportunities with the Okanagan Shuswap Natural Resource District (MFLNRORD), Central Okanagan Regional District, and BC Wildfire Service.

# Appendix 1 Wildfire Management Zones

## INTRODUCTION

Forestry research has found that incorporating natural disturbances into forest management practices and planning may be one of the best means to maintain landscape resilience in the face of an uncertain future (Drever et al. 2006; Millar et al. 2007; Long 2009; Turner 2010). While incorporating wildfire risk and ecology into forest management could have value across the entire Plan Area, operational realities, competing objectives, funding constraints, and legislative barriers may necessitate focusing on these considerations primarily within specific portions of the landscape. The wildfire risk mitigation activities that will be most appropriate and effective will also vary according to the risks identified and their context—particularly vegetation type and proximity to values at risk. The intent of the Wildfire Management Zones discussed here is to identify areas in which to prioritize incorporating wildfire principles into forest management, and provide guidance surrounding how best to implement risk mitigation and fire-related restoration at a high level for each area.

WMZ were delineated here for Westbank First Nation’s tenure only. It is the belief of the Planning Team that high-level management zones are most appropriately identified in close collaboration with the land manager. The risk analysis results from this WRMP can be used to support development of WMZ outside the tenured area through future discussions with adjacent land managers in the Plan Area while incorporating their strategic objectives and operational realities. The value of fire-minded forest management in these WMZs may also be enhanced by collaboration with adjacent tenure holders and communities, to enable addressing logical “firesheds” and connecting treated areas with natural barriers to fire spread that may cross administrative lines.

## INTENT

WMZ in this context are intended as broad areas within the CFA and FNWL where creating enhanced wildfire resilience, reducing fire hazard associated with vegetation, and restoring fire (or its mechanical surrogates) as a process are most warranted in the long term. Wildfire risk mitigation and disturbance-based management could still have value elsewhere in the CFA, but the delineated WMZ are proposed as the areas that should take precedence for this focus given the strategic objectives of the WBFNCF and important features of the landscape.

Several of these WMZ overlap areas addressed in other management strategies of this WRMP, and the associated approaches are intended to be complementary. The specific interventions recommended in other management strategies can provide guidance for addressing critical risks at a local level and over a more immediate time frame. Those interventions can become part of a larger framework of fire-minded forest management developed for each WMZ.

**It is important to note that these are not proposed as boundaries of landscape fuel breaks or a contiguous single fuel management treatment.** Implementing wildfire mitigation activities within these WMZ may have the effect of disrupting large fire progression and/or moderating future fire severity; however this outcome would depend on many factors that are beyond the scope of this WRMP. While particular treatment areas within the WMZ may later be utilized as suppression features, the entire WMZ itself will not function as a barrier to fire spread. How a fire moves through the area will depend on weather patterns and the condition and arrangement of component stands at the time of the fire. The exact mitigation activities that will be implemented across a particular WMZ over time

will depend on the range of forest management considerations that dictate best practices and operational realities. A management framework that is continuously adapted to the combination of disturbance ecology, vegetation, patch dynamics, social/operational context, and topography within each WMZ is recommended.

## WMZ BOUNDARY SELECTION PROCESS

The boundaries of WMZ were selected based on currently available information and the scope of the project. These may require adjustment over time to reflect changing conditions. Factors considered in this process included but were not limited to the following:

- ▶ The composition and structure of forest fuels;
- ▶ Topography;
- ▶ Forest health considerations;
- ▶ Historical fire and weather patterns, and historical fire regimes;
- ▶ Ignition densities and causes;
- ▶ Prevailing and critical winds and implications for likely fire progression;
- ▶ The strategic fire management goals of the WBFNCF;
- ▶ The results of the wildfire risk analysis;
- ▶ BCWS PSTA data; and
- ▶ The location of values at risk, including evacuation corridors.

## MITIGATION ACTIVITIES

The following section seeks to describe approaches that could be used within each of the WMZ (and the greater Plan Area) to address wildfire risk and resilience. Forest management activities designed for a wildfire management purpose can take many forms depending on the specific objectives of the land manager and the social and environmental context. One important goal of wildfire risk mitigation central to sustainability of a forest tenure and adjacent communities is reducing the risk of large severe wildfires propagating across the landscape. Recent research suggests that past disturbance history (including forest management) and its relationship to landscape mosaic is a major driver of future fire behavior (Prichard et al. 2017, 2018a, 2018b; Hessburg et al. 2019). The boundary of past fires can play an important role in steering the spread and moderating the severity of future fires (Stevens-Rumann et al. 2014a, 2016; Prichard et al. 2018a). If wildfires will continue to be largely suppressed and replaced by forest management as the dominant disturbance on the landscape, then forestry activities will need to emulate important physical and spatial attributes of wildfire as a process to maintain a functional mosaic that resists megafires.

With these factors in mind, the following sections describe a suite of mitigation activities that can be utilized to reduce fuel hazard and/or to enhance wildfire resilience at multiple scales within WMZ (and the Plan Area) over the long term. Implementation of these is not mutually exclusive, and one or more may be appropriate to apply in a particular treatment or harvest unit over time. Combinations of these activities are often grouped into the familiar term “fuel management,” such as described in Agee and Skinner 2005, but their use can be tailored to reflect the unique management objectives and considerations associated with each project area. In certain instances, economic value may be the primary driver for entering a particular stand, but that need not preclude applying some wildfire risk mitigation as part of the harvest. In other areas (often those identified as priority units for restoration or fuel management treatments in the familiar sense), reducing fuel hazard may be the most important objective due to proximity of critical values at risk, and thus multiple mitigations may be applied.

### Thinning/Partial Cutting

Removal of a portion of the overstory canopy and thinning the understory can mitigate the potential for crown fire behavior by reducing the density of aerial fuels present (“canopy bulk density”) (Agee and Skinner 2005). Thinning smaller understory stems can also reduce the ability of fire to propagate into the canopy by increasing the separation distance between the surface fuels and the canopy (“fuel strata gap”). The amount and nature of thinning that is appropriate for wildfire risk reduction requires careful consideration based on ecology and the overall effect the treatment will have on both the aerial and surface fuels in the stand. Removing a greater percentage of the canopy may not always result in the lowest wildfire risk. Increased light exposure can contribute to understory growth, and thereby increase fine surface and ladder fuel loads. A significantly more open forest canopy may also result in greater exposure to winds and solar heating, thereby accelerating fuel drying (Agee et al. 2000). Together these factors can result in an increased probability of ignition, rate of spread, and risk of surface to crown transition, and require more frequent stand maintenance to mitigate. The stand density and diameter distribution that will be most appropriate to target with a partial cut must be determined by forest professionals with wildfire behavior expertise, to weigh the balance of factors, including forest health considerations and the wind-firmness of the tree species in the stand. In some areas a very open stand may be both ecologically appropriate and represent the most effective reduction in fuel hazard. In other areas, striking a careful balance between reducing crown fire risk and maintaining a shaded, moist understory may be the more judicious approach. In certain locations within the wettest forest types or where root disease is a major challenge, thinning of any nature may not be appropriate or effective for achieving fire management objectives, and an approach focused on other interventions may be the most judicious.

Regardless of the exact cutting specifications, partial cutting for fuel management objectives typically involves the retention of the largest overstory trees that have increased survival probability during a wildfire event due to having thicker bark and a greater height to live crown (Agee and Skinner 2005). Research suggests retaining these individuals can reduce subsequent fire severity and better preserve ecological function following fire, when enacted in concert with other interventions (Hessburg et al. 2016).

Partial cutting activities, whether conducted by hand or machine, will also typically generate debris that must be mitigated so as to not increase surface fuel loads, and will thus typically be conducted in concert with a surface fuel treatment (see Surface Fuel Abatement and Prescribed Fire, below).

### Pruning

The presence of low branches on trees can act as a means for fire to move from the surface to the crown and contributes to overall canopy bulk density (Wagner 1977; Agee and Skinner 2005; Cruz and Alexander 2010). Pruning can be used as a silviculture intervention in both young and mature conifer stands to reduce the vertical “ladder fuel” continuity and raise the base height of the canopy. Particularly in stands where trees are not windfirm, or where root disease precludes partial cutting, pruning can be an important step to reduce the risk of a surface-to-crown fire transition, even if canopy bulk density cannot otherwise be altered without compromising competing management objectives. This can be applied in conjunction with other mitigations such as thinning, or on its own; however pruning will generate debris that must typically be mitigated to avoid increasing fire hazard (see Surface Fuel Abatement and Prescribed Fire, below).

### Surface Fuel Abatement

This activity involves removing or disposing of forest debris (whether natural or generated through management intervention) that acts as a carrier of surface fires. This can be applied in stands post-harvest or to existing forested stands to be retained, whether in conjunction with other activities or on its own. Abatement can be completed by hand, machine, prescribed fire, or a combination.

In recently harvested areas, tenure obligations already require surface fuel abatement, so this activity is familiar to all tenure holders. One means to enhance wildfire resilience in WMZ and elsewhere, however, may be to conduct these activities to a greater intensity and standard than the minimal legal requirement. Different approaches for piling, specialized machine attachments such as brush rakes, and/or staged treatments involving hand crews can all be utilized to achieve a lower residual surface fuel loading. Secondary fibre utilization can also help offset costs associated with these activities. In instances where fibre cannot feasibly be removed, pile burning remains the primary means for fibre disposal and hazard abatement. Chipping to accelerate decomposition and scatter within the block can sometimes also be appropriate. Broadcast burning can be a particularly powerful means to mitigate fine fuels in harvested areas and is discussed in a later section.

In forested areas, surface fuel cleanup can also be helpful, whether in conjunction with thinning or in stands where the entire overstory will be retained. Depending on the structure of the stand, surface fuel cleanup in forested areas is often completed by hand, due to operational constraints associated with machinery. Considerations related to understory/broadcast burning in forest stands are discussed in a later section.

Coarse woody debris represents important wildlife habitat and can also play a role in insect and pathogen dynamics, and so any surface fuel treatment should be carefully developed to balance objectives.

### Species Conversion and Alternative (Wildfire) Stocking Standards

Species composition is an integral component of fire behavior, as trees species greatly differ in their canopy and ladder fuel composition, leaf litter, and bark thickness—all of which can contribute to fire behavior and spread (Agee and Skinner, 2005). The proportion of species mixes across the landscape is also a critical component of a resilient mosaic from an ecological and wildfire risk perspective.

Broadleaf trees are a natural component of many forest types found in the Plan Area—whether in pure stands or as components of mixed-species forests, and can play an important role in disrupting large fire progression across a landscape. Research has shown that removal of broadleaf species such as Aspen (*Populus tremuloides*) and Birch (*Betula papyrifera*) can result in perceptible changes in fire behavior (Girardin et al. 2013). Broadleaf species generally have reduced crown fire potential and contribute to surface fuel beds that burn with reduced intensity compared to conifers. The introduction of broadleaf species as preferred and acceptable species into stocking standards, where appropriate and not already enacted, can provide for stand compositions that are consistent with both wildfire management and ecological objectives. Approval under the Forest Stewardship Plan (FSP) or an exemption will be required to enact this approach.

In certain instances where a greatly reduced fuel hazard is desired but tree species present preclude thinning and/or a shaded understory is essential to meet objectives, complete conversion of the treatment area to deciduous from a mixed-species or pure conifer stand may be warranted. This decision has implications for many other values, however, and needs to be carefully considered.

In addition to reincorporating broadleaf species into silvicultural strategies, species selection to enhance fire resilience could also include the introduction of conifers that are both fire-adapted when mature, and more resilient to warming climatic conditions. These could include western larch (*Larix occidentalis*), ponderosa pine (*Pinus ponderosa*), and Douglas-fir (*Pseudotsuga menziesii*), where these are not already planted or naturally regenerating.

### Juvenile Spacing

An alternative approach to partial cutting for reducing canopy bulk density could also be the use of reduced planting densities. However, due to typical juvenile tree loss from insects, disease, and animal browse in the region, planting to a lowered stocking density for wildfire management purposes can result in extremely low stocking numbers. While

low stocking densities can provide forest fuel separation desired for wildfire behavior reduction and be ecologically appropriate in some areas, the lack of viable future timber supply may not be consistent with tenure management goals across the CFA.

Planting to a relatively standard density, and subsequently spacing when seedlings have become established (10-15 years) can be effective to ensure that both stand density and wildfire management goals are met.

This approach should be exercised judiciously in concert with other considerations such as those associated with forest health and surface fuel abatement.

### Prescribed Fire

Although fire plays an important ecological role in the forests of the Plan Area, the presence of many values threatened by fire across the landscape may be such that allowing wildfires to burn naturally will not be appropriate in most instances. One approach that may be valuable to emulate wildfires is the controlled use of fire as a management tool. Use of fire has also been described by multiple First Nations across BC as an important component of their traditional ecological knowledge and practices (Turner et al. 2000).

Prescribed fire can take many forms, depending on the objective and setting. In addition to mitigating aerial and surface fuels, prescribed fire can reinvigorate fire-adapted plant communities and provide important soil nutrient cycling functions. In all types of prescribed fire, a primary objective is often the **consumption of fine fuels** (e.g. <7.5cm in diameter) that are nearly impossible to dispose of by mechanical means and play a critical role in fire spread. While harvesting can emulate both low and high severity fires by thinning the canopy and ladder fuels, a critical difference is the surface fuel bed that is left behind. Recently burned areas are often devoid of fine fuels and can resist future fires for periods of many years (Stevens-Rumann et al. 2014b; Prichard et al. 2018b, 2018a). Conversely harvested areas have been found to accelerate fire spread and increase fire severity rather than hamper it in some instances (Stone et al. 2008). Even in areas where pile burning or raking has been utilized to mitigate coarse surface fuel loading, a continuous spread of fine debris often remains post-harvest that can promote fire spread and increase intensity even under more moderate conditions (Fahnestock 1960).

Although a wide range of prescribed fire types are possible and may be appropriate across a landscape from an ecological perspective, liability and operational constraints typically limit those that can be realistically applied. In the CFA and Plan Area, given current operational constraints and prevailing vegetation types, two primary methods of prescribed fire may be the most appropriate: 1) broadcast burning of harvest debris in cutblocks, and 2) low-intensity surface/understory burns in naturally-open forests, treated forests, and grasslands.

Broadcast burning cutblocks could have value across the entire CFA and Plan Area and may be particularly important in areas dominated by wetter or transitional forest types where high severity wildfires would have predominated historically. Partial cutting in these forest types is not always feasible or ecologically appropriate, and so mitigating fire hazard in harvested areas is one of the most effective means available to increase landscape resistance to future megafires. Broadcast burning blocks in these areas can both disrupt future fire flow and provide a better ecological mimic of fire as a natural disturbance process than harvest alone. The intent of such a program would not be high-intensity burns common in previous decades that were designed to consume debris of all sizes and often escaped containment. The intent would be to first mitigate coarse debris as needed through mechanical means or pile burning as the first stage of treatment to meet tenure obligations, followed by a broadcast burn of low intensity to target specifically the fine debris not abated by other means. This program needs to be carefully applied in consideration of other important factors such as wildlife values, forest health concerns, soil preservation, and invasive species, among others. Additionally, designing cutblocks with burn containment in mind can greatly facilitate implementation and simplify planning. Burns can be conducted in units with significant areas of retention;



however, the location and nature of this retention can greatly impact the complexity and feasibility. Often significant additional planning and preparation will be required to burn harvested areas with multiple retention patches.

Surface/understory broadcast burns in forested stands (and grasslands) are most appropriately applied in ecosystems where trees and native plants are fire-adapted and where stands were historically subject to a low- to mixed-severity fire regime prior to fire exclusion. This would include stands dominated by ponderosa pine, Douglas-fir, western larch, sagebrush, juniper, and grassland species, among others. In many instances, delivery of a burn that is within the historical range of variability for fire behavior and will elicit the desired fire effects may require mechanical thinning and/or surface fuel abatement as a preliminary treatment prior to burning. Burn indices and ignition patterns need to be considered carefully to avoid crown scorch to residual trees and undue soil heating that can hamper plant community recovery.

Implementing a prescribed fire program is complex and requires guidance and collaboration with the BC Wildfire Service, other regional fire experts, and a qualified burn boss. Initial burns should be conducted in circumstances where delivery is relatively simple and has a high probability of a successful outcome. Once capacity and social license have been established, the program can progress to attempt more complex burns with greater associated risk. A dedicated and thorough public and stakeholder engagement process will also be required to generate support for the program.

## ZONE DESCRIPTIONS

The following seven (7) proposed Wildfire Management Zones have been delineated within the western unit of the CFA:

1. **Okanagan Connector West (OCW);**
2. **Okanagan Connector East (OCE);**
3. **Peachland (PL);**
4. **Westbank (WB);**
5. **West Kelowna (WK);**
6. **Bear Creek (BC);** and
7. **Lambly Lake (LL).**

The following two (2) Wildfire Management Zones have been delineated within the eastern unit of the CFA and FNWL:

1. **Big White (BW);** and
2. **Eastern Road Corridor (ERC).**

Brief descriptions of the rationale and considerations unique to each WMZ are described below, grouped according to the BEC zones and general ecosystem types overlapped by WMZ boundaries. A table summarizing these WMZ and high-level management guidance is provided in Figure 8.

## WETTER AND TRANSITIONAL FOREST TYPES (ESSF AND MS BEC ZONES)

The historical fire regime in these WMZ would have been dominated by mixed- and high-severity fire regimes, and many of the tree species present are not resistant to fire given their relatively thin bark, shallow root systems, and crown structure that often includes low branches with dense foliage. Stands in forests of the Engelmann Spruce – Subalpine Fir and Montane Spruce BEC zones are often naturally dense, contain large surface and ground fuel loads in all size classes, and have shaded moist understories that are not available to burn except following extended drying, often during pronounced droughts. So while the maximum potential fire behavior of these stands can be very aggressive, the incidence of sustained ignitions is often limited to more extreme conditions, due to the moist nature of these forests. Stands within their historical range of variability will often represent a high fuel hazard, but interventions designed to reduce this hazard may not align with ecological and social objectives. Thus fuel management treatments in these WMZs need to carefully balance a variety of factors and be designed to avoid inadvertent forest health impacts and windthrow that could compromise their effectiveness. Altering stands to reduce crown fire potential and expected surface fire intensity may not represent a natural condition for these ecosystems, but may be warranted in key areas to provide for public safety, provided these are implemented judiciously. Treatments should also consider tactics beyond thinning such as pruning, surface fuel cleanup, deciduous conversion, alternative stocking standards, and post-harvest broadcast burning. In particular, broadcast burning in clearcut or patch-cut areas to better emulate post-fire fuel beds would represent a risk reduction activity that is still consistent with the historical fire ecology of these ecosystems.

The sections below provide a brief description of the rationale and specific considerations in each WMZ of this ecosystem classification.

### Okanagan Connector West (OCW)

This WMZ was delineated to reflect the presence of a major evacuation corridor and the need to maintain a buffer of reduced hazard along this route. Highway 97C “Okanagan Connector” is a vital option for local residents and visitors in the region for escape to the west during a wildfire event, and a key artery for suppression resources to access the region from other parts of the province. Maintaining key stands along the highway in a more fire resistant condition may also serve to increase the road’s utility as a suppression feature. The 97C corridor was broken into two separate WMZ to reflect the gradient of vegetation and climatic conditions that occurs along the highway’s length, and enable management to be tailored accordingly. The Okanagan Connector East WMZ is discussed in a later section addressing drier forest types. Special consideration should be given in the design of any fuel management treatments or harvest within the Okanagan Connector West WMZ to anticipate the effect stand intervention will have on both the aerial and surface fuel hazard given the forest types present. Human ignitions are common along this and other highways, and treatments that increase surface fuel drying can often have the unintended consequence of increasing ignition probability. However, reducing the potential for flame and ember impingement along the roadway is also a key aspect of maintaining the highway’s viability as an evacuation route. These and other factors will need to be balanced. Incorporation of deciduous species along the highway in key areas may represent the best balance of all factors, including visual quality for travellers along the route.

### Eastern Road Corridor

As with the Okanagan Connector WMZs, this area has been delineated to reflect the presence of key roadways expected to be utilized in an evacuation and populated during a wildfire event. Improvement of these road corridors from a fuels perspective may also aid their use for suppression in the future. As with the highway 97C corridor, the need for reducing potential aerial fire behavior and entrapment needs to be balanced with maintaining shade and

moisture on the surface and acknowledging visual quality and ecological objectives that may compete with fire hazard reduction.

### **Big White**

This WMZ has been delineated to follow ridgelines, roadways, and the community forest boundary to encompass as much of the immediate fireshed surrounding the Big White Ski Resort as possible within administrative constraints. Although the ecosystems in this region may be adapted to mixed- to high-severity fires, the landscape mosaic will still play a driving role in the progression of future fires. The Ski Resort represents a concentration of social and economic values at risk and is heavily visited in the summer months for recreation. The judicious application of strategic fuel management treatments tailored to wetter forest types combined with the maintenance of a landscape mosaic that naturally resists the flow of large fires may be the best approach to preserving these values while still respecting the ecological integrity of these ecosystems. Broadcast burning of any clearcut or patchcut areas may be one of the most powerful tools to this end, as it will better emulate the effect fires (rather than a harvesting surrogate alone) would have had on the landscape. Research has shown that recently burned areas can resist the spread of future fires and moderate their severity (Stevens-Rumann et al. 2014a, 2016; Prichard et al. 2018b, 2018a), thereby increasing the resilience of the landscape and providing better suppression opportunities.

### **DRIER FOREST TYPES (IDF, PP, AND BG BEC ZONES)**

The forest types in these drier ecosystems would have been driven by low- to mixed-severity fire regimes historically, and naturally included open stand structures with high canopy base heights and limited ladder fuels at certain stages of succession and landscape settings, given this disturbance history. The combined effects of fire exclusion and forest management practices have meanwhile resulted in extensive ingrowth and increased fire hazard in many stands at lower and mid elevations across southern BC, including in the Okanagan region (Blackwell and Gray 2003). Grasslands and sage and antelope brush woodlands also may also have become encroached under fire exclusion, and continued grass and needle litter buildup and shrub senescence can not only increase the fire hazard associated with these areas, but can threaten biodiversity through suppression of native plant communities and loss of wildlife habitat. Stand interventions designed to reduce fuel hazard are thus often consistent with ecological values and restoration objectives in drier forest types such as those dominated by ponderosa pine, larch, and Douglas-fir. Given their fire and drought-related adaptations, species in these ecotypes are also generally more conducive to the full suite of practices available for fuel management and wildfire-minded commercial harvest, including partial cutting/thinning. The most appropriate treatment in a given area will still need to consider a variety of factors, including local variation in vegetation, proximity to values at risk, ignition densities, wildlife, invasive species, and recreation, among others. In some locations fuel treatments that target a very low stand density may be appropriate. In other areas the surface fuel changes associated with a highly open canopy may dictate maintaining a greater measure of shading, particularly where human ignitions are frequent or where prolific grass growth could threaten adjacent values. Stands located on cooler aspects and/or those dominated by lodgepole pine will require different approaches and interventions than those dominated by Douglas-fir, larch, and ponderosa pine, given their varying attributes from a fire ecology, forest health, and silvics perspective. Prescribed burning of multiple forms may be a valuable maintenance treatment and restoration tool in many portions of these WMZ to manage fine fuel loads and reinvigorate native plant communities. Where appropriate, alternative stocking standards and incorporation of deciduous species into the landscape mosaic may also be beneficial to resilience and ecological function.

