# Holy Cross Energy (HCE) Avon-to-Gilman Electric (115-kV) Transmission Line

## Wildfire Risk Review

**Date:** 10/22/2021

**Fire Behavior Analyst:** Rodrigo B. Moraga, FBAN / Wildland Fire Specialist, Anchor Point Group LLC

**Client:** Town of Minturn, CO



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## Executive Summary

Holy Cross Electric Association, Inc., also known legally as Holy Cross Energy (HCE) (an electric cooperative formed under the authority of the Rural Electrification Act of 1936), proposes to construct a new 115-kV transmission line between the existing Gilman and Avon Substations in Eagle County, Colorado (project area). The entire proposed route is about 8.9 miles and would cross approximately 3.4 miles of National Forest System (NFS) land. Much of the proposed route is within existing rights-ofway (ROWs) already occupied by other linear utility facilities and infrastructure, including a HCE distribution line, as well as a gas pipeline and distribution line operated by Xcel Energy (Xcel).

This report considers the effects of the Proposed Action on the wildfire risk to the Town of Minturn. This review is focused on the first element of Issue #2 of the Notice of Proposed Action: "The project may increase the risk of wildfire in the areas it is proposed to cross… this examines the wildland fire hazards and risks associated with the introduction of a potential wildfire ignition source".

This analysis found that the fuels, weather, and topography typical of the area are very conducive to the rapid spread of wildfires during peak fire season. The numerous residences, commercial properties, and natural areas within the project boundary would likely be adversely impacted by a wildfire originating under the proposed transmission line. The fire behavior analysis component of this report does not estimate the probability of ignition occurring but is focused on fire behavior and impacts to the Town of Minturn if a fire was to occur. The No-HARM risk modeling, utilized to rate and rank individual structure risk does include a probabilistic component.



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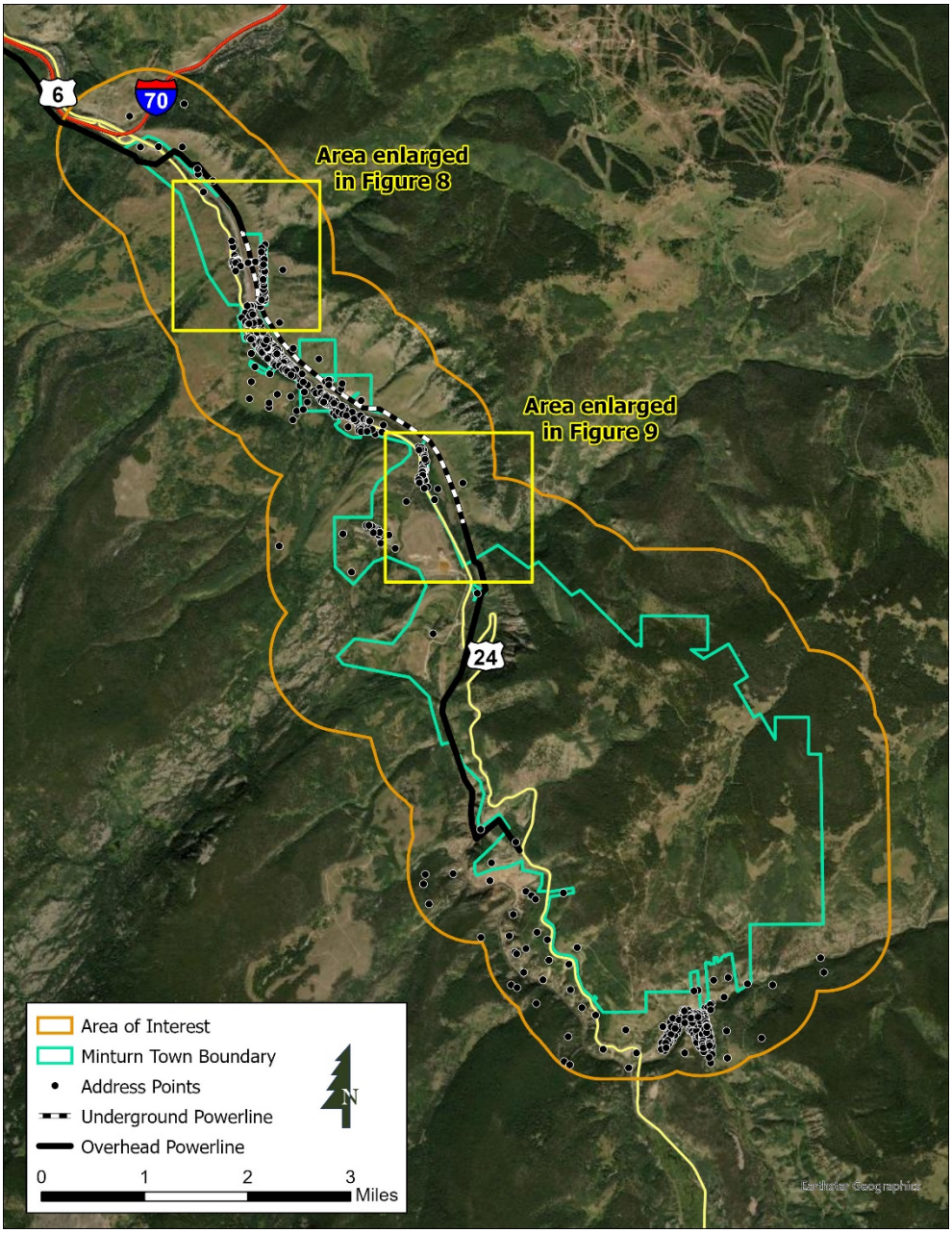


*Figure 1 Proposed Holly Cross Energy (HCE) Avon to Gilman Electric (115kV) Transmission Line*



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## Current Conditions

The following is a revised excerpt from the 2011 Eagle River Community Wildfire Protection Plan (CWPP) which covered the Town of Minturn.

| | |
|---|---|
| Number of Structures | 877 |
| Utilities Above or Below Ground | Above – numerous overhead power lines |
| General Construction | Mixture of combustible/noncombustible siding; roofs are mostly metal, with some shake-shingle roofs |
| Average Lot Size | <1 Acre |
| Dual Access Roads | Two ways in/out; many one-way side roads |
| Road Widths, Slope, and Surface | Wide highway, side roads <20'; mostly flat; paved |
| Emergency Vehicle Turnarounds | Not adequate in most areas |
| Water Supply | Hydrants in town are not always reliable; dry hydrants at Kings Ranch |
| Proximity to Staffed Fire Station | <1 mile |
| Other Hazards | High housing density; railroad tracks through town; heavy traffic on Hwy 24 |

The town of Minturn is located in the valley bottom along highway 24. The town has a high wildfire rating as per the 2011 CWPP and confirmed with the analysis for this project. The population of the town is approximately 1,100. The valley sides surrounding the town are steep and are covered primarily with grass and sage at the lower slopes transitioning to aspen, lodgepole and mixed conifer on the higher slopes. Side roads through town are narrow and lack adequate turnaround for large apparatus. Smaller subdivisions of the town include Kings Ranch and the Maloit Park School area, both of which are accessed by one-way-in-and-out roads and are surrounded by flammable vegetation. Some homes on the edge of town have done limited defensible space work, but more needs to be done to be fully effective. Street signs throughout town are metal and reflective, though they are not present in all areas.

Due to limited firefighting resources, especially during the early stages of an expanding wildfire incident, high home density, and/or long response times, available firefighting resources may not be adequate to protect homes in the town.



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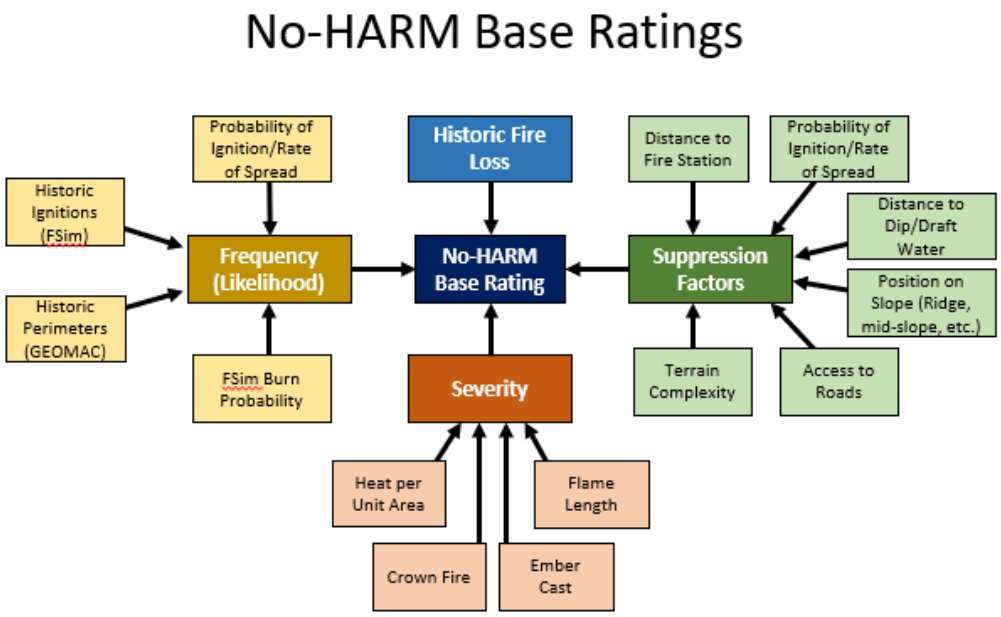
## Risk Assessment

Anchor Point's National Hazard and Risk Model (No-HARM) for wildfire was created in response to the growing need for accurate information on the hazard and risk to structures in the United States due to wildfire. No-HARM risk assessment methodology directly addresses the need for a fire-science based, risk assessment. No-HARM uses a state-of-the-art software model to create a map of risk due to wildfire. Fire behavior modeling uses local information about fuel, weather and topography, to generate estimates of fire behavior in the form of rate of spread, crown fire, maximum ember distance, and fireline intensity. Fireline intensity can be thought of as the interaction of flame length and rate of spread and is considered the best overall predictor of potential fire behavior. Fire behavior calculations are constructed utilizing high resolution fire weather data, detailed vegetation (or fuel) modeling, and topographic condition. This data is critical to assess the hazard/risk to structures and other infrastructure due to wildfire. Additionally, No-HARM incorporates historic wildfire occurrence to predict the potential for wildfire activity in the future. Using historic ignition points, fire perimeters, probability of ignition, and simulated fire spread to simulate future fire seasons, the model provides the probability of an area burning in any given year. No-HARM evaluates site specific elements such as distance to fire stations and water sources but it also incorporates area-wide components such as the volume of embers that may impact the town.



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## No-HARM Risk Rating

Of the 12,606 acres assessed by No-HARM, 90% of the land mass is rated as High. And additional 8% as very high. Overall, this is an indicator that fire in the area could have a high impact on built infrastructure in the study area.

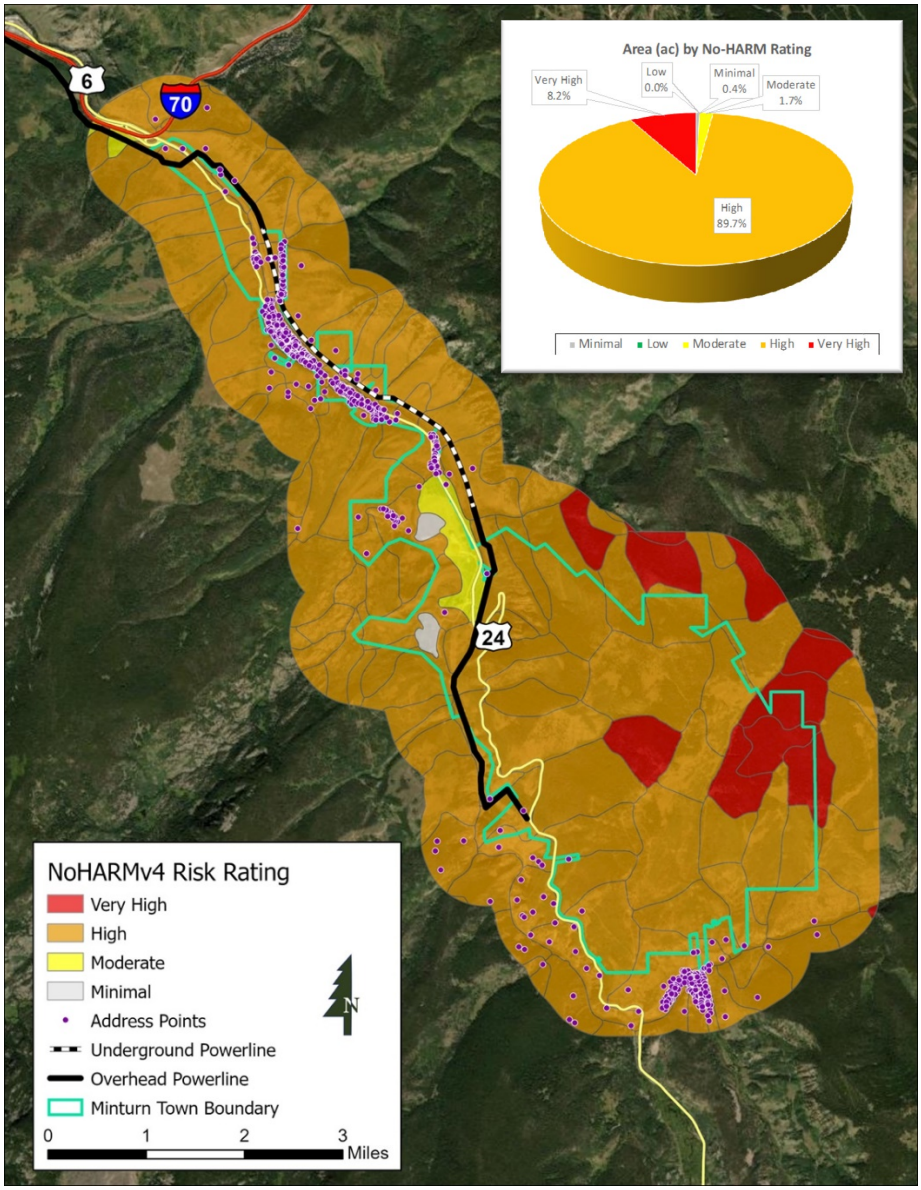


*Figure 2 No-HARM Risk Ratings*



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**Structure Risk Ratings**

There are 877 address points in the study area. These represent both residential and commercial addresses. The No-HARM has rated virtually all as having a high rating.

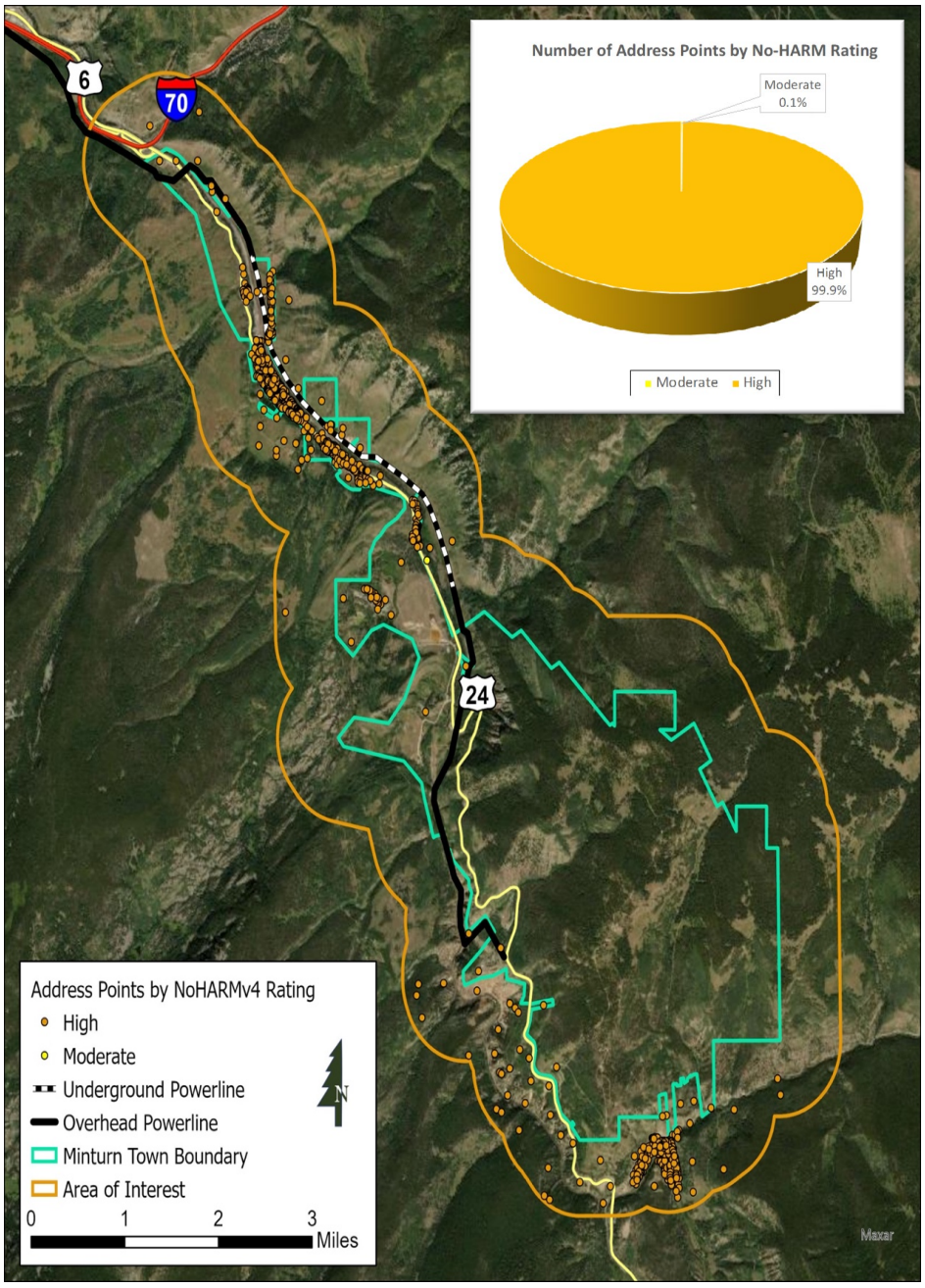


Figure 3 Structure Risk Ratings



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**No-HARM Fire Environments**

No-HARM divides the landscape into three distinct fire environments based on fire behavior and structure density.

**Wildland** areas cover the majority of the landscape having relatively continuous fuel with only a few structures and roads and little other human disturbances. Limited access and rugged terrain can make suppression difficult or impossible.

**Intermix** areas are generally residential neighborhoods with enough fuel between structures to allow a surface wildfire to burn through relatively unimpeded.

**Interface** areas have a high structure density and consist primarily of roads, houses and other infrastructure. There is very little combustible vegetation and the threat of wildfire is related to the proximity of surrounding fuels.

The interface zone can be thought of as the ember zone and is defined as the more urban areas within No-HARM. In these areas, embers pose the greatest threat to structures. In comparison, other areas, such as Wildland and Intermix zones have exposure not only from embers but direct flame impingement, as well. The Interface zone is not always an area that is evaluated or considered in wildfire threat determination, yet nationwide, one third of all structure loss is in this more urban ember zone.

**Structures in Interface**

Although the overall landscape assessed is classified as wildland (see figure 5 below) only 30% of the structures are located in Wildland. As seen in figure 4, a majority of the structures are located in the Interface zone. The fire behavior analysis in this report highlights the potential for embers to be generated by the conifer trees in the area, potentially affecting structures in the Interface or ember zone.

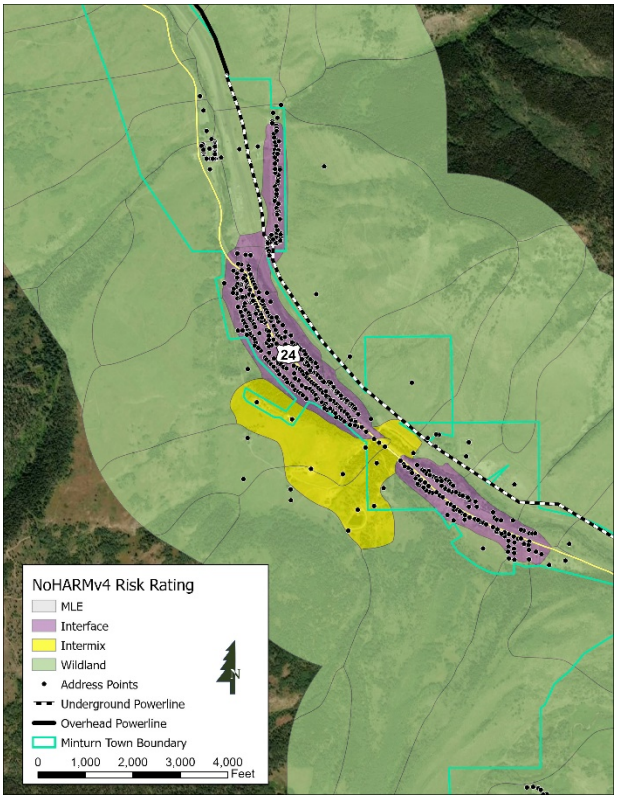


*Figure 4 No-Harm Map (Zoomed in to Interface area)*



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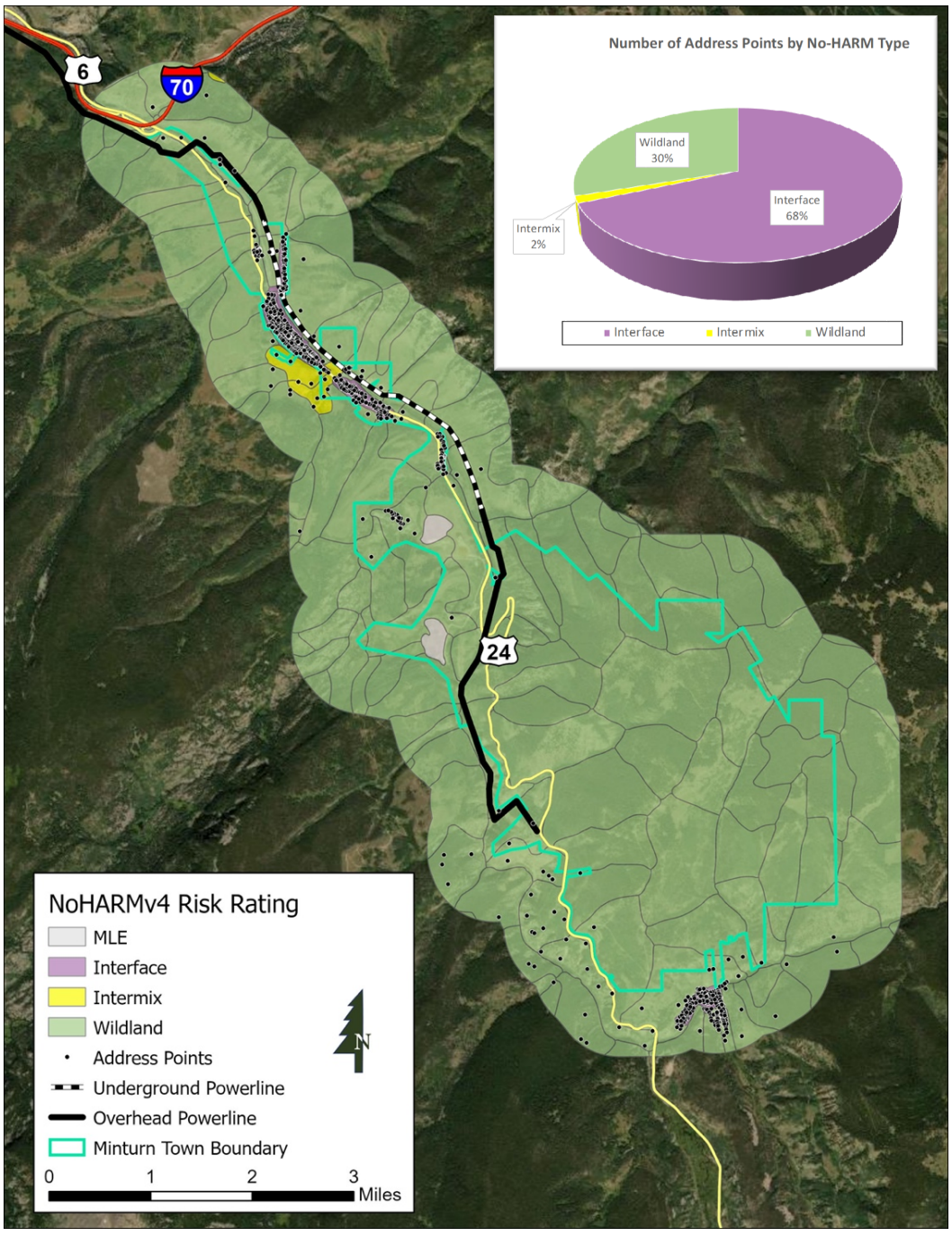


*Figure 5 No-Harm Rating by Area Type*



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## Fire Behavior Results

**Fuels**[1]

The vegetation (Fuel) in the analysis area varies, primarily by elevation. The fuels along the valley floor, under and around the powerlines is primarily a Sage and grass mix (GS2) with some Aspen and mixed conifer on the higher slopes. The grass/shrub fuels have a high rate of spread especially under windy conditions. Along the Eagle River there are conifers (TU5) that abut some of the communities. While these trees are not under the powerlines, the fire could easily spread into these stands. Conifers are prone to torching and crowning and will spread embers readily.

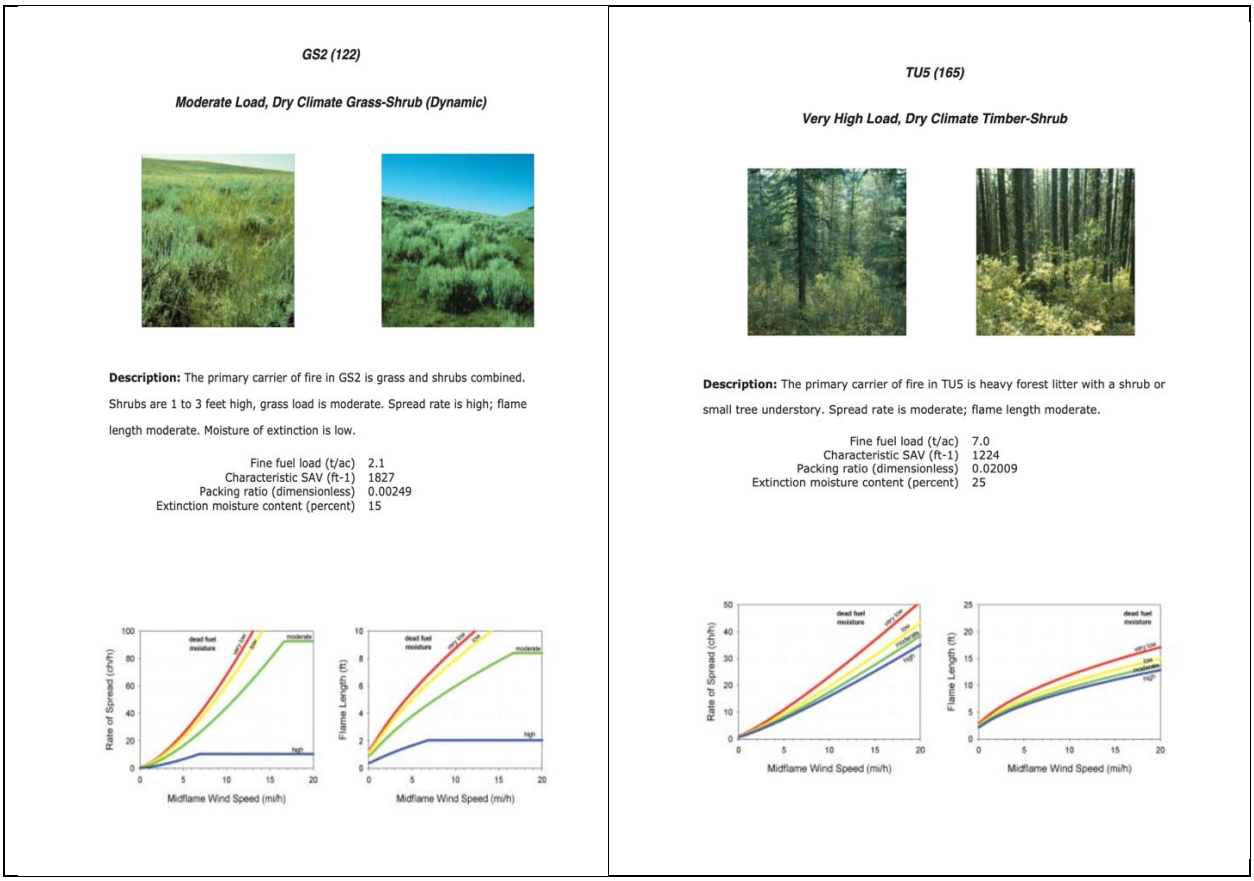


*Figure 6 Description of Fuel Models used in analysis*

[1] Scott, Joe H.; Burgan, Robert E. 2005. Standard fire behavior fuel models: a comprehensive set for use with Rothermel's surface fire spread model. Gen. Tech. Rep. RMRS-GTR-153. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 72 p.



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**Topography**
The analysis landscape is a U-shaped valley with mostly flat valley bottom that transitions to steeper hillsides. The valley runs Northwest to Southeast and the Eagle River follows the same pattern on the east side of highway 24.

**Weather**
The analysis was run using weather information from the Dowd Junction Remote Automated Weather Station (RAWS) which is located north of the study area and is the closest fire weather station. 90th percentile weather parameters were used to determine the fuel moistures and windspeeds to use in the fire behavior modeling. Windspeeds from 0-20 were used to cover a range of possible scenarios.

| | | |
|---|---|---|
| **Fuel/Vegetation, Surface/Understory[2]** | | |
| Fuel Model | | GS2, TU5 |
| **Fuel Moisture** | | |
| 1-h Fuel Moisture | % | 4 |
| 10-h Fuel Moisture | % | 5 |
| 100-h Fuel Moisture | % | 10 |
| Live Herbaceous Fuel Moisture | % | 35 |
| Live Woody Fuel Moisture | % | 91 |
| **Weather** | | |
| Midflame Wind Speed (upslope) | mi/h | 0, 4, 8, 12, 16, 20 |
| **Terrain** | | |
| Slope Steepness | % | 0 |

*Figure 7 Fire Behavior Inputs*

[2] Figure 7 represents the numerous inputs that were used in the Behave Plus V6 software model to calculate fire behavior characteristics.



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The following tables show the results of the fire behavior analysis:

Surface Fire Rate of Spread is how fast a fire burns across the given fuel type and is measured in chains/hour (ch/hr). (80 ch/hr = 1 mile/hr )

Flame length is the measure of the flame from base to tip (in feet) and is a proxy for how intense or hot the fire burns. Flame lengths above 4 feet cannot be suppressed by direct attack by a hand crew.

*Table 1 Fire Rate of Spread*

| Rate of Spread (ch/hr) | | | | | | |
|---|---|---|---|---|---|---|
| | Midflame Windspeed (Upslope) miles/hour | | | | | |
| Fuel Model | 0 | 4 | 8 | 12 | 16 | 20 |
| TU5 | 1.0 | 8.1 | 17.0 | 26.7 | 37.0 | 47.8 |
| GS2 | 1.3 | 19.6 | 51.7 | 92.5 | 140.0 | 193.3 |

*Table 2 Flame Lengths*

| Flame Lengths (feet) | | | | | | |
|---|---|---|---|---|---|---|
| | Midflame Windspeed (Upslope) miles/hour | | | | | |
| Fuel Model | 0 | 4 | 8 | 12 | 16 | 20 |
| TU5 | 2.8 ft | 7.2 ft | 10.1 ft | 12.4 ft | 14.4 ft | 16.2 ft |
| GS2 | 1.4ft | 4.9 ft | 7.6 ft | 10.0 ft | 12.1 ft | 14.0 ft |



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**Fire Behavior Analysis**

The results vary by fuel model and will be discussed individually. The modeling was done with zero slope to simplify the analysis. There are very steep slopes both east and west of the powerlines. Slope will increase the rate of spread and flame length exponentially as it burns uphill.

GS2 (sage and grass) has higher rates of spread that increase drastically with faster windspeeds. The powerlines are within ¼-mile of some structures so the fire could spread to them within an hour with only a 4 mph wind if the wind direction was detrimental (toward structures). In GS2, the flame length is 5 feet with a 4mph wind. Flame lengths above 4 feet are too dangerous for direct attack by firefighters and as flames reach 10-11 feet, aerial resources are needed for suppression. Sage plants have oil that burns very hot and is difficult to extinguish with water. They also generate moderate amounts of embers which help to spread the fire.

TU5 (conifer trees) have a lower rate of spread but can still be a problem because the trees are very close together. The predicted flame lengths are quite high, even at very low windspeeds. The primary concern with conifers is that they are prone to torching and group torching, where several trees ignite from bottom to top which in turn generates significant embers that are lofted up and ahead of the main fire front. The embers from conifers are the most likely to start fires if they land on a structure, woodpile or deck.

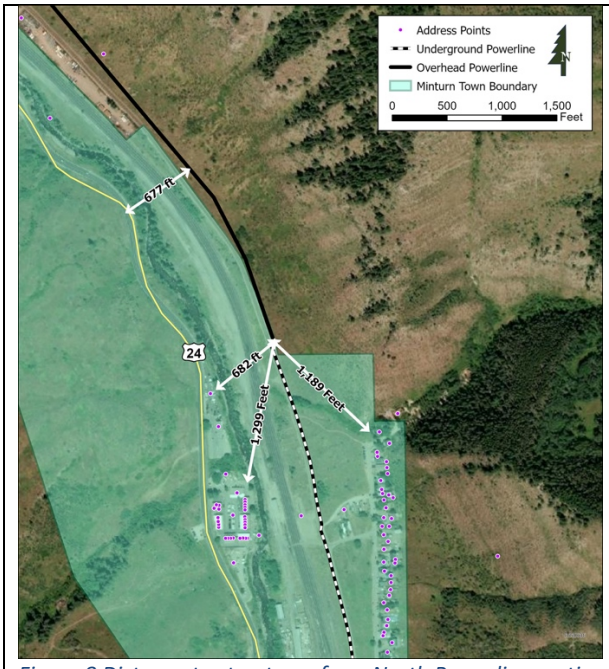

*Figure 8 Distance to structures from North Powerline section*

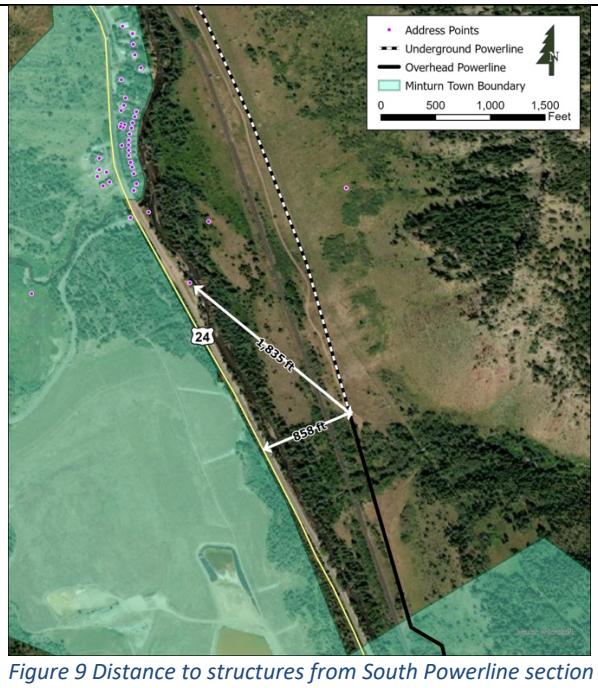

*Figure 9 Distance to structures from South Powerline section*



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**Summary**

- There are several important elements to consider in this report. Nearly 100% of the structures in and around Minturn are highly vulnerable to wildfire. The fire behavior analysis shows that fires starting under the transmission line may move rapidly and or exhibit significant fire behavior. These elements can impact evacuation as well as structure impact. The fire behavior analysis does not consider the probability of a fire starting by the new transmission line, it only predicts the fire behavior if a fire were to start. This is important as the probability of the new infrastructure starting a fire should be evaluated to determine if it increases the probability or likelihood of new fires.

- The No-HARM assessment considers modeled and historic probability of fire in the area. It identifies a score of 20 out of 50 or a moderate probability of fire in the study area. This moderate value is likely impacted by the elevation and duration of winter weather in the area. The impact of the new powerline is not considered in this probability factor.

- Wildfire Risk Rating - There are multiple analysis of the wildfire risk rating of Minturn available. Wildfire risk evaluation methodologies vary significantly, often depending on the use case. For example, the USFS often utilizes a wildfire risk assessment framework that incorporates highly valued resources and assets such as watersheds, wildlife habitat in addition to communities and infrastructure. This approach can generate very different wildfire risk values verse a wildfire risk assessment that is purely focused on communities and infrastructure or simply individual home risk. Wildfire risk assessments must target the most appropriate use case.

    - One of the first, formal, wildfire risk assessment for Minturn was completed within the Eagle County Community Wildfire Protection Plan (CWPP). The original plan was completed in 2005 with updates in 2010 and 2011. Page 90 of the original plan shows Minturn rated as high. https://static.colostate.edu/client-files/csfs/pdfs/EagleCountyCWPP-Revision2011.pdf

    - A 2011 CWPP for the Eagle River Fire Protection District of which Minturn is in, also rated Minturn as high. This assessment, conducted by Anchor Point, was more detailed than the county-wide CWPP, as it focused only on one fire protection district within the county. ERFPD CWPP 2011
        - This 2011 CWPP was updated by Eagle River FPD Staff in 2019. A different methodology was utilized, and Minturn was rated as Moderate. https://csfs.colostate.edu/media/sites/22/2019/11/ERFPD_CWPP_2020.pdf



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Other wildfire assessments, not within a CWPP are also available.

- The Colorado Wildfire Risk Public Viewer – managed by the Colorado State Forest Service shows areas around Minturn as a mixture of moderate, high and very high "Fire Intensity"

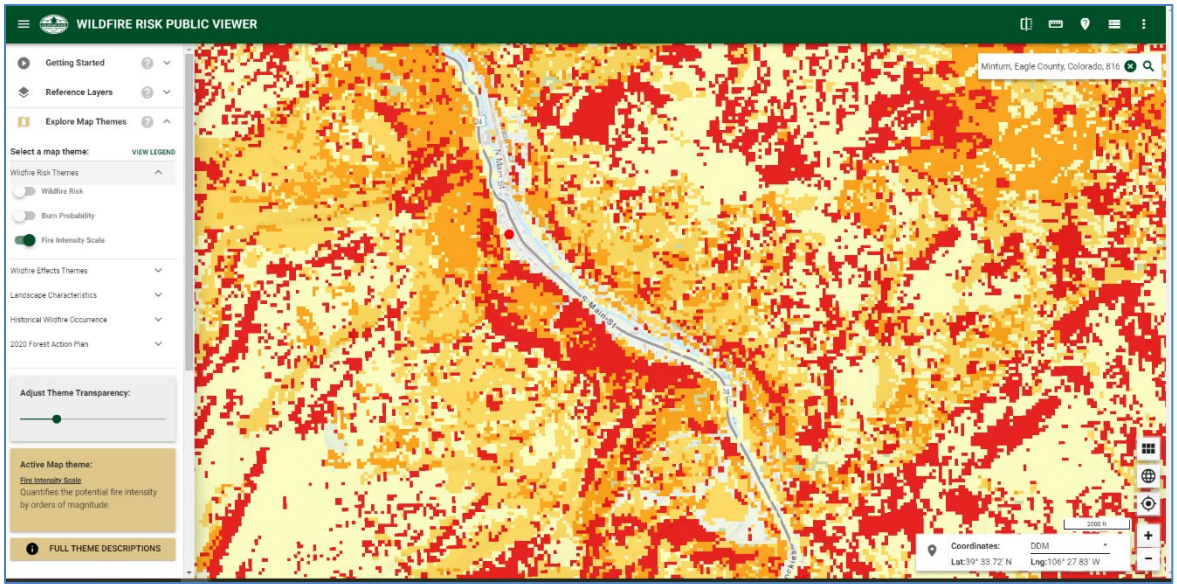


*Figure 10 COWRAP Public Viewer - Fire Intensity Scale*

**Conclusion:** If a fire were to start in the study area, regardless of the ignition source, and the local weather and fuel were conducive to supporting significant fire behavior, there are 877 structures in the study area and over 12,000 acres of land that are vulnerable to significant impact. There are several risk assessments associated with the city of Minturn. The majority list the Town and surrounding areas as having a high risk to wildfire. Regardless if the town is considered Moderate or High wildfire risk, the predicted fire behavior by both the USFS and Anchor Point shows fire behavior significant enough to impact land and adversely impact the built environment.



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