## South Platte Basin Implementation Plan

# DRAFT - Technical Memorandum: Watershed Programs – Forest Health and Management

South Platte Basin Roundtable
Metro Roundtable

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# 1 Executive Summary

This memorandum summarizes existing conditions and programs related to forest health and management that effect water quality in upper tributary watersheds in the South Platte River basin. Other on-going and potential watershed programs to address potential water quality degradation and/or other environmental and recreational concerns may be addressed by the "nonconsumptive water use team" assisting with the SP-BIP under a separate contract for the South Platte and Metro roundtables.

The South Platte Basin is a critical watershed in Colorado. For example, water used by the Denver metropolitan residents originates in the Upper South Platte Basin. The headwaters of other major South Platte River tributaries provide the essential raw water supply for towns and cities from Boulder on the south to Fort Collins on the north and extending significantly eastward to Greeley and Fort Morgan through long distance treated water pipeline systems with diversion and storage facilities along the Front Range foothills with significant exposure to major fire events. There is an increasing recognition of the importance of watershed health and water quality in this area considering that more than 3.5 million people currently reside in the South Platte River basin and that there have been many recent examples where adverse hydrologic conditions and major forest fires have highlighted vulnerabilities to municipal and industrial water service disruptions. With the population of the basin expected to grow to more than 6.8 million people by 2050 (the planning horizon for CWP), these concerns are expected to grow.

Wildfires dramatically reduce natural protection from erosion and sediment transport that healthy forests and watersheds provide to all types of raw water diversion, storage and conveyance facilities. High severity fires remove layers of leaves, twigs, branches, and needles that help prevent erosion. In the event of high precipitation following a fire, the risk of flash floods that mobilize suspended sediment, ash, and debris is high. These contaminants block the flow paths to and enter water systems, causing disruptions to water deliveries and degradation of water quality in all types of water supplies. Recently in the South Platte Basin, September floods caused large amounts of erosion and destruction, impacting water supply systems and water quality.

Related factors that contribute to reducing watershed health include insects and disease that compromise large tracts of forested areas and major flood events that can result in severe erosion and move tremendous volumes of sediment and debris that alter the courses of South Platte River tributaries with numerous municipal and agricultural diversion facilities. Historically, wildfires have impacted water supplies and will continue to do so. Collaborative watershed programs may help prevent or minimize future water supply disruptions.

Due to the suppression of wildfire, excess amounts of fuel (i.e., dead trees, dried leaves, etc.) are present in forested watersheds. Current forest management practices are aimed at reducing the risk of high severity fires by reducing the amount of fuel available. For example, the Northern Colorado Water Conservancy District (Northern Water) has partnered

with state and national agencies to restore forest and watershed health before fires occur, as well as develop operations and response plans. Denver Water has also partnered with state and national agencies to help fund forest treatment and watershed protection projects critical to Denver Water's water supply.

Working closely with land agencies to create the proper prevention and planning methods will decrease the likelihood of the occurrence of fires impacting water quality and quantity.

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# 2 Overview of Issues and Interests

The South Platte River basin is the home to the majority of Colorado's population, and native water supplies are critical to both urban and rural areas for municipal, agriculture, industrial, consumptive uses and nonconsumptive environmental and recreational needs. For example, water used by the Denver metropolitan residents originates in the Upper South Platte Basin The headwaters of other major South Platte River tributaries provide the essential raw water supply for towns and cities from Boulder on the south to Fort Collins on the north and extending significantly eastward to Greeley and Fort Morgan through long distance treated water pipeline systems with diversion and storage facilities along the Front Range foothills with significant exposure to major fire events. There is an increasing recognition of the importance of watershed health and water quality in this area considering that more than 3.5 million people currently reside in the South Platte River basin and that there have been many recent examples where adverse hydrologic conditions and major forest fires have highlighted vulnerabilities to municipal and industrial water service disruptions. With the population of the basin expected to grow to more than 6.8 million people by 2050 (the planning horizon for CWP), these concerns are expected to grow[1].

Presented below are brief overviews of several of the primary issues and interests associated with fire hazards and forest management for the South Platte River basin.

