



Summer Village of Ghost Lake

Wildfire
Hazard & Risk
Assessment

2024



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Introduction

Background

Wildfires are an important part of Alberta’s ecosystem. Much of Alberta’s landscape relies on wildfires to regenerate plant life and animal habitat. Without wildfire, the landscape would undergo diversity loss, and old growth will invite the proliferation of disease and insects. However, as communities extend further into grassland and forested areas, there is an increased risk of wildland urban-interface (WUI) fires. In the coming years, scientists project that wildfires are going to occur more frequently and with higher severity (Coogan, et al, 2019). In 2023, the total amount of area burned across Canada was 18.5 million hectares, more than double Canada’s previous record in 1995 (CIFFC, 2023). The purpose of this Wildfire Hazard & Risk Assessment is to provide the Summer Village of Ghost Lake with an analysis of the potential wildfire hazards and risks. Understanding the impacts of wildfire before they occur will assist the Summer Village with its wildfire planning, preparedness, and mitigation strategies for wildland urban-interface fires.



Wildland Urban Interface

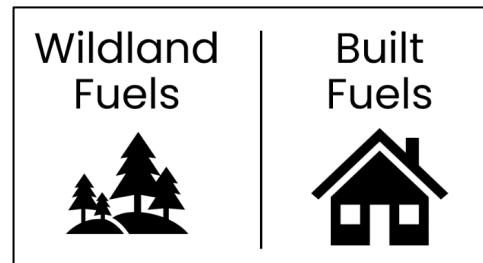
The wildland urban interface is described as the area where human development and the natural environment intersect (CIFFC, 2017). The fuels in the WUI are categorized as wildland fuels and built fuels. Wildland fuels include all natural and cultivated vegetation. Built fuels refer to structures such as residential homes and infrastructure. Wildland fuels and built fuels both have different burning characteristics. When combined, they create a complex mosaic of fuel that will cause unique burning characteristics that affect the ignition and fire behaviour. By understanding the factors that influence fire behavior such as fuel-typing, weather, and historical fire trends we can assess the potential adverse effects of wildfire on communities and homeowners. It is essential for residents to understand the wildfire hazards and risks in order to effectively prepare their home and community to minimize the likelihood of ignition within the community.

Hazard & Risk

The term hazard refers to an activity that may cause property damage, social and economic disruption, injury or loss of life (UNDDR, 2017). The most commonly accepted practice to measure wildfire hazard is to evaluate the potential wildfire behavior by analyzing the fuels, topography, and weather conditions that are most likely to influence a potential wildfire. It is essential to evaluate the wildfire hazard in order to identify the following:

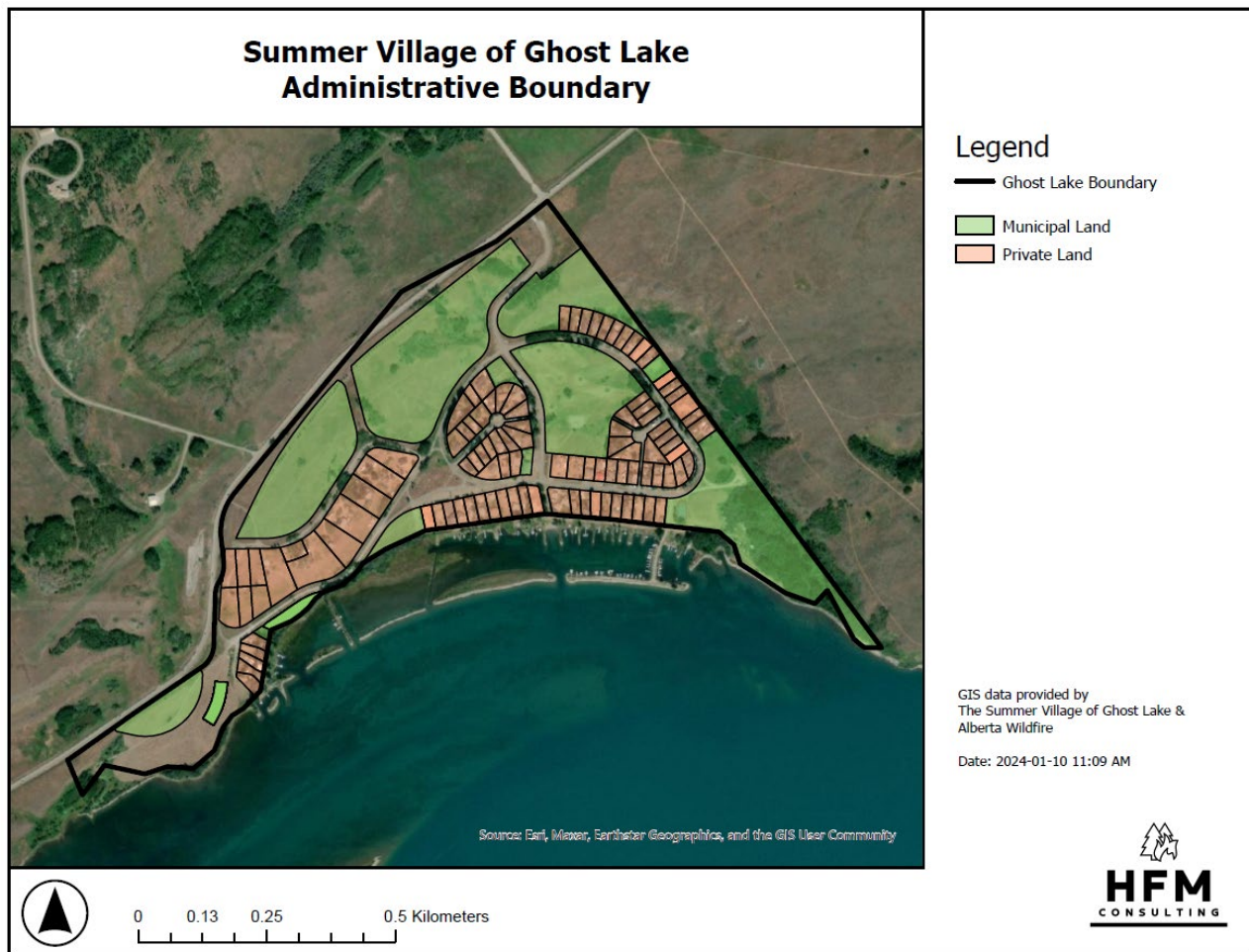
- Evaluate potential threats and risks that a wildfire may pose to a community.
- Educate residents on how to prepare for wildfires and mitigate the adverse effects within the community.
- Assist local wildfire and emergency response agencies.

Wildfire risk refers to the likelihood of a wildfire occurring within the Summer Village and the potential impacts of the wildfire on the community. These impacts could include ecological, economic, and social effects to the community and its residents.