### **Okanagan Connector East (OCE)**

As with the adjacent WMZ to the west, the Okanagan Connector East WMZ is intended to produce a buffer of reduced fuel hazard along the Highway 97C evacuation route. The eastern portion of this WMZ is also delineated to reflect topography and fuels surrounding developed and residential areas as the highway approaches Okanagan Lake and the Westbank area. Improvement of this corridor from a fuel hazard perspective in key areas may also better enable its use as a suppression feature in the future and help disrupt landscape fire flow under certain conditions.

### **Peachland**

The Peachland WMZ follows ridgelines and the CFA boundary to create a buffer region around developed areas with a high density of values at risk in the vicinity of the Peachland community and the Brenda Mines Road evacuation corridor. A more resilient landscape mosaic and network of treated areas in this WMZ may also serve to disrupt landscape fire flow along the axis of Okanagan Lake during periods where strong winds funnel through the canyon topography.

### **Westbank**

This WMZ boundary connects to the western edge of the Okanagan Connector East WMZ and elsewhere follows the CFA boundary and ridgelines to create a buffer region around portions of the Westbank and West Kelowna communities. The WMZ also incorporates terrain downslope of the Jackpine Forest Service Road, which can serve as an evacuation route. The intent for management within this WMZ would be to create a network of fuel treatments, restored areas, and a patchwork across the landscape that would moderate the spread and severity of future fires. This would not only provide for increased public safety, but may also contribute to biodiversity, cultural, and ecological objectives at the same time. Treatments along evacuation corridors may reduce their risk of compromise during a wildfire, and provide for better suppression opportunities.

### **West Kelowna**

The objectives and rationale for the West Kelowna WMZ are very similar to those of the Westbank and Peachland WMZs located to the west and southwest, respectively. This WMZ is intended to create a buffer of enhanced resilience around the West Kelowna community and surrounding areas, and follows logical high topography along its western boundary. Efforts to manage fuels in key locations adjacent to values and to connect treated areas with natural barriers to fire spread will enhance the ability of the landscape to constrain future fire growth, and provide for enhanced ecological resilience overall within this WMZ.

### **Bear Creek**

This relatively small WMZ was delineated based on close proximity to Bear Lake Rd, which is a potential evacuation route to the north. Fire management activities in this WMZ will have the greatest value if enacted in concert with treatments and restoration conducted in adjacent land jurisdictions.

### **Lambly Lake**

This WMZ was delineated to encourage development of a buffer of reduced fuel hazard along the road corridor leading to Lambly Lake, which can serve as an evacuation route. The southern boundary of this WMZ also follows logical topography from a fire perspective as it connects to the CFA boundary on either side. Thus enhancing fire resilience and creating a favorable patchwork of stand conditions within this WMZ may aid in disrupting landscape fire flow and/or provide for better suppression features in key locations. The forest types in portions of this WMZ

may be slightly wetter or transitional, given that it overlaps the Montane Spruce BEC zone on its southwestern end, and is generally located at a higher elevation than other WMZ in this ecotype category. Care should be given to develop harvest strategies and fuel treatments in a manner that respects the unique attributes of these ecosystems and their associated fire ecology.

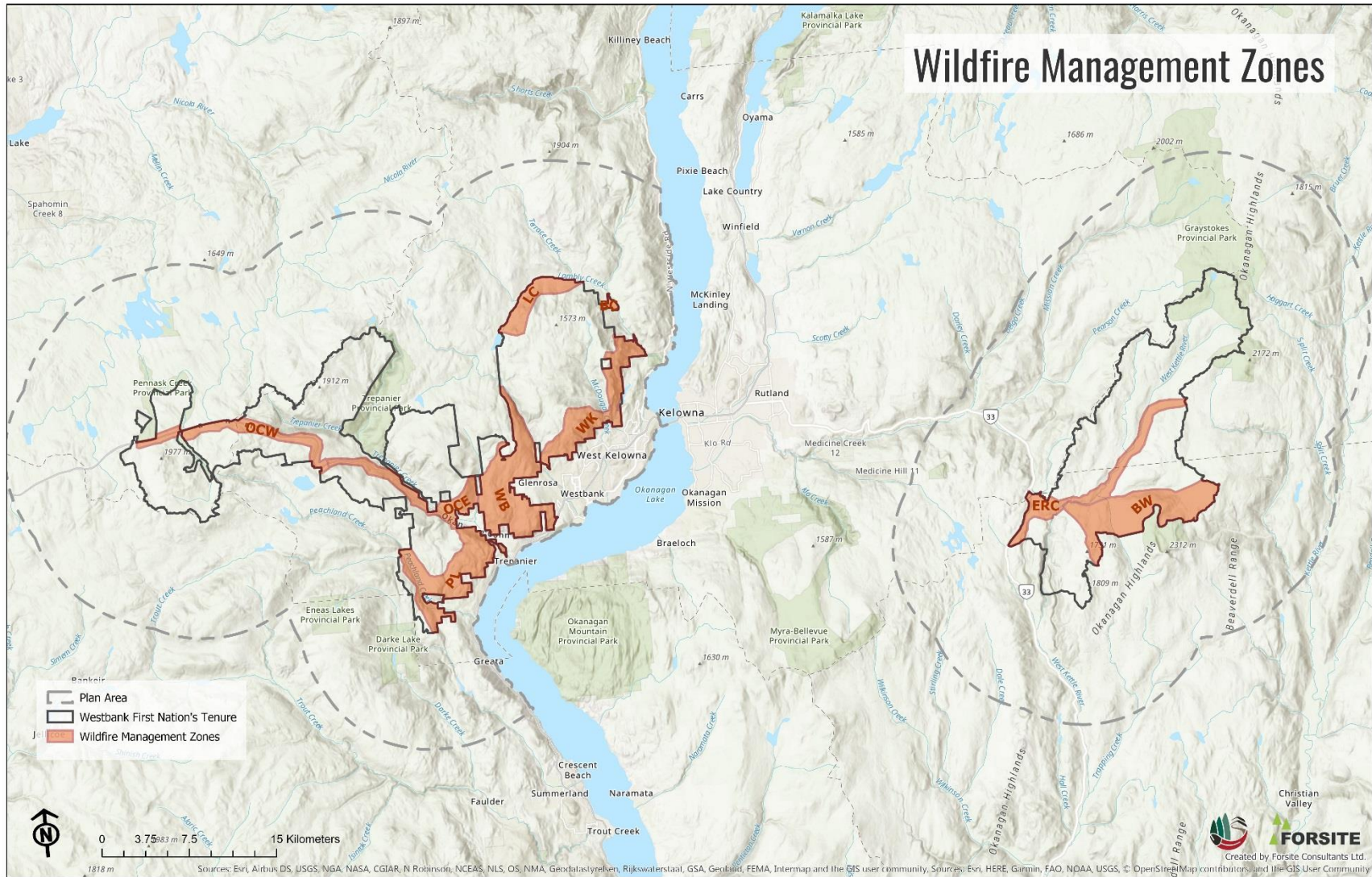


Figure 9. Wildfire Management Zones

Figure 10. Wildfire Management Zone Summary<sup>33</sup>

WMZ NAME	Code	Size (ha)	BEC Zones	Prevailing historical fire regime type	Adaptations for resistance present in dominant tree species:			Applicability of Fire Risk Mitigation Activities						
					Fire	Wind	Drought	Thinning/ Partial Cutting	Pruning	Surface Fuel Abatement	Juvenile Spacing	Alternative Stocking Standards	Post-Harvest Broadcast Burning	Surface/ Understory Burns in Forests and Grasslands
Okanagan Connector West	OCW	1466	ESSF, MS	Mixed-Severity, High-Severity				✓	✓	✓	✓	✓	✓	
Okanagan Connector East	OCE	1433	IDF	Low-Severity, Mixed Severity	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Peachland	PL	2811	IDF, PP	Low-Severity, Mixed Severity	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Westbank	WB	3655	IDF, PP, MS	Low-Severity, Mixed Severity	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
West Kelowna	WK	2434	IDF, PP, MS	Low-Severity, Mixed Severity	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Bear Creek	BC	91	IDF	Low-Severity, Mixed Severity	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lambly Lake	LL	1078	IDF, MS	Low-Severity, Mixed Severity	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Big White	BW	3602	ESSF, MS	Mixed-Severity, High-Severity				✓	✓	✓	✓	✓	✓	
Eastern Road Corridor	ERC	1835	ESSF, MS	Mixed-Severity, High-Severity				✓	✓	✓	✓	✓	✓	

LEGEND			
✓	Adaptation present in most or all species	✓	Activity may be valuable for fuel hazard reduction and consistent with ecological considerations in most forest types present
✓	Adaptation present in some species	✓	Activity may be valuable for fuel hazard reduction and consistent with ecological considerations in some forest types present
(Blank)	Not present	✓	Activity may be valuable for fuel hazard reduction but may not be consistent with ecological considerations in most forest types present
		(Blank)	Activity generally not appropriate or recommended in the forest types present

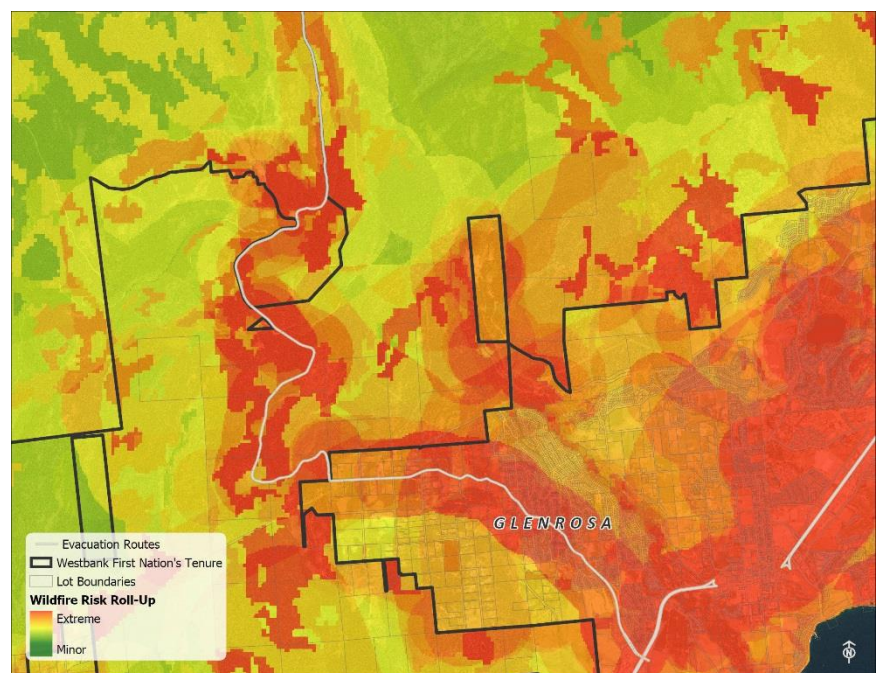
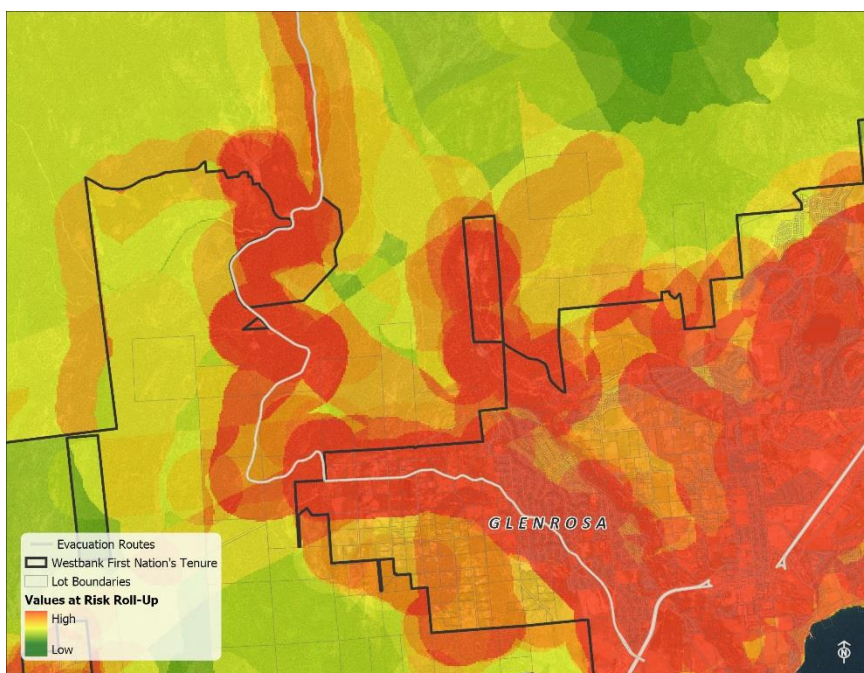
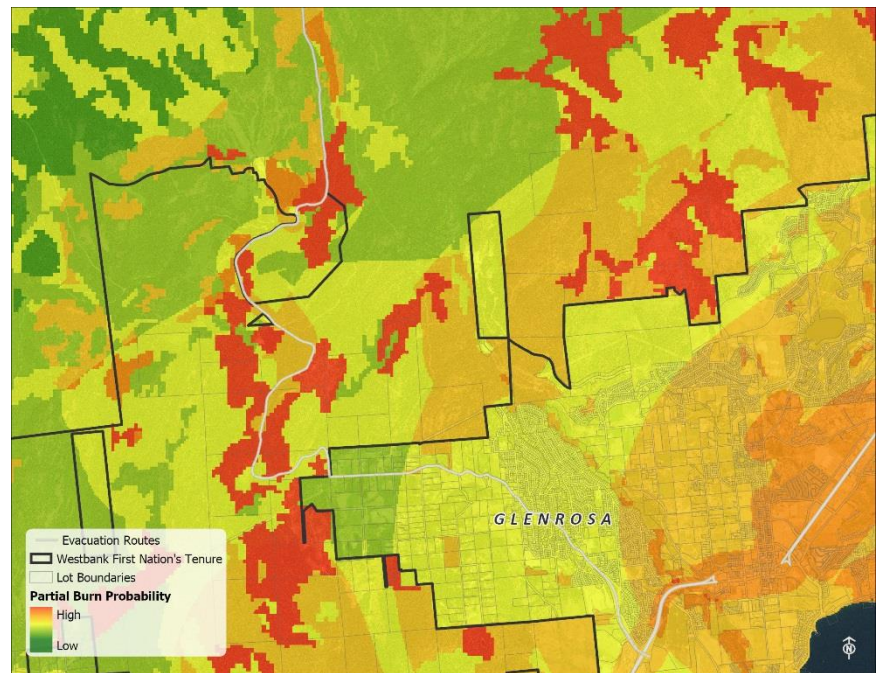
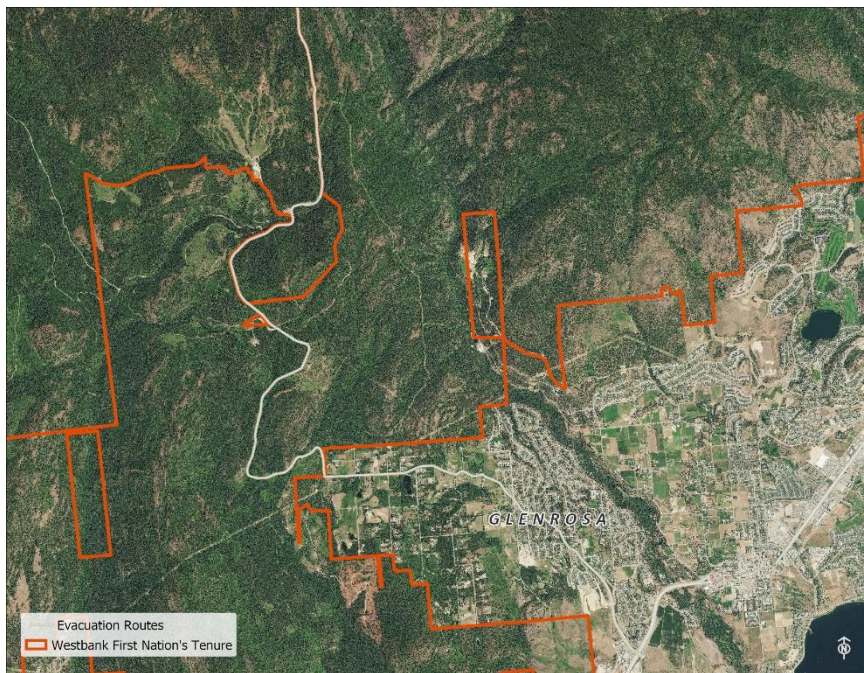
<sup>33</sup> It is important to note that the summary given here is a **very broad generalization** of the ecosystem attributes and best management principles that apply within each WMZ from a wildfire risk and ecology perspective. This table is not intended to provide a definitive guide for forest management planning and treatment design within each WMZ, but merely a visual tool for coarse comparison.

# Appendix 2 Detailed Management Strategies

## 01. Upper Glenrosa Strategy

July 2020

The City of West Kelowna’s Upper Glenrosa neighbourhood falls within the wildland urban interface (WUI) intermix and is located adjacent to Westbank First Nation’s Community Forest Agreement (CFA). Upper Glenrosa and adjacent area within the Westbank Community Forest has been identified by the Planning Team as a specific area of interest with significant values at risk that could be affected by a wildfire event. The strategies below represent actions that could be used to respond to the wildfire risks as identified.



### Summary of Values at Risk

#### HUMAN LIFE AND SAFETY

- Residences/structures
- Recreation area, sites, and trails
- Community of West Kelowna
- Jackpine FSR evacuation route

#### CRITICAL INFRASTRUCTURE

- BC Hydro transmission and primary distribution lines
- Crystal Mountain Resort
- Telemark Nordic Club

#### HIGH ENVIRONMENTAL AND CULTURAL VALUES

- Water licenses (domestic and irrigation PODs)
- Community watersheds (Trepanier Creek, Powers)
- Range Development
- Species at Risk Occurrence (Steer’s Head)

#### RESOURCES VALUES

- Area-based forest tenure (Community Forest)
- High-value Forests
- Mule Deer Winter Range
- Recreation sites and trails (Telemark Cross Country Ski Trails)
- Controlled Recreation Area (Crystal Mountain)
- Visually Sensitive Areas



## Management Strategies

### 1.1 COMPLETE AND MAINTAIN FUEL MANAGEMENT TREATMENTS ADJACENT TO AND ON PRIVATE LAND

**DISCUSSION:** Upper Glenrosa is a notable neighbourhood in the WUI intermix of West Kelowna with ongoing and planned development expanding further into the interface. The forested area adjacent to this neighbourhood falls within Westbank First Nation's CFA and presents high wildfire risk, driven by high headfire intensity and proximity to values. The presence of structures in close proximity to significant surrounding forested lands elevates the need for fuel management in this area. Since 2015, several fuel management treatments have been completed in a portion of this area, immediately adjacent to private land, by Ntityix Resources.

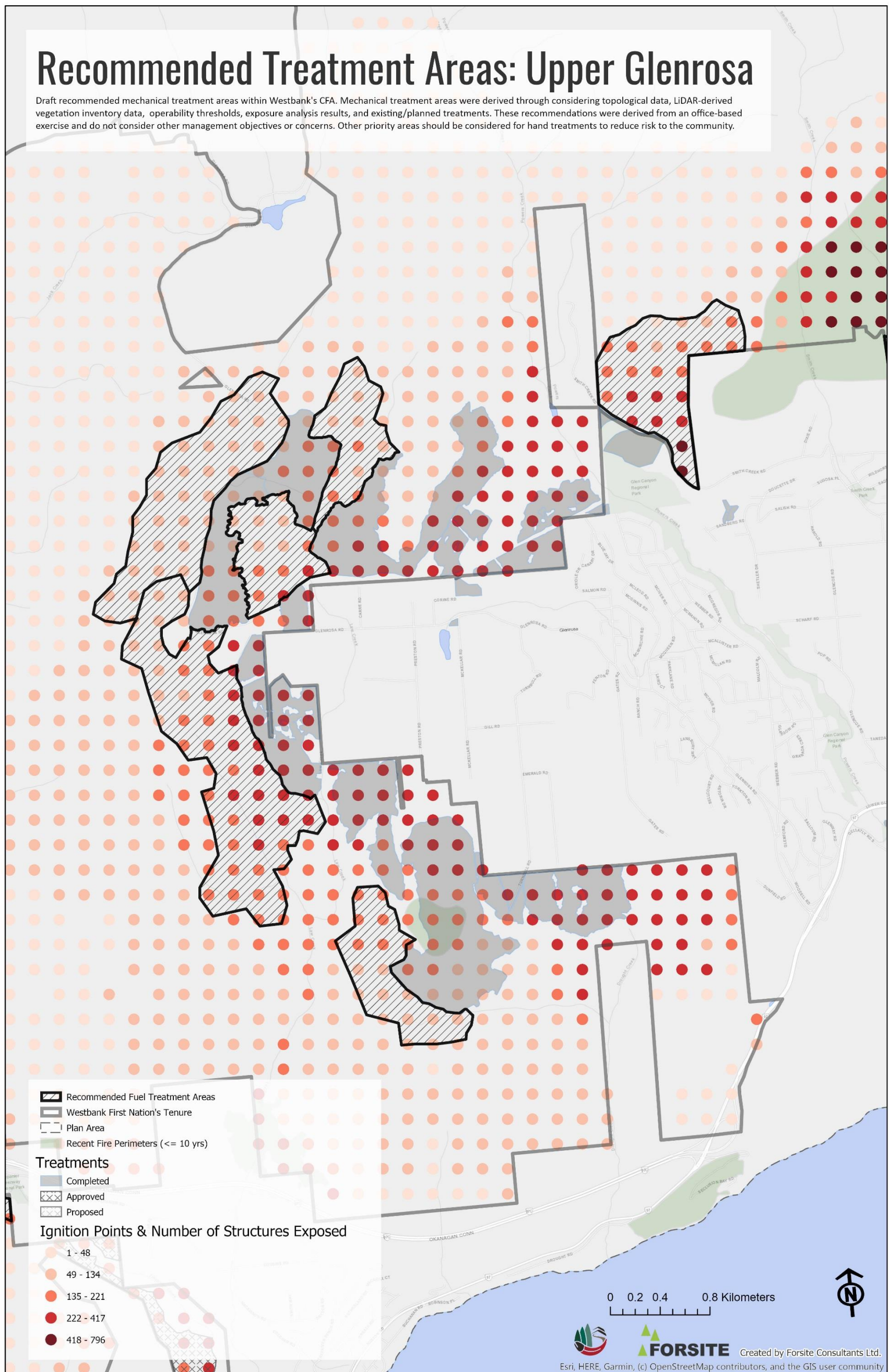
**ACTIONS:**

1. Assess fuel loads in existing fuel management treatments within the CFA to identify necessary maintenance in order to retain the intended benefits.
2. Develop and implement additional fuel hazard reduction treatments where feasible in locations identified in *Figure 1: Recommended Mechanical Fuel Treatment Areas* to reduce potential exposure to structures and risks to human life and safety in the event of a wildfire.
  - a. Consider existing fuel treatments and infrastructure (i.e. major travel corridors), topography, and vegetation to identify suitable areas to tie into existing fuel management treatments to create effective fuel treatments.
3. Support and collaborate with the City of West Kelowna, Central Okanagan Regional District, and BC Wildfire Service to develop strategies for improving the resiliency of Upper Glenrosa and the adjacent CFA. Consider:
  - a. Efficacy of City of West Kelowna bylaws and/or development guidelines included in the Official Community Plan (OCP) relating to new development in the WUI.
  - b. Fuel loads adjacent to and on private land.