**Wildfire:** Forest fires have threatened raw water diversions in the South Platte River basin throughout recorded history. Recently, the Buffalo Creek Fire of 1996 was followed by substantial flooding and erosion that transported approximately 433,000 cubic yards of coarse sediment into Strontia Springs Reservoir[2], through which approximate 80 percent of Denver Water's supply and a large portion of the City of Aurora's raw water is diverted. The 1996 sediment delivery was nearly 30 times the annual rate of sediment input anticipated during reservoir design, causing significant degradation to the water quality supplied to the Denver Metro area[2]. The impacts at the Strontia Springs facility cost Denver Water millions of dollars for repairs and rehabilitation[3].

Similarly, the Haymen Fire of 2002 also caused large sediment loads to be delivered to Strontia Springs Reservoir. Runoff and debris from the High Park Fire in the summer of 2013 caused Munroe Canal diversion to become plugged with rock and debris, interrupting irrigation deliveries and causing major concerns at the intakes for the Fort Collins and Greeley systems[4].

Forest conditions within the South Platte Basin's watersheds have a strong influence on not only the water quality but also the quantity of water that is available for downstream uses

[1] CWCB 2011. Colorado's Water Supply Future, SWSI 2010 South Platte Basin Report Basinwide Consumptive and Nonconsumptive Water Supply Needs Assessments. CDM Smith, Denver, Colorado. June 2011.

[2] Martin, D. (2000). "Studies of Post-Fire Erosion in the Colorado Front Range Benefit the Upper South Platte Watershed Protection and Restoration Project". *Watershed Management Council Networker*. 9(1).

[3] CSFS. (2010). Colorado Statewide Forest Resource Assessment. Fort Collins, Colorado.

[4] NCWCD. (2013). "Headwaters Partnership."

under normal conditions and especially under stressed conditions. The benefits of a healthy forest watershed include:

- Protecting soil from erosion
- Enhancing soil moisture storage and groundwater recharge
- Reducing flooding
- Filtering contaminants in runoff
- Maintaining plant communities contributing to water quality and quantity

Wildfires dramatically reduce natural protection from erosion and sediment transport that healthy forests and watersheds provide to all types of raw water diversion, storage and conveyance facilities. High severity fires remove layers of leaves, twigs, branches, and needles that help prevent erosion. In the event of high precipitation following a fire, the risk of flash floods that mobilize suspended sediment, ash, and debris is high. These contaminants block the flow paths to and enter water systems, causing disruptions to water deliveries and degradation of water quality in all types of water supplies. Recently in the South Platte Basin, September 2013 floods caused large amounts of erosion and destruction, impacting water supply systems and water quality. In portions of northeast Colorado, the estimated recurrence intervals for the cumulative precipitation for this storm was up to 500 years; impacting multiple raw water diversion systems, wastewater treatment plants, raw and treated water pipelines, and other water infrastructure. Loveland, Greeley, and the Left Hand Water Conservancy District experienced heavy damage to their water systems. The City of Evans experienced severe damage to their wastewater treatment plant, forcing an order for residents and businesses to not flush toilets, wash dishes, or do laundry for several days[5].

Risks of post-fire erosion in watersheds that are an important source of drinking water have been identified by the Colorado State Forest Service. Most of the forests in the South Platte River basin have been identified as being at a very high or high risk of post-fire erosion. The upper watersheds of the South Platte River and its major tributaries from Clear Creek to the Cache la Poudre River are of particular importance because water from these watersheds provides raw water to many major water providers including Aurora, Boulder, Denver Water, Fort Collins, Northern Colorado Water Conservancy District, and others.

Figure 2-1 shows a watershed prioritization map that was compiled by the Front Range Watershed Protection Data Refinement Work Group for the watershed above Strontia Springs Reservoir. This prioritization system combines a hazard ranking system including wildfire hazard, flooding/debris flow risk, and soil erodibility for each sub-watershed[6]. The black checkered areas indicate zones of concern which were defined as the source water area upstream from important surface water intakes, upstream diversion points, and classified drinking water supply reservoirs that have a higher potential for contributing significant sediment or debris[6]. High hazard identified sub-watersheds create a risk to zones of concern.

[5] CDPHE. (2013). Drinking Water and Wastewater Treatment Facility Flooding Update.

[6] FRWPDRWG. (2009). Protecting Critical Watersheds in Colorado from Wildfire: A Technical Approach to Watershed Assessment and Prioritization.