Planning Area

The Summer Village of Ghost Lake (SVGL) is located between Ghost Lake and Bow Valley Trail (HWY1A) approximately 25km west of Cochrane Alberta (51.20636°N, 114.76546°W). The Summer Village is predominantly surrounded by grassland with clusters of mixed wood stands throughout the community. Land ownership includes private and municipal lands. The land directly west of the community is owned by the Stoney Nakoda Nation. In the spring and fall, this area can pose a significant risk to the community as it contains a significant grass fuel load. Winds are predominantly from the west and limited natural fuel breaks north of Ghost Lake increase the community's risk of an incoming grass fire. The figure below provides a map of the administrative boundaries within the Summer Village.



Community Description

The Summer Village of Ghost Lake is primarily comprised of residential single detached lots and municipal land. There are 112 lots with an average lot size of 0.14 hectares. There is a total of 44.3 hectares of municipal land within the community. The Summer Village has a Fire Service Agreement with the MD of Bighorn, identifying the MD of Bighorn Emergency Management as the primary wildfire response agency for the community. The MD of Bighorn Emergency Management has three fire districts, Benchlands, Exshaw, and Jamieson Road. Additionally, the MD of Bighorn has a wildfire mutual aid agreement with the Province of Alberta. If activated, the mutual aid agreement would provide the Summer Village with additional wildfire suppression support from the Ministry of Forestry and Parks. The table below provides a summary of the general information for the Summer Village of Ghost Lake.

General Community Information				
Community	Summer Village of Ghost Lake			
Location	23km west of Cochrane Alberta on Hwy 1A			
	Latitude	51.20636°N	Longitude	114.76546°W
Description	Number of Dwellings	92	Number of Residents	82
	Structures with Ignition Resistant Siding	25%-50%	Structures with Ignition Resistant Roofing	>85%
	Wildfire Response	<ul style="list-style-type: none"> MD of Bighorn Emergency Services Wildfire Management – Calgary Forest Area 		
	Wildfire Planning & Legislation	<ul style="list-style-type: none"> Wildfire Hazard and Risk Assessment Fire Safety Bylaw Municipal Emergency Management Plan (<i>in progress</i>) 		

Stakeholders

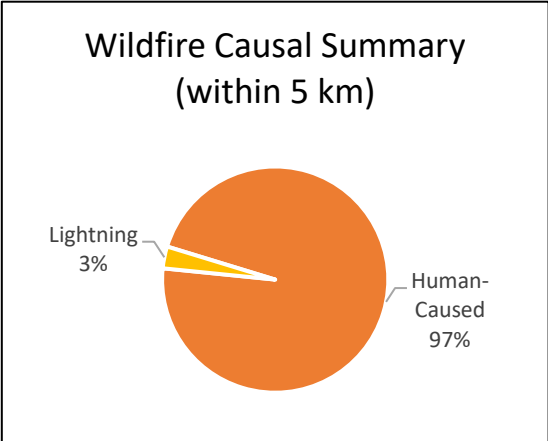
Identifying and communicating with individuals and groups who may be affected is a key component to successful planning and implementation of wildfire-related projects. The following table provides a list of the stakeholders to consider in future projects.

Agency	Name	Description
Provincial Government	Forestry and Parks	Wildfire prevention and response within the Forest Protection Area.
	Environment and Protected Areas	Support environmental conservation and sustainability. Land approvals, such as Temporary Field Authorizations (TFA).
	Municipal Affairs	Guidance on governance, safety standards, and funding support systems.
	Driving and Transportation	Construction and maintenance, signage installation/approvals, and traffic control on provincial roads.
	Ministry of Public Safety and Emergency Services	Support for emergency planning, response, and recovery (AEMA).
Municipal Government	SVGL Administration & Elected Officials	Guidance on community planning, regulations, and FireSmart projects.
	SVGL Planning and Development	Guidance on land use and residential development standards.
	M.D. of Bighorn Emergency Management	Primary emergency response agency for the Summer Village.
First Nations	Stoney Nakoda Nations	First Nations located directly west of the Summer Village.
Residents and Associations	SVGL Residents	Residents of the Summer Village of Ghost Lake
Business and Industry	TransAlta	Own/operation hydroelectric dam south of the Summer Village
	FORTIS	Manage powerlines/poles and utilities
Non-Governmental Organizations	FRIAA	Provide funding for FireSmart projects
	FireSmart Canada	Provides resources and guidance to assist communities with reducing the impacts of wildfire.

