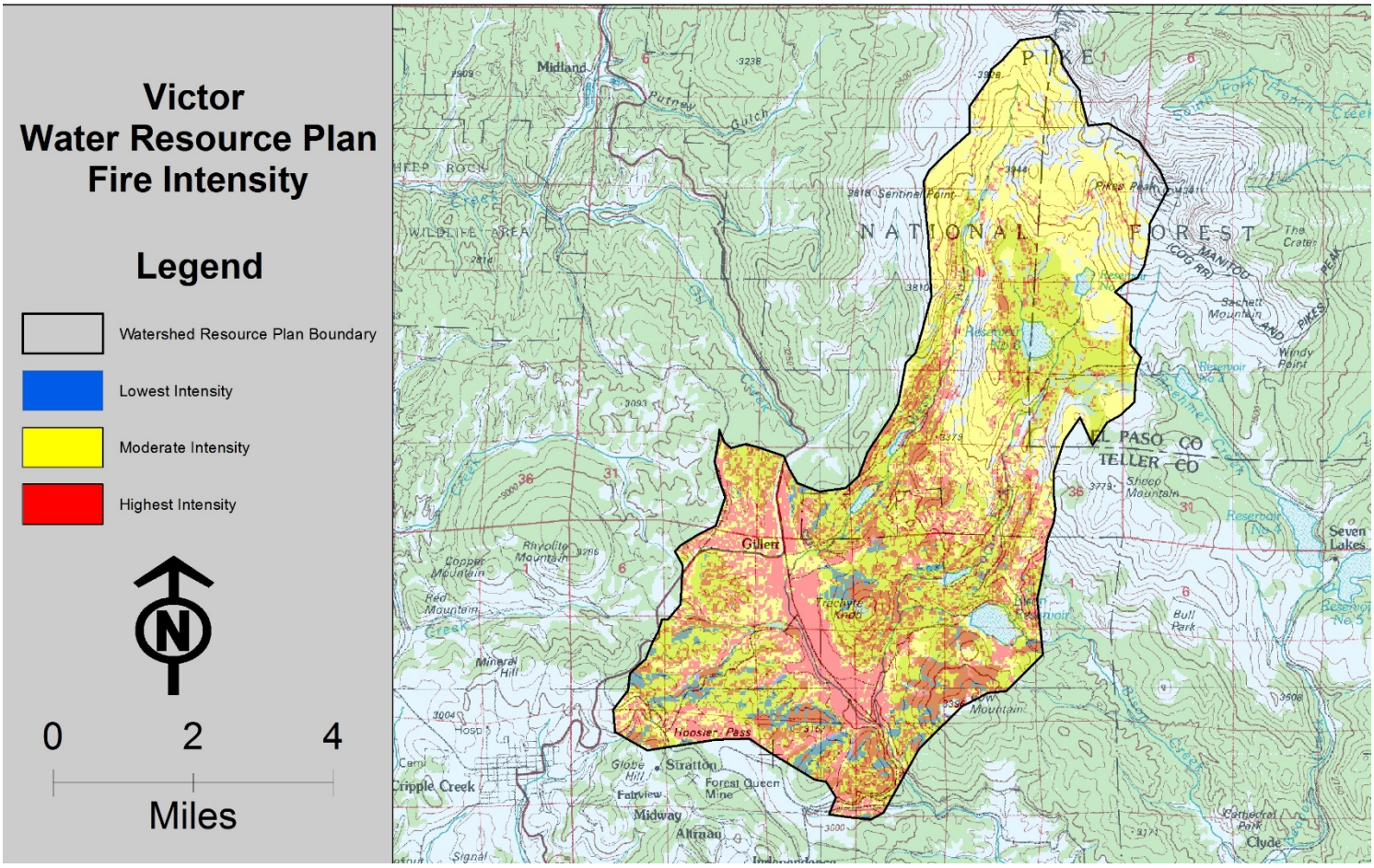
Wildfire Risk Mitigation Plan
For Bison Reservoir



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Introduction and Background

With the assistance of the Colorado Rural Water Association, the City of victor completed a Source Water Protection Plan in March of 2014. Among the city's concerns is the hazard posed by wildfire to Bison reservoir, one of the city's principal water sources.

