Sanctuary of Peace PUD
WILDLAND FIRE AND HAZARD MITIGATION REPORT

December 20, 2018

General Description

The Sanctuary of Peace PUD is a private residential development planned for the purpose of developing 26 single family attached units (13 structures total) on approximately 50 acres of densely forested land.

The property is located at the intersection of State Highway 83 and Bennet Hill Lane. (see attached vicinity map).

This area does have a distinct and recent wildfire history. The Black Forest Fire burned across the property in June of 2013. It would become the most destructive wildfire in Colorado's history. Over 14,000 acres were burned with approximately 500 structures destroyed.

Wildfire Hazard

Based upon the Wildfire Hazard Area Map (WHAM) developed by the Colorado State Forest Service in 1974, the site of the proposed Sanctuary of Peace development of contains a low hazard for meadows and a severe hazard rating for trees with ponderosa pine being the primary forest type. While this risk rating is forty-two years old, environmental change occurs very slowly in the Rocky Mountain West, so this rating still provides a relative accurate summary for the property.

As the Black Forest fire burned through a majority of the pine forest, a severe hazard for trees is a high estimate at the present time.

The Colorado Wildfire Risk Assessment Portal (CO-WRAP) was recently developed by the Colorado State Forest Service in 2012. The primary goal stated for this project is to "provide a consistent, comparable set of scientific results to be used as a foundation for wildfire mitigation and prevention planning…" This resulted in a web-based mapping tool that provides wildfire risk assessment for Colorado. This tool was also used to assess the relative wildfire risk to the property.

Within the CO-WRAP mapping tool, wildfire risk represents "the possibility of loss or harm occurring from a wildfire." The wildfire risk for the subdivision is indicated as having the lowest risk.

The wildfire threat is defined as the likelihood of an acre burning. Within the CO-WRAP, the proposed development area is rated at the lowest wildfire threat level.

Based upon the fact that the Black Forest Fire burned through the existing forest in 2013, the wildfire threat analytic could be perceived as incorrect. As there were no significant improvements or residential structures, the risk of loss would appear to be relatively correct. But there was a residential structure lost in the Cathedral Pines subdivision to the south in spite of intensive mitigation and forest health treatments.

While there was and continues to be an increase of ground fuel from annual pine needle drop, it is not readily available. The pine needles compress into a tight arrangement that does not burn readily. So even though over sixteen years passed since the prescribed fire, the pine needle layer was insufficient to ignite a crown fire. This may be considered a testament to the use of prescribed fire in lowering wildfire behavior.

Secondly, the historical thinning treatments reduced or eliminated the presence of ladder fuels to allow a ground fire to reach into the forest canopy. Thinning treatments were based upon a shelterwood system, where a new stand or forest is established under the canopy or shade of the existing forest stand. This typically involves the removal of weakened, stressed, and crowded trees in the understory and the removal of crowded trees and trees of poor growth form in the overstory. This type of treatment will typically result in an open park-like stand where it will be difficult for a wildfire to sustain itself as a crown fire.

Additionally, as the shelterwood system results in the shading of the forest floor, ponderosa pine has difficulty in regenerating itself from seed. Typically, there is not widespread pockets of crowded young trees commonly referred to as “doghair”. These “doghair” pockets can readily provide enough fuel to burn and ignite the forest canopy overhead. Another benefit of this shading is the self-pruning effect of ponderosa pine. As the level of sunlight lowers as the forest canopy closes, the lower limbs of the pine will die-back, resulting in trees with few or no live green branches on the lower portion of the main trunk. This has the effect of reducing the availability of pathways for a wildfire to leave the ground and burn into the canopy. While there is evidence of young trees being killed in the forest, the relative wide spacing of these trees or groups of trees was insufficient in generating sufficient heat to ignite the main forest canopy.

The previous observations are further supported by the effects of the wildfire when it passed through small patches of “doghair” stands. As these are tight stands of multiple trees, it would be expected that a fire would consume these locations in their entirety. This was not the case in almost all instances that were observed. Based on the very low scorch pattern at the base of the trees, the fire passed through these thick pockets of pine at a very low intensity and flame length. There was not sufficient heat generated to ignite and burn these small stands that would normally be readily available for combustion.

Wildfire Behavior

Three major components affect wildfire behavior; fuels, topography and weather.

Fuels

The area was field checked, and the results of the WHAM and the CO-WRAP were modified based upon the observed fuel models on the property. The USDA – Forest Service Intermountain Forest and Range Experiment Station in Ogden, Utah, developed these fuel model descriptions. They are used as aids in estimating fire behavior (see Appendix A).