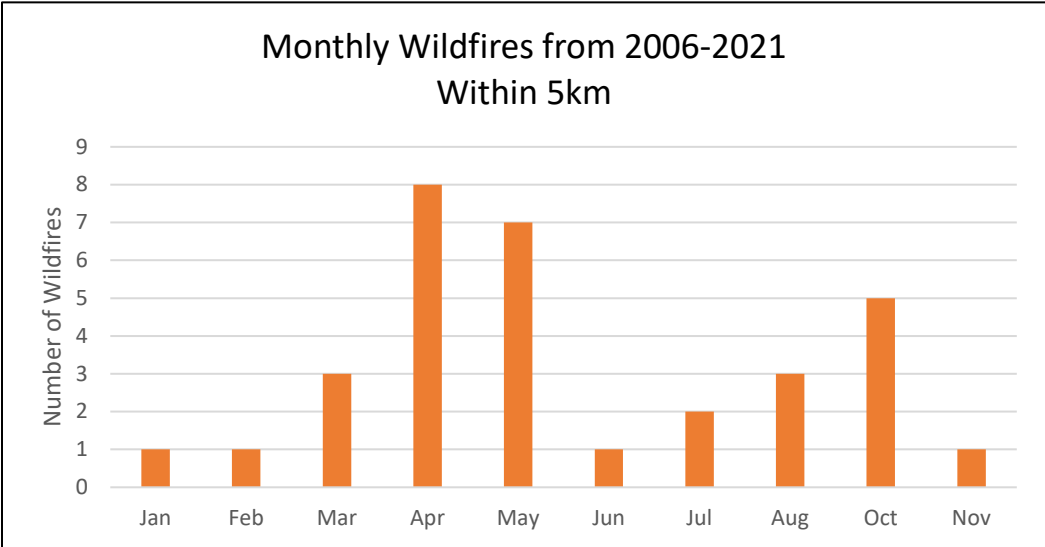
Risk Assessment

Historical Fire Data

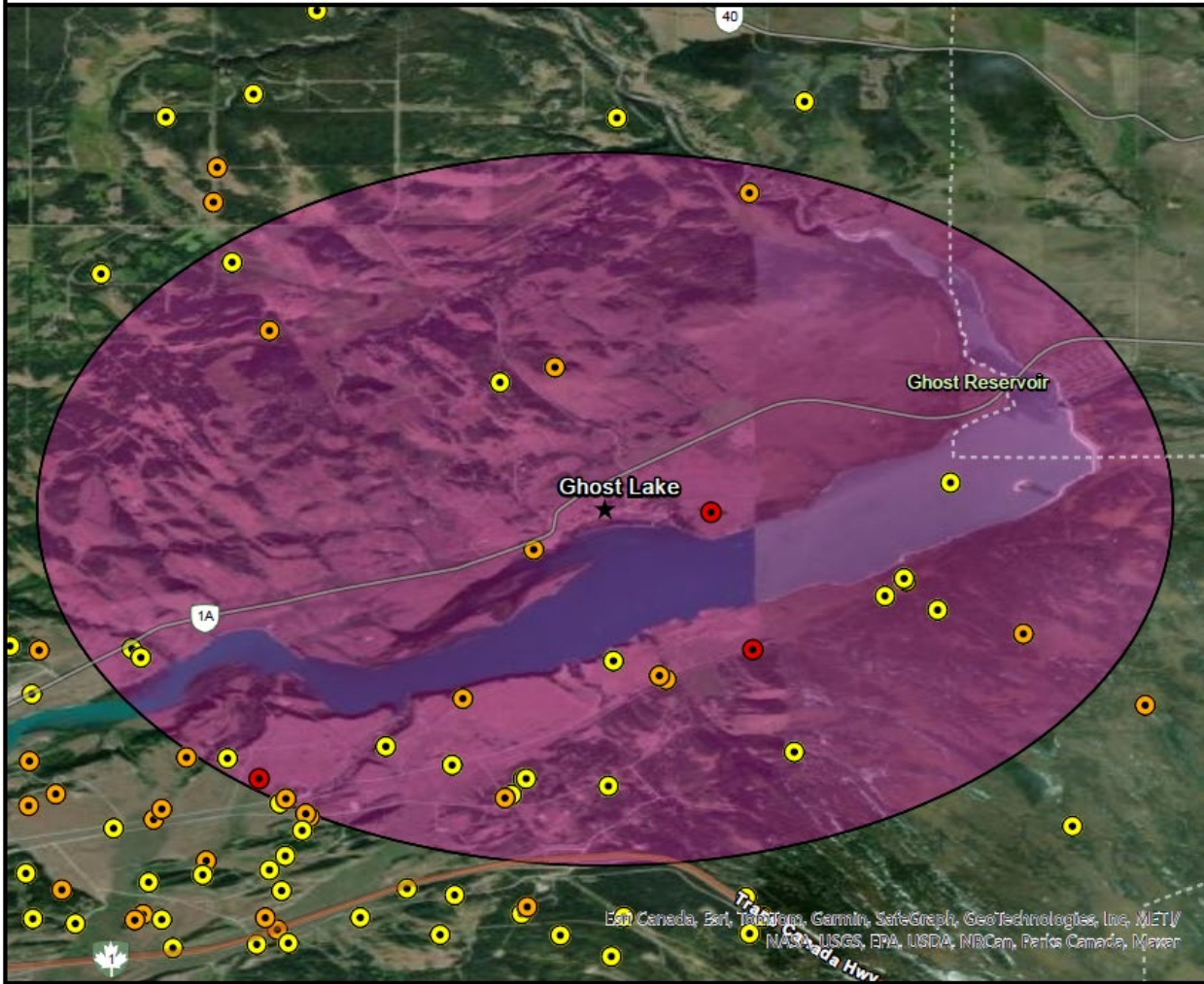
From 2006 to 2021, there were thirty-two wildfires within 5 kilometers of the Summer Village. Fifty-six percent of wildfires were less than 0.1 hectares in size or less. Less than ten percent of the fires were greater than four hectares, with the largest fire being a 160-hectare grass fire in 2011. The data suggest that the region is susceptible to high frequency-low intensity grassfires that are primarily human-caused. The majority of fires have been in grassland or mixed wood fuel types. Investigation reports identified ninety seven percent of all fires as man-caused, and only three percent as natural (lightning) caused.



The analysis of historical wildfires showed that the majority of wildfires within 5 kilometers of the community occur in the months of April and May. These fires have typically been smaller due to reduced fire weather conditions and response times by Fire Departments and Alberta Wildfire. The next page provides a map with the location of wildfires from 2006-2021.



Summer Village of Ghost Lake Historical Fires (2006 - 2021)



Legend

- ★ Summer Village of Ghost Lake
- 5 km FireSmart Community Zone

Wildfire Size Class (count)

- A (18)
- B (11)
- C (3)

GIS data provided by
The Summer Village of Ghost Lake &
Alberta Wildfire

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Fire Class Size

- A (0 to 0.1 ha)
- B (> 0.1 ha to 4.0 ha)
- C (> 4.0 ha to 40.0 ha)
- D (> 40.0 ha to 200 ha)
- E (> 200 ha)

Esri Canada, Esri, Trimble, Garmin, Safe-Graph, GeoTechnologies, Inc, METV
NASA, USGS, EPA, USDA, MRCan, Peris Canada, Maxar



0 1.25 2.5 5 Kilometers



Ecological Analysis

The Summer Village is located in the Montane ecozone within the Foothills Parkland Subregion (Alberta Parks, 2014). The area is defined by rolling hills of native grasslands and aspen woodlands. The Foothills Parkland has shorter growing seasons, with cooler summers but warmer winters. Due to the shorter growing season, there is a reduced amount of intensive cultivation. The grasslands are more heavily used for grazing or less-intensive agriculture such as hay and feed grains.

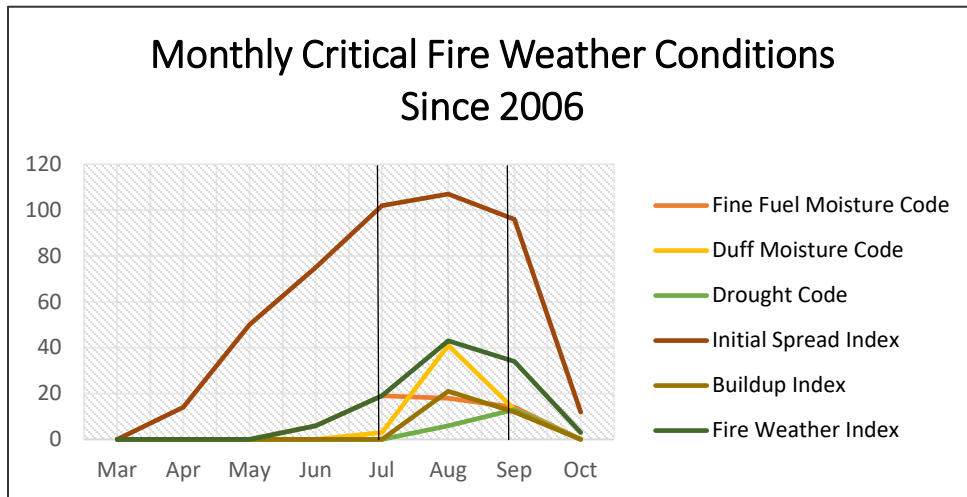
The Summer Village is most likely to experience critical fire weather conditions between July and September.

