COLORADO'S WATER PLAN

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Chapter 7: Water Resource Management & Protection

INITIAL DRAFT 7.1: Watershed Health and Management (previously Chapter 5.3)

The policy of the state of Colorado: to better understand and promote watershed health and to support development of watershed coalitions and watershed master plans that address needs from a diverse set of local stakeholders.

Introduction

Colorado's mountain watersheds have a strong influence on the quality and quantity of water. Watershed geography includes physical science, such as climate and geology, as well as the relationship that humans have with the land. Healthy watersheds provide ecosystem services that benefit ecological processes, local and state economies, and social stability. Ecosystem services include flow regulation, flood attenuation, water purification, erosion control, and habitat protection.

This section begins by defining the physical processes that influence watershed health. We then recommend strategies for successful stewardship of watersheds and water supply, and summarize the watershed health strategies developed in the Basin Implementation Plans.

7.1.1 Watershed Health Science

A watershed is an area of land in which all water drains to a common point. Watersheds exist at all spatial scales, from the tiniest of tributaries to the largest rivers on earth. John Wesley Powell defined a watershed as "that area of land, a bounded hydrologic system, within which all living things are inextricably linked by their common water course and where, as humans settled, simple logic demanded that they become part of a community." Four major U.S. rivers, including the Arkansas, Colorado, Platte, and Rio Grande originate in our headwater state of Colorado. These four rivers drain one-third of the lower U.S. and provide water to 18 downstream states and the country of Mexico. As snowmelt and rain travels down gradient to reach these rivers it must go through varying terrain. It interacts with the biology and the physical environment of the watershed. This is the watershed's ecosystem. Water quality and quantity are intimately linked to a watershed's health.

Watershed health can be broadly defined as a measure of ecosystem structure and function. Species diversity comprises structure. Function refers to productivity and hydrology. A critical element of hydrologic function is flow regime. Flow regime defines the magnitude, duration, frequency, rate of change, and timing of flows in stream systems. Magnitude refers to a river's discharge. Duration describes a period of time a river experiences a given discharge. The frequency at which a river experiences a given discharge and the rate at which discharges increase and decrease, i.e. change, also characterizes flow regime. Finally, the timing of discharges, or seasonality, is influenced by a watershed's hydrologic function. Figure 7.1-1 below represents an

annual median flow hydrograph for a snowmelt driven stream. It describes the different elements of flow regimes. Society has adapted its water supply infrastructure to the flow regime of its watersheds. Changes in ecosystem structure and function have direct and indirect impacts on a stream's flow regime.

