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YAMPA-WHITE-GREEN

Basin Implementation Plan

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SECTION 1. INTRODUCTION

Welcome to the Yampa-White-Green **Basin Roundtable's Basin** Implementation Plan Update!

The Basin Implementation Plan Update serves three primary purposes. First, it builds on the 2015 Plan and charts a path forward for the Yampa-White-Green Basin Roundtable . Water is critical to the Basin, and it is the BRT's responsibility to plan for the future. Second, it supports the Colorado Water Conservation Board's efforts to update the Colorado Water Plan. Finally, it is a tool to engage with stakeholders and the public to work together toward common solutions.

The heart of the Basin Implementation Plan (BIP) are the Basin goals, which were established in 2015 and continue to be supported by the Yampa-White-Green Basin Roundtable (BRT) today.

Eight Basin Goals guide the efforts of the BRT and seek to balance firming up supplies for existing uses and future growth while meeting recreational and environmental needs. But the BRT cannot accomplish the Goals alone. It must work with stakeholders throughout the Basin to advance projects and processes that will help ensure the goals are met. To this end, the BIP Update includes a list of Projects that are being pursued by stakeholders in the Basin. Ultimately, the Projects will help to close the gap between future water supplies and future water demands. For planning purposes, the BIP Update includes the five planning scenarios from the 2019 Technical Update to the Colorado Water Plan. The five planning scenarios consider a range of future climatic conditions and future consumptive demands that impact the supplies and gaps for agriculture, municipalities, industry, and environmental and recreational needs.

The BIP Update is a product of the BRT. Members of the BRT and interested stakeholders formed the BIP Committee to provide guidance and oversight. The BIP Committee held 11 meetings during 2019/2020 to revisit the original BIP, document the Basin's accomplishments toward achieving the Basin Goals, consider new challenges and opportunities that have arisen since 2015, review water supply and gap data from the 2019 Technical Update and Analysis to the Colorado Water Plan[1] (Technical Update), and explore alternative management strategies. Additionally, the BIP Committee reached out to stakeholders to gather updates on previously identified projects and processes and collect information on new projects that advance the Basin Goals. This work has been successfully accomplished despite the difficulties of the COVID-19 pandemic.

[1] https://cwcb.colorado.gov/colorado-water-plan/technical-update-to-the-plan

The BIP Update is organized into the following sections:

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The original 2015 BIP contains a wealth of information, much of which is not reproduced in this BIP Update. Please refer to the 2015 BIP for additional information on:

- **Previous studies conducted for the Yampa-White-Green Basin (pages 1-4 through 1-6)**
- **Watershed health (pages 4-6 through 4-9)**
- **Forest health and wildfires (pages 4-10 through 4-13)**

Basin Implementation Planning Process

In 2005, the Colorado State Legislature passed the Colorado Water for the 21st Century Act. This legislation established nine basin roundtables throughout the state to provide a forum for stakeholders to discuss water issues and find collaborative solutions. The roundtables are comprised of volunteers who represent a wide range of water interests. In 2015, the Yampa-White-Green BRT produced the first iteration of the Yampa-White-Green BIP with grant funding from the Colorado Water Conservation Board (CWCB). The BIPs from the nine basin roundtables were incorporated into the first iteration of the Colorado Water Plan. To prevent the Colorado Water Plan from growing outdated, it is to be updated on a regular basis. The State of Colorado will update the Technical Analysis, which gives the roundtables the opportunity to revisit and update their respective BIPs. The updated BIPs will support the update to the Colorado Water Plan.

The Analysis and Technical Update to the Colorado Water Plan (Technical Update) was published in 2019. A new methodology was developed to provide more robust estimates of future water supply gaps and risks. This new methodology implements scenario planning with the State of Colorado's water rights allocation models. The five planning scenarios described in the Colorado Water Plan are summarized in Section 5. The Technical Update uses the Colorado Decision Support System (CDSS) models to perform the water availability analysis for the five planning scenarios. These tools provide a range of future conditions for the Yampa-White-Green BRT to consider in its planning efforts.

Photo Source: Kent Vertrees, Friends of the Yampa

Basin overview

The Yampa, White, and Green River Basins, referred to as the YWG Basin, includes Routt, Rio Blanco, Moffat, and small portions of Eagle and Garfield Counties in Colorado. The region has a rich agricultural heritage and a strong tourist economy driven by snow sports, boating, fishing, and hunting. Environmental assets include, among other things, wilderness areas, endangered fish species, and vast natural landscapes. The YWG Basin also contains some of the richest deposits of fossil fuels in the nation.

Landscapes vary greatly from wet, high-mountain elevations to sagebrush steppes to downstream desert canyons. River hydrology is dominated by snowmelt and, like most rivers in Colorado, flows vary greatly from the low flows of winter to the high flows of the spring runoff back to the low flows of the hot, dry summer. The timing and the volume of flows also vary greatly year to year.

Geography

The YWG Basin is approximately 7,660 square miles. The Yampa River rises in the Park, Gore, and Flat Tops mountain ranges and flows generally north then west through several municipalities, the largest being Steamboat Springs and Craig. The lower 46 miles of the Yampa River flow west through Dinosaur National Monument to its confluence with the Green River, a few miles upstream of the Colorado-Utah state line. The Yampa River is the largest tributary to the Green River, with mean annual flow of 1.1 million acre-feet (MAF) in a broad range of 0.3 to 2.3 MAF[2]. Major tributaries to the Yampa River include the Elk, Williams Fork and Little Snake Rivers. Irrigated agriculture can be found alongside the Yampa River and its tributaries.

Farther south, the White River flows through the Colorado towns of Meeker and Rangely and into Utah where it meets the Green River near the Utah town of Ouray about 27 miles southwest of Vernal. Average annual flow out of Colorado on the White River is approximately 0.5 MAF in a broad range of 0.2 to 1.3 MAF[3]. Like the Yampa Basin, there is irrigated agriculture throughout the White Basin.

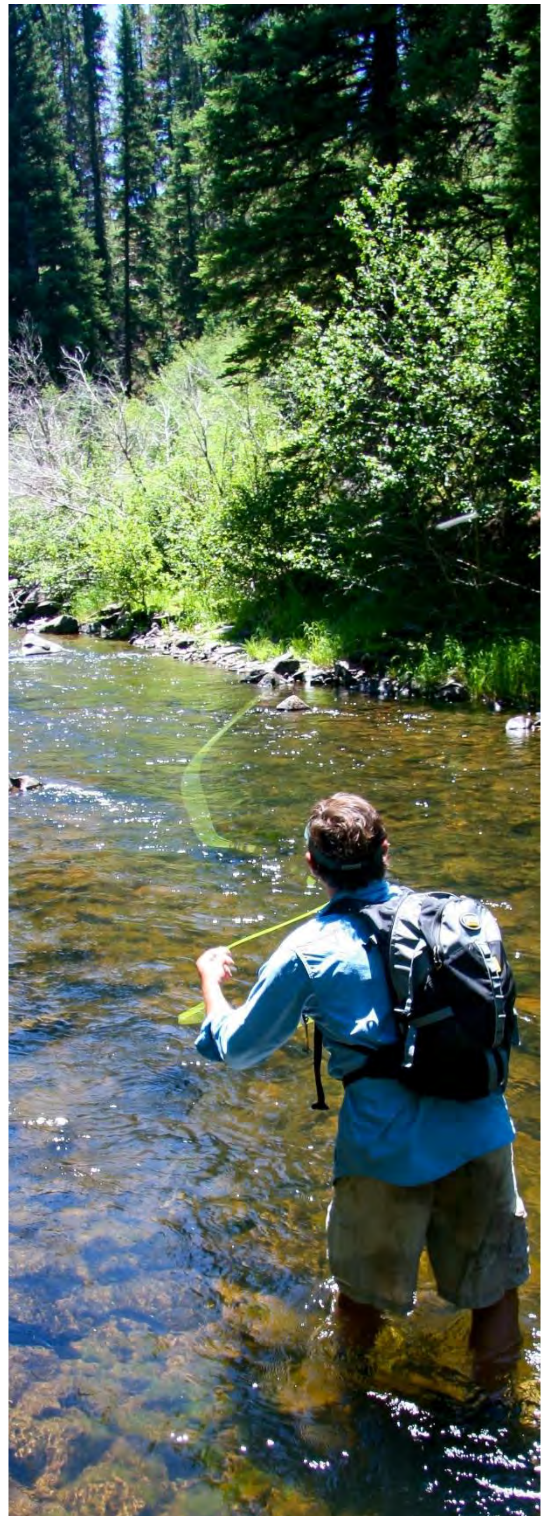
Photo Source:
Kent Vertrees, Friends of the Yampa

[2] Historical observation at USGS gage 09251000 - Yampa River near Maybell, CO (1916-2018).
[3] Historical observation at USGS gage 09306500 - White River near Watson, UT (1923-2018)

Rising in the Wind River Range of Wyoming, the Green River flows south through the Green Basin and into Flaming Gorge Reservoir. Scheduled releases from the reservoir largely control the flows downstream into Brown's Park in the northwest corner of Colorado. Vermillion Creek, the largest tributary in this area, enters the Green River at the southeast end of Brown's Park. The Green River continues south through Dinosaur National Monument, where the Yampa River enters it at Echo Park, then flows generally west through the monument and into the Uinta Basin of Utah. There is agricultural activity in the bottomlands of Vermillion Creek and the Green River.

Elevations range from more than 12,000 feet in the headwaters to just over a mile high at the state line. Average annual precipitation varies from more than 60 inches near Rabbit Ears Pass to approximately 10 inches near the state line. Most of the water yield in the basin is attributable to snowmelt from the higher-elevation portions of the White Basin.

Economy

The YWG Basin is predominantly rural and agricultural, consisting of private agricultural lands and towns along the river corridors and large tracts of multi-use public lands dominating the uplands. Economic drivers include agriculture, resource extraction, power generation, tourism, and recreation. Most economic activity is intimately dependent on adequate moisture and a dependable surface water supply.

The area remains sparsely populated, with about 45,300 people residing in Moffat, Routt, and Rio Blanco counties. Steamboat Springs and Craig are the major population centers in the Yampa Basin, with 12,928 and 8,928 residents, respectively. Rangely and Meeker are the major population centers in the White Basin, with about 2,400 residents each. Moffat County and Rio Blanco County populations are fairly stable. Routt County has doubled in population since 1980, with growth concentrated in the upper Yampa Valley near Steamboat Springs. This growth attests to the importance of recreation-based activities, as people are drawn to the basin by the ski area and other outdoor recreational opportunities.

Water Development

The YWG Basin is relatively undeveloped and uses a smaller portion of its native flow compared to the more developed basins in the state. The annual average historical (1975 through 2013) diversion volume in the YWG Basin for municipal, industrial, and agricultural uses (i.e., consumptive use) is approximately 798,000[4] acre-feet per year (AFY). These historical diversions resulted in annual average consumptive use of approximately 189,000 AFY[5] from 1975 through 2013. The majority of the existing storage is in the Upper Yampa River Basin and is largely for industrial and municipal use, although there are some agricultural storage supplies. These storage facilities also provide flat-water recreation opportunities. In the White Basin, the three reservoirs are primarily used for wildlife habitat, flat-water recreation, and hydropower. For the purpose of local water planning, the Yampa, White, and Green Basins can be considered independently, as no diversions currently exist between them.

[4] CDSS Historical Models for the Yampa and White Basin (2015)
[5] CDSS Historical Models for the Yampa and White Basin (2015)

SECTION 2. BASIN CHALLENGES

Introduction

The great challenge for the YWG Basin is balancing traditional economic activities with emerging consumptive demands while meeting environmental and recreational needs. The specifics of this challenge have shifted significantly over the past five years. Pressures related to previously burgeoning energy development have eased dramatically, at least for the time being. Drought impacts, apparently driven by climate change, have continued to grow; it now appears they will predominate in basin water planning, particularly with respect to the Colorado River Compact and possible new Colorado River basin initiatives, such as Drought Contingency Planning and Demand Management which are aimed at addressing overall system shortages.

Balancing traditional economic activities with emerging consumptive demands while meeting environmental and recreational needs is the overarching challenge in the basin.

Consumptive uses for coal-fired power production, a significant use within the Yampa Basin, are expected to go to zero within the next two decades. Whether those uses will change to other consumptive uses, e.g., combined-cycle natural gas electrical production or pumped storage hydropower, or to non-consumptive uses, is uncertain. It is expected that much more will be known in the next BIP update. Regardless, the plant closures represent significant social and economic challenges.

Non-consumptive environmental and recreational needs require flows to sustain endangered native fish, riparian plant communities, sport fisheries, whitewater boating, and ecological integrity. The challenge for the BRT is ensuring that the valuable non-consumptive basin characteristics are not at risk, even during drought periods. Integrating non-consumptive uses and consumptive water needs is the focus of two important planning efforts, the Yampa River Integrated Water Management Plan (IWMP) and the White River Integrated Water Initiative (IWI).

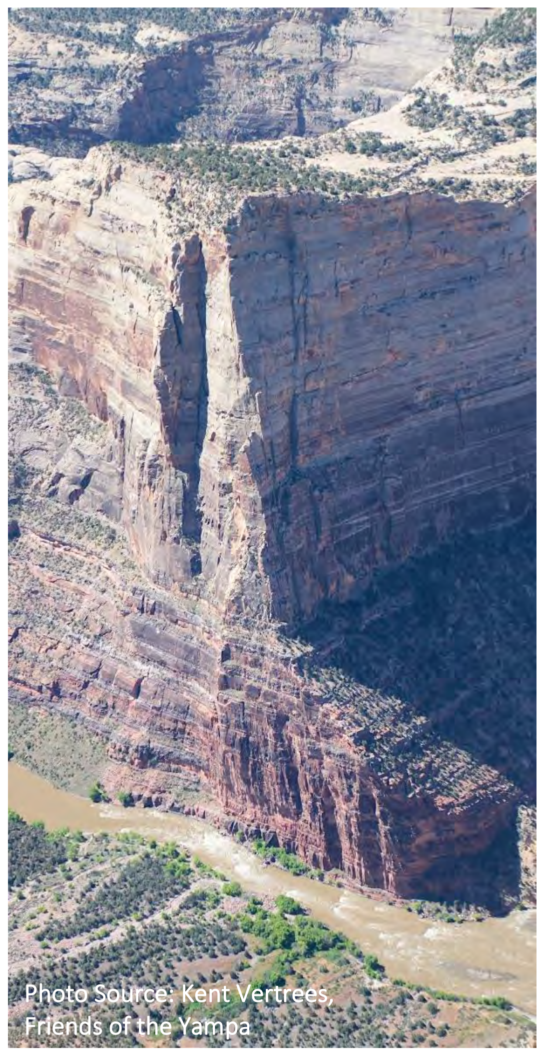

Photo Source: Kent Vertrees, Friends of the Yampa

Water-Energy Nexus

The nexus between water development and energy production presents both challenges and opportunities for the YWG Basin. Specifically in the Yampa Basin, the planned closure of the coal-fired electric generation stations is a serious economic and social challenge; however, it presents the opportunity for water planners to consider a new paradigm. In the White Basin, natural resource extraction related to oil and natural gas, oil shale, and Nahcolite (baking soda) continue to bedevil water planners with their high volatility and uncertainty.

Coal-Fired Electric Generation

Electrical generation, along with coal mining, has been a prominent and important part of the Yampa Basin for almost 50 years. The electrical power providers that own the Craig and Hayden stations manage a significant portion of the region’s vast natural resources, including land, water rights, and coal reserves for energy production. This has helped electrify rural and urban areas across the west.

The power providers are now in the process of transforming their dependence on fossil fuels to renewable generation. As a result, both the Craig Station, in Moffat County, and the Hayden Station, in Routt County, will be retired by 2030. The owners of the Craig and Hayden stations have communicated their understanding of the regional importance of the generating stations and the power they supply, and the impact of these changes to the Yampa Basin.

The plant closures also raise questions about the water that has been tied to the stations for half a century. Over the next five to ten years, the owners of the stations are expected to consider potential options while working with the community to understand and seeking to address local interests.

Pumped Storage Hydropower

The power plant and supporting coal mine closures are a significant economic and social challenge. There may be an opportunity to find a new method for producing electricity. One option may be pumped storage hydropower (PSH). Water is pumped uphill during periods of abundant electricity and later released from storage to generate electricity on demand. PSH serves as a “battery” and can smooth out the variable electrical supply generated by renewable power supplies, such as wind and solar. As electric power providers move toward renewable power supplies, the need for on-demand electrical supplies will grow.

The Yampa Basin is well positioned to host PSH. The Yampa Basin has significant changes in elevation, and the transmission capacity and potentially the water rights associated with Craig and Hayden stations will become available after their closure. At least one of the electric power providers in the Yampa Basin is studying PSH, the BRT has included a project to examine PSH (YW 2020-0040), and a third-party PSH provider is exploring projects in the basin.

Oil and Natural Gas

The White Basin has new, sustaining oil and gas fields in Rio Blanco County. Significant fields within the White Basin are the Rangely, Wilson Creek, White River Dome, and Piceance-Yellow Creek fields. Major oil and gas companies currently working in Rio Blanco County are Chevron, Inc.; ExxonMobil (XTO Energy); Caerus Energy; and Terra Energy Partners, in addition to various independent companies. These companies hold conditional and absolute water rights used for drilling and project operations.

Price declines have led to a dramatic decrease in drilling. Currently, there is only one drill rig active in the White Basin. This presents an economic and social challenge to the White Basin.

The 2015 Phase III Energy Development and Water Needs Assessment, a joint effort of the Yampa-White-Green and Colorado Basin roundtables. estimated that water needs for oil and natural gas, even at high production and development levels, were relatively minor compared to other needs; however, it is difficult to plan for water development related to oil and natural gas due to the volatility in the industry.

Oil Shale

The Green River Formation within the Piceance Basin of Garfield and Rio Blanco Counties is the most significant deposit of oil shale in the world. Major holders of oil shale mineral rights in the White River Basin are the Bureau of Land Management, ExxonMobil (XTO Energy), ConocoPhillips, and Mahogany Energy Resources, LLC (formally Shell Frontier Oil and Gas). The Bureau of Land Management's oil shale leasing program does not presently have active lease holders.

Although development of oil shale is not expected for the foreseeable future, energy interests hold a considerable portfolio of water rights. The conditional water rights are in good standing and could ultimately be used for its development. Some interests have also acquired absolute agricultural water rights, some of which have been changed to allow their use for energy purposes, although for the time being they currently continue to be used for agricultural purposes. If development of oil shale occurs and oil shale companies are not able to perfect conditional water rights, they may need to rely more heavily on conversion and use of agricultural water rights to the detriment of agricultural communities and economies.

A description of the likely consumptive use of water for an oil shale project is also contained in the Energy Development Water Needs Assessment Update Phase III Final Report, 2015[6]. The high degree of uncertainty surrounding oil shale development and related water demands are a challenge.

Colorado River Compact

The State of Colorado is party to the 1922 Colorado River Compact and the 1948 Upper Colorado River Compact. The 1922 Compact assumed the Colorado basin produces at least 15 MAF per year on average. This assumption may not hold true under a warmer, drier climate. Two large reservoirs—Lake Powell and Lake Mead—serve to buffer the year-to-year water supply variability. As the total water supply for the reservoirs decline, the risk of lakes Powell and Mead being drawn down to critically low levels and a "call" under compact administration increases. The risks specifically to the YWG Basin of a compact call are unknown because it is not certain how the Colorado State Engineer would administer such a call; however, there is the potential that water use could be severely and detrimentally curtailed.

In the face of persistent drought and anticipated long-term growth in demand for water, Colorado and the other six Colorado River Basin states have prepared Drought Contingency Plans (DCPs). One element of the Upper

[6] https://www.coloradoriverdistrict.org/wp-content/uploads/2015/04/20140630-Report-Energy-Phase-III-Final.pdf

Basin DCP is to investigate the feasibility of Demand Management (DM). If implemented, DM will become a future program which, on a voluntary, temporary, and compensated basis, will seek to conserve consumptive use of water to help the Upper Basin States, including Colorado, to continue to meet their Compact obligation under the Colorado River Compact.

Depending on the amount, extent, timing, duration, and sufficiency of compensation, DM could have significant detrimental impacts to local and regional agricultural economies and communities. Alternatively, a DM program could be done in ways that represent a net benefit to communities and economies. The YWG BRT's Big River Committee and local DM efforts are discussed further in Section 4: Goals, Objectives & Achievements.

Climate Change

The changing climate conditions in the YWG Basin present a significant challenge. In 2014, the CWCB published *Climate Change in Colorado: A Synthesis to Support Water Resources Management and Adaptation* (Lukas et al). This report found that "statewide annual average temperatures have increased by 2.0º [Fahrenheit] over the past 30 years and 2.5º F over the past 50 years." This level of warming is consistent with global trends. While the report does not find any long-term trends in average annual precipitation, the effects of warming alone are being seen in the water cycle. Hotter temperatures contribute to earlier snowmelt and peak runoff. Less snowmelt appears in the rivers as more water is used by forests and rangeland and lost to evaporation. The shift in runoff timing and the decrease in overall streamflow extends the late summer low-flow period. These changes to the river system create challenges for water users and the environment. These impacts are being experienced by water users in the YWG Basin today.

The Technical Update includes climate change projections in three of the five planning scenarios, which allows the BIP Update to examine a range of potential impacts to water users. Warming is expected to continue, exacerbating the trends toward earlier runoff, less streamflow, and longer low-flow periods. Drought conditions occur more frequently and with more severity. Crops require more irrigation water to produce the same yield under warmer conditions. Similarly, lawns and greenspace require more water, which increases the demand for municipal and domestic supplies. The decline in streamflow has negative consequences for the environmental and recreational attributes that are prized in the YWG Basin.

A warming climate may also increase the risk of forest fires. Wildfire frequency and severity is increasing in the western United States. After a severe wildfire, the impacted watershed produces less water with lower quality; therefore, water managers are joining efforts to improve forest health and create more wildfire-resistant landscapes. For example, the City of Steamboat Springs, in partnership with Mount Werner Water District, led the Fish Creek Critical Community Wildfire Watershed Protection Plan (CWP)[2] in 2019. This plan highlights how overgrown forests, pest infestations, and climate change are setting up conditions for severe wildfires—beyond what the ecosystems have adapted to.

Water Quality

Although the Yampa and White rivers exhibit relatively good water quality, rising stream temperatures and increasing nutrient loads are emerging concerns for these basins. In the face of a warming climate, these problems will be exacerbated.

In the White River, benthic algae—a component of stream food webs—attached to the stream bottom can reach uncharacteristic and nuisance levels on substrates when water chemistry and physical factors are out of balance with biological and physical removal mechanisms. Local observations and work done by Colorado Parks and Wildlife in 2016 highlighted nuisance benthic algal productivity in the upper reaches of the White River. Additionally, benthic algal occurrences and impacts have been identified below Rangely extending to the state line. Taylor Draw Dam has done spike-flow releases to "flush" the river for the benefit of water users and stream ecology. The high levels of benthic algae in the stream have reportedly developed in the last few years and have caused problems for water users along the White River.

The White River and Douglas Creek Conservation District are leading an effort to ascertain what is driving the algae growth in the White River, ultimately to improve the overall health of the watershed. A Technical Advisory Group has been convened to guide data collection and research potential causes. So far, data have been collected and analyzed by Colorado Parks and Wildlife (CPW), Trout Unlimited (TU), and consultants. Early results indicate stream temperature in the upper White River above Meeker is suitable for cold water fishes, and that macroinvertebrate assemblages are balanced and diverse. The full analysis of the collected data will be analyzed, and a U.S. Geological Survey (USGS) peer-reviewed report will be published in 2021[7].

The Yampa River from Stagecoach Reservoir to its confluence with Elkhead Creek below Hayden was placed on the U.S. Environmental Protection Agency's 303d Impaired Waterbody List for stream temperature. In response, water managers, including the City of Steamboat Springs, Upper Yampa Water Conservancy District, and CPW, have increased their stream temperature data collection efforts to better characterize the conditions for aquatic life. In the absence of long-term data sets, it is difficult to determine if these impairments are the result of a warming trend or reflect the natural range of stream temperature that had not been previously measured. Regardless, temperature conditions in the upper Yampa River are decreasingly habitable for native fishes, such as mountain whitefish and cutthroat trout, and sport fishes, such as rainbow trout and brown trout. Upstream impoundments, migration barriers on tributaries, and decreasing late summer flows are constraining habitats and decreasing the availability of late summer thermal refuges for temperature-sensitive native fishes. Flow, groundwater flux, air temperature, and solar radiation are powerful stream temperature drivers. The cumulative impacts of climate change, drought, floodplain development, and loss of native cottonwood forests and their shading effects are some of the likely contributors to stream temperature impairments. Summer stream temperatures on the Yampa River are expected to worsen as the climate warms unless local land and water managers can invest in broad-scale flow and riparian restoration.

In addition to temperature, nutrient loading is another water quality concern in the Upper Yampa. A USGS study found that nutrient loads increased significantly from 1999 to 2018 at Steamboat Springs, which indicates that

[7] https://www.whiterivercd.com/white-river-algae-study.html

streamflow and land use changes may be increasing nutrient inputs. Additionally, low flows increase mineral concentrations and chemical composition, which impacts the use of water for municipal water providers. These inputs include, but are not limited to, pH, temperature, organic carbon, dissolved oxygen, and alkalinity. Too much sediment can also present problems for municipal providers.

During multiple summer sampling events at Stagecoach Reservoir, the physical and chemical factors indicated conditions conducive to cyanobacterial blooms. These included surface-water temperatures greater than 20 degrees Celsius and total phosphorus and total nitrogen concentrations that exceeded Colorado Department of Public Health and Environment interim concentrations for water quality standards.