Traditionally, low intensity wildfires were one of the natural agents in the life cycle of grass, but as wildfire suppression has been increased, grassland management relies more heavily on grazing and cultivation. Trees within the subregion are primarily comprised of Aspen in upland sites and Balsam Poplar in moist areas. Wildfire spread days, where wildfire shows rapid growth rates, will typically occur during high or extreme weather conditions. Research has shown that the probability of fire spread days increase rapidly after certain fire conditions are met (Wang, 2023). The table below provides a summary of the threshold conditions for the Montane ecozone and the associated fire danger rating.

Critical Fire Weather Conditions in the Montane Ecozone		
Indices	Threshold	Fire Danger Rating
Fire Weather Index (FWI)	> 28.3	Very High to Extreme
Buildup Index (BUI)	> 103	Extreme
Initial Spread Index (ISI)	> 7.6	High to Extreme
Drought Code (DC)	> 481	Extreme
Duff Moisture Code (DMC)	> 68	Extreme
Fine Fuel Moisture Code (FFMC)	> 92	Extreme

Wang (2023): Critical fire weather conditions during active fire spread days in Canada.

The table shows that the Summer Village can experience critical fire weather conditions even if the FWI and ISI are not in extreme. This is due to the significant grass hazard surrounding the community. The dates where fire conditions near the Summer Village exceeded the threshold were compiled and distributed by month since 2006. Based on this analysis, the Summer Village is most likely to experience critical weather conditions between July and September. The graph on the next page summarizes the critical fire weather conditions since 2006.



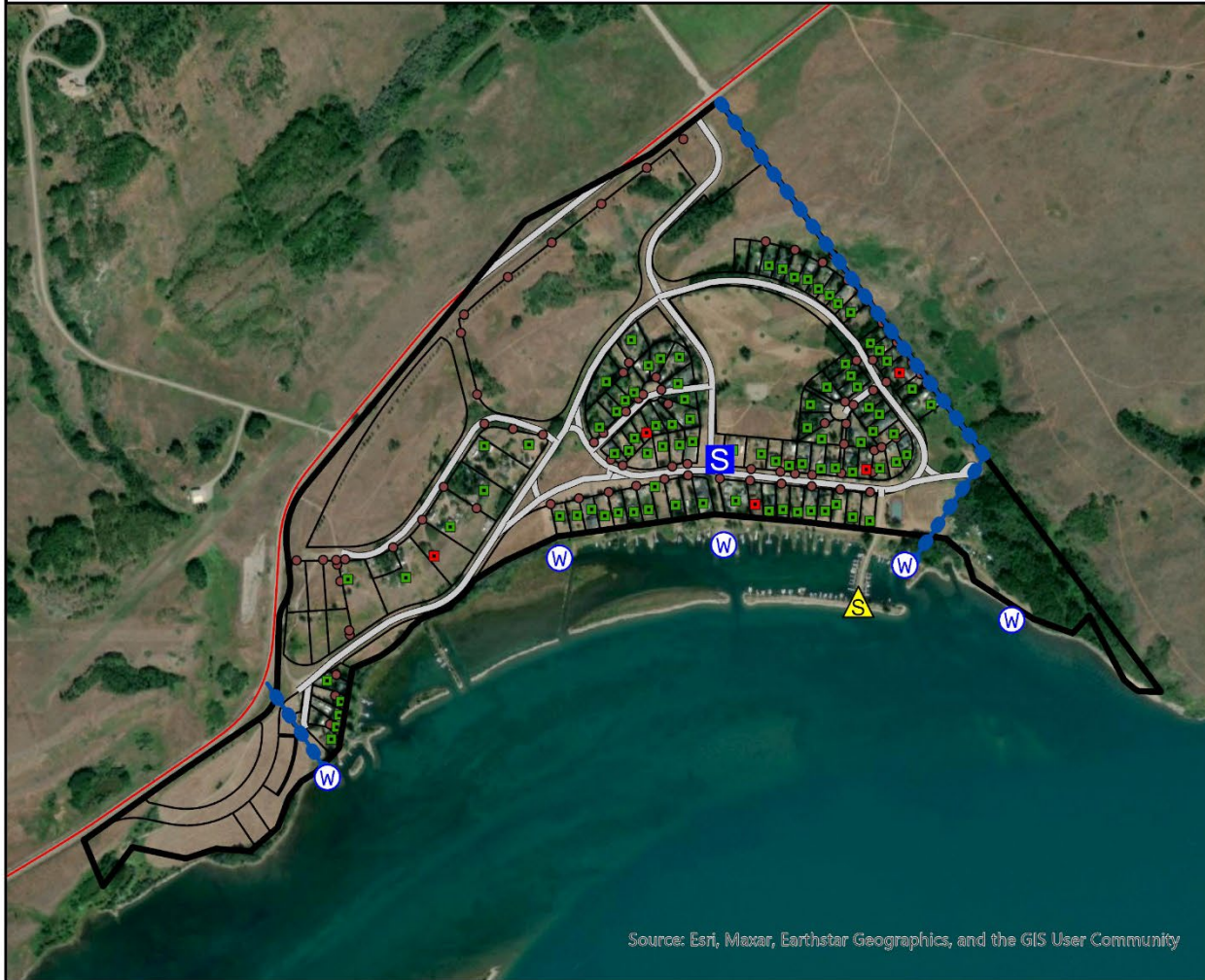
Detection & Response

There is a single primary road entering the community from Bow Valley Trail on the east end. A secondary egress road also exists on the west end of the community with limited access. The closest fire department is the Jamieson Road Fire Department, a volunteer station, located approximately 5 kilometers north of the community. Fire response on the Stony Nakoda Nation is typically from the Stony Nakoda Fire Department or Alberta Wildfire. There is currently no fire suppression equipment stored within the community. During the fire season, the closest fire lookout is Barrier Lookout, located approximately 35 kilometers southwest of the community. Detections surrounding the community have been from both 911 dispatch and 310-FIRE.

Values at Risk

The Summer Village is primarily comprised of single residential detached homes. In addition to residential homes, other values-at-risk include a community building, utility infrastructure (including power lines/poles and underground lines), detached structures, and docks. Planned sprinkler line locations have been established on the east and west sides of the community, and a staging area and safe refuge area have been identified for residents in the event of an emergency. Below is a map of the community's values at risk.