**ACTION RESPONSIBILITY:** Ntityix Resources, City of West Kelowna

**PARTNERS:** Central Okanagan Regional District, BC Wildfire Service, Private Landowners

**RISK RESPONSE GOAL:** Reduce wildfire risk through fuel hazard reduction.



**Figure 11.** Recommended Fuel Treatment Areas for Upper Glenrosa. Red boundaries indicate treatment areas where mechanical treatments are likely feasible. Priority Areas identified through the exposure analysis should still be considered for fuel management treatments, however it is likely that hand treatments will need to be considered in these areas.

## 1.2 EVACUATION PLANNING FOR THE JACKPINE FSR

**DISCUSSION:** The Jackpine Forest Service Road (FSR) is an alternative evacuation route for Glenrosa that leads to the Bear FSR, ultimately providing access from Glenrosa to Westside Road or the Okanagan Connector (Highway 97c) (Figure 2). Maintenance and signage of the Jackpine FSR, however, varies greatly depending on current harvesting operations or other intermittent maintenance operations conducted by the Regional District. With current uncertainty around ownership and planning/maintenance of the evacuation route, the Jackpine FSR does not currently provide a reliable evacuation route for the public.

**ACTIONS:**

1. Assess the current condition of the Jackpine FSR as a reliable evacuation route. Consider:
  - a. Physical condition of the FSR for public access.
  - b. Fuel loads along the evacuation corridor.
  - c. Cellular coverage.
2. Conduct formal evacuation planning for the Jackpine FSR. Consider discussing and assigning responsibility to the following aspects to enhance the resiliency and reliability of the evacuation route:
  - a. Regular scheduled maintenance (i.e. grading).
  - b. Evacuation route signage.
3. Based on the assessment of fuels along the evacuation corridor, engage with relevant forest tenure-holders and BC Wildfire Service to discuss potential fuel modifications along the corridor.

**ACTION RESPONSIBILITY:** Province of BC, Okanagan Shuswap Resource District, Central Okanagan Regional District, Ntityix Resources, City of West Kelowna

**PARTNERS:** Tolko Industries Ltd., BC Wildfire Service

**RISK RESPONSE GOAL:** Enhance the viability of the Jackpine FSR through evacuation planning and maintenance commitments.

## 1.3 PURSUE EMERGENCY AND EVACUATION PLANNING FOR THE COMMUNITY

**DISCUSSION:** Emergency and evacuation planning is a critical component for preparing seamless emergency response in the event of a wildfire threatening the community. Ensuring that the City of West Kelowna has a comprehensive evacuation plan to reduce risk to human life and safety as well as critical infrastructure is critical to decrease uncertainty in the event of a catastrophic event.

**ACTIONS:**

1. Identify and understand areas of the community along the WUI with one-way (egress) access in Upper Glenrosa (Figure 2). Develop strategies to respond to the related risks that may consider:
  - a. Ensuring evacuation route signage is in place during the fire season.
  - b. Cell coverage.
  - c. Resiliency of evacuation routes (i.e. grass alongside evacuation corridors, etc.).

**ACTION RESPONSIBILITY:** City of West Kelowna

**PARTNERS:** Central Okanagan Regional District, BC Wildfire Service, Ntityix Resources

**RISK RESPONSE GOAL:** Ensure evacuation planning and emergency planning is robust to reduce risk in the event of an evacuation to Upper Glenrosa.

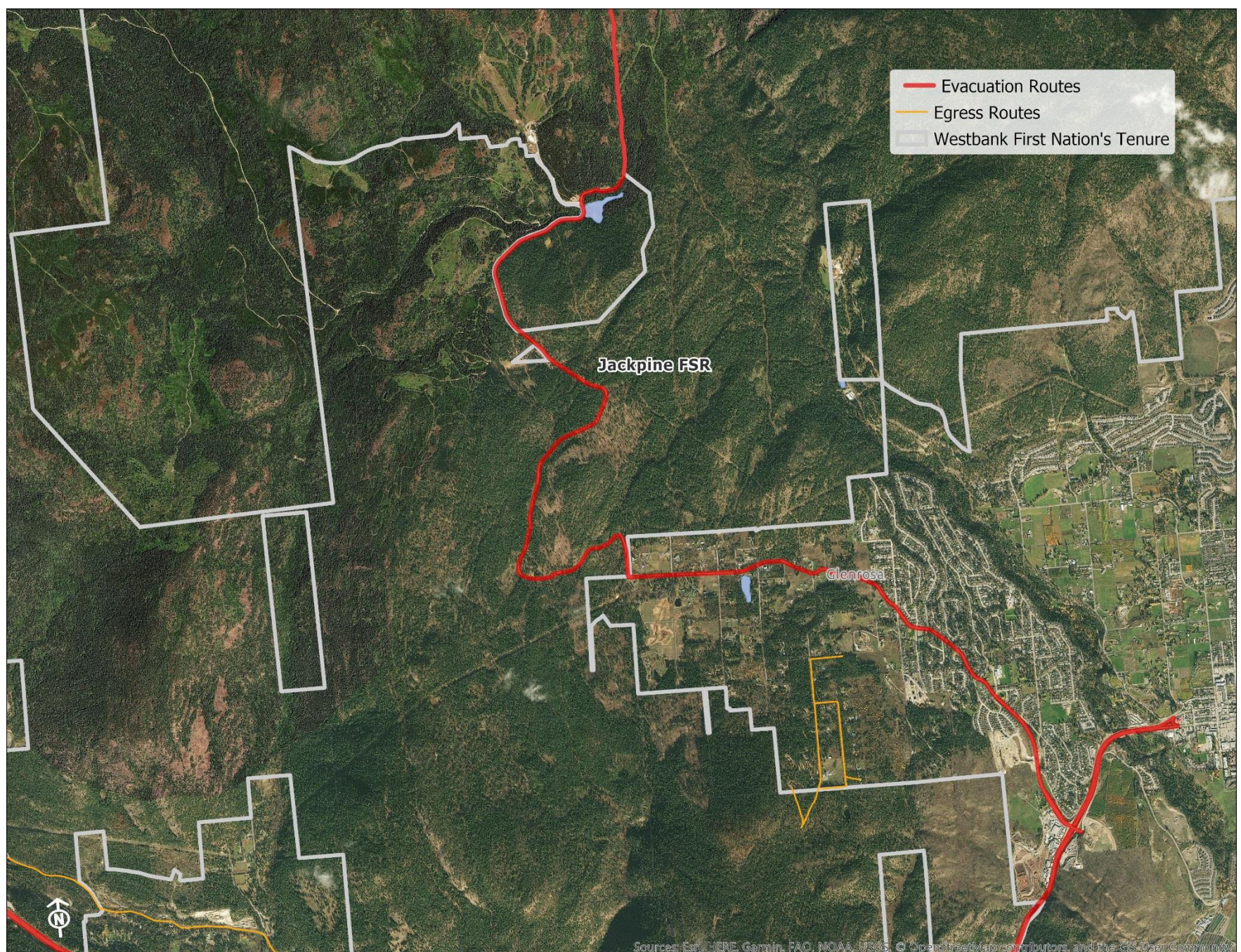


Figure 12. Jackpine FSR and egress routes in Upper Glenrosa.

## 1.4 EDUCATE AND ENGAGE PRIVATE LANDOWNERS & THE PUBLIC

**DISCUSSION:** Community education and engagement is a critical component of wildfire planning and management. While Ntityix Resources can mitigate identified hazards within Westbank First Nation's tenured area, fuel management solely within the CFA will not reduce wildfire risk on private property. Without the engagement and participation of private landowners, these efforts may not be as successful in responding to the risks. Communicating the results of this WRMP and the implications for community members is a critical step necessary to reduce overall wildfire risk management in Upper Glenrosa.

**ACTIONS:**

1. Collaborate with the BC Wildfire Service in the engagement and education with private land owners regarding the results of the WRMP and the overall wildfire risks. Consider:
  - a. A door-to-door program to discuss wildfire risks on private properties and existing resources.
  - b. Co-hosting an Open House where programs like FireSmart can be discussed.
2. Participate in planned events around wildfire risk management to connect with the general public and disseminate information.
3. Increase monitoring of area through Compliance and Enforcement and Westbank First Nation's Conservation Officer Position.

**ACTION RESPONSIBILITY:** City of West Kelowna, Ntityix Resources

**PARTNERS:** BC Wildfire Service, Private Landowners

**RISK RESPONSE GOAL:** Informed transfer of risk to the private land owners/public. Reduced risk through increased public action.

## 1.5 CONSIDER THE USE OF PRESCRIBED FIRE

**DISCUSSION:** Fire exclusion has resulted in unnatural fuel compositions in fire prone areas that support high intensity wildfires. Long-term forest management for wildfire management objectives should be more reflective of the natural disturbance regime and ecological factors related to wildland fuels. Prescribed fire can be used to achieve multiple objectives. The primary purpose of prescribed fire is the consumption of fine or modification of fuels for a range of objectives. Traditional and cultural First Nation values, wildlife habitat, biodiversity, and fuel management can benefit from the reintroduction of fire to the landscape. Negative connotations with wildfire has led to challenges in gaining public acceptance, however recent unprecedented fire seasons are changing the narrative and public acceptance around proactive fire management. Previously treated (i.e. thinned) stands and grassland areas surrounding private land and/or high risk areas in Upper Glenrosa provide ideal opportunities to utilize prescribed fire as a form of maintenance to reduce fine and flashy fuels.

**ACTIONS:**

1. Engage with Westbank First Nation and other local First Nations to discuss traditional or historical prescribed burning practices and the desire to return fire to the landbase.
2. Collaborate with BC Wildfire Service and City of West Kelowna to review tools to increase the use of low-intensity prescribed fire and identify potential treatment areas/Potential Operational Delineations (PODs). Consider factors including, but not limited to:
  - a. Presence of containment lines;
  - b. Burnable and contiguous fuels for consumption;
  - c. Public support for prescribed fire and associated smoke;
  - d. Operable landbase;
  - e. Timing of burn operations; and
  - f. Availability of resources to implement the planning and execution.
3. Support the City of West Kelowna in a proactive public education program related fuel management and specifically the use of prescribed fire.
4. Engage with Okanagan Shuswap Resource District to leverage funding sources for prescribed fire for ecosystem restoration in support of reducing wildfire hazard.
5. Identify a pilot prescribed fire area within the vicinity of Upper Glenrosa and engage with BC Wildfire Service in early planning phases to aid in development of treatment design to align with burn plans for these activities.
  - a. Implement burn planning, assess efficacy, public buy-in, etc. and develop additional strategies for future implementation.

**ACTION RESPONSIBILITY:** Ntityix Resources

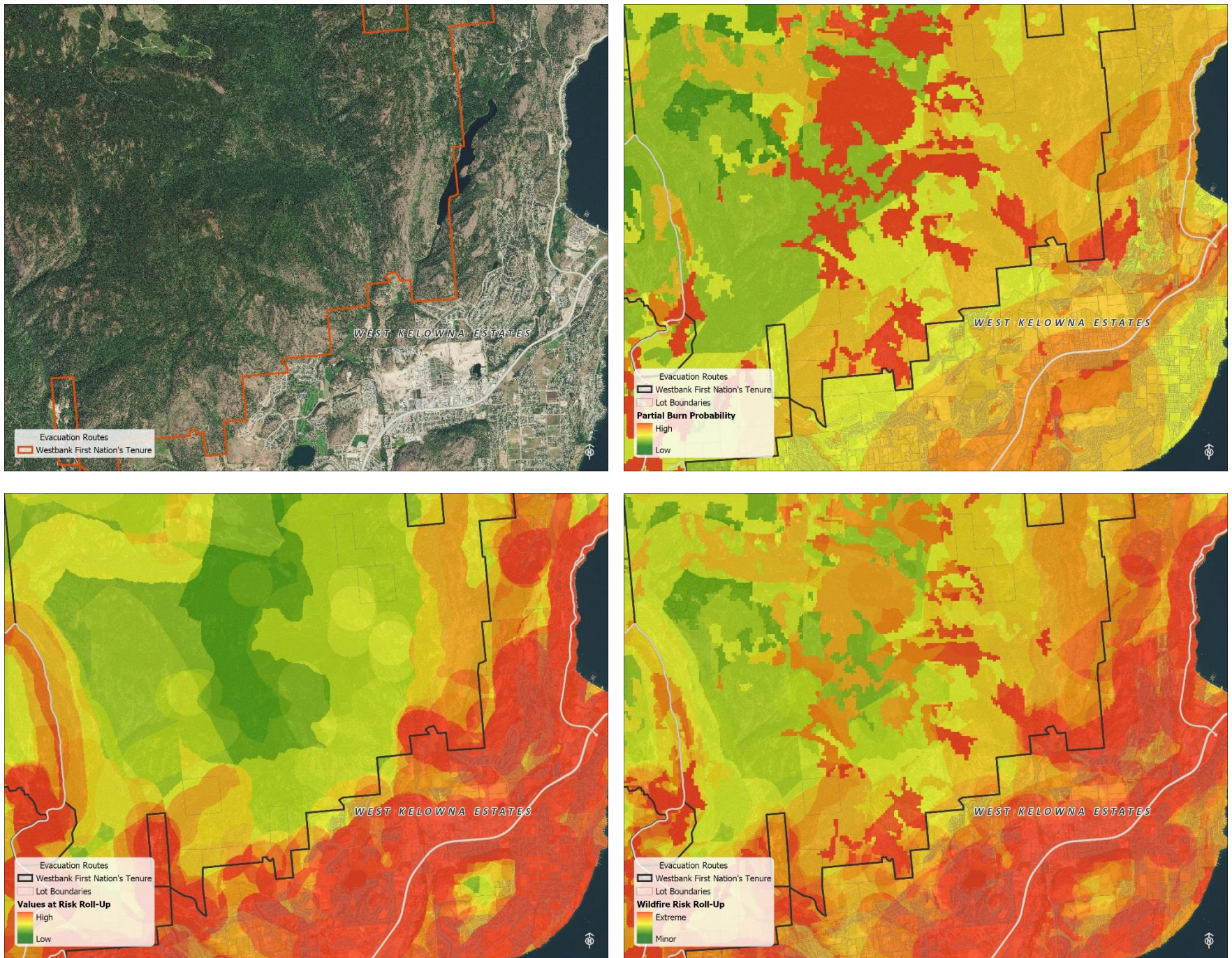
**PARTNERS:** Westbank First Nation, City of West Kelowna, BC Wildfire Service, Okanagan Shuswap Resource District

**RISK RESPONSE GOAL:** Reduce wildfire risk through the introduction of prescribed burning as a management tool.

## 02. West Kelowna & West Kelowna Estates Strategy

July 2020

The West Kelowna Estates area is a prominent neighbourhood in the northeast of the City of West Kelowna that is located adjacent to Westbank First Nation’s Community Forest Agreement (CFA). Situated near significant contiguous fuels with high headfire intensity, the Planning Team has identified this location as a specific area of interest with extreme wildfire risk. The strategies below represent actions that could be used to respond to the wildfire risks as identified.



### Summary of Values at Risk

#### HUMAN LIFE AND SAFETY

- Residences/structures
- Recreation trails
- Community of West Kelowna
- Evacuation Routes (Hwy 97, Westside Rd)
- Egress Routes
- Critical Travel Corridors

#### CRITICAL INFRASTRUCTURE

- BC Hydro transmission and primary distribution lines
- Fortis Gas Distribution Stations
- Communications Towers
- BC Wildfire Weather Station
- First Responder Facilities (West Kelowna Fire Department 33)
- Major & Minor Community Infrastructure (Schools, Heliport, Wineries, Golf Clubs)

#### HIGH ENVIRONMENTAL AND CULTURAL VALUES

- Water licenses (domestic and irrigation PODs)
- Water Tanks
- Community watersheds (Rose Valley, Powers)
- Range Development
- Species at Risk Occurrences (various species)

#### RESOURCES VALUES

- Area –based forest tenure (Community Forest)
- Mule Deer Winter Range
- Recreation trails
- Rose Valley Regional Park, Glen Canyon Regional Park
- Visually Sensitive Areas (Retention)

## Management Strategies

### 2.1 COMPLETE AND MAINTAIN FUEL MANAGEMENT TREATMENTS ADJACENT TO AND ON PRIVATE LAND

**DISCUSSION:** West Kelowna Estates is a notable neighbourhood in northeast West Kelowna. The adjacent forested area to this neighbourhood falls within Westbank First Nation's CFA and presents high wildfire risk, driven by high headfire intensity and proximity to values. The presence of structures in close proximity to significant surrounding forested lands elevates the need for fuel management in this area. A few fuel management treatments have occurred in this area dating from 2011 to 2016.

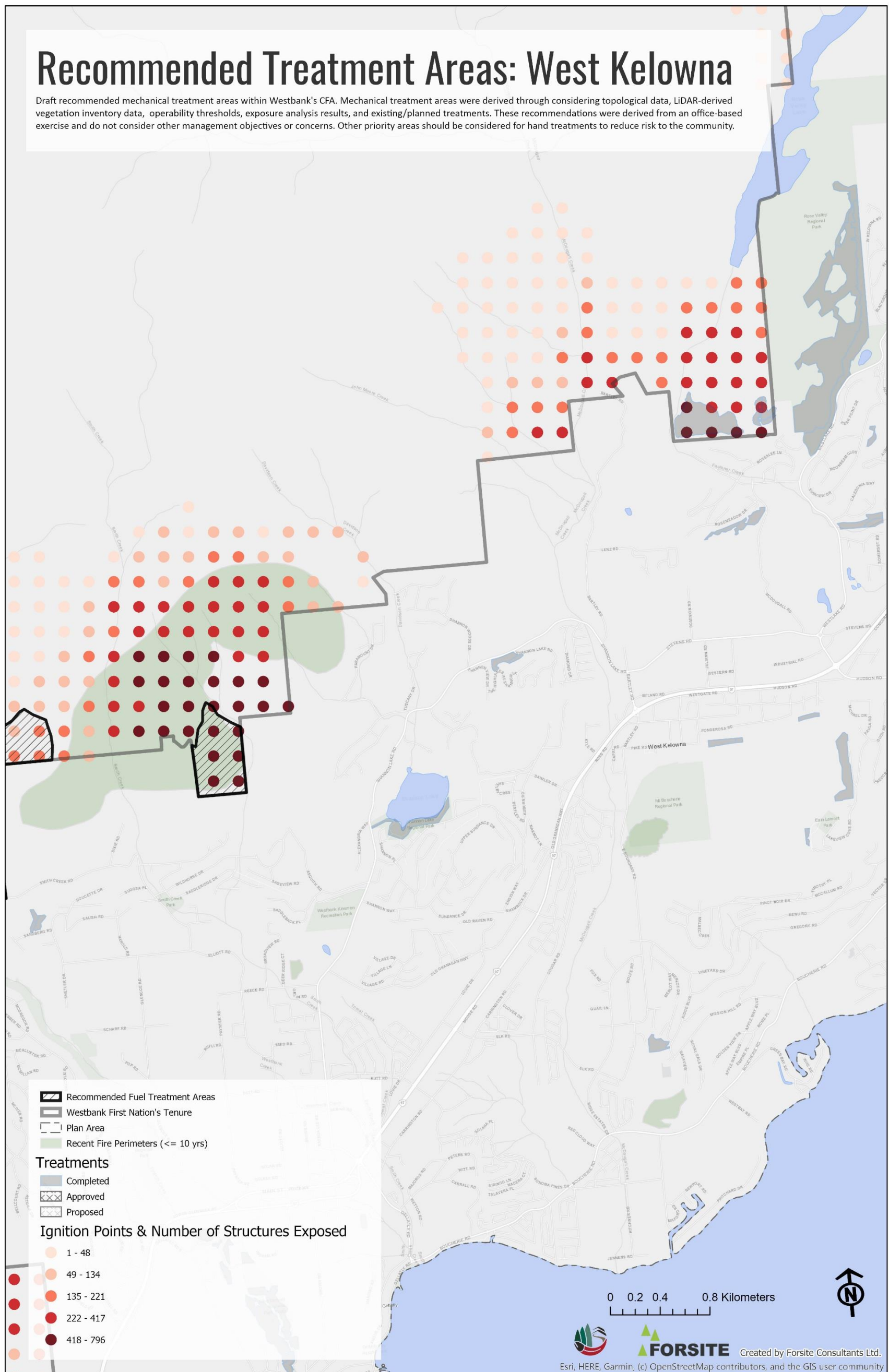
**ACTIONS:**

4. Assess fuel loads in the existing fuel management treatment within the CFA immediately adjacent to private land to identify necessary maintenance in order to retain the intended benefits.
5. Develop and implement additional fuel hazard reduction treatments in locations identified in *Figure 3: Recommended Fuel Treatment Areas* to reduce potential exposure to structures and risks to human life and safety in the event of a wildfire.
  - a. Consider existing fuel treatments and infrastructure (i.e. major travel corridors), topography, and vegetation to identify suitable areas to tie into existing fuel management treatments to create a more effective fuel treatment.
  - b. Consider economically viable harvest opportunities/methods to reduce high burn probability within the CFA to the north of West Kelowna Estates.
6. Support and collaborate with the Central Okanagan Regional District, and BC Wildfire Service to develop strategies for improving the resiliency of West Kelowna Estates and the adjacent CFA. Consider:
  - a. Efficacy of City of West Kelowna bylaws and/or development guidelines included in the Official Community Plan (OCP) relating to new development in the WUI.
  - b. Fuel loads adjacent to and on private land.