## Figure 2-1. Upper South Platte Zones of Concern and Watershed Prioritization Map


Source: Front Range Watershed Protection Data Refinement Work Group, Protection Critical Watersheds in Colorado from Wildfire: A Technical Approach to Watershed Assessment and Prioritization, 2009

Additionally, a similar study has been done on a broader scale for the State of Colorado by the USDA Forest Service. Along the Front Range, many areas were identified as having the watershed health at risk or impaired. These watersheds are the headwaters of the major tributaries of the South Platte Basin and propose risk to raw water supplies of the Basin. The watershed condition classification was developed in order to identify areas where implementation of watershed restoration efforts should take place.

More than one million people currently live in Colorado's wildland-urban interface zone which raises concern about the presence of people increasing the risk of wildfire[7]. With increasing population in the South Platte Basin, the number of people living within this zone will increase; further increasing the risk of wildfire.

**Insects and Disease:** Colorado's forests are experiencing intense insect and disease activity. Mountain pine beetle kill has affected much of the predominantly lodgepole pine forests in Colorado. Throughout the state, mountain pine beetles have currently killed nearly 2 million acres, which includes virtually all of the state's mature lodgepole pines in addition to other forest types[8]. Table 2-1 shows the number of acres affected by beetle kill in the counties of the South Platte Basin.

### Table 2-1. Cumulative Acres of Affected Lodgepole, Limber, and Ponderosa Pine, 1996-2010

| County | Number of acres |
|---|---|
| Boulder | 122,455 |
| Clear Creek | 78,497 |
| Gilpin | 54,577 |
| Jefferson | 32,150 |
| Larimer | 681,507 |

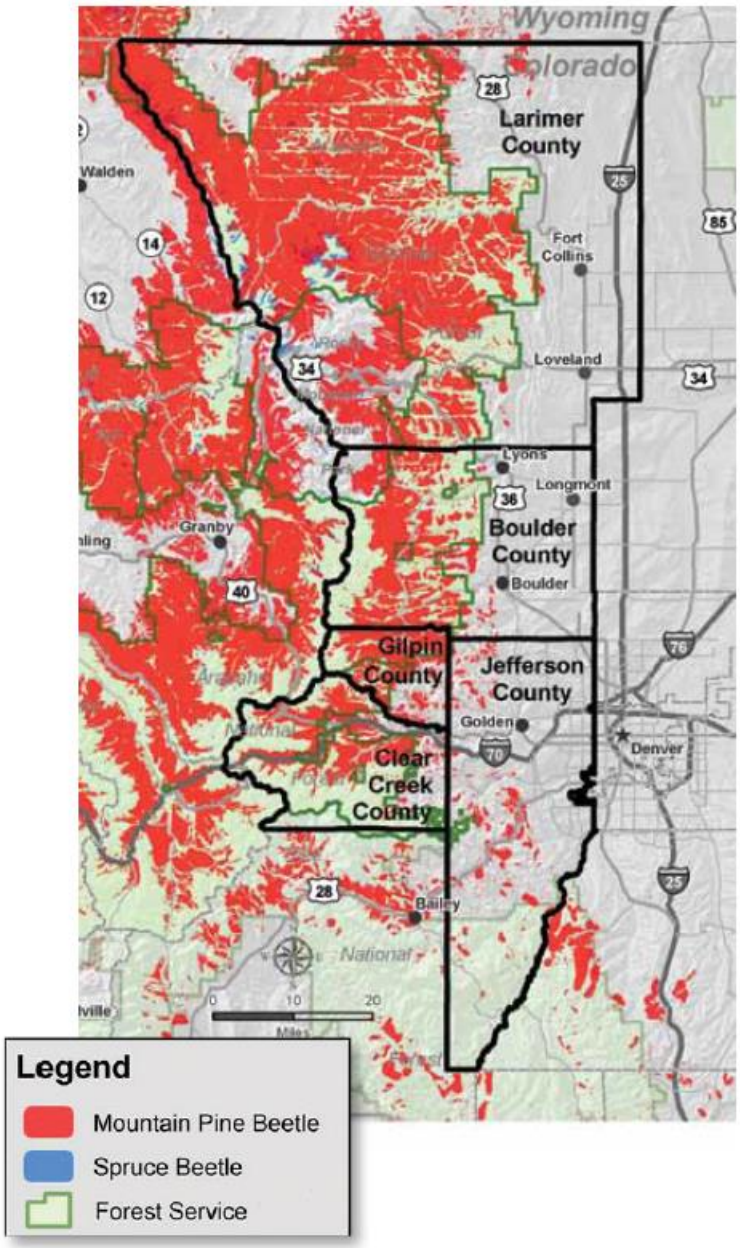
Source: USFS Mountain Pine Beetle on the Colorado Front Range