Summer Village of Ghost Lake Values at Risk





Legend

-  Ghost Lake Boundary
-  Power Poles
-  Sprinkler Lines
-  Safe Refuge Area
-  Staging Area
-  Water Access

Roads

-  Roads
-  Highway

Structures

-  Combustible
-  Non-Combustible

GIS data provided by
The Summer Village of Ghost Lake &
Alberta Wildfire

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Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community



0 0.13 0.25 0.5 Kilometers



Hazard Assessment

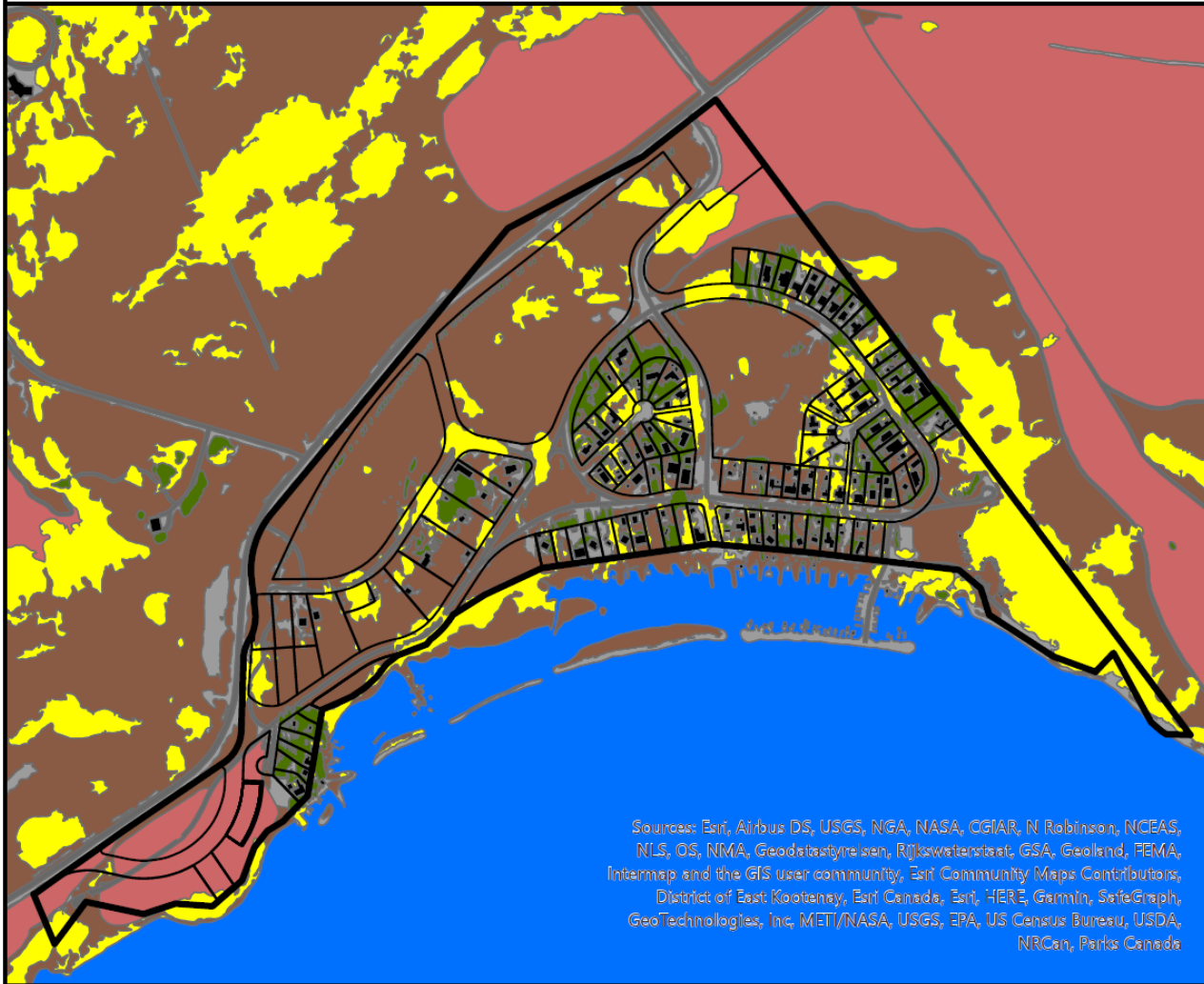
Wildland Fuel Assessment

The wildland fuel types were categorized using high resolution multi-spectral satellite imagery. The wildland fuels were separated into coniferous fuels, deciduous fuels, grass, cropland, water, and non-fuels. Non-fuel regions were further classified into infrastructure and gravel/pavement.

The Summer Village is primarily comprised of Grassland resulting significant hazard during portions of the year where the grass is cured or dry. During the summer, much of the grassland fuel type will change from matted grass to standing grass in the late summer and fall as the grass recovers from the snowpack (NRC, 2019). Although coniferous stands only accounted for 1.7% of the total area, most of the coniferous vegetation is located around residential lots. Table 1 provides a breakdown of the different fuel types and their proportions within the 500-meter WUI zone. The next page contains a map of the various fuel types within the Summer Village.

Fuel Description (FBP Type)	Area (ha)	Proportion of Area (%)
Coniferous Forest (C-2)	5.89	1.7%
Deciduous Forest (D1/D2)	56.60	16.6%
Grassland/Cropland (O1-A)	183.96	53.8%
Water	76.79	22.5%
Infrastructure	2.23	0.6%
Non-Combustible Fuel	16.44	4.8%
Totals	341.91	100

Summer Village of Ghost Lake Wildland Fuel Type Map



Legend

— Administrative Boundary

□ Land Use

Wildland Fuel (FBP Type)

- Barren Land
- Broadleaf (D1/D2)
- Buildings
- Cropland (O1-A)
- Grassland (O1-A)
- Needleleaf (C-2)
- Roads
- Water

GIS data provided by
The Summer Village of Ghost Lake
Alberta Wildfire
Robb Consulting Inc.

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Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatasynthese, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community, Esri Community Maps Contributors, District of East Kootenay, Esri Canada, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, US Census Bureau, USDA, NRCan, Parks Canada