**ACTION RESPONSIBILITY:** Ntityix Resources, City of West Kelowna

**PARTNERS:** Central Okanagan Regional District, BC Wildfire Service, Private Landowners

**RISK RESPONSE GOAL:** Reduce wildfire risk through fuel hazard reduction.



**Figure 13.** Recommended Fuel Treatment Areas for West Kelowna Estates. Red boundaries indicate treatment areas where mechanical treatments are likely feasible. Priority Areas identified through the exposure analysis should still be considered for fuel management treatments, however it is likely that hand treatments will need to be considered in these areas.

## 2.2 MANAGE FOR THE RESILIENCY OF COMMUNITY WATERSHEDS IN LIGHT OF WILDFIRE RISK

**DISCUSSION:** The Powers and Lambly Creek Community Watersheds supply drinking water to approximately 24,000 residents across West Kelowna and Westbank<sup>1,2</sup>. Wildfire poses a high-risk to both the water quality and quantity associated with these community watersheds.

**ACTIONS:**

1. Initiate dialogue within the City of West Kelowna and Westbank regarding the risk of catastrophic loss of forest cover within the community watersheds due to wildfire. Consider the following:
  - a. Current condition of the watersheds and relative levels of disturbance.
  - b. Current susceptibility of the watersheds to wildfire (i.e. fuel continuity and loads, forest health concerns, etc.).
  - c. Targets or thresholds to maintain sufficient water quality and quantity to the community.
  - d. Guidance for forest management companies to include in their fuel management activities that protect water quality.
  - e. Identification of strategic harvest areas to mitigate wildfire risk.
  - f. Significant concerns from community groups as it pertains to disturbance in the watershed.
2. Develop strategies in response to this discussion to support improved watershed resilience.

**ACTION RESPONSIBILITY:** City of West Kelowna, Westbank

**PARTNERS:** Central Okanagan Regional District, Okanagan Shuswap Resource District, BC Wildfire Service, Ntityx Resources, Relevant Community Groups

**RISK RESPONSE GOAL:** Reduce risks to water supply through fostering a landscape more resilience to wildfire.

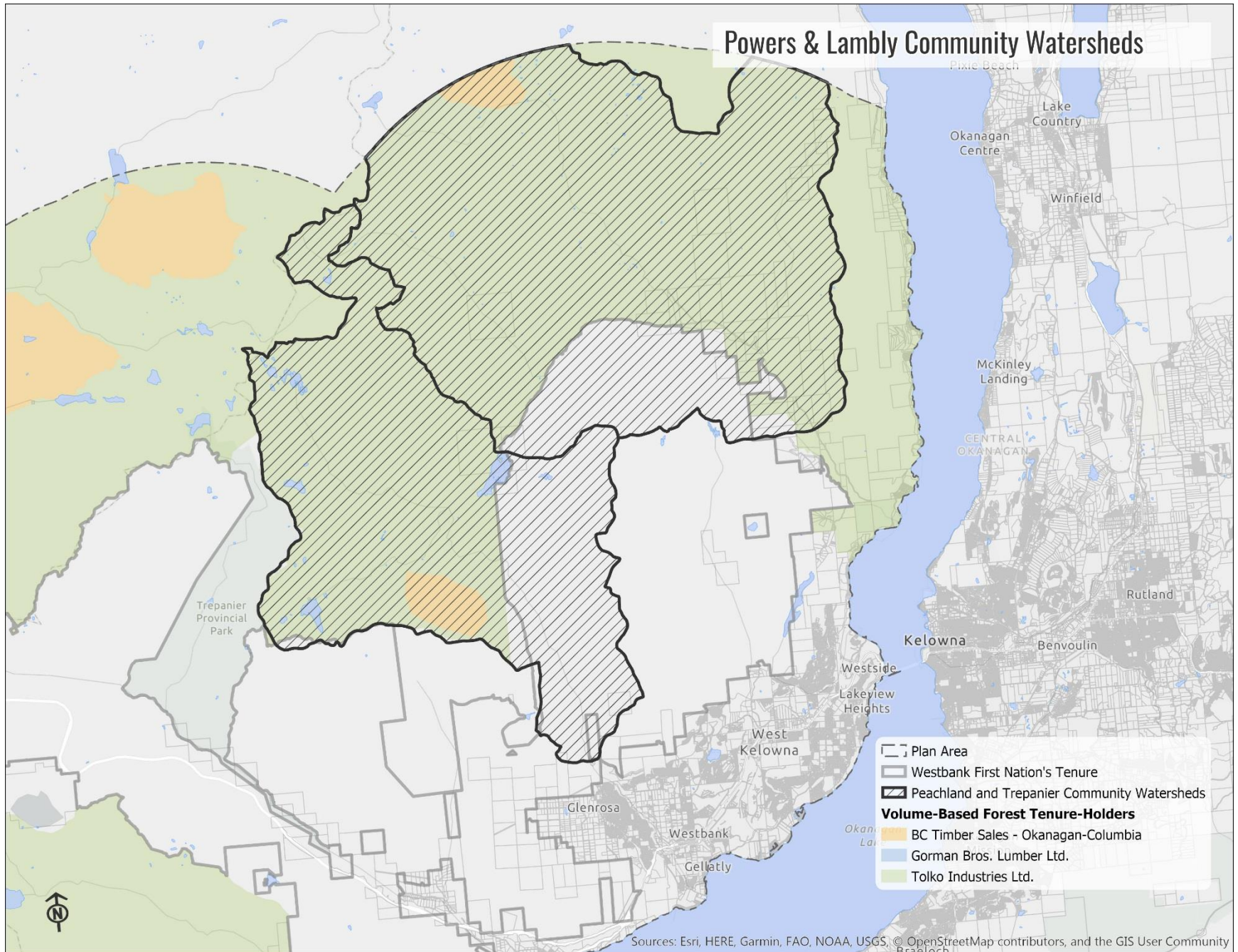


Figure 14. Powers and Lambly Community Watersheds and relevant forest-tenure holders.

## 2.3 EDUCATE AND ENGAGE PRIVATE LANDOWNERS & THE PUBLIC

**DISCUSSION:** Community education and engagement is a critical component of wildfire planning and management. While Ntityx Resources can mitigate identified hazards within Westbank First Nation’s tenured area, fuel management solely within the CFA will not reduce wildfire risk on private property. Without the engagement and participation of private landowners, these efforts may not be as successful in responding to the risks. Communicating the results of this WRMP and the implications for community members is a critical step necessary to reduce overall wildfire risk management in West Kelowna Estates.

**ACTIONS:**

4. Collaborate with the BC Wildfire Service in the engagement and education with private land owners regarding the results of the WRMP and the overall wildfire risks. Consider:
  - a. A door-to-door program to discuss wildfire risks on private properties and existing resources.
  - b. Co-hosting an Open House where programs like FireSmart can be discussed.
  - c. Development of an educational and informative brochure discussing wildfire risks and how private landowners can play their part.
5. Participate in planned events around wildfire risk management to connect with the general public and disseminate information.

<sup>1</sup>[http://a100.gov.bc.ca/appsdata/acat/documents/r19510/PowersCreekAssessment\\_1280267186154\\_7e3b1986e719e48e421f230d694baea72c5122d76de17e3f3fe7528330c7fab.pdf](http://a100.gov.bc.ca/appsdata/acat/documents/r19510/PowersCreekAssessment_1280267186154_7e3b1986e719e48e421f230d694baea72c5122d76de17e3f3fe7528330c7fab.pdf)

<sup>2</sup>[http://a100.gov.bc.ca/appsdata/acat/documents/r19919/LamblyCreekSourceAssessmentReport2\\_1285792136244\\_e0bd7e8bbf1803c8604e85502c8be38c9fd8648a0fa17eab4fafd53e92a49e90.pdf](http://a100.gov.bc.ca/appsdata/acat/documents/r19919/LamblyCreekSourceAssessmentReport2_1285792136244_e0bd7e8bbf1803c8604e85502c8be38c9fd8648a0fa17eab4fafd53e92a49e90.pdf)



6. Continue to post wildfire awareness signs along major transportation corridors, at camp sites, and at high-use recreation areas that specify the current wildfire danger rating and how to report a wildfire.

**ACTION RESPONSIBILITY:** Ntityx Resources, City of West Kelowna

**PARTNERS:** BC Wildfire Service

**RISK RESPONSE GOAL:** Informed transfer of risk to the private land owners/public. Reduced risk through increased public action.

## 2.4 PURSUE EMERGENCY AND EVACUATION PLANNING FOR THE COMMUNITY

**DISCUSSION:** Emergency and evacuation planning is a critical component for preparing seamless emergency response in the event of a wildfire threatening the community. Ensuring that the City of West Kelowna has a comprehensive evacuation plan to reduce risk to human life and safety as well as critical infrastructure is critical to decrease uncertainty in the event of a catastrophic event.

**ACTIONS:**

2. Identify and understand areas of the community along the WUI with one-way (egress) access in West Kelowna Estates (Figure 4). Develop strategies to respond to the related risks that may consider:
  - a. Ensuring evacuation route signage is in place during the fire season.
  - b. Cell coverage.
  - c. Resiliency of evacuation routes (i.e. grass alongside evacuation corridors, etc.).

**ACTION RESPONSIBILITY:** City of West Kelowna

**PARTNERS:** Central Okanagan Regional District, BC Wildfire Service, Ntityx Resources

**RISK RESPONSE GOAL:** Ensure evacuation planning and emergency planning is robust to reduce risk in the event of an evacuation to West Kelowna Estates.

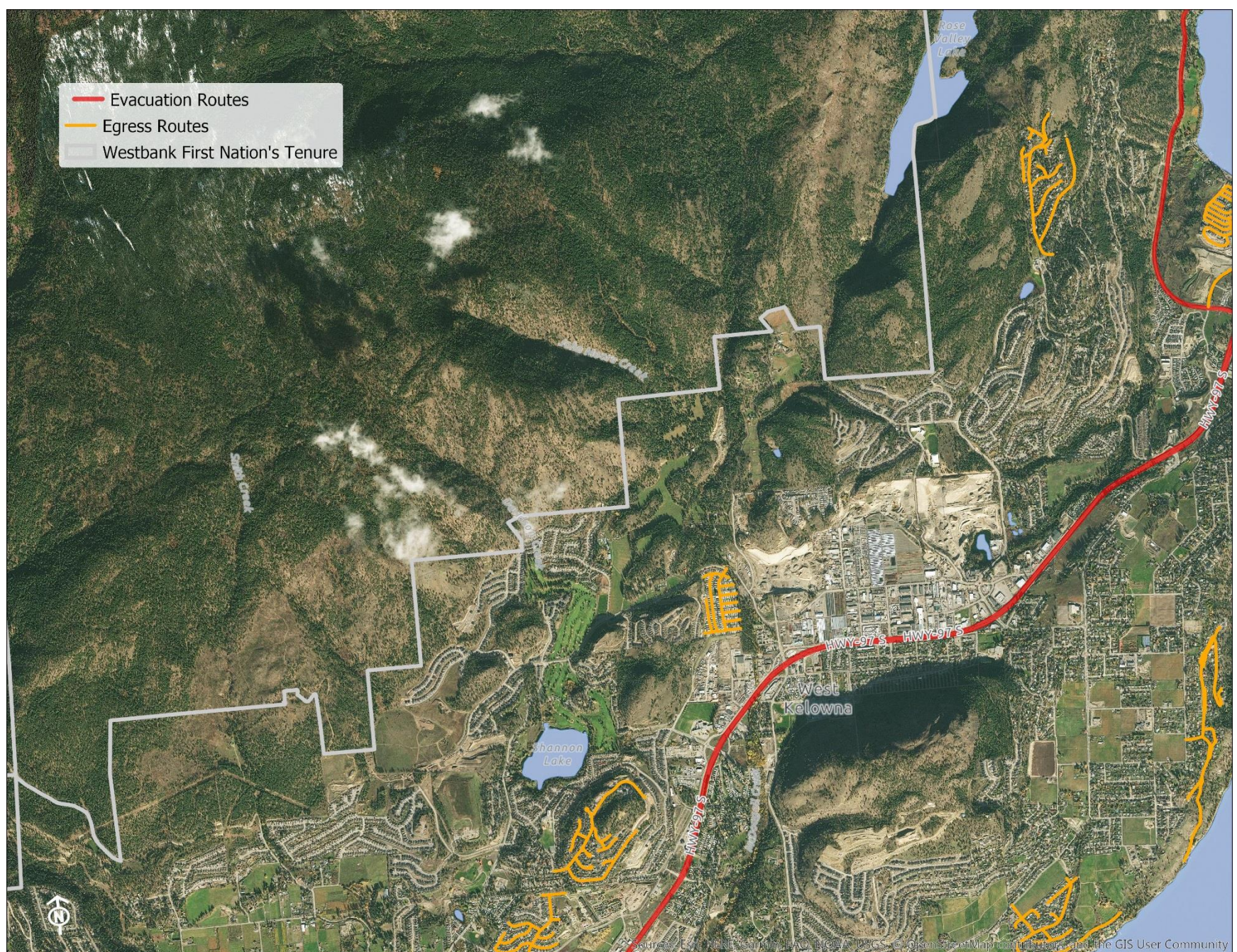


Figure 15. Evacuation and egress routes identified in West Kelowna Estates.

## 2.5 CONSIDER THE USE OF PRESCRIBED FIRE

**DISCUSSION:** Fire exclusion has resulted in unnatural fuel compositions in fire prone areas that support high intensity wildfires. Long-term forest management for wildfire management objectives should be more reflective of the natural disturbance regime and ecological factors related to wildland fuels. Prescribed fire can be used to achieve multiple objectives. The primary purpose of prescribed fire, however, is the consumption of fine fuels that are virtually impossible to address through mechanical and hand treatments. Traditional and cultural First Nation values, wildlife habitat, biodiversity, and fuel management can benefit from the reintroduction of fire to the landscape. Negative connotations with wildfire has led to challenges in gaining public acceptance, however recent unprecedented fire seasons are changing the narrative and public acceptance around proactive fire management. Previously treated (i.e. thinned) stands and grassland areas surrounding private land and/or high risk areas in the West Kelowna Estates area provide ideal opportunities to utilize prescribed fire as a form of maintenance to reduce fine and flashy fuels.

**ACTIONS:**

6. Engage with Westbank First Nation and other local First Nations to discuss traditional or historical prescribed burning practices and the desire to return fire to the landbase.
7. Collaborate with BC Wildfire Service and City of West Kelowna to review tools to increase the use of low-intensity prescribed fire and identify potential treatment areas/Potential Operational Delineations (PODs). Consider factors including, but not limited to:

- a. Presence of containment lines;
  - b. Burnable and contiguous fuels for consumption;
  - c. Public support for prescribed fire and associated smoke;
  - d. Operable landbase;
  - e. Timing of burn operations; and
  - f. Availability of resources to implement the planning and execution.
8. Support the City of West Kelowna in a proactive public education program related fuel management and specifically the use of prescribed fire.
  9. Engage with Okanagan Shuswap Resource District to leverage funding sources for prescribed fire for ecosystem restoration in support of reducing wildfire hazard.
  10. Identify a pilot prescribed fire area within the vicinity of West Kelowna Estates and engage with BC Wildfire Service in early planning phases to aid in development of treatment design to align with burn plans for these activities.
    - a. Implement burn planning, assess efficacy, public buy-in, etc. and develop additional strategies for future implementation.

**ACTION RESPONSIBILITY:** Ntityix Resources

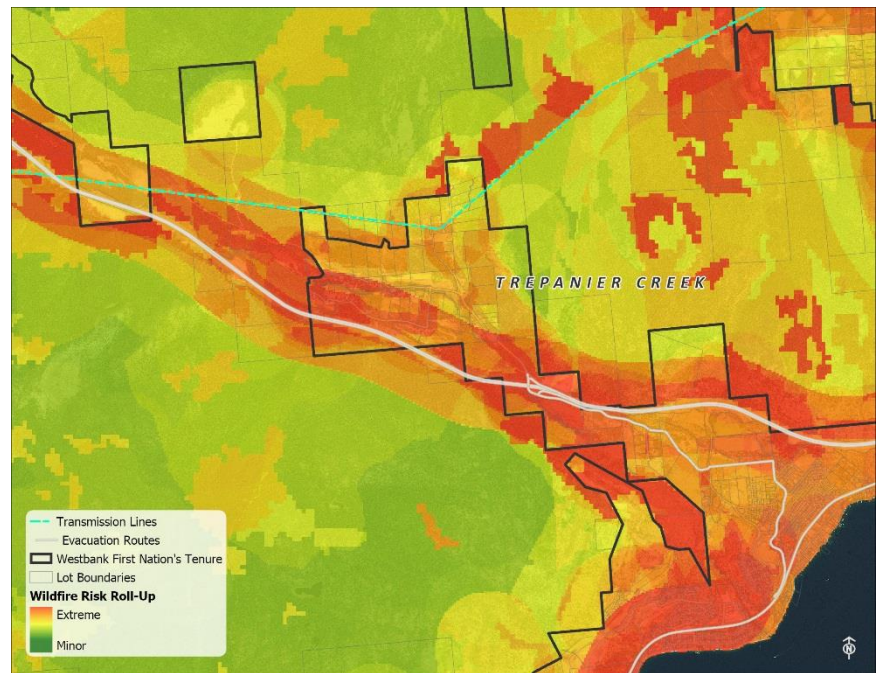
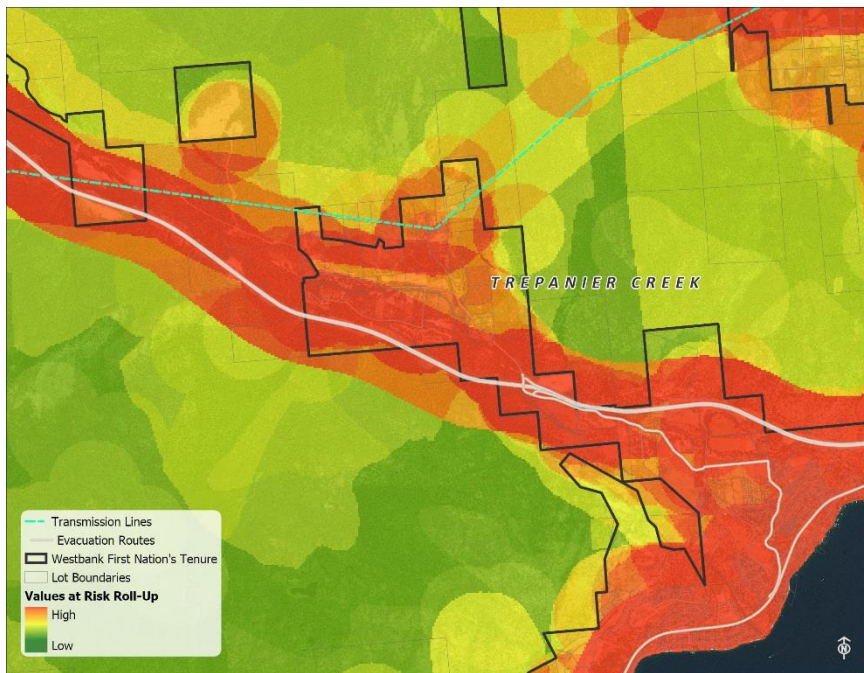
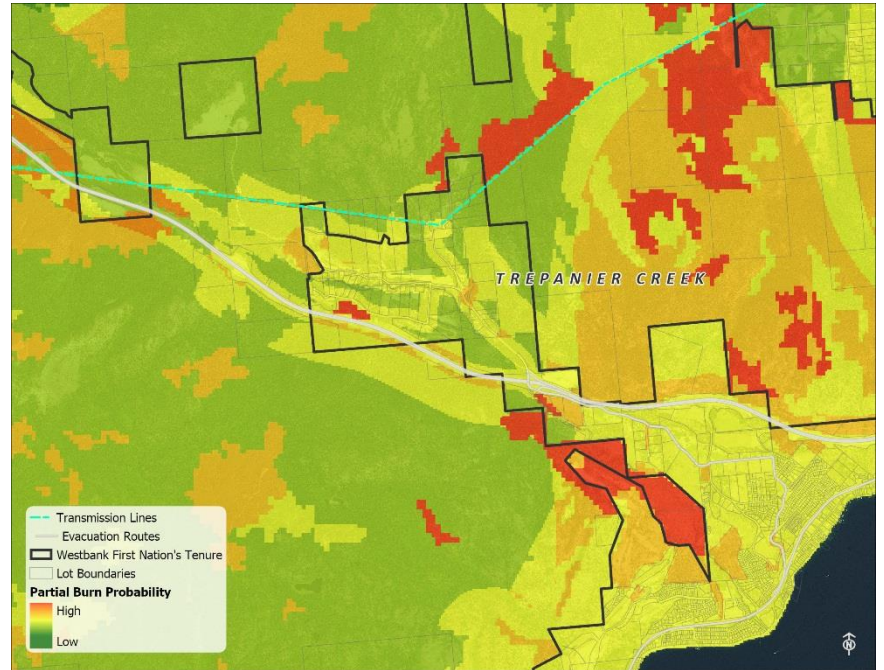
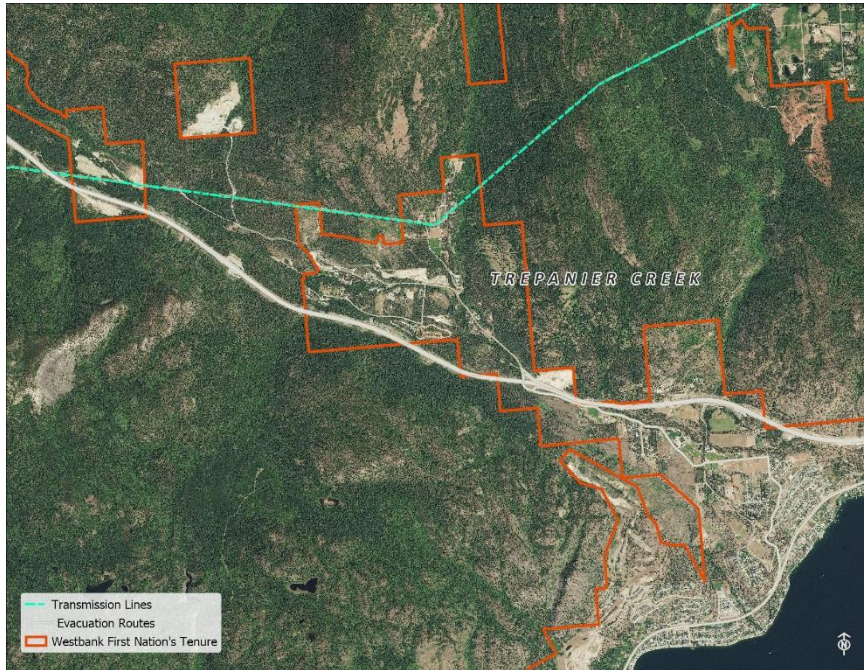
**PARTNERS:** Westbank First Nation, City of West Kelowna, BC Wildfire Service, Okanagan Shuswap Resource District

**RISK RESPONSE GOAL:** Reduce wildfire risk through the introduction of prescribed burning as a management tool.

## 03. Trepanier Creek Strategy

July 2020

The Trepanier Creek is an area between the City of West Kelowna (to the northeast) and the District of Peachland (to the southwest), situated at the base of the Okanagan Connector (Highway 97c). Significant critical infrastructure, namely a BC Hydro transmission line runs perpendicular to Trepanier Creek, where adjacent stands have been identified as high risk to wildfire due to projected fire intensity. The Planning Team has identified this location as a specific area of interest with high wildfire risk. The strategies below represent actions that should be applied to respond to the identified risks across the area of interest given the nature of the identified risks and proposed risk response



## Summary of Values at Risk

### HUMAN LIFE AND SAFETY

- Residences/structures
- Recreation trails
- Community of Peachland, Community of West Kelowna
- Evacuation Routes (Hwy 97c, Trepanier Road)
- Egress Routes (Trepanier Bench Road)
- Critical Travel Corridors

### CRITICAL INFRASTRUCTURE

- BC Hydro transmission and primary distribution lines
- Fortis Gas Distribution Stations
- Ministry Repeater
- Minor Community Infrastructure (Thompson Okanagan Connector Visitor Centre)

### HIGH ENVIRONMENTAL AND CULTURAL VALUES

- Water licenses (domestic and irrigation PODs)
- Community watersheds (Trepanier Creek)
- Range Development
- Known Fish-Bearing Streams
- Species at Risk Occurrences (various species)

### RESOURCES VALUES

- Area-based tenure (CFA)
- Mule Deer Winter Range
- Recreation trails
- Coldham Regional Park, Trepanier Creek Greenway Regional Park
- Visually Sensitive Areas (Retention)

## Management Strategies

### 3.1 ENGAGE WITH UTILITIES REGARDING FUEL MANAGEMENT ALONG INFRASTRUCTURE & RIGHT-OF-WAY

**DISCUSSION:** A BC Hydro transmission line runs perpendicular to Trepanier Creek, running immediately adjacent to stands that are of high risk to wildfire. Although regular infrastructure and right-of-way maintenance for the transmission line is likely conducted, it is critical that interagency cooperation and collaborative planning ensures adequate maintenance is achieved to reduce risk of wildfire from or to the transmission line.

