Eagle River Community Water Plan

Revised: October 2024

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TO THE POINT peak FACILITATION GROUP

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The Confluence of Science & Application

Preface

"When you put your hand in a flowing stream, you touch the last that has gone before and the first of what is still to come." – Leonardo Da Vinci

Eagle River Coalition, formerly the Eagle River Watershed Council, initiated the Eagle River Community Water Plan in order to develop proactive water management recommendations that anticipate changes to local hydrology and water demand.

The State of Colorado laid the groundwork for this plan with the adoption of the Colorado Water Plan in 2015 that set out to have 80 percent of locally prioritized rivers covered by stream management plans by 2030. Through the planning process, we wanted to seek multiple benefits, engage community members and consider a changing environment while balancing all uses and protecting river health.

The Eagle River Watershed supports diverse uses of water that may be impacted by population growth and increasing municipal demand for water in Eagle County, climate change and volatility, and projects related to the Eagle River Memorandum of Understanding (ERMOU)–an intergovernmental agreement for developing municipal water supplies in the upper Eagle River watershed.

Therefore, the overall goal of the Eagle River Community Water Plan is to consider past, present and future human and ecosystem river health values to identify opportunities to correct historical degradation and prevent and mitigate against non-desirable future conditions.

Funding and Partner Support

The Eagle River Community Water Plan was made possible by efforts within the Colorado Water Plan adopted in 2015 and subsequent grant programs through the Colorado Water Conservation Board. Additional funding was provided by Homestake Water Project Partners, Eagle Park Reservoir Company, Eagle River Water & Sanitation District, Vail Resorts, Climax Mine (Freeport McMoran), Colorado River District, Eagle County and the towns of Vail, Avon, Gypsum and Minturn. The organizations indicated below regularly participated in the planning process and provided valuable insights, suggestions, and edits. The Eagle County Conservation District provided input on behalf of the agricultural community.

Town of Gypsum · Eagle County · Minturn · Climax Molybdenum, A Freeport-McMoRan Company · Vail Resorts, Experience of a Lifetime · Aurora Water · Eagle River Water & Sanitation District · Colorado Springs Utilities, It's how we're all connected · Colorado River District · Avon Colorado · Town of Vail · Edwards Colorado · Eagle County Conservation District · Eagle Valley Land Trust · The Eagle River Fund · Northwest Colorado Water Quality / Quantity Committee · National Forest Foundation · American Rivers, Rivers Connect Us

Disclaimer

The issues, needs, projects, and processes described here articulate the community's goals and objectives for collaboratively addressing the region's water future. The perspectives characterized here reflect outcomes of engagement with community members between 2017 and 2022. The Eagle River Community Water Plan does not supersede or serve as a substitution for any local, state, or federal permitting processes or subvert any existing water rights. Any objective or action identified in the ERCWP should be considered within the existing legal and regulatory framework.

A Note From the Eagle River Coalition

The Eagle River Watershed is not an unknown or unstudied resource. Many plans, projects and efforts precede this water plan. However, many of those planning efforts and assessments focus on existing water quality issues and current conditions. In order to mitigate human and environmental demand shortages that are generally undesirable, the Eagle River Community Water Plan placed greater focus on future water quantity and quality issues. This approach was motivated by the growing recognition that the future may bring altered hydrology and increased demand for water.

Within the Watershed, there are numerous user types and water uses to account for. Water is removed from the Eagle River and its tributaries in varying amounts at different times of the year to support agriculture, domestic uses, and recreation (e.g., rafting and snow making). Water is also diverted from the headwaters across the Continental Divide through a system of transbasin diversions for use on the Front Range. The water left in rivers and streams supports fishing, boating and other recreational uses, which contribute to residents' high quality of life and the success of the local economy. The well-being of our communities relies on healthy aquatic ecosystems. The health of streams and river, in turn, is significantly influenced by the amount and timing of streamflows and the degree to which those flows resemble natural conditions.

The Eagle River Coalition initiated the Eagle River Community Water Plan with a two-part mission to 1) consider past, present, and future human needs and river health issues to identify opportunities to correct historical degradation and prevent and mitigate against non-desirable future conditions for environmental and recreational water uses; and 2) understand the independent and interactive impacts of population growth, water use, reservoir development, and climate change (air temp. and precipitation patterns) on human and ecosystem water needs.

We hope this planning effort can help water managers and policy makers better understand the community's concerns about the well-being of our streams and rivers. Notably, this effort produced a set of Management Objectives that synthesize what stakeholders and the community want to achieve and represent a shared vision for streams and rivers in Eagle County.

Sincerely,

James Dilzell

Executive Director
Eagle River Coalition

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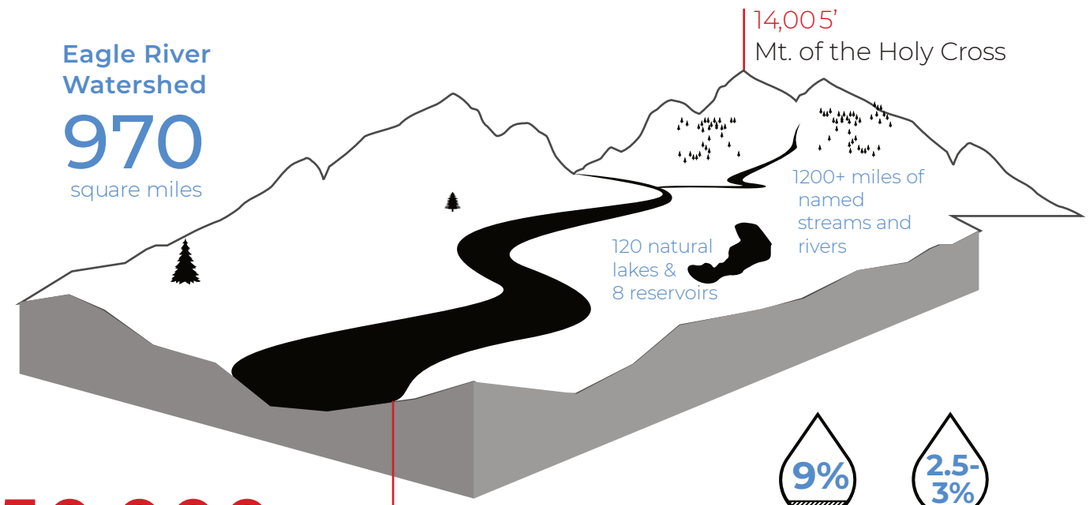
Glossary of Terms

BIP	Basin Implementation Plan
BLM	Bureau of Land Management
CBRT	Colorado Basin Roundtable
CEC	Community Engagement Committee
CTG	Core/Technical Group
CWCB	Colorado Water Conservation Board
CWP	Colorado Water Plan
EGS	Ecosystem Goods and Services
ER20	Eagle River 20 Simulation Model
ERC	Eagle River Coalition (formally Eagle River Watershed Council)
ERCWP	Eagle River Community Water Plan
ERMOU	Eagle River Memorandum of Understanding
ERWP	Eagle River Watershed Plan
IWMP	Integrated Water Management Plan
SMP	Stream Management Plan
TMD	Transmountain Diversion
USFS	United States Forest Service
USGS	United States Geological Service

Plan Summary



50,000+
people in Eagle County depend full-time on a healthy watershed

9%
2.5-3%
The Eagle River contributes about 9% of the Colorado River's flow at the Utah border. and between 2.5-3% of the total Colorado River Basin annual discharge.

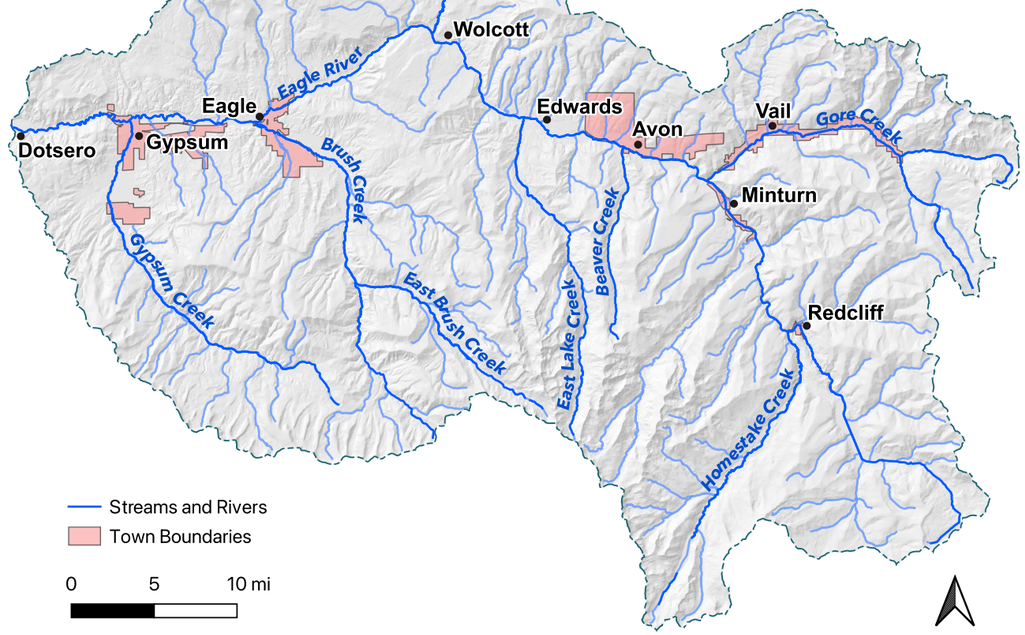
The Eagle River watershed is home to a network of clear mountain streams and rivers that cover approximately 960 square miles of rugged mountain ridges and verdant river valleys. Elevations in the watershed range from 6,100 feet near Dotsero to 14,003 feet at the summit of Mount of the Holy Cross, supporting a diversity of ecological communities reflective of this dramatic elevation range. Unique among most Colorado watersheds, approximately 98% of the Eagle River basin is located in a single jurisdictional boundary - Eagle County. Nearly 75% of the watershed is on public land managed by two federal agencies, the United States Forest Service (USFS) and the Bureau of Land Management (BLM). Flowing north then west for about 77 miles, the Eagle River originates in steep headwaters catchments above tree-line near Tennessee Pass. It is fed by numerous ephemeral, intermittent and perennial streams, springs and seeps as it descends through montane forests and semi-arid valley bottoms near its confluence with the Colorado River at Dotsero. Water from the mainstem Eagle River and its many tributaries supports a high diversity of ecological and human uses as they traverse Eagle County. Understanding and protecting these uses is the primary interest of the Eagle River Community Water Plan (ERCWP, or the "Plan").

Although the natural flow regime[1] of many waterways in the Eagle watershed are much more intact than other Colorado streams and rivers, human settlement and the associated consumptive use and management of water inexorably alters streamflow. Roughly 75% of the average annual flow volume of the Eagle River occurs during the months of May, June and July. The remaining 25% of flow is spread across the rest of the year, supporting aquatic and terrestrial wildlife, numerous recreational uses, and helping to meet community demands for affordable, clean and reliable water supplies (ERWP, 1996). Reservoir storage and transmountain diversions reduce streamflows during snowmelt periods on many headwaters streams, with additional flow impacts rippling downstream. Conversely, these releases augment flows in some reaches during summer and fall low flow periods when water diversions for municipal and agricultural uses would otherwise reduce flows well below natural conditions. A warming climate and increasing demand for agricultural and municipal water in Eagle County and Front Range communities is likely to significantly alter patterns of streamflow in local streams and rivers in the coming decades.

The Eagle River flows into the 21st century amidst a host of changing landscapes and climate characteristics. Increasing human populations, shifting values towards water uses, and increasing impacts to streams and rivers from climate change place new pressures on local streams and rivers to satisfy the needs of both human communities and aquatic ecosystems[2]. These changes may have corresponding impacts on environmental and recreational water uses.

Planning Area

The primary geography considered by the Plan's various technical analyses includes the mainstem Eagle River below the confluence with Homestake Creek and Gore Creek below the Confluence with Black Gore Creek. A less-intensive evaluation and project identification effort was also carried out on Gypsum Creek and Brush Creek. Community values identified in the ERCWP apply more broadly to the entire watershed.



[1] A river's flow regime is the natural pattern of flow over time and can be described by the magnitude, timing, and frequency of high and low flows. In the Rocky Mountains, the natural flow regime typically features high, fast flows in late spring and early summer, declining through summer and early fall until low winter base flows settle into place.
[2] https://dnrweblink.state.co.us/CWCB/0/edoc/217373/ColoradoWaterPlanPublicReviewDraft.pdf

Planning Goals

Eagle River Coalition (ERC) seeks to understand environmental and recreational (E&R) water needs within the Eagle River Basin. Assessing impacts of future water development and climate change on river health and socially valuable aspects of the river is central to this task. This interest led ERC to coordinate the activities of the ERCWP. ERC produced the Plan collaboratively with local stakeholders and Front Range water providers to achieve the following[1]:

- Support the sustainable development of natural and physical resources and the maintenance of ecological processes and biological diversity;
- promote the equitable and sustainable use and development of water;
- encourage public involvement in resource management and planning;
- promote the sharing of responsibility for resource management and planning between the local city and county governments, municipal water providers, out-of-basin water interests, the community, and state and federal government agencies;
- provide timely information and forecasts that directly support environmental, social, economic, conservation and resource management policy development and decision-making by local governments, utilities and special districts;
- secure a pleasant, safe and desirable working, living, and recreational environment for all residents and visitors to Eagle County;
- conserve those areas or other places which are of scientific, aesthetic, or otherwise of special cultural or environmental value;
- recognize the significant social and economic benefits resulting from the sustainable use of water resources for the supply of drinking water and commercial activities dependent on local rivers and streams;
- maintain healthy, functioning ecosystem processes and high levels of biodiversity in aquatic ecosystems;
- provide for the fair, orderly and efficient allocation of water resources to meet the community's needs;
- increase the community's understanding of aquatic ecosystems and the need to use and manage water in a sustainable and cost-efficient manner;
- provide information supporting procedures for evaluation, implementation, enforcement, and review of water resources management activities; and
- consider the multiple uses of water and the ways that each use may be affected differently by climate change, population growth, and other stressors.

The Plan promotes sustainable resource use and development. The concept of sustainable development means managing for the use, development and protection of natural and physical resources in a way, or at a rate, that enables communities to provide for their social, economic and cultural well-being and for their health and safety while: 1) sustaining the potential of natural and physical resources to meet the reasonably foreseeable needs of future generations in Eagle County; 2) safeguarding the life-supporting capacity of water and aquatic ecosystems; and 3) avoiding the need to mitigate any adverse effects of human activities on the environment[2].

The Plan assesses historical hydrological conditions and presents a range of potential water use and management futures to consider how well these futures continue to support the diversity of human and ecosystem needs. The primary output of this plan is a collaboratively prioritized set of management strategies that reflect the goals, needs, and values of the local community. The goals, objectives and strategies developed under the Plan are not, necessarily, restricted to the same geography as that covered by the technical analyses.

[1] Informed, in part, by the New South Wales Water Management Act 2000 No. 92, the Tasmania Water Management Act 1995, and the Victoria Environment Protection Act 2017.
[2] Tasmania Water Management Act 1999

The two-part mission of the Eagle River Community Water Plan is to:

- consider past, present, and future human needs and river health issues to identify opportunities to correct historical degradation and prevent and mitigate against non-desirable future conditions for environmental and recreational water uses; and
- understand the independent and interactive impacts of population growth, water use, reservoir development, and climate change (air temperature and precipitation patterns) on human and ecosystem water needs.

See **Appendix A** for a more detailed discussion of the planning goals and objectives.

Use of the Plan

This Plan provides a road map for community members, local governments and other organizations eager to implement projects that support diverse water needs. Specifically, the Plan provides: 1) a framework for characterizing potential impacts/changes to riverine conditions and/or identifying areas where river health may be most impacted by the interaction between proposed water management activities and other physical and biological components of the ecosystem, 2) an understanding of environmental and recreational needs gaps as they are affected by hydrological variability and increasing demands for water in Eagle County and on the Front Range, and 3) a set of durable planning objectives that may help guide the distribution of funds to support high-priority environmental and/or recreational needs across Eagle County. Importantly, the conformance of goals and objectives identified in the ERCWP and the Colorado River Basin Roundtable (CBRT) Basin Implementation Plan (BIP) should facilitate the procurement of state and federal funding for local project implementation.

The ERCWP serves as a guidance document that provides insight into watershed-level values and priorities. Through the planning process, stakeholders outlined objectives and identified strategies to create a foundation for the communities of the Eagle River to mitigate potential future impacts on the values they hold associated with the River.

- Stakeholders can use the Plan to better understand community values associated with the Eagle River and leverage the objectives and strategies identified in the plan to apply for grants and other funding opportunities.
- Land managers can use the Plan to help decide where and how to allocate resources.
- Decision-makers can use the contents of the ERCWP as supporting information to make informed decisions about where and how to align policy and allocation of resources in a manner that reflects stakeholder and community perspectives.

Planning Context

The Colorado Water Plan (CWP) seeks to understand the state's water needs, identify gaps and promote projects and processes to meet those needs. The CWP recognizes the potential for changes in water supplies necessary to sustain local communities and meet diverse water needs. The state of Colorado encourages local stakeholders to engage in strategic planning efforts that collaboratively address their changing water futures[1]. Specifically, the Colorado River Basin Roundtable called for Stream Management Plans and Integrated Management Plans in the BIP as a means for filling important data and information gaps[2]. ERC's 2013 Eagle River Watershed Plan (ERWP) further promoted stream management planning to aid locally-sustainable water management.

> ***"[...] where individual reaches of rivers or streams are identified as impaired or having inadequate flows, craft and implement Streamflow Management Plans that offer creative and cost effective strategies to address ecological, domestic, recreational and agricultural water needs." (ERWP, 2013)***

In 2018, ERC and other local stakeholders recognized a general lack of information necessary to understand environmental and recreational water needs in the Eagle River Watershed, and how these needs may be impacted by climate change and/or water development activities. These stakeholders saw opportunity to fill this important data gap and supplement ongoing planning efforts by local municipal water providers focused on meeting future demands under increasingly variable environmental conditions. The ERCWP was conceptualized as an effort to provide a nuanced evaluation of changing environmental conditions and recreational use opportunities on streams and rivers in response to a changing climate, growing population and changing patterns of land use.

Community Engagement Process

The Eagle River Community Water Plan implemented a structured stakeholder process to elicit feedback from the community regarding water use and management in the planning area (see **Appendix B** for more information). The planning process promoted sound strategic planning and coordinated action by various government and non-government entities and members by:

- providing a venue for discussing the multiple uses of water and the ways that each contributes to the vitality of local communities;
- ensuring that the impacts on E&R water uses were considered when contemplating future use and development of water; and
- establishing a structured and facilitated dialog among parties for setting objectives and identifying best practices, policies and other recommendations for the use, development and protection of water resources.

Engagement with stakeholders via surveys, webinars, and in-person workshop settings featured activities that helped stakeholders contemplate relationships between existing patterns of water use, ecosystem condition, the goods and services that streams and rivers deliver to local communities, and the potential for future impacts to the delivery of those goods and services due to climate change and/or water development activities. At the first ERCWP Stakeholder Group meeting in June 2018, stakeholders formed several groups in order to guide the development of the plan: the ERCWP Stakeholder Group, the Core/Technical Group, and the Community Engagement Committee. Each group had a distinct role in the formation of the ERCWP.

19 Stakeholder Group Meetings

1061 Total Hours

[1] https://dnrweblink.state.co.us/CWCB/0/edoc/217373/ColoradoWaterPlanPublicReviewDraft.pdf
[2] https://dnrweblink.state.co.us/cwcbsearch/0/edoc/216708/Colorado_BIP_Volume2_2022.pdf

ERCWP Stakeholder Group

The ERCWP Stakeholder Group consisted of stakeholders from environmental and conservation organizations, local and Front Range water providers, community members, ERMOU signatories, outfitters, conservation districts, regional government entities, local municipalities, Eagle County, and state agencies. The Stakeholder Group had an open membership for anyone interested in providing feedback on the ERCWP. The Stakeholder Group met regularly to conduct peer-to-peer learning about topics significant to the ERCWP, provide updates and input on parallel technical developments and community engagement efforts, and identify additional high-priority planning issues. The ERCWP Stakeholder Group was responsible for developing the ERCWP objectives, strategies, and project list in this plan. The Stakeholder Group was open to anyone interested in the future of the river and committed to regular and active participation in meetings.