0 0.13 0.25 0.5 Kilometers



Wildfire Behaviour Potential

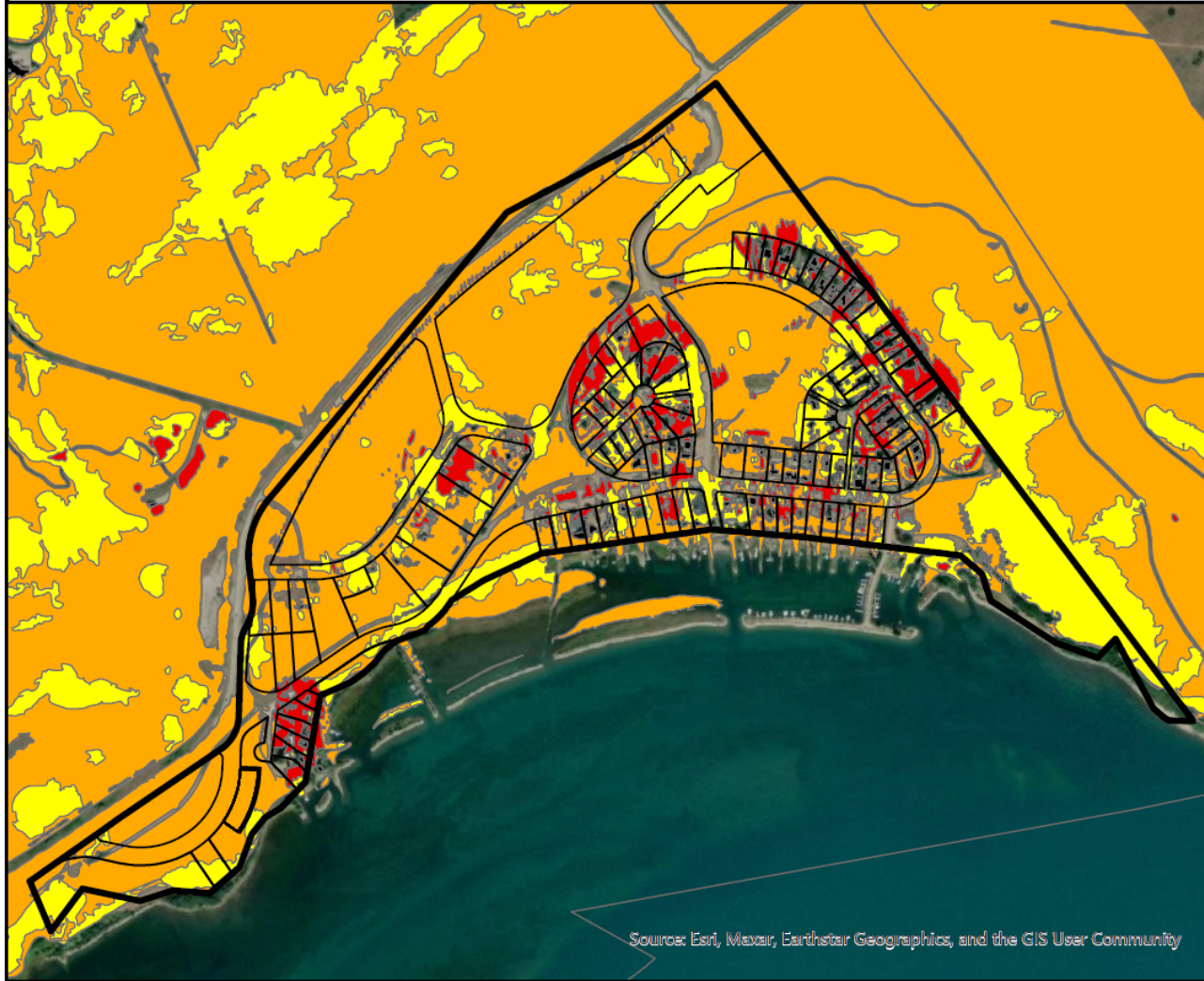
The wildfire behavior potential is used to quantify the wildfire hazard within the Summer Village by predicting a wildfire’s intensity. Areas with coniferous wildland fuels present a high hazard for the community. These areas will likely generate highly active fire behavior where direct attack suppression strategies will have limited success. Suppression efforts in these regions may be limited to indirect attack, and helicopter/tanker drops. Fire behaviour potential It is a useful metric to help identify and prioritize areas that require FireSmart mitigation. With appropriate vegetation management, fire intensity can be reduced to a manageable level and allow ground suppression techniques to be successful.

The fire behaviour potential in the Summer Village shows that over 50% of the area has a moderate fire hazard. This is primarily due to the significant amount of grassland in and around the community. The table below summarizes the wildfire behavior potential for all fuels found within the WUI surrounding the Summer Village of Ghost Lake, AB. The next page contains a map of the Summer Village’s fire behaviour potential.

Fuel Description	Wildfire Behaviour Potential	Proportion of Area (%)
Coniferous Forest (C-2)	High Hazard	1.7
Grassland/Cropland (O1-A)	Moderate Hazard	53.8
Deciduous Forest (D1/D2)	Low Hazard	16.6
Water	No Hazard	
Non-Combustible Fuel	No Hazard	27.9
Roads	No Hazard	
Infrastructure	*	*

**Note. Although infrastructure does pose a hazard to wildfire transmission within a community, this structure-to-structure fire propagation is not considered in this report.*

Summer Village of Ghost Lake Fire Behaviour Potential



Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Legend

- Ghost Lake Boundary
- Infrastructure
- High Hazard
- Moderate Hazard
- Low Hazard
- Non-Fuel

GIS data provided by
The Summer Village of Ghost Lake
Alberta Wildfire
Robb Consulting Ltd.

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0 0.13 0.25 0.5 Kilometers



Exposure Assessment

Exposure Assessments are new tool developed collaboratively between the University of Alberta, Alberta Wildfire Management Branch, and FireSmart Canada to identify wildfire hazard relative to a community's values (PIP, 2017). Exposure Assessments can help communities prioritize their mitigation efforts in areas that most hazards to homeowners. Wildfires can reach structures through two primary methods: ember transport or radiant heat (Beverly et al., 2010).

Studies have shown that homeowners can reduce their wildfire risk by up to 75%

Ember Transport

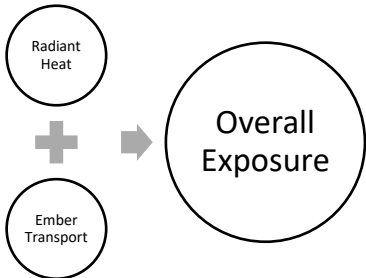
Falling embers that are transported by wind or air have the potential to create entirely new fires beyond the fire perimeter called spot fires (CIFFC, 2017). These spot fires can ignite both wildland fuels and built fuels. Between 50 – 90% of homes destroyed by wildfires are originally ignited by embers (Czajkowski et al. 2020). As the majority of wildland fuels adjacent to the Summer Village are grassland, the overall risk of ember transport is greatly reduced, however, there are still high-hazard areas in the community that should be prioritized. The majority of these areas are located on private property.