Recovery of the Endangered Fish Species

The Upper Colorado River Basin is historical and current habitat for the humpback chub, bonytail chub, Colorado pikeminnow, and razorback sucker. These four endangered fish species are the focus of the Upper Colorado River Endangered Fish Recovery Program (Recovery Program). The fish species have long life spans, live in warm water, and have adapted to the high-sediment and high-flow-variability characteristics of desert rivers. The Yampa, White, and Green rivers provide critical habitat for the wild and stocked populations of these fish. In 2005, the United States Fish and Wildlife Service (USFWS) issued a Final Programmatic Biological Opinion (PBO) on the *Management Plan for the Endangered Fish in the Yampa River Basin* (USFWS 2005)[8]. Together, the Recovery Program and these documents provide umbrella Section 7 Endangered Species Act (ESA) compliance for existing water depletions and a defined amount of future depletions in Wyoming and Colorado and actions that are taken to assist in the recovery of the endangered fish in the Yampa River. A key component of the Management Plan was the enlargement of Elkhead Reservoir to provide storage water to supplement late-season streamflow through the designated critical habitat reach on the Yampa River, which extends from the City of Craig to the Green River confluence. For purposes of the BIP Update, this reach is referred to as the Lower Yampa Reach. The Yampa River Management Plan and PBO provide certainty for the water users in the basin that existing and future depletions can occur without jeopardizing the species.

Currently, stakeholders in the White River Basin are involved in an effort to develop a Management Plan to serve as the basis of a PBO for the Recovery Program. Several of the BRT members are serving on the White River Planning Team and White River Workgroup. It is anticipated that the Management Plan and PBO will provide ESA compliance in the White River in Utah and Colorado for existing water uses, allow for some level of future depletions, and identify actions that will be taken to assist in the recovery of the endangered fish. It is anticipated that the White River Management Plan and PBO will be completed before September 2023, and the implementation timeline will be defined in the plan.

Based on a Species Status Assessment completed in 2018, the USFWS recommended downlisting the humpback chub from endangered to threatened. A proposed downlisting rule and associated 4(d) rule was published in the

[8] https://www.coloradoriverrecovery.org/documents-publications/section-7-consultation/yampa-river-pbo.html

Federal Register on January 22, 2020. The final rule has been drafted and is awaiting approval for publication in the Federal Registry. Similarly, based on a Species Status Assessment in 2018, the razorback sucker was recommended for downlisting from endangered to threatened. A proposed downlisting rule (with an associated 4(d) rule) has been developed and is in review.

The Colorado pikeminnow and bonytail chub remain designated as endangered. Biologists continue to study the fish and learn more about their needs. Stocking programs and removal of non-native predators have shown promising results. Recent surveys of the endangered species have located individuals in the Yampa and White rivers; therefore, these reaches will continue to be important for recovery due to their quality habitat. The Flaming Gorge Dam operations' Record of Decision and habitat restoration work on the Green River are also key to recovery efforts.

Despite remarkable accomplishments by the Recovery Program, the complete recovery of the four endangered fish will not be accomplished by September 2023 when the Cooperative Agreement and congressional authorization expires; however, the Recovery Program partners are confident that significant strides toward recovery will continue via a Recovery Program extension. Program partners are currently working on this reauthorizing and extension, which includes identifying funding sources, the reauthorization timeframe, and future recovery actions. Recovery Program partners intend for the Recovery Program to continue after September 2023, and that the Yampa River Management Plan and PBO will continue to be implemented pursuant to the Cooperative Agreement.


Photo Source: Melanie Fischer, U.S. Fish and Wildlife Service

SECTION 3. GOALS, OBJECTIVES, AND ACHIEVEMENTS

In 2015, the YWG BRT identified eight Basin Goals, which it continues to support. The principle underlying all of the goals is the maintenance and protection of historical water use and the protection of water supplies for future in-basin needs. The goals ultimately seek to promote a sustainable and diversified economy supported by a healthy river.

Each goal includes objectives that describe how the goal might be achieved and define success. The YWG BRT has sought to define objectives that can be accomplished by the BRT or by stakeholders in the basin, and that avoid arbitrary targets. Since 2015, the YWG BRT and stakeholders throughout the YWG Basin have been working toward achieving the goals. This progress is documented in the following section. Additionally, new challenges have surfaced, and the YWG BRT has defined new objectives to address changing conditions in the YWG Basin.

Yampa-White-Green Basin Goals (order does not indicate priority)	
GOAL 1	Protect the YWG Basin from compact curtailment of existing decreed water uses and some increment of future use
GOAL 2	Restore, maintain, and modernize water storage and distribution infrastructure
GOAL 3	Protect and encourage agriculture uses of water in the YWG Basin within the context of private property rights
GOAL 4	Improve agricultural water supplies to increase irrigated land and reduce shortages
GOAL 5	Identify and address municipal and industrial (M&I) water shortages
GOAL 6	Quantify and protect environmental and recreational water uses
GOAL 7	Maintain and consider the existing natural range of water quality that is necessary for current and anticipated water uses
GOAL 8	Develop an integrated system of water use, storage, administration, and delivery to reduce water shortages and meet environmental and recreational needs

Woven through the YWG Basin Goals is a strong emphasis on public education, participation, and outreach (PEPO). These efforts are led by a very active PEPO Committee. For more information on the YWG BRT's PEPO strategy, please refer to Section 8.

2015 Goals, Achievements, and Updated Objectives

GOAL 1: Protect the YWG Basin from compact curtailment of existing decreed water uses and some increment of future uses.

The 2015 BIP identified protection of present and future uses as the most important issue in the YWG Basin. This issue remains today. The vitality of the YWG Basin depends on maintaining the historical water uses that have come to define the YWG Basin since its settlement. To protect these uses, the YWG BRT seeks to pursue legal and advocacy options to protect the Basin in the event of compact administration pursuant to the Colorado River Compact.

Significant progress has been made since 2015 in terms of actions by individual entities and the YWG BRT at the local level, as show in

Table 1. The YWG BRT continues to support the 2015 BIP objectives and has identified specific areas to prioritize in the near term. The YWG BRT has also developed new objectives, which are primarily related to the state and inter-state level.

Table 1: 2015 Objectives, Achievements since 2015, and Current Near-term Focus

2015 BIP Objectives	Achievements Since 2015	Current (Near-term) Focus
Document existing baseline of major decrees; environmental compliance agreements, including the Yampa PBO and in-progress White PBO; water rights administration protocols; and related operations, including documentation of permitted future depletions in basins under such PBOs.	Phase 3 Project[1] The YWG BRT supported the development of the White River PBO by funding refinements to the White River Model under the Phase 3 Project.	Develop or support the development of additional documentation of water rights administration protocols. • Support the Recovery Program's efforts to recover the endangered fish. • Understand the depletion accounting performed by the State of Colorado as required by the Yampa PBO and document permitted future depletions. • Stay involved with the development of the White River Management Plan and PBO. • Get involved, as appropriate, with Recovery Program actions on the Green River, especially as they intersect with the Flaming Gorge Reservoir Record of Decision (ROD). • Support, through financial help and education, water uses installing measurement devices.
Detail the projected effects of water shortages (from drought and climate change) that may require additional water storage development to satisfy existing and future uses.	Phase 3 Project[1] The YWG BRT provided grant funding to support two efforts by the Colorado River District to model and understand potential impacts of compact curtailment[2].	Support ongoing modeling of the White River for the PBO, which includes a monthly climate change scenario along with a daily time stamp quantifying baseline conditions.
Review Division 6 water rights abandonment list and educate pre-compact water rights' owners on how to maintain existing decreed water rights.	Individual entities throughout the basin are working to protect pre-Compact uses and portfolios. A significant amount of outreach and action associated with installing measuring devices, repairing and rehabilitating headgates, and submitting water rights use records, all of which support pre-compact water rights, has taken place since 2015.	Educate pre-compact water rights' owners on how to maintain existing decreed water rights. Create opportunities for pre-compact rights to remain active.
Periodically update and refine estimates for anticipated and unanticipated future water uses.	The Technical Update prepared by the State of Colorado as part of the Colorado Water Plan Update is incorporated into this document. The modeling started with the Phase 3 models and added representation of the five planning scenarios (discussed in Section 5). The Technical Update is part of the cyclical planning process for the State. The Technical Update includes five estimates of future water use.	

1. *Phase 3 Project: The YWG BRT completed the YWG BRT BIP Modeling Phase 3 Project in 2018. This project improved the CDSS modeling of the Yampa and White basins in order to document baseline conditions in workshops, presentations, and a final report. Depletions for major uses and non-consumptive needs are quantified. The Phase 3 modeling effort compared paleohydrology (in the Yampa Basin) and two potential climate change conditions developed by the State of Colorado known as the "In Between" and the "Hot and Dry" scenarios. Water storage project proponents volunteered to have their future projects included in the model, and the impacts on shortages to consumptive and non-consumptive needs are documented.*
2. *Along with the other West Slope Basin roundtables, the YWG BRT helped fund the Colorado River Development and Curtailment Risk Study in 2016 and Basin Roundtable Technical Study on Colorado River Risk Response Options - Phase 2 in 2017.*

Since 2015, stakeholders have accomplished infrastructure improvement projects that benefit both the infrastructure owners and the river. These projects are excellent examples of multi-benefit projects that the YWG BRT will continue to support. The YWG BRT has also identified near-term focus areas to keep the emphasis on these types of projects.

NEW OBJECTIVES

The BRT has developed the following new objectives to further Goal 1:

1. **Ensure the YWG BRT has strong and responsive representation on the IBCC.**
2. **Since 2015, the YWG BRT has formed a Big River Committee (BRC) that is exploring Colorado River Compact matters, such as drought contingency planning and DM. The BRC has developed a recommended draft demand management statement, which articulates principles that are important when developing a DM program and offer protection of essential basin interests. See the Currently Underway section below for more discussion of BRC's work. And for additional details on the BRC and the full DM statement, visit https://yampawhitegreen.com.**
3. **It is anticipated that soon the Colorado State Engineer will develop rules for administering a Colorado River Compact Curtailment. The State Engineer has indicated he will request input from water users. The YWG BRT plans on engaging in the process and encourages its members to do the same.**
4. **Create a process to inform, involve, and educate the public on the IBCC's activities and progress of Colorado River Compact negotiations.**
5. **Create a mechanism by which public input and feedback can be relayed to the IBCC and Colorado River Compact negotiators.**

GOAL 2: Restore, maintain, and modernize water storage and distribution infrastructure

To preserve critical historical water rights and use, as well as watershed health, existing infrastructure in the YWG Basin must be restored, maintained, and modernized. This goal is closely related to several other Basin goals. For example, preserving infrastructure that enables the use of water rights that predate the Colorado River Compact helps to protect basin's water supplies in the event of administration under the compact. Improving agricultural infrastructure helps to improve agricultural water supplies. Modernizing structures located in the river can protect environmental and recreational water uses. Improvements to infrastructure can impact discharges to the stream and water quality. To accomplish the other seven goals, the YWG Basin needs high-quality, high-functioning infrastructure.

Restoration or modernization efforts can address multiple purposes, such as increasing diversion reliability and accuracy, adding hydropower generation, and improving fish and boat passage. There is a nexus between infrastructure improvement and watershed health that is currently being explored by the Yampa River Integrated Water Management Plan (IWMP) and the White River Integrated Water Initiative (IWI). The YWG BRT encourages water users and stakeholders to focus on this nexus when embarking on infrastructure projects.

Table 2: 2015 Objectives, Achievements since 2015, and Current Near-term Focus

2015 BIP Objectives	Achievements Since 2015	Current (Near-term) Focus
Identify opportunities and constraints for agricultural water efficiency improvements (that do not cause injury to other water users or environmental values). This may include interviewing agricultural producers to understand the efficiency, conservation, and/or preservation expectations for the YWG Basin.	As part of the Yampa IWMP, a diversion infrastructure assessment of 45 structures was completed in 2020[1].	The BRT supports the completion of an agricultural return flow study that will help answer these questions.
Identify specific locations in the YWG Basin where infrastructure requires improvement or replacement to preserve existing uses. This may include identifying the potential for value-added multi-purpose to be included, i.e., hydropower to finance agricultural storage, and diversion structure improvements to increase water supply and improve fish and boat passage.	Gibraltar Ditch Project[2] Williams Diversion Project[3] Maybell Canal Water Conservation Project[4] Maybell Ditch Diversion Structure Rehabilitation and Headgate Modernization[5] Upper Yampa Water Conservancy District (UYWCD) Grant Program[6] Walker Ditch Headgate Replacement[7] Sheriff Reservoir Spillway Improvement (Oak Creek)[8]	Continue to support the Yampa IWMP, White River IWI and other stakeholders in the basin undertaking multi-benefit infrastructure projects. Where applicable, monitor the reduction in water loss through more efficient water use, including less seepage through leaky ditches, headgates, and storage ponds. Monitor impacts to return flows and groundwater levels.
Recommend potential solutions in collaboration with local water users. The evaluation of infrastructure projects includes an initial assessment of cost, financing, permitting issues, and potential impacts to other water users. An example may include lining earthen delivery systems and taking inventory of the capacities of existing reservoirs and repairing storage-limited older projects. Research opportunities and constraints to maintain the existing water storage capacity in the	See projects above	The CWCB has a reservoir dredging program that could assist local efforts.

2015 BIP Objectives	Achievements Since 2015	Current (Near-term) Focus
YWG Basin.		
Research potential grant programs for infrastructure improvements.	Yampa River Fund[9] UYWCD Grant Program[6]	Work with Colorado River District Community Funding Partnership[10] to increase the success of YWG stakeholder applications. Work with federal grant programs, such as the Natural Resources Conservation Service and Bureau of Reclamation's WaterSMART, to assist stakeholders in applying for grants.
Identify and include collective partnerships for infrastructure improvements that may provide multi-use benefit, (e.g., fish passage).	See projects above Yampa IWMP Diversion Infrastructure Assessment[1]	Continue to support the Yampa IWMP and White River IWI Support stakeholders in finding partnerships
Evaluate appropriate measuring infrastructure for improved administration of the river.	The Division Engineer has ordered measurement devices be installed on diversion structures. Water users are working to comply with the order.	Conduct public outreach to raise awareness of funding opportunities, such as the UYWCD Grant Program[6] Lobby to increase the number of stream gages in the basin.
Conduct a headgate study in all three river basins that compiles efficiency and effectiveness of existing infrastructure, accessibility to diversion point, and use.	The Yampa IWMP Diversion Infrastructure Assessment[1.] The White River IWI is proceeding with a headgate and riparian assessment.	

1. *Yampa IWMP Diversion Infrastructure Assessment: During the fall of 2019 and summer of 2020, the IWMP assessed the functionality and river conditions of 45 diversion structures. For more information and to read the final report, visit the IWMP website at https://sites.google.com/view/ywgroundtable/assess-conditions?authuser=0*
2. *Gibraltar Ditch Project: The Gibraltar Ditch irrigators and the Nature Conservancy worked together to re-design the diversion structure with twin goals of improving conditions for the irrigators and the river. This site was particularly challenging due to the very dynamic geomorphic conditions, low gradient, and a railroad crossing. An engineered riffle crest was installed in the river. The irrigators use super sacks during the irrigation season to control the water surface elevation for the diversion instead of gravel push-up dams. In combination with the engineered riffle crest, the super sacks are more successful than the previous gravel push-up dam. The in-river infrastructure is low impact, allowing for fish and boat passage. The temporary nature of the super sacks allows the system to respond dynamically to the variable hydrograph, enhancing the riparian corridor and wetlands. The solution avoided impacting the railroad crossing, making the project financially feasible.*
3. *Williams Diversion Project: In 2021, The Nature Conservancy is moving forward with a design/build of the Williams Diversion, Irrigation Delivery and Habitat Enhancement Project at Morgan Bottom on the Yampa River. The Nature Conservancy is partnering with local irrigators to restore the Williams Diversion on Carpenter Ranch and replace the headgate while promoting riparian benefits, and fish and boat passage. The recent diversion assessment conducted by the IWMP will assist with optimizing sustainable design and habitat protection.*
4. *Maybell Canal Water Conservation Project: The Maybell Irrigation District lined 2,900 feet of earthen irrigation canal. This eliminated water seepage and resulted in improved water delivery efficiency and water quality improvements to the Yampa River, and greatly reduced the risk of a canal breach. The project was funded in part by a WaterSmart Grant. The Maybell Irrigation District also installed nine check structures in the ditch to allow better water management by slowing down the flow and raising the water level in the ditch. This improvement work was funded by a YWG BRT grant and The Nature Conservancy.*
5. *Maybell Ditch Diversion Structure Rehabilitation and Headgate Modernization: The project includes engineering design and construction plans to improve the diversion structure and replace the headgate on the Maybell Ditch. Once installed, the modern headgate will allow irrigators to better control the volume of water diverted from the Yampa. This will improve flows for non-consumptive users along 18 miles of the Yampa, as well as improve delivery for Maybell irrigators. This work is a partnership with Maybell Irrigation District, The Nature Conservancy, and Friends of the Yampa. https://yampawhitegreen.com/projects*
6. *UYWCD Grant Program: The UYWCD and the YWG BRT have partnered to provide 50/50 matching funds for a $200,000 grant pool that assists irrigators in the Upper Yampa River Basin install measuring devices, headgates, and diversion infrastructure upgrades. The Diversion Infrastructure Improvement Project offers a 50% reimbursement for installations or upgrades under $10,000. The simple application process makes grant funds available to a diverse group ranging from small projects, like the installation of a Parshall flume, to large projects, such as diversion structure upgrades that improve river health. As of April 2021, the grant program had distributed a total of $34,991.00. Additionally, UYWCD has provided in-kind contributions, including development and distribution of application and marketing materials in the amount of $7,500. Potential applicants have inquired about funding eligibility for projects to be completed in 2021.*
7. *Walker Ditch Headgate Replacement: The Project replaces a major diversion headgate and flood control structure serving the Walker Ditch located on the Yampa River three miles east of Hayden. The project headgate was constructed in approximately 1940 after the river migrated*

north away from the original 1890 headgate location. The 1940 river migration required an extension of the ditch through the old channel and new headgate structure on the new river channel.

8. *Sheriff Reservoir Spillway Improvement: As stated in the Town of Oak Creek's grant application, Sheriff Reservoir provides the sole source of water storage for the Town of Oak Creek... Three significant dam safety issues have been identified by the Colorado Division of Water Resources (DWR) Division 6 Dam Safety Engineer at this 67-year-old dam. The spillway capacity is well below the minimum DWR requirements, which could result in a dam overtopping failure. Sinkholes were identified in the dam's glacial moraine foundation in 2018, which indicates a potential for dam failure due to foundation erosion... The outlet works gate is also experiencing operational problems due to the age of the outlet gate ... The Town would use the grant funds to work with the DWR in 2021 to optimize mountain hydrology and better define basin infiltration, incorporate envelope curve methods, and conduct a risk analysis to refine the final design criteria, which could reduce the project cost by millions of dollars.*

9. *Yampa River Fund: The Fund launched in 2019. "The Yampa River Fund is a collaborative community-based organization dedicated to identifying and funding activities that protect the water supply, wildlife habitat, and recreational opportunities provided to us by the Yampa River. The Yampa River Fund will invest in conservation and restoration activities that positively impact Yampa River flows to support the livelihoods of recreation outfitters and ranchers throughout the valley, and to ensure that a healthy, flowing Yampa River remains the thriving center of our communities for generations to come." For more information, refer to https://www.yampariverfund.org.*

10. *Colorado River District Community Funding Partnership: "The Colorado River District's Community Funding Partnership was created in 2021 to fund multi-purpose water projects on the Western Slope in five project categories: productive agriculture, infrastructure, healthy rivers, watershed health and water quality, and conservation and efficiency. Funding for the program was approved by Western Colorado voters as part of ballot question 7A in November 2020. These funds provide a catalyst for projects that are priorities for residents in the District to receive matching funds from state, federal, and private sources." For more information, visit https://www.coloradoriverdistrict.org/community-funding-partnership/*

NEW OBJECTIVES

The YWG BRT has developed the following new objectives to further this goal:

1. **Support avenues to share best management practices for municipal systems to address leak detection and tank inspections, among others.**

2. **Create demonstration projects to use as educational tools for best management practices.**

GOAL 3: Protect and encourage agriculture uses of water in the YWG Basin within the context of private property rights.

This goal is primarily focused on policy and education. The YWG BRT supports the continuation of viable agriculture in the YWG Basin. This goal seeks to strike a balance between supporting agricultural water users remaining in agriculture and preserving their legal ability to change their water use. While the YWG BRT opposes the dry-up of agricultural land in the YWG Basin, it also recognizes the importance of private property rights in the successful operation of Colorado's long-standing water rights system. Therefore, the YWG BRT is committed to encouraging the preservation of agriculture through any effective voluntary means. To further that goal, future education efforts of the YWG BRT may also focus on encouraging the preservation of agricultural land in the YWG Basin. Of particular interest are projects that can use senior agricultural water rights that may be at risk of abandonment.

An emerging concern related to this goal is the conversion of working ranches to second homes for absentee landowners. The aesthetic quality of the ranch may be preserved, but agricultural production declines. The YWG BRT encourages keeping agricultural lands in production to maintain a viable agricultural economy.

The YWG BRT would like to highlight the importance of conservancy and conservation districts in the Yampa-White-Green Basin. These districts can represent the needs of agricultural water users and help promote policy discussions that benefit agriculture. Local districts can also educate their constituents on water issues. In the White River Basin, the White River and Douglas Creek Conservation Districts are leading the White River Integrated Water Initiative (IWI) effort. This is one example of how local districts can bolster agricultural water use and seek partnerships with municipal, industrial, environmental, and recreational groups.

Table 3: 2015 Objectives, Achievements since 2015, and Current Near-term Focus

2015 BIP Objectives	Achievements Since 2015	Current (Near-term) Focus
Evaluate potential cooperative and/or incentive programs to reduce agricultural water shortages		
Identify projects that propose to use at-risk water rights, alternative transfer methods, and water banking that protects and encourages continued agricultural water use		
Encourage and support M&I projects that have components that preserve agricultural water uses	Rangely, Rio Blanco County[1]	
Encourage land use policies and community goals that enhance agriculture and agricultural water rights	Yampa River Leafy Spurge Project[2] 2016 Rio Blanco County Land and Resource Plan and Policies[3]	

1. *Rangely, Rio Blanco County: In early 2021, Rio Blanco Water Conservation District awarded a conditional water right that includes water specific for Rangely, along with augmentation to create a nearly White River Basin-wide blanket augmentation plan that protects agriculture's ability to use full water rights while reducing the future potential of a municipal "buy and dry" of agricultural lands.*
2. *Yampa River Leafy Spurge Project: The YWG BRT provided grant funding for the Yampa River Leafy Spurge Project—Integrated Management & Predictive Modelling—Research Component. The project is establishing an effective program of integrated management for leafy spurge, an emerging threat to the regional agricultural economy and riparian watershed health.*
3. *2016 Rio Blanco County Land and Resource Plan and Policies: In May of 2016, Rio Blanco County finalized and adopted the Plan. For more information, visit https://rbc.us/578/Natural-Resources.*

NEW OBJECTIVES

The YWG BRT has developed the following new objectives to further this goal:

1. **Support local conservancy and conservation districts with efforts to bolster agricultural water use and seek partnerships with municipal, industrial, environmental, and recreational groups.**
2. **Engage agricultural users in water policy and management discussions by using proven and effective communication tools that reach agricultural producers.**
3. **Invest in education and outreach efforts that inform a broader audience (both in-basin and statewide) about agricultural water management and needs and how they can be met in the YWG Basin.**

GOAL 4: Improve agricultural water supplies to increase irrigated land and reduce shortages.

This goal is closely related to the previous goal but focuses on infrastructure and research instead of policy and education. While it is common for agricultural areas in Colorado to be water-short, agricultural shortages represent a real need and opportunity for improvement. In areas around the YWG Basin, irrigators presently practice deficit irrigation due to lack of water supplies. Agriculture is vulnerable to climate change due to the expected changes in hydrology, and the increase in crop irrigation requirements due to warming temperatures. In addition, the YWG Basin is the only basin in the State projecting the addition of up to 14,805 irrigated acres in the Yampa Basin and up to 2,800 irrigated acres in the White Basin. The potential for new developable irrigation lands in the Yampa Basin was documented in the BRT's Agricultural Needs Study (2010). In the White Basin, Rio Blanco Water Conservancy District has completed a study identifying non-federal lands with high suitability for farming. The analysis undertaken in the BIP Update seeks to better define the "ag gap" in the YWG Basin. This fits with the CWCB's emphasis on comparing agricultural, M&I, and environmental and recreational gaps on an equal footing.

As discussed above, the YWG BRT has initiated the Yampa IWMP and supports the White River IWI. Both of these projects seek to identify multi-benefit projects that will address agricultural water supplies and improve environmental and recreational conditions. Progress has also been made on identifying and characterizing agricultural gaps. The YWG BRT has developed near-term focus areas to help continue making progress on the objectives outlined in the 2015 BIP.