25 Technical Group Meetings

424 Total Hours

Core/Technical Group

The Core/Technical Group (CTG) focused solely on the technical aspects of the ERCWP. Members of this group self-selected to participate in the group. The CTG consisted of members from state agencies, ERMOU partners, technical consultants, regional governmental entities, Eagle County, and local municipalities. The CTG met monthly until the completion of the technical elements of the plan. The purpose of the CTG was to ensure that those who have ideas or preferences about the technical elements of the ERCWP have the opportunity to provide meaningful feedback and direction to Lotic Hydrological (the technical consultant).

Word cloud created by community members during a live survey activity at a community meeting in 2019. Participants were asked to provide words that captured their experiences with local rivers and streams, their personal water uses, or their concerns for the well being of local waterways.

Community Engagement Committee

The Community Engagement Committee (CEC) focused solely on providing ongoing advice and expertise to the technical consultant and Peak Facilitation Group to help deliver the most effective community engagement possible during the ERCWP process. The Community Engagement Committee was comprised of members from local municipalities, Eagle County, ERMOU partners, state agencies, environmental and conservation organizations, local and Front Range water providers, outfitters, and conservation districts. The Community Engagement Committee designed and provided input on several community engagement strategies, including community meetings and several surveys, and helped interpret results.

The ERCWP was created with significant input through the ERCWP Stakeholder Group, Core/Tech Group and Community Engagement Committee. From 2018 to 2022, the Stakeholder Group, Community Engagement Committee and Technical Advisory Group met 53 times for a total of 1,433 hours.

ERC hopes that the voice of the community reflected in this Plan continues to be informative and useful to elected officials and other decision-makers as they endeavor to plan for Eagle County's water future in a manner consistent with the goals and principles set forth here.

Throughout the ERCWP planning process, the CEC employed several methods to engage the broader community and solicit feedback on different elements of the ERCWP. The CEC organized community meetings with in-person activities and exercises to gather community perspectives and values. They also set up booths at existing events with similar exercises to reach specific audiences. Some of the engagement opportunities collected demographic data for the purpose of communicating with decision-makers about who was providing input on the ERCWP and whether those providing input on the ERCWP were representative of the population in Eagle Valley. The CEC designed three different surveys to collect community feedback: two conducted in 2019 and another conducted in 2022.

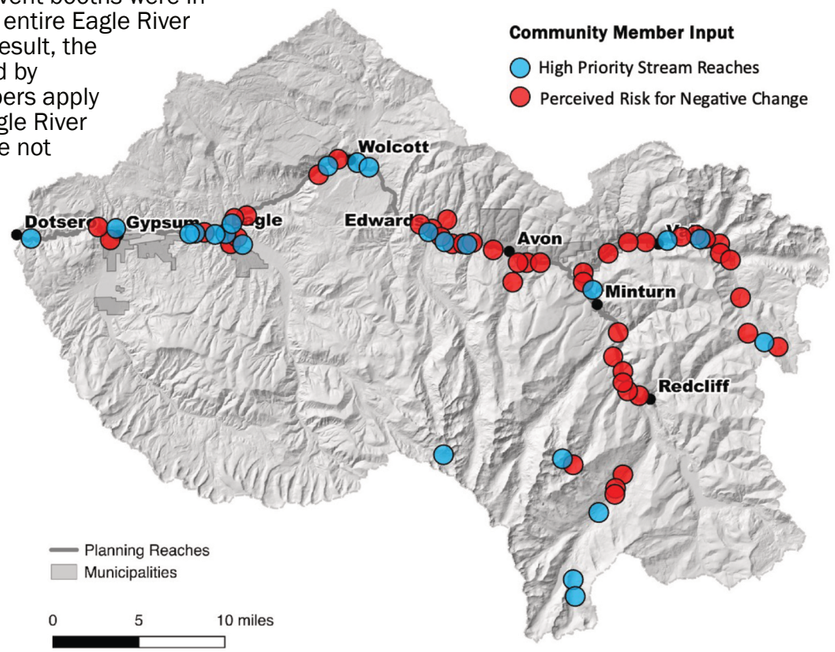
15 Outreach Meetings

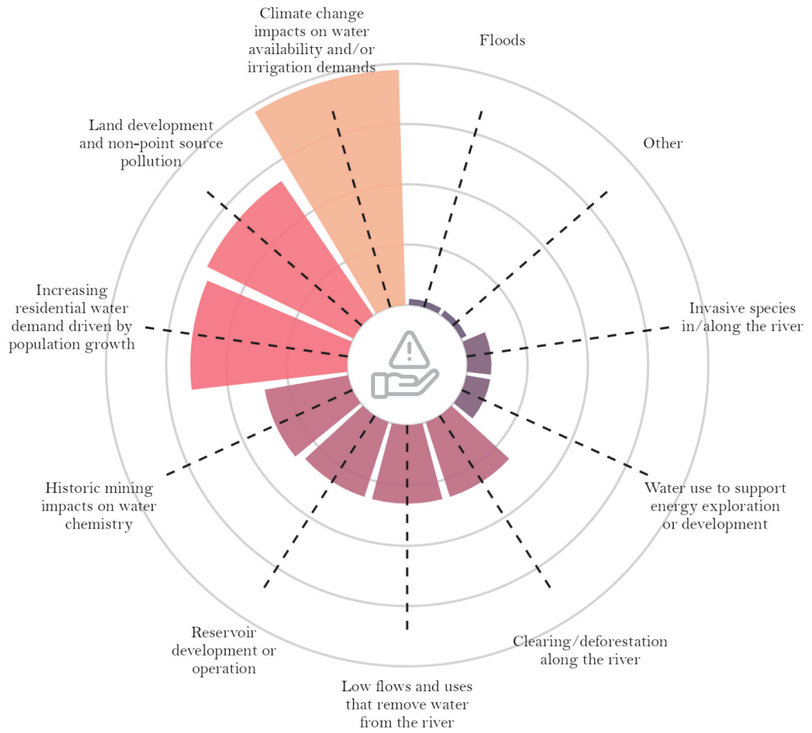
130 Total Hours

Nearly 30 percent of Eagle County identifies as Hispanic, according to US Census results. Therefore, the CEC made deliberate efforts to engage members of the Hispanic and Spanish-speaking community in Eagle County. In 2019, the CEC organized a community meeting with Spanish-speaking facilitator. Eagle County provided Spanish translation services so that one community survey could be distributed in Spanish.

Input from Community Members

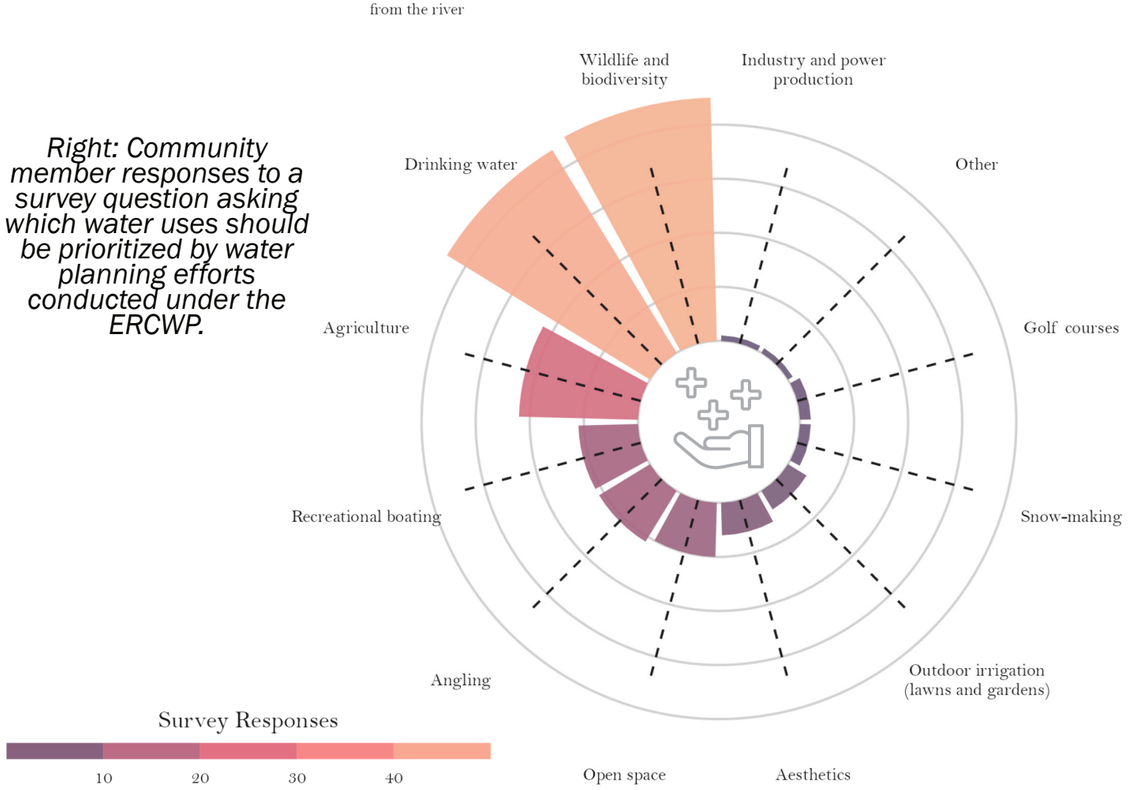
In early 2019, the CEC hosted two community meetings, one down-valley and one up-valley. One of these meetings included a Spanish-speaking facilitator. The purpose of the community meetings was to provide information about the ERCWP planning effort and gather information from community members about their perspectives on the priority water uses on the Eagle River. Meeting participants participated in several activities designed to collect their input. One activity asked community members to indicate on a map of the watershed, locations they had a special attachment to and thought should be prioritized by the ERCWP, and locations that they perceived at particular risk for negative change in the future (see map below). A survey questionnaire was additionally used to collect input about perceived risks to the health of streams and rivers throughout the watershed and community members' water use priorities for the ERCWP (see opposite page for summarized survey responses). A separate survey was distributed to community members, asking about streamflow preferences on different stream reaches needed to support whitewater boating activities. In total, more than 400 community members provided input to the planning process. Questions asked of the community via surveys, community workshops, and event booths were in the context of the entire Eagle River Watershed. As a result, the feedback provided by community members apply to the broader Eagle River watershed and are not restricted to the same geography as the technical assessment.





Left: Community member responses to a survey question asking participants to indicate their greatest perceived risks to the health of the Eagle River and its tributaries.

Right: Community member responses to a survey question asking which water uses should be prioritized by water planning efforts conducted under the ERCWP.



Assessment of Current Conditions

The ERCWP process began with a comprehensive search of scientific literature, resource studies and reports (**Appendix D**), and a review of existing policy, water rights (**Appendix E**), and management actions specific to the Eagle River watershed. This review provided context for understanding the diversity of social and environmental objectives that influence local and regional water use and management, and the array of historical conditions and trends in natural conditions. While numerous works were completed by local parties and agency partners like U.S. Geological Survey (USGS) concerning water quantity, quality, and the condition of aquatic life, fisheries, and riparian health in the watershed, a smaller subset of publications have particular relevance to streamflows and non-consumptive water use and needs for ecosystems and recreation. Sources critical to the development of the ERCWP include:

- **Colorado Water Plan**, 2015 (updated 2023): serves as the foundation of the ERCWP by providing initiatives, connections, and values to meet Colorado's current and future consumptive, recreational, and environmental water needs.
- **Technical Update to the Colorado Water Plan** (2019): communicates and makes publicly-available the state's supply and demand projection data, and the methods, analytical tools, and results used to underpin the CWP's findings and recommendations.
- **Colorado Basin Roundtable Basin Implementation Plan** (2015, updated 2022): identifies stream management plans (SMPs) and Integrated Water Management Plans (IWMPs) as top priorities. The CBRT states that such planning is vital to providing sufficient water for environmental needs among the many competing uses and demands for water, and thereby restoring and protecting ecological processes that connect land and water while ensuring that streams also serve the needs of human populations.
- **Eagle River Memorandum of Understanding Project Alternatives Study** (2016) provides evaluations of some potential project alternatives to develop water storage and conveyance projects in the Eagle River basin for West Slope and East Slope interests. The ERMOU was executed in 1998 by multiple signatories. Various development alternatives are currently being considered. Future permitting will assess impacts on water quantity and quality in the Eagle River. For instance, water diversions and storage can reduce the intensity of spring runoff flows that are important in the maintenance of aquatic habitat. Spring flows flush fine sediments from the channel substrate and provide the high-quality gravel beds needed by aquatic insects and fish for reproduction. High flows also maintain riparian communities through flooding of the banks and riparian zones adjacent to the river. Studies have not been conducted to determine how much of a "flushing" flow is actually needed on the Eagle River to maintain optimal habitat for aquatic life and bank recharge.
- **Eagle River Watershed Plan** (2013): provides information, goals, strategies and action items related to water and land management practices in the Eagle River basin. The 2013 document updates and replaces the 1996 version and includes significant new information, community input plus the vision for watersheds in Eagle County. Several issues and recommendations are discussed which provide relevant background to the development of an IWMP. The ERWP is organized around five water related topics (Quantity, Quality, Land Use, Wildlife and Recreation) all of which provide direction and insights for the ERCWP.
- **Eagle River Inventory and Assessment** (2005): an inclusive, scientific baseline inventory and assessment of the Eagle River with a prioritized list of restoration and conservation projects, including brief descriptions and cost estimates. It also measures public support for various prospective projects and other recommended actions. A comprehensive list of ten watershed restoration principles from scientific literature and case studies to improve the likelihood of success was included for reference and subsequent work plans.
- **Eagle River Assembly, Assembly Report** (1994, updated 2000): convened to find a path through the acrimonious gridlock surrounding Colorado Springs and Aurora's efforts to develop the Homestake II project. The assembly reported potential strategies that would: 1) improve the condition of the river, and 2) assure adequate water supplies for future needs. The resulting assessment concluded that flows in the Eagle River were inadequate to meet existing environmental and water supply demands in average years and dryer than average years, principally in late summer and winter months. Environmental concerns were based on identified `stream flow deficits' where the amount of water in the stream was not adequate to meet recommended instream flow rights that had been implemented years earlier (CWCB flow rights) for the protection of fish. Work by the Assembly eventually led to the 1998 Eagle River Memorandum of Understanding, which specified conditions for sharing allocated but undeveloped water in joint or individual water projects, and potential priority focus areas for projects.
- **USGS Assessment of surface-water quantity and quality, Eagle River watershed, Colorado** (2007): provides a historical characterization of water quantity and quality, including spatial patterns and trends. Findings from the report helped direct ongoing water quality monitoring activities coordinated by the Eagle River Coalition.

This historical body of work provides a rich context for understanding historical and present issues facing water users, water managers, and community members. optimizing water management decisions to support existing uses while, simultaneously, alleviating constraints on the delivery of important ecosystem goods and services (EGS). It is often difficult to quantify EGS value given their nature as non-market common public amenities. Clean water, healthy fisheries, or stunning viewscapes provide intangible benefits that do not easily fit within the economic valuation and cost-benefit frameworks that typically drive resource management decisions. However, when delivery of EGS is acutely constrained, some corresponding impact—direct or indirect—to local economies, livelihoods, or quality-of-life frequently arises, driving the need to identify alternative resource management strategies. The ERCWP considers three primary attributes (the "Attributes") commonly associated with EGS and frequently affected by water resource management activities: channel dynamics, riparian health, and aquatic habitat.

Channel Dynamics

Channel dynamics encompass the fluvial and geomorphological processes that interact to control channel form and evolution across a range of spatial and temporal scales. Channel dynamics respond to interactions between patterns of rainfall and runoff, catchment-scale physical attributes (e.g. surficial geology, topography), riparian community structure, and local use practices (e.g. transportation corridor alignment, grazing practices). As a result, human management activities that modify the hydrological regime, alter patterns of erosion, adjust the structure of the channel bed, or modify riparian vegetation may yield fundamental shifts in the geometry and behavior of the stream at the channel (tens of yards) or reach (hundreds of yards) scale.

Alteration of sediment supply, channel forming flows, or streambank vegetation may lead to complex interactive effects that result in reduced resiliency of local channel forms. For example, in unconfined alluvial streams, degradation of riparian forests frequently results in diminished bank cohesion, an increased rate of channel avulsion, and a progressive widening and filling of the stream channel itself. These high-dynamic channel states generally provide poor aquatic habitat and present a risk to streamside property and infrastructure.

Riparian Health

Riparian areas support a wide variety of physical, biological, and ecological processes. Riparian zones generate important organic inputs for stream ecosystems, support streambank cohesion, perform vital nutrient cycling roles, and lend to the quality of aquatic habitat by providing shade and buffering against temperature extremes. The hydrological regime, sediment and channel dynamics, invasive vegetation, and near-stream land uses frequently impact the functionality of riparian areas.

Riparian areas exist in a complex equilibrium state governed by the local geometry of the channel/floodplain system and the inter-annual pattern of flood flows and baseflows. Occasional scouring of overbank areas provides the necessary habitat for germination of many riparian plant species. Following germination, seedlings require a relatively slow reduction in water table height over the progression of the growing year. Rapid water table reduction or late season water table heights that drop below the rooting depth of cottonwoods and other riparian plants stresses vegetation and can leads to mortality. Management activities that alter the magnitude, timing, or frequency of peak flows and baseflows, therefore, may limit riparian recruitment leading to decadent stands with little or no regeneration.

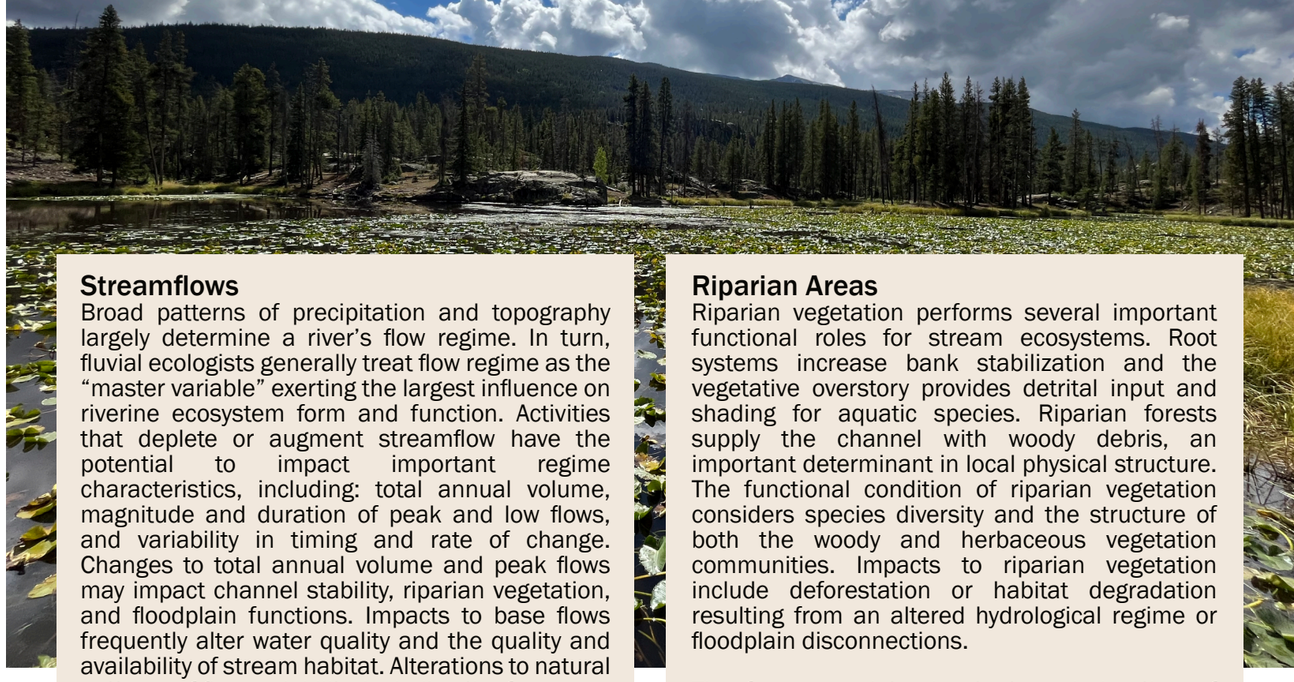
Aquatic Habitat

Interactions between streambed structure, channel hydraulics, water chemistry, vegetative shading, and organic matter inputs dictate the quality of habitat available for fish, macroinvertebrates, and macrophytes. In alluvial stream systems, high quality habitat typically supports vibrant and productive aquatic ecosystems—the kind of ecosystems that sustain robust trout fisheries. Habitat quality shares a directly proportional relationship to food-chain length in many systems. Ecosystems supporting long food chains tend to display greater resilience to changing external forcing variables like climate. Land and water management activities that affect sediment transport dynamics, streambed complexity, riparian shading, and local hydraulics comprise important primary controls on aquatic habitat quality.