**ACTIONS:**

7. Discuss WRMP risk results with BC Hydro, with specific reference to the transmission line related wildfire risks that are of concern. Consider the following
  - a. Maintenance activities and scheduled intervals;
  - b. Current fuel load and hazards along the transmission line ROW and adjacent stands.
  - c. Utilization of Ntityix tenure to support BC Hydro goals regarding fuel management adjacent to the powerline ROW.
  - d. Transmission line expansion plans and proactive incorporation of wildfire risk factors in location/design.
8. Develop harvesting/fuel modification treatments adjacent to the BC Hydro powerline that could be used to support risk reduction.
  - a. Consider partial cutting with surface fuel clean-up and access restrictions.

**ACTION RESPONSIBILITY:** Ntityix Resources

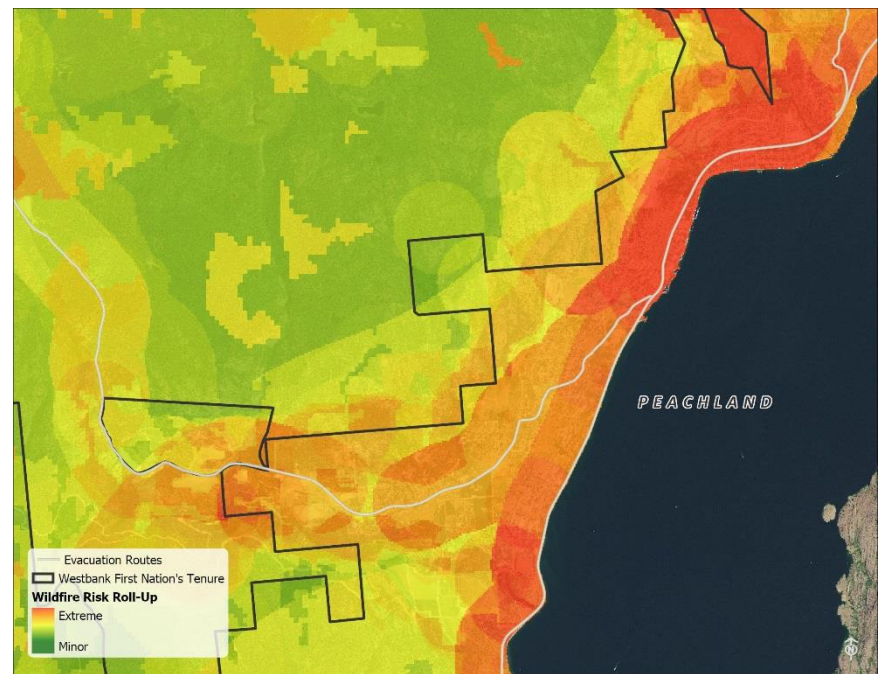
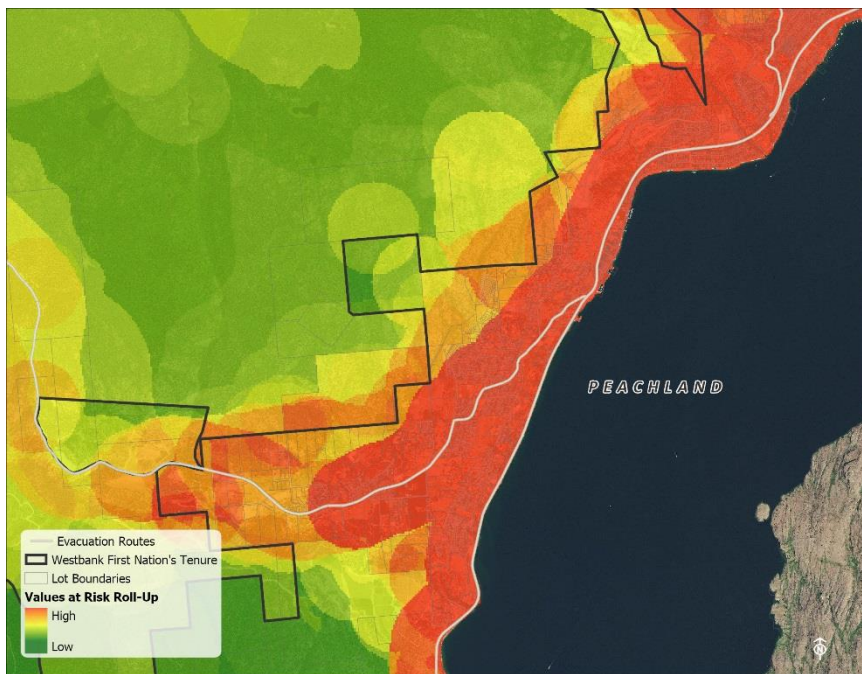
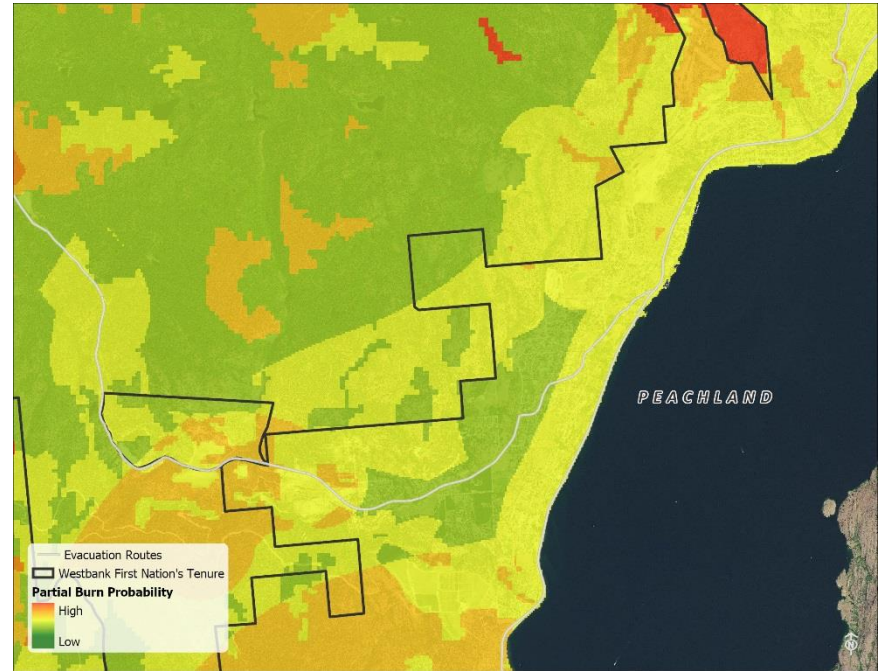
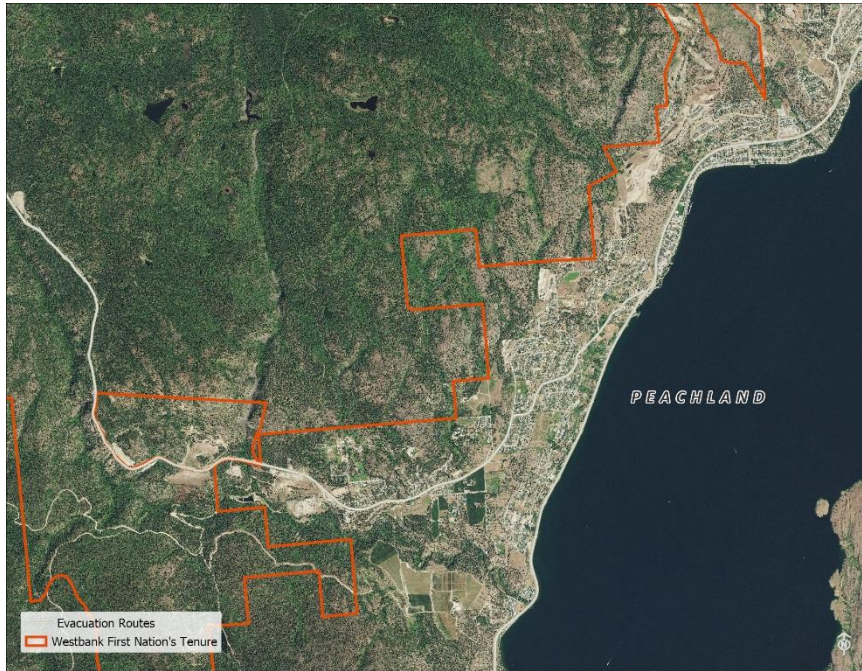
**PARTNERS:** BC Hydro, Central Okanagan Regional District, BC Wildfire Service

**RISK RESPONSE GOAL:** Informed transfer of risks to BC Hydro. Reduced wildfire risk related to the BC Hydro transmission line.

## 04. Peachland Strategy

July 2020

Peachland is a district municipality of over 5,000 residents and is a hub for recreation and agri-tourism activities<sup>3</sup>. Located on a steep south-facing sideslope along Okanagan Lake, the Planning Team has identified this location as a specific area of interest with high wildfire risk. The strategies below represent actions that could be used to respond to the wildfire risks as identified.



### Summary of Values at Risk

#### HUMAN LIFE AND SAFETY

- Residences/structures
- Facilities
- Recreation trails
- Community of Peachland
- Evacuation Routes (Hwy 97, Connector, Brenda Mines FSR)
- Egress Routes (Ponderosa Drive Community)
- Critical Travel Corridors

#### CRITICAL INFRASTRUCTURE

- BC Hydro transmission and primary distribution lines
- Fortis Gas Distribution Stations
- First Responder Facilities
- Major & Minor Community Infrastructure (Schools, Community Hall, Foodbank, Golf Clubs)

#### HIGH ENVIRONMENTAL AND CULTURAL VALUES

- Water licenses (domestic and irrigation PODs)
- Community watersheds (Peachland, Trepanier)
- Range Development
- Known Fish-Bearing Streams
- Species at Risk Occurrences (various species)

#### RESOURCES VALUES

- Area-based forest tenure (Community Forest)
- Volume-based forest tenures (Tolko, Gormans)
- Mule Deer Winter Range
- Recreation trails
- Hardy Falls Regional Park
- Visually Sensitive Areas (Retention)

<sup>3</sup> <https://www.britishcolumbia.ca/invest/communities/british-columbia/thompson-okanagan/central-okanagan/peachland/>

## Management Strategies

### 4.1 COMPLETE AND MAINTAIN FUEL MANAGEMENT TREATMENTS ADJACENT TO AND ON PRIVATE LAND

**DISCUSSION:** Peachland is located on a steep sideslope adjacent to forested area that falls within Westbank First Nation's CFA and presents high wildfire risk, driven by high headfire intensity and proximity to values. The presence of structures in close proximity to significant surrounding forested lands in combination with local knowledge of "problem" weather events elevates the need for fuel management in this area. Several significant fuel management treatments to the south of town are being planned by the Okanagan Shuswap Resource District.

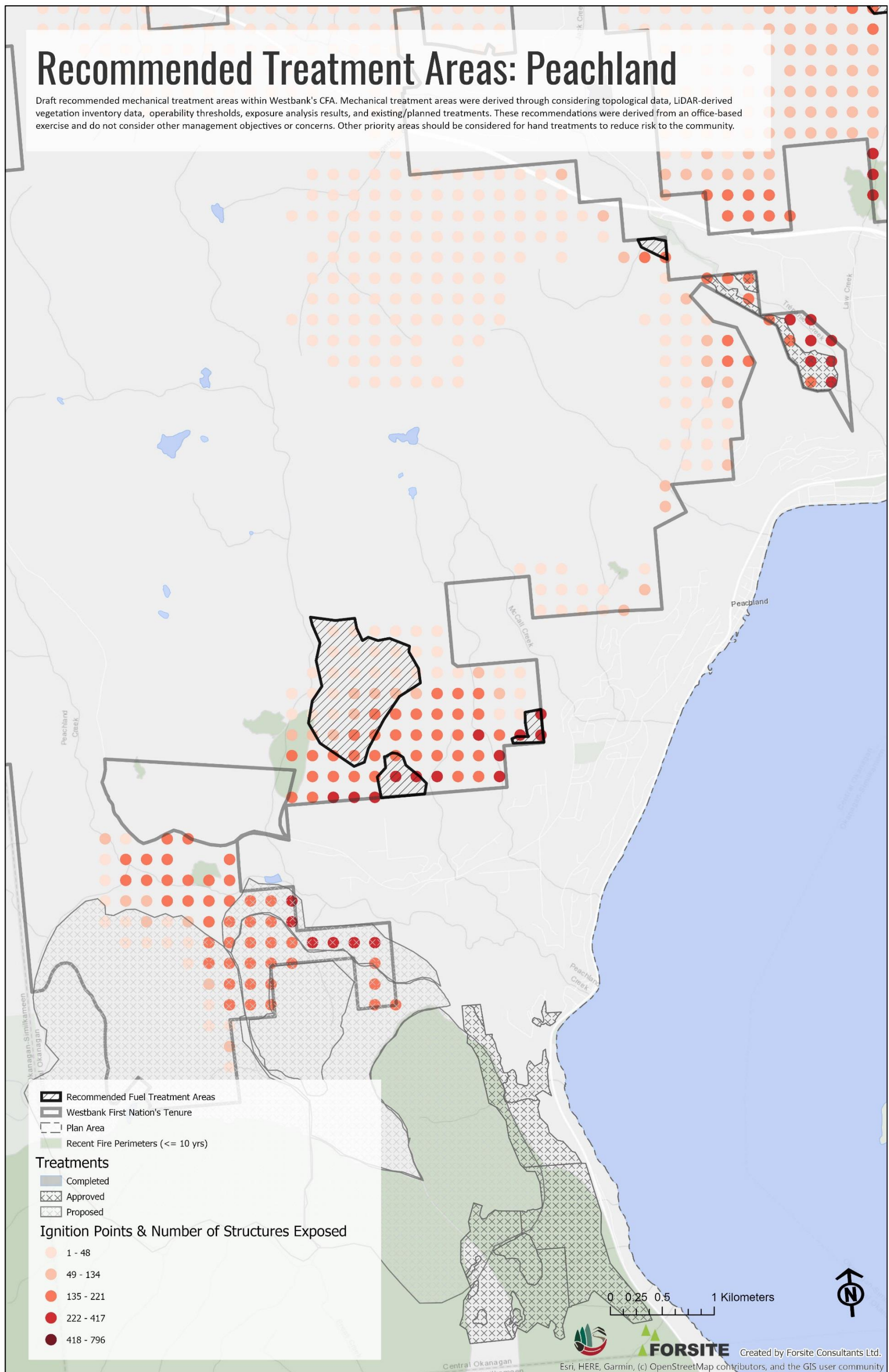
**ACTIONS:**

9. Assess fuel loads in the existing fuel management treatments around the community (within and outside the CFA) to identify necessary maintenance treatments in order to retain the intended hazard reduction benefits. Consider prescribed fire as a management tool in this maintenance effort.
10. Develop and implement additional fuel hazard reduction treatments in locations identified in *Figure 5: Recommended Fuel Treatment Areas* to reduce potential exposure to structures and risks to human life and safety in the event of a wildfire.
  - a. Consider existing fuel treatments and infrastructure (i.e. major travel corridors), topography, and vegetation to identify suitable areas to tie into existing fuel management treatments to create a more effective, landscape-level fuel treatment.
11. Support and collaborate with the Okanagan Shuswap Resource District, BC Wildfire Service, and other relevant forest tenure-holders (i.e. Tolko and Gorman Bros) to develop strategies for improving the resiliency the community and the adjacent CFA. Consider:
  - a. Efficacy of District of Peachland bylaws and/or development guidelines included in the Official Community Plan (OCP) relating to new development in the WUI. It is recommended that new developments follow FireSmart guidelines.
  - b. Fuel loads adjacent to and on private land.

**ACTION RESPONSIBILITY:** Ntityix Resources, District of Peachland

**PARTNERS:** Okanagan Shuswap Resource District, BC Wildfire Service, Tolko Industries, Gorman Bros.

**RISK RESPONSE GOAL:** Reduce wildfire risk to the community (human life, infrastructure) through fuel hazard reduction.



**Figure 16.** Recommended Fuel Treatment Areas for Peachland. Red boundaries indicate treatment areas where mechanical treatments are likely feasible. Priority Areas identified through the exposure analysis should still be considered for fuel management treatments, however it is likely that hand treatments will need to be considered in these areas.

## 4.2 MANAGE FOR THE RESILIENCY OF COMMUNITY WATERSHEDS IN LIGHT OF WILDFIRE RISK

**DISCUSSION:** The Peachland Creek and Trepanier Creek Community Watersheds supplies water to the majority of Peachland (Figure 6). Wildfire poses a high-risk to both the water quality and quantity associated with these community watersheds that supply ~90% of Peachland’s drinking water<sup>4</sup>.

**ACTIONS:**

3. Initiate dialogue within the District of Peachland regarding the risk of catastrophic loss of forest cover within the community watersheds due to wildfire. Consider the following
  - a. Current condition of the watersheds and relative levels of disturbance.
  - b. Current susceptibility of the watersheds to wildfire (i.e. fuel continuity and loads, forest health concerns, etc.).
  - c. Targets or thresholds to maintain sufficient water quality and quantity to the community.
  - d. Guidance for forest management companies to include in their fuel management activities that protect water quality.
  - e. Identification of strategic harvest areas to mitigate wildfire risk.
  - f. Significant concerns from community groups as it pertains to disturbance in the watershed.
4. Develop strategies in response to this discussion to support improved watershed resilience.

**ACTION RESPONSIBILITY:** District of Peachland

**PARTNERS:** Community Groups (i.e. Healthy Watersheds Committee), Central Okanagan Regional District, Okanagan Shuswap Resource District, BC Wildfire Service, Ntityx Resources, Tolko Industries, Gorman Bros.

**RISK RESPONSE GOAL:** Reduce risks to Peachland’s water supply through fostering a landscape more resilience to wildfire.

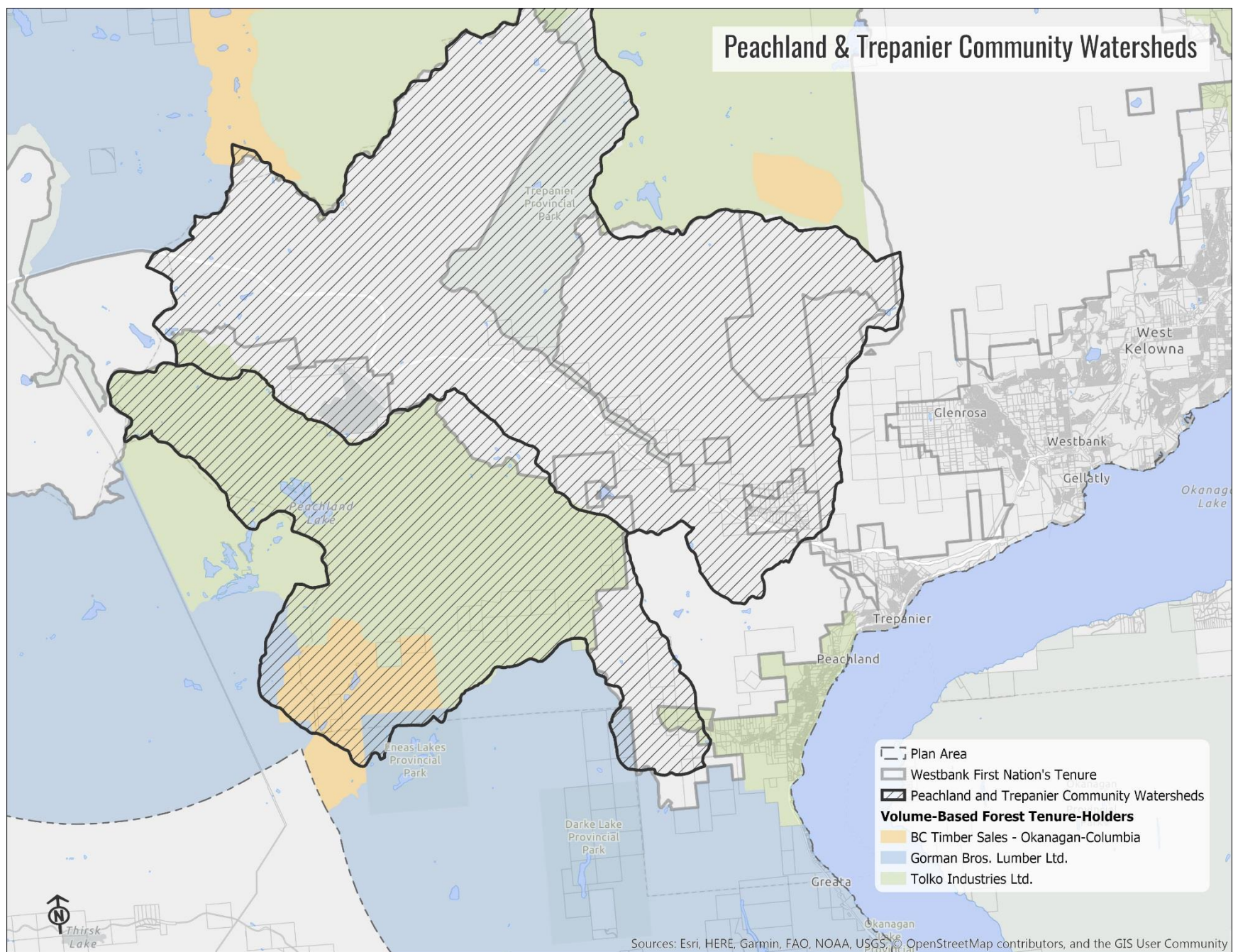


Figure 17. Peachland and Trepanier Community Watersheds and relevant forest-tenure holders.