Table 4: 2015 Objectives, Achievements since 2015, and Current Near-term Focus

2015 BIP Objectives	Achievements Since 2015	Current (Near-term) Focus
Identify specific locations in the YWG Basin where agricultural shortages exist and quantify the shortages in times, frequency, and duration. Consider the potential effects of climate change, drought, and compact administration on water availability. Identify projects that will bring new irrigable lands in the YWG Basin into production using new water diversions.	Phase 3 Project[1] The Technical Update modeling presented in this document includes agricultural shortages. The YWG BRT provided grant funding to continue lysimeter operations and consumptive use quantification in high-altitude irrigated meadows in the YWG Basin. This project collects much-needed data on agricultural water use. UYWCD Elk River Blanket Augmentation Plan Developed Scope of Work for Ag Return Flow Study	Return Flow Study Support ongoing modeling of the White River for the PBO, which includes a monthly climate change scenario along with a daily time stamp quantifying baseline conditions. This modeling may be useful for identifying specific reach shortages. Wolf Creek Reservoir includes an augmentation component that could be used to support junior water rights to irrigate new ag lands or better irrigate existing ag lands.
Recommend possible site-specific solutions in collaboration with local water users. Recommendations include an initial analysis of hydrology (water variability), cost, financing, and permitting. Recommended projects could include new storage, especially locations for small-scale agricultural water storage projects, enlargement or repair of existing reservoirs, and infrastructure to improve irrigation system efficiency, among others.	The YWG BRT provided grant funding for Crosho Lake and Reservoir - Simon #1 Dam Outlet Replacement. This project fixes structural problems and enables the dam to operate safely as an agricultural water supply. Martin Springs Irrigation Project[2] White River Storage Project Phase 2A Study[3]	Continue support for the Yampa IWMP and White River IWI processes, which will result in project recommendations. Investigate and pursue opportunities to improve agricultural efficiencies and place the saved water in storage for late-season releases to agriculture. Encourage project proponents for projects such as Lake Avery Enlargement and Wolf Creek Reservoir[3] to include agriculture as they continue to advance their projects.
Evaluate multiple objectives of recommended solutions.		Continue support for the Yampa IWMP and White River IWI processes, which are looking for multi-benefit solutions. Continue support for the Yampa IWMP and White River IWI as they complete diversion infrastructure assessments and refine non-consumptive needs characterizations.
Develop methods to assist with streamlining permitting in a cost-effective manner.		The Lower White River Storage Project Pre-Permitting grant scope of work issued by the CWCB includes a specific task referring to the "Colorado Water Supply Planning and Permitting Handbook" (October 2017), developed after a "Lean Process Improvement Event" hosted by the State of Colorado and EPA. This process is supported by the CWCB and YWG BRT.
Preserve the current baseline of approximately 119,000 irrigated acres and expand by 12% by 2030.	The Technical Update modeling presented in this document includes new irrigated acres.	
Reduce agricultural shortages basinwide by 10% by the year 2030.		

1. *Phase 3 Project: The YWG BRT completed the Yampa-White-Green Basin Roundtable Basin Implementation Plan Modeling Phase 3 Project in 2018. This project documented current conditions in the Yampa and White basins by improving the CDSS modeling and crafting a final report. Water use and shortages to agriculture are included. The Phase 3 modeling effort considered paleohydrology (in the Yampa Basin) and two*

potential climate change conditions developed by the State of Colorado known as the "In Between" and the "Hot and Dry" scenarios. Impacts on shortages to agriculture are documented.

2. *Martin Springs Irrigation Project: This project will make improvements to an existing storage pond and point of diversion. They will dredge an existing pond to remove accumulated sediment. This will provide capacity for the absolute storage right of 3.5 acre-feet. They will install a stainless-steel head gate and 12" HDPE pipe diversion structure and construct approximately 600 feet of lateral swales for 11.42 irrigated acres. https://yampawhitegreen.com/projects/.*

3. *White River Storage Project Phase 2A Study: In March of 2015, the Rio Blanco Water Conservancy District completed an initial feasibility study to identify potential water storage sites in the White River Basin, referred to as the Phase 1 study. The Phase 1 study evaluated 25 potential storage sites along the White River and concluded that a new reservoir, located near the confluence of the White River and Wolf Creek, would provide a very efficient, cost effective, multipurpose water project for northwestern Colorado. The objective of the Phase 2A Study is to continue work to refine the primary alternatives (Wolf Creek Reservoir) to meet the many important water conservation needs within the Rio Blanco Water Conservancy District so that the project permitting phase may begin.*

NEW OBJECTIVES

A key challenge facing agriculture is warming temperatures. The BRT has identified new actions to help gather and disseminate the kind of information agricultural producers will need to increase resilience:

1. **Support refining CWCB's irrigated acreage assessment, specifically the acreage to ditch assignments. The total number of irrigated acres is updated every five years. Ditch service areas were assigned in 1993 and are only updated if a problem is identified. The irrigated acreage assessment is a key input to the CDSS models, which are used to identify water shortages.**

2. **Support a return flow study. The usual agricultural practice in the YWG basin is flood irrigation, which increases the soil moisture and generates lagged return flows that come back to the river later. More information is needed to understand the potential trade-offs to the river if high-efficiency irrigation methods are implemented on a large scale.**

3. **Support research and education on alternative irrigation regimes, impacts of invasive species and noxious weeds, improved hydrological forecast modeling, cloudseeding, and climate change adaptation.**

4. **Support education and programs that improve soil and range health.**

5. **Support education and programs that improve forest/watershed health.**

6. **Refine the Agricultural Needs Assessment, especially to produce a user-friendly and accessible map of lands of significant agricultural value.**

GOAL 5: Identify and address M&I water shortages

As the YWG Basin continues to grow, its M&I water needs must be identified and addressed. The later development of the YWG Basin and the junior status of its water rights portfolio among Colorado River Basin tributaries is a concern. The rights used to fill reservoirs for municipal use are generally adequate with respect to in-basin uses but are junior to many adjudication dates within the Colorado River Basin and San Juan River Basin in Colorado. Gaining sufficient security for these uses against curtailment is an important point in our BIP.

Population growth and future anticipated and unanticipated needs are also concerns for the Basin. The Technical Update reports that "between the years 2015 and 2050, it is projected to change from approximately 44,000 to between 39,000 and 103,000 people in the low and high growth projections, respectively." Adequate storage, along with strong municipal conservation measures, must be coordinated with drought plans to adequately address the situation. Additionally, redundancy of supply sources is an important consideration for municipal providers in the YWG Basin in order to prepare for potential wildfire impacts to municipal watersheds. Projects useful for both drought and supply redundancy planning should be identified and pursued. Municipal and domestic water providers regularly engage in planning for their systems. The BRT supports these planning efforts and encourages water suppliers to execute their plans. Recently, the BRT has identified a new objective to support smaller water providers in performing water supply master planning based on best practices.

Industrial demands in the YWG Basin are in a time of great uncertainty. Traditionally, the largest users of industrial water in the Yampa Basin have been coal-fired power plants at Craig Station (operated by Tri-State Transmission and Generation) and Hayden Station (owned and operated by Xcel Energy), and the supporting coal mines (ColoWyo Mine and Trapper Mine). Both Tri-State and Xcel have announced their plants and supporting coal mines will be closing. The entities are exploring their options with regard to their land and water right assets. The YWG BRT supports a new industry coming to the Yampa Basin to replace the lost jobs. The BRT encourages Tri-State and Xcel to find creative uses for their water rights.

In the White River Basin, the future of energy development remains uncertain. As discussed in the Energy Development Water Needs Assessment Update Phase III Final Report (2014), the Piceance Basin in the White River contains extensive deposits of conventional oil and oil shale. Currently, oil and gas companies are extracting oil and natural gas in the White River Basin at a modest scale, but the potential for development is large.

Progress has been made on the 2015 BIP Objectives related to this goal. The BRT has set additional near-term focus objects and new objectives for the BIP Update.

Table 5: 2015 Objectives, Achievements since 2015, and Current Near-term Focus

2015 BIP Objectives	Achievements Since 2015	Current (Near-term) Focus
Identify specific locations in the YWG Basin where M&I shortages may exist in drought scenarios and quantify the shortages in time, frequency, and duration.	The BRT completed the YWG BRT BIP Modeling Phase 3 Project. This project documented current conditions in the Yampa and White basins by improving the CDSS modeling and crafting a final report. Water use and shortages to M&I are included. The Technical Update modeling presented in this document includes M&I shortages.	
Identify impacts throughout the YWG Basin in the context of water shortages (drought and climate change), wildfire, and potential compact compliance obligations on M&I demands.	The Phase 3 Project and the Technical Update consider drought and climate change. Fish Creek Critical Community Wildfire Watershed Protection Plan (Steamboat Springs)[1]	
Identify projects and processes that can be used to meet M&I needs.	The BIP Update Projects list addresses this objective. Steamboat Springs and Mount Werner Water Master Plan	Support the Yampa IWMP and White River IWI.
Encourage collaborative multi-purpose storage projects.	Collaborative multi-purpose projects are a significant part of the Yampa IWMP and White River IWI. The YWG BRT provided grant funding for the White River Storage Project - Phase 2A Study. New storage in the White River could serve Rangely, agriculture, industry, and environmental needs. Decreed uses for the proposed Wolf Creek Reservoir include municipal water for the Town of Rangely and replacement water that can be released to offset other future water uses within the District boundaries and within the Yellow Jacket Water Conservancy District.	Support the Yampa IWMP and White River IWI.
Support efforts of water providers to secure redundant supplies in the face of potential watershed impacts from wildfire.	City of Steamboat Springs has secured a storage contract from Steamboat Lake to support a future redundant supply on the Elk River.	The City of Steamboat Springs and Mount Werner Water are in the process of expanding their Yampa wells to provide redundancy.
Encourage municipal entities to meet some future municipal water needs through water conservation and efficiency.	Many municipal entities have enacted water conservation and efficiency programs. This includes the City of Steamboat Springs' Water Conservation Plan, which was funded by the CWCB. The YWG BRT provided grant funding to support the Water Infrastructure and Supply Efficiency (WISE) Partnership: Conjunctive Use Infrastructure project.[2]	Continue to support water conservation for all suppliers of M&I water.

1. *Fish Creek Critical Community Wildfire Watershed Protection Plan: The (CWP)2 was jointly developed by the City of Steamboat Springs and Mount Werner Water & Sanitation District. As stated on its website, the plan looks before, during, and after a wildfire to protect the critical*

drinking water supply and infrastructure as well as overall watershed health. For more information, visit https://www.steamboatsprings.net/928/Fish-Creek-Watershed-Wildfire-Protection

2. *Along with basin roundtables across the state, the YWG BRT helped to fund the WISE Partnership: Conjunctive Use Infrastructure Project. The project developed more sustainable water practices in the Denver and Denver Metro area. The WISE partnership allows Denver Water, Aurora Water, and South Metro Water Supply Authority to share their resources under certain circumstances to minimize unsustainable groundwater pumping for municipal use.*

NEW OBJECTIVES

M&I water providers in the YWG Basin face considerable changes in the future. Accomplishing the following new objectives will help them be prepared:

1. **Support water supply master planning as a way for entities to identify their water supply gaps and develop strategies. In particular, the YWG BRT will connect smaller water providers with the necessary resources to develop water supply master plans.**

2. **Encourage water providers' planning processes to look beyond 2050. While the BIP Update has a planning horizon of 2050, other planning efforts should not feel so constrained.**

3. **Identify challenges for municipal providers in light of new regulations. These include corrosion control for drinking water supplies to reduce in-home levels of lead and copper, and wastewater system nutrient, temperature, metals regulations, and wastewater collection system inflow and infiltration requirements. The YWG BRT can play a role in developing strategies that work across the YWG Basin.**

4. **Identify and implement source water protection programs. This objective could be accomplished through partnerships across the YWG Basin.**

5. **Connect municipal and special district water providers with technical resource, and grant programs and provide a forum for a two-way exchange of ideas to enhance participation.**

GOAL 6: Quantify and protect environmental and recreational water uses

Environmental and recreational water uses are critical to the economy and way of life in the YWG Basin. The YWG BRT recognizes the economic value of the relatively natural flow regimes of the Yampa and White river systems. This goal addresses how to protect these values.

The YWG BRT has been at the forefront of quantifying environmental and recreational water uses. In 2010, the Environmental and Recreational Non-Consumptive Focus Mapping was completed. This study identified important non-consumptive characteristics by reach. In 2012, the Watershed Flow Evaluation Tool (WFET) was developed, which evaluates the risk to environmental and recreational attributes based on changes to the flow regime. For the Technical Update, the WFET framework was applied statewide on a monthly basis to produce the Flow Tool. The Flow Tool provides a common platform for non-consumptive needs and flow-ecology relationships throughout Colorado. In the 2015 BIP, the YWG BRT inventoried and mapped environmental and recreational projects. This list has been updated for the BIP Update and incorporated into the Projects list.

The Colorado Water Plan encouraged the use of Stream Management Plans and other tools to help protect environmental and recreational attributes. The YWG BRT has taken this recommendation seriously. The YWG BRT provided grant funding to support the City of Steamboat's Yampa River Management Plan in 2016 and the implementation of the Yampa River Forest Restoration Project and Temperature Mitigation Project, which are some of the actions identified in the plan. As discussed above, the YWG BRT is leading the Yampa IWMP. This project seeks to collect new data to better quantify environmental water uses in the four segments of interest and to protect agricultural, environmental, and recreation water uses through multi-benefit projects. The YWGBRT also supports the White River IWI and looks forward to partnering with the conservation districts as they move through their community-driven processes.

Recovery of the endangered fish native to the Yampa, White, and Green rivers is important to the YWG BRT. The BRT would like to call attention to how the fishes use the Yampa, White, and Green rivers as one connected habitat and encourage the USFWS to consider a holistic approach, when appropriate and feasible under the constraints of the existing and future PBOs and Management Plans, and the Flaming Gorge Record of Decision.

Progress has been made on the 2015 BIP objectives related to this goal. The YWG BRT has set additional near-term focal points and new objectives for the BIP Update.

Table 6: 2015 Objectives, Achievements since 2015, and Current Near-term Focus

2015 BIP Objectives	Achievements Since 2015	Current (Near-term) Focus
Identify specific locations in the YWG Basin where identified non-consumptive needs are not being met. Apply the findings and results on flow-alteration risks and non-consumptive needs from the WFET, Alternative Transfer Methods, and Projects and Methods studies for the YWG Basin and compare those with the hydrologic, operational, and depletion assumptions for the PBO and proposed BIP projects. Otherwise, quantify flow needs in time, frequency, and duration at nodes identified in the study.	The Phase 3 modeling effort examined the Yampa and White rivers on a daily time-step at identified non-consumptive attribute locations using the WFET and the boatable days survey by American Whitewater. The impacts of alternative operational scenarios were considered.	

2015 BIP Objectives	Achievements Since 2015	Current (Near-term) Focus
Recommend potential site-specific solutions and projects in collaboration with local water users. Recommended solutions may include an initial analysis of the hydrology, the impact of climate change, interstate compacts, cost, financing, and permitting.	City of Steamboat's Yampa River Health Assessment & Streamflow Management Plan[1] Yampa IWMP White River IWI Lake Avery 3 in 10 Lease and water user coordination[2] Colorado Water Trust, UYWCD, City of Steamboat and CWCB collaboration to supplement Yampa River streamflow with releases from Stagecoach Reservoir.	Continue to support the on-going efforts of Yampa IWMP and White River IWI.
Perform analyses to maximize the effectiveness of recommended solutions for meeting multiple objectives (i.e., consumptive and non-consumptive). Examples of projects include appropriating new in-stream flow water rights; water rights and storage leasing; diversion, headgate, structures, and river improvement to enhance irrigation efficiencies; and riparian restoration and habitat improvement to improve specific and general watershed health for consumptive and non-consumptive uses alike.	It is anticipated that this will be an outcome of the Yampa IWMP. The White River IWI is also focused on multiple benefits.	Continue to support the on-going efforts of Yampa IWMP and White River IWI.
Recognize that floodplains, riparian areas, and wetlands are natural storage reservoirs, and implement restoration projects to maintain and improve these storage reservoirs. Rehabilitation of degraded riparian areas and reconnection of floodplains in degraded stream systems allows spring floods to recharge groundwater tables for slow release to the stream system later in the summer, which supports low flows and helps maintain non-consumptive benefits.	The YWG BRT provided grant funding for the Yampa River Leafy Spurge Project—Integrated Management & Predictive Modelling—Research Component. The project is establishing an effective program of integrated management for leafy spurge, an emerging threat to regional agricultural economy and riparian watershed health. The White River Partnership[3] will begin riparian restoration along the main stem of the White River and Yellow Creek beginning April 2022.	Track restoration projects and support maintenance of restored habitats. Implement riparian restoration activities identified in Steamboat Stream Management Plan (SMP), Yampa IWMP, White River IWI, and Steamboat Wetland Restoration Feasibility Study. Lower White River Weed and Pest District is undertaking a riparian restoration project, which is specified as a goal of the White River IWI. Reconnect streams with floodplains. Maintain and restore wetland and riparian habitats.
The PBO and its depletion coverage for the Yampa River Basin for existing and future anticipated and unanticipated depletions will meet base flow targets in critical habitat areas and assist with endangered fish recovery.	In 2015, the Aspects of the Yampa River Flow Regime Essential for Maintenance of Native Fishes by Kevin R. Bestgen was published. This report provided an update to the science and helps guide the releases from Elkhead Reservoir to supplement natural flows to support the fish recovery and disadvantage the non-native species.	Continue support of Elkhead Reservoir operations to assist with recovery. Continue to have YWG BRT members engage in implementing the Yampa Management Plan, including if, in the future, the flow recommendations are revisited.

2015 BIP Objectives	Achievements Since 2015	Current (Near-term) Focus
A PBO for the White Basin would provide certainty for existing and a portion of future anticipated depletions and would assist with endangered fish recovery	Currently, the Recovery Program is preparing a Management Plan for the White River Basin. In 2019, the USFWS finalized its Review of Fish Studies with Interim Flow Recommendations for Endangered Fishes of the White River, Colorado and Utah. It is anticipated that this Management Plan and accompanying future PBO will finalize flow recommendations, cover a portion of new development in the White Basin, and identify actions to promote the recovery of the endangered fish. The YWG BRT provided funding for the daily flow model development.	Continue to support the finalization of the White River Management Plan and PBO. Encourage the USFWS to consider a holistic approach, when appropriate and feasible, to recovering the endangered fish in the Yampa, White, and Green rivers.
Investigate the flow needs of non-consumptive attributes not included in the WFET.	Steamboat SMP (Yampa River Health Assessment & Streamflow Management Plan)	Yampa IWMP White River IWI
Research and design multi-purpose projects to improve riparian or aquatic ecology and bank stability without changing the existing flow regime while voluntarily modernizing irrigation diversion systems and reducing bedload deposits. Similar projects will be researched and designed to improve recreational boating while voluntarily modernizing irrigation systems.	Steamboat Springs SMP Lower Elkhead Creek Restoration Project[4] See additional irrigation infrastructure improvement projects listed under Goal 2: Restore, maintain, and modernize water storage and distribution infrastructure.	Yampa IWMP White River IWI
Recognize and protect the economic values of the relatively natural flow regimes of the Yampa and White River systems.	The Yampa River Fund conducted an economic analysis of the benefits of river health.	
Analyze the impact of future projects on non-consumptive needs. Ascertain whether further non-consumptive future projects need to be identified.	This objective is addressed in Section 6.	

1. *"The purpose of the Yampa River Health Assessment and Streamflow Management Plan is to identify and implement a long-term strategy for protecting and improving the health and resiliency of the Yampa River near Steamboat Springs…This plan provides the community of Steamboat Springs with an executable implementation strategy and scientifically based and stakeholder-driven foundation for future planning, decision making, and negotiation for the management of the Yampa River." For more information, refer to https://steamboatsprings.net/587/Yampa-River-Health-Streamflow-Management*

2. *Lake Avery 3 in 10 Lease and water user coordination: CPW operated three releases in a 10-year period from 2011 through 2020 to supplement streamflow in the White River during extremely low flow. Outreach to local diverters, coupled with releases from Lake Avery, allowed this program to improve the fishery conditions through the White River instream flow reach from August through October in 2012, 2018, and 2020. Local diverters and the Yellow Jacket Water Conservation District worked cooperatively to ensure the releases stayed in the river. Yellow Jacket Water Conservation District also contributed water from its rights in the Highland Ditch. Now that the original 10-year period is over, CPW is exploring additional options, such as the newly created 5 in 10 Lease under HB 20-1157.*

3. *White River Partnership (WRP): Formalized from 2019-2021 to improve the riparian zone of the White River. 14 partners and 3 advisory entities from the White River basin in Colorado and Utah developed a memorandum of understanding and restoration framework to collaboratively work towards controlling tamarisk, Russian olive, and other invasive vegetation and replacing it with healthy, native vegetation. The WRP secured funds to begin restoration implementation in April 2022 on approximately 30 acres of the White River main stem and Yellow Creek. Additional information and contact available here: https://riversedgewest.org/white-river-partnership*

4. *The Lower Elkhead Creek Restoration Project is a large-scale restoration effort aiming to 1) restore the riparian corridor, 2) improve river function and health, and 3) help protect working lands and agricultural operations on lower Elkhead Creek. Phase 1 of the project started in Fall 2020 and will be a multi-year effort. The Phase 1 project area includes approximately five miles of lower Elkhead Creek (directly downstream of Elkhead Reservoir), more than 200 acres of adjacent agricultural land, and several pre-compact water rights and points of diversion (including the Smith Ditch and Starr Irrigation Ditch). Trout Unlimited and Natural Resources Conservation Service are working with private landowners on lower Elkhead Creek to come up with solutions that benefit both the creek and agricultural operations.*

NEW OBJECTIVES

The YWG BRT's primary focus is the continued support and completion of the Yampa IWMP and the White IWI; however, four new objectives were identified that will likely dove-tail into the current efforts:

1. **Quantify non-consumptive demand for municipalities (drives wastewater discharge permits and infrastructure needs) and strategies to meet those targets.**
2. **Support development or increased flexibility of delivery mechanisms for points of diversion, such as instream flow designations or other tools.**
3. **Support the Yampa River Fund. Launched in 2019, the fund "is a collaborative community-based organization dedicated to identifying and funding activities that protect the water supply, wildlife habitat, and recreational opportunities provided to us by the Yampa River. The Yampa River Fund will invest in conservation and restoration activities that positively impact Yampa River flows to support the livelihoods of recreation outfitters and ranchers throughout the valley, and to ensure that a healthy, flowing Yampa River remains the thriving center of our communities for generations to come." For more information, visit https://www.yampariverfund.org.**
4. **Invest in education and outreach efforts that inform a broader audience (both in-basin and statewide) about environmental and recreational water needs and how they can be met in the basin programs and provide a forum for a two-way exchange of ideas to enhance participation.**

GOAL 7: Maintain and consider the existing natural range of water quality that is necessary for current and anticipated water uses

The quality of water in the YWG Basin reflects the robust health of the natural environment of the western slope of Colorado. Water quality and quantity are intrinsically linked, in that quality directly affects the value of a water right for all uses—M&I, agriculture, recreation, and environmental. As demands for use of this resource increase, water quality management becomes more critical.

Progress has been made on the 2015 BIP objectives related to this goal. The YWG BRT has set additional near-term focus objectives and new objectives for the BIP Update.

Table 7: 2015 Objectives, Achievements since 2015, and Current Near-term Focus

2015 BIP Objectives	Achievements	Near-term Focus
Encourage and support water quality protection and monitoring programs in the sub-basins of the YWG Basin through watershed groups, municipalities, land management agencies, and other efforts.	Fish Creek Critical Community Wildfire Watershed Protection Plan (Steamboat Springs)[1] City of Steamboat's Yampa River Health Assessment & Streamflow Management Plan[2] 2016 Upper Yampa River Watershed Plan[3] Characterization of Streamflow, Suspended Sediment, and Nutrients in the Upper Yampa River Basin[4] White River Algae Research Project[5] White River Temperature Study[6] White River Benthic Macroinvertebrate Study[7]	Partner with the weed and pest districts to support integrated pest management in the White River Basin[8] Support implementation of the 2016 Upper Yampa River Watershed Plan[3] Support the continuation of a water quality study in the lower Yampa and the White basins Support the River Health Scorecard by Friends of Yampa (IPP 2020-0054) Support the Steamboat Springs stream temperature monitoring program

1. *Fish Creek Critical Community Wildfire Watershed Protection Plan was jointly developed by the City of Steamboat Springs and Mount Werner Water & Sanitation District. As stated on its website, the plan looks before, during, and after a wildfire to protect the critical drinking water supply and infrastructure as well as overall watershed health. For more information, visit https://www.steamboatsprings.net/928/Fish-Creek-Watershed-Wildfire-Protection*

2. *"The purpose of the Yampa River Health Assessment and Streamflow Management Plan is to identify and implement a long-term strategy for protecting and improving the health and resiliency of the Yampa River near Steamboat Springs...This plan provides the community of Steamboat Springs with an executable implementation strategy and scientifically based and stakeholder-driven foundation for future planning, decision making, and negotiation for the management of the Yampa River." For more information, visit https://steamboatsprings.net/587/Yampa-River-Health-Streamflow-Management*

3. *In 2016, the Upper Yampa Watershed Group published the Upper Yampa River Watershed Plan: Protecting and Managing Long Term Health. The mission of the Upper Yampa Watershed Group is "maintaining and improving the chemical, physical, and biological health of the upper Yampa River and its tributaries through the creation of a non-regulatory plan that informs decision making and increases local capacity to protect and enhance water quality, promote water conservation, and sustain the present health of the watershed." The Plan identifies trends of concern by sub-basin and projects that address the concerns. For more information, refer to https://steamboatsprings.net/DocumentCenter/View/8714/Upper-Yampa-Watershed-Plan---May-2016?bidId=*

4. *The Characterization of Streamflow, Suspended Sediment, and Nutrients in the Upper Yampa River Basin project will obtain a better understanding of the causes of increased prolific algal occurrences in the Upper Yampa River watershed. https://yampawhitegreen.com/projects*

5. *The White River Algae research project scope of work will be conducted by USGS to improve the understanding of why an excessive amount of benthic algae is occurring in the White River over the past 3 to 5 years. A better understanding based on science is expected to lead to the development of mitigation strategies for decreasing benthic algae in the White River. https://yampawhitegreen.com/projects*

6. *The White River Temperature Study was conducted in 2019-2020 by Trout Unlimited and CPW. Study objectives were to 1) identify spatial and temporal trends in stream temperature, 2) explore local effects of air temperature and discharge on stream temperature, 3) examine the thermal suitability of the upper White River for aquatic biota, and 4) provide the USGS with continuous temperature data for inclusion in its*

investigation of benthic algal occurrence. The final report is available online: *https://www.whiterivercd.com/uploads/2/6/0/6/26068836/stream_temps_in_upper_white_river_-_hodge-eyre.pdf*

7. *White River Benthic Macroinvertebrate Study (aka Bug Study) was conducted in 2017-2019 by Trout Unlimited and CPW in cooperation with the White River and Douglas Creek Conservation Districts. Primary tasks were to 1) characterize spatial and temporal pattens in benthic macroinvertebrate (i.e., bug) communities, and 2) explore evidence (or lack thereof) for algae and insecticide effects on benthic macroinvertebrates. For more information, visit* *https://www.whiterivercd.com/uploads/2/6/0/6/26068836/final_white_river_macroinvertebrate_analysis_report_2017-2019.pdf*

8. *In Rio Blanco County, there are three weed and pest districts: Rio Blanco County Weed and Pest District; Piceance Creek Weed and Pest District; and Lower White River Weed and Pest District. These districts:*
   - i. *Prevent the spread of dangerous economically devastating weed species*
   - ii. *Preserve the integrity of the landscape and conserve local resources*
   - iii. *Deter management costs for adjoining landowners*
   - iv. *Prevent long-term environmental degradation in areas such as, but not limited to riparian, agricultural, and wildlife areas*
   - v. *Comply with the Colorado Noxious Weed Act*

The BRT and the weed and pest districts have overlapping interests in several areas. For water quality, both are interested in preventing aquatic nuisance and invasive species. These species can flourish when water quality is degraded and further damage water quality through their life cycles. The YWG BRT will pursue opportunities to work with the weed and pest districts to improve water quality throughout the White River Basin.