Many aquatic species rely on specific and relatively narrow ranges of water depth, velocity and substrate types to perform various feeding/resting behaviors or complete different life stages. Fragmentation or degradation of habitat for aquatic species may, therefore, arise from modification of the hydrological regime, which alters local channel hydraulics and the spatial distribution of water depths and velocities. In a similar fashion, activities that physically alter the structure of the streambed may impact habitat quality by transforming the local hydraulic channel response to a given streamflow. The critical interaction between local structure and hydraulics gives credence to restoration approaches that aim to improve ecosystem function by reconfiguring channel cross-sectional geometry or planform patterns.

Functional Assessment Criteria

The complex interplay between the human, physical, chemical, and biological components of the riverine systems complicates the task of identifying appropriate management strategies that respond to local concerns about one or more of the Attributes. Each Attribute aggregates a suite of connected processes or characteristics. Therefore, evaluating the functional condition of multiple components of the system represents the first step towards developing a management plan that focuses actions on those components of the system constraining the delivery of highly valued EGS. The existence of complex interactions between Attributes makes it necessary to disaggregate them into a collection of state variables. These variables describe more fundamental ecosystem processes and provide a more straightforward basis for measurement and evaluation. The ERCWP assessed functional condition and identified constraints on the delivery of EGS based on a suite of physiochemical, biologic, geomorphic, hydrologic and hydraulic state variables. These include: streamflows, streambed sediment, water quality, riparian areas, river form, aquatic habitat, and aquatic life. Evaluation of each variable enabled a robust characterization of existing conditions and supported predictive assessments of changes in future state across a range of spatial scales.



Streamflows
Broad patterns of precipitation and topography largely determine a river's flow regime. In turn, fluvial ecologists generally treat flow regime as the "master variable" exerting the largest influence on riverine ecosystem form and function. Activities that deplete or augment streamflow have the potential to impact important regime characteristics, including: total annual volume, magnitude and duration of peak and low flows, and variability in timing and rate of change. Changes to total annual volume and peak flows may impact channel stability, riparian vegetation, and floodplain functions. Impacts to base flows frequently alter water quality and the quality and availability of stream habitat. Alterations to natural patterns of flow variability, including the frequency and timing of floods, impact fish, aquatic insects and other biota with life history strategies tied to predictable rates of occurrence or change.

Streambed Sediment
The production and transport of sediment within a stream system is a crucial determinant of stream form, habitat quality and general long-term stability. Functional condition considers the amount and timing of sediment production from the contributing watershed via surface and channel erosion, and sediment transport to and through the stream channel. Watershed-scale disruptions, such as deforestation, wildfire or reservoir construction/operation, can alter sediment regime characteristics.

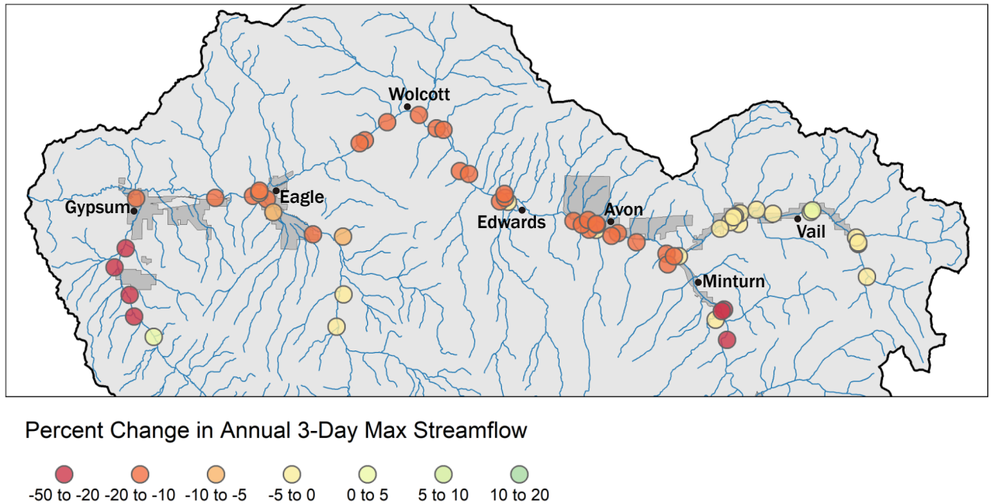
Water Quality
Natural geological weathering and human activities occurring at the scale of the contributing watershed largely dictate the physicochemical properties apparent on a stream reach. Biogeochemical processing by stream organisms may alter local water quality conditions to a small degree. Physical water quality conditions (e.g. water temperature), while somewhat influenced by local patterns of channel form and stream-side vegetation, remain fundamentally rooted in upstream conditions.

Riparian Areas
Riparian vegetation performs several important functional roles for stream ecosystems. Root systems increase bank stabilization and the vegetative overstory provides detrital input and shading for aquatic species. Riparian forests supply the channel with woody debris, an important determinant in local physical structure. The functional condition of riparian vegetation considers species diversity and the structure of both the woody and herbaceous vegetation communities. Impacts to riparian vegetation include deforestation or habitat degradation resulting from an altered hydrological regime or floodplain disconnections.

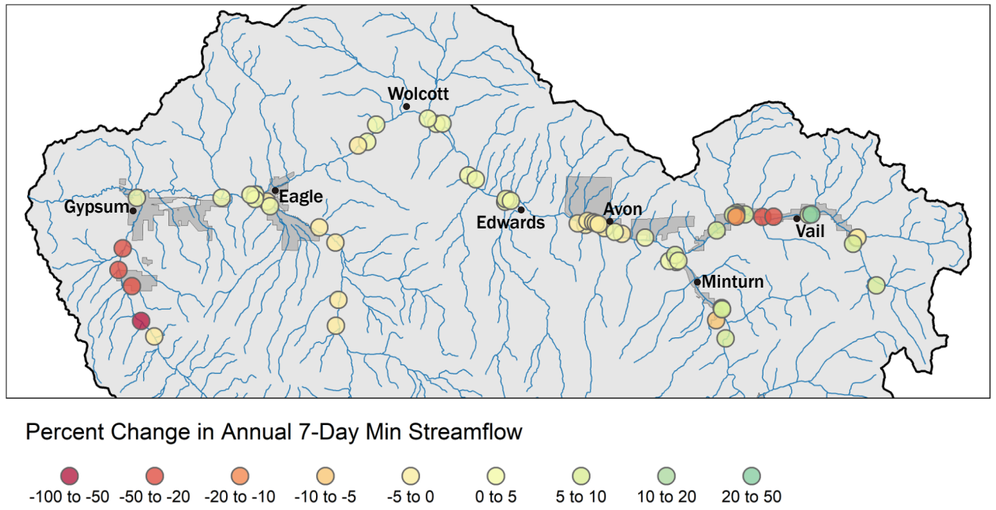
The frequency, lateral extent, and duration of interactions between the channel and the adjacent floodplain create a characteristic pattern of hydrological connectivity that determines the extent to which the river accesses and hydrates overbank areas. Overbank flows elevate the water table in the alluvial aquifer and produce favorable conditions for riparian vegetation. Typical floodplain connectivity impairments result from watershed-scale impacts to the flow regime or localized geomorphic impacts from artificial levees, ditches, channelization, or channel enlargement.

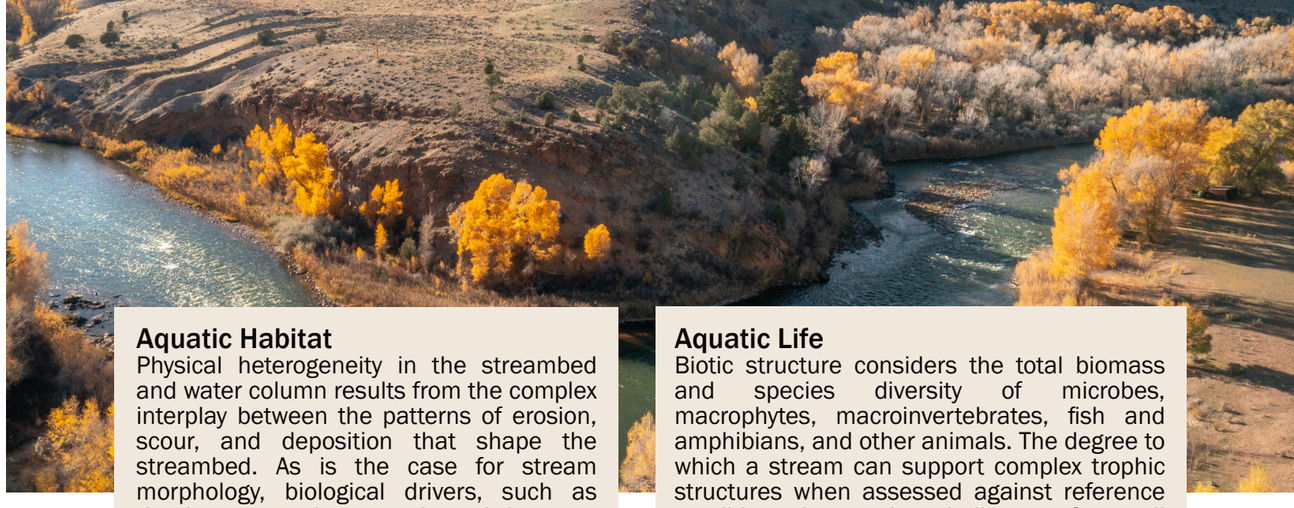
River Form
A stream's morphological patterns reflect the interplay between hydrology, channel hydraulics, sediment supply, beaver activity, and stream-side vegetation. Assessments of stream morphology consider the patterns of channel evolution, planform, cross-sectional dimensions, and channel profile. Impacts to stream morphology may arise from construction of roads and levees, extirpation of beavers, reduction of the active floodplain width, and disruption of sediment supplies due to dam construction. Stream's exhibiting morphological characteristics inappropriate for local valley forms and sediment regime may display elevated channel instability or a reduction in physical heterogeneity of the streambed.

*The map below depicts assessed historical changes to 3-day peak streamflows at locations across the planning area resulting from surface water diversions, reservoir storage, and transmountain diversions. The largest reductions in peak flow occurred historically on the Eagle River above Minturn and on Gypsum Creek. Most mainstem Eagle River locations show reductions on the order of 10-20%. See **Appendices F & G** for more details.*



*The map below depicts assessed historical changes to 7-day minimum streamflows at locations across the planning area resulting from surface water diversions, reservoir storage, and transmountain diversions. The largest reductions in minimum flow occurred historically on Gore Creek during the winter months and on Gypsum Creek during the late summer and fall period. See **Appendices F & G** for more details.*



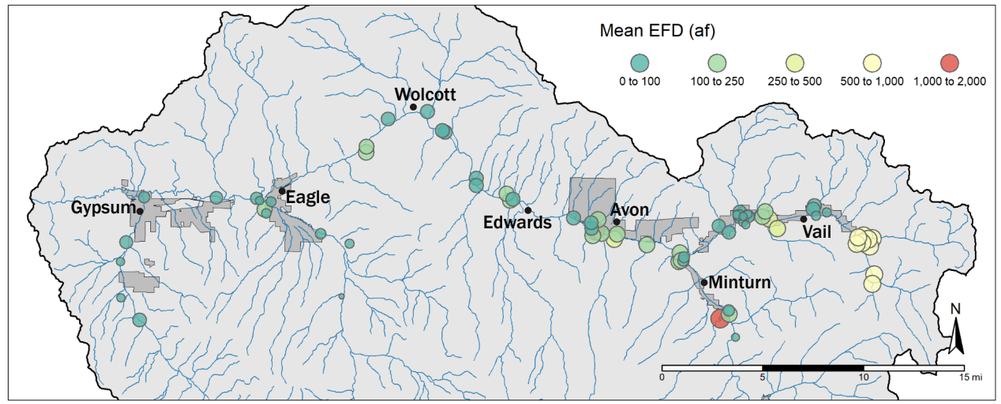


Aquatic Habitat

Physical heterogeneity in the streambed and water column results from the complex interplay between the patterns of erosion, scour, and deposition that shape the streambed. As is the case for stream morphology, biological drivers, such as riparian vegetation, wood, and beavers, may also exert significant control over physical structure. Assessments of physical structure consider the hydraulic structure (water depth and velocity distributions), bed and bank features, and substrate material. Heterogeneity is a critical determinant of habitat quality for many aquatic organisms including macroinvertebrates and fish. Activities that physically alter the structure of the streambed, disrupt the sediment regime, or reduce large woody debris supplies to a reach frequently impact the physical structure and degree of heterogeneity present in the stream channel.

Aquatic Life

Biotic structure considers the total biomass and species diversity of microbes, macrophytes, macroinvertebrates, fish and amphibians, and other animals. The degree to which a stream can support complex trophic structures when assessed against reference conditions is a prime indicator of overall ecosystem health. The living components of the stream system are the components most frequently recognized for their ties to EGS. The biotic makeup of a stream is impacted by all other ecosystem state variables. As a result, any activity that impairs other processes at the watershed, reach, or channel scale may similarly affect biotic structure. For example, disruptions in the hydrological regime impact the structural complexity of the streambed and water column. This complexity is an important control on habitat quality for fish and macroinvertebrates and, where it is reduced, a corresponding impairment of biotic structure may result.



*The map above depicts Environmental Flow Deficits (EFDs) at locations across the planning area. EFDs reflect the amount of water in acre-feet (af) that would be needed to meet the Colorado Water Conservation Board Instream Flow (ISF) water right–a flow target meant to provide minimum protections for aquatic life–during a typical year. The largest deficits are evident in the upper Gore Creek watershed and on the Eagle River below Cross Creek. See **Appendix H** for more details.*

Characterization of Future Risks

A key focus of the ERCWP was characterizing risks to river health and non-consumptive water uses due to changing hydrology or future water demands (**Appendix C**). Evaluation of potential future trajectories for Eagle River streamflows (**Appendix F**), and secondary impacts on aquatic habitat quality (**Appendix I**), riparian condition (**Appendix J**), water quality (**Appendix K**), water temperatures (**Appendix L**), , sediment mobilization (**Appendix M**), and recreational use opportunities (**Appendix N**) relied on inferences drawn from observed conditions, numerous completed trends analyses, and results produced by scientific modeling tools.

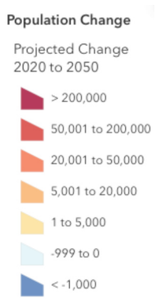
The use of hydrological simulation modeling results allowed for comparison of potential future streamflow trajectories with current and historical conditions and to consider how streamflow changes may affect various components of river health and the ability of local streams and rivers to support a variety of human uses. Multiple potential futures can be imagined for population growth and water use in Eagle County. Each of these futures may be accompanied by one of several climate change trajectories. Representing the synergistic impacts of growing populations and a changing climate is not a trivial task. Fortunately, the Eagle River Water and Sanitation District worked to provide a detailed water supply planning model (the "ER20" model) for the watershed that was tailored to describe changing streamflow conditions under a variety of potential future scenarios relevant to the planning process. This work roughly mirrored the approach used by Colorado Water Conservation Board to provide similar water planning models as a component of the Colorado Water Plan. The geographic scope of the ER20 model results included in the ERCWP was limited to the Eagle River mainstem below the confluence with Homestake Creek, Gore Creek below Black Gore Creek, Bush Creek, and Gypsum Creek. The impacts of population growth, development of new reservoirs in the upper watershed, and three different climate change trajectories were evaluated in ten different model scenarios.

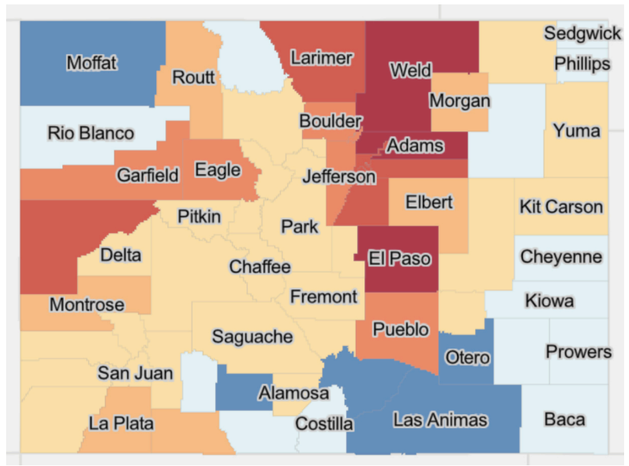
Municipal Water Demand

According to the Colorado State Demographer, Eagle County's population in 2020 was approximately 55,000 and is expected to exceed 70,000 by 2050. A growing population will increase demands for and use of municipal water supplies. Increasing demand for water will necessitate additional water diversions and/or new reservoir construction. Potential future risks to streams and rivers in the planning area associated with increasing municipal water demand include the following:

- Increased municipal diversions needed to satisfy a growing population places increasing pressure on instream flows, water quality (temperature, DO, and nutrients), and habitat connectivity for fish.

Population growth projections provided by the State of Colorado Demographers Office.