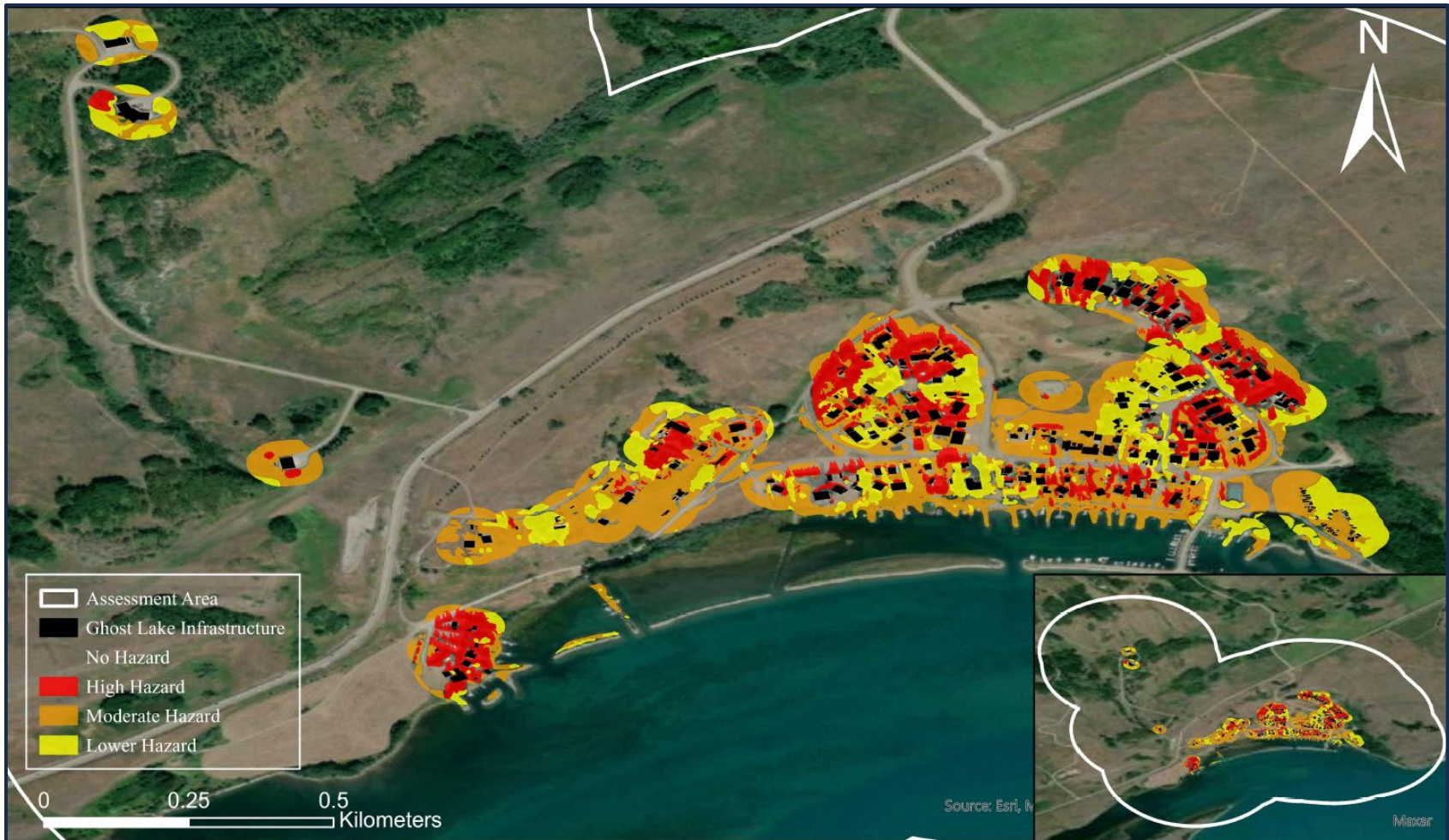
Radiant Heat

High temperatures caused by wildfire have the potential to ignite nearby built fuels or wildland fuels. The intensity of the wildfire will directly influence the probably of igniting nearby fuels through radiant heat. The majority of areas that have the highest exposure from radiant heat are located on private land. Studies have shown that homeowners who take mitigative measures such as updating their homes with fire-resistant materials and reducing the amount of fuel within 10m of their home can reduce their wildfire risk by up to 75% (Czajkowski et al. 2020).

Overall Exposure

The map on the next page combines ember transport and radiant heat data to produce an overall summary of the areas with the highest exposure. The data shows that the southeast and west end of the Summer Village should be prioritized.





Summer Village of Ghost Lake

Wildfire Exposure Risk: Radiant Heat (0-30 Meters)

Worldview-3 0.31m Resolution Multispectral Imagery
 Produced: December 15th, 2023

Cartographer: HFM Consulting

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Summer Village of Ghost Lake

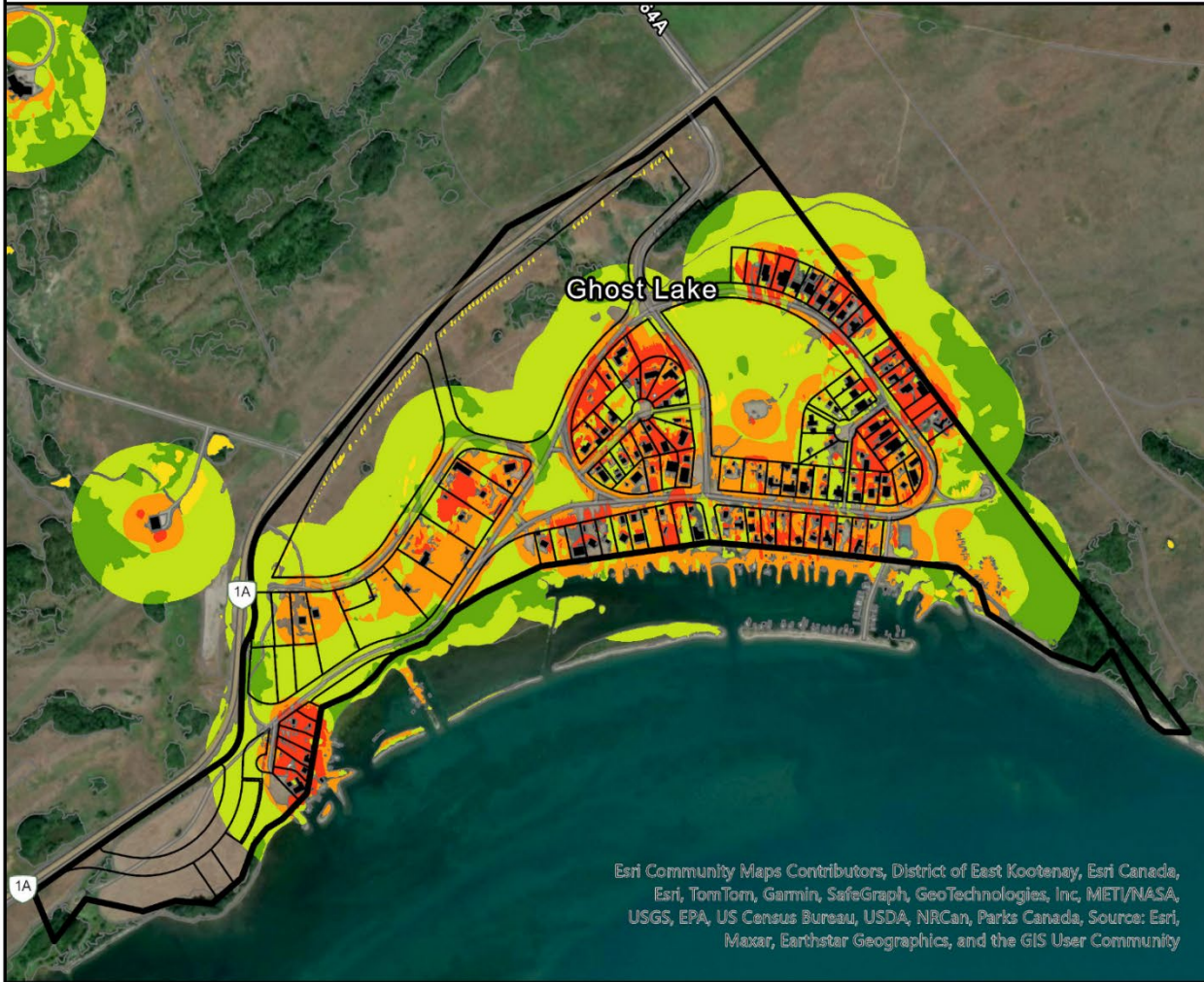
Landscape Wildfire Exposure: Radiant Heat (0-30 Meters)