NEW OBJECTIVES

The YWG BRT has traditionally focused on issues of water quantity, but good water quality cannot be taken for granted. The YWG BRT has identified the following new objectives:

1. **Evaluate solutions to address how temperature problems might be alleviated in the face of a warming climate.**
2. **Address sediment transport on the lower White River.**
3. **Support nutrient management throughout the YWG Basin. Increase data collection and studies to address algae blooms in Stagecoach Reservoir and Steamboat Lake. Support the completion of the White River algae study and any necessary follow up work.**
4. **Increase public access to data and facilitate better coordination with the water quality work currently being done in the basin. Investigate the feasibility of a single database or data portal.**
5. **Support non-point-source water quality efforts (i.e., riparian and flow restoration and land use practices) that benefit point-source dischargers, such as wastewater treatment facilities, through water quality trading and improved assimilation capacity.**
6. **Engage in collaborative efforts to address wildfire-watershed risks.**
7. **Facilitate public awareness of threats to water quality, including catastrophic wildfire, and promote participation in efforts to mitigate those threats.**

GOAL 8: Develop an integrated system of water use, storage, administration, and delivery to reduce water shortages and meet environmental and recreational needs.

The YWG Basin has the opportunity to create a system of coordinated operation to meet multiple goals stated for the YWG Basin. An appropriately planned system of storage, use, and administration will be conceived to optimize river operations in a manner agreed upon by YWG Basin interests and within the context of private property rights. An integrated system can assist the natural river systems deliver water to M&I systems, reduce agricultural shortages, and decrease low flow threats to environmental needs. With good design and operation, concerns about significant reductions of high-flow processes can be mitigated or eliminated. The YWG BRT will use modeling to understand the synergy between storage deliveries and return-flow delay by agricultural use and conservation. This system can be realized with full recognition of existing uses and future PBO depletion allowances.

Table 8: 2015 Objectives, Achievements since 2015, and Current Near-term Focus

2015 BIP Objectives	Achievements	Near-term Focus
Use CDSS modeling to evaluate storage operation, delivery locations, and river flows	Through the Modeling Phase 3 Project completed in 2018, the YWG BRT funded the refinement of the Yampa and White CDSS models and used those models to evaluate future projects that volunteered to be considered by the project. Model scenarios were developed to explore the interactions among projects and the impacts to water supplies and river flows.	
Evaluate contracting possibilities with existing and proposed storage options	The YWG BRT provided grant funding in support of the Upper Yampa Water Conservancy District Master Plan Modeling. The City of Steamboat Springs completed an agreement with Xcel Energy and CPW for the City's use of water from Steamboat Lake.	Investigate the necessary legal mechanisms or cooperative inter-government agreements to coordinate water deliveries from Stagecoach Reservoir or other UYWCD reservoirs to supplement streamflow to support the endangered species in the Lower Yampa Reach (YW-2020-0056).
Discuss river administration opportunities	The YWG BRT frequently invites the Division Engineer to present at YWG BRT meetings. The office of the Division Engineer is engaged with BRT activities. DWR flow measurement device letters were sent out in 2019 to diverters in the Yampa Basin and in 2020 to diverters in the White Basin.	Installing flow measurement devices is a top priority for Douglas Creek and White River Conservation District, and the Yellow Jacket, Rio Blanco, and Upper Yampa conservancy districts. The YWG BRT is also supporting measurement devices through the IWMP and IWI projects.
Review needs for infrastructure improvements	The Yampa IWMP conducted a diversion infrastructure assessment on 45 structures.	White River IWI is conducting a diversion structure assessment in 2021
Encourage cooperative partnerships	The YWG BRT supports the Yampa River Fund.[1]	

1. *See information on the Yampa River Fund under Goal 6: Quantify and protect environmental and recreational water uses at locations identified in the non-consumptive needs study of the YWG BRT*

NEW OBJECTIVES

The YWG BRT has developed the following new objectives to further this goal:

1. **Foster public awareness of water scarcity challenges associated with climate change. Provide a forum for state representatives to educate constituents on the Colorado River Compact and associated policies and administration. Create opportunities for public engagement on Future Projects implementation.**

2. **Implement stakeholder engagement, diversion structure improvements, and riparian and flow restoration opportunities to be outlined in the Yampa IWMP.**

3. **Implement stakeholder engagement, diversion structure improvement, and riparian and flow restoration opportunities to be outlined in the White River IWI.**

Ongoing Initiatives in Support of Goals and Objectives

The YWG BRT has several major initiatives currently underway that will result or are already resulting in substantial advancement of the Basin's Goals and objectives. These are the Yampa River IWMP, the White River IWI, the Basin Roundtable Grant Program, the Big River Committee, and the Recovery Program. These initiatives are discussed in the following sections.

Yampa River IWMP

In 2019, the YWG BRT began developing an IWMP to make progress on its 2015 BIP goals through a collaborative stakeholder process. The effort combines community input with science and engineering assessments to identify actions to protect existing and future water uses and support healthy river ecosystems in the face of growing populations, changing land uses, and climate uncertainty.

A group of volunteer committee members selected by the YWG BRT coordinates the project. From 2019 to early 2021, the IWMP Committee extensively engaged with agricultural, environmental and recreational, and municipal stakeholders, as well as conducted science and engineering assessments. This included an assessment of 45 diversion structures in all four project river segments, as well as a remote assessment of river health. Additional field data collection and stakeholder engagement is planned for 2021.

Based on the data and input analyzed thus far, three areas of focus for the IWMP Committee have emerged:

- Agricultural infrastructure: Strengthen agricultural diversion infrastructure to benefit agricultural operations while ultimately improving river health, fish, and flows.
- Riparian habitat, wetland, and natural bank stability: Identify projects and strategies that balance the needs of water infrastructure with increasing high-quality habitat in riparian lands through voluntary incentives for riverside landowners to sustainably manage their lands and livestock.
- Flows and shortages: Improve the YWG Basin's ability to meet the river flow needs of the fishery, seasonal recreational boaters, and agricultural water users by identifying preferred flows and alleviating shortages today and in the future through accurate datasets and modeling, coordinated storage of water that maintains a natural hydrograph, and better use of the array of available mechanisms to deliver water where it's most needed.

For each focus area, a work group of the IWMP Committee developed draft objectives and, with the YWG BRT's approval, is proceeding with summer 2021 field work. The Committee's goal is to have work plans by early 2022 that advance key initiatives in each of the priority areas and to identify funding options to implement them. The Committee and YWG BRT will prioritize multi-benefit and/or broadly supported projects that address critical needs.

White River IWI

In 2019, the White River and Douglas Creek Conservation Districts worked with the community and a Planning Advisory Committee (PAC) to determine the feasibility and level of interest in developing an integrated water initiative on the White River. Approximately 30 community interviews and four public meetings were conducted in different corners of the White River Basin. These meetings and interviews helped determine that there was sufficient support to pursue an integrated water initiative for the White Basin and identified several issues such a plan could address.

Based on the interviews and public meeting input, the PAC agreed the IWI would be a "community-based initiative to identify actions promoting a healthy river that ensures a vibrant agricultural community and maintains healthy fisheries while protecting water rights, quantity, and quality with respect for the local customs, cultures, and property rights."

The PAC set the following goals for the IWI:

1. Protect and preserve existing water rights and other beneficial water uses.
2. Protect and enhance water quantity and quality by promoting best management practices for:
    - Forest health
    - Riparian health
    - Rangeland health
    - Favorable conditions of streamflow
3. Identify opportunities for creation or improvement of infrastructure to support efficient consumptive and non-consumptive uses.
4. Support the development and maintenance of efficient and necessary long-term storage solutions that will improve, enhance and ensure irrigation, river health, water quantity, water quality, and native and recreational fisheries.

In 2021-2022, the PAC will continue to work with communities in the White Basin to develop objectives and river-segment-specific goals, as well as develop the Phase 3 scope of work. The effort will include a diversion structure assessment and riparian health assessment to develop a baseline and identify potential projects that would advance the above stated mission and goals.

YWG BRT Grants

Grant funding is a strategic way for the BRT to advance the YWG Basin Goals and thereby help implement the BIP. As a volunteer organization, the BRT is unable to undertake projects directly; however, the YWG BRT can provide funding to individuals and entities to help realize water projects that benefit people and the environment. Many such projects would not be feasible without these funds.

The YWG BRT awards grants to support water supply projects or initiatives through the State's Water Supply Reserve Fund (WSRF), either through the "Basin account" or through the "State account". For awards out of the Basin account, projects must advance more of the YWG BRT's BIP goals. For awards from the State account, they must advance one or more of the Colorado Water Plan goals.

Grants may be awarded for:

- Technical assistance regarding permitting, feasibility studies and environmental compliance
- Studies or analysis of structural, nonstructural, consumptive, and non-consumptive water needs, projects, or activities
- Structural and nonstructural water projects or activities

Basin account grant requests are reviewed by the Grant Committee, which scores the applications. The full BRT discusses and votes on the applications. Next, the application is reviewed by the CWCB Board to ensure it meets relevant criteria and has the required matching funds. Different levels of matching funds are required depending on the type of grant requested. State account grant requests follow a similar process, but the CWCB Board oversees the final approval. Because applications to CWCB must be received 110 days before a CWCB Board meeting and must first be approved by the YWG BRT, applicants should submit their grant applications well in advance.

Information about the process and how to apply is available on the BRT website[9]. More information about the grant program is available on the CWCB[10] website.

The following is a list of WSRF grants awarded for YWG Basin projects since 2015, also available on the BRT's website[11]. For more information about the projects themselves, please review the "Achievements" section of the BIP or refer to the BRT website Projects page[12].

Applicant	Project	Basin Account Ask	CWCB Account Ask	Total	Matching	POP
Upper Yampa Water Conservancy District	Upper Yampa Water Conservancy District Master Plan Modeling in the Yampa River Basin	$25,000	$0	$25,000	$25,000	2015-16
Routt County Conservation District	Yampa White Green Basin Roundtable Phase II Agricultural Needs/Return Flow Preliminary Assessment	$13,250	$0	$13,250		2015-16
South Metro Water Wise Supply Authority	Water Infrastructure and Supply Efficiency (WISE) Partnership: Conjunctive Use Infrastructure	$10,000	$0	$10,000		2015-16
Colorado River Water Conservation District	Colorado River Development & Curtailment Risk Study	$8,000	$0	$8,000	$20,000	2016
Crosho Lake Corporation	Crosho Lake and Reservoir - Simon #1 Dam Outlet Replacement	$30,000	$108,380	$138,380	$61,435	2016-18
Colorado State University	Continuation of lysimeter operations and consumptive use quantification in high-altitude, irrigated meadows in the Yampa/White Basin	$11,304	$11,304	$22,608	$26,854	2016-20
Community Agriculture Alliance	Develop/Implement of Water Ed/Outreach: A 3-Year Program of Collateral Dissemination, Media Networking, Forums and Workshops	$150,000				2016-20
Colorado River Water Conservation District	Yampa-White-Green Basin Implementation Plan Modeling	$150,000				2016-20
City of Steamboat Springs	Steamboat Springs Yampa River Management Plan	$21,000			$88,875	2016-18
Maybell Irrigation District	Maybell Ditch Improvement Project	$45,675			$151,700	2016-18
Rio Blanco Water Conservancy District	White River Storage Project Phase 2A Study	$85,000	$82,888	$167,888	$182,112	2017-20
Colorado River Water Conservation	Basin Roundtable Technical Study on Colorado River Risk Response	$10,000	$0	$10,000		2017- (Comple

9 https://yampawhitegreen.com/grants/
10 https://cwcb.colorado.gov/loans-grants/water-supply-reserve-fund-grants
11 https://docs.google.com/spreadsheets/d/11IFMEMjuz8V6rQbBEghk4iKBAXb7-H6mLT8NdQuM6z0/edit#gid=891834841
12 https://yampawhitegreen.com/projects/

Applicant	Project	Basin Account Ask	CWCB Account Ask	Total	Matching	POP
District	Options - Phase 2					ted)
John McConnell Math and Science Center	Advancing K-12 Water Education in Western Colorado	$15,000	$33,333	$48,333	$133,000	2017-23
Friends of the Yampa	Yampa River Leafy Spurge Project	$89,000	$0	$89,000	$76,572	2018-21
White River Conservation District	White River Algae Research Project	$99,000	$0	$99,000	$347,400	2018-21
Upper Yampa Water Conservancy District	Characterization of Streamflow, suspended Sediment & Nutrients in The Upper Yampa River Basin	$77,424	$0	$77,424	$67,076	2019-20
City of Steamboat Springs	Yampa River Forest Restoration & Temperature Mitigation Project	$25,000	$0	$25,000	$150,000	2019-21
BRT/CO River District	Yampa River Basin Integrated Water Management Project	$154,524	$0	$154,524	$528,000	2019-23
Walker Ditch Company	Walker Ditch Headgate Replacement	$62,222	$0	$62,222	$20,741	2019-21
The Nature Conservancy	Maybell Ditch Diversion Structure and Headgate Rehabilitation Project	$75,000	$0	$75,000	$298,500	2019-22
Deborah Martin	Martin Spring Irrigation and Storage Improvements	$7,462	0	$7,462	$2,488	2019-23
Yampatika Outdoor Awareness	Yampa White Green Rivers K-12 Curriculum	$99,053	$0	$99,053		2019-23
Upper Yampa Water Conservancy District	Diversion Infrastructure Improvement Project	$100,000	$0	$100,000		2020-22
Trout Unlimited, Inc.	Lower Elkhead Creek Restoration Project, Phase I	$50,000	$150,000	$200,000		2020-
Nicholas & Ann Charchalis	Drescher Dam Rehabilitation - Engineering Design	$10,000	$0	$10,000		2020-
Community Agriculture Alliance	Yampa-White-Green Education and Outreach	$99,000	$0	$99,000		2020-23
White River Conservation District	White River Integrated Water Initiative	$49,800	$66,000	$115,800	$79,000	2020-

As evidenced by the post-2015 achievements discussed above and the clear emphasis the YWG BRT has placed on the Yampa IWMP and the White River IWI, the YWG BRT is pursuing a strategy of encouraging, facilitating, and funding multi-benefit projects. These efforts are improving conditions in the basins and will be continued in the future.

Big River Committee

In 2015, the YWG BRT formed a Big River Committee comprised of diverse interests representing a broad range of stakeholders within the YWG Basin to explore Colorado River Compact matters. Having a dedicated committee to explore options keeps the YWG BRT engaged with these topics. Overarching goals of the BRC are to:

- Help inform the YWG Interbasin Compact Committee (IBCC) representative, the Division 6 CWCB Board Member and other State agencies of YWG Basin stakeholder feedback as they explore Colorado Compact issues, Demand Management, and related policy positions.
- Educate the YWG BRT and stakeholders on Compact issues.
- Educate the YWG BRT and stakeholders on the Bureau of Reclamation's interim Operational Guidelines for Lake Powell and Lake Mead and their renegotiation.
- Determine what role the YWG BRT can play in renegotiating the Interim Guidelines.
- Provide a forum to investigate complex technical questions and provide summaries and recommendations to the YWG BRT and stakeholders.
- Provide equitable access and transparent communication to the BRT and encourage participation by non-roundtable members.

In the face of persistent drought and anticipated long-term growth in demand for water, Colorado and the other six Colorado River Basin states have prepared Drought Contingency Plan (DCPs). One element of the Upper Basin DCP is to investigate the feasibility of Demand Management (DM). If implemented, DM will become a future program which, on a voluntary, temporary, and compensated basis will seek to conserve consumptive use of water to help the Upper Division States, including Colorado, to continue to meet their Compact obligations under the Colorado River Compact. Because of the significant impact that a DM program could have on the YWG Basin, the Roundtable has carefully considered this topic, and developed 7 Principles which it believes to be important in the structure of any future DM program implemented in Colorado. The Principles were published in the Basin's DM Statement Executive Summary in March, 2021[13].

[13] https://drive.google.com/file/d/1YpIQhFCnzzK5FgZ5mQO0Eo8Y19kmDak6/view

SECTION 4. SUPPLY, DEMAND, AND POTENTIAL WATER NEEDS

This section provides an overview of the CWCB's 2019 Technical Update, minor model enhancements performed as part of the BIP Update process, and updated results for the YWG Basin supply, demand, and potential water needs.

Technical Update Overview

As outlined in the Technical Update Volume 1 (2019), the Technical Update offers a more robust approach to water supply planning than the previous State-wide Water Supply Initiatives (SWSI), based on these key features:

- CDSS Tools: The Technical Update modeled the Baseline and five planning scenarios using the tools available through the Colorado Decision Support System (CDSS). CDSS is a water management system developed by the CWCB and the Division of Water Resources for each of Colorado's major water basins. Tools in CDSS include HydroBase, GIS data, StateCU (consumptive use model), and StateMod (water rights allocation model). The YWG BRT is very familiar with these tools and has used them in previous projects.
- 1051 water usage data: House Bill 2010-1051 required the CWCB to implement a process for report water use and conservation data by covered entities. Information from this database was used to estimate municipal water demands. For more information, refer to the Technical Update Volume 1 report.
- Incorporates scenario planning: Five planning scenarios come directly from the Colorado Water Plan. The drivers are population growth, emerging technologies impacting crop water needs, per capita water use, social values, and climate change.

The CDSS tools have a long history of development, starting in 1994. Most recently, the CDSS StateMod models for the West Slope were updated in 2015, the South Platte model was completed, and the Arkansas model is under development. The YWG BRT has prioritized developing CDSS models of the basins. From 2016 through 2018, the BRT funded and participated in the Yampa-White-Green Basin Roundtable Basin Implementation Plan Modeling Phase 3 Project. As part of this effort, the CDSS Yampa and White River StateMod models were refined based on stakeholder input to build confidence that the models accurately represented the basins. Additionally, the models were converted from a monthly time-step to a daily time-step in order to simulate streamflow results needed for detailed environmental and recreational assessments. These models were the starting point for the Technical Update, especially the Baseline scenario; however, the Technical Update model uses a monthly time-step. This simplification was necessary to be consistent with the other basins in the state and to accommodate the climate change considerations in some of the planning scenarios.

For more details on the model, refer to the CDSS documentation found on the CWCB website[14]. This document provides information on model development, data sources for the input files, estimation techniques, and quality of the historical calibration.

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[14] https://cdss.colorado.gov/modeling-data/surface-water-statemod

Model Enhancements

As part of the BIP Update process, the Technical Update assumptions and results were reviewed by the YWG BIP Update Committee. This review process resulted in minor enhancements to the models, which are summarized below. For more details, refer to Appendix A.

Revisions to the White Model involved refining industrial demands.

- In the Technical Update, the model included diversions to Chevron Oil demand via the California Co Pipeline. The California Co Pump Station has been used more frequently in recent years and was added to the White Model.
- In the Technical Update, sand and gravel, mining, and golf course demands were not considered. These uses were added to the White Model.

Revisions to the Yampa Model involved refining industrial demands, reservoir operations associated with meeting M&I demands, the USFWS' flow recommendations, and adjustments to agricultural crop demands under climate change.

- In the Technical Update, it was assumed that Hayden Station, Craig Station, and associated coal mines would be in operation in 2050. Under some of the planning scenarios, it was assumed that water demands for the thermoelectric plants would increase. After the Technical Update was published, it was announced that the power plants would be decommissioned prior to 2050. For the five planning scenarios, the industrial demands were revised to account for this new information. The current level of demands associated with the power plants were applied to the five planning scenarios and the use type was changed from thermoelectric to large industry.
- Sand and gravel mining and golf course demands were refined.
- Long Lake Reservoir was added to the Yampa Model. This reservoir is located in the Fish Creek watershed and supplies the City of Steamboat Springs.
- Stagecoach Reservoir operations and users were revised to be consistent with the 2021 Stagecoach Reservoir Fill and Release Policies document.
- The Recovery Program Critical Reach streamflow targets supplemented by releases from Elkhead Reservoir were updated to reflect the "Procedures for Releasing and Administering Water from Elkhead Reservoir to Augment Yampa River Flows for Endangered Fish" (October 3, 2017).
- The agricultural efficiencies used with climate change conditions were corrected in the Yampa Model.

The water demands, supply, and gap presented below reflect the revised model assumptions.

Baseline Scenario

The Baseline scenario is designed to be the starting point for planning analysis. The Baseline scenario represents current consumptive demands, current instream flow reaches and recreational in-channel diversions (RICDs), existing infrastructure, and current reservoir operations. For the Technical Update, current M&I demands are circa 2015. This current information is then superimposed on historical variable climate and hydrology. The goal of the Baseline scenario is to show the impacts of current water practices over a variety of historical climate and hydrology. This enables planners to understand physical and legal constraints on the system. Historical diversions reflect operational decisions that many not be valid in the future. The Baseline scenario removes the historical practices in order to evaluate water availability.

Agriculture is the largest consumptive water use sector; therefore, special care is taken to represent crop irrigation requirement. For the Technical Update, agricultural demands represent the amount of water needed from the river to meet the crop irrigation requirement. This approach allows agricultural demands and gaps to be compared with municipal, industrial, and in-river uses. To calculate the agricultural demand at the headgate, two pieces of information are needed:

- Crop irrigation requirement
- Irrigation efficiency

Crop irrigation requirement is calculated using current irrigated acreage, crop types, and climate variability (time series of monthly temperature and precipitation). Current crop information is based on the CDSS 2010 irrigated acreage assessment. This dataset tracks irrigated parcels, crop type, irrigation method, and irrigation water source. Figure 1 shows the irrigation method (flood or sprinkler) employed on the irrigated acreage in the basins. The majority of acreage is flood irrigated. Sprinkler irrigation can be found primarily in Water District 44.

For each diversion structure, a representative set of monthly irrigation efficiency values of wet, dry, and average year types was developed based on historical diversion records. In general, agricultural diversions are more efficient during dry years.

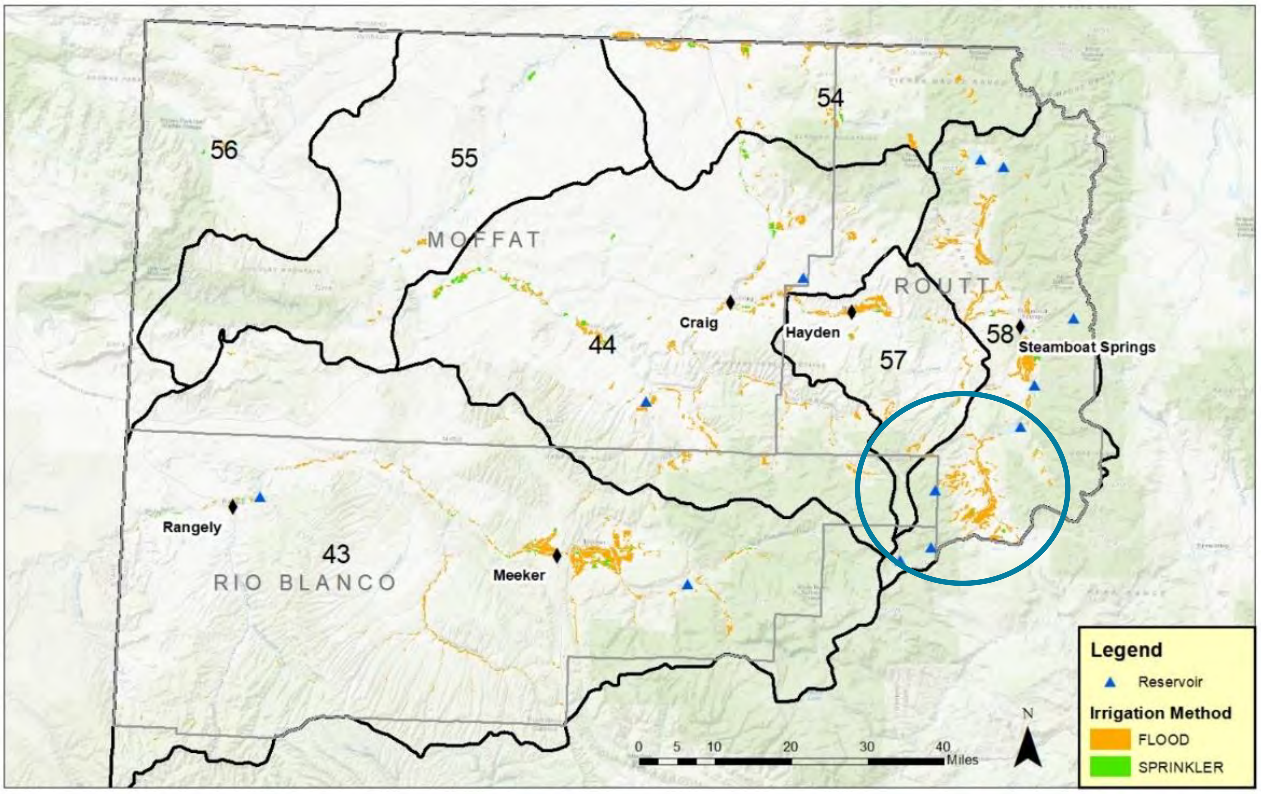


Figure 1: Map of Irrigation Method in the Yampa-White-Green Basins

The map's blue triangles show the location of reservoirs that are represented in the model. The Yampa and White basins have less storage available than other basins in the state. Reservoirs that supply supplemental water supply to agriculture are:

- Stillwater
- Yamcolo
- Allen Basin
- Stagecoach

These four reservoirs, shown in the blue circle in Figure 1, are located in south Routt County. Additionally, Crosho and Chapman reservoirs provide supplemental water to agricultural users in south Routt County, but these are not included in the model. Agricultural water users could contract for water out of Elkhead Reservoir, but currently there are no agricultural contracts.

As shown in Figure 2, agriculture in the basins is primarily producing pasture grass (hay) or alfalfa. These crops generally support the cattle industry.

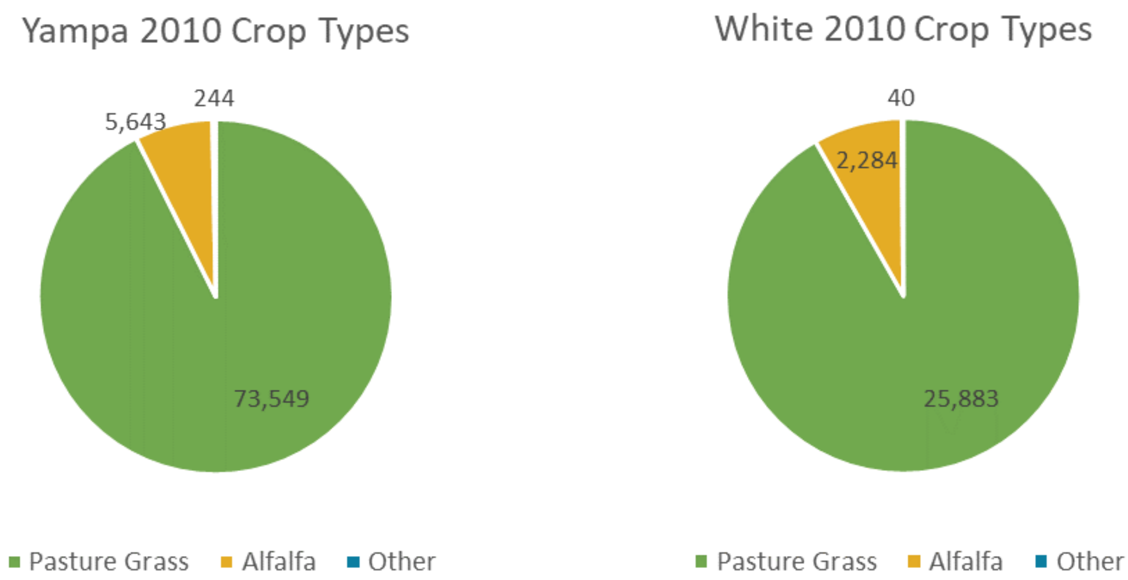


Figure 2: Primary crop types in the Yampa and the White basins (acres)

Municipal water demands refer to water used by cities, towns, and domestic water providers. Self-supplied industry refers to industrial water users that have their own water supplies (not provided by a city or town). This includes mining, oil and gas development, snowmaking, and power plants. Municipal and self-supplied industrial demands in the Baseline scenario are intended to represent current (as of 2015) levels of water use. A fixed monthly demand pattern was developed. As shown in Table 9 and on the map in Figure 3, the following entities are explicitly represented, meaning that their demands, water rights, and infrastructure are captured in the models.

Table 9: Municipal and Self-supplied Industry

Municipal Providers	Self-supplied Industry
Steamboat Springs/Mount Werner Water	Steamboat Resort snowmaking
Craig	Hayden Station (Xcel Energy)
Meeker	Craig Station (Tri-State)
Rangely	ColoWyo (coal mine)
	Maybell Mill Pipeline
	California Co Pipeline (Chevron)

Other municipal/domestic providers and industrial users are represented in an aggregate fashion by county and then distributed to the applicable water district. The intent of the Baseline scenario is to represent 100 percent of the consumptive uses in the basin; therefore, the other municipal/domestic demands are based on the population not served by the large municipal providers and assumed gallons per capita per day (GPCD). For more information the methodology and data sets used to develop the GPCD estimates, refer to the Municipal and Industrial Demands section below. The smaller industrial users represent mining (coal and natural soda, among others.), sand and gravel operations, oil and gas development, and golf courses.

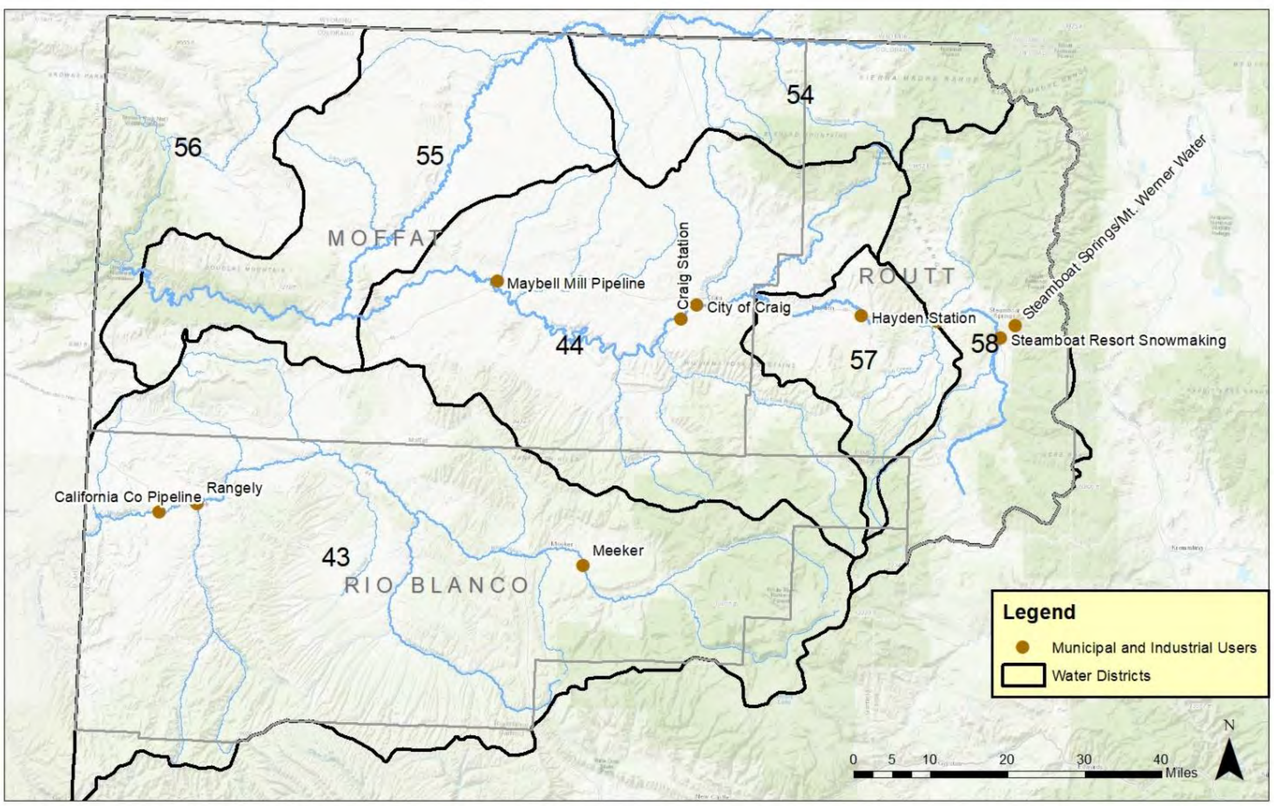


Figure 3: Map of Municipal and Self-supplied Industrial Users in the Baseline Model

In the Baseline model, CWCB instream flow reaches, RICDs, and other locations with streamflow targets have the daily streamflow targets represented as monthly streamflow volume. Representing environmental and recreational needs is a high priority for the YWG BRT because these attributes are highly valued in the basin. Through a variety of previous planning efforts, the YWG BRT has developed a map of environmental and recreational focus areas. As part of this BIP Update, a CWCB workshop was held April 7 to brainstorm if new focus areas or new attributes need to be added to the map in the future, as shown in Figure 4. In addition to these focus areas, environmental attributes exist on virtually all streams and lakes. The YWG BRT encourages all water users to consider multi-benefit projects that can improve the natural conditions throughout the basins. For more information on the individual attributes of each focus area, refer to the 2015 BIP.

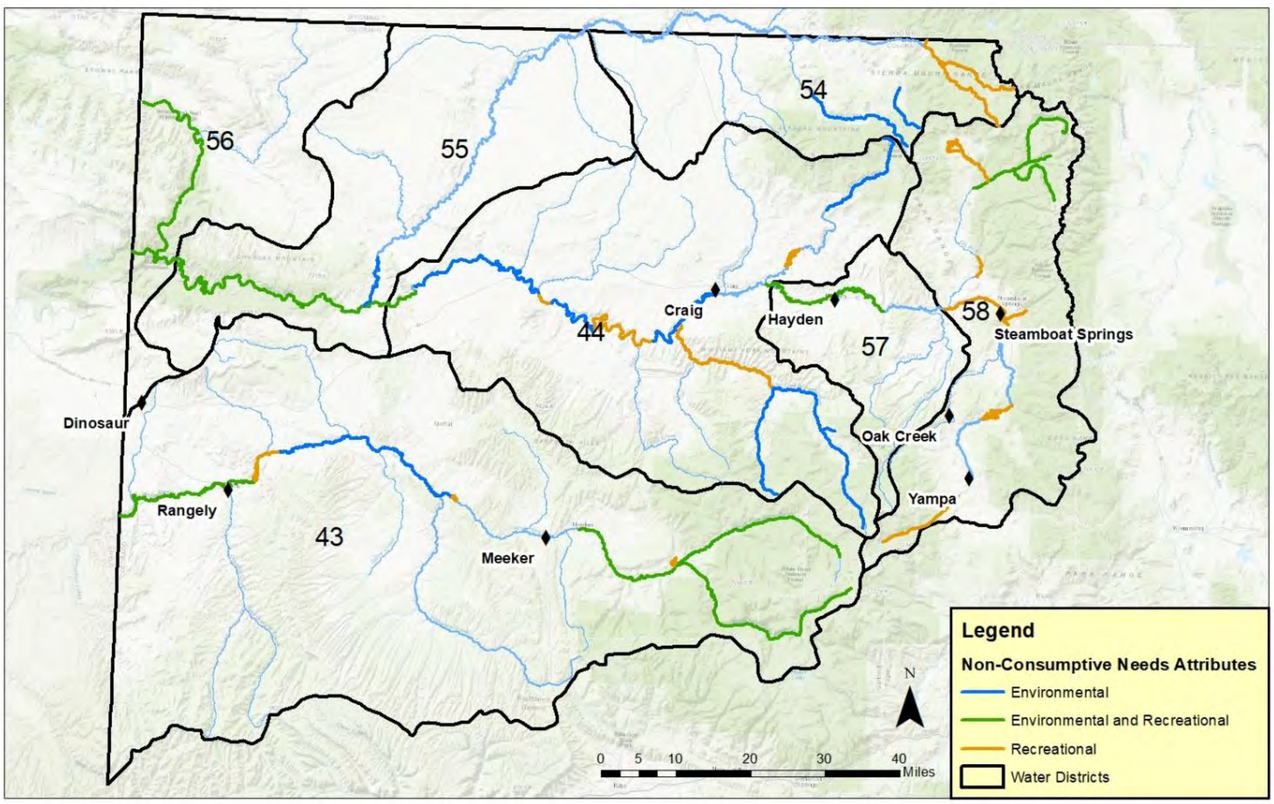


Figure 4: Map of Environmental and Recreational Focus Areas

In addition to the environmental and recreational focus areas in Figure 4, the CWCB has decreed instream flow water rights for the reaches mapped in Figure 5. Instream flow reaches help protect streamflow from junior water rights development. The reaches generally define target streamflow rates that vary by season and are designed to support aquatic habitat. The reaches highlighted in pink are included in the StateMod model because there is enough information to represent them. These reaches are generally lower in the river network. As shown on the map in green, many of the instream flow reaches are located in the headwaters of the basin and are not included in the model. There is limited information about the physical flow at these locations, which makes accurate representation in the model difficult.

Results from the instream flow reaches included in the model are presented below.

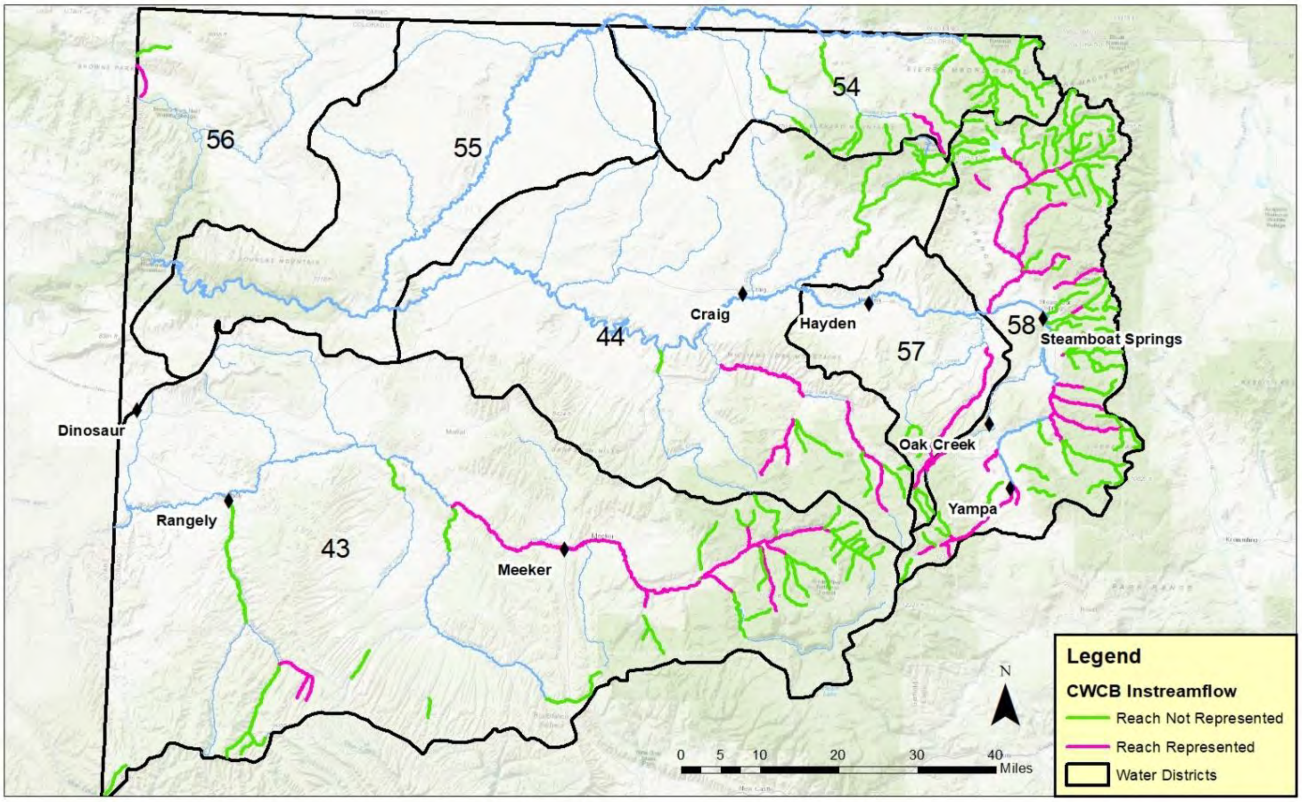
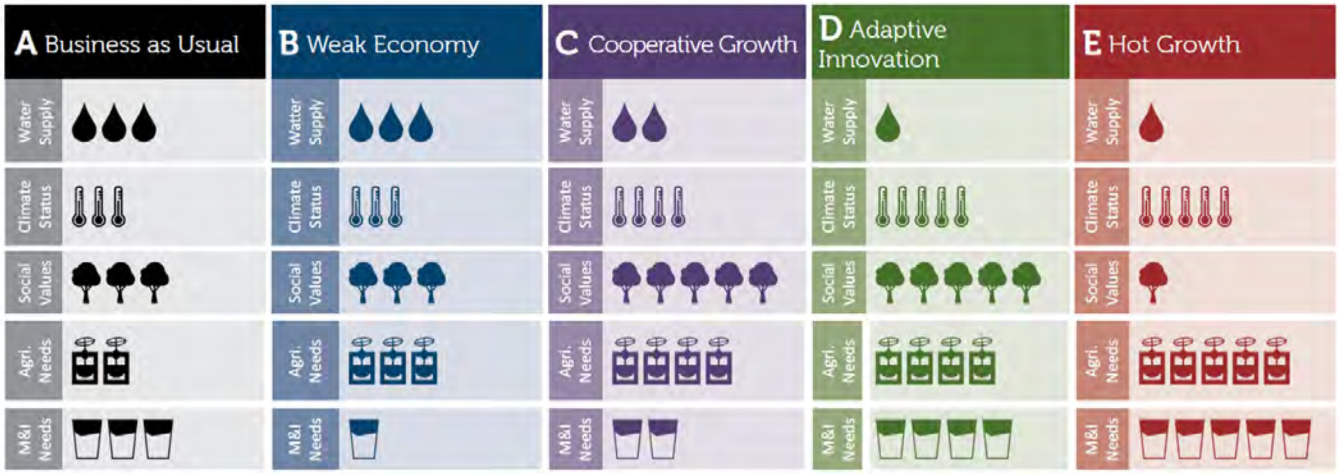


Figure 5: CWCB Instream Flow Reaches decreed in the basin and represented in the model

Five Planning Scenarios

The Colorado Water Plan outlined five planning scenarios, which were implemented in the models for the Technical Update. Scenario planning examines a range of plausible futures, embracing the uncertainty inherent in planning for the future while enabling water planners to look for resilient solutions. Key drivers of water supply and demand vary across the scenarios. Figure 6 summarizes the scenarios.



A Business as Usual	B Weak Economy	C Cooperative Growth	D Adaptive Innovation / E Hot Growth
• Population growth increases at trends predicted by the State Demography Office (SDO). • Future hydrology, per capita water demands, and adoption of conservation measures are similar to what has recently occurred.	• The world's economy slows, and the state's population growth is less than predicted. • Hydrology is similar to recent patterns. • This scenario puts the least amount of stress on our future water supplies and is a bookend for scenarios.	• Statewide population is similar to predictions by SDO but is distributed differently across the state. • Climate is moderately warmer, and irrigation demands increase. • People seek to mitigate increased demands by more aggressively adopting water conservation.	• Both scenarios assume that population growth is higher than projected, and both assume a much warmer and drier future climate. • The scenarios' primary differences revolve around conservation. In the Adaptive Innovation scenario, the state aggressively adopts conservation measures in both municipal and agricultural sectors. In the Hot Growth scenario, conservation is not a focus.

Figure 6: Five Planning Scenarios

Hydrology

Hydrology is the primary driver of conditions in the YWG Basin. The Technical Update considered current conditions and two climate change projections. The "In Between" and "Hot and Dry" climate projections were derived from the multi-phase Colorado River Water Availability Study (CRWAS). They were selected as representative traces from the suite of climate change conditions. In Between represents moderate crop irrigation requirement and moderate runoff. Hot and Dry represents high crop irrigation requirement and low runoff. As a point of comparison, current climate conditions exhibit low crop irrigation requirement and moderate runoff. Figure 7 replicates Figure 4-9 from Colorado's Water Plan and shows the relative position of the selected climate scenarios compared to the available down-scaled climate projects developed by the U.S. Bureau of Reclamation used in CRWAS.

FIGURE 4-9 PLOT OF RUNOFF CROP IRRIGATION REQUIREMENTS USING THE BUREAU OF RECLAMATION ARCHIVE

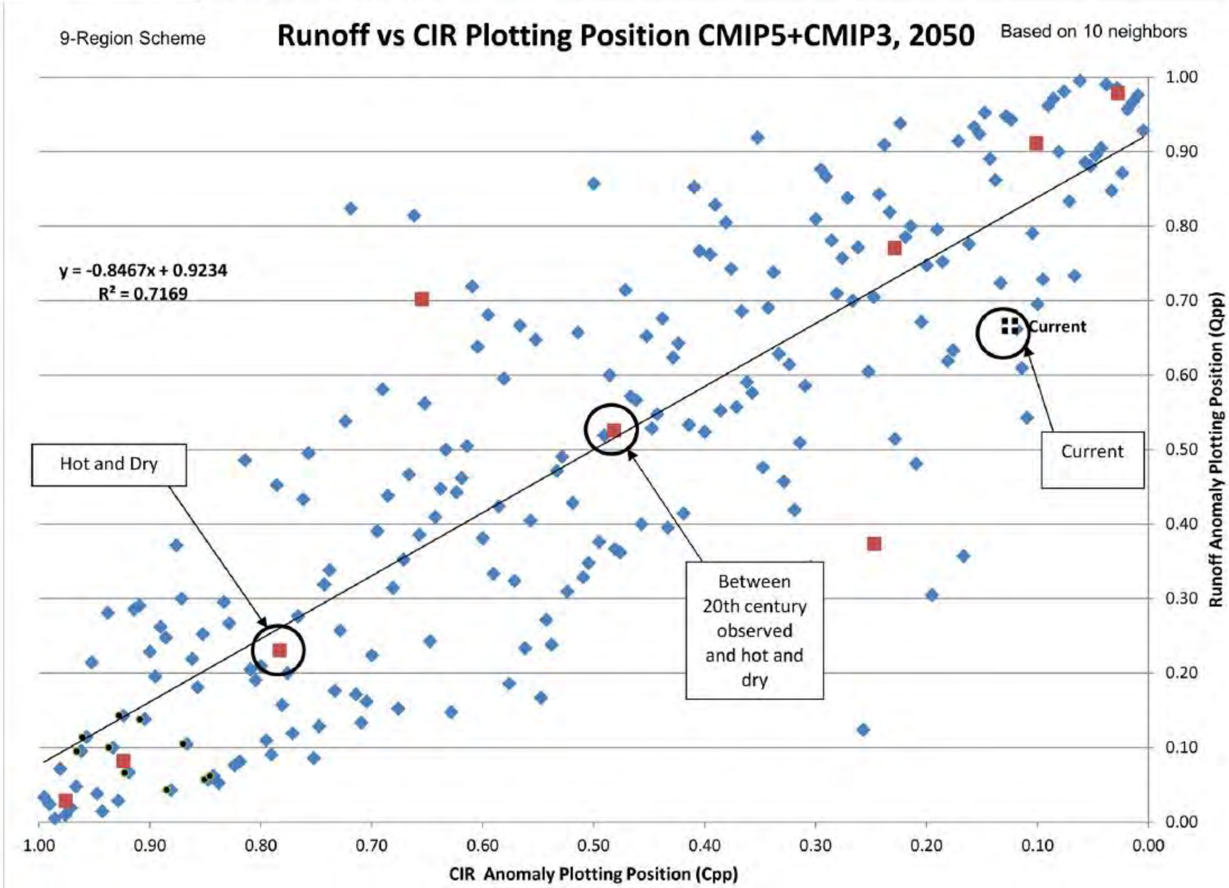


Figure 7: Plot of Runoff vs Crop Irrigation Requirements using the Bureau of Reclamation Archive from the Colorado Water Plan.

The climate scenarios represent temperature and precipitation conditions projected for the year 2050. To develop the natural flow hydrology required for StateMod input, climate-projected temperature and precipitation was used as input to a rainfall-runoff model that estimated natural hydrology. Climate-change adjustment factors were developed and imposed on the observed natural hydrology. This approach is designed to replicate observed variability. The climate change hydrology represents potential future conditions but has been “tied” to observed years. For the Tech Update, the period of record is 1975 through 2013. The climate change hydrology is only available on a monthly time-step.

The graphs and tables below compare the Current, In Between, and Hot and Dry hydrology time series. Figure 8 and Figure 9 compare the average monthly natural flow (flow absent the effect of humans) for the three hydrology time series. Figure 8 shows the Yampa River at Deerlodge because this gage location is at the bottom of the Yampa River Basin. All of the major tributaries to the Yampa River have joined the river upstream of this gage. This gage records the vast majority of the streamflow before the Yampa River joins the Green River. Similarly, Figure 9 shows the White River near Watson. This gage is located just over the Colorado-Utah state line and represents the vast majority of the streamflow, before the White River joins the Green River.

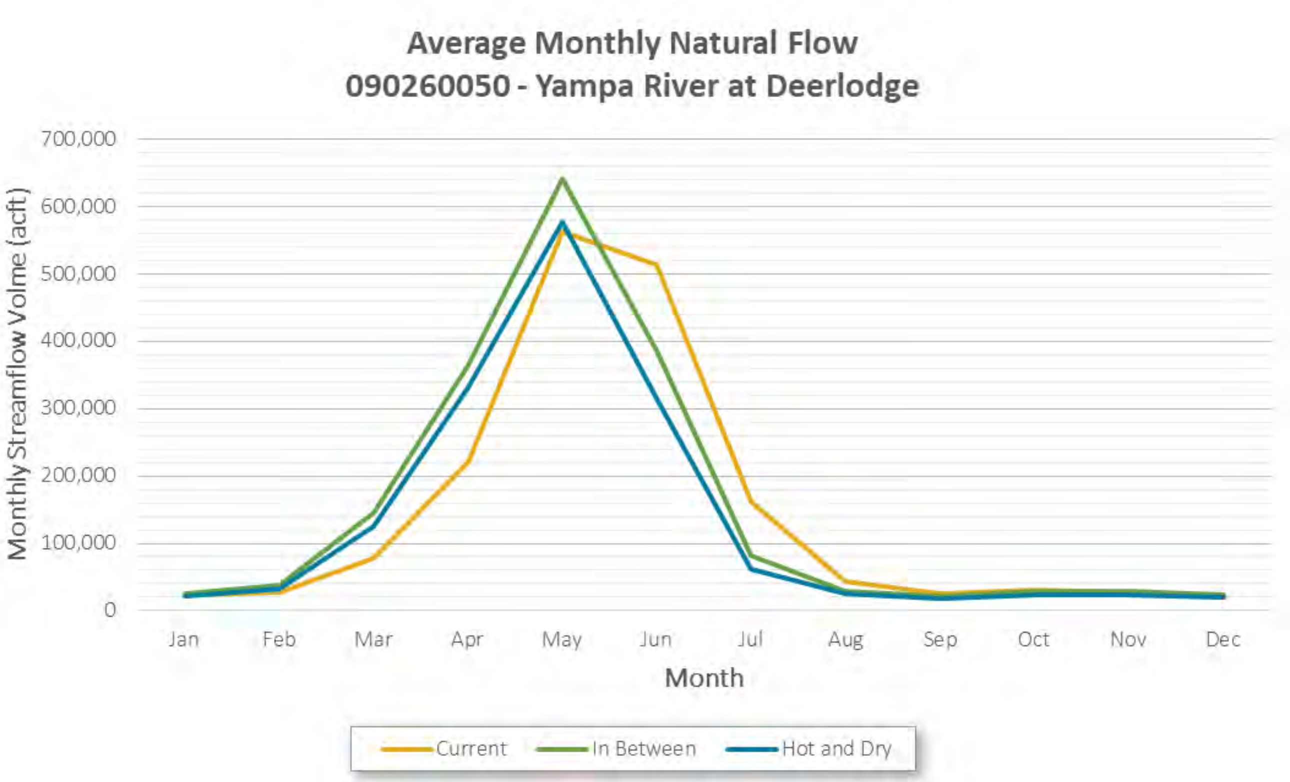


Figure 8: Average Monthly Natural Flow Comparison (Yampa River at Deerlodge)

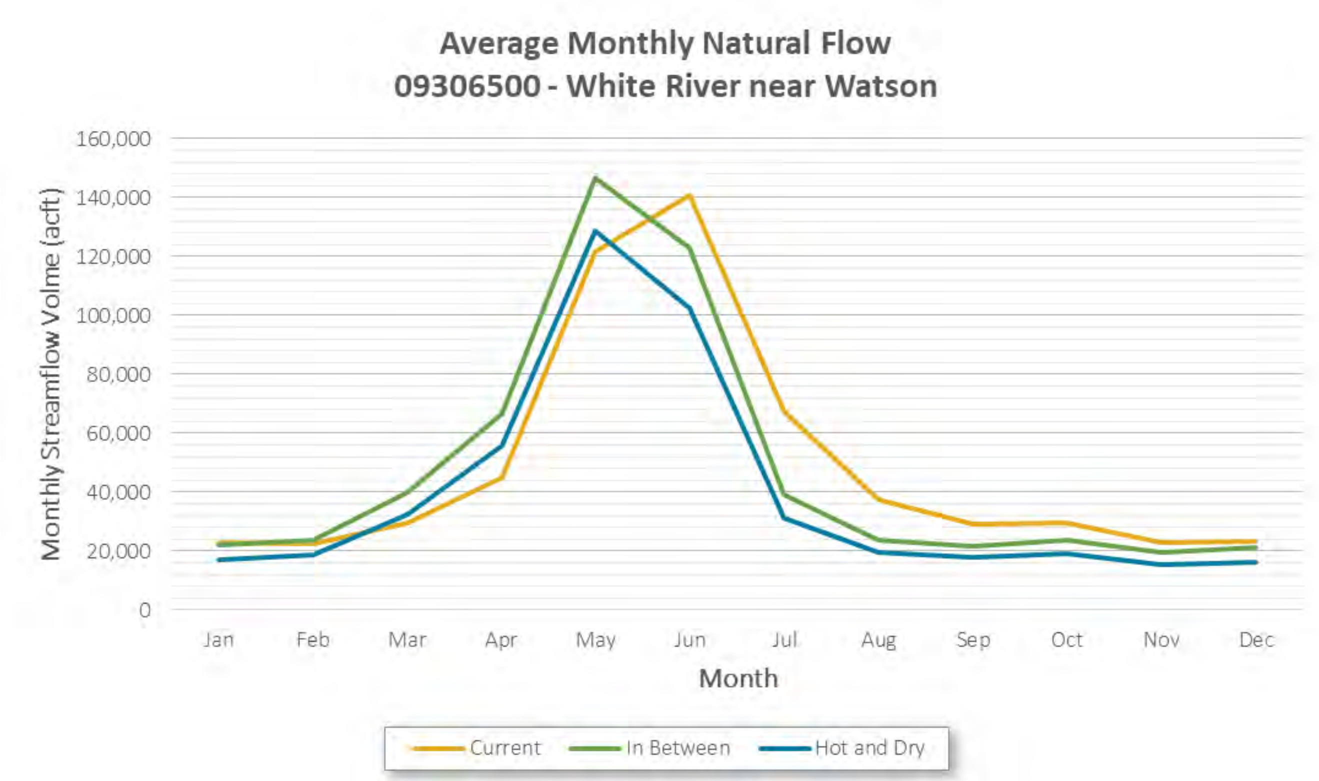


Figure 9: Average Monthly Natural Flow Comparison (White River near Watson)

Key observations from the average monthly natural flow comparison are:

- The runoff shifts earlier in the year for both In Between and Hot and Dry climate change hydrology.
- The peak runoff volume for In Between hydrology is slightly larger than Current.
- The peak runoff volume for Hot and Dry is the same or smaller than Current.
- The shift to an earlier runoff effectively lengthens the low-flow period at the end of the summer. Flows in July and August are lower for In Between and Hot and Dry than for Current.
- Winter flows in the Yampa River are about the same as Current.
- Winter flows in the White River are generally lower than Current.

Table 10 and Table 11 show the range of annual values for the hydrology scenarios from 1975 through 2013, which is the period of record used for the Technical Update.

Table 10: Annual Natural Flow Comparison (Yampa River at Deerlodge)

	Current (AF)	In Between (AF)	Hot and Dry (AF)
Annual Max	3,445,000	4,009,200	3,637,900
Annual Mean	1,734,400	1,815,100	1,574,900
Annual Min	639,600	575,800	488,000

Table 11: Annual Natural Flow Comparison (White River near Watson)

	Current (AF)	In Between (AF)	Hot and Dry (AF)
Annual Max	1,017,000	955,000	803,900
Annual Mean	591,800	570,800	475,000
Annual Min	288,400	250,000	201,800

Key observations from the annual natural flow comparison are:

- For the Yampa River at Deerlodge, In Between hydrology has a larger annual maximum and annual mean volume than Current. The annual minimum volume is smaller than Current. The In Between scenario will include conditions where monthly flows have an earlier timing than Current conditions, with some years having a larger flow volume and some years having a smaller volume.
- For the Yampa River at Deerlodge, Hot and Dry hydrology has a larger annual maximum volume than Current. The annual mean and annual minimum volume are smaller. In general, the Hot and Dry scenario will include monthly flows that have an earlier timing than Current conditions, with most years having smaller annual flow volumes.
- For the White River near Watson, both In Between and Hot and Dry conditions are drier than Current.

In addition to changes to the overall annual statistics, the drier conditions in the climate-adjusted hydrology results in longer droughts. For the purposes of this report, a drought is defined as a single year or consecutive years below the current annual average natural flow volume. For the Yampa River at Deerlodge, a year with less natural flow than 1,734,434 AF is considered a drought. For the White River near Watson, a year with less natural flow than 591,769 AF is considered a drought. Figure 10 and Figure 11 show the frequency of drought lengths at the two gage locations from 1975 through 2013.

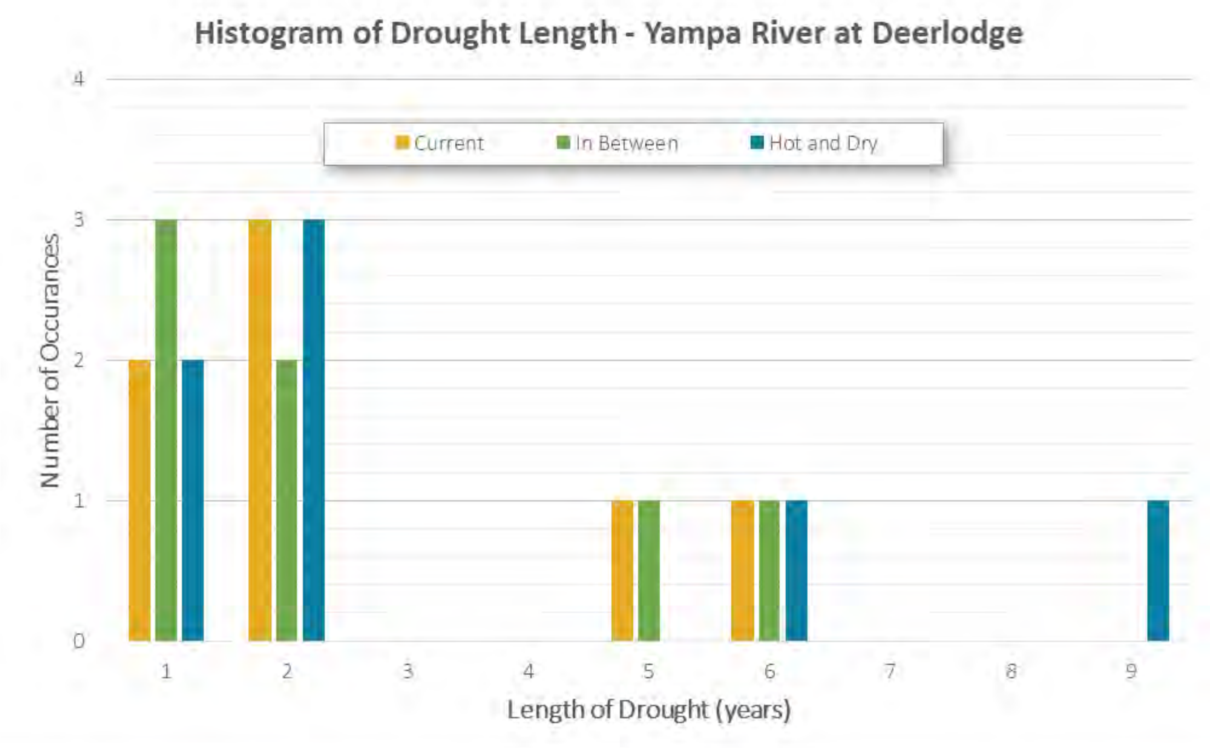


Figure 10: Histogram of Drought Length (Yampa River at Deerlodge natural flows from 1975 to 2013)

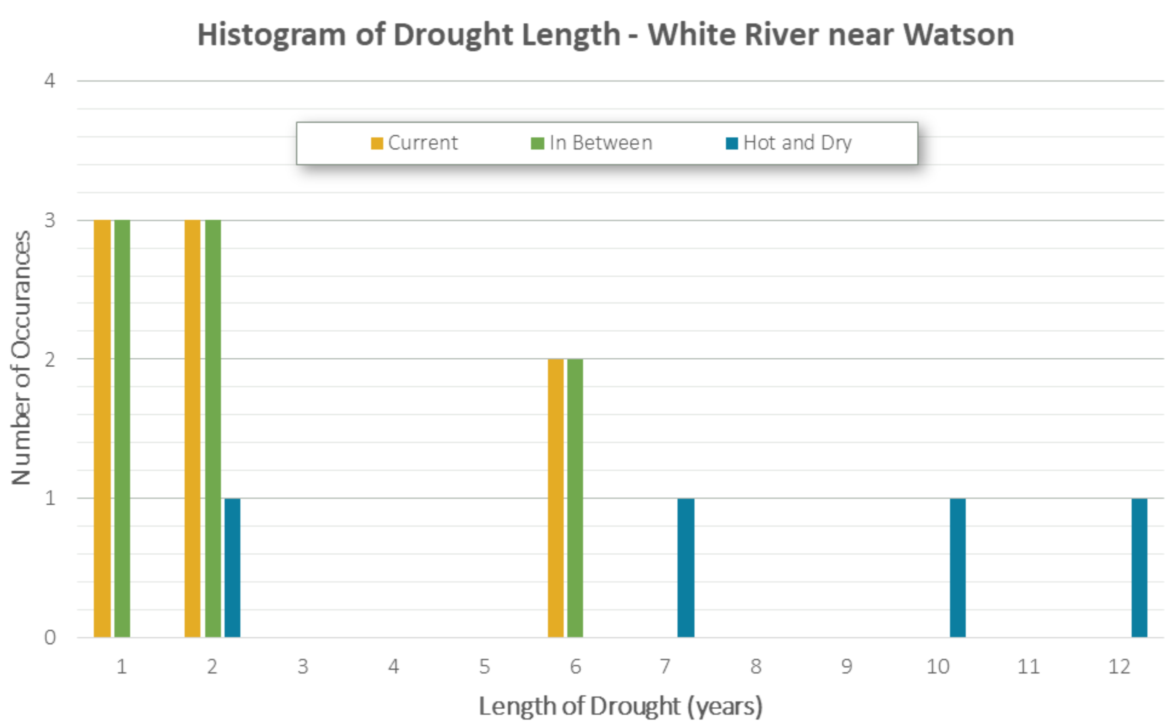


Figure 11: Histogram of Drought Length (White River near Watson natural flows from 1975 to 2013)

Key observations from the natural flow histogram of drought length comparison are:

- For both Yampa and White rivers, In Between hydrology produces very similar numbers and drought lengths.
- For both Yampa and White rivers, Hot and Dry hydrology produces longer droughts.

Agricultural Demands

For the Technical Update, agricultural demands were adjusted to reflect the future conditions described in the planning scenarios. Four primary drivers were considered:

- **Urbanization.** Population is expected to increase in the basins, and some of that growth will likely occur onto lands that are currently irrigated. A reduction of 1,500 acres is assumed for the Yampa Basin and up to 360 acres for the White Basin.
- **Future agricultural projects**. In the 2010 Agricultural Water Needs Study, the YWG BRT identified 14,805 acres of potentially irrigable land in the Yampa Basin. Additionally, up to 2,800 acres of new acreage is being contemplated as a future depletion for the PBO under development in the White Basin.
- **Climate Change.** Three of the planning scenarios incorporate climate-adjusted hydrology and crop irrigation requirements. Changes to hydrology are discussed above. The crop irrigation requirements increase due to warmer temperatures and changes in precipitation.
- **Emerging Technologies.** The Adaptive Growth scenario assumes that irrigation efficiencies will increase, most likely through improved instrumentation, automation, and irrigation methods. Simultaneously, crop irrigation requirement will decrease, most likely through innovations in crop hybrids.

The adjustment to agricultural demands is summarized in Table 12. For more details, refer to the Technical Update.

Table 12: Planning Scenario Adjustments for Agricultural Demands in the Yampa and White Basins

Sub-basin	Adjustment Factor*	Business as Usual	Weak Economy	Cooperative Growth	Adaptive Innovation	Hot Growth
Yampa	Change in irrigated land due to urbanization	1,500 acre reduction	1,500 acre reduction	1,500 acre reduction	1,500 acre reduction	1,500 acre reduction
Yampa	Planned agricultural development projects	1,000 acre increase 100% alfalfa	1,000 acre increase 100% alfalfa	5,000 acre increase 50/50 grass pasture/ alfalfa	14,805 acre increase 50/50 grass pasture/ alfalfa	14,805 acre increase 50/50 grass pasture/ alfalfa
Yampa	IWR climate factor	-	-	19%	34%	34%
Yampa	Emerging technologies	-	-	-	10% IWR reduction 10% system efficiency increase	-
White	Change in irrigated land due to urbanization	360 acre reduction	-	360 acre reduction	360 acre reduction	360 acre reduction
White	IWR climate factor	-	-	22%	37%	37%
White	Emerging technologies	-	-	-	10% IWR reduction 10% system efficiency increase	-

**See section 2.2.3 of the Technical Update (2019) for descriptions of adjustment methodologies and assumptions*

Municipal and Self-supplied Industrial Demands

For the Technical Update, municipal demands were developed based on population multiplied by GPCD. Population projections were sourced from the State Demographer Office. GPCD values were prepared by county using the following four data sources, listed in order of priority:

1. Data reported to the CWCB by water providers pursuant to House Bill 2010-1051
2. Municipal water efficiency plans
3. Targeted water-provider outreach
4. 2015 Basin implementation plan

Population projections and GPCD vary across the planning scenarios in order to represent the potential impact of climate, urban land use, technology, regulations, and social values. Table 13 shows the current and projected populations for the Yampa and White Basins. Population in the Yampa Basin is expected to increase under all five planning scenarios. The most aggressive increase is seen in the Hot Growth scenario, which assumes the population will almost triple. The White Basin is generally expected to have an increase in population, except for the Weak Economy scenario, which assumes the population will decline.

Table 13: Current and Projected Populations for the Yampa and White Basins

Sub-basin	Baseline (2015)	Business as Usual	Weak Economy	Cooperative Growth	Adaptive Innovation	Hot Growth
Yampa	37,200	59,900	34,400	63,500	86,000	91,900
White	6,500	7,400	4,200	7,000	10,600	11,300
Yampa-White Total	43,700	67,200	38,600	70,400	96,600	103,200

Self-supplied industrial demands were revised as part of the BIP Update based on new information regarding the future of the power plants in the Yampa Basin and better data on current industrial users in the White Basin. Table 14 and Table 15 provide a detailed accounting of current self-supplied industrial demands in the Yampa and White Basins, respectively. Table 16 categorizes the demands and shows how they change for each planning scenario. In the Yampa Basin, there is uncertainty regarding the future of Hayden Station and Craig Station water rights. The power plant operators have announced that the plants will be closed prior to 2050; however, it is possible that new industry will replace the coal-fired thermoelectric generation. Therefore, the current demands, associated water infrastructure, and water rights are re-categorized from Thermoelectric category to Large Industry. In the White Basin, there is uncertainty regarding future oil shale development, which is reflected in the large range of demand values in the Energy Development category.

Table 14: Detailed Yampa Basin Industrial Baseline Demands (AFY)

Sub-sector	Entity or County Aggregate	Annual Demand (AFY)	Notes
Large Industry	ColoWyo	552	
Large Industry	Maybell Mill Pipeline	350	
Large Industry	Moffat Aggregate	360	Assumes one golf course (300 AFY), and three sand and gravel operations (20 AFY each)
Large Industry	Routt Aggregate	1,360	Assumes four golf courses (300 AFY each), Twenty Mile (Peabody) coal mine (100 AFY), and three sand and gravel operations (20 AFY each)
Snowmaking	Steamboat Resort	281	
Snowmaking	Routt Aggregate	10	
Thermoeletric	Hayden Station	5,339	
Thermoeletric	Craig Station	14,012	
Energy Development	Moffat Aggregate	1,000	Current oil and gas operations
Energy Development	Routt Aggregate	500	Current oil and gas operations

Table 15: Detailed White Basin Industrial Baseline Demands (AFY)

Sub-sector	Entity or County Aggregate	Annual Demand (AFY)	Notes
Large Industry	California Co Pipeline	1,869	
Large Industry	Rio Blanco Aggregate	750	Assumes one golf course (300 AFY), and 450 AFY for sand and gravel operations (Yellow Jacket Water Conservancy District's 2016 Water Storage Feasibility Study)
Energy Development	Rio Blanco Aggregate	1,600	Current oil and gas operations

To translate the county-level aggregate demands to the models, the demands are assigned to water districts based on the spatial overlap with the county. The White Model further divides the Rio Blanco aggregate into a mainstem location upstream of the White River near Boise gage and a Piceance Creek location. The mainstem location has three-quarters of the energy development demand, and the remaining one-quarter is at the Piceance Creek location. While the majority of future energy development is likely to occur in the Piceance Creek watershed, there is limited water availability. Energy development will likely need to tap water supplies from the mainstem of the White River, which is consistent with the conditional water rights held by the oil and gas industry.

Table 16: Yampa and White Basins Industrial Baseline and Projected Demands (AFY)

Basin	Sub-sector	Baseline	Business as Usual	Weak Economy	Cooperative Growth	Adaptive Innovation	Hot Growth
Yampa	Large Industry	2,517	21,309	18,859	20,959	20,959	23,064
	Thermoelectric*	19,351	0	0	0	0	0
	Snowmaking	292	572	572	572	572	572
	Energy Development	1,542	2,189	1,119	1,119	1,119	7,538
White	Large Industry	2,575	2,575	2,509	2,575	2,575	2,651
	Energy Development	1,741	5,736	2,746	2,746	2,746	34,988

*Note that demands associated with the Thermoelectric sub-sector are transferred to the Large Industry sub-sector in the five planning scenarios.

Figure 12 and Figure 13 depict the Yampa and White basins Industrial demands by sub-sector for the Baseline and the five planning scenarios. In the Yampa Basin, the graph highlights the shift from Thermoelectric to Large Industrial sub-sector. In the White Basin, the future Energy Development sub-sector varies from 2,746 AFY up to 34,988 AFY. The large range in values reflects the uncertainty surrounding future oil shale development. There are large deposits of oil shale in the basin, but its extraction is currently not economically feasible. If extraction becomes feasible in the future, it is unknown how much water will be needed. The planning scenarios allow the YWG BRT to consider a range of impacts.

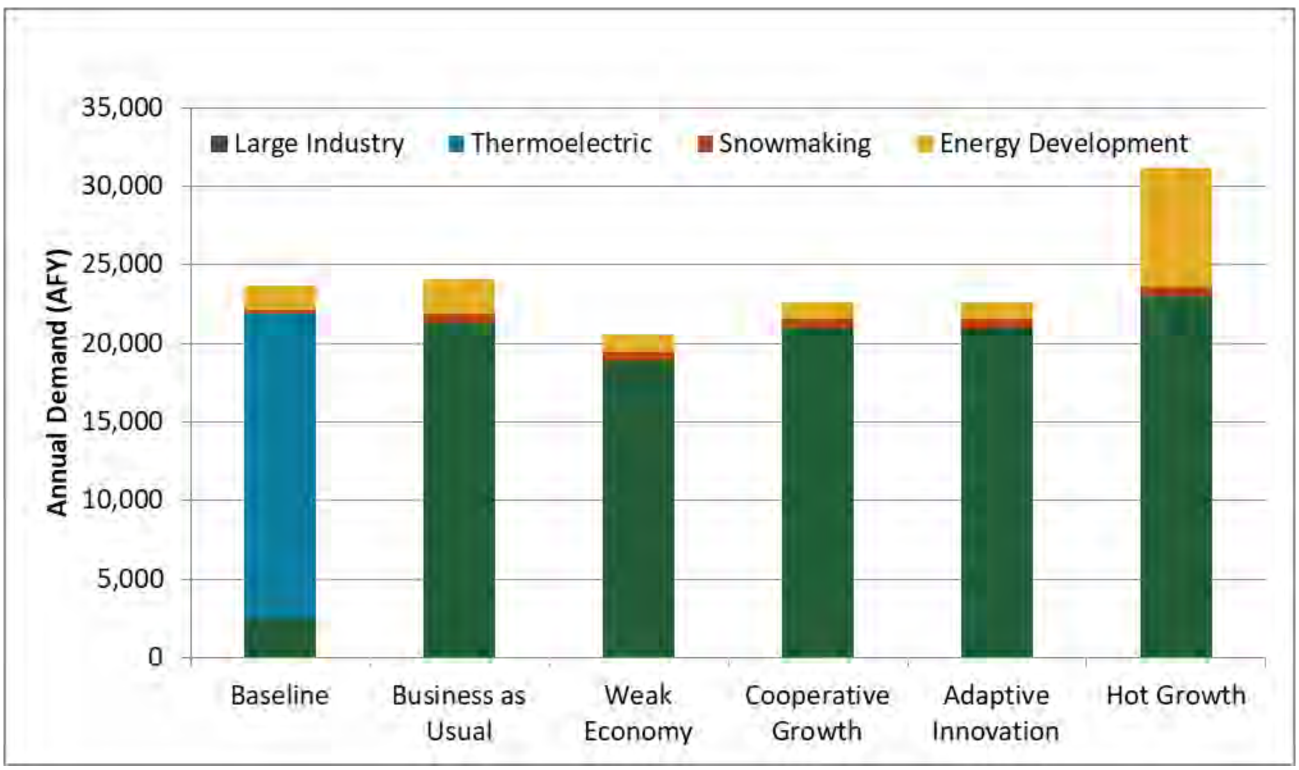


Figure 12: Yampa Basin Industrial Baseline and Projected Demands

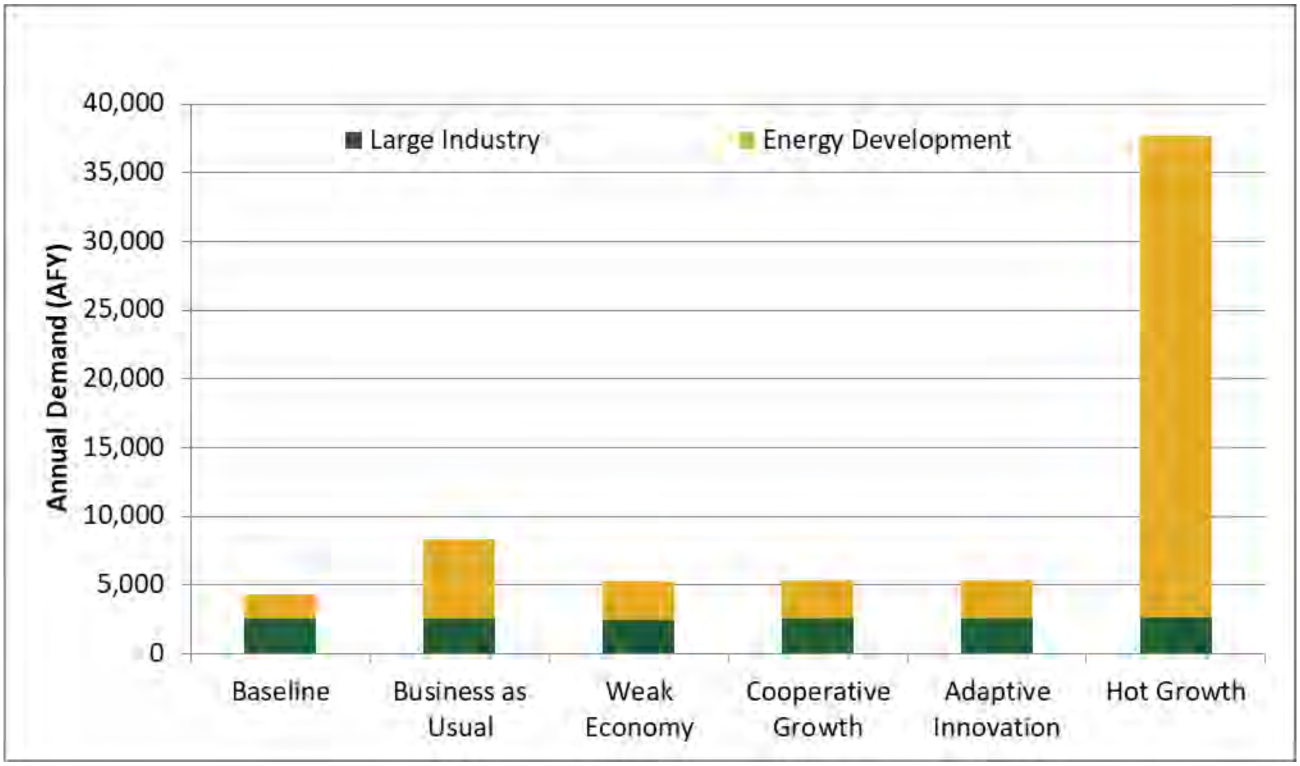


Figure 13: White Basin Industrial Baseline and Projected Demands

Non-Consumptive Needs

In addition to the consumptive uses for agriculture, municipal, and industrial, the models represent the CWCB instream flow reaches, RICDs, and the Lower Yampa Critical Reach for the Endangered Species Recovery Program. These demands do not vary across the planning scenarios. The results presented in the next section highlight the changes to streamflow at select locations in the basins.

Technical Update Supply and Gap

The Baseline and five planning scenarios explore a range of possible future demands and hydrologic conditions. The results from the scenarios show the available supply used to meet the future demands and any gaps in supply. The gaps in supply highlight the vulnerability in the basins. Results are presented first for the Yampa Basin (Table 17 and Table 18) and second for the White Basin (Table 19 and Table 20). For agriculture, results are presented for both the total demands at the headgate and for consumptive use (CU).

Table 17: Yampa Basin Agricultural Gap Results (AFY)

		Scenario					
		Baseline	Business as Usual	Weak Economy	Cooperative Growth	Adaptive Innovation	Hot Growth
Average	Average Annual Demand	402,500	403,600	403,600	522,500	461,000	684,300
	Average Annual Gap	13,600	13,600	13,900	36,500	50,500	77,200
	Average Annual Gap Increase from Baseline	-	-	260	22,900	36,900	63,600
	Average Annual Percent Gap	3%	3%	3%	7%	11%	11%
	Average Annual CU Gap	7,600	7,600	7,700	20,100	32,600	42,100
Maximum	Demand In Maximum Gap Year	448,900	448,900	450,500	533,000	452,600	667,500
	Gap In Maximum Gap Year	64,900	64,900	63,700	95,800	104,100	154,300
	Increase from Baseline Gap	-	-	-	31,000	39,300	89,500
	Percent Gap in Maximum Gap Year	14%	14%	14%	18%	23%	23%

Table 18: Yampa Basin M&I Gap Results (AFY)

		Scenario					
		Baseline	Business as Usual	Weak Economy	Cooperative Growth	Adaptive Innovation	Hot Growth
Average	Average Annual Demand	32,800	32,800	27,200	32,300	34,700	46,500
	Average Annual Gap	-	-	20	150	760	2,010
	Average Annual Gap Increase from Baseline	-	-	20	150	760	2,010
	Average Annual Percent Gap	0%	0%	0%	0%	2%	4%
Maximum	Demand In Maximum Gap Year	32,800	32,800	27,200	32,300	34,700	46,500
	Gap In Maximum Gap Year	310	310	190	420	1,150	3,130
	Increase from Baseline Gap	-	-	-	110	840	2,820
	Percent Gap in Maximum Gap Year	1%	1%	1%	1%	3%	7%

In the Yampa Basin, agricultural demands are at least 10 times larger than the combined M&I demands. The Baseline scenario shows that agriculture currently experiences a 14 percent gap in the maximum gap year. On average, the annual Baseline gap in the Yampa Basin is 3 percent. For the planning scenarios that have a climate change component, the gap for agriculture increases. This is caused by a combination of the following climate change factors:

- The peak runoff occurs earlier in the growing season, which effectively extends the late-irrigation season. The late-irrigation period is characterized by low streamflow and high crop irrigation requirements. Currently, the majority of agricultural shortages occur during the late-irrigation season. Climate change increases shortages by making this part of the growing season longer.
- Crop irrigation requirements increase due to warmer temperatures.

The maximum gap years show substantial shortages to agriculture. For the planning scenarios that have a climate-change component, the maximum gap increases beyond levels seen in historical record. This will cause additional stress on the agricultural industry. Agriculture may need to develop new strategies to address extreme drought years if climate change occurs similar to the assumptions in the planning scenarios.

Figure 14 shows a time series of the average annual percent gap in the Yampa Basin. This figure shows the annual variability in supply depending on hydrological conditions. For example, the average annual percent gap is largest in 2002, which was an extremely hot and dry year. 2012 and 1977 also stand out as years with large percent gaps. The Adaptive Innovation and Hot Growth scenarios incorporate the Hot and Dry climate change hydrology. The agricultural gaps in these two scenarios are consistently larger than scenarios with historical hydrology. Even in very wet years, such as 1982, 1983, and 1984, the annual percent gap is greater than 5 percent.

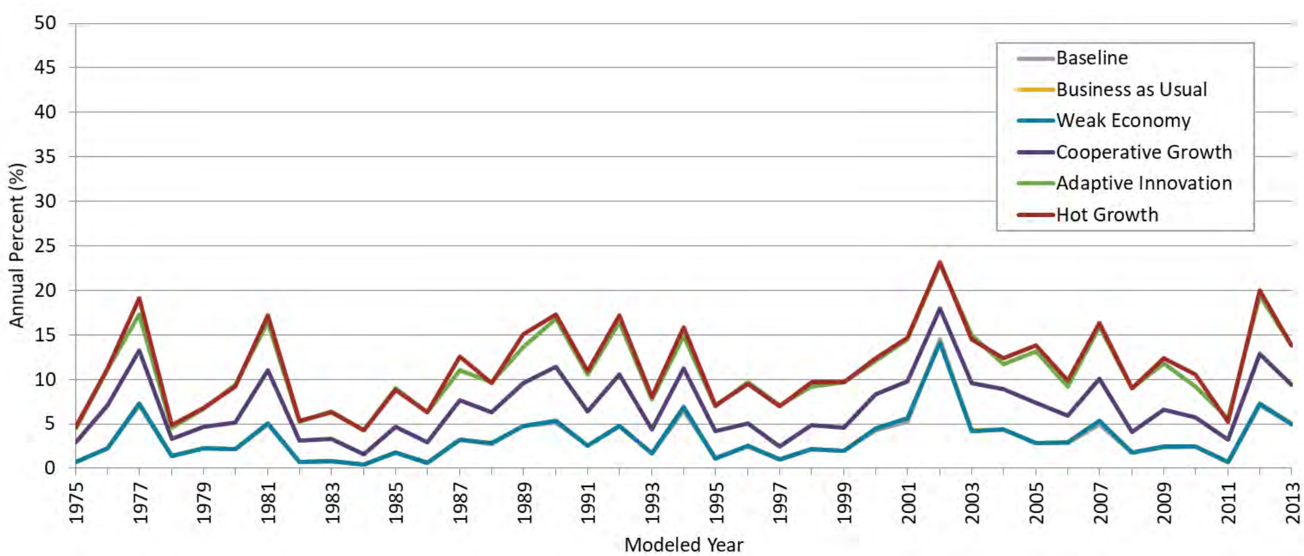


Figure 14: Time Series Graph of Yampa Basin Agricultural Average Annual Percent Gap

Table 19 provides detailed reporting of agricultural supply and gap by location. For this table, the Yampa Basin was divided into the headwater upstream of Stagecoach Reservoir, the Elk River watershed, the Williams Fork watershed, the Little Snake watershed, other tributaries, and the mainstem. The largest annual demand is on the mainstem. The largest average annual percent gaps are in "Other Tributaries" and Williams Fork for all planning scenarios. The Elk River watershed has the smallest average annual percent gap, followed by the mainstem. The headwaters above Stagecoach region have the greatest access to reservoir water. Of the approximately 12,700 irrigated acres above Stagecoach, about 10,600 acres can be supplied with supplemental reservoir releases. In contrast, about 845 acres have access to supplemental reservoir releases on the mainstem of the Yampa.

Table 19: Yampa Basin Agriculture Supply and Gap Reported by Location

Yampa Basin Agricultural Gap Results by Region

Tributary	Average Annual Demand (AFY)	Average Annual Gap (AFY)	Average Annual Percent Gap (%)	Average Annual CU Gap (AFY)
Baseline				
Above Stagecoach	63,400	564	1%	306
Elk River	41,500	174	0%	94
Little Snake River	72,400	2,240	3%	1,250
Mainstem	107,000	336	0%	194
Other Tribs	72,000	7,030	9%	4,010
Williams Fork	33,300	2,880	8%	1,550
Business as Usual				
Above Stagecoach	61,500	496	1%	269
Elk River	41,500	165	0%	89
Little Snake River	72,400	2,260	3%	1,260
Mainstem	112,000	723	1%	402
Other Tribs	70,600	6,980	9%	3,980
Williams Fork	33,300	2,870	8%	1,550
Weak Economy				
Above Stagecoach	61,500	505	1%	274
Elk River	41,500	164	0%	89
Little Snake River	72,400	2,250	3%	1,250
Mainstem	112,000	706	1%	393
Other Tribs	70,600	6,980	9%	3,980
Williams Fork	33,300	2,870	8%	1,550
Cooperative Growth				
Above Stagecoach	77,200	3,230	4%	1,760
Elk River	51,400	953	2%	517
Little Snake River	87,600	4,980	6%	2,780
Mainstem	167,000	6,950	4%	3,790
Other Tribs	84,500	14,100	16%	7,980
Williams Fork	38,900	5,060	13%	2,730
Adaptive Innovation				
Above Stagecoach	59,900	3,410	6%	2,190
Elk River	41,300	1,870	4%	1,200
Little Snake River	67,500	5,060	7%	3,330
Mainstem	179,000	20,000	11%	12,900
Other Tribs	67,300	13,800	20%	9,220
Williams Fork	31,200	4,650	15%	2,970
Hot Growth				
Above Stagecoach	85,100	8,380	10%	4,560
Elk River	57,700	3,020	5%	1,640
Little Snake River	99,600	8,230	8%	4,590
Mainstem	284,000	27,700	9%	15,000
Other Tribs	94,000	20,100	21%	11,400
Williams Fork	43,500	7,110	16%	3,840

The combined municipal and self-supplied industry sector in the Yampa Basin shows very small gaps. Gaps begin to get larger for the two planning scenarios that use the Hot and Dry climate change assumptions. The shortages experienced by the sector are primarily experienced by domestic water providers and industrial users that are represented at aggregate nodes. The representation of these smaller water users lacks the details of the larger users. This is an area of the model that could be improved in the future, especially if this information is useful to the planning efforts of these entities; however, the total demand of these users is a small portion of the basin's total demands, so the impact to basin-level planning is also relatively small.

Table 20: White Basin Agricultural Gap Results (AFY)

		Scenario					
		Baseline	Business as Usual	Weak Economy	Cooperative Growth	Adaptive Innovation	Hot Growth
Average	Average Annual Demand	246,700	242,900	246,700	293,900	177,800	319,700
	Average Annual Gap	1,200	1,200	1,200	3,200	3,400	5,900
	Average Annual Gap Increase from Baseline	-	-	-	2,000	2,200	4,700
	Average Annual Percent Gap	0%	1%	1%	1%	2%	2%
	Average Annual CU Gap	660	670	670	1,700	2,200	3,200
Maximum	Demand In Maximum Gap Year	242,300	238,500	242,300	281,400	174,300	307,600
	Gap In Maximum Gap Year	6,000	6,100	6,000	10,000	8,600	12,300
	Increase from Baseline Gap	-	-	-	4,000	2,600	6,300
	Percent Gap in Maximum Gap Year	2%	3%	3%	3%	5%	4%

Table 21: White Basin M&I Gap Results (AFY)

		Scenario					
		Baseline	Business as Usual	Weak Economy	Cooperative Growth	Adaptive Innovation	Hot Growth
Average	Average Annual Demand	7,200	11,800	7,800	8,700	9,500	42,800
	Average Annual Gap	0	2,900	570	610	680	27,400
	Average Annual Gap Increase from Baseline	-	2,900	570	610	680	27,400
	Average Annual Percent Gap	0%	25%	7%	7%	7%	64%
Maximum	Demand In Maximum Gap Year	7,200	11,800	7,800	8,700	9,500	42,800
	Gap In Maximum Gap Year	0	3,800	740	800	1,200	33,400
	Increase from Baseline Gap	-	3,800	740	800	1,200	33,400
	Percent Gap in Maximum Gap Year	0%	32%	9%	9%	13%	78%

Agriculture in the White Basin is modeled with almost no gap; however, members of the YWG BRT report that agricultural users do experience gaps, especially on tributaries. As shown in Table 22, agricultural users in the Piceance Creek watershed have an average annual percent gap of 5 percent for Baseline, Business as Usual, and Weak Economy; 11 percent for Cooperative Growth; 17 percent for Adaptive Innovation; and 19 percent for Hot Growth. This is an area where additional improvements to the model could be made in the future. Otherwise, the general trends observed in the Yampa Basin are also found in the White Basin. No agricultural users in the White Basin have access to reservoir storage.

Table 22: White Basin Agriculture Supply and Gap Reported by Location

White Basin Agricultural Gap Results by Region

Tributary	Average Annual Demand (AFY)	Average Annual Gap (AFY)	Average Annual Percent Gap (%)	Average Annual CU Gap (AFY)
Baseline				
Headwaters	28,100	32	0%	17
Mainstem	184,000	135	0%	73
Other Tribs	7,990	145	2%	78
Piceance Cr	20,700	886	5%	478
Business as Usual				
Headwaters	28,100	32	0%	17
Mainstem	180,000	135	0%	73
Other Tribs	7,990	145	2%	78
Piceance Cr	20,700	891	5%	481
Weak Economy				
Headwaters	28,100	32	0%	17
Mainstem	184,000	135	0%	73
Other Tribs	7,990	145	2%	78
Piceance Cr	20,700	891	5%	481
Cooperative Growth				
Headwaters	33,700	190	1%	108
Mainstem	218,000	234	0%	127
Other Tribs	9,650	290	3%	156
Piceance Cr	25,600	2,390	11%	1,290
Adaptive Innovation				
Headwaters	19,400	216	1%	142
Mainstem	131,000	255	0%	166
Other Tribs	6,080	279	5%	178
Piceance Cr	16,800	2,560	17%	1,640
Hot Growth				
Headwaters	37,400	527	1%	296
Mainstem	238,000	362	0%	199
Other Tribs	10,500	521	5%	281
Piceance Cr	25,800	4,300	19%	2,320

The combined municipal and self-supplied industry sector in the White Basin shows no gap in the Baseline scenario but increased gaps for the five planning scenarios. For the Business as Usual, Weak Economy, and Cooperative Growth scenarios, there is no municipal gap. For the Adaptive Innovation and Hot Growth scenario, the municipal gap is a very small portion of the total gap. The energy development sector drives the water supply gaps in the White Basin. Although the oil and gas industry holds numerous conditional water rights throughout the basin, there are not enough physical water supplies to meet the future demands year-round. If energy development is to occur in the White Basin, reservoir storage is necessary. As previously discussed, the oil and gas industry also holds water rights that are currently being leased back to agriculture. The model did not examine the impact of using these water rights for industry; however, these water supplies may not be sufficient during the late-irrigation season or winter to fully satisfy the future energy development demand, especially in the Hot Growth scenario.

The Technical Update provided high-level results of risks to environmental and recreational attributes using the Flow Tool. Eight gaged locations (six in the Yampa Basin and two in the White Basin) are incorporated into the Flow Tool. Figure 15 shows 12-digit HUC watersheds and their relative number of environmental and recreational attributes.

- Yampa River at Steamboat Springs, Colorado (09239500)
- Elk River at Clark, Colorado (09241000)
- Elkhead Creek near Elkhead, Colorado (09245000)
- Yampa River near Maybell, Colorado (09251000)
- Little Snake River near Lily, Colorado (09260000)
- Yampa River at Deerlodge Park, Colorado (09260050)
- White River below Meeker, Colorado (09304800)
- White River near Watson, Utah (09306500)

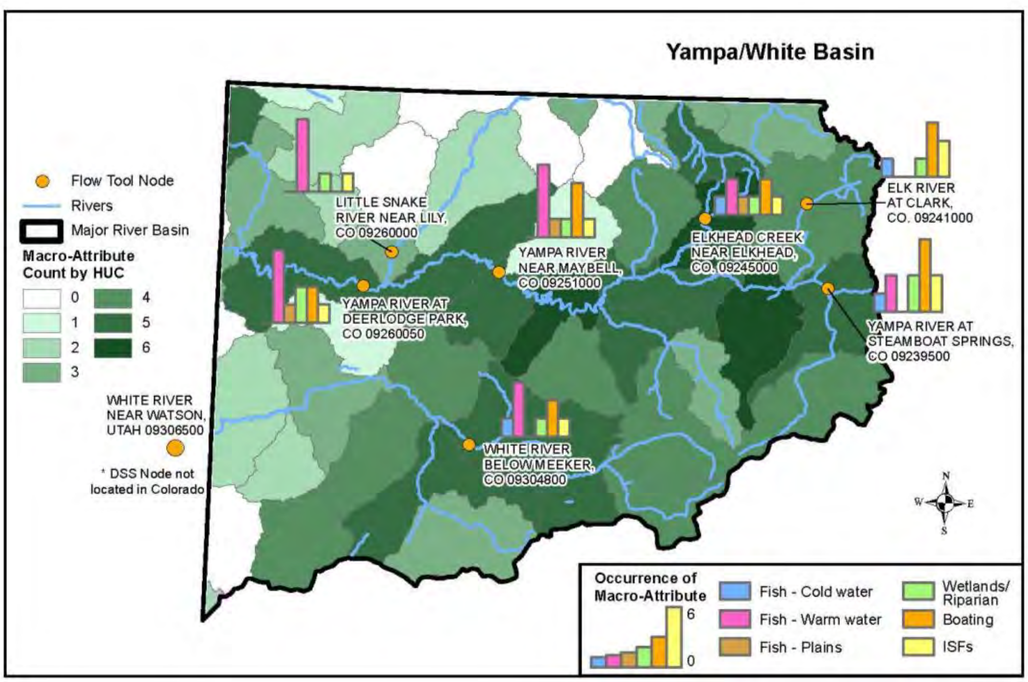


Figure 15: Flow Tool Locations Selected for the Yampa and White Basins

The following points summarize the key Flow Tool results presented in the Technical Update:

- Flow-related risk to riparian/wetland plants remains low to moderate across the basin.
- Flow-related risk to warm water fish is projected to increase under climate change due to several factors:
    - The change in timing for peak flows. The earlier runoff may not align with the species' needs.
    - The reductions in mid- and late-summer flows lead to a loss of habitat and favor reproduction and survival of non-native fish.
- The increase in risk to warm water fish is particularly concerning for the Yampa and White Basins because this includes the endangered fish species. Note that the flow-related risks identified by the Flow Tool are independent of the flow recommendations for endangered fish in the Yampa PBO and in any future PBO for the White River, which are set by the federal government only for the purpose of managing the Recovery Program. ESA compliance is determined by implementation of the Recovery Program, not by strict adherence to flow recommendations.
- Flow-related risk to trout (cold water fish) increase under climate change because:
    - The reduction in mid- and late-summer flows leads to a loss of habitat.
    - Lower flows are linked to higher stream temperatures.
- Instream flow reaches and RICDs are at risk of being met less often under climate change.

The planning scenarios show a range of possible futures and highlight different vulnerabilities in the basins. A common theme is the risk associated with climate change.


Photo Source: Kent Vertrees, Friends of the Yampa

Non-Consumptive Needs Results

In addition to the Flow Tool, the model results were analyzed at locations of interest for environmental and recreational needs. Table 23 shows results for the Steamboat RICD, and Table 25 shows results for the Lower Yampa Reach. Both tables report the percent of months in which the streamflow target is met. The Steamboat RICD streamflow target is a simplified representation of the daily decreed streamflows to accommodate the monthly time-step of the model. For the Lower Yampa Reach, the streamflow target is for July, August, September, and October. The target for these four months depends on the year type, as shown in Table 24. The daily streamflow is translated into monthly flow volumes for the purposes of the model. The results for Business as Usual and Weak Economy are very similar because these scenarios assume that current hydrological conditions will continue into the future. The streamflow targets are met less frequently in Cooperative Growth due to the decrease in natural flow under the In Between climate change hydrology. The streamflow targets are rarely met in Adaptive Innovation and Hot Growth due to the further decrease in natural flow under the Hot and Dry climate change hydrology. There are a few months in Adaptive Innovation that meet the streamflow targets less often than Hot Growth. This is caused by the change in agricultural return flows due to increased efficiency in Adaptive Innovation.

The Technical Update looked at monthly streamflow data. These screening-level analysis results are based on monthly flows and flow targets and do not capture or analyze the impact on daily flows.

Table 23: Steamboat RICD Statistics for the Five Planning Scenarios

Percent of Months Streamflow Target is Met

Scenario	April	May	June	July	August
Steamboat RICD					
Capacity	200	825	1025	175	47.5
Baseline	100%	97%	72%	56%	79%
Business as Usual	100%	97%	72%	56%	82%
Weak Economy	100%	97%	72%	59%	82%
Cooperative Growth	100%	97%	62%	18%	67%
Adaptive Innovation	100%	95%	41%	8%	31%
Hot Growth	100%	95%	38%	8%	46%

Table 24: Lower Yampa Reach Streamflow Targets

Year Type	Streamflow Target (cfs)
Dry	93
Average	134
Wet	200

Table 25: Lower Yampa Reach Statistics for the Five Planning Scenarios

Percent of Months Streamflow Target is Met

Scenario	July	August	September	October
Lower Yampa Reach				
Baseline	90%	67%	51%	100%
Business as Usual	92%	69%	54%	100%
Weak Economy	92%	69%	59%	100%
Cooperative Growth	59%	18%	28%	92%
Adaptive Innovation	38%	3%	18%	82%
Hot Growth	38%	3%	18%	87%

The YWG BRT is interested in understanding how the streamflow regime changes at the location of the proposed Craig White Water Park and the future White PBO reach. Currently, these locations do not have streamflow targets established. Instead, Table 26 presents the average percent change in streamflow volume from the Baseline scenario. This table highlights that the monthly average streamflow volume is not expected to change substantially in Business as Usual and Weak Economy. Large changes in streamflow are expected under the climate change conditions in Cooperative Growth, Adaptive Innovation, and Hot Growth.

The White River Management Plan and PBO are currently under development. As part of the process, daily streamflow conditions are being considered under different scenarios, such as baseline, a range of future depletions, and a range of climate change hydrology and demands. The scenarios being modeled to support the Management Plan do not align with the five planning scenarios for the BIP; therefore, caution should be used when comparing results from the two efforts. While it is anticipated that the White River Management Plan and PBO will provide flow recommendations for endangered fish, these are set by the federal government only for the purpose of managing the Recovery Program. Endangered Species Act compliance is determined by implementation of the Recovery Program, not by strict adherence to flow recommendations.

Table 26: Future Craig White Water Park and Future White River PBO Reach Statistics for the Five Planning Scenarios

Average Percent Change from Baseline Flow

Scenario	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Craig White Water Park												
Business as Usual	0%	0%	-1%	-0%	-0%	0%	0%	-0%	0%	-1%	0%	2%
Weak Economy	0%	1%	0%	1%	1%	0%	0%	0%	0%	0%	1%	3%
Cooperative Growth	76%	-41%	3%	25%	6%	-63%	-35%	107%	21%	-1%	-12%	-22%
Adaptive Innovation	62%	-49%	-17%	8%	-9%	-72%	-52%	81%	10%	-17%	-31%	-41%
Hot Growth	61%	-46%	-15%	8%	-9%	-71%	-55%	81%	8%	-12%	-27%	-39%
White River PBO												
Business as Usual	-0%	0%	-0%	-0%	-0%	0%	0%	-0%	-0%	-0%	-0%	-0%
Weak Economy	-0%	-0%	-0%	0%	-0%	-0%	-0%	-0%	-0%	-0%	-0%	-0%
Cooperative Growth	53%	-56%	-8%	5%	-3%	-62%	-28%	35%	19%	-12%	-18%	-35%
Adaptive Innovation	27%	-72%	-32%	-18%	-26%	-77%	-39%	9%	5%	-33%	-40%	-51%
Hot Growth	23%	-74%	-28%	-16%	-23%	-79%	-47%	9%	-2%	-28%	-33%	-54%

Finally, the results from the five planning scenarios are analyzed at the CWCB instream flow reaches and are reported in Table 27 through Table 37. With the exception of the instream flow reaches on the mainstem of the White River, the instream flow reaches are not impacted by diversions to future municipal or industrial users. The streamflow results from the five planning scenarios are driven by diversions and return flows from agriculture and climate change. For Business as Usual and Weak Economy, agriculture is assumed to operate with the same efficiency and crop irrigation requirement as historical conditions. It is also assumed that historical streamflow conditions will continue. The results from these two planning scenarios are very similar to current conditions in the CWCB instream flow reaches. One note is that some of the instream flow reach targets are almost never met during the winter. This is due to a lack of physical streamflow in the reach. The instream flow target may not be representative of conditions year-round.

For Cooperative Growth, the In Between climate-adjusted crop irrigation requirements and hydrology are used. Recall that the In Between hydrology produced a mixed signal. During some months, areas of the basin will experience higher flows than historical conditions. During other months, the flows will be lower. The instream flow target results also show this mixed signal.

For Adaptive Innovation and Hot Growth, the Hot and Dry climate-adjusted crop irrigation requirements and hydrology are used. Recall that the Hot and Dry hydrology produces increased crop irrigation requirements and lower streamflow. For Adaptive Innovation, the increase in crop irrigation requirement is offset by an assumed reduction in crop irrigation requirement due to emerging technology. For instream flow reaches with senior agricultural diversions, the Adaptive Innovation results fall between the Cooperative Growth and Hot Growth results. If climate change causes streamflow levels to decline as shown in these two scenarios, the instream flow reaches will experience a corresponding decline in the number of months that the streamflow target is met.

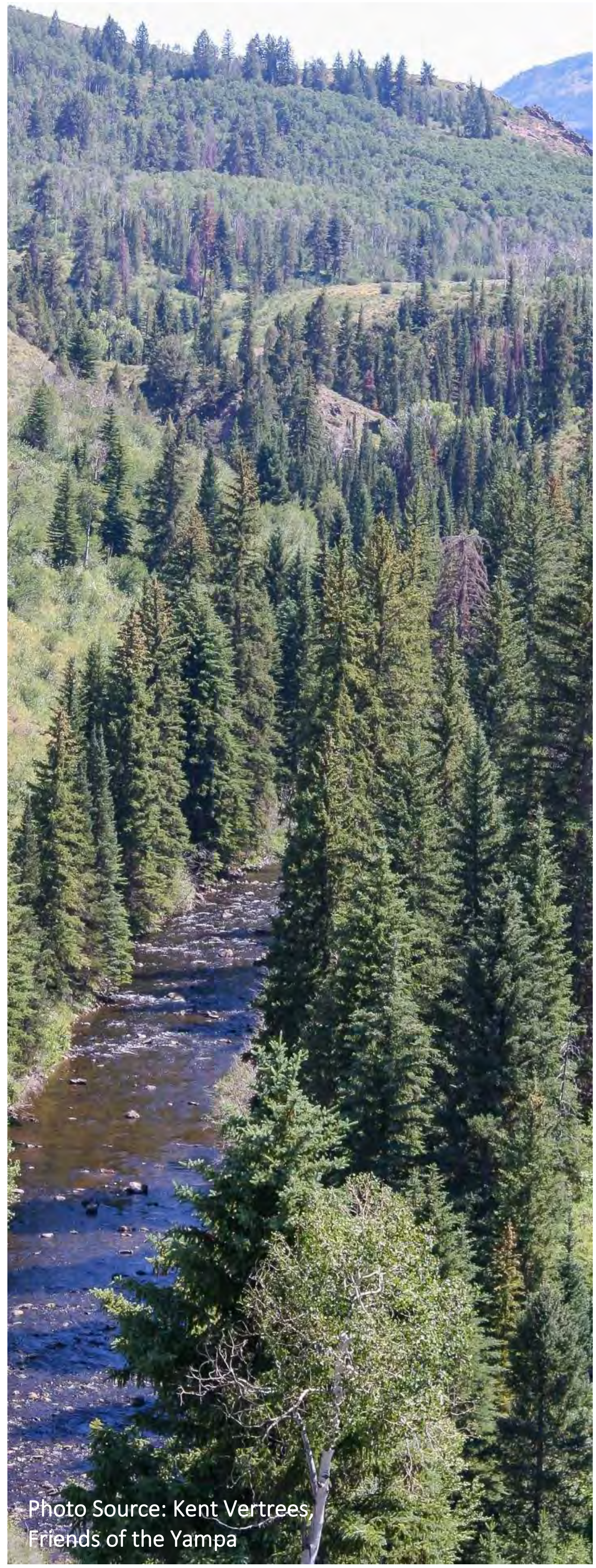


Photo Source: Kent Vertrees, Friends of the Yampa

WHITE RIVER INSTREAM FLOW REACHES

Table 27: Percent of Months the CWCB Instream Flow Targets are Met - White River, Part 1

Percent of Months Streamflow Target is Met

Scenario	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CATHEDRAL CK MSF												
Baseline	69%	82%	69%	69%	77%	77%	87%	77%	62%	59%	51%	62%
Business as Usual	69%	82%	69%	69%	77%	77%	87%	77%	62%	59%	51%	62%
Weak Economy	69%	82%	69%	69%	77%	77%	87%	77%	62%	59%	51%	62%
Cooperative Growth	72%	85%	67%	69%	77%	74%	82%	79%	74%	67%	51%	64%
Adaptive Innovation	74%	82%	67%	59%	72%	74%	82%	79%	74%	67%	51%	64%
Hot Growth	74%	82%	67%	59%	69%	74%	82%	74%	74%	67%	51%	64%
LAKE CREEK MSF												
Baseline	62%	77%	59%	64%	74%	74%	82%	69%	56%	49%	44%	56%
Business as Usual	62%	77%	59%	64%	74%	74%	82%	69%	56%	49%	44%	56%
Weak Economy	62%	77%	59%	64%	74%	74%	82%	69%	56%	49%	44%	56%
Cooperative Growth	67%	77%	54%	62%	74%	74%	77%	72%	62%	59%	51%	59%
Adaptive Innovation	62%	74%	54%	56%	69%	74%	74%	67%	59%	56%	51%	54%
Hot Growth	62%	74%	54%	56%	69%	74%	72%	64%	59%	56%	51%	54%
SOLDIER CREEK MSF												
Baseline	69%	82%	69%	69%	77%	77%	87%	77%	62%	59%	51%	62%
Business as Usual	69%	82%	69%	69%	77%	77%	87%	77%	62%	59%	51%	62%
Weak Economy	69%	82%	69%	69%	77%	77%	87%	77%	62%	59%	51%	62%
Cooperative Growth	72%	85%	67%	69%	77%	74%	82%	79%	74%	67%	51%	64%
Adaptive Innovation	74%	82%	67%	59%	72%	74%	82%	79%	74%	67%	51%	64%
Hot Growth	74%	82%	67%	59%	69%	74%	82%	74%	74%	67%	51%	64%
WHITE RIVER MSF												
Baseline	97%	100%	100%	100%	100%	92%	79%	56%	59%	100%	100%	97%
Business as Usual	97%	100%	100%	100%	100%	92%	79%	56%	59%	100%	100%	97%
Weak Economy	97%	100%	100%	100%	100%	92%	79%	56%	59%	100%	100%	97%
Cooperative Growth	49%	51%	95%	100%	100%	85%	23%	3%	8%	46%	51%	44%
Adaptive Innovation	15%	15%	72%	100%	100%	85%	26%	3%	3%	15%	15%	18%
Hot Growth	15%	15%	72%	100%	97%	77%	15%	0%	3%	15%	18%	18%

Table 28: Percent of Months the CWCB Instream Flow Targets are Met - White River, Part 2

Percent of Months Streamflow Target is Met

Scenario	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
FAWN CR MSF												
Baseline	100%	100%	100%	100%	100%	79%	92%	100%	100%	100%	100%	100%
Business as Usual	100%	100%	100%	100%	100%	79%	92%	100%	100%	100%	100%	100%
Weak Economy	100%	100%	100%	100%	100%	79%	92%	100%	100%	100%	100%	100%
Cooperative Growth	100%	100%	100%	100%	100%	64%	26%	64%	79%	100%	100%	100%
Adaptive Innovation	97%	100%	100%	100%	100%	79%	46%	54%	62%	92%	97%	95%
Hot Growth	97%	100%	100%	100%	100%	49%	21%	38%	46%	92%	97%	95%
MARVINE CREEK MSF												
Baseline	64%	44%	46%	100%	100%	100%	90%	74%	69%	87%	74%	59%
Business as Usual	64%	44%	46%	100%	100%	100%	90%	74%	69%	87%	74%	59%
Weak Economy	64%	44%	46%	100%	100%	100%	90%	74%	69%	87%	74%	59%
Cooperative Growth	18%	21%	74%	100%	100%	90%	44%	5%	5%	15%	15%	13%
Adaptive Innovation	8%	13%	59%	100%	100%	90%	38%	3%	3%	5%	5%	8%
Hot Growth	8%	13%	59%	100%	100%	85%	26%	0%	3%	5%	5%	8%
MILLER CK MSF												
Baseline	74%	72%	85%	90%	95%	77%	92%	85%	95%	97%	59%	64%
Business as Usual	74%	72%	85%	90%	95%	77%	92%	85%	95%	97%	59%	64%
Weak Economy	74%	72%	85%	90%	95%	77%	92%	85%	95%	97%	59%	64%
Cooperative Growth	74%	74%	90%	97%	64%	77%	85%	77%	87%	95%	56%	64%
Adaptive Innovation	67%	72%	90%	85%	59%	74%	79%	72%	85%	95%	51%	56%
Hot Growth	67%	72%	90%	85%	56%	74%	77%	67%	85%	95%	54%	59%
NORTH FK WHITE R MSF-L												
Baseline	64%	46%	49%	100%	100%	100%	95%	92%	82%	87%	74%	62%
Business as Usual	64%	46%	49%	100%	100%	100%	95%	92%	82%	87%	74%	62%
Weak Economy	64%	46%	49%	100%	100%	100%	95%	92%	82%	87%	74%	62%
Cooperative Growth	18%	21%	74%	100%	100%	92%	56%	13%	10%	21%	18%	13%
Adaptive Innovation	8%	13%	59%	100%	100%	90%	44%	5%	3%	5%	8%	8%
Hot Growth	8%	13%	59%	100%	100%	90%	44%	5%	3%	5%	8%	8%

Table 29: Percent of Months the CWCB Instream Flow Targets are Met - White River, Part 3

Percent of Months Streamflow Target is Met												
Scenario	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
NORTH FK WHITE R MSF-U												
Baseline	87%	90%	87%	100%	100%	100%	95%	95%	95%	97%	97%	87%
Business as Usual	87%	90%	87%	100%	100%	100%	95%	95%	95%	97%	97%	87%
Weak Economy	87%	90%	87%	100%	100%	100%	95%	95%	95%	97%	97%	87%
Cooperative Growth	36%	33%	87%	100%	100%	97%	64%	33%	31%	36%	33%	28%
Adaptive Innovation	13%	13%	69%	100%	100%	92%	56%	13%	5%	13%	15%	13%
Hot Growth	13%	13%	69%	100%	100%	92%	51%	10%	5%	13%	15%	13%
SOUTH FORK WHITE R MSF												
Baseline	82%	95%	95%	100%	100%	100%	95%	100%	95%	100%	100%	87%
Business as Usual	82%	95%	95%	100%	100%	100%	95%	100%	95%	100%	100%	87%
Weak Economy	82%	95%	95%	100%	100%	100%	95%	100%	95%	100%	100%	87%
Cooperative Growth	28%	26%	64%	100%	100%	100%	69%	26%	15%	26%	28%	26%
Adaptive Innovation	13%	13%	38%	100%	100%	100%	56%	13%	5%	10%	10%	13%
Hot Growth	13%	13%	38%	100%	100%	97%	54%	13%	5%	10%	10%	13%
UTE CREEK MSF												
Baseline	100%	100%	100%	100%	100%	100%	97%	100%	97%	100%	100%	100%
Business as Usual	100%	100%	100%	100%	100%	100%	97%	100%	97%	100%	100%	100%
Weak Economy	100%	100%	100%	100%	100%	100%	97%	100%	97%	100%	100%	100%
Cooperative Growth	100%	100%	100%	100%	100%	97%	79%	92%	82%	100%	100%	100%
Adaptive Innovation	87%	97%	100%	100%	100%	100%	79%	74%	56%	87%	90%	87%
Hot Growth	87%	97%	100%	100%	100%	100%	77%	67%	54%	87%	90%	87%

YAMPA RIVER INSTREAM FLOW REACHES

Table 30: Percent of Months the CWCB Instream Flow Targets are Met - Yampa River, Part 1

Percent of Months Streamflow Target is Met

Scenario	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
EAST FK WILLIAMS F MSF-L												
Baseline	100%	100%	100%	100%	100%	100%	97%	97%	95%	100%	100%	100%
Business as Usual	100%	100%	100%	100%	100%	100%	97%	97%	95%	100%	100%	100%
Weak Economy	100%	100%	100%	100%	100%	100%	97%	97%	95%	100%	100%	100%
Cooperative Growth	100%	100%	100%	100%	100%	100%	90%	46%	77%	100%	100%	100%
Adaptive Innovation	100%	100%	100%	100%	100%	97%	69%	41%	64%	100%	100%	100%
Hot Growth	100%	100%	100%	100%	100%	97%	72%	41%	56%	100%	100%	100%
EAST FK WILLIAMS F MSF-U												
Baseline	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Business as Usual	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Weak Economy	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Cooperative Growth	100%	100%	100%	100%	100%	100%	100%	62%	90%	100%	100%	100%
Adaptive Innovation	100%	100%	100%	100%	100%	100%	95%	62%	90%	100%	100%	100%
Hot Growth	100%	100%	100%	100%	100%	100%	95%	72%	87%	100%	100%	100%
PINE CREEK MSF												
Baseline	100%	100%	100%	100%	100%	74%	18%	13%	8%	74%	100%	100%
Business as Usual	100%	100%	100%	100%	100%	74%	18%	13%	8%	74%	100%	100%
Weak Economy	100%	100%	100%	100%	100%	74%	18%	13%	8%	74%	100%	100%
Cooperative Growth	100%	100%	100%	100%	100%	51%	13%	8%	10%	74%	100%	100%
Adaptive Innovation	100%	100%	100%	100%	100%	62%	13%	33%	21%	69%	97%	100%
Hot Growth	100%	100%	100%	100%	97%	33%	13%	44%	15%	67%	97%	100%
WILLIAMS FORK RIVER MSF												
Baseline	100%	100%	100%	100%	100%	97%	82%	72%	51%	100%	100%	100%
Business as Usual	100%	100%	100%	100%	100%	97%	82%	72%	51%	100%	100%	100%
Weak Economy	100%	100%	100%	100%	100%	97%	82%	72%	51%	100%	100%	100%
Cooperative Growth	100%	100%	100%	100%	100%	95%	38%	8%	31%	100%	100%	100%
Adaptive Innovation	100%	100%	100%	100%	100%	92%	21%	0%	10%	97%	100%	100%
Hot Growth	100%	100%	100%	100%	100%	90%	21%	0%	10%	97%	100%	100%

Table 31: Percent of Months the CWCB Instream Flow Targets are Met - Yampa River, Part 2

Percent of Months Streamflow Target is Met												
Scenario	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
BEAVER CREEK MSF												
Baseline	97%	100%	100%	100%	100%	100%	100%	97%	97%	97%	100%	97%
Business as Usual	97%	100%	100%	100%	100%	100%	100%	97%	97%	97%	100%	97%
Weak Economy	97%	100%	100%	100%	100%	100%	100%	97%	97%	97%	100%	97%
Cooperative Growth	97%	100%	100%	100%	100%	100%	90%	67%	95%	97%	100%	97%
Adaptive Innovation	95%	97%	100%	100%	100%	100%	79%	44%	95%	97%	100%	95%
Hot Growth	95%	97%	100%	100%	100%	100%	77%	41%	92%	97%	100%	95%
SLATER CR MSF												
Baseline	100%	100%	100%	100%	100%	92%	49%	33%	46%	97%	100%	100%
Business as Usual	100%	100%	100%	100%	100%	92%	49%	33%	46%	97%	100%	100%
Weak Economy	100%	100%	100%	100%	100%	92%	49%	33%	46%	97%	100%	100%
Cooperative Growth	100%	100%	100%	100%	100%	67%	5%	10%	49%	97%	100%	100%
Adaptive Innovation	100%	100%	100%	100%	100%	62%	3%	18%	49%	100%	100%	100%
Hot Growth	100%	100%	100%	100%	100%	54%	3%	5%	44%	97%	100%	100%
SOUTH FK WILLIAMS FK MSF												
Baseline	51%	92%	85%	97%	100%	95%	56%	41%	31%	44%	64%	51%
Business as Usual	51%	92%	85%	97%	100%	95%	56%	41%	31%	44%	64%	51%
Weak Economy	51%	92%	85%	97%	100%	95%	56%	41%	31%	44%	64%	51%
Cooperative Growth	54%	90%	95%	97%	100%	92%	18%	5%	46%	46%	64%	54%
Adaptive Innovation	46%	82%	90%	97%	100%	87%	13%	3%	41%	31%	51%	36%
Hot Growth	46%	82%	90%	97%	100%	87%	10%	3%	41%	31%	51%	36%
TROUT CREEK MSF-L												
Baseline	85%	90%	85%	100%	100%	97%	59%	26%	28%	67%	85%	87%
Business as Usual	85%	90%	85%	100%	100%	97%	59%	26%	28%	67%	85%	87%
Weak Economy	85%	90%	85%	100%	100%	97%	59%	26%	28%	67%	85%	87%
Cooperative Growth	74%	74%	95%	100%	100%	82%	23%	0%	15%	54%	79%	85%
Adaptive Innovation	51%	44%	95%	100%	100%	74%	18%	0%	5%	36%	51%	59%
Hot Growth	51%	44%	95%	100%	100%	69%	15%	0%	5%	36%	51%	59%

Table 32: Percent of Months the CWCB Instream Flow Targets are Met - Yampa River, Part 3

Percent of Months Streamflow Target is Met

Scenario	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
BEAR RIVER MSF-L												
Baseline	100%	100%	100%	97%	44%	62%	28%	26%	23%	79%	85%	100%
Business as Usual	100%	100%	100%	100%	49%	62%	31%	28%	26%	87%	87%	100%
Weak Economy	100%	100%	100%	100%	49%	62%	31%	28%	26%	87%	87%	100%
Cooperative Growth	87%	92%	100%	97%	59%	46%	3%	0%	3%	59%	36%	67%
Adaptive Innovation	90%	95%	100%	95%	59%	49%	8%	0%	3%	46%	31%	51%
Hot Growth	64%	90%	100%	95%	36%	41%	3%	0%	3%	41%	18%	26%
ELK RIVER MSF-L												
Baseline	33%	3%	59%	97%	100%	100%	87%	69%	41%	62%	44%	51%
Business as Usual	33%	3%	59%	97%	100%	100%	87%	67%	41%	62%	44%	51%
Weak Economy	33%	3%	59%	97%	100%	100%	87%	67%	41%	62%	44%	51%
Cooperative Growth	28%	21%	79%	100%	100%	100%	49%	0%	18%	49%	41%	41%
Adaptive Innovation	15%	8%	74%	100%	100%	97%	38%	0%	15%	21%	21%	21%
Hot Growth	15%	8%	74%	100%	100%	97%	38%	0%	8%	21%	18%	21%
WILLOW CK MSF-M2												
Baseline	97%	100%	97%	97%	100%	100%	100%	100%	100%	97%	100%	97%
Business as Usual	97%	100%	100%	100%	100%	100%	100%	100%	100%	97%	100%	97%
Weak Economy	97%	100%	100%	100%	100%	100%	100%	100%	100%	97%	100%	97%
Cooperative Growth	95%	97%	97%	100%	100%	100%	100%	100%	100%	97%	92%	97%
Adaptive Innovation	95%	97%	97%	100%	100%	100%	100%	95%	100%	97%	97%	95%
Hot Growth	95%	97%	97%	100%	100%	100%	100%	97%	100%	97%	97%	95%
YAMPA RIVER MSF												
Baseline	74%	77%	100%	100%	100%	90%	54%	54%	62%	74%	77%	85%
Business as Usual	74%	77%	100%	100%	100%	90%	54%	59%	64%	77%	77%	82%
Weak Economy	74%	77%	100%	100%	100%	90%	54%	59%	62%	77%	77%	82%
Cooperative Growth	67%	87%	100%	100%	100%	72%	8%	8%	18%	56%	54%	62%
Adaptive Innovation	46%	74%	100%	100%	92%	56%	3%	0%	5%	33%	36%	41%
Hot Growth	49%	77%	97%	100%	95%	59%	5%	3%	8%	44%	46%	36%

Table 33: Percent of Months the CWCB Instream Flow Targets are Met - Yampa River, Part 4

Percent of Months Streamflow Target is Met												
Scenario	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
BIG CREEK MSF												
Baseline	0%	3%	5%	97%	100%	100%	69%	5%	3%	10%	0%	0%
Business as Usual	0%	3%	5%	97%	100%	100%	69%	5%	3%	10%	0%	0%
Weak Economy	0%	3%	5%	97%	100%	100%	69%	5%	3%	10%	0%	0%
Cooperative Growth	0%	5%	38%	100%	100%	100%	44%	0%	3%	3%	3%	0%
Adaptive Innovation	0%	3%	28%	100%	100%	100%	28%	0%	0%	0%	3%	0%
Hot Growth	0%	3%	28%	100%	100%	100%	26%	0%	0%	0%	3%	0%
COAL CREEK MSF												
Baseline	87%	92%	100%	100%	100%	97%	100%	100%	97%	100%	95%	92%
Business as Usual	87%	92%	100%	100%	100%	97%	100%	100%	97%	100%	95%	92%
Weak Economy	87%	92%	100%	100%	100%	97%	100%	100%	97%	100%	95%	92%
Cooperative Growth	95%	100%	100%	100%	100%	97%	100%	100%	97%	100%	95%	95%
Adaptive Innovation	95%	97%	100%	100%	100%	95%	92%	100%	97%	100%	95%	92%
Hot Growth	95%	97%	100%	100%	100%	95%	92%	100%	97%	100%	95%	92%
DOME CREEK MSF												
Baseline	5%	3%	62%	100%	97%	90%	82%	85%	33%	64%	15%	3%
Business as Usual	5%	3%	62%	100%	97%	90%	82%	82%	33%	64%	15%	3%
Weak Economy	5%	3%	62%	100%	97%	90%	82%	82%	33%	64%	15%	3%
Cooperative Growth	13%	26%	95%	100%	97%	74%	33%	56%	31%	44%	33%	13%
Adaptive Innovation	13%	23%	90%	100%	95%	64%	18%	41%	15%	26%	23%	13%
Hot Growth	13%	23%	90%	100%	95%	64%	18%	54%	15%	26%	23%	13%
ELK RIVER MSF-U												
Baseline	0%	0%	