New Reservoirs & TMDs

The possibility exists for development of new water storage and transmountain diversion (TMD) projects in the upper watershed. The ERMOU outlines a plan for further development of the Homestake Reservoir and diversion system that includes 20,000 acre-feet of average annual yield passed under the divide for use by Colorado Springs and Aurora and 10,000 acre-feet of firm dry year yield, stored in the reservoir(s) for West Slope uses. New reservoir storage and TMD projects under the Eagle River MOU will alter patterns of streamflow along the mainstem of the Eagle River. Potential future risks and/or benefits to streams and rivers in the planning area associated with new water development projects include the following:

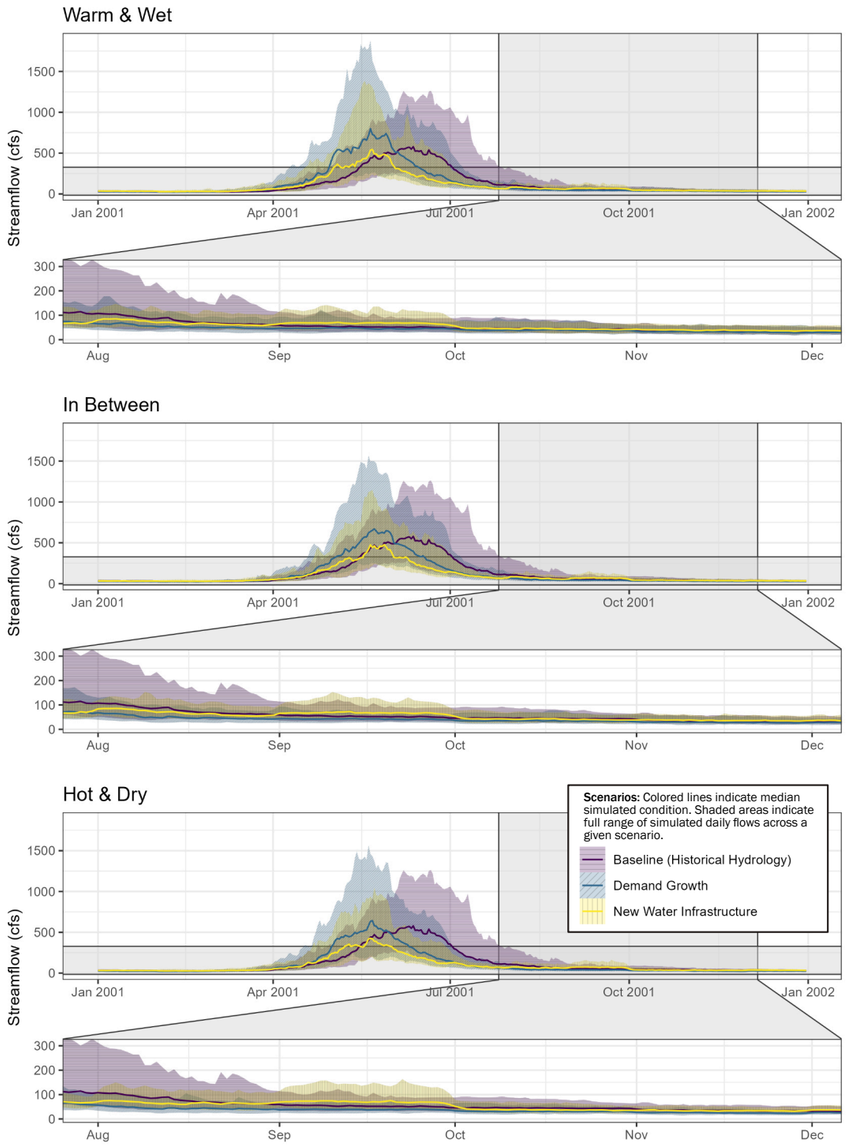
- New TMDs impact annual flow volumes and reduce peak flows on local streams and rivers, decreasing the frequency of streambed sediment mobilization needed to maintain high quality habitat for fish and aquatic macroinvertebrates. Late summer flow reductions increase the frequency and duration of ISF water right shortages, further limiting aquatic habitat quality.
- Water releases from new reservoirs help mitigate the impact of a warming climate and new TMDs on late summer baseflows in the upper watershed. Water storage comes at the expense of decreased peak flows necessary for flushing fine sediments from the streambed. Reduced high flow magnitudes and durations impact whitewater boating activities on downstream reaches, an important component of Eagle County's vibrant recreational economy.
- Releases of cool water from reservoirs helps mitigate elevated water temperature events in the late summer on some segments of the Eagle River, improving conditions for aquatic insects and fish.

Climate Change

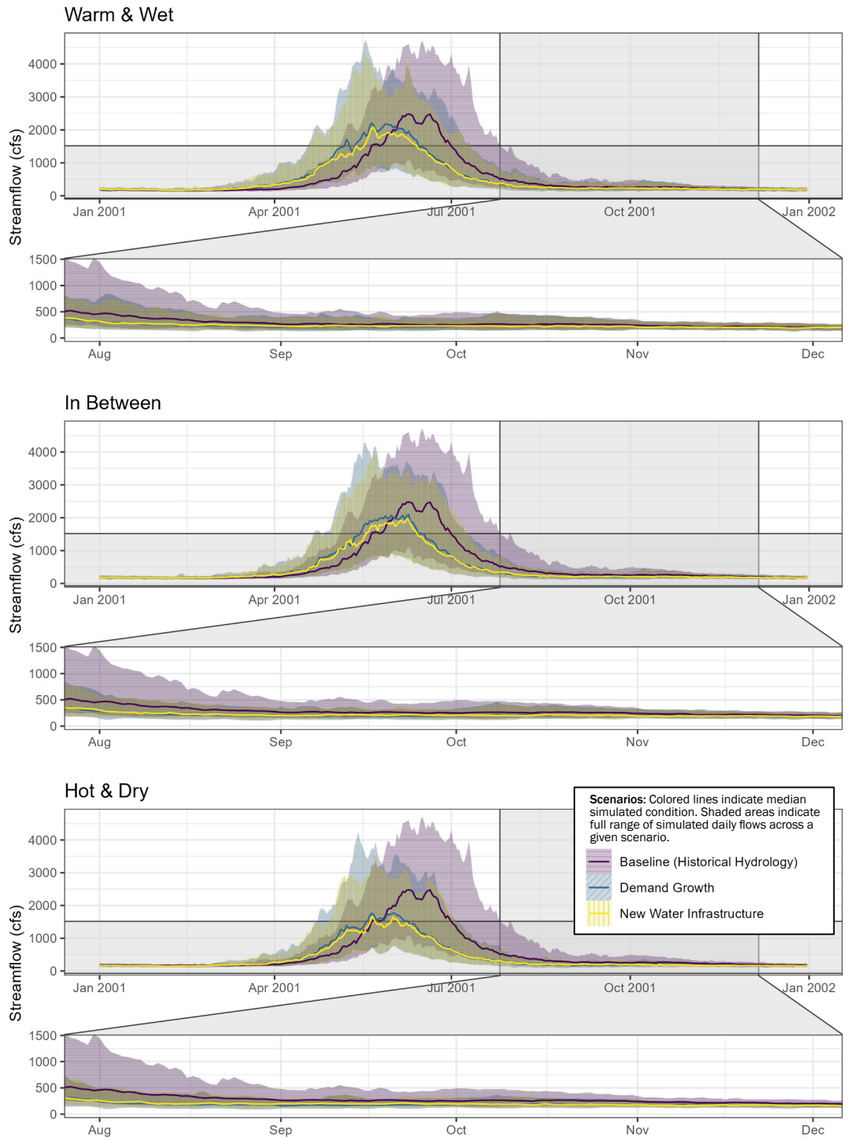
The Colorado State Climatologist indicates that statewide annual average air temperatures increased by +2.3°F between 1980-2022. By 2050 (the 2035-2064 period average), Colorado statewide annual temperatures are projected to warm by +2.5°F to +5.5°F compared to a 1971-2000 baseline, and +1.0°F to +4.0°F compared to today, under a medium-low emissions scenario (RCP4.5). Rising air temperatures are expected to increase vegetative demands for water, dry out soils, and change patterns of snowmelt in Eagle County. Potential future risks to streams and rivers in the planning area associated with climate change include the following:

- Wetter and warmer winters slightly increase peak flow magnitudes and variability due to earlier melt and increased probability of rain-on-snow events. Increased peak flow magnitudes may be accompanied by shorter duration of high flows.
- Total streamflow declines due to warming temperatures (increased vegetation ET demand, lower soil moisture, and longer growing/irrigation season) outpace potential gains from precipitation increases, causing overall streamflow declines.
- Severity and duration of acute low-flow events increase in summer/fall, negatively impacting abundance of aquatic insects.
- Decreased total flow volumes and reduced base flow magnitudes alter total annual sediment transport capacity, degrading habitat quality.
- Onset and peak snowmelt shifts earlier in the runoff season, increasing the duration of late season low flow conditions and elevated water temperature conditions.
- Declining late summer/early fall flows place make it more difficult to meet and maintain instream flows using reservoir releases. Water quality (temperature, DO, and nutrients), and habitat connectivity for fish degrade.
- Baseflow declines reduce stream network connectivity during late summer and fall, restricting refuge seeking movements, seasonal migration, and spawning activities of native and sport fish.

The graphic below indicates simulated changes in streamflow behavior on the **Eagle River near Minturn**. Colored overlays indicate key differences in streamflows between the current (Baseline) condition and scenarios representing 1) changed reservoir operations in response to increased local water demand (Demand Growth) and 2) the construction of new TMDs and reservoirs in the upper watershed (New Water Infrastructure). Notably, no significant water diversions for West Slope use exist above this location so the Demand Growth scenario largely reflects impacts of climate change. The top graphic indicates changes under a "Warm & Wet" climate future, the middle graphic indicates changes under an "In Between" climate future. The bottom graphic indicates changes associated with a "Hot and Dry" climate future. In all climate scenarios, spring runoff shifts to earlier in the year and the bulk of snowmelt occurs more quickly than under current conditions. Increasing in-basin water demand reduces late season flows. New TMDs and water storage in new or enlarged reservoirs reduce peak flows. Releases of stored West Slope water can offset some of the low flow impacts associated with climate change.



The graphic below indicates simulated changes in streamflow behavior on the **Eagle River near Gypsum.** Colored overlays and tiled representations of climate change scenarios are identical to the opposing figure. Patterns at this lower watershed location are somewhat different, however. In all climate scenarios, spring runoff shifts to earlier in the year and peak flow magnitudes are reduced. The length of the runoff season is largely unaltered. The Demand Growth scenario at this location reflects increased upstream water diversions to meet growing municipal uses (due to population growth) and agricultural uses (due to increased evaporative demand from crops). The coupled effects of climate change and increasing in-basin water demand reduces late season flows. New TMDs and water storage in new or enlarged reservoirs in the upper watershed lead to a modest reduction in peak flows–a reflection of the mitigating influence of large tributary inflows from Gore Creek, Lake Creek, Brush Creek, and Gypsum Creek. Unlike more upstream locations, no benefit to low flows associated with reservoir releases is observed during the late summer period in the New Water Infrastructure scenario. See **Appendix F** for a more detailed discussion of historical and potential future hydrology in the planning area.



Impacts to river health and opportunities for local communities to use and enjoy local water sources are not only sourced from drivers of hydrological change. Shifts in land use and land cover can drastically alter inputs to the stream environment and degrade the physical and biological condition of floodplains and riparian areas. Wildfire is an ever-present risk to the health of streams and rivers and the ability of human communities to use water for a variety of activities. No modeling work was available to support a quantitative evaluation of wildfire impacts under the ERCWP. However, significant evidence is available from other watersheds that helped inform our characterization of risks associated with wildfire. The impacts of urbanization on floodplains and riparian zones in Eagle County are well-documented. While it was not possible under the ERCWP to predict the exact patterns of future urban development that may impact floodplains and riparian zones, observed historical patterns will likely persist. The impact of historical development on floodplain structure and riparian condition along the river corridor was assessed under the ERCWP.

Urbanization

Every town in Eagle County is positioned along the mainstem Eagle River or Gore Creek. Historical and ongoing development of residential and commercial areas and transportation corridors in floodplains and other near-stream areas degrades riparian forests, decreases water quality, and, in some cases, directly impacts the structure of stream channels. The addition of 15,000 people in the county by 2050 will necessitate additional development. The 2025 update to the Eagle County Strategic Plan outlines strategies for accommodating a growing population in a manner that is consistent with community values. A growing population will likely increase recreational uses of local streams and rivers. Increased recreational uses of stream and river corridors may degrade the quality of riparian areas. Potential future risks to streams and rivers in the planning area associated with urbanization include the following:

- Continued increases to impervious area, increased stormwater volumes, and riparian degradation impact aquatic community structure and limit the presence of sensitive aquatic species.
- Stormwater runoff and physical channel modification alter sediment supply and transport regimes, potentially degrading aquatic habitat.
- Continued development further alters, degrades, removes, or fragments riparian forest buffers.

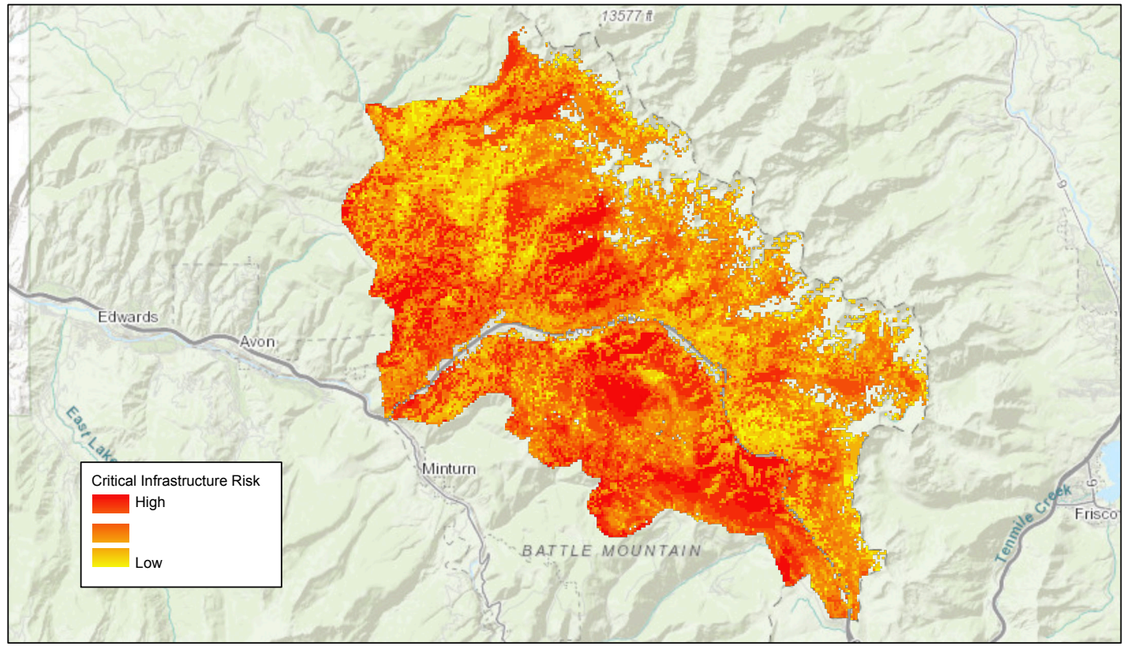
Below: Conceptual development rendering along the Eagle River near Edwards.

Wildfire

The Colorado Division of Fire Prevention and Control notes that the 20 largest wildfires in state history occurred since 2001. A warming climate and ongoing impacts from beetle infestations suggest that fire activity will only increase in the future. Burned watersheds often experience significant degradation of water quality and aquatic habitat as streams are inundated by fine sediments. Mudslides and debris flows present a danger to life and property. Flashier streamflow responses to rainfall events can produce floods that damage agricultural water diversions and municipal water treatment infrastructure. A comprehensive discussion of wildfire risks in the planning area is provided in the Eagle County Community Wildfire Protection Plan. Potential future risks to streams and rivers in the planning area associated with wildfire include the following:

- Runoff from burn scars degrades physical habitat and degrades water quality for aquatic insects and fish.
- Increased sediment fluxes impact channel shaping processes, increasing aggradation rates and altering seasonal sediment transport patterns.
- Inputs of fine sediment degrade spawning habitat quality for trout and impacts critical riffle habitat for aquatic macroinvertebrates.
- Runoff from burned areas increases dissolved metals loading to streams, potentially further degrading the quality of waters already impacted by discharges from the Eagle Mine.

The map below indicates wildfire risk to infrastructure in the Gore Creek watershed as assessed by the Town of Vail Community Wildfire Protection Plan



Vail GIS, Eagle County GIS | TOV Wildfire | County of Eagle, Bureau of Land Management, Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS |

Reach-Scale Assessment Results

Domain experts completed focused evaluations of the ten state variables and associated sub-variables. State variable assessments evaluated current conditions and characterized the degree of departure from an expected reference state using a weight-of-evidence approach. A variety of assessment methodologies—some rapid and coarse, some focused and intensive—produced evidence that reflects ecosystem processes across a range of spatial scales with varying degrees of objectivity. The coarsest approaches (Level 1) produced qualitative, reconnaissance-level variable assessments that guided more targeted investigations. Rapid assessments (Level 2) focused on specific areas of concern and involved more field-intensive surveys that reinforced expert opinions regarding the presence and magnitude of functional impairment. In some cases, intensive quantitative (Level 3) evaluations sought to explicitly account for the complex interactions between state variables and management activities. All assessment results are summarized in reach-scale "Report Cards" of river health (**see pages 30-53**) that summarize the functional condition of ecosystem variables and sub-variables using an academic grading scale at right. See **Appendix O** for details on the assessment criteria used to generate the Report Cards. This approach intends to quickly communicate technical assessment results to a wide variety of audiences. Each report card is accompanied by a location map and a discussion of the primary causes of impairment on the reach. In addition to grades for the existing condition of variables and sub-variables, each report card includes an indication of the potential for drivers of future condition (**see discussion on pages 22-27**) to influence local conditions.

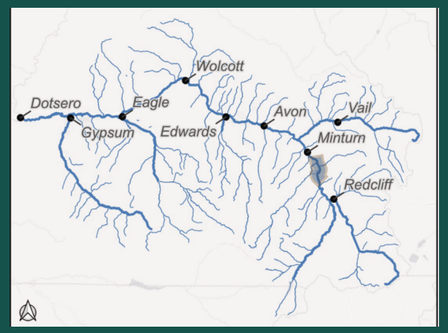
Grade	Degree of Impairment
A	None
B	Minor
C	Significant
D	Severe
F	Profound
?	Data Gap

The report card at right summarizes functional assessment scores for stream reaches across the planning area using an academic grading scale (above) to indicate the degree of impairment to a suite of ecological variables and sub-variables. The most severe and widespread impairments are related to alteration of streamflow patterns and degradation of water quality. Similar reach-scale report cards are presented in subsequent pages.

	Eagle River								Gore Creek		Brush Creek	Gypsum Creek
Variable / Sub-Variable	Tigiwon	Minturn	Avon	Edwards	Wolcott	Eagle	Gypsum	Dotsero	East Vail	West Vail	Eagle Ranch	Town Center
Streamflows												
Dry Year Base Flow	B	A	A	A	A	B	A	B	B	A	D	F
Typical Year Base Flow	B	B	A	A	A	A	A	A	A	A	C	F
Moderate Flood Frequency	F	F	D	D	D	D	D	D	A	A	F	F
Dry Year Peak Flow	D	C	C	B	B	C	C	C	C	C	C	F
Typical Year Peak Flow	C	C	B	B	B	B	B	B	A	A	B	D
Dry Year Total Volume	D	C	C	C	C	C	C	C	B	B	C	D
Typical Year Total Volume	C	B	B	B	A	B	A	A	A	A	A	C
Streambed Sediment												
Continuity and Transport	A	A	A	B	A	A	A	A	B	A	A	B
Flushing Flows	C	A	B	D	?	F	A	A	A	A	?	?
Water Quality												
Metals	F	D	A	A	A	A	A	A	A	A	A	A
Nutrients	A	A	B	C	C	C	C	B	A	C	A	?
Water Temperature	A	A	A	B	B	C	C	C	A	B	?	?
Riparian Areas												
Floodplain Physical Condition	B	B	B	A	C	B	C	B	C	B	C	C
Riparian Vegetation	B	C	B	B	B	B	C	B	C	B	B	C
River Form												
Channel Structure & Dynamics	B	B	B	B	A	B	B	A	C	B	B	C
Aquatic Habitat												
Habitat Structure	B	B	A	A	A	A	A	A	B	A	B	C
Longitudinal Connectivity	A	A	A	A	A	B	A	A	A	A	B	C
Aquatic Life												
Aquatic Insects	B	B	C	C	?	?	?	A	D	D	A	?
Fish	C	C	B	B	A	A	A	A	A	A	B	?

Upper Eagle River

Rex Flats to the Confluence with Cross Creek



Current and Historical Drivers of Degradation

Aquatic insect communities near Minturn show increasing levels of stress/impact compared to upstream communities, potentially a result of Eagle Mine discharges and urban runoff from Minturn. Sensitive fish taxa like rainbow trout and sculpin are largely absent from the reach. Metals exceed relevant water quality standards, resulting in a 303(d) listing. This reach is also impacted by historical channel modification and habitat simplification.

Flows are altered on this reach by upstream reservoirs and TMDs. The frequency of years where flows are sufficient to mobilized bed sediments declined by approximate 30%. The frequency of peak flows equivalent to the natural 1-in-4 year flood declined more than 80% due to water use and management. Peak flows during typical and dry years declined 31-38% respectively. Total annual flow volumes in dry years declined 38% when compared to natural historic conditions.