## 4.3 EDUCATE AND ENGAGE PRIVATE LANDOWNERS & THE PUBLIC

**DISCUSSION:** Community education and engagement is a critical component of wildfire planning and management. While Ntityx Resources can mitigate identified hazards within Westbank First Nation’s tenured area, fuel management solely within the CFA will not reduce wildfire risk on private property. Without the engagement and participation of private landowners, these efforts may not be as successful in responding to the risks. Communicating the results of this WRMP and the implications for community members is a critical step necessary to reduce overall wildfire risk management in Peachland.

**ACTIONS:**

7. Collaborate with the BC Wildfire Service in the engagement and education with private land owners regarding the results of the WRMP and the overall wildfire risks. Consider:
  - a. A door-to-door program to discuss wildfire risks on private properties and existing resources.
  - b. Co-hosting an Open House where programs like FireSmart can be discussed.
  - c. Development of an educational and informative brochure discussing wildfire risks and how private landowners can play their part.
8. Participate in planned events around wildfire risk management to connect with the general public and disseminate information.
9. Continue to post wildfire awareness signs along major transportation corridors, at camp sites, and at high-use recreation areas that specify the current wildfire danger rating and how to report a wildfire.

**ACTION RESPONSIBILITY:** Ntityx Resources, District of Peachland

**PARTNERS:** BC Wildfire Service, Tolko Industries, Gorman Bros.

**RISK RESPONSE GOAL:** Informed transfer of risk to the private land owners/public. Reduced risk through increased public action.

<sup>4</sup> <https://www.peachland.ca/cms/wpattachments/wpID164atID555.pdf>



#### 4.4 PURSUE EMERGENCY AND EVACUATION PLANNING FOR THE COMMUNITY

**DISCUSSION:** Emergency and evacuation planning is a critical component for preparing seamless emergency response in the event of a wildfire threatening the community. Ensuring that the District of Peachland has a comprehensive evacuation plan to reduce risk to human life and safety as well as critical infrastructure is critical to decrease uncertainty in the event of a catastrophic event.

**ACTIONS:**

3. Identify and understand areas of the community along the WUI with one-way (egress) access in Peachland (Figure 7). Develop strategies to respond to the related risks that may consider:
  - a. Ensuring evacuation route signage is in place during the fire season.
  - b. Cell coverage.
  - c. Resiliency of evacuation routes (i.e. grass alongside evacuation corridors, etc.).

**ACTION RESPONSIBILITY:** District of Peachland

**PARTNERS:** Central Okanagan Regional District, BC Wildfire Service

**RISK RESPONSE GOAL:** Ensure evacuation planning and emergency planning is robust to reduce risk in the event of an evacuation to Peachland.

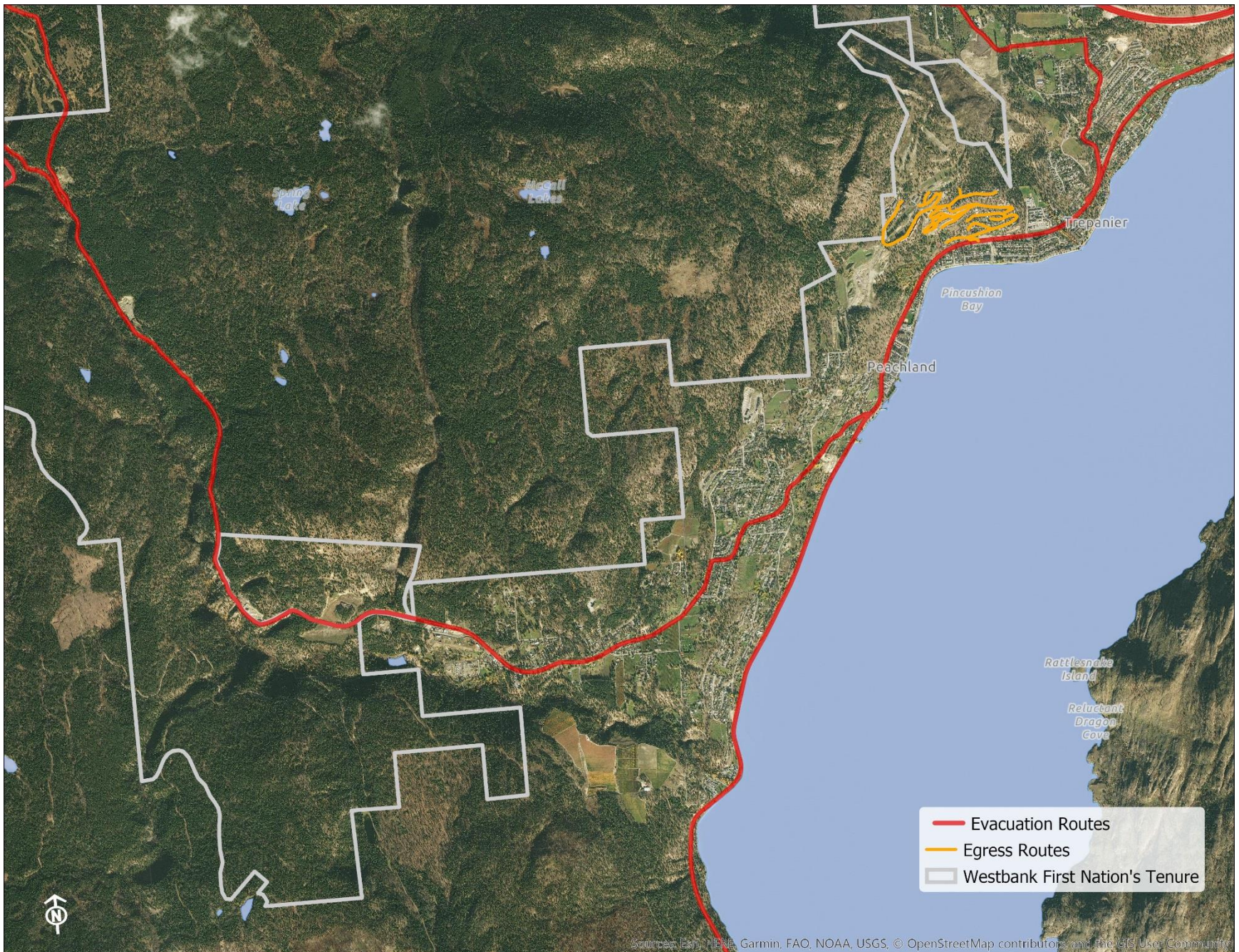


Figure 18. Identified evacuation routes and egress routes for the District of Peachland.

#### 4.5 CONSIDER THE USE OF PRESCRIBED FIRE

**DISCUSSION:** Fire exclusion has resulted in unnatural fuel compositions in fire prone areas that support high intensity wildfires. Long-term forest management for wildfire management objectives should be more reflective of the natural disturbance regime and ecological factors related to wildland fuels. Prescribed fire can be used to achieve multiple objectives. The primary purpose of prescribed fire, however, is the consumption of fine fuels that are virtually impossible to address through mechanical and hand treatments. Traditional and cultural First Nation values, wildlife habitat, biodiversity, and fuel management can benefit from the reintroduction of fire to the landscape. Negative connotations with wildfire has led to challenges in gaining public acceptance, however recent unprecedented fire seasons are changing the narrative and public acceptance around proactive fire management. Previously treated (i.e. thinned) stands and grassland areas surrounding private land and/or high risk areas in the Peachland area provide ideal opportunities to utilize prescribed fire as a form of maintenance to reduce fine and flashy fuels.

**ACTIONS:**

11. Engage with Westbank First Nation and other local First Nations to discuss traditional or historical prescribed burning practices and the desire to return fire to the landbase.
12. Collaborate with BC Wildfire Service and District of Peachland to review tools to increase the use of low-intensity prescribed fire and identify potential treatment areas/Potential Operational Delineations (PODs). Consider factors including, but not limited to:
  - a. Presence of containment lines;
  - b. Burnable and contiguous fuels for consumption;
  - c. Public support for prescribed fire and associated smoke;
  - d. Operable landbase;
  - e. Timing of burn operations; and
  - f. Availability of resources to implement the planning and execution.
10. Engage with Okanagan Shuswap Resource District to leverage funding sources for prescribed fire for ecosystem restoration in support of reducing wildfire hazard.

13. Support the District of Peachland in a proactive public education program related fuel management and specifically the use of prescribed fire.

**ACTION RESPONSIBILITY:** Ntityix Resources

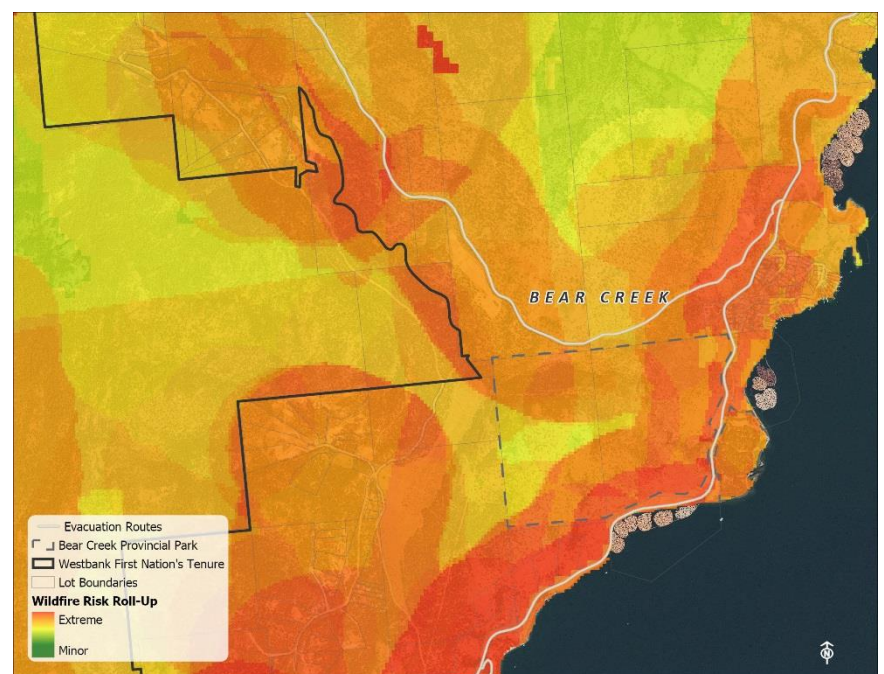
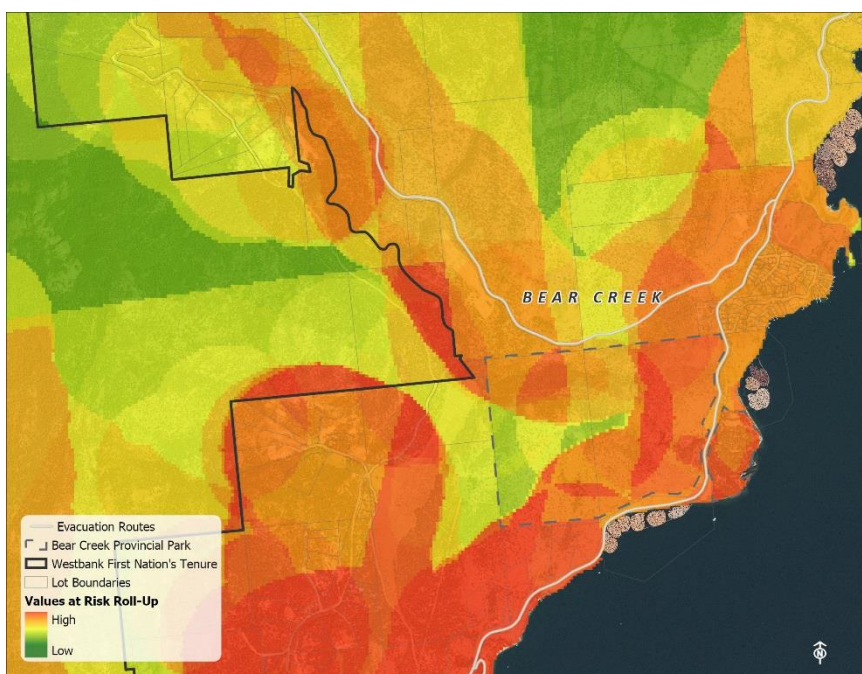
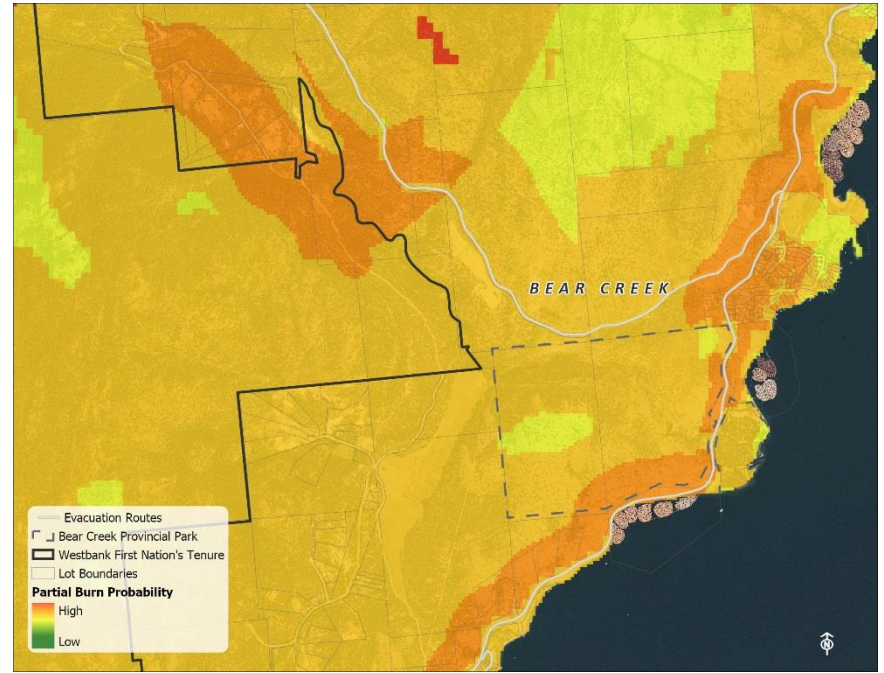
**PARTNERS:** Westbank First Nation, District of Peachland, BC Wildfire Service, Okanagan Shuswap Resource District

**RISK RESPONSE GOAL:** Reduce wildfire risk through the introduction of prescribed burning as a management tool.

## 05. Bear Creek Strategy

July 2020

Bear Creek Provincial Park is located on the outskirts of West Kelowna along Westside Road. The park has 122 vehicle accessible campsites and a large day-use area<sup>5</sup>. Access to Bear Creek Provincial Park is limited by a single route, acting as the only point of access in to and out of the park. Due to the vulnerability of the Provincial Park and associated values at risk, Bear Creek Provincial Park has been identified by the Planning Team as a specific area of interest that could be impacted by a wildfire event. The strategies below represent actions that could be used to respond to the wildfire risks as identified.



### Summary of Values at Risk

#### HUMAN LIFE AND SAFETY

- Residences/structures
- Recreation areas and trails
- Evacuation Route (Westside Road, Bear FSR)
- Egress Route

#### CRITICAL INFRASTRUCTURE

- BC Hydro primary distribution lines

#### HIGH ENVIRONMENTAL AND CULTURAL VALUES

- Community watersheds (Skiing Brook, Trapping Creek)
- Range Development
- Known Fish-bearing Stream
- Species at Risk Occurrence (Black cottonwood/Common snowberry plant community)

#### RESOURCES VALUES

- Area-based forest tenures (Westbank, TFL49 – Tolko)
- Volume-based forest tenures (Tolko)
- Mule Deer Winter Range
- Bear Creek Provincial Park and trails
- Visually Sensitive Areas (Retention)

<sup>5</sup> <http://britishcolumbia.com/things-to-do-and-see/parks-and-trails/thompson-okanagan/bear-creek-provincial-park/>

# Management Strategies

## 5.1 ENHANCE EVACUATION ROUTE OUT OF BEAR CREEK PROVINCIAL PARK THROUGH FUEL MANAGEMENT TREATMENTS

### DISCUSSION:

With only one viable access route in/out of Bear Creek Provincial Park servicing all visitors, this road serves as an evacuation route for the park (Figure 8). Adjacent contiguous fuels along this corridor and the susceptibility of the egress route elevate the wildfire risk to the Provincial Park.

### ACTIONS:

12. Assess current condition, fuel load, and treatments that have been completed or are proposed along the corridor.
13. Engage with BC Wildfire Service and Okanagan Shuswap Resource District to discuss options for fuel hazard reduction along the corridor.
14. Determine fire suppression responsibility for the Park.
15. Consider a collaborative plan for the corridor to meet the overall objective(s) for the area, considering:
  - a. The use of low-intensity prescribed burning to support risk reduction.
  - b. Collaborative management and shared risk.

**ACTION RESPONSIBILITY:** BC Parks

**PARTNERS:** BC Wildfire Service, Central Okanagan Regional District, Okanagan Shuswap Resource District

**RISK RESPONSE GOAL:** Enhance the resiliency of evacuation corridor out of Bear Creek Provincial Park.

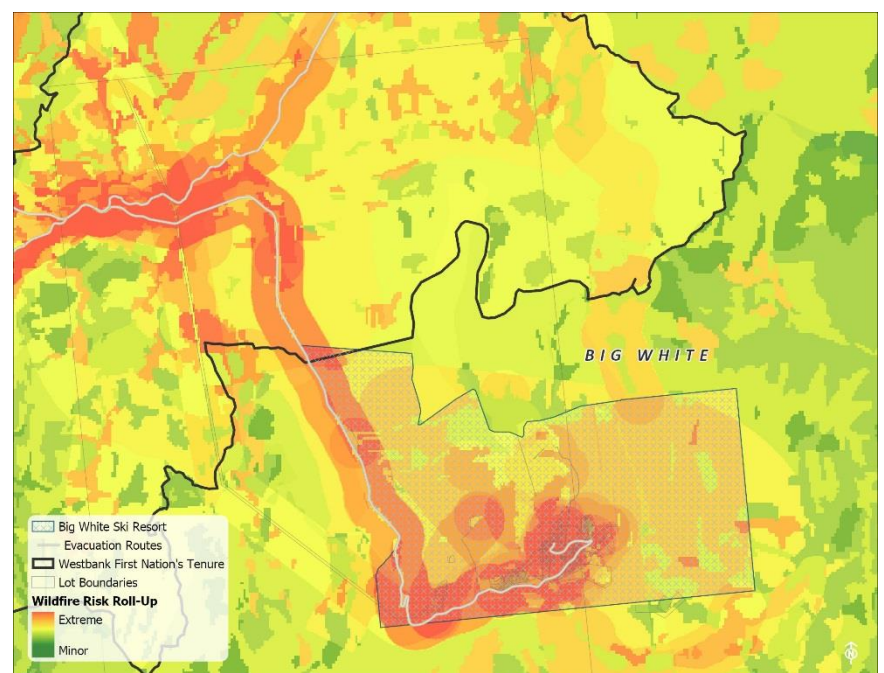
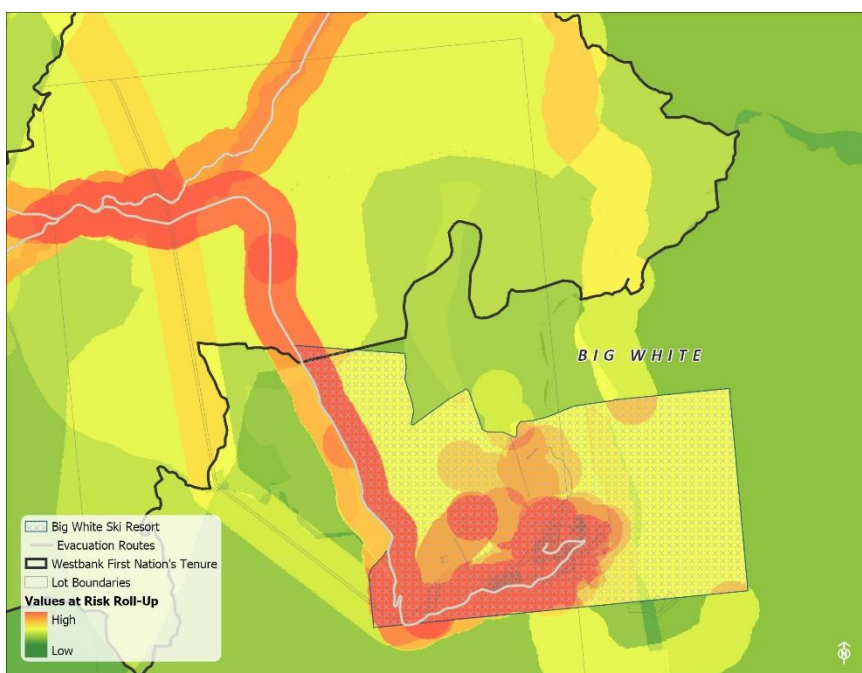
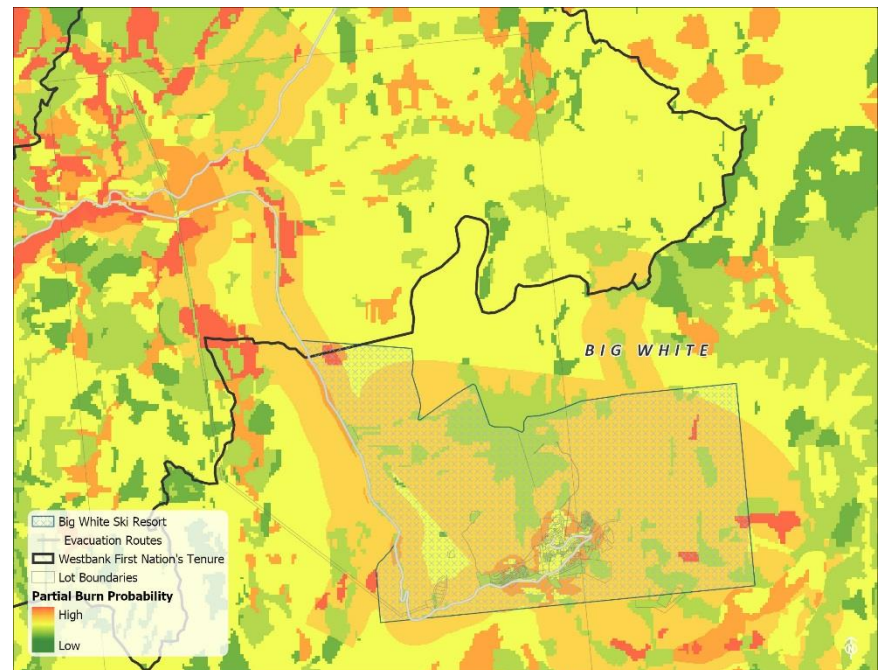
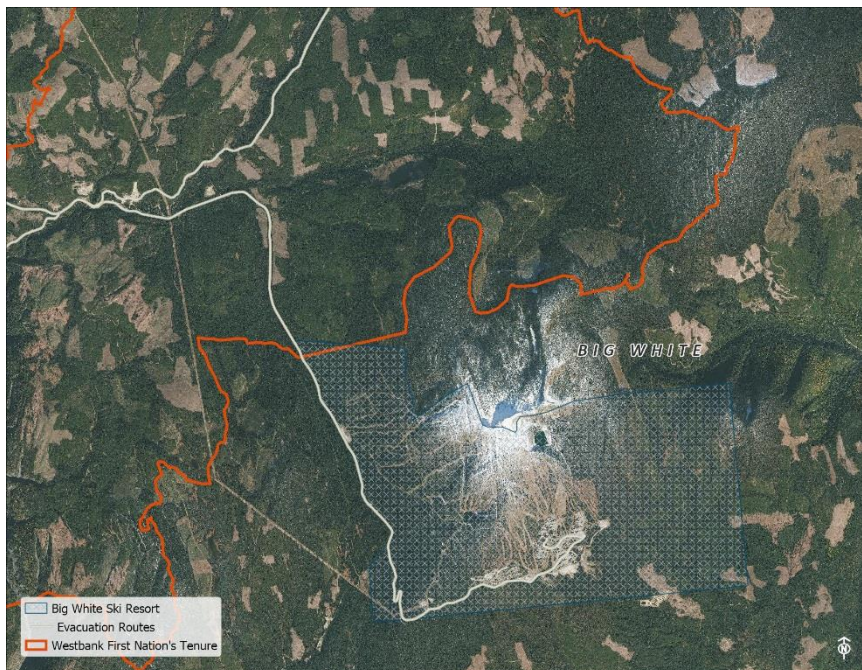


Figure 19. Bear Creek Provincial Park and access.