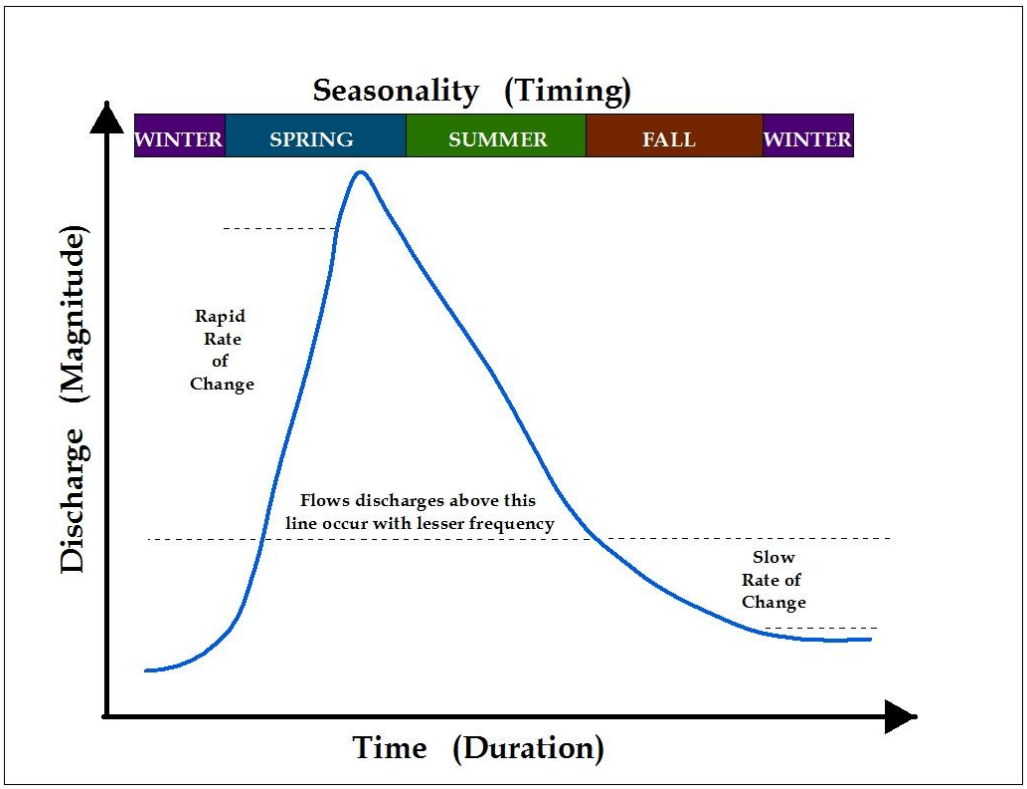

Figure 7.1-1 Stream Hydrograph

Forested watersheds support dynamic ecosystems that are subject to natural perturbations, e.g. fire, flood, and drought.[ii] Resilient ecosystems function in a state of dynamic equilibrium. These watersheds experience natural disturbances with no significant impact on function. Oftentimes the impacts from fire, flood, and drought are exacerbated by anthropogenic perturbations. For example, watersheds which historically managed to exclude fires have changed ecosystem structure and productivity. When ecosystem function thresholds are crossed, a watershed no longer exists in equilibrium. The resultant changes to hydrologic function and water quality have direct impacts on water supply.

Watersheds work to connect terrestrial, freshwater and coastal ecosystems, and provide ecosystem services, such as carbon sequestration, water supply, filtration and purification.[iii] Colorado watersheds support multi-objective uses for both consumptive and nonconsumptive water supply. Eighty percent of Colorado's population relies on forested watersheds to deliver municipal water supplies.[iv] Watershed health management strategies developed to protect this domestic supply will also protect other uses in the watershed. Sediment is the most concerning non-point source pollutant contributed from our forested lands.[v] An unbalanced delivery of sediment in rivers has negative impacts on both consumptive and nonconsumptive water uses. Sediment is contributed to river systems through natural processes that connect land and water. Increased volumes of sediment are contributed as a result of erosion caused by high to moderate burn severity fires,

forest road infrastructure with failing stormwater management infrastructure, and other processes in which the landscape is altered by human or natural causes.

Forests provide ecosystem services for watersheds which help to protect, restore, and sustain water quality and quantity. Healthy forested watersheds absorb rainfall and snow melt and allow it to runoff slowly, recharge aquifers, sustain stream flows and filter pollutants. Watersheds are largely protected when forest ecosystems are healthy because soil is protected; thereby preventing erosion, promoting soil moisture storage enhancement, and groundwater recharge.[vi] These services can offset natural hazards by reducing floods, maintaining plant communities, and reducing contaminants. Present day forest health concerns are largely attributed to climate change and forest stand density,[vii] i.e. ecosystem productivity.

7.1.2 Managing Partnerships for Healthy Watersheds

Managing watersheds for healthy ecosystem structure and function is a unique opportunity for water supply stakeholders. Successful watershed management necessitates a pragmatic approach that includes coalition-building, data collection, planning, prioritization, implementation, and monitoring. This is a cyclical process, and each phase requires continued efforts. Watersheds exist across political boundaries, and watershed health management involves collaboration amongst many interested entities. Natural resource management may be the driver that catalyzes a need for collaboration, but there are social, political, and economic interests that must be represented as well.