Affected trees create fuel for wildfires, increasing the chance of high intensity, sustained fires. In 2011, The U.S. Forest Service's Rocky Mountain Region spend $32 million to clean up, clear out, or burn dead trees left behind by the mountain pin beetle epidemic. Five counties listed in Table 2-1are collaboratively working with the U.S Forest Service to slow the spread of Mountain Pine Beetles in forest, parks, and open spaces. Forest crews and contractors are removing thousands of acres of dead, dying, and targeted trees in high value areas like roads, campgrounds, trailheads, and power lines. Arapaho and Roosevelt National Forest crews are also taking out woodpiles, brush, and anything near communities that may fuel wildfires. Figure 2-2 shows the areas of the South Platte Basin that have been impacted by beetle kill.

[7] CSFS. (2010). Colorado Statewide Forest Resource Assessment. Fort Collins, Colorado.

[8] CSFS. (2010). Colorado Statewide Forest Resource Assessment

## Figure 2-2. Areas affected by Beetle Kill in the South Platte Basin as of 2010




**Source: US Forest Service**, Mountain Pine Beetle on the Colorado Front Range

Once infestation has begun, management options to mitigate intensity and spread are limited[9]. Infested forests can be thinned to prevent the spread of beetle kill. Trees can be sprayed with carbaryl to prevent the infestation, however, this process is time consuming and expensive. There is no effective means of mitigation large areas of infected forests.

The massive die off of lodgepole pines is expected to have direct and indirect effects of watershed processes including water yield, water quality and timing of flows. Annual water yields are expected to increase, with earlier onset and longer duration of spring snowmelt flows. Hydrologic models suggest that water yield may increase by up to 30 percent in some

[9] CSFS. (2010). Colorado Statewide Forest Resource Assessment.

watersheds, mostly in wet years[10]. Actual increases in many watersheds are likely to be less due to understory regrowth. As forest regrows, water yields will gradually return to pre-epidemic patterns over the next 50-60 years[10]. Water quality is not expected to be impacted by lodgepole mortality alone, as good ground cover will remain to promote infiltration and prevent hillslope and channel erosion. Erosion potential and risks to soil and water quality increase dramatically if severe wildfires occur.

**Climate Change:** Many of the watershed health problems in the past 20 years, including increased wildfire severity and scale, extensive insect and disease infestations, and flooding may have, in part, been driven by climate change[11]. The year 2002 was a record setting wildfire season and the current mountain pine beetle epidemic has been identified as impacts of the changing climate[6]. Mountain ecosystems are expected to experience the most severe ecological impacts from climate change and/or other causes of more severe variability in temperature and the timing and magnitude of rain and snowfall.

# 3 Existing Programs

## 3.1 Forest Management

Fire suppression in recent years has led to excessive vegetation density, abundant fuel, and species declines, providing extensive fuel for wildfires[12]. Reducing vegetative competition and enhancing appropriate age and species diversity through forest management can reduce the risk of damaging wildfire in high priority watersheds[11]. Also, mechanical thinning of overly dense lands and use of prescribed fire can influence forest resilience. Reducing fuel and implementing defensible space around homes and structures can significantly reduce the risk to people living on the wildlife-urban interface. Reforestations after a fire event will provide vegetation diversity.

Ecosystem rehabilitation is an important process in preventing post-fire erosion. This can include a wide variety of measures including creating check structures in drainages using more natural materials such as straw bales, spreading straw and other materials to protect the soil, reseeding efforts, and using water bars to reduce soil erosion on roads[13].

## 3.2 Community Wildfire Protection Plans

Under the Healthy Forests Restoration Act, community wildfire protection plans identify protection priorities and establish fuel treatment projects in and surrounding communities. Each committee is made up of diverse local interests including local government, local fire authority, local Colorado State Forest Service representatives, representatives of relevant federal land management agencies, and other relevant non-governmental partners. Currently, many areas of South Platte Basin forested counties have community wildfire protection plans.

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[10] US Forest Service Briefing Paper. Watershed Impacts of Bark Beetle Epidemic.

[11] CSFS. (2010). Colorado Statewide Forest Resource Assessment.