## 06. Big White Ski Resort

July 2020

Big White Ski Resort is the third largest resort in British Columbia and is located about 60km southeast of Kelowna on Big White Mountain, the highest summit in the Okanagan Highland. Big White is home to a central village that includes accommodations (condos, hotels, and vacation homes), grocery stores, eateries, and other shops, and is considered a community for the purpose of this WRMP. Access to Big White is limited to Big White Road, which serves as an evacuation and egress route for the entire resort. Due to the vulnerability of the resort, values at risk within the controlled recreation area/community, and burn probability of the area, Big White and Big White Road have been identified by the Planning Team as a specific area of interest that could be affected by a wildfire event. The strategies below represent actions that could be used to respond to the wildfire risks as identified in the Big White Community/Resort.



### Summary of Values at Risk

#### HUMAN LIFE AND SAFETY

- Residences/structures
- Big White Controlled Rec Area
- Community of Big White
- Evacuation Route & Egress Route (Big White Rd)

#### CRITICAL INFRASTRUCTURE

- Fortis transmission and primary distribution lines
- Communications Towers
- Water Tanks
- First Responders Facilities (Big White Community Policing, Big White Village Fire Department)
- Big White Ski Resort
- Other minor community facilities (i.e. restaurants, shops)

#### HIGH ENVIRONMENTAL AND CULTURAL VALUES

- Community watersheds (Skiing Brook, Trapping Creek)
- Species at Risk Occurrence (American Badger)

#### RESOURCES VALUES

- Wildlife Habitat Areas (Grizzly Bear)
- Big White Controlled Recreation Area
- Big White Ecological Reserve
- Visually Sensitive Areas (Retention)

## Management Strategies

### 6.1 IMPROVE RESILIENCY OF BIG WHITE ROAD CORRIDOR AS AN EVACUATION ROUTE AND THE RESORT'S POWER SUPPLY THROUGH FUEL MANAGEMENT

**DISCUSSION:** Big White Road is the only viable evacuation route in/out of the Big White Community. This corridor services all visitors in and out of the ski resort and is a location of extreme wildfire risk relative to the WRMP Plan Area. A FortisBC primary distribution line generally parallels Big White Road and is the main supply of power to the community (*Figure 9*). Some fuels related work has been undertaken within this corridor. Regular vegetation management work is completed by FortisBC in the powerline right-of-way (ROW) component of this corridor. Collaboration and integrated planning can be used to support the resiliency of both the utilities line and the evacuation route.

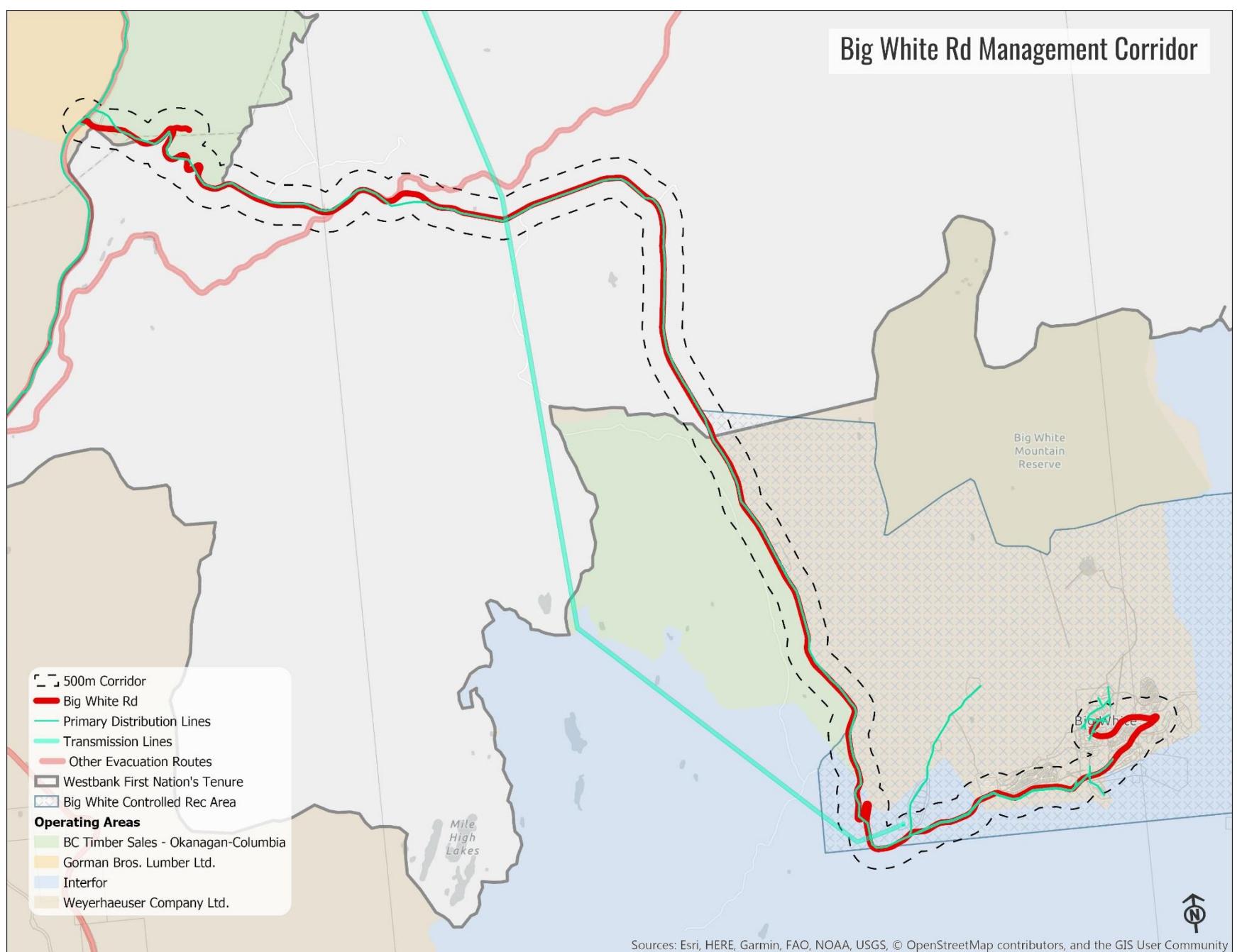
#### ACTIONS:

1. Complete a comprehensive fuels assessment in a 500m corridor along the Big White Road and the main utility line. Assess current condition of this corridor in order to understand priorities, fuel load, and treatments that have been completed or are proposed along the corridor.
2. Engage and collaborate with FortisBC and the Okanagan Shuswap Resource District to develop a corridor resiliency plan that identifies/prioritizes fuel hazard zones or areas for treatment. Consider:
  - a. Prioritization/ranking of fuel treatment activities
  - b. Ongoing maintenance.
  - c. Powerline ROW vegetation management activities.
  - d. Grizzly bear habitat area and associated general wildlife measures.
  - e. Use of prescribed fire to help meet hazard reduction goals.
3. In light of the corridor resiliency plan, engage and collaborate with FortisBC to review current maintenance activities and scheduling associated with the primary distribution lines, considering the efficacy of the current treatment regime as a wildfire hazard reduction tool. Consider:
  - a. Maintenance activities and scheduled intervals.
  - b. Current fuel load and hazards along the distribution line and associated right-of-way.
4. Engage and collaborate with forest tenure-holders (i.e. Interfor, Weyerhaeuser, Ntityx Resources) to discuss the potential to facilitate fuel treatments along the corridor.
5. Engage with the Ministry of Transportation to support the assessment of the current status, width and maintenance regime associated with Big White Road to ensure its effectiveness in the efficient movement of traffic during and emergency evacuation. Develop actions to remediate any identified issues.

**ACTION RESPONSIBILITY:** Big White Ski Resort

**PARTNERS:** FortisBC, Ministry of Transportation, Okanagan Shuswap Resource District, BC Wildfire Service, Interfor, Weyerhaeuser, Ntityx Resources

**RISK RESPONSE GOALS:** Reduced evacuation-related risks to human life. Reduced short- and medium-term impacts to the resort caused by prolonged power loss.



**Figure 20.** Big White Road, Fortis primary distribution line, and the proposed 500m management corridor.

## 6.2 DEVELOP A STRATEGY TO REDUCE WILDFIRE FIRE POTENTIAL FROM THE SOUTH

**DISCUSSION:** Forest cover conditions, exacerbated by reduced fire on the landscape has resulted in significant wildfire hazard south of Big White – resulting in an elevated wildfire risk to the community. With dominant wildfire season winds coming from the southwest, fuel loads to the south should be assessed and managed in order to reduce wildfire risk to the community/resort (Figure 10).

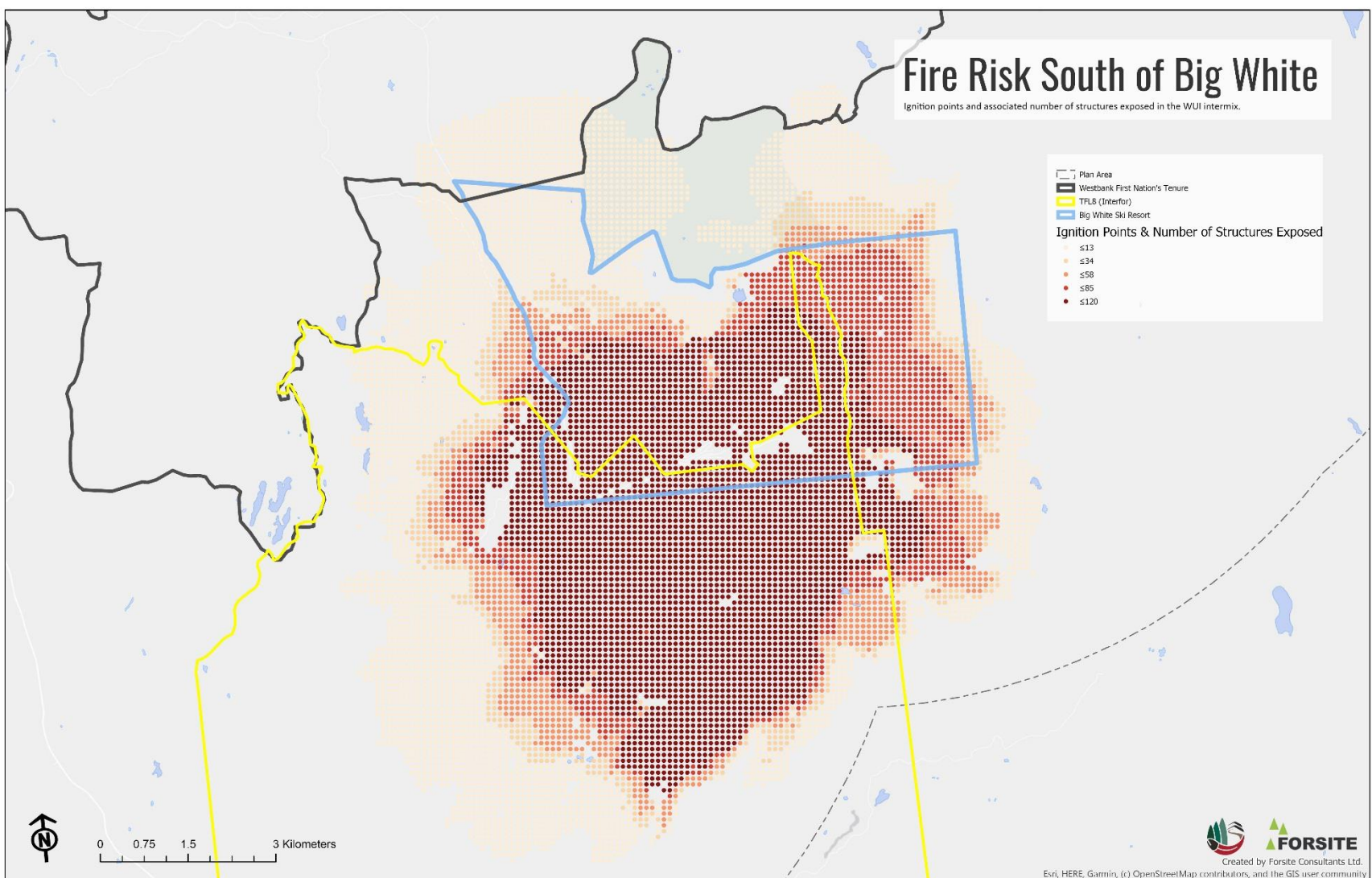
**ACTIONS:**

14. Assess fuel loads to the south of Big White.
15. Develop fuel reduction strategy for this fuel hazard zone. Consider the following
  - a. Harvesting treatments that have been completed in the area and where follow-up treatments could be utilized.
  - b. Proposed harvesting in the area and ability to influence overall approach to harvesting, retention and overall fuel loading.
  - c. Prescribed fire (broadcast burning) as a mechanism to reduce fuels on the landscape.
  - d. Landscape-level fuel reduction in light of other stewardship values.
16. Collaborate with the BC Wildfire Service and develop Potential Operational Delineations (PODs) in the area south of Big White to support wildfire suppression operations and active use of prescribed fire on the landscape.

**ACTION RESPONSIBILITY:** Big White Ski Resort, Interfor Corporation

**PARTNERS:** BC Wildfire Service, Okanagan Shuswap Resource District

**RISK RESPONSE GOAL:** Reduce risks to human life and infrastructure in the Big White community through reduction in the likelihood of catastrophic wildfire entering the community from the south.

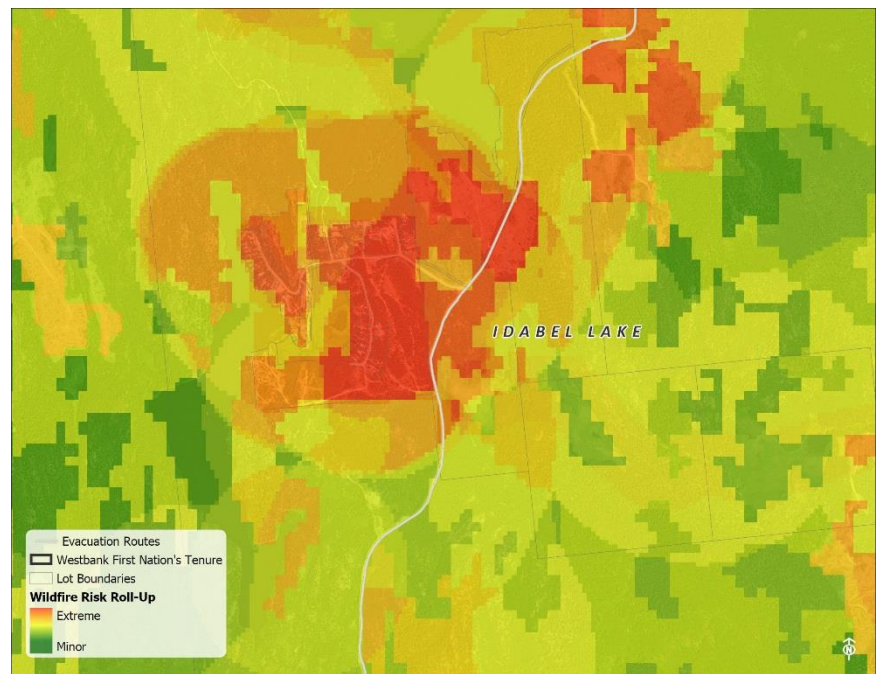
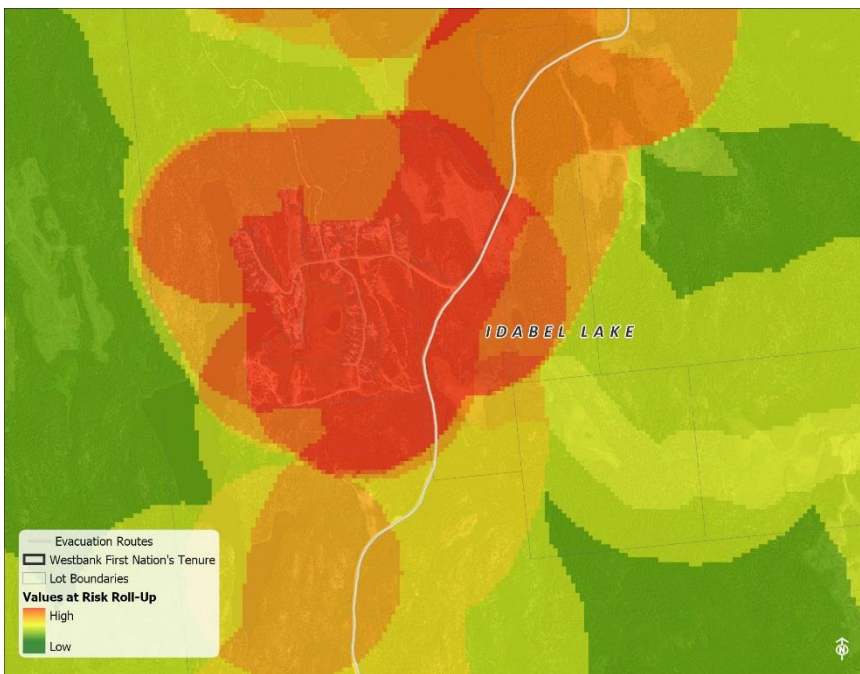
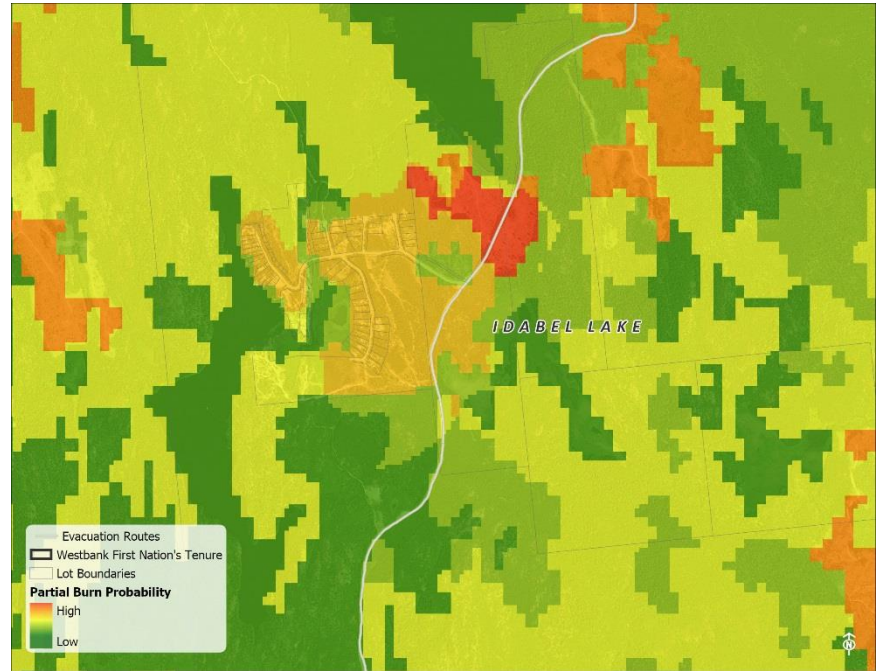


**Figure 21.** Potential wildfire risk to the south of Big White based on ignition points and relative number of structures exposed using 95<sup>th</sup> percentile conditions for the area.

# 07. Idabel Lake Strategy

July 2020

A small, secluded community exists on Idabel Lake roughly 50km southwest of Kelowna. With a mix of permanent residences and vacation properties, the Idabel Lake community has been identified by the Planning Team as a specific area of interest with significant values at risk that could be affected by a wildfire event due to the vast contiguous fuels surrounding the community. The strategies below represent actions that could be used to respond to the wildfire risks as identified.