A *watershed approach* is a flexible framework for managing water resource quality and quantity within specified drainage areas, or watersheds. This approach includes stakeholder involvement and management actions supported by sound science and appropriate technology. Coalition building typically starts when interested parties come together to discuss a watershed health concern. For example, many watersheds in Colorado are identified as having a high post-fire erosion risk as well as being a critical watershed for water supply.[viii] (Figure 7.1-2). This is a case of where concerned stakeholders are engaging in collaborative dialogues to address a very real watershed health concern. Coalitions may form to address a variety of concerns including pre and post fire mitigation, forest mortality, water quality impairments, flood mitigation and recovery, and land use change. Other groups may come together to discuss watershed protection in a well functioning ecosystem. Collaboration before a threshold crossing disturbance takes place sets the stage for faster and more resilient recovery measures.

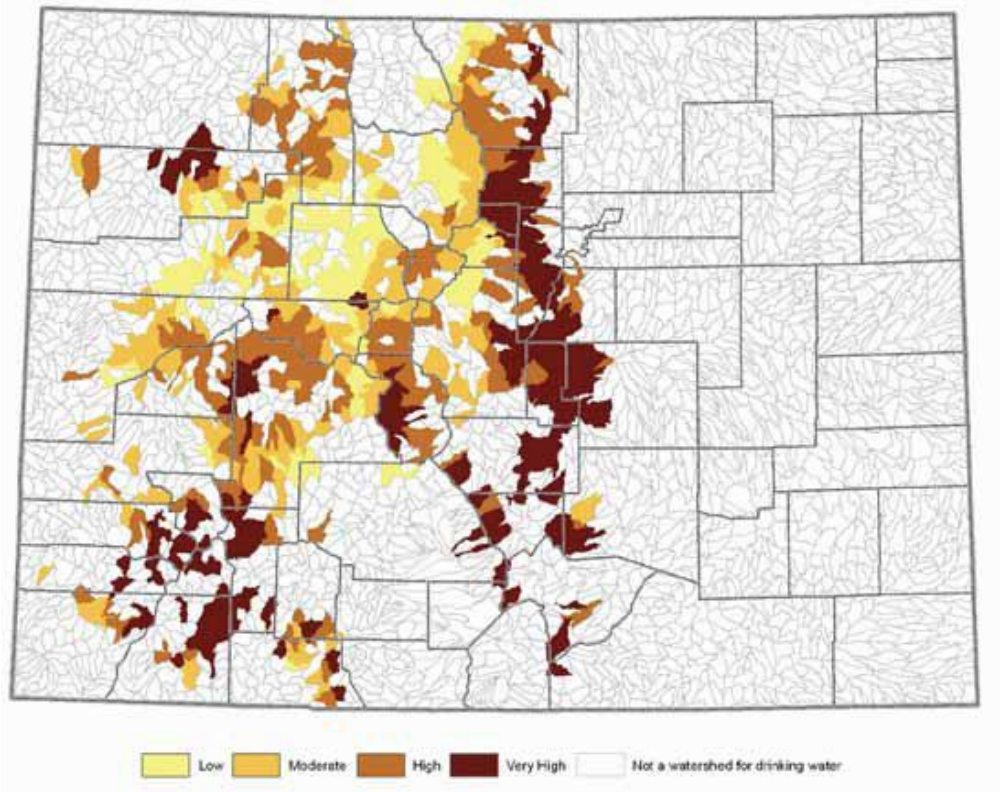

Figure 7.1-2 CSFS Erosion Risk Map

An organizational structure is recommended whether the coalition chooses to incorporate or not. The coalition should be open to diverse interest within the watershed. It should also be open to interests directly affected by outputs of the watershed. Diverse stakeholder input at the beginning stages of coalition building increases the likelihood of actions to improve watershed health. Engaged community members will be more likely to participate in building political will, developing management options, and supporting project implementation. Stakeholders that may be represented include all levels of government, special districts, private landowners, businesses, citizens, non-profits, educators, recreational interests, agricultural interests, grantors, and conservationists. A coordinator that works for the coalition improves the chances for continued coalition success. The coordinator serves all coalition stakeholders equally, and they act to represent the interests of all coalition members. They are the unifying body, the moderator, the facilitator, and the manager. It is helpful for this person to have a background in both non-profit and governmental work.[ix]