Worldview-3 0.31m Resolution Multispectral Imagery
 Produced: December 15th, 2023

Cartographer: HFM Consulting Services

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Summer Village of Ghost Lake Overall Wildfire Exposure



Legend

— Administrative Boundary

□ Land Use

Exposure

1 (Low)

2

3

4

5 (Extreme)

GIS data provided by
The Summer Village of Ghost Lake
Alberta Wildfire
Robb Consulting Services Inc.

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Esri Community Maps Contributors, District of East Kootenay, Esri Canada,
Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA,
USGS, EPA, US Census Bureau, USDA, NRCan, Parks Canada, Source: Esri,
Maxar, Earthstar Geographics, and the GIS User Community



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Recommendations

Vegetation Management

Vegetation Management is a tool used to reduce a wildfire's intensity or impact on a community. The purpose of vegetation management around the Summer Village is three-fold. First, vegetation management will reduce the intensity, severity, and rate of spread of an incoming wildfire. Second, it would provide first responders with better access to the community's water sources. Third, it provides an opportunity to educate residents on the benefits of FireSmart.

As the primary wildland fuel within the Summer Village is grassland, the first recommendation is to develop a maintenance program to reduce the amount of grassland fuels. This could include treatments such as mowing, grazing, or hazard reduction burning. The priority area will be on the west side of the community to reduce the threat of incoming grassfires from the west and along highway 1a. The clusters of spruce trees within the community should be treated to FireSmart standards to reduce the chances of individual trees igniting and transporting embers further into the community. Reducing vegetation in these areas will reduce wildfire intensity and provide better/safer access for first responders who are utilizing the lake as a water source. Lastly, the decadent willow in the southeast of the community to should be removed to reduce the fuel load and allow new green willow to regenerate.



Development & Legislation

Post-fire studies, such as the research completed after the Fort McMurray Fire in 2016, identified the importance of building homes with fire-resistant material (Westhaver, 2017). Structures built with fire-resistant roofing, siding, and decking material are less likely to ignite from airborne firebrands or radiant heat. Integrating FireSmart principles into legislation, bylaws, and development standards is a key step towards protecting communities from wildfire. Although over 90% of homes have fire-resistant roofing, less than half have fire-resistant siding.

In addition to legislative requirements for building materials, FireSmart principles are also applicable to land use requirements such as maximum grass height, fire pit requirements, and address sign standards. Addressing these issues will not only help protect the Summer Village from incoming wildfires, but it will also reduce the probability of a wildfire starting within the community.

Education & Engagement

The success of implementing wildfire mitigation strategies relies heavily on the participation of homeowners and residents. The FireSmart Home Ignition Zone (HIZ) divides build fuels and wildland fuels into three zones: the immediate zone, intermediate zone, and extended zone. For the majority of homeowners within the Summer Village, the intermediate zone and immediate zone falls within private property. New research has emphasized the importance of protecting the intermediate zone and immediate zone from radiant heat and fire embers (PIP, 2017). Providing educational tools and resources such as Advanced FireSmart Home Assessments, Open Houses, and FireSmart Manuals will equip homeowners to take



the necessary steps to reduce the risk of wildfire to their properties and the Summer Village.

Interagency Cooperation & Cross-Training



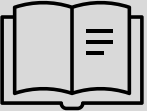


Maintaining strong partnerships between elected officials, government agencies, and first responders is key to the success of effectively managing an emergency. It is important for officials within the Summer Village who will be involved in wildfires to develop and maintain relationships with responding agencies. To accomplish this the Summer Village should conduct wildland/urban interface training between the Summer Village officials and responding agencies such as Alberta Wildfire, AEMA, RCMP, and the MD of Bighorn Fire Department. An opportunity for cross training is to combine a Fire Department mock-exercise with hazard reduction burning.

Emergency Planning

There are two primary ways to engage in emergency planning within the Summer Village. This first is to build specific wildfire prevention and mitigation plans that will aid the community in reducing the impact of wildfire. The second is to address interface characteristics and response in existing plans, policies, and legislation. Activities such as wildfire simulations and tabletop exercises can strengthen emergency planning by testing the effectiveness of current planning. The Summer Village should also review emergency planning annually to ensure that information is up to date.

Summary of Recommendations

The following provides a summary of the recommendations made in this plan:

	<p>Vegetation Management</p>	<ul style="list-style-type: none"> • Develop an annual maintenance program for the community’s grassland fuels. • Prune all coniferous trees within the community two meters from the ground to the lowest branch. • Remove decadent willow from the southeast quadrant of the community. • Collaborate with FORTIS to ensure that vegetation along power distribution easements meets standards.
	<p>Legislation</p>	<ul style="list-style-type: none"> • Incorporate FireSmart Principles into the Summer Village of Ghost Lake development, Land Use, and Fire Safety legislation. • Implement the use of fire pit permits to ensure that fire pits meet the required safety standards.
	<p>Education</p>	<ul style="list-style-type: none"> • Provide homeowners with wildfire and FireSmart public education and engagement activities. • Complete and maintain FireSmart recognition through FireSmart Canada Neighbourhood Recognition Program (FSNRP).
	<p>Interagency Cooperation</p>	<ul style="list-style-type: none"> • Conduct wildland/urban interface training between the Summer Village officials and responding agencies such as Alberta Wildfire, AEMA, RCMP, and the MD of Bighorn Fire Department.
	<p>Emergency Planning</p>	<ul style="list-style-type: none"> • Complete a tabletop exercise to test and validate the Summer Village’s emergency planning. • Stock sprinklers and pumps and drtest wildfire equipment annually. • Review and update emergency planning documents annually.

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