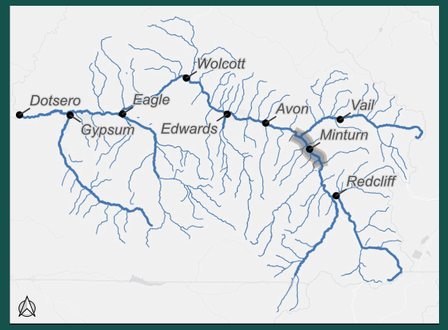
Grade	Degree of Impairment
A	None
B	Minor
C	Significant
D	Severe
F	Profound
?	Data Gap

Icon	Expected Effect Size
↑	Strongly Positive
↑	Somewhat Positive
○	Niether Positive or Negative
↓	Somewhat Negative
↓	Strongly Negative
⊗	Not Assessed

Functional Assessment		Potential Future Drivers							
Variable / Sub-Variable	Existing Condition	Increasing Municipal Water Use	Urbanization	Warm & Wet Climate Future	In-Between Climate Future	Hot and Dry Climate Future	New TMDs	Increased Reservoir Capacity	Wildfire
Streamflows									
Base Flow: Dry Year	B	○	○	↓	↓	↓	○	↑	○
Base Flow: Median Year	B	○	○	↓	↓	↓	↓	↑	○
High Peakflow Frequency	F	↓	○	↑	↑	↑	↓	↓	○
Peak Flow: Dry Year	D	○	○	↑	↓	↓	↓	↓	○
Peak Flow: Median Year	C	○	○	↑	↑	○	↓	↓	↑
Total Volume: Dry Year	D	○	○	○	↓	↓	↓	↑	○
Total Volume: Median Year	C	○	○	↑	↓	↓	↓	↓	○
Streambed Sediment									
Continuity and Transport	A	○	○	○	○	↓	↓	↓	↓
Flushing Flows	C	○	○	○	○	○	↓	↓	○
Water Quality									
Metals	F	○	○	○	○	○	↓	↓	↓
Nutrients	A	○	○	○	○	○	○	○	↓
Temperature	A	○	○	○	↓	↓	○	↑	○
Riparian Areas									
Floodplain physical condition	B	○	○	○	○	○	○	○	○
Riparian vegetation	B	○	○	○	○	○	○	○	○
River Form									
Channel Structure and Dynamics	B	○	○	○	○	○	○	○	↓
Aquatic Habitat									
Habitat Structure	B	○	○	○	○	○	○	○	↓
In-channel Hydrologic Connectivity	A	○	○	↓	↓	↓	↓	↑	○
Aquatic Life									
Aquatic Insects	B	○	○	↓	↓	↓	○	↑	↓
Fish	C	○	○	↓	↓	↓	○	↑	↓

Upper Eagle River

Cross Creek to Gore Creek



Current and Historical Drivers of Degradation

Sensitive fish taxa are largely absent due to water quality impacts from the Eagle Mine. Ambient metals concentrations exceed relevant water quality standards, resulting in multiple 303(d) listings and only partial/seasonal attainment of standards.The growth and development of juvenile salmonids is impacted by metals.

Flows are altered by upstream TMDs and reservoirs. The frequency of peak flows equivalent to the natural 1-in-4 year flood declined significantly due to water use and management. Peak flows during typical and dry years declined 24-30% respectively. Total annual flow volumes in dry years declined 32% when compared to natural historic conditions.

Development in the Town of Minturn results in significant alteration to sediment transport continuity, lateral floodplain extent, and physical habitat structure in the stream channel.

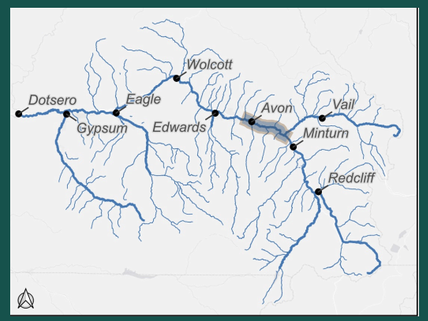
Grade	Degree of Impairment
A	None
B	Minor
C	Significant
D	Severe
F	Profound
?	Data Gap

Icon	Expected Effect Size
⬆	Strongly Positive
↑	Somewhat Positive
○	Niether Positive or Negative
↓	Somewhat Negative
⬇	Strongly Negative
⊗	Not Assessed

Functional Assessment		Potential Future Drivers							
Variable / Sub-Variable	Existing Condition	Increasing Municipal Water Use	Urbanization	Warm & Wet Climate Future	In-Between Climate Future	Hot and Dry Climate Future	New TMDs	Increased Reservoir Capacity	Wildfire
Streamflows									
Base Flow: Dry Year	A	○	○	↓	↓	↓	○	↑	○
Base Flow: Median Year	B	○	○	↓	↓	↓	↓	↑	○
High Peakflow Frequency	F	↓	○	↑	↑	↑	↓	↓	○
Peak Flow: Dry Year	C	○	○	↑	○	↓	↓	↓	○
Peak Flow: Median Year	C	○	○	↑	○	↓	↓	↓	↑
Total Volume: Dry Year	C	○	○	↓	↓	↓	↓	↑	○
Total Volume: Median Year	B	○	○	↑	↓	↓	↓	↓	○
Streambed Sediment									
Continuity and Transport	A	↓	○	○	○	↓	↓	↓	⬇
Flushing Flows	A	○	○	○	○	↓	↓	↓	○
Water Quality									
Metals	D	○	○	○	○	○	↓	↓	↓
Nutrients	A	○	○	○	○	○	○	○	↓
Temperature	A	○	○	○	↓	↓	○	↑	○
Riparian Areas									
Floodplain physical condition	B	○	○	○	○	○	○	○	○
Riparian vegetation	C	○	○	○	○	○	○	○	○
River Form									
Channel Structure and Dynamics	B	○	○	○	○	○	○	○	↓
Aquatic Habitat									
Habitat Structure	B	○	○	○	○	○	○	○	↓
In-channel Hydrologic Connectivity	A	○	○	↓	↓	↓	↓	↑	○
Aquatic Life									
Aquatic Insects	B	○	○	↓	↓	↓	○	↑	⬇
Fish	C	↓	○	↓	↓	↓	○	↑	↓

Middle Eagle River

Gore Creek to Avon WWTP



Current and Historical Drivers of Degradation

Although this segment is not listed as an impaired waterway by Colorado's Water Quality Control Division, macroinvertebrate health indices in Avon hover slightly above the state of Colorado's impairment threshold and are consistently lower than sites upstream and downstream. Indices of sensitive taxa presence are the lowest of anywhere on the mainstem Eagle River, indicating degraded water quality conditions. Impaired water quality is likely sourced from urban runoff in the vicinity of Avon.

The frequency of peak flows equivalent to the natural 1-in-4 year flood declined nearly 60% due to upstream water use and management. Peak flows during dry years declined 21% and total annual volumes declined 22% when compared to natural historic conditions.

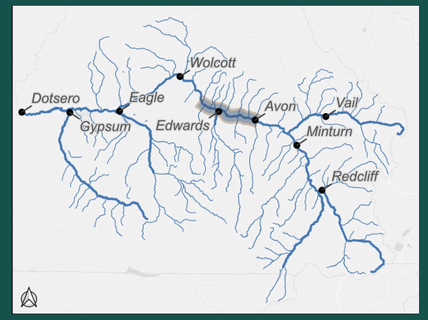
Grade	Degree of Impairment
A	None
B	Minor
C	Significant
D	Severe
F	Profound
?	Data Gap

Icon	Expected Effect Size
↑	Strongly Positive
↑	Somewhat Positive
○	Niether Positive or Negative
↓	Somewhat Negative
↓	Strongly Negative
⊗	Not Assessed

Functional Assessment		Potential Future Drivers							
Variable / Sub-Variable	Existing Condition	Increasing Municipal Water Use	Urbanization	Warm & Wet Climate Future	In-Between Climate Future	Hot and Dry Climate Future	New TMDs	Increased Reservoir Capacity	Wildfire
Streamflows									
Base Flow: Dry Year	A	○	○	↓	↓	↓	○	↑	○
Base Flow: Median Year	A	○	○	↓	↓	↓	↓	↑	○
High Peakflow Frequency	D	○	○	↑	↑	↑	↓	↓	○
Peak Flow: Dry Year	C	○	○	↑	○	↓	↓	↓	○
Peak Flow: Median Year	B	○	○	↑	○	↓	↓	↓	○
Total Volume: Dry Year	C	○	○	↓	↓	↓	↓	↑	○
Total Volume: Median Year	B	○	○	↑	○	↓	↓	↓	○
Streambed Sediment									
Continuity and Transport	A	○	↓	↑	○	↓	↓	↓	↓
Flushing Flows	B	○	○	○	○	↓	↓	↓	○
Water Quality									
Metals	A	○	○	○	○	○	↓	○	○
Nutrients	B	○	○	○	○	○	○	○	○
Temperature	A	○	○	○	↓	↓	○	↑	○
Riparian Areas									
Floodplain physical condition	B	○	○	○	○	○	○	○	○
Riparian vegetation	B	○	↓	○	○	○	○	○	○
River Form									
Channel Structure and Dynamics	B	○	○	○	○	○	○	○	○
Aquatic Habitat									
Habitat Structure	A	○	○	○	○	○	○	○	○
In-channel Hydrologic Connectivity	A	○	○	↓	↓	↓	↓	↑	○
Aquatic Life									
Aquatic Insects	C	○	↓	↓	↓	↓	○	↑	↓
Fish	B	↓	○	↓	↓	↓	○	↑	↓

Middle Eagle River

Avon WWTP to Squaw Creek



Current and Historical Drivers of Degradation

Although this segment is not listed as an impaired waterway by Colorado's Water Quality Control Division, macroinvertebrate health indices in Avon hover slightly above the state of Colorado's impairment threshold and are consistently lower than sites upstream and downstream. Indices of sensitive taxa presence are the lowest of anywhere on the mainstem Eagle River, indicating degraded water quality conditions. Ambient nutrient concentrations do not exceed standards but are regularly within 50% of the standard value. Impaired water quality is likely sourced from urban runoff in the vicinity of Avon.

Flows are altered on this reach by upstream water use and management. The frequency of peak flows equivalent to the natural 1-in-4 year flood declined more than 40%. Peak flows during dry years declined 20%. Total annual flow volumes in dry years declined 26% when compared to natural historic conditions.

Grade	Degree of Impairment
A	None
B	Minor
C	Significant
D	Severe
F	Profound
?	Data Gap

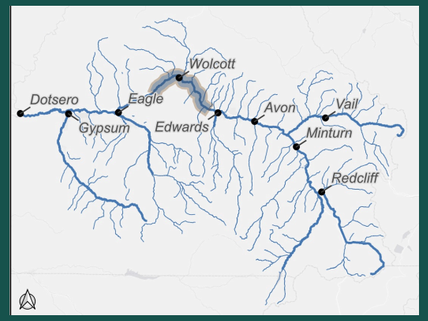
Icon	Expected Effect Size
↑	Strongly Positive
↑	Somewhat Positive
○	Niether Positive or Negative
↓	Somewhat Negative
↓	Strongly Negative
⊗	Not Assessed

Functional Assessment		Potential Future Drivers							
Variable / Sub-Variable	Existing Condition	Increasing Municipal Water Use	Urbanization	Warm & Wet Climate Future	In-Between Climate Future	Hot and Dry Climate Future	New TMDs	Increased Reservoir Capacity	Wildfire
Streamflows									
Base Flow: Dry Year	A	○	○	↓	↓	↓	○	↑	○
Base Flow: Median Year	A	○	○	↓	↓	↓	↓	↑	○
High Peakflow Frequency	D	○	○	↑	↑	↑	↓	↓	○
Peak Flow: Dry Year	B	○	○	↑	↑	↓	↓	↓	○
Peak Flow: Median Year	B	○	○	↑	○	○	↓	↓	○
Total Volume: Dry Year	C	○	○	○	↓	↓	↓	○	○
Total Volume: Median Year	B	○	○	↑	○	↓	↓	↓	○
Streambed Sediment									
Continuity and Transport	B	○	↓	↑	○	↓	↓	↓	↓
Flushing Flows	D	○	○	↑	↑	↓	↓	↓	○
Water Quality									
Metals	A	○	○	○	○	○	↓	○	○
Nutrients	C	○	↓	○	○	↓	○	○	○
Temperature	B	○	○	↓	↓	↓	○	↑	○
Riparian Areas									
Floodplain physical condition	A	○	↓	○	○	○	○	○	○
Riparian vegetation	B	○	↓	○	○	↓	○	↓	○
River Form									
Channel Structure and Dynamics	B	○	↓	○	○	○	○	○	○
Aquatic Habitat									
Habitat Structure	A	○	○	○	○	○	○	○	○
In-channel Hydrologic Connectivity	A	○	○	↓	↓	↓	↓	↑	○
Aquatic Life									
Aquatic Insects	C	○	○	↓	↓	↓	○	↑	↓
Fish	B	↓	○	↓	↓	↓	○	↑	↓

REPORT CARDS

Lower Eagle River

Squaw Creek to Hollingsworth Ditch



Current and Historical Drivers of Degradation

This section of the Eagle River is impacted by transportation corridors including Hwy 6 and railroad tracks. This infrastructure bisects and fragments pocket floodplains. Legacy floodplain modification (e.g., filling and grading) is apparent in unconfined areas around Wolcott.

Flows are altered on this reach by upstream water use and management. The frequency of years achieving bed sediment mobilization near Red Mountain Ranch declined more than 70%. Total annual flow volumes in dry years declined 23% from natural historic conditions. The frequency of peak flows equivalent to the natural 1-in-4 year flood declined more than 35%. Annual 3-day peak flow magnitudes declined 19%.

Nutrients are an emerging water quality concern. Ambient nutrient concentrations do not exceed regulatory standards for water quality but regularly exceed 50% of the standard value.

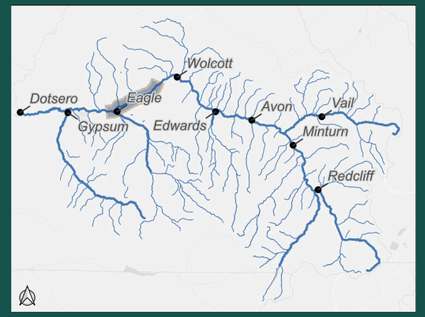
Grade	Degree of Impairment
A	None
B	Minor
C	Significant
D	Severe
F	Profound
?	Data Gap

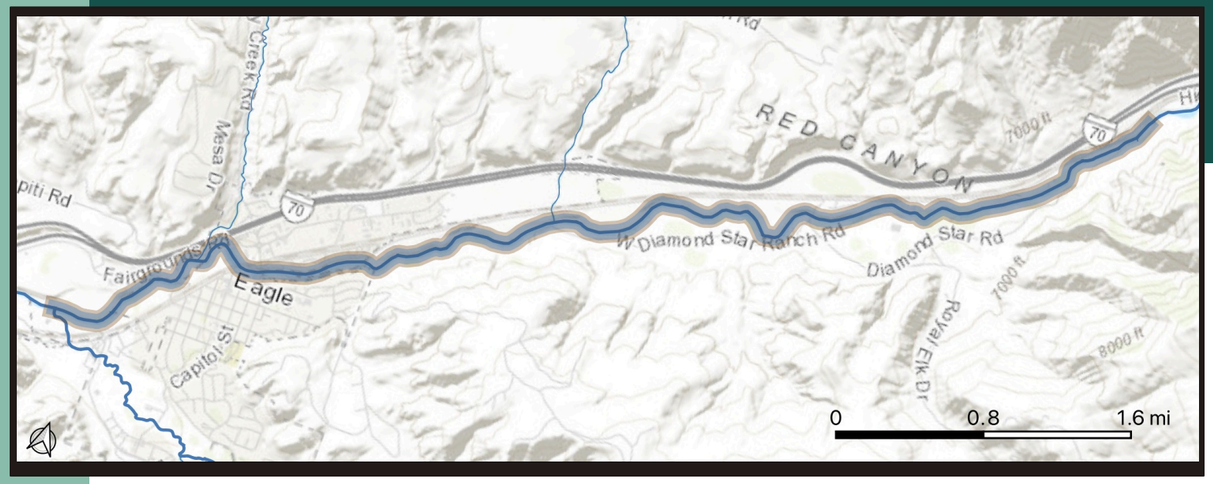
Icon	Expected Effect Size
↑	Strongly Positive
↑	Somewhat Positive
○	Niether Positive or Negative
↓	Somewhat Negative
↓	Strongly Negative
⊗	Not Assessed

Functional Assessment		Potential Future Drivers							
Variable / Sub-Variable	Existing Condition	Increasing Municipal Water Use	Urbanization	Warm & Wet Climate Future	In-Between Climate Future	Hot and Dry Climate Future	New TMDs	Increased Reservoir Capacity	Wildfire
Streamflows									
Base Flow: Dry Year	A	○	○	↓	↓	↓	○	↑	○
Base Flow: Median Year	A	○	○	↓	↓	↓	↓	↑	○
High Peakflow Frequency	D	○	○	↑	↑	↑	↓	↓	○
Peak Flow: Dry Year	B	○	○	↑	↑	↓	↓	↓	○
Peak Flow: Median Year	B	○	○	↑	○	↓	↓	↓	○
Total Volume: Dry Year	C	○	○	↓	↓	↓	↓	○	○
Total Volume: Median Year	A	○	○	↑	○	↓	↓	↓	○
Streambed Sediment									
Continuity and Transport	A	○	↓	↑	○	↓	↓	↓	↓
Flushing Flows	?	⊗	⊗	⊗	⊗	⊗	⊗	⊗	○
Water Quality									
Metals	A	○	○	○	○	○	○	○	○
Nutrients	C	○	○	○	○	○	○	○	○
Temperature	B	○	○	↓	↓	↓	○	↑	○
Riparian Areas									
Floodplain physical condition	C	○	○	○	○	○	○	○	○
Riparian vegetation	B	○	○	○	○	○	○	○	↓
River Form									
Channel Structure and Dynamics	A	○	○	○	○	○	○	○	○
Aquatic Habitat									
Habitat Structure	A	○	○	○	○	○	○	○	○
In-channel Hydrologic Connectivity	A	○	○	↓	↓	↓	↓	↑	○
Aquatic Life									
Aquatic Insects	?	○	↓	↓	↓	↓	○	↑	↓
Fish	A	↓	○	↓	↓	↓	○	○	↓

Lower Eagle River

Hollingsworth Ditch to Brush Creek





Current and Historical Drivers of Degradation

This section of the Eagle River flows through Red Canyon. Flows are altered on this reach by upstream water use and management. The frequency of years achieving bed sediment mobilization saw modest declines of up to 10%. The frequency of peak flows equivalent to the natural 1-in-4 year flood declined 44%. Total annual flow volumes in dry years have declined 26% from natural historic conditions.

Nutrients are an emerging water quality concern. Ambient nutrient concentrations do not exceed regulatory standards for water quality but regularly exceed 50% of the standard value.

Late summer water temperatures in this section of the Eagle River often approach or exceed WQCD and Colorado Parks and Wildlife (CPW) thresholds for impairment of aquatic life. Elevated water temperature conditions impact the sport fishery and opportunities for recreational angling. CPW regularly implements summer fishing closures on this reach.