[12] Martin, D. (2000). "Studies of Post-Fire Erosion in the Colorado Front Range Benefit the Upper South Platte Watershed Protection and Restoration Project".

[13] Moench, R., and Fusaro, J. (2008). *Soil Erosion Control After Wildfire*. Colorado State University Extension.

## 3.3 Colorado-Big Thompson Headwaters Partnership

The Colorado-Big Thompson (C-BT) Headwaters Partnership was formed in 2012 by Northern Water, the U.S. Bureau of Reclamation, the Colorado State Forest Service, and the U.S. Forest Service. The partnership seeks to restore forest and watershed health before fires occur, and make plans to protect water supplies after fires. Much of Northeastern Colorado's drinking water supply comes from the Colorado-Big Thompson Project, where burn areas are susceptible to increased rates of runoff and erosion. C-BT also serves more than 120 ditch companies for irrigation of about 650,000 acres of land[14]. The partnership has begun to remove beetle kill lodgepole pine trees and other sources of forest fire fuel. The partnership is also developing an operating plan that will develop goals for overall watershed health, targeted types of treatment, and estimated costs for these treatments[14].

## 3.4 Denver Water

Denver Water, the largest water supplier to the Denver metropolitan area, has formed a partnership with the Rocky Mountain Region of the U.S. Forest Service, Department of Agriculture to improve forest and watershed conditions. Denver Water plans to match the U.S. forest Service's $16.5 million investment, totaling $33 million, toward forest treatment and watershed protection projects over a five-year period in priority watersheds critical to Denver Water's water supply[15].

# 4 Potential Opportunities

Through working closely with local, state, and federal land agencies, other areas of watershed health protection and sustainability can be identified. Areas where only preliminary or no wildfire protection plans exist should be identified and addressed. Colorado House Bill 14-1008 will authorize the Colorado Water Resources and Power Development Authority to make loans to private entities for purposes of forest health projects[16]. The Bill was introduced in January of 2014.

The Arkansas, South Platte, and Metro Roundtables are in the process of considering a Watershed Health Basin Plan Working Group. According to the proposed scope of work, the working group would:

- Invite state, federal, and non-governmental organizations to actively participate in the process of formulating watershed health plans
- Capture the experience of stakeholders and consumptive water users from the past decade of fire suppression and post-fire mitigation and recovery in Colorado

[14] NCWCD. (2013). "Headwaters Partnership."

[15] Denver Water. (2014). "From Forests to Faucets: U.S. Forest Service and Denver Water Watershed Management Partnership".

[16] House Bill 1008, 69th Gen. Assem., Reg. Sess. (2014).

- Develop a common technical platform that integrates with prior basin non-consumptive needs assessments and provides full integration of the non-consumptive needs of each basin in its watershed health plan

The group proposes to deliver manuals on fire suppression, post-fire mitigation, forest health and other watershed health incentives, like wetland construction for water quality. These manuals will be based on current best management practices (BMPs) of local, state, and federal agencies that have substantial experience in these critical watershed health issues.

# 5 Conclusions

This memorandum summarizes fire-related watershed health and protection projects and processes that protect critical water supply. The non-consumptive team will address issues such as watershed health including water quality degradation and the potential for diminishing environmental and recreational qualities. Watershed health impacts both water quality and quantity. The need for proactive watershed management will increase as the population of the South Platte River basin increases. Therefore, the South Platte Basin should take reasonable precautions to prevent high severity fires, control spread of insects and disease, and minimize impacts of flooding. The Upper South Platte Basin is of particular concern as it supplies water to major water providers in the South Platte and Metro Basins. Areas of concern have been identified and action should be taken to decrease the possibility of high severity forest fires from occurring in these areas.

Currently, forest management and communities located in forests have taken precautions to prevent wildfires from occurring and lessening the impacts when they occur. However, there are still high levels of combustionable fuel in many forested watersheds and there remains a high probability of severe forest fires. Historically, wildfires have impacted many types of critical water supply facilities and they will continue to do so. Proactive planning and prevention measures will lessen the risk and impact. Examples of these proactive programs include the partnership between Northern Water and state and national forest agencies to restore forest and watershed health before fires occur, as well as develop an operating plan. Denver Water has also partnered with state and national agencies to help fund forest treatment and watershed protection projects critical to Denver Water's water supply. Working closely with land agencies to create the proper prevention and planning methods will decrease the likelihood of the occurrence of fires impacting water quality and quantity.

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