Watershed planning can happen at different levels depending on the coalition's mission, objective, and goals. A watershed plan is a strategy that provides assessment and management information for a geographically defined watershed, including the analyses, actions, participants, and resources related to developing and implementing the plan. The development of a watershed plan will require a certain level of technical expertise and the participation of a variety of people with diverse skills and knowledge. Different members of the coalition have varying skill sets that aid in the assemblage and assimilation of watershed information (GIS data, maps, monitoring reports, risk analysis, existing assessments).

A holistic watershed planning approach will provide the most technically sound and economically efficient means of addressing watershed health concerns. The process is strengthened through the

involvement of stakeholders. This approach will address all the beneficial uses of the water supplied by the watershed, the criteria needed to protect the uses, and the strategies required to restore or protect ecosystem productivity and function. This approach expedites cooperative and integrated water supply planning, which leads to successful implementation of watershed health management strategies.

7.1.3 Basin Implementation Plan Strategies

Watershed health for the individual basins is largely focused on forest health concerns. This was a recommended focus area in the Basin Implementation Plan guidance provided by the CWCB. Forest health concerns are centered on wildfire, flooding, and sedimentation. Basins were asked to identify projects and methods that would protect critical water supplies and the environment in the event of a natural disaster occurring at the watershed scale. It was recommended that existing watershed assessments be assembled or developed. It was also recommended that collaborative discussions on managing forests to benefit water supply begin. Basins with water supplies originating in another basin were encouraged to partner with each other.

All of the Basin Roundtables identify wildfire as a watershed health concern. This includes recovery from existing fires and identifying pre-fire mitigation strategies. The Arkansas Basin illustrates a process with a strong emphasis on pre-disaster preparedness through collaborative dialogues with potentially affected parties. Figure 7.1-3 outlines the Watershed Health and Emergency Event Life Cycle.

Figure 7.1-3 Coalition Stakeholder Figure

The Rio Grande Basin's approach to watershed health is closely in line with that of the Arkansas Basin, and the Rio Grande Basin participated in the Arkansas Basin's watershed health planning process. The primary goal of the Basin is to "protect, preserve and/or restore the sustainability of the Rio Grande Basin watershed by focusing on the watershed health and ecosystem function". The Basin developed a collaborative watershed coalition during the West Fork Fire, and they realize the benefits of such a group for restoration and protection of forested watersheds. The coalition known as RWEACT (Rio Grande Watershed Emergency Action Coordination Team) has modeled post fire hydrology, improved on their ability to forecast storms and identify flood potential, and developed post-wildfire flood risk analysis maps. The Basin's watershed health actions emphasize forest health management and pre-disaster preparedness. This includes forest thinning and prescribed burning. They also acknowledge a need to develop markets for forest products.

The South Platte and Metro Basins also participated in the Arkansas Basin's watershed health planning process. They propose a collaborative dialogue that focuses on post-fire mitigation across watershed (Basin) boundaries. The deliverables from this process will include forest health manuals developed at a statewide level. The Basin watershed health section also discusses insect infestations, but it concludes that this has little direct impact on water quality and quantity.

The Southwest Basin has a history of collaborative watershed groups focusing on watershed health topics. This includes forest health and resiliency planning for the San Juan watershed, water quality monitoring on the Animas River, watershed health assessments for the San Miguel watershed, and development of Source Water Protection Plans for 23 public water suppliers. A Source Water Protection Plan inventories potential sources of drinking water contamination in a defined watershed.