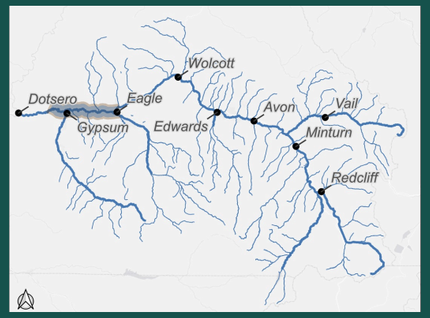
Grade	Degree of Impairment
A	None
B	Minor
C	Significant
D	Severe
F	Profound
?	Data Gap

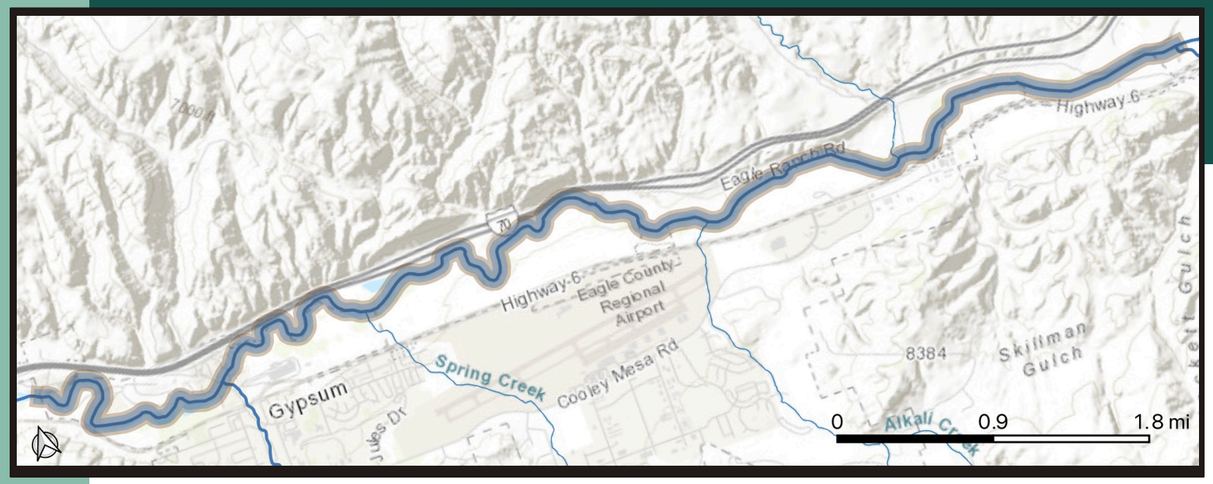
Icon	Expected Effect Size
↑	Strongly Positive
↑	Somewhat Positive
○	Niether Positive or Negative
↓	Somewhat Negative
↓	Strongly Negative
⊗	Not Assessed

Functional Assessment		Potential Future Drivers							
Variable / Sub-Variable	Existing Condition	Increasing Municipal Water Use	Urbanization	Warm & Wet Climate Future	In-Between Climate Future	Hot and Dry Climate Future	New TMDs	Increased Reservoir Capacity	Wildfire
Streamflows									
Base Flow: Dry Year	B	○	○	↓	↓	↓	○	↑	○
Base Flow: Median Year	A	○	○	↓	↓	↓	↓	↑	○
High Peakflow Frequency	D	○	○	↑	↑	↑	↓	↓	○
Peak Flow: Dry Year	C	○	○	↑	↑	↓	↓	↓	○
Peak Flow: Median Year	B	○	○	↑	○	↓	↓	↓	○
Total Volume: Dry Year	C	○	○	↓	↓	↓	↓	○	○
Total Volume: Median Year	B	○	○	↑	○	↓	↓	↓	○
Streambed Sediment									
Continuity and Transport	A	○	↓	↑	○	↓	↓	↓	↓
Flushing Flows	F	○	○	○	↑	↓	↓	↓	○
Water Quality									
Metals	A	○	○	○	○	○	○	○	○
Nutrients	C	○	○	○	○	○	○	○	○
Temperature	C	○	○	↓	↓	↓	○	↑	○
Riparian Areas									
Floodplain physical condition	B	○	○	○	○	○	○	○	○
Riparian vegetation	B	○	↓	○	○	○	○	○	↓
River Form									
Channel Structure and Dynamics	B	○	○	○	○	○	○	○	○
Aquatic Habitat									
Habitat Structure	A	○	○	○	○	○	○	○	○
In-channel Hydrologic Connectivity	B	○	○	↓	↓	↓	↓	↑	○
Aquatic Life									
Aquatic Insects	?	○	↓	↓	↓	↓	○	↑	↓
Fish	A	↓	↓	↓	↓	↓	○	○	↓

Lower Eagle River

Brush Creek to Gypsum Creek





Current and Historical Drivers of Degradation

Significant alteration to riparian areas and floodplain structure exist throughout this reach, largely due to I-70 and agricultural land uses that resulted in filling, grading, or riparian deforestation. Flows are altered on this reach by upstream water use and management. The frequency of peak flows equivalent to the natural 1-in-4 year flood declined by 33%. Peak flows during dry years declined 22% from natural historic conditions. Total flow volumes during dry years decreased 22%.

Nutrients are an emerging water quality concern. Ambient nutrient concentrations do not exceed regulatory standards for water quality but regularly exceed 50% of the standard value.

Water temperatures in this section of the Eagle River often approach or exceed WQCD and Colorado Parks and Wildlife (CPW) thresholds for impairment of aquatic life. Elevated water temperature conditions impact the sport fishery and opportunities for recreational angling. CPW regularly implements summer fishing closures on this reach.

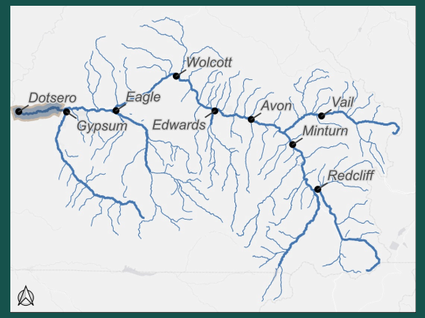
Grade	Degree of Impairment
A	None
B	Minor
C	Significant
D	Severe
F	Profound
?	Data Gap

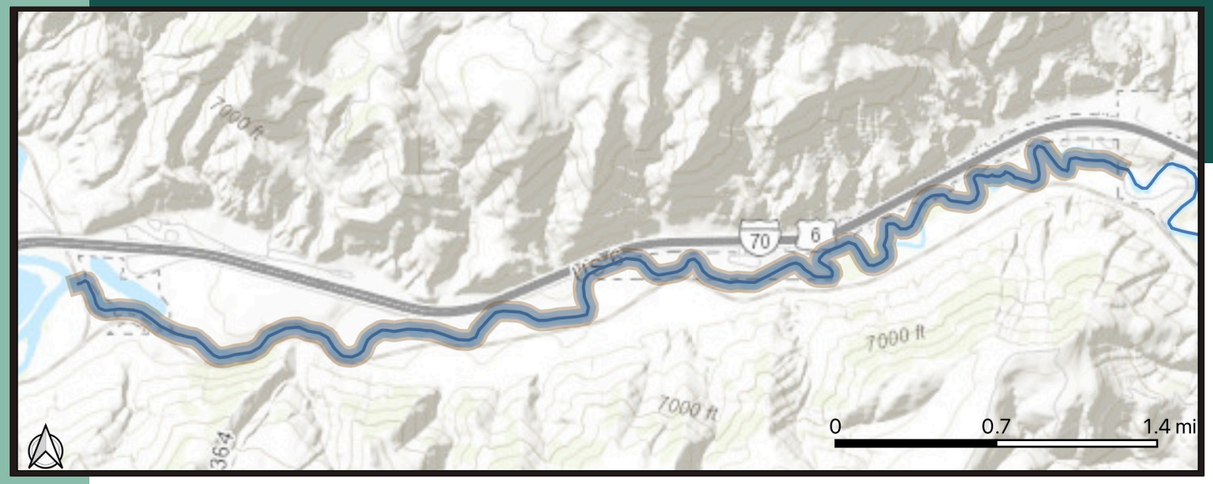
Icon	Expected Effect Size
↑	Strongly Positive
↑	Somewhat Positive
○	Niether Positive or Negative
↓	Somewhat Negative
↓	Strongly Negative
⊗	Not Assessed

Functional Assessment		Potential Future Drivers							
Variable / Sub-Variable	Existing Condition	Increasing Municipal Water Use	Urbanization	Warm & Wet Climate Future	In-Between Climate Future	Hot and Dry Climate Future	New TMDs	Increased Reservoir Capacity	Wildfire
Streamflows									
Base Flow: Dry Year	A	○	○	↓	↓	↓	○	↑	○
Base Flow: Median Year	A	○	○	↓	↓	↓	↓	↑	○
High Peakflow Frequency	D	○	○	↑	↓	↓	↓	↓	○
Peak Flow: Dry Year	C	○	○	↑	↑	↓	↓	↓	○
Peak Flow: Median Year	B	○	○	○	↓	↓	↓	↓	○
Total Volume: Dry Year	C	○	○	○	↓	↓	↓	○	○
Total Volume: Median Year	A	○	○	○	↓	↓	↓	↓	○
Streambed Sediment									
Continuity and Transport	A	○	↓	↑	○	↓	↓	↓	↓
Flushing Flows	A	○	○	○	○	↓	↓	↓	○
Water Quality									
Metals	A	○	○	○	○	○	○	○	○
Nutrients	C	○	↓	○	○	↓	○	○	○
Temperature	D	○	○	↓	↓	↓	○	↑	○
Riparian Areas									
Floodplain physical condition	C	○	↓	○	○	○	○	○	↓
Riparian vegetation	C	○	↓	○	↓	↓	○	↓	↓
River Form									
Channel Structure and Dynamics	B	○	○	○	○	○	○	○	○
Aquatic Habitat									
Habitat Structure	A	○	○	○	○	○	○	○	○
In-channel Hydrologic Connectivity	A	○	○	↓	↓	↓	↓	↑	○
Aquatic Life									
Aquatic Insects	?	○	○	↓	↓	↓	○	↑	↓
Fish	A	↓	↓	↓	↓	↓	○	○	○

Lower Eagle River

Gypsum Creek to Colorado River





Current and Historical Drivers of Degradation

Historical modification of floodplains for residential and commercial uses resulted in historical filling, grading, and riparian deforestation in the Town of Gypsum limits. Floodplains and river channels downstream of Gypsum exhibit unique morphologies but appear relatively unimpaired by human land use activities. A recent wildfire burned a large cottonwood gallery below Gypsum in recent years. Recovery trajectories for riparian vegetation are uncertain.

Flows are somewhat altered on this reach by upstream water use and management. The frequency of peak flows equivalent to the natural 1-in-4 year flood declined by 33%. Peak flows during dry years declined 22% from natural historic conditions. Total annual flow volumes in dry years declined 22%. A trends analysis shows significant declines in late summer streamflows between 1996-2020.

Water temperatures in this section of the Eagle River often approach or exceed WQCD and Colorado Parks and Wildlife (CPW) thresholds for impairment of aquatic life. Elevated water temperature conditions impact the sport fishery and opportunities for recreational angling. CPW regularly implements summer fishing closures on this reach.

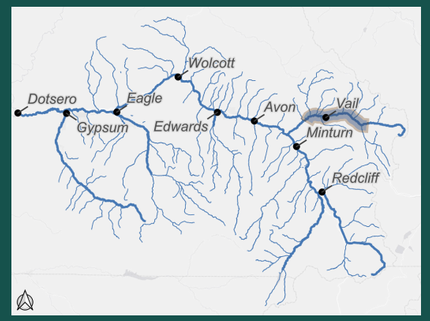
Grade	Degree of Impairment
A	None
B	Minor
C	Significant
D	Severe
F	Profound
?	Data Gap

Icon	Expected Effect Size
⬆	Strongly Positive
↑	Somewhat Positive
○	Niether Positive or Negative
↓	Somewhat Negative
⬇	Strongly Negative
⊗	Not Assessed

Functional Assessment		Potential Future Drivers							
Variable / Sub-Variable	Existing Condition	Increasing Municipal Water Use	Urbanization	Warm & Wet Climate Future	In-Between Climate Future	Hot and Dry Climate Future	New TMDs	Increased Reservoir Capacity	Wildfire
Streamflows									
Base Flow: Dry Year	B	○	○	⬇	⬇	⬇	○	↑	○
Base Flow: Median Year	A	○	○	⬇	⬇	⬇	○	○	○
High Peakflow Frequency	D	○	○	○	↓	↓	↓	↓	○
Peak Flow: Dry Year	C	○	○	↑	↑	⬇	↓	↓	○
Peak Flow: Median Year	B	○	○	↓	⬇	⬇	↓	↓	○
Total Volume: Dry Year	C	○	○	↓	⬇	⬇	○	○	○
Total Volume: Median Year	A	○	○	○	↓	⬇	↓	↓	○
Streambed Sediment									
Continuity and Transport	A	○	↓	↑	○	↓	↓	↓	↓
Flushing Flows	A	○	○	○	○	↓	↓	↓	○
Water Quality									
Metals	A	○	○	○	○	○	○	○	○
Nutrients	B	○	↓	○	○	○	○	○	○
Temperature	D	○	○	↓	⬇	⬇	○	○	○
Riparian Areas									
Floodplain physical condition	B	○	↓	○	○	○	○	○	↓
Riparian vegetation	B	○	○	○	↓	↓	↓	↓	⬇
River Form									
Channel Structure and Dynamics	A	○	○	○	○	○	○	○	○
Aquatic Habitat									
Habitat Structure	A	○	○	○	○	○	○	○	○
In-channel Hydrologic Connectivity	A	○	○	↓	⬇	⬇	○	↑	○
Aquatic Life									
Aquatic Insects	A	○	○	↓	↓	↓	○	↑	↓
Fish	A	↓	○	↓	⬇	⬇	○	○	○

Upper Gore Creek

Black Gore to Vail WWTP



Current and Historical Drivers of Degradation

The section of Gore Creek above Vail is included on Colorado's 303(d) list of impaired waterways. Water quality degradation manifests in low aquatic macroinvertebrate heath index scores. Expected sources of degradation include stormwater runoff, riparian degradation, pesticide application, and transportation infrastructure runoff.

Significant alteration of stream channels occurred during the development of roads and commercial and residential areas along the creek. Extensive bank armoring, channel straightening, and habitat simplification exist along the Vail Golf Course and through Vail Village. Significant alteration to continuity, lateral extent, and structure of riparian forest communities exists throughout due to town development, residential development, or the golf course.

Water storage and operations of Black Lakes produce modest impacts to the flow regime. Peak flows in dry years declined 21% relative to natural conditions. A trends analysis shows significant declines in late summer streamflows between 1996-2020.

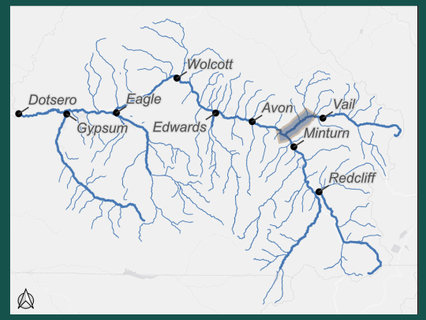
Grade	Degree of Impairment
A	None
B	Minor
C	Significant
D	Severe
F	Profound
?	Data Gap

Icon	Expected Effect Size
⬆	Strongly Positive
↑	Somewhat Positive
○	Niether Positive or Negative
↓	Somewhat Negative
⬇	Strongly Negative
⊗	Not Assessed

Functional Assessment		Potential Future Drivers							
Variable / Sub-Variable	Existing Condition	Increasing Municipal Water Use	Urbanization	Warm & Wet Climate Future	In-Between Climate Future	Hot and Dry Climate Future	New TMDs	Increased Reservoir Capacity	Wildfire
Streamflows									
Base Flow: Dry Year	B	↑	○	↓	⬇	⬇	○	↑	○
Base Flow: Median Year	A	↑	○	↓	⬇	⬇	○	↑	○
High Peakflow Frequency	A	○	○	↑	↑	↓	○	○	○
Peak Flow: Dry Year	C	○	○	⬆	⬆	↓	○	○	○
Peak Flow: Median Year	A	○	○	↑	○	⬇	○	○	↑
Total Volume: Dry Year	B	○	○	↓	⬇	⬇	○	○	○
Total Volume: Median Year	A	○	○	↑	○	⬇	○	○	○
Streambed Sediment									
Continuity and Transport	B	○	↓	↑	○	↓	○	○	↓
Flushing Flows	A	○	○	⬇	○	↑	○	○	○
Water Quality									
Metals	A	○	○	○	○	○	○	○	↓
Nutrients	A	○	○	○	○	○	○	○	↓
Temperature	A	○	○	○	○	○	○	○	○
Riparian Areas									
Floodplain physical condition	C	○	○	○	○	○	○	○	○
Riparian vegetation	C	○	○	○	○	○	○	○	○
River Form									
Channel Structure and Dynamics	C	○	○	○	○	○	○	○	↓
Aquatic Habitat									
Habitat Structure	B	○	○	○	○	○	○	○	↓
In-channel Hydrologic Connectivity	A	↓	○	↓	⬇	⬇	○	○	○
Aquatic Life									
Aquatic Insects	D	○	○	↓	⬇	⬇	○	○	⬇
Fish	A	○	○	↓	⬇	⬇	○	○	⬇

Lower Gore Creek

Vail WWTP to Eagle River



Current and Historical Drivers of Degradation

The section of Gore Creek above Vail is included on Colorado's 303(d) list of impaired waterways. Water quality degradation manifests in low aquatic macroinvertebrate heath index scores. Expected sources of degradation include stormwater runoff, riparian degradation, pesticide application, and transportation infrastructure runoff. This section of Gore Creek is also impacted by discharges from the Vail Wastewater Treatment Plant (WWTP). Elevated nutrient concentrations are evident.

Water storage and operations of Black Lakes and water withdrawals for municipal supply produce modest impacts to the flow regime. Winter water withdrawals for snowmaking can impact streamflows but are generally offset by discharges from the WWTP and releases from Black Lakes. Peak flows during typical and dry years declined more than 20%. A trends analysis shows significant declines in late summer streamflows between 1996-2020.

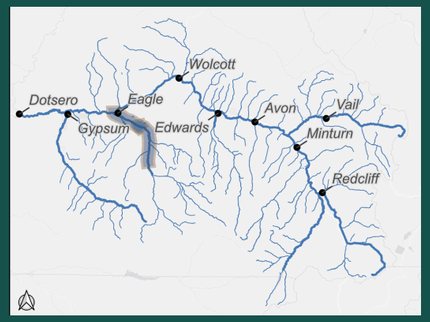
Grade	Degree of Impairment
A	None
B	Minor
C	Significant
D	Severe
F	Profound
?	Data Gap

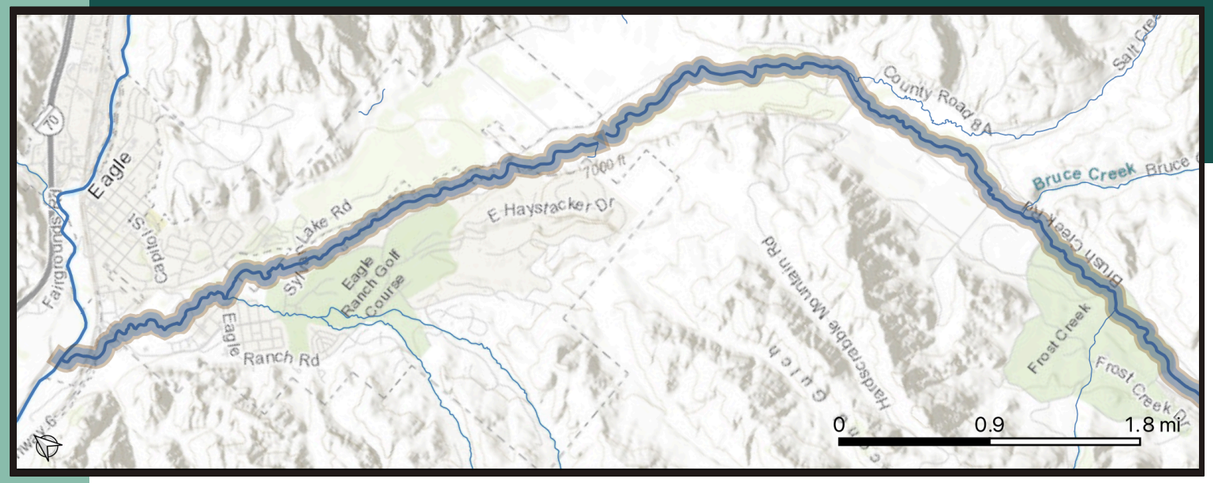
Icon	Expected Effect Size
⬆	Strongly Positive
↑	Somewhat Positive
○	Niether Positive or Negative
↓	Somewhat Negative
⬇	Strongly Negative
⊗	Not Assessed

Functional Assessment		Potential Future Drivers							
Variable / Sub-Variable	Existing Condition	Increasing Municipal Water Use	Urbanization	Warm & Wet Climate Future	In-Between Climate Future	Hot and Dry Climate Future	New TMDs	Increased Reservoir Capacity	Wildfire
Streamflows									
Base Flow: Dry Year	A	○	○	⬇	⬇	⬇	○	○	○
Base Flow: Median Year	A	○	○	⬇	⬇	⬇	○	○	○
High Peakflow Frequency	A	○	○	↑	↑	↓	○	○	○
Peak Flow: Dry Year	C	○	○	⬆	○	↓	○	○	○
Peak Flow: Median Year	A	○	○	○	↓	⬇	○	○	↑
Total Volume: Dry Year	B	○	○	○	⬇	⬇	○	○	○
Total Volume: Median Year	A	○	○	↑	↓	⬇	○	○	○
Streambed Sediment									
Continuity and Transport	A	○	○	○	○	↓	○	○	⬇
Flushing Flows	A	○	○	○	○	↓	○	○	○
Water Quality									
Metals	A	○	○	○	○	○	○	○	↓
Nutrients	C	○	↓	○	○	↓	○	○	↓
Temperature	B	○	○	○	↓	↓	○	○	○
Riparian Areas									
Floodplain physical condition	B	○	○	○	○	○	○	○	○
Riparian vegetation	B	○	○	○	○	○	○	○	○
River Form									
Channel Structure and Dynamics	B	○	○	○	○	○	○	○	○
Aquatic Habitat									
Habitat Structure	A	○	○	○	○	○	○	○	↓
In-channel Hydrologic Connectivity	A	↓	○	↓	⬇	⬇	○	○	○
Aquatic Life									
Aquatic Insects	D	○	○	↓	↓	↓	○	○	⬇
Fish	A	○	○	↓	↓	↓	○	○	⬇

Brush Creek

Town Diversion to Eagle River





Current and Historical Drivers of Degradation

Past or present agricultural activities and recent residential and urban development near the Town of Eagle resulted in extensive floodplain and channel encroachment and modifications or removal of riparian vegetation .