The criteria for choosing a fuel model reflects that a wildfire will burn in that fuel type which best supports that fire. There may be more than one fuel model represented on any given area of land. In addition, current and expected weather conditions will influence the condition of these fuels.

The forested area can be described as Fuel Model 8. “Slowly burning ground fires with low flame lengths are generally the case…”

It can be further defined as TL1 – Low Load Compact Conifer Litter. In this fuel model the primary carrier is compact litter such as needles with a depth of 1-2 inches. This fuel model is very characteristic of a recently burned forest. Based upon the prescribed fire in 1996 and the Black Forest fire in 2013, it is very appropriate to use this fuel model and reflects the actual fire behavior experienced.

Even at wind speeds of twenty miles per hour, a fire’s rate of spread and flame length will be very low. However, under severe weather conditions such as high temperatures, low humidity combined with high winds, this fuel model can pose a significant hazard. Again, based upon the scorch height on the pine, it appears that the wildfire backed down the slope, in spite of the extreme fire weather conditions present.

Topography

The topography of the site is one of the main factors that will influence a fire spread. The aspect or compass direction that any slope faces influence the fuel type that exists and the amount of preheating these fuels receive by the sun. Aspect can also influence the effects of diurnal winds, as they move upslope during the daylight hours and down slope during the evening and early morning hours.

The topography of the property drains to the west from the top of the ridge. From the top of the ridge, the slope drops slightly to the east to a small drainage saddle which then flows to the north. Land lying east of the drainage saddle flows to Black Forest Road.

Weather

Weather is the most variable of all the factors. The accumulative effects of weather over time can influence vegetation curing and fuel moisture content.

Grasses, for example, are described as being one-hour time lag fuels. Time lag is a measure of the rate at which a given dead fuel gains or loses moisture. Hence grasses tend to be influenced by the weather conditions on an hourly basis. Wood fuels that are three inches in diameter or larger are considered to be 1,000-hour time lag fuels. This fuel requires a long period of time of dry or wet weather in order to affect its combustibility.

Winds can influence the direction and rate of spread of a wildfire. Of greater concern is the short spotting of the fire by embers transported by winds ahead of the main fire.

Several common weather factors link three recent wildfire events in the local area, the Hayman Fire in 2002, Waldo Canyon Fire in 2012 and the recent Black Forest Fire (2013). The presence of low humidity (4%), high daytime temperatures (90^{o} F) and high wind speeds (20-25 mph) with gusting conditions (30-40 mph).

Wildfire Mitigation

It should be noted here that the occurrence of a wildland fire on this property and any subsequent spread of a wildfire to adjacent land could never be totally eliminated.

The potential for loss can be reduced and the odds can be improved that initial response forces can be successful in keeping a wildfire to the smallest size possible and structure loss to a minimum; however, there will always exist a level of risk of loss to a wildfire. This loss can occur very quickly with little or no advanced warning.

The only way to reduce the risk of loss from a wildfire is to modify the factors that influence fire behavior. Of the three factors discussed previously, the only factor that could be modified prior to a wildland fire is the fuels. The efforts in modifying fuels can be targeted to their arrangement, continuity and availability.

Due to the recent passage of fire through the forest, specific mitigation treatments are listed under the ‘Forest Management’ section of this report.

Arrangement

The arrangement of fuel considers the size, shape and compactness of the fuel itself. Smaller fuel sizes have a greater surface area exposure for preheating. If these smaller sized fuels are only lightly compacted in spacing this results in easier ignition and increased combustion.

Fuels that are tightly compacted and larger in size have lower surface areas. This reduces the ease of ignition and combustion.

One technique in reducing the readily ignitable fuel level would be to remove fuels, such as dead leaves, fallen limbs and other small organic debris, from the site. However, it is not reasonable nor practical to remove these types of fuels from the entire property.

Based upon the burn evidence from the Black Forest Fire, the existing fine ground fuels were compacted and should remain in place in the future. Whenever possible these fuels should not be raked up or disposed of. The removal may allow the establishment of grasses or woody shrubs, which pose a higher wildfire risk. Retention of the compacted needle/litter layer prevents this from occurring on a large scale.

During the construction phase of any residential structure, the most likely source of ignition will come from personnel and activities. These sources of ignition may come from flammable chemicals, improperly discarded cigarettes, shorts in electrical equipment, and other means.

The most ignitable fuels should be removed from all areas that are within fifty feet of the pad of any proposed residential structure. This will reduce the amount of small, flashy fuel in close proximity to the structure. It will also retard the spread of a fire from the immediate site and provide suppression forces additional time to contain a fire quickly.