Dylan Eiler, of the CRWA, contacted the Colorado State Forest Service (CSFS), Woodland Park District for assistance evaluating the potential hazards to the reservoir. The reservoir and surrounding area was first analyzed using the Colorado Wildfire Risk Assessment Portal (CO-WRAP), a GIS based program. Initial analysis with CO-WRAP indicated that there were significant wildfire risks to the reservoir. The CO-WRAP report lead to a visit to the reservoir on June 2, 2016 to observe the actual conditions. The recommendations that follow are the result of that visit.

Current Conditions

Bison Reservoir is located on the south slope of Pikes Peak, and is fed by Bison Creek, a stream that heads in Cathedral Park and flows north into the reservoir. Bison Creek flows through a steep drainage between the head waters and the reservoir. A fire within the watershed above the reservoir could potentially threaten Bison Reservoir with sediment and debris flow into the stream.

Forests in the immediate vicinity of the reservoir and on adjoining lands are a mix of Engelmann spruce and aspen. Dense stands of spruce with some aspen pockets dominate the hillsides to the south of the reservoir. North of the reservoir, aspen tends to dominate the forest, but an understory of spruce is developing beneath the aspen. In time the spruce will overtop and shade out the aspen.

Land ownerships in the area are a mix of private, state and public lands. The larger surrounding area is a vitally important source of municipal water. Cripple Creek has municipal reservoirs a few miles to the north, and Colorado Springs Utilities manages an extensive network of reservoirs and infrastructure on the south slope of Pikes Peak. Cripple Creek, with CSFS assistance, is currently developing a Community Wildfire Protection Plan that addresses protection of their reservoirs as a priority, and Colorado Springs Utilities contracts with the CSFS to manage their Pikes Peak watershed.

There is a fishing lease of the reservoir and it is extensively used for recreation. Many undeveloped campsites ring the lake. There are two structures on the property. Both are in an area of low fire hazard, and have good defensible space.

Wildfire Hazard

Fire Behavior on any site and at any time is dependent on three factors: weather, topography and fuels.

Weather: Weather influences fire behavior as both a long term and transient phenomenon. Long term weather trends such as extended drought increase the possibility of ignition and increase the rate of fire spread.

Large plants, trees and larger shrubs, recover moisture content slowly after a prolonged drought, and may remain drier than normal for several years after a drought ends. Grasses and herbaceous fuels may recover moisture quickly after a short rain, but also loose moisture quickly after short dry periods.

The intensity and spread of a wildfire is also affected by the weather conditions existing that day. For example, a large thunderstorm about 20 miles north of the Waldo Cañon Fire was responsible for pushing the fire down downslope into the Mountain Shadows neighborhood. High temperatures, low humidity, and strong winds increase the intensity and rate of spread. Wind direction at any given moment is the primary determinant for the direction of fire spread.

Topography: Topography includes the degree of slope and the shape of the terrain. Hot gases rise in front of the fire along the slope face, pre-heating the vegetation above a fire. As slope increases the effect of the preheating and increased spread increases, and fires may move up to four times faster with flames twice as long than a fire on level ground.