Summer baseflows in Aug/Sep of typical and dry years declined between 25-37% when compared to natural historic conditions. High peak flow frequency (the frequency of years with peaks above the natural flow 4-yr recurrence) declined profoundly (> 50%). Agricultural and municipal water uses decrease annual flow volumes by 25% during dry years.

Ambient nutrient concentrations do not exceed standards but approach it by exceeding 50% of the standard threshold or having maximum observed concentrations that are above the threshold.

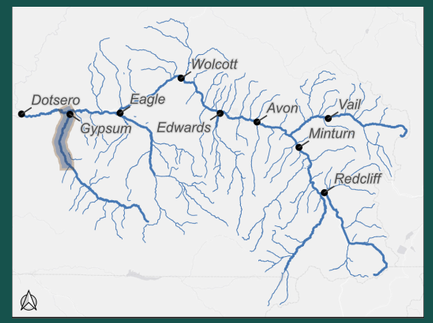
Grade	Degree of Impairment
A	None
B	Minor
C	Significant
D	Severe
F	Profound
?	Data Gap

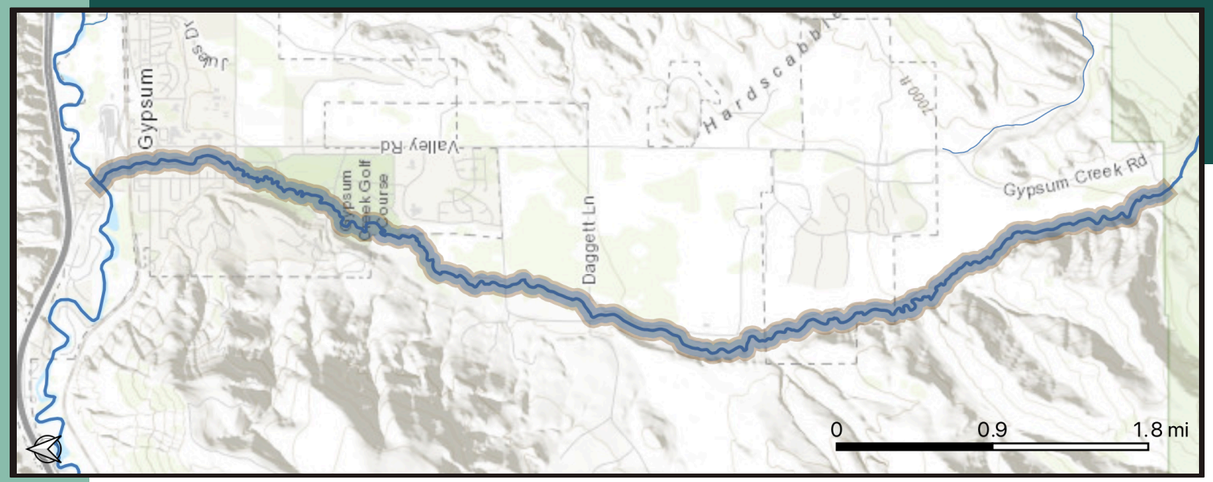
Icon	Expected Effect Size
⊕	Strongly Positive
↑	Somewhat Positive
○	Niether Positive or Negative
↓	Somewhat Negative
⊖	Strongly Negative
⊗	Not Assessed

Functional Assessment		Potential Future Drivers							
Variable / Sub-Variable	Existing Condition	Increasing Municipal Water Use	Urbanization	Warm & Wet Climate Future	In-Between Climate Future	Hot and Dry Climate Future	New TMDs	Increased Reservoir Capacity	Wildfire
Streamflows									
Base Flow: Dry Year	D	↓	○	↓	↓	↓	○	○	○
Base Flow: Median Year	C	○	○	↓	↓	↓	○	○	○
High Peakflow Frequency	F	○	○	↓	↓	↓	○	○	○
Peak Flow: Dry Year	C	○	○	○	↓	↓	○	○	○
Peak Flow: Median Year	B	○	○	↓	↓	↓	○	○	↑
Total Volume: Dry Year	C	○	○	↓	↓	↓	○	○	○
Total Volume: Median Year	A	○	○	↓	↓	↓	○	○	○
Streambed Sediment									
Continuity and Transport	A	↓	○	○	↓	↓	○	○	↓
Flushing Flows	?	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗
Water Quality									
Metals	A	○	○	○	○	○	○	○	↓
Nutrients	A	○	↓	○	○	○	○	○	↓
Temperature	?	○	○	↓	↓	↓	⊗	⊗	⊗
Riparian Areas									
Floodplain physical condition	C	○	↓	○	○	○	○	○	○
Riparian vegetation	B	○	↓	○	↓	↓	○	○	↓
River Form									
Channel Structure and Dynamics	B	○	↓	○	○	○	○	○	↓
Aquatic Habitat									
Habitat Structure	B	○	↓	○	○	○	○	○	↓
In-channel Hydrologic Connectivity	B	○	○	↓	↓	↓	○	○	○
Aquatic Life									
Aquatic Insects	A	○	↓	↓	↓	↓	○	○	↓
Fish	B	○	↓	↓	↓	↓	○	○	↓

Gypsum Creek

USFS Boundary to Eagle River





Current and Historical Drivers of Degradation

Significant physical channel alteration, including bank armoring, straightening, and simplification, exists throughout the Town of Gypsum. Channel encroachment and high flow capacity reduction appears evident on many ranches and outlying suburbs due to flow losses at large ditches. Extensive encroachment on stream channels and floodplains exist from past or present agricultural uses and recent residential development.

Seasonal or permanent barriers to aquatic organism passage exist at low flows at specific locations on the reach. Significant alteration to continuity, lateral extent, and structure or riparian communities exists due to town development and agricultural land uses. These changes significantly degrade stream and floodplain habitat.

Agricultural and municipal water uses alter the streamflow regime. High peak flow frequency declined profoundly (~90%). Peak flows during typical and dry years declined by 37-60% compared to natural historic conditions. Summer baseflows during Aug/Sep in average and dry years declined by 50-80% relative to natural conditions. Total annual flow volumes in dry years declined 37%.

Grade	Degree of Impairment
A	None
B	Minor
C	Significant
D	Severe
F	Profound
?	Data Gap

Icon	Expected Effect Size
⬆	Strongly Positive
↑	Somewhat Positive
○	Niether Positive or Negative
↓	Somewhat Negative
⬇	Strongly Negative
⊗	Not Assessed

Functional Assessment		Potential Future Drivers							
Variable / Sub-Variable	Existing Condition	Increasing Municipal Water Use	Urbanization	Warm & Wet Climate Future	In-Between Climate Future	Hot and Dry Climate Future	New TMDs	Increased Reservoir Capacity	Wildfire
Streamflows									
Base Flow: Dry Year	F	○	○	⬇	⬇	⬇	○	⬆	○
Base Flow: Median Year	F	○	○	⬇	↓	⬇	○	○	○
High Peakflow Frequency	F	○	○	↓	⬇	⬇	○	○	○
Peak Flow: Dry Year	F	○	○	↓	⬇	⬇	○	○	○
Peak Flow: Median Year	D	○	○	⬇	⬇	⬇	○	⬇	⬆
Total Volume: Dry Year	D	○	○	↓	⬇	⬇	○	○	○
Total Volume: Median Year	C	○	○	⬇	⬇	⬇	○	○	○
Streambed Sediment									
Continuity and Transport	B	↓	↓	○	↓	⬇	○	○	⬇
Flushing Flows	?	⊗	⊗	⊗	↓	⊗	⊗	⊗	⊗
Water Quality									
Metals	A	○	○	○	○	○	○	○	↓
Nutrients	?	○	↓	○	○	○	○	○	↓
Temperature	?	○	○	↓	⬇	⬇	⊗	⊗	⊗
Riparian Areas									
Floodplain physical condition	C	○	↓	○	○	○	○	○	○
Riparian vegetation	C	○	↓	○	↓	⬇	○	○	↓
River Form									
Channel Structure and Dynamics	C	○	↓	○	○	○	○	○	↓
Aquatic Habitat									
Habitat Structure	C	○	↓	○	○	○	○	○	↓
In-channel Hydrologic Connectivity	C	○	○	↓	⬇	⬇	○	○	○
Aquatic Life									
Aquatic Insects	?	○	↓	↓	↓	⬇	○	○	⬇
Fish	?	○	↓	⬇	⬇	⬇	○	○	⬇

Identifying At-Risk Values

Water resources are highly valued by the local community. Streams and rivers provide municipal water supply, enhance natural beauty of the landscape, support the local tourism economy and provide numerous cultural, social and intrinsic functions. The ERCWP seeks to identify how these values may be at risk in a changing and uncertain world. A shared understanding of system behavior is a crucial foundation for conversations regarding the potential impact of alternative water management approaches on ecosystem function or recreational use opportunity. The technical information discussed in the sections above intends to support the development of that shared understanding.

Understanding how to weigh the relative importance of the numerous values at risk can be a difficult exercise for both the public and water managers. A useful framework is to consider risks through the lens of 'how likely is this event or outcome to occur?' and 'how impactful will it be if it does?'. Values at Risk can then be differentiated by the likelihood of a negative impact on a value or issue of concern, and the severity of the consequence associated with that impact. Dividing the risk space into four quadrants yields risk ratings and treatment pathways where:

Risk Rating 1: High priority. Corresponds to impacts that are both likely and are expected to produce significant negative consequences. These high-priority risks require sufficient allocation of resources and proactive treatment to reduce likelihood and/or the consequences associated with an event.

Risk Rating 2: Medium priority. Corresponds to impacts that are likely but are expected to be manageable and/or not produce significant negative consequences. These medium-priority risks should be managed strategically over the long-term.

Risk Rating 3: Medium priority. Corresponds to impacts that are rare or difficult to plan for but are expected to produce significant negative consequences if/when they do occur. These medium-priority risks compel additional investigation into the event triggers and response pathways in order to be better prepared for reactive management of an event.

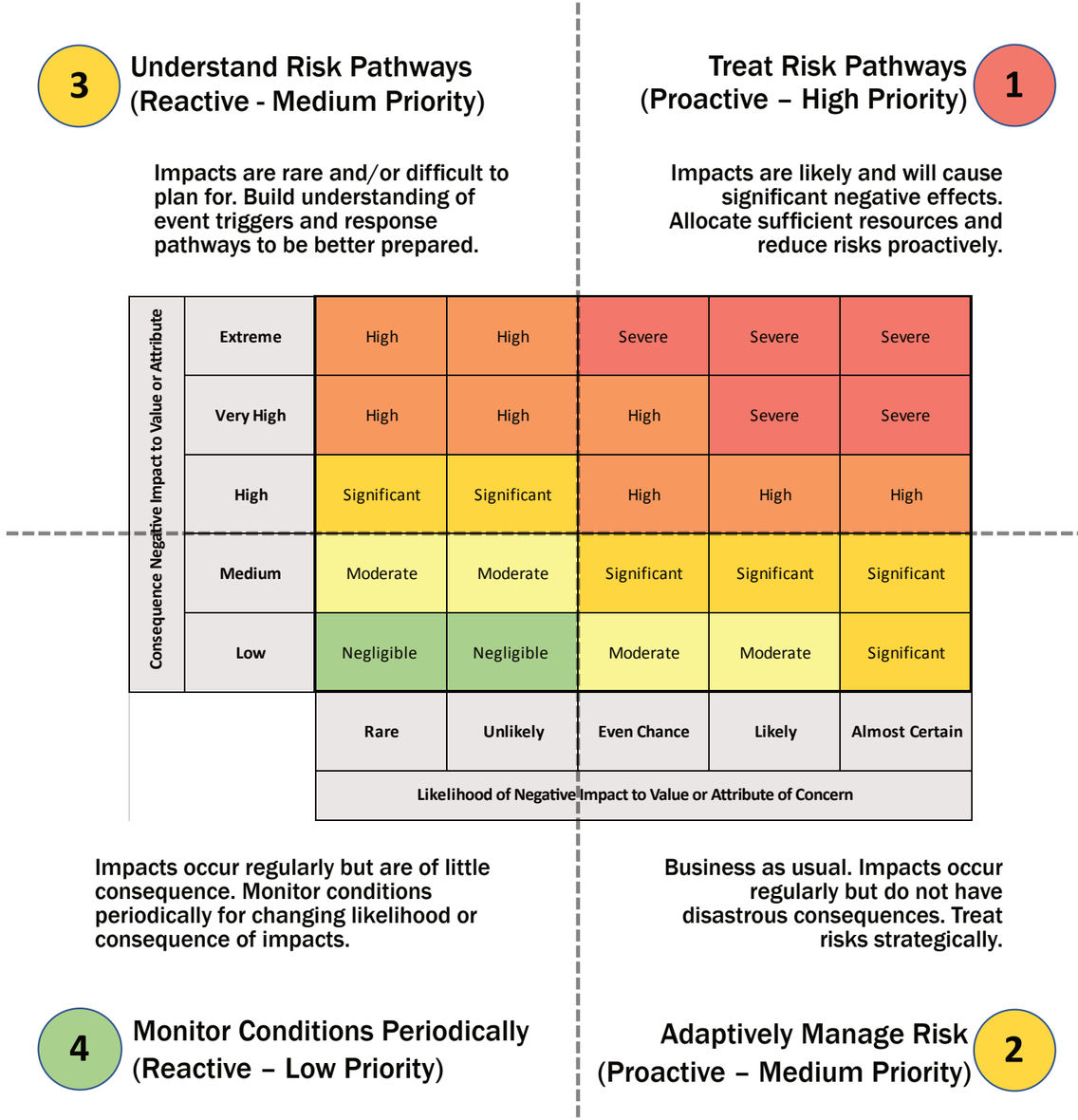
Risk Rating 4: Low priority. Corresponds to impacts that occur regularly but are of relatively minor consequence to the issue or value of interest. These low-priority risks entail periodic monitoring or assessment of conditions to alter stakeholders to changing event likelihood or consequence severity.

Potential future risks to the values derived from local streams and rivers were explored and identified through a process of stakeholder elicitation and workshops. Community workshop activities included causal chain diagramming, small group discussion, and multi-voting. Outcomes of these stakeholder processes were reviewed and summarized into two categories:

- Environmental and Recreational Uses
- Consumptive and Municipal Uses

The relatively high ranking of environment and recreation water uses by community members, coupled with the relative surplus of existing planning activity and information conducted in other venues for municipal and agricultural water uses, provides a rational basis for focusing on these uses in future decision-making processes regarding water resource use and development.

The following pages summarize the Values at Risk identified through the ERCWP process. A more detailed discussion of the Values at Risk is provided in **Appendix C**.



The figure above is a conceptualized risk space relating 1) the likelihood of some negative impact to a value or attribute of concern and 2) the consequence of that impact. Varying degrees of likelihoods and consequences are indicated in the gray boxes. The associated level of risk to the value or attribute of concern is indicated in the colored boxes. The risk space is divided into four quadrants that suggest different strategies and priorities for responding to risk. Values at Risk identified during the ERCWP are assigned to these four risk quadrants on the following pages.

RISK RATING

1

High priority. Corresponds to impacts that are both likely and are expected to produce significant negative consequences. These high-priority risks require sufficient allocation of resources and proactive treatment to reduce likelihood and/or the consequences associated with an event.

Wildlife and Biodiversity

- Instream flow deficits limited in most areas of the watershed but are more prevalent in upper reaches of Gore Creek and on the Eagle River near Avon. Deficits may become more severe on the mainstem Eagle River and on Gore Creek near Vail, especially during dry years, due to growing water demands and a changing climate.

Municipal Water Supply

- Growing populations and warming air temperatures increase demand for municipal water supply in systems throughout the watershed.
- Increases to in-basin municipal diversions and/or storage of surface water due to the combined effects of climate change and population growth may alter patterns of streamflow in a manner that negatively impacts riverine ecosystems along the Eagle River below Cross Creek, Gore Creek, Brush Creek and Gypsum Creek.
- Increases to transmountain diversions due to increasing water demand on the Front Range may alter patterns of streamflow in a manner that negatively impacts riverine ecosystems on the Eagle River.

Angling

- Elevated summer and fall water temperatures driven by changes in water use and climate lead to more fishing closures and reduced fishery quality; the largest impacts are expected below Edwards.

Recreational Boating

- Altered streamflow on the Eagle River due to changes in water use and climate may reduce the frequency and duration of suitable conditions for a variety of whitewater boating activities and shift a greater number of those suitable conditions to the early spring period.

Aesthetics and Viewscapes

- Development in floodplains and placement of infrastructure within the river corridor degrades the aesthetic quality of the landscape, particularly on Gore Creek; similar potential for future degradation exists along the Eagle River between Wolcott and Gypsum.

Snowmaking

- Warming winter air temperatures may lead to an inability for local ski resorts to make snow in the early winter months, which may reduce the total available skier days.
- Warming climate and shifting precipitation patterns may mean that snowmaking is required for a longer period in any given year; increasing the duration of the impact of snowmaking activities on streamflows, particularly in Gore Creek.

RISK RATING 2

Medium priority. Corresponds to impacts that are likely but are expected to be manageable and/or not produce significant negative consequences. These medium-priority risks should be managed strategically over the long-term.

Municipal Water Supply

- Out-of-basin augmentation of local municipal water use fails to mitigate impacts of that use on local ecosystems.
- Loading of metals from historical and ongoing mining activities negatively impacts drinking water supply quality on the Eagle River above Avon.

Angling

- Altered streamflow on the Eagle River below Edwards due to changes in water use and climate may reduce the frequency and duration of suitable conditions for float fishing and shift a greater number of those suitable conditions to the late winter/early spring period.

Aesthetics and Viewscapes

- Growing populations and increasing urban/suburban development pressure leads to conversion of agricultural lands and a loss of open, green spaces in upland areas buffering communities or along river corridors.

Agriculture

- Aging water supply infrastructure may increase operation and maintenance costs for some agricultural producers, eroding the economic viability of local farming/ranching enterprises. Inefficiencies in water delivery infrastructure may also limit agricultural users' ability to adapt and respond to climate change.
- Water use by phreatophytes along open ditches increases consumptive use.