Once a residential structure is built, a wildfire safety zone should be established. Wildfire safety zones are intended to slow a fire down so that it may be controlled and extinguished. There are three zones that comprise a wildfire safety zone.

The first zone is the one that contains the most opportunity for modification. The minimum width recommended is thirty feet and is divided into three segments.

As these zones will be unique for each lot that is developed, it will be difficult to make specific recommendations here. However, it is recommended that each lot be treated prior to completion of the structure.

Specific information on the development of wildfire safety zones are available through the CSU Cooperative Extension Service in the Quick Guide Series Fire 2012-1, Protecting Your Home from Wildfire: Creating Wildfire-Defensible Zones. The web page is linked here at Creating Fire Safe Zones.

Continuity

The second factor affecting fuels that can be modified is their continuity. Is the fuel continuous or patchy in nature? Is the fuel layered in such a manner that it can leave the ground and spread into a vegetative canopy?

In this instance, the fuels in the grass and timber fuel models are continuous. Obviously, the pasture/grasslands contain an unbroken line of fuel reaching from tree line to the east and north.

In the timber fuel model, it is the ground fuels and aerial fuels that are continuous. While there are open spaces within the forest, these should not have a lasting impact on a wildfire's spread.

Availability

The availability of fuels to physically burn is influenced by the weather on a daily or yearly basis and cannot be readily influenced or mitigated.

the availability of any fuels that may be burned should be considered a year-round hazard and not limited to the summer months. There have been a number of wildfire events, although small, in the past few months within the city limits of Colorado Springs and in eastern El Paso County.

Recent weather patterns have contributed to a long-term drought situation that has influenced the availability of the fuels to burn. The trend of above average day time temperatures and below normal precipitation levels have allowed fuels to reach a higher state of availability than might normally be the case, particularly during winter months. This may result in wildfire acting in a manner that might be more characteristic of late summer burning conditions.

Other Considerations

Firebrands & Secondary Ignitions

It is becoming more apparent that a majority of structure loss is not occurring during the passage of a burning wildfire front but from ignition of the structure by firebrands and secondary ignitions. Firebrands are burning materials or embers that are lifted into the air by convective wind currents. Firebrands can be cast hundreds of feet in advance of the fire front.

Roads and Driveways

Roads and driveways to individual lots should be constructed in accordance with NFPA 1141, Fire Protection for Planned Building Groups. Specifically, road widths should not be less than twenty-four feet to allow for simultaneous access of emergency equipment and evacuation of residents.

Driveways should provide a minimum width of twelve feet and a minimum vertical clearance of fifteen feet. The grade of any driveway should not exceed 12%. The entrance to any driveway from public roads should not exceed a ninety-degree angle.

Construction Considerations

As the fuels in this subdivision are trees and grasses, predictable sources of fuel that will burn and allow entry of a wildfire into the structure will be debris that is trapped under or next to the building or the accumulation of needles in the roof gutters. Porch, foundation, roof and attic openings should be screened off or

enclosed to keep debris from accumulating and burning underneath. This is particularly important where wooden decks are planned at ground level.

It is strongly recommended that all decks that are planned at ground level be required to be sealed off and enclosed in order to prevent the accumulation of flammable debris underneath them.

Based upon recommendations from FEMA, overhangs, if used, should be enclosed with a flat, horizontal soffit with a one-hour fire resistance rating. The fascia should be constructed of non-combustible material.

The combustibility of a roof is the one of the most important factors in determining the risk of a structure to damage or loss from a wildfire. The use of combustible materials such as wood shingles does not necessarily increase their susceptibility to fire. However, as a wood shingle roof ages and is influenced by the weather, individual shingles may start to warp, curl and lose the tightness that is exhibited upon initial installation.

Combustible roofs become at risk due to the expected aerial firebrands that will be created as wildfire moves through the proposed development. The lodging of brands in combustible roof materials allows entrance for a wildfire into a structure. In this author's experience of fighting wildfire, it is difficult to defend a combustible roof.

Non-combustible roof materials should be used in the construction of all structures on this site.

Whenever possible, complex roof designs should be avoided. Flammable material, such as pine needles, may accumulate at roof to wall edges such as a dormer or chimney. This leaves what may be a non-combustible roof vulnerable to ignition. Non-combustible materials such as metal flashing should be used at the intersections between horizontal and vertical surfaces if some exposed component would be considered combustible. Roof vents should have mesh screens installed to reduce the risk of embers entering into the attic area.