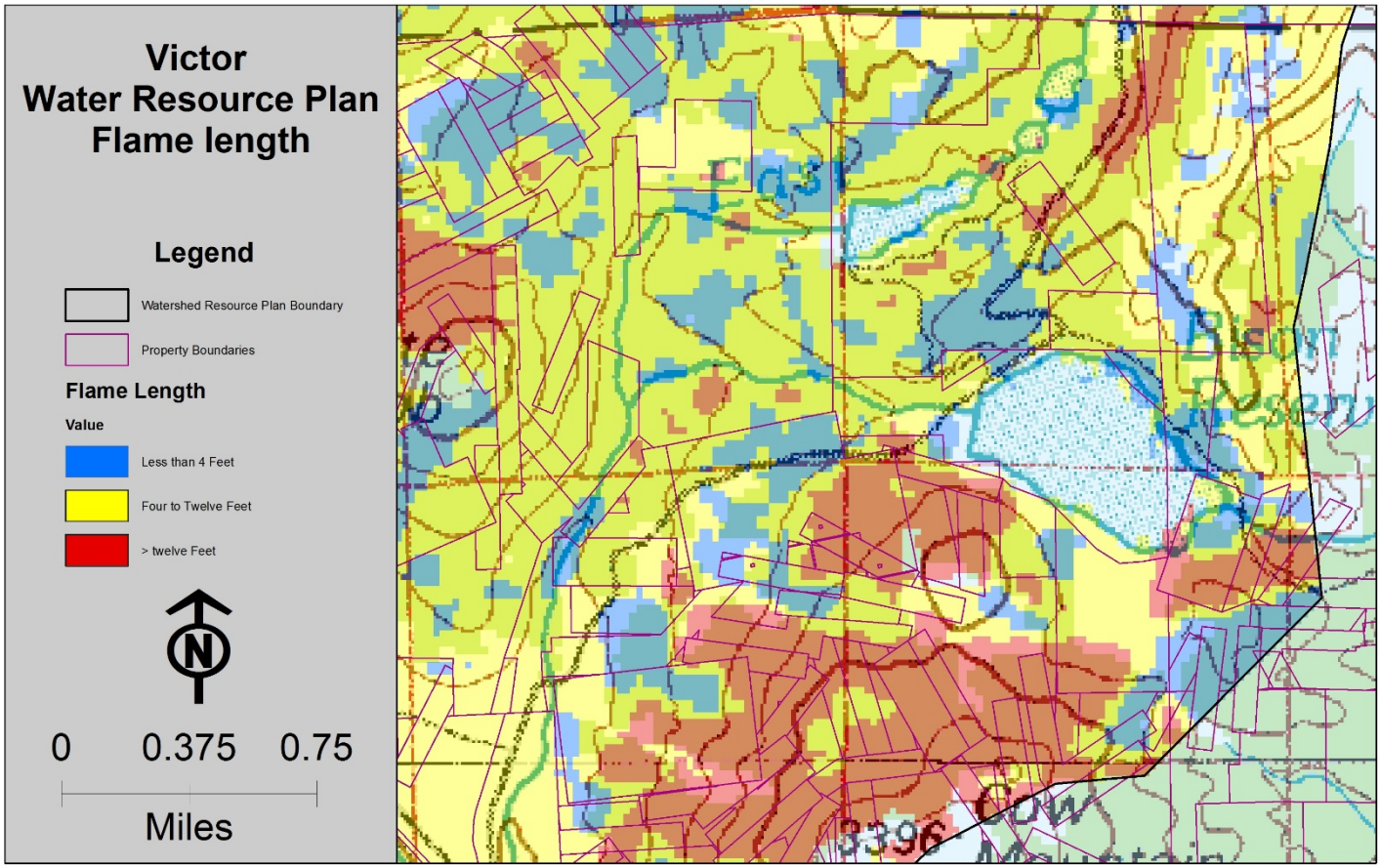
Drainages act as chimneys that funnel heat and winds up the drainage. Homes in drainages, or at the tops of drainages, are particularly vulnerable to wildfires. The direction a slope faces, or its aspect, also influences fire behavior. South and west facing slopes tend to be drier and thus, exhibit more intense fire behavior than moister east and north facing slopes.

Fuels: The two fuel types in a WUI are vegetative and structural. Vegetative fuels consist of living and dead trees, bushes, and grasses. Typically, grasses ignite more easily and burn more quickly but with less intensity than trees. Fires can move quickly through grass and herbaceous vegetation, and these smaller fuels are often the kindling that moves fires to larger size fuels.