The Yampa, White, and Green Basin state that over one-third of their jobs are dependent on water quality influenced by watershed health. They acknowledge that communities in the Basin are susceptible to water quality issues caused by severe wildfires. The Basin references a Critical Community Watershed Wildfire Protection Plan entitled "Upper Yampa Phase I Watershed Assessment: Prioritization of Watershed Base Hazards to Water Supply". Watershed Wildfire planning is oftentimes recommended for watersheds critical to water supply. They provide composite hazard rankings for wildfire hazards, flooding/debris flow risk, and soil erodibility. This data is combined with Source Water Assessment and Protection data to prioritize critical watersheds .[x] Presently the Watershed Wildfire Protection Plans are geared towards prioritizing forest health treatments for watersheds critical to drinking water supply, but they could be applied to any prioritized water use.

The Gunnison Basin is addressing forest health concerns by partnering with the Colorado and U.S. Forest Services to manage forests, insects, and wildfire. They also anticipate education and outreach associated with this effort. They did not participate in the Arkansas Basin's watershed health planning process, but they do plan to reference materials produced in the effort for future watershed health projects.

The North Platte Basin references a study that monitors forest beetle kill, wildfire potential, and impacts to water quality and quantity. The study is nearing completion. It looks at management alternatives in the post beetle kill forest environment. The basin intends to review, disseminate, and implement recommendations identified in the study.

The Colorado Basin identifies 14 collaborative watershed groups actively engaged in improving watershed health. Primary watershed health concerns in the Basin include wildfire risk and the evolving forest landscape. Both have the potential to impair water supply. The Basin supports watershed wildfire assessments.

7.1.4 Next Steps

In order to better understand and promote watershed health, and to support development of watershed coalitions and watershed master plans that address needs from a diverse set of local stakeholders, several next steps are necessary.

1. Identify watersheds critical to water supply.
2. To support the technical work, Watershed Master Plans may be necessary; work toward a long term goal of developing watershed master plans for every large watershed area.
3. Identify existing watershed groups and existing watershed plans and assessments.
4. Encourage and support capacity in many areas that currently do not have watershed groups or other groups that work with a broad set of local stakeholders.
5. Assist stakeholders in existing watershed groups with tools and resources to address gaps and build capacity in existing plans

References

[i] Williams, J.E., C. A. Wood, and M.P. Dombeck, editors. 1997. Watershed Restoration: Principles and Practices. American Fisheries Society, Bethesda, Maryland.

[ii] Id.

[iii] Postel, Sandra L. and Barton H. Thompson, Jr. 2005. Watershed Protection: Capturing the Benefits of Nature's Water Supply Services. Natural Resources Forum, 29 (2005) 98-108.

[iv] Edwards, Richard M. and Greg Sundstrom. 2013. Colorado Forestry Best Management Practices, Forest Stewardship Guildlines for Water Quality Protection, 2012 Field Audit Report. Colorado State Forest Service.

[v] Id.

[vi] Colorado State Forest Service. 2008. Colorado Statewide Forest Resource Assessment- A Foundation for Strategic Discussion and Implementation of Forest Management in Colorado. Retrieved from http://csfs.colostate.edu/pages/statewide-forest-assessment.html

[vii] Colorado State Forest Service. 2013. Report on the Health of Colorado's Forests, Caring for Colorado's Forests: Today's Challenges, Tomorrow's Opportunities.

[viii] CSFS, 2008.

[ix] Ekarius, Carol, 2014. Building Successful Watershed Coalitions. Presentation at the Colorado Watershed Symposium, July 2014.

[x]Front Range Watershed Protection Data Refinement Work Group. 2009. Protecting Critical Watersheds in Colorado From Wildfire: A Technical Approach to Watershed Assessment and Prioritization.