## Summary of Values at Risk

### HUMAN LIFE AND SAFETY

- Residences/structures
- Recreation trails
- Community of Idabel Lake
- Egress route (Idabel Lake Rd)
- McCulloch FSR evacuation route

### CRITICAL INFRASTRUCTURE

- Fortis primary distribution lines
- Ministry Repeater
- BC Wildfire Service Weather Station

### HIGH ENVIRONMENTAL AND CULTURAL VALUES

- Species at Risk Occurrence (American Badger)

### RESOURCES VALUES

- Volume-based forest tenures (Weyerhaeuser)
- Moose Winter Range
- Recreation trails



## Management Strategies

### 7.1 PRIORITIZE FUEL MANAGEMENT TREATMENTS ADJACENT TO PRIVATE LAND

**DISCUSSION:** Idabel Lake is a small community nestled amongst expansive forested area. With a relatively high burn probability and significant human life and safety values, this community is high risk in light of a catastrophic wildfire event. The presence of structures in close proximity to significant surrounding forested lands and absence of existing treatments elevates the need for fuel management in this area.

**ACTIONS:**

16. Work with BC Wildfire Service and relevant forest-tenure holders (Weyerhaeuser) to develop strategies for improving the resiliency of the community and the adjacent CFA. Consider:
  - a. Fuel loads adjacent to and on private land.
  - b. Emergency response resources.
  - c. Resiliency of Idabel Lake Road as an egress route providing entry to/from the community to McCulloch FSR (evacuation route).
17. Develop and implement additional fuel hazard reduction treatments to reduce potential exposure to structures and risks to human life and safety in the event of a wildfire.
  - a. Consider existing infrastructure (i.e. major travel corridors), topography, and vegetation to identify suitable areas. Attempt to link treatments together where feasible to produce more effective treatments.

**ACTION RESPONSIBILITY:** Central Okanagan Regional District

**PARTNERS:** BC Wildfire Service, Weyerhaeuser

**RISK RESPONSE GOAL:** Reduce wildfire risk to community through fuel hazard reduction adjacent to private land.

### 7.2 EDUCATE AND ENGAGE PRIVATE LANDOWNERS

**DISCUSSION:** Community education and engagement is a critical component of wildfire planning and management. Fuel management solely within crown lands will not reduce wildfire risk on private property. Without the engagement and participation of private landowners, these efforts may not be as successful in responding to the risks. Communicating the results of this WRMP and the implications for community members is a critical step necessary to reduce overall wildfire risk management in the Idabel Lake community.

**ACTIONS:**

11. Collaborate with the BC Wildfire Service in the engagement and education with private land owners regarding the results of the WRMP and the overall wildfire risks. Consider:
  - a. A door-to-door program to discuss wildfire risks on private properties and existing resources.
  - b. Co-hosting an Open House where programs like FireSmart can be discussed.
  - c. Development of an educational and informative brochure discussing wildfire risks and how private landowners can play their part.
12. Participate in planned events around wildfire risk management to connect with the general public and disseminate information.
13. Continue to post wildfire awareness signs along major transportation corridors, at camp sites, and at high-use recreation areas that specify the current wildfire danger rating and how to report a wildfire.

**ACTION RESPONSIBILITY:** Central Okanagan Regional District

**PARTNERS:** BC Wildfire Service

**RISK RESPONSE GOAL:** Informed transfer of risk to the private land owners/public. Reduced risk through increased public action.

### 7.3 CONSIDER THE USE OF PRESCRIBED FIRE

**DISCUSSION:** Fire exclusion has resulted in unnatural fuel compositions in fire prone areas that support high intensity wildfires. Long-term forest management for wildfire management objectives should be more reflective of the natural disturbance regime and ecological factors related to wildland fuels. Prescribed fire can be used to achieve multiple objectives. The primary purpose of prescribed fire, however, is the consumption of fine fuels that are virtually impossible to address through mechanical and hand treatments. Traditional and cultural First Nation values, wildlife habitat, biodiversity, and fuel management can benefit from the reintroduction of fire to the landscape. Negative connotations with wildfire has led to challenges in gaining public acceptance, however recent unprecedented fire seasons are changing the narrative and public acceptance around proactive fire management. Harvested stands provide ideal opportunities to utilize prescribed fire as a form of maintenance to reduce fine and flashy fuels.

**ACTIONS:**

17. Engage with local First Nations to discuss traditional or historical prescribed burning practices and the desire to return fire to the landbase.
18. Collaborate with BC Wildfire Service and relevant forest-tenure holders (i.e. Weyerhaeuser) to review tools to increase the use of broadcast burning and identify potential treatment areas/Potential Operational Delineations (PODs). Consider factors including, but not limited to:
  - a. Presence of containment lines;
  - b. Burnable and contiguous fuels for consumption;
  - c. Public support for prescribed fire and associated smoke;
  - d. Operable landbase;
  - e. Timing of burn operations; and
  - f. Availability of resources to implement the planning and execution.
19. Engage with BC Wildfire Service early in planning phases to aid in development of treatment design to align with Burn Plans.

**ACTION RESPONSIBILITY:** Central Okanagan Regional District

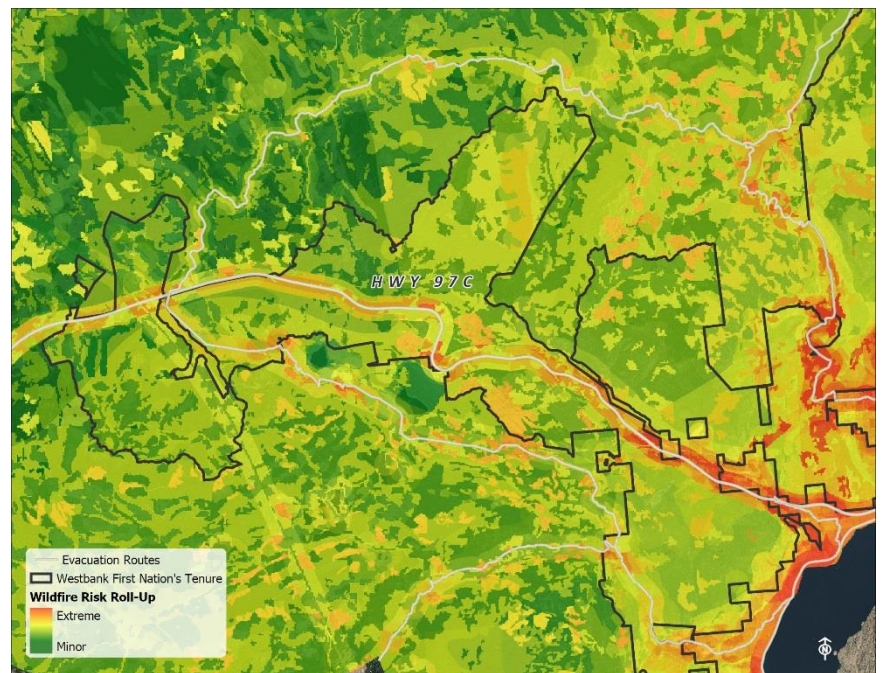
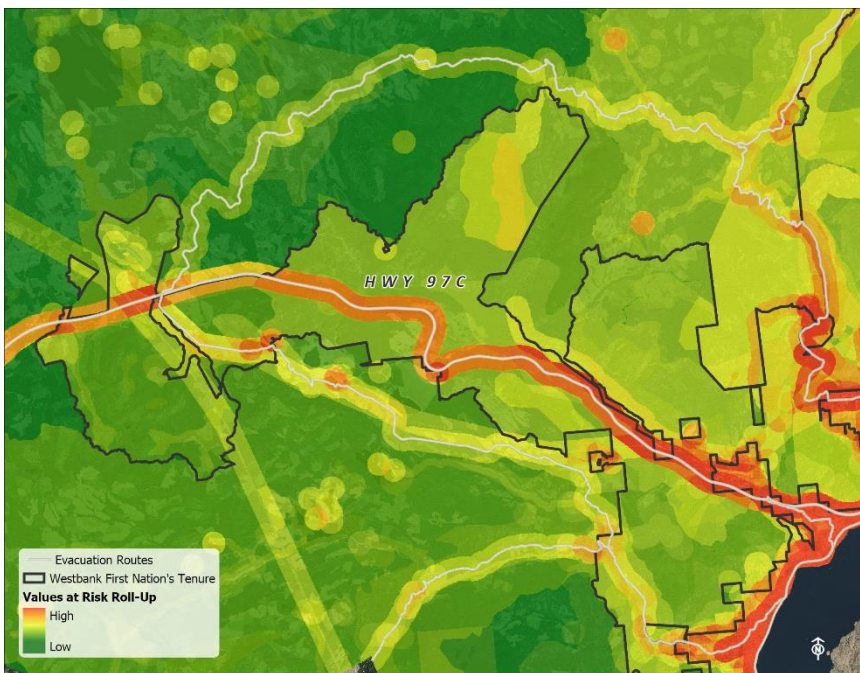
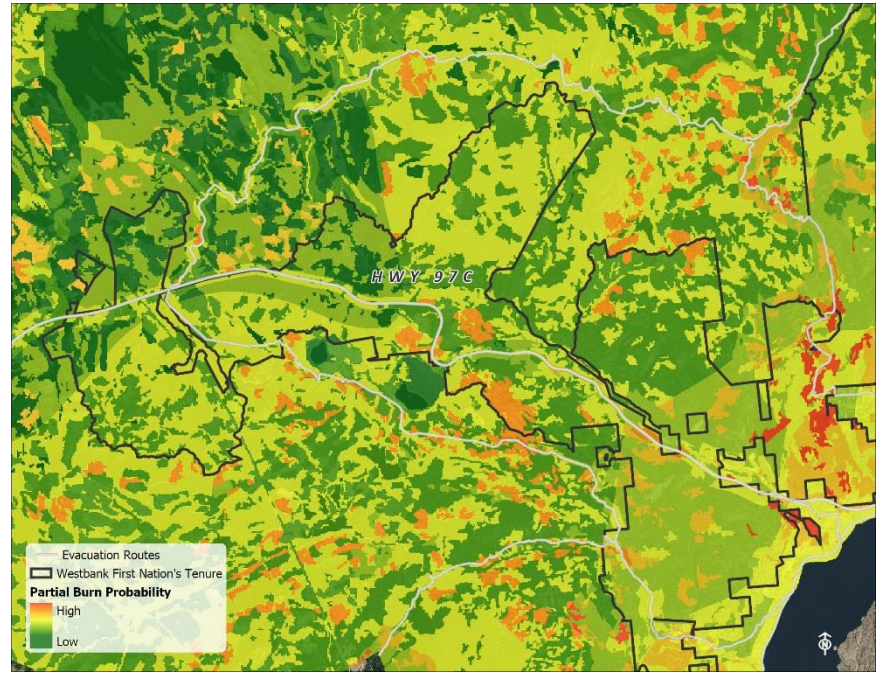
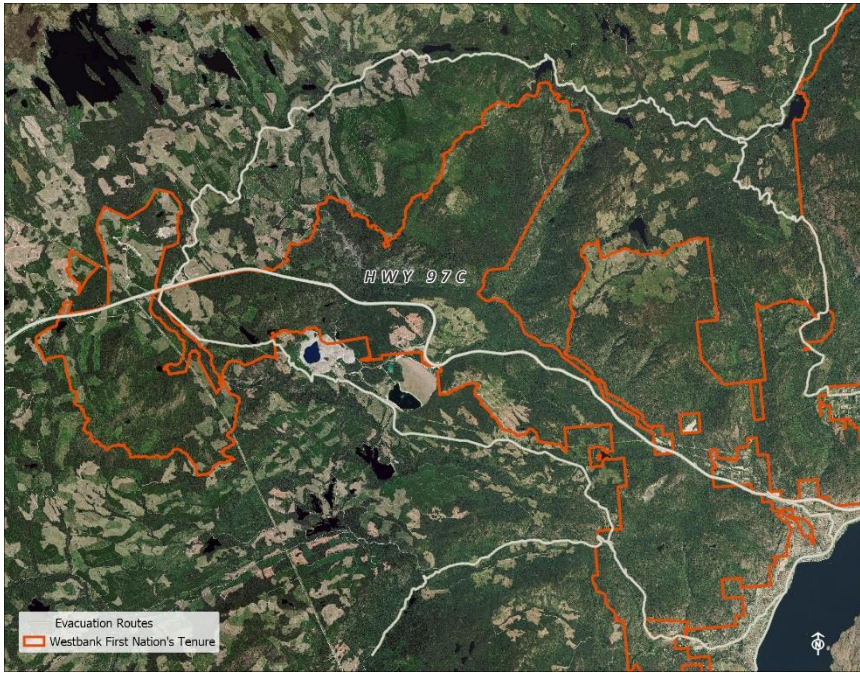
**PARTNERS:** BC Wildfire Service, Weyerhaeuser, Okanagan Shuswap Resource District, Local First Nations

**RISK RESPONSE GOAL:** Reduce wildfire risk through the introduction of prescribed burning as a management tool.

## 08. Okanagan Connector Strategy

July 2020

Highway 97c, or the Okanagan Connector, is an east-west highway linking the Okanagan Valley to the Lower Mainland via the Coquihalla. The Okanagan Connector begins near Peachland and connects to Merritt, running through Westbank First Nation's Community Forest. The Okanagan Connector is a critical travel corridor to the region and a major evacuation route for the Okanagan Valley. This area has been identified by the Planning Team as a specific area of interest that could be affected by a wildfire event. The strategies below represent actions that could be used to respond to the wildfire risks as identified.



### Summary of Values at Risk

#### HUMAN LIFE AND SAFETY

- Evacuation Route/ Critical Travel Corridor

#### CRITICAL INFRASTRUCTURE

- Pennask Windfarm
- BC Hydro transmission line and primary distribution lines

#### HIGH ENVIRONMENTAL AND CULTURAL VALUES

- Range Development
- Known Fish-bearing Stream
- Trepanier Community Watershed

#### RESOURCES VALUES

- Area-based forest tenure (Community Forest)
- High Value Forests
- Mule Deer Winter Range
- Moose Winter Range (identified by Ntityix Resources)
- Pennask Creek Provincial Park, Trepanier Provincial Park
- Visually Sensitive Areas (Retention)

## Management Strategies

### 8.1 ASSESS THE RESILIENCY OF THE OKANAGAN CONNECTOR AS AN EVACUATION ROUTE

**DISCUSSION:** The Okanagan Connector is a critical evacuation route and travel corridor the Okanagan Valley. A significant portion of the Connector within this WRMP Plan Area falls within the tenure of Westbank First Nation. The importance of the reliability and resiliency of this evacuation corridor is critical in the event of a catastrophic wildfire, and could aid in the emergency response and evacuation for communities such as Westbank, West Kelowna, and Peachland. Although the risk identification model did not indicate higher risk, the value that this corridor provides elevates the need for enhanced planning and interagency cooperation to ensure the resiliency of this evacuation route.

**ACTIONS:**

6. Engage with the Ministry of Transportation to discuss the wildfire risks in the area with specific attention to the Okanagan Connector evacuation route.
7. Assess the fuel related hazards along the corridor, including current fuel conditions, treatments that have been completed or are proposed, and potential impacts related to both wildfire and smoke on the evacuation route.
  - a. Consider whether wildfire risk along the corridor is sufficiently addressed with current measures and controls, or if additional treatments are required to satisfy the level of risk.
  - b. Communicate the results of the assessment with the Ministry of Transportation in support for common understanding of the risks.
8. Collaborate with partners to develop and implement a collaborative fuel management plan for the corridor, considering:
  - a. Overall fuel conditions and loading.
  - b. Current and planned vegetation management and/or harvest plans
  - c. The use of low-intensity prescribed burns to support risk reduction.
  - d. Corridor right-of-way and vegetation (i.e. grass) management.
  - e. Collaborative management and shared risk.

**ACTION RESPONSIBILITY:** Ntityix Resources, Ministry of Transportation, Central Okanagan Regional District

**PARTNERS:** Okanagan Shuswap Resource District, BC Wildfire Service, City of West Kelowna, Westbank, District of Peachland

**RISK RESPONSE GOAL:** Assess the resiliency of the Okanagan Connector as an evacuation route and reduce wildfire risk.

## 09. General Management Strategies

July 2020

A series of general management strategies were developed through the Ntityx WRMP. These represent actions that apply to a broad area or all of the project area and are not specific to a given location on the landbase.

### 9.1 REINFORCE AND SUPPORT A WILDFIRE RISK COMPONENT TO THE WESTBANK FIRST NATION CONSERVATION OFFICER ROLE/POSITION

**DISCUSSION:** The Westbank First Nation has established a Conservation Officer role within their organization. This role has the potential to support a range of wildfire risk related responsibilities that could have a significant and meaningful impact in risk response

**ACTIONS:**

18. Meet with the Westbank First Nation to discuss the current CO role and the potential to expand this role as it pertains to wildfire related responsibilities. Consider:
  - a. Compliance and enforcement roles regarding use of fire, possible ignition sources, etc.
  - b. Education on the dangers of fire as well as the potential use fire.
  - c. Communications with landbase users and the general public.
  - d. Possibility for government support and/or funding.
19. Support the development of the role and these responsibilities including:
  - a. Description of role and scope.
  - b. Materials to support the implementation of the role.
20. Monitor effectiveness of the role to ensure ongoing benefits in risk response are realized.

**ACTION RESPONSIBILITY:** Ntityx Resources, Westbank First Nation

**PARTNERS:** BC Wildfire Service, Private Landowners

**RISK RESPONSE GOAL:** Reduce wildfire risk through reduced human ignitions, improved resilience in the community due to awareness of fire (threats and benefits).

### 9.2 ENSURE THE RESILIENCE OF COMMUNICATIONS TOWERS TO WILDFIRE

**DISCUSSION:** Communications Towers and their associated power supply represent a significant component of emergency management activities – both for emergency management personnel and also for the general public. Ensuring the resilience of this resource in the face of wildfire is critically important.

**ACTIONS:**

1. Ensure all of the communications infrastructure (specifically com towers) have been identified (*Figure 11*). Confirm the power supply associated with each tower (generator, including length of operation) or powerline supplied.
2. Work with com tower proponents to assess the resilience of the communications towers and their associated power supply to wildfire. Consider partnering with relevant forest licencees in the case of crown forest land
3. Develop and implement strategies in response for the identified risks. These could include:
  - a. Alternate strategies for power supply.
  - b. Fuel management and maintenance plans/prescriptions to reduce adjacent fuel hazards.
  - c. Other operational procedures.

**ACTION RESPONSIBILITY:** Communications Tower Proponents, Ntityx Resources, Central Okanagan Regional District

**PARTNERS:** BC Wildfire Service, City of West Kelowna, Big White

**RISK RESPONSE GOAL:** Reduce risk to communications infrastructure. Reduced risks due to resilience communications resulting in more effective wildfire response and evacuation.

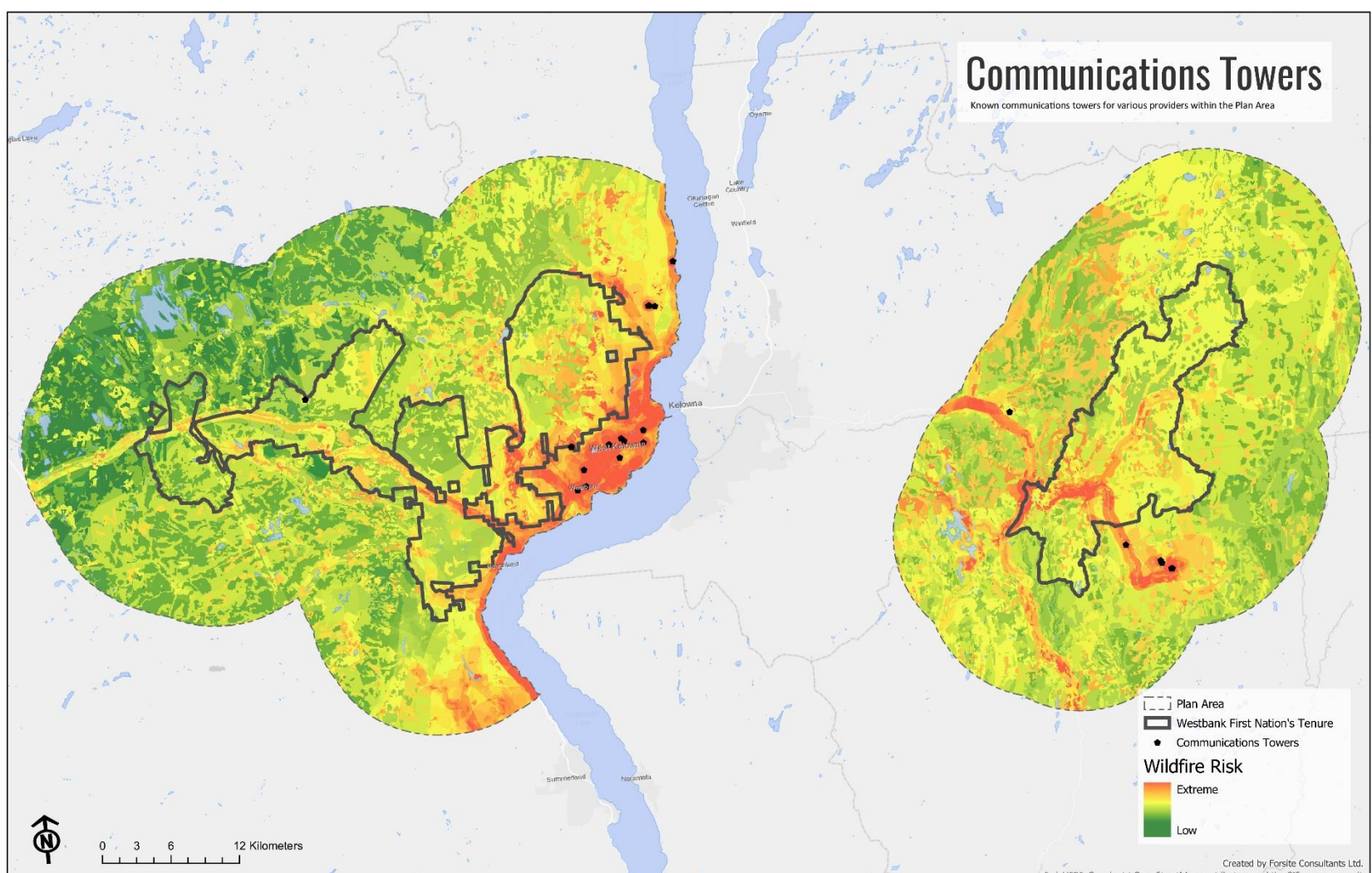


Figure 22. Identified communications towers belonging to various providers within the Plan Area.