Any dead or living branches on the lower eight feet of trees or shrubs between 6 and 18 inches tall underneath trees are called ladder fuels. Ladder fuels help convert a ground fire to a crown fire (tree tops) that moves much more quickly and with more heat. The length of flames is directly correlated with the amount of heat a fire produces. Flame lengths less than four feet can be attacked directly by hand crews, but flame lengths greater than four feet require indirect attack methods where firefighters must work a safe distance away from the flaming front. Fuel modification is designed to reduce the amount of heat produced by a wildfire.

Non-vegetation fuels include houses, ancillary buildings, fences, and firewood piles. Structures in the WUI can be considered as additional fuel. In fact a burning structure can ignite a wildfire, and defensible space can prevent a burning structure from spreading fire to the surrounding vegetation as well as preventing a wildfire from igniting a structure.

Nor are hazardous fuels around a home limited to natural vegetation. Landscaping is often a fire hazard. During wildfires, many homes are lost because of the vegetation planted around the structure. Juniper (Pfizer) shrubs planted near foundations, landscape timbers, wood mulches and wood fences are often sources of home ignitions. Landscapes should be planned with the threat of wildfire in mind.

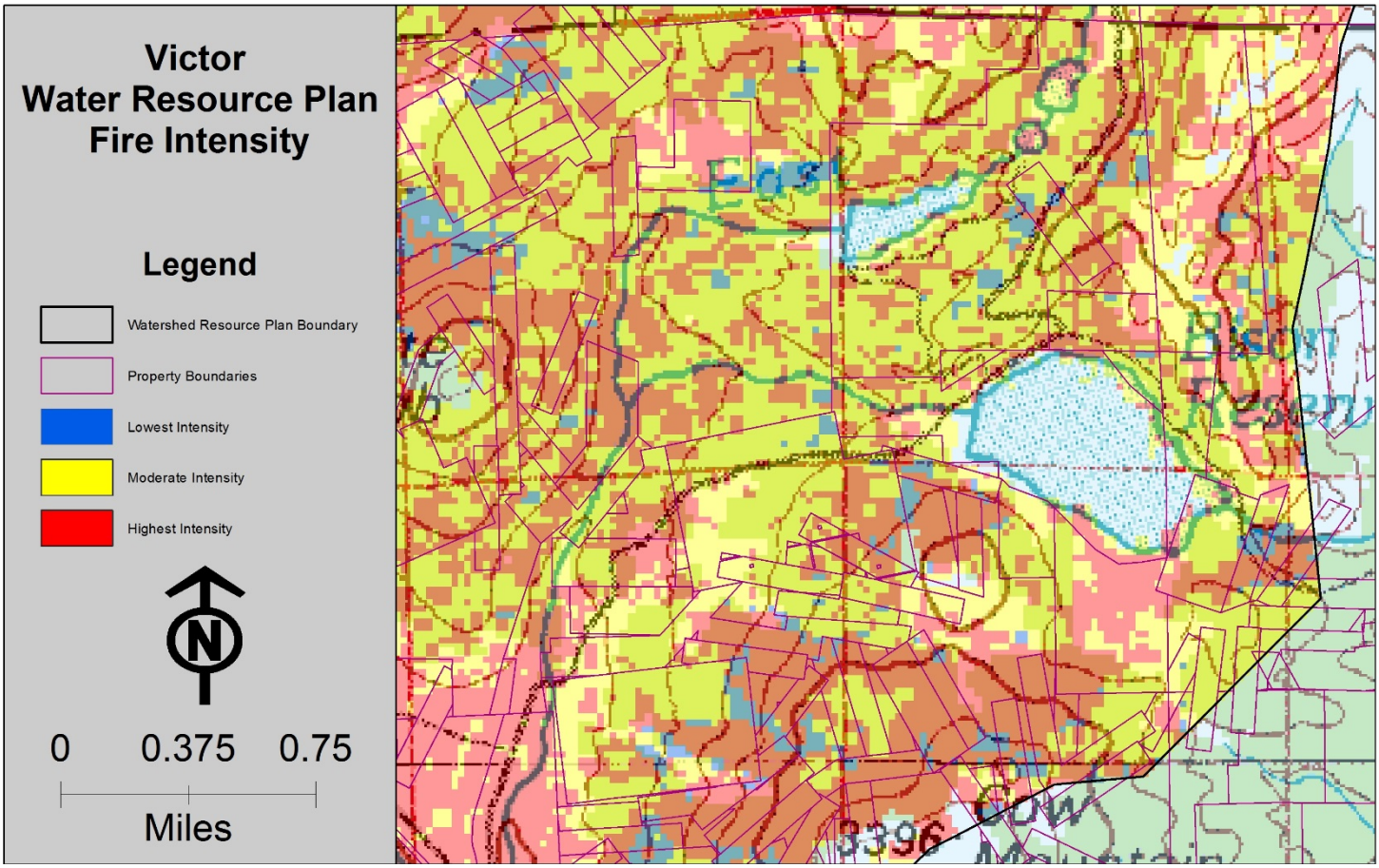


The important point to remember here is that neither typography nor weather can be altered. *Only fuels can be manipulated before a wildfire to reduce fire intensity or influence the fire spread.*

Wildfire hazard was judged to be moderate to high on the reservoir property and surrounding lands. Hazard is highest in the denser stands of Engelmann spruce on steeper slopes. Wildfires in these areas would certainly reach the forest canopy due to the abundant small spruces trees in the understory. Once in the forest canopy, it is very likely that the fire would become a crown fire running through the tops of the trees. On steeper slopes, fire intensity would be greater, leading to the possibility of soil damage and post fire erosion.

Areas of aspen with a spruce understory were judged to be moderate. The spruce is the worst hazard in these stands. Pure aspen stands do not carry fire in the crowns, but the spruce understory can still produce flame lengths in excess of four feet that would prevent direct attack by hand crews.

Areas of pure aspen have a low hazard.



Prescriptions For Hazard Reduction