Wildlife and Biodiversity

- Warm stream temperatures degrade the health of the cold-water fishery in the middle and lower watershed.
- Sedimentation impacts from large wildfires may produce acute fish-kill or macroinvertebrate loss events. Downstream aquatic habitat conditions may be degraded and require several years to recover. Impacts may occur broadly across the watershed.
- Continued water quality impacts from Eagle Mine impact fishery structure on the Eagle River near Minturn.
- Combined effects of climate change and upstream water development may exacerbate water quality impacts from Eagle Mine on the fishery near Minturn.
- Climate change and future municipal water demands may deplete streamflows on Gypsum Creek, disconnecting headwaters reaches from the mainstem Eagle River.
- Traction sand and road salts sourced from the I-70 corridor over Vail Pass may impact aquatic habitat quality on Gore Creek. Road expansion is likely to increase the quantity of both making it into the creek in the future.
- Native cutthroat trout populations that exist in small tributary streams at high elevations may be at risk for fire, hybridization with non-native species, or future fragmentation of habitat due to infrastructure development.
- Continued urbanization is expected to disproportionately impact riparian areas along the Eagle River mainstem below Wolcott, on Gore Creek and along tributaries like Brush Creek and Gypsum Creek.
- Ongoing agricultural activities on select parcels in the river corridor near Edwards and between Eagle and Gypsum suppress recovery of native riparian plant communities.
- Recovery trajectories are uncertain for recently burned areas of riparian forest along the Eagle River near Gypsum; ongoing climate change and development pressures may limit natural recovery potential.
- Development in floodplains and placement of infrastructure within the river corridor fragments terrestrial wildlife habitats on streams and rivers throughout the watershed.

RISK RATING 3

Medium Priority. Corresponds to impacts that are rare or difficult to plan for but are expected to produce significant negative consequences if/when they do occur. These medium-priority risks compel additional investigation into the event triggers and response pathways to be better prepared for reactive management of an event.

Wildlife and Biodiversity

- Future water temperature increases driven by changes in climate may lead to the complete loss of the cold-water fishery and a shift in species composition to a warm-water fishery in the lower watershed.
- Existing high-quality riparian areas along the mainstem Eagle River near Edwards and between Wolcott and Gypsum appear at greatest risk for change due to altered peak flow hydrology under various climate change and water use scenarios.

Municipal Water Supply

- Warming air temperatures may decrease the overall effectiveness of outdoor water conservation programs/projects.
- Consolidation of water supply to a smaller number of diversion points following low-frequency/high-impact events (e.g., hazardous material spill on Vail Pass, catastrophic wildfire) may lead to increasingly altered streamflows on some reaches of stream.
- Large wildfires may significantly degrade the quality of drinking supply for smaller municipal systems (e.g., on Brush Creek and Gypsum Creek).

Angling

- Changes to streamflow, water quality and/or fishing pressures may alter the status of the Gold medal fishery on lower Gore Creek and the candidate Gold Medal reaches on the Eagle River near Avon and Gypsum.
- Increasing likelihood of fishing closures on some subset of stream/river reaches may increase angling pressures on other reaches, degrading the fishing experience and the quality of the sport fishery.

RISK RATING 4

Low Priority. Corresponds to impacts that occur regularly but are of relatively minor consequence to the issue or value of interest. These low-priority risks entail periodic monitoring or assessment of conditions to alter stakeholders to changing event likelihood or consequence severity.

Wildlife and Biodiversity

- Water quality degradation from urbanization may degrade macroinvertebrate communities and qualifying conditions for Gold medal fishery status on lower Gore Creek and on the Eagle River near Avon and near Gypsum.
- Aquatic biology on the Eagle River and Gore Creek is supported by a high degree of hydrological connectivity among reaches and between mainstem channels and various tributaries in the middle and upper watershed. Warming air and water temperatures under climate change may induce some thermal barriers to fish movement in the middle and lower watershed.
- Structural/physical habitat degradation caused by legacy agricultural activities and infrastructure placement occurs sporadically along the Eagle River mainstem below Town of Eagle and along Gore Creek in the vicinity of the public golf course.
- Growing resident and visitor populations may increase nutrient loading from wastewater treatment plants and stormwater runoff while changing streamflows under climate change may reduce the diluent capacity of receiving waters during some times of year, creating problematic conditions for aquatic life.

Municipal Water Supply

- Questions regarding the impact of arsenic on water supply quality remain due to uncertainty in the regulatory environment.

Agriculture

- Changing economic and social pressures may lead to a progressive reduction in the number of productive agricultural operations.

Translating Values at Risk to Management Objectives

Stakeholders to the ERCWP reflected on the Values at Risk (**pages 54-61**) and identified a set of durable Management Objectives (**Appendix A**) that can be used to guide policy development and project implementation in the Eagle River watershed. Stakeholders worked to ensure that identified objectives are measurable, operable, meaningful and motivational:

Measurable means that progress toward meeting the objective can be quantified over time

Operable means that the community does not expect that meeting the objective will require broad participation of governments, organizations or individuals not represented in the planning process or who reside outside of Eagle County; or require an infinite time horizon

Meaningful means the objective is issue-based and relevant to the ERCWP planning goals

Motivational means that local organizations, governments or individuals whose participation is required for the objective to be successful should, generally, be inspired or have the political will to act to meet the objective.

Management Objectives are issue-based statements that respond directly to the issues that the community expects the ERCWP to address. A summary of the ERCWP objectives is presented in the graphic at right. Identified objectives are presented in greater detail elsewhere. Detailed objectives reference specific geographies and timeframes over which they apply and can be assessed. They are also accompanied by clear and measurable targets for success; and a set of proposed performance indicators or metrics that can be used to evaluate objective success over time (Note: the selected metrics may change over time as new information and assessment techniques come available). The Management Objectives included in the ERCWP are aspirational in nature and should not be misconstrued as enforceable policy statements. They should also not be interpreted as consensus statements or as the maximum necessary standard for meeting the goals of the ERCWP.

Management objectives identified through the ERCWP process.

Issue of Concern	Objective
Wildlife and Biodiversity	Protect riparian and wetland ecosystem condition and function
	Support viability of native and sport fish populations
	Maintain or enhance surface water quality for aquatic biota
Municipal Water Supply	Meet projected municipal water demands of expected population growth in Eagle County given the uncertainty of a changing climate
	Improve municipal water system efficiency
	Strengthen connections between land use planning and water use
	Limit negative impacts of municipal water use on the natural environment
	Maintain or enhance surface water and groundwater supply quality
	Reduce water consumption for outdoor amenities (ponds, fountains, golf courses, parks, turf fields, etc.)
	Limit water quality impacts of water use by outdoor amenities
Angling	Maintain Gold Medal trout fishery eligibility on Gore Creek and the Eagle River
	Protect riparian ecosystems at fishing access points
	Maintain opportunities for float fishing on the Eagle River
	Enhance user knowledge of river ethics, parking at public access points, maximum user capacity of a give reach for enjoyment, etc.
	Promote conditions conducive to fishery health
Recreational Boating	Provide for adequate recreational boating access to the Eagle River and Gore Creek
	Maintain opportunities for recreational boating on the Eagle River and Gore Creek
	Enhance user knowledge of river ethics, parking at public access points, maximum user capacity of a give reach for enjoyment, etc.
Agriculture	Maintain green spaces and terrestrial habitat provided by productive irrigated agriculture
	Improve efficiency of existing irrigation water delivery and irrigation systems
Aesthetics and Viewscapes	Recognize the importance of maintaining the aesthetic qualities of healthy functioning stream and river corridors
Snowmaking	Minimize negative environmental impacts associated with water demands for snowmaking

Support for Ongoing Identification and Prioritization of Management Strategies

The Management Objectives (**Appendix A**) represent a critical primary deliverable from the ERCWP. They provide a framework for ongoing efforts to identify projects, policies, and other actions that support the goals of the Plan. In this way, the ERCWP is envisioned as a dynamic process that does not end with the publication of this document or associated planning outputs. The Eagle River Coalition intends to continue engagement with local stakeholders to identify, fund, and implement critical actions that further the goals and mission of the Plan.

Initial Strategy List

The final steps in the ERCWP planning process involved identification of an *initial* set of alternative actions that support he identified Management Objectives. Stakeholders to the ERCWP participated in several workshops to evaluate the outcomes from various technical assessments, consider the values at risk and management priorities expressed through the Management Objectives. The outcome of these workshops was a draft set of 92 projects, policies, and other managements actions subjected to further evaluation. The planning team assessed the list of ideas against the Management Objectives and performed a cursory feasibility analysis to reduce the list to 30 potential Strategies that can help mitigate future risks to the values and benefits the local community derives from streams and rivers. Those Strategies were organized into 9 broad categories:

- Instream habitat restoration
- Management of instream flows
- Climate studies/infrastructure
- Riparian habitat restoration
- Recreation infrastructure
- Recreation use limits
- Turf reduction and landscaping
- Water rates
- Education and community outreach

Each remaining Strategy was evaluated against the perceived constraints, or challenges that might limit the ability of the community to actually implement the action. Strategies were also assessed by identifying the number of Management Objectives they respond to. These outcomes of these evaluations were captured as a pair of dimensionless indices that allow for relative comparisons among the Strategies.

The first step in computing the Responsiveness to Objectives Index involved answering a series of questions exploring the degree to which each Strategy related to each Management Objective. Those questions are provided below.

Management Objective Responsiveness Questions

- How strongly does this Strategy respond to a Management Objective?
- Does it respond to more than one?
- Do you think this Strategy can achieve the desired result without completing other Strategies first?
- How would you measure/determine that this Strategy had the intended effect on the Management Objective?

Initial set of project and policy Strategies identified through the ERCWP process. Each Strategy is accompanied by a pair of dimensionless indices that describe their respective responsiveness to the Management Objectives and the number and type of limiting factors that may complicate implementation of the Strategy.

Strategy	ID	Description	Scaled Evaluation Indices	
			Responsiveness to Objectives	Perceived Limiting Factors
Instream Habitat Restoration	HAB-1	Partner with local conservation district to construct fish passage structures around select agricultural water diversions on Gypsum Creek and Brush Creek	2.9	1
	HAB-2	Partner with USFS and CPW to install Aquatic Organism Passage (AOP) Projects on tributaries holding native trout	1.8	0
	HAB-3	Implement aquatic and riparian habitat restoration project on the Eagle River below Gypsum impacted by wildfire	2.5	2
	HAB-4	Reroute Wearyman Road (connector of Shrine Pass and Red Cliff) to reduce sedimentation	1.0	1
	HAB-5	Conduct post-project monitoring for instream habitat restoration projects to quantify effectiveness	0.8	3
Management of Instream Flows	Q-1	Construct modeling tools to evaluate feasibility of mitigating water temperature impacts on lower Eagle River through reservoir releases	3.5	5
	Q-2	Pilot Water Temperature Reduction Project	7.0	2
	Q-3	Support the Colorado River District's efforts to secure the Shoshone Power Plant water rights in Glenwood Canyon	7.0	1
Climate Studies/ Infrastructure	CSI-1	Support the Central Colorado Mountains River Basin Weather Modification Program	1.2	2
	CSI-2	Incentivize installation and use of smart irrigation controls on residential dwellings	3.2	1
Riparian Habitat Restoration	RIP-1	Continue to pursue riparian/wetland restoration opportunities identified in the Eagle River Inventory and Assessment that fall outside the ERCWP planning area	3.2	2
	RIP-2	Use riparian condition mapping produced by the ERCWP to plan and implement riparian habitat restoration with private landowners in Edwards near the confluence with Lake Creek and between Eagle and Gypsum	8.3	2
	RIP-3	Plan and implement riparian habitat restoration projects with public land entities on upper Brush Creek and Gypsum Creek.	7.6	1
	RIP-4	Increase river canopy shading along the lower Eagle River with large trees to address increasing river temperatures	6.6	1
	RIP-5	Utilize conservation easements to protect riparian habitat, wetlands, and floodplains, especially near Edwards, Wolcott, and between Eagle and Gypsum	3.9	3
	RIP-6	Develop recommendations for complementary riparian setbacks in Eagle County and the towns of Eagle County	7.5	2
Recreation Infrastructure	REC-1	Inventory and upgrade existing boat ramp infrastructure (e.g., hard and soft), river access points, and nearby recreational areas	6.2	2
	REC-2	Improve efficiency of existing irrigation water delivery and irrigation systems for parks, golf courses, and ball fields	0.6	3
Recreation Use Limits	USE-1	Study the impacts of recreational boating and angling on aquatic species, especially during elevated temperature events	0.6	1
	USE-2	Study user pay systems for river use, including the effectiveness, feasibility and equity of such regulations	0.6	1
Turf reduction and Landscaping	TRF-1	Implement turf replacement and stormwater demonstration projects throughout the county	6.8	3
	TRF-2	Organize an education and outreach program to promote water-wise landscaping throughout the county	6.8	0
	TRF-3	Establish a local source/nursery for native drought-tolerant and/or riparian vegetation	3.2	1
	TRF-4	Establish landscape guidelines for turf reduction for new developments or rebuilds	6.8	1
	TRF-5	Develop an incentive program for community members to re-landscape their properties and reduce turf	6.8	2
	TRF-6	Establish policies to reduce water use on existing properties	7.2	1
Water Rates	RTE-1	Promote use of Eagle River Water and Sanitation District's tiered water rate cost structure in other jurisdictions	7.0	1
	RTE-2	Establish water budgets for residential and commercial properties throughout Eagle County	3.5	1
Education and Community Outreach	EDU-1	Establish a long-term stakeholder coalition to prioritize, fund, and implement projects	0.0	1
	EDU-2	Engage with homeowners by bringing information to their homes to reduce excessive water use	3.6	1

Index values were computed by summing weighted responsiveness scores for each Strategy. Weights reflected a Strategy's correspondence to the prioritization of water uses expressed by community members and the Value at Risk ratings associated with each Management Objective that the Strategy responds to. The scoring approach is outlined below.

∑ (Responsiveness Scores X Water Use Ranking Weights X Value At Risk Weights) = Index Score

3 - Strongly Responsive
2 - Moderately Responsive
1 - Somewhat Responsive
0 - Not Applicable

7 - Wildlife and Biodiversity
6 - Municipal Use
5 - Agriculture
4 - Recreational Boating
3 - Angling
2 - Aesthetics
1 - Snowmaking

4 - Treat Risk Pathways
3 - Adaptively Manage Risk
2 - Understand Risk Pathways
1 - Monitor Conditions

The Limiting Factors Index was assessed for each Strategy by considering a series of questions related to the potential challenges posed by various factors. The questions contemplated by the project team are provided below, organized by limiting factor category.

Limiting Factors Questions

Secondary Effects
- What are potential adverse or unintended consequences (e.g. environmental or socioeconomic) produced by the Strategy; how might these be addressed

Implicated Stakeholders
- Is there a local champion individual or organization for this Strategy ?
- Who are the decision-making bodies or individuals implicated by this Strategy (e.g. local governments, federal resource management agencies)?
- Who are the key constituencies who must be influenced/agree to participate in order to successfully implement the Strategy (who has something to gain; who has something to lose)? What motivates them (e.g., $$$, fear, ease, peers)? Why will they support/oppose the strategy? What's the process required to engage or address them?

Underlying Factors
- Is there an underlying factor that acts as a critical driver or barrier that must be addressed to implement this Strategy or that may limit its effectiveness after it is implemented (e.g. climate change may decrease water supply and constrain efforts to manage water creatively for other uses)?
- Is it feasible for us, or someone else within the community, to fully address this factor successfully on a reasonable time scale? If not, to what extent can the factor be addressed locally?

Scope and Scale
- What degree of legal interest/work is required to implement the Strategy (e.g., water rights, conservation easements, management agreements)?
- What degree, frequency or level of management is required (e.g. one-time effort, bi-annual, monthly, etc.)?
- To what degree will the Strategy require local, state, or federal permits and how difficult will it be to secure those?

Costs
- What's the estimated order of magnitude cost to implement the Strategy (e.g., tens of thousands of dollars, hundreds of thousands, millions)?
- Is funding available locally? If not, what are the other likely sources of funding? How much match funding (as a percentage of the total expected cost) can be expected to come from the local community?

Weights were assigned to each Strategy corresponding to each of the potential limiting factors using the rating system described below. The limiting factor scores were then summed for each Strategy area. This summed value was used as the index score. The dominant limiting factors identified across the full set of Strategies were Costs and Implicated Stakeholders.

Limiting Factor Weights

0 - Not Applicable: This issue is not relevant to the action or was previously overcome.

1 - Some Concern: This issue presents some barriers for action implementation/success but it can be easily resolved by continued efforts of local stakeholders in the near-term.

2 - Significant Concern: This issue is expected prohibit implementation or severely limit success of the action in the near term. Significant work/attention are likely required resolve it.

3 - Deal breaker: This issue seems insurmountable but is critical to the success of the action. It is not clear how it can be resolved now or in the future.

Those Strategies deemed most responsive to the Management Objectives and presenting few issues or constraints for implementation may be prioritized for implementation on shorter timelines. Other Strategies remain important priorities for the community, but additional roadmapping and groundwork is likely required before implementation can proceed. Over time, community members will identify additional Strategies for responding to the Management Objectives. Evaluating the opportunities presented by new Strategies relative to those stated here may benefit from a structured process like a Multi-Criteria Decision Analysis (MCDA). The approach outlined above provides ERC and its partners with a template for MCDA implementation.

Implementation of the Strategies

The list of Management Objectives (**Appendix A**) and Strategies (**Appendix P**) provided by the Plan (and updated in coming years by the community) intends to function as a roadmap for activities that preserve and enhance the ability of streams and rivers in the Eagle River Watershed to meet human and ecosystem needs. Identified lists of Limiting Factors can be used as a "punch list" of tasks that require completion prior to pursuit of a Strategy. Implementation of individual Strategies will be most effective when and where local stakeholders and an identified project champion partner to secure necessary funding, conduct outreach to the community, and oversee the implementation of projects or policies.

Implementation of the Strategies outlined in the ERCWP, and additional Strategies identified by ERC and its partners in the future, will only be successful with collaboration and cooperation among affected stakeholders, elected officials, and resource managers. The collection of entities implicated by the Strategies are varied and diverse. While ERC expects to play a central coordination role for implementation of the Plan, there is no single entity expected to carry the torch for implementation of the full set of Strategies.

The rationale for the actions embodied in the Plan's list of Strategies is expected to support requests for and receipt of funding from local, regional, state, and federal sources. A non-exclusive list of potential funding sources for Strategy implementation includes the following:

- **Eagle River Fund**
- **Colorado River District Community Funding Partnership**
- **Colorado Basin Roundtable Water Supply Reserve Fund**
- **Colorado Water Conservation Board Watershed Restoration Grants**
- **Colorado Water Conservation Board Colorado Water Plan Grants**
- **Colorado Water Conservation Board Turf Replacement Program**
- **U.S. Bureau of Reclamation Water Smart Grants**

The wealth of technical material provided by the ERCWP should support grant application development and provide a pathway for long-term assessment of project outcomes. Characterizing project success or failure will be critical to ongoing efforts to update the Plan through addition, modification, or removal of Management Objectives and the identification of new Strategies.

Updates to the Plan

The long-term success and relevance of the Eagle River Community Water Plan hinges on periodic review of the Values at Risk, stated Monitoring Objectives, and Strategies by those individuals and organizations charged with the Plan's implementation. Specific activities that should occur in the future to ensure the lasting relevancy and utility of the ERCWP to the local community include:

(a) Regular consideration of Monitoring Objectives and associated performance measures relative to the current state of knowledge and assumptions underlying the Values at Risk;

(b) annual stakeholder review of implementation successes and other achievements relative to the recommended Strategies and development of a work-plan for activities in the upcoming year;

(c) comprehensive assessments conducted on relevant ecological or social timeframes that collate new data and provide new analyses to identify emergent hydrological, ecological and human conditions and trends;

(d) major updates to the Eagle River Community Water Plan conducted every ten years based on most recent comprehensive assessment results and input from the community;

(e) ongoing monetary support of projects, programs, and policy initiatives that work to further the achievement of the Monitoring Objectives; and

(f) annual targeted updates on Eagle River Community Water Plan activities provided to local government, community groups, and/or other stakeholder organizations.

Many of the Community Values identified by the ERCWP apply broadly across the Eagle River Watershed. However, the technical assessment of local conditions was geographically limited. Accordingly, future updates to the ERCWP may benefit from an extension of the technical assessment to include a wider geographical area. Throughout the planning process, some community members emphasized the need to extend the technical assessment approaches used under the ERCWP to evaluate the existing and potential future conditions of the upper Eagle River and Homestake Creek, especially as those waterways may be impacted by projects completed under the Eagle River MOU. More focused analysis and planning work on Lake Creek, Brush Creek and Gypsum Creek may also identify additional planning needs and opportunities.