Siding materials, while not as critical as compared to roof, can help to lower the overall risk of a structure to damage from a wildfire. Where the wildfire risk is low, the primary fuel involved will be grass on relatively flat slopes. A wildfire in these areas can be high in intensity but typically have a low duration. In other words, grass fires burn hot and fast. Therefore, there may not be enough heat buildup to ignite combustible siding materials. In these locations the use of non-combustible siding may not significantly reduce the risk to wildfire, particularly where a stone border is placed around the foundation.

Where a higher wildfire risk is found, such as in the ponderosa pine forest, the opposite can be true. During periods of drought, ponderosa pine needles develop an extra waxy layer of cuticle over the needles to retard moisture loss from the tree. The needles will become a hotter fuel when ignited. Depending on the proximity of trees, in particular young reproduction, this additional fuel availability may be sufficient to ignite combustible siding materials.

It is recommended that residential lots within the boundary of the existing forest, that non-combustible siding materials should be used in the construction of structures.

Water Supply

At the present time, there is no readily available water supply for ground suppression fire resources. The local fire protection districts will need to haul water into the site during a fire.

The development lies within the Donald Westcott Fire Protection District (DWFPD). DWFPD has a fire station located at 15505 State Highway 83. This station has a Type 1 engine and a Type 3 engine available for initial attack. Both have a 500-gallon water capacity. There is also a water tender available with a 1,500-gallon water capacity.

Home Owners Association

The Home Owner's Association (HOA) will be responsible for some or all of the implementation and annual inspection of the wildfire mitigation activity, particularly in regard to fuel availability. Specific activities should be developed through a Community Wildfire Protection (CWPP). This effort is supported through National Fire Protection Association (NFPA) through its Firewise Communities and Fire Adapted Communities Programs. Additional information can be obtained at the website through the link

It is suggested here, at a minimum, that the HOA schedule cleanup days in the spring and in fall after needle drop. This will allow an opportunity for the community to work together to improve and maintain their wildfire safety. The Association should budget for the removal and disposal of the material that is collected.

In the event of a wildfire incident, evacuation becomes a major factor in the response efficiency of the fire suppression forces. Once the construction of residences within the development occurs, an evacuation plan should be developed in cooperation with the local fire protection district. This plan should result in the appropriate evacuation routes being designated and signage placed along those routes.

The HOA, at the very minimum, should develop an educational plan to help keep the threat from wildfire foremost in the community's mind. This may include articles in the HOA newsletter, presentations at meetings and even posting the wildfire hazard on a daily basis at the entrances to the Flying Horse at Shamrock Ranch community.

Forest Management

there has been some level of forest management activity since 1973. As part of the wildfire hazard evaluation, a forest inventory was performed, the results of which are included here. The intent of the inventory is to provide a current assessment of the forest resource and to provide activities that can be taken to ensure that health into the future. These activities will also maintain or reduce the moderate wildfire hazard that exists.

The forest should be considered as a ponderosa pine forest. While a nominal number of other species, such as Douglas-fir, spruce and aspen, can be found within the property, the forest will reproduce naturally to ponderosa pine. This is a fire adapted specie and is well suited to the site.

The current forest is composed primarily of ponderosa pine having an average diameter of 12.2 inches. Aspen was tallied during the inventory a low representation on the site.

Aspen exists only as a remnant population. It is found only in exposed locations within the drainages. While healthy aspen should be retained in small pockets, it should not be actively managed to increase its presence in the forest. This is due, in part, to its presence in the lower extent of its range in the local area. Aspen does not have sufficient growing conditions on this site to increase its population to become a sustainable forest type.

Dwarf mistletoe (DMT) remains a slight threat to the forest, mostly in locations that were treated in the past. In these locations, most notably along the southern boundary with Cathedral Pines, not all of the larger infested trees were removed. In the last fifteen to twenty years, these retained trees may have been infected and have produced aerial shoots. These shoots produce seed which can spread the infection. So at the time of control treatment, these shoots may not have been visible. In any event, some of the large trees that were retained to provide seed to reforest these DMT treated locations will need to be removed.

Since the initial treatment, the ponderosa pine has reproduced from seed produced by the retained trees. But DMT has also infected some of this pine reproduction. This should be considered as the most important priority for management.

Prior to the sale of any residential lots, the previously DMT treated locations should be entered and any infections should be treated. This may be as simple as pruning a single tree branch or complete removal of individual trees. At the same time, these locations, as well as any “doghair” stands should be thinned as well. This will reduce, if not eliminate, the last major wildfire threat condition.

The work plan for forest management and subsequent wildfire mitigation are as follows:

Prior to the sale of residential lots,

1. Thin reproduction in DMT control areas and any other “doghair” stands to a target GSL of 90. This is approximately 450 to 500 trees on a per acre basis. Trees that are the tallest, with a straight main trunk and a large diameter trunk at ground level should be retained. The branches of the remaining trees should not touch one another in most instances.
2. Tree that have visible aerial shoots of dwarf mistletoe in the upper one-half of the live green crown should be removed entirely. As it may take up to four years for an infection to produce an aerial shoot, there is a high probability more branches are infected than can be visibly seen. This should reduce, if not eliminate, future infections. Otherwise, individual branches should be pruned off at the main trunk.
3. All material that is cut (slash), such as trees and branches, should be chipped in place or removed from the site in its entirety. This will prevent an increase in the presence of available dead ground fuel, particularly near the southern boundary with Cathedral Pines.
4. Forest locations along the property perimeter should be thinned, if necessary, so as to create a fuel break. In those areas, the branches of adjacent trees should not touch one another. All dead ground fuels larger than one-inch in diameter as well as any slash from trees removal should be chipped or removed from the site. The width of the fuel break should be at least the average tree height at the location. This will typically range from 50 to 70 feet.

As trees will be removed during the development of the golf course, it will be reasonable to treat forested open space locations at the same time. For these locations the work plan is as follows:

1. All of the open space locations will be thinned to a target GSL of 90. Depending on the diameter of the trees, this might result in 15 upwards of 50 trees needing to be removed on a per acre basis.
2. As in almost all cutting treatments, slash that is generated should be chipped on site or removed so as to reduce the wildfire hazard.

Prior to the occupancy approval for structures on residential lots, the following should be completed:

1. Each lot in the forested area should be inspected for dwarf mistletoe. Any visible infections should be removed.
2. Each lot in the forested area should inspected for any additional wildfire mitigation treatment. Any treatment necessary should be completed prior to occupancy.

These inspections can be completed by private consultants, the state Forest service or a qualified representative of the local fire protection district.

Appendix A

Maps

Appendix B

Fuel Model Descriptions

Fuel Model 8 Summary Pages

Source: Anderson, Hal E. Aids to Determining Fuel Models for Estimating Fire Behavior, National Wildfire Coordinating Group, General Technical Report INT-122, April 1982.

“This report presents photographic examples, tabulations, and a similarity chart to assist fire behavior officers, fuel management specialists, and other field personnel in selecting a fuel model appropriate for a specific field situation. Proper selection of a fuel model is a critical step in mathematical modeling of fire behavior and fire danger rating.”

Fuel Model GR2 & TL1 Summary Pages

Source: Scott, Joe H. & Burgan, Robert E. 2005. Standard fire behavior fuel models: a comprehensive set for use with Rothermel’s (1972) 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.

“This report describes a new set of standard fire behavior fuel models for use with Rothermel’s surface fire spread model and the relationship of the new set to the original 13 fire behavior fuel models.”

Timber Group

Fire Behavior Fuel Model 8

Slow-burning ground fires with low flame lengths are generally the case, although the fire may encounter an occasional "jackpot" or heavy fuel concentration that can flare up. Only under severe weather conditions involving high temperatures, low humidities, and high winds do the fuels pose fire hazards. Closed canopy stands of short-needle conifers or hardwoods that have leafed out support fire in the compact litter layer. This layer is mainly needles, leaves, and occasionally twigs because little undergrowth is present in the stand. Representative conifer types are white pine, and lodgepole pine, spruce, fir, and larch.

This model can be used for 1978 NFDRS fuel models H and R. Photographs 22, 23, and 24 illustrate the situations representative of this fuel.

Fuel model values for estimating fire behavior

Total fuel load, < 3-inch, dead and live, tons/acre	5.0
Dead fuel load, ¼-inch, tons/acre	1.5
Live fuel load, foliage, tons/acre	0
Fuel bed depth, feet	0.2

Photo 22. Surface litter fuels in western hemlock stands of Oregon and Washington.

Photo 23. Understory of inland Douglas-fir has little fuel here to add to dead-down litter load.

Photo 24. Closed stand of birch-aspen with leaf litter compacted.

TL1 (181)

Low Load Compact Conifer Litter

Description: The primary carrier of fire in TL1 is compact forest litter. Light to moderate load, fuels 1 to 2 inches deep. May be used to represent a recently burned forest. Spread rate is very low; flame length very low.

Fine fuel load (t/ac)	1.0
Characteristic SAV (ft-1)	1716
Packing ratio (dimensionless)	0.04878
Extinction moisture content (percent)	30