The prescriptions that follow are highly general methods to reduce fire hazard in and around the Bison Reservoir watershed. The brief visit to the reservoir did not allow for a detailed inspection of the forests on surrounding properties. Permission from those landowners would be required before their property could be entered.

Detailed prescriptions in a particular forest stand require precise observation of the trees the insect and disease conditions present, and the objectives of the landowner. Even so, fire hazard prescriptions in particular forest types follow a general pattern.

Dense stands of Engelmann spruce, because the trees are not deeply rooted, requires a system of clumps and openings to prevent the residual trees from blowing down. Fire mitigation in these stands follows a pattern of enlarging existing openings to reduce forest canopy continuity and removal of ladder fuels from the understory.

In aspen stands with an Engelmann spruce understory, the typical prescription is to remove most of the spruce regeneration from the understory. This prescription has the

advantage of preventing eventual overtopping of aspen by spruce and preservation of the aspen stand.

Pure aspen stands, as noted earlier, do not pose a crown fire threat. However aspen tend to have large amounts of woody debris on the forest floor. Usually most of this down wood is removed to reduce fuel.

Recommendations:

In the short term the city should concentrate on the forests camp sights adjoining the reservoir. It was noted during our visit that the campsites are primitive with undeveloped fire rings and dense spruce understory surrounding many campsites. The camping area is the greatest source of a potential fire ignition as a result of careless campers failing to douse their fires.

Installation of developed fire pits with lids, such as those in state parks and Forest Service campgrounds would do much to alleviate this danger.

Begin thinning of extensive areas of Engelmann spruce regeneration from the aspen stands to reduce the threat of fire spreading through the spruce. Some spruce should be left between campsites to maintain some visual seclusion, and the majority of spruce removals should take place farther from the campsites.

Given that much of the surrounding land is not owned by the City of Victor, an effective program of mitigation will require cooperative effort across boundaries. This is a process that will take some time, but will be beneficial to all of the parties. The improvements in wildfire risk and forest health will benefit all of the landowners and the city of Victor.

Victor should work with other area water providers, state and federal landowners to begin a coordinated program of watershed protection on a regional scale. Regional efforts, because of their larger scale compete better for grant funding than smaller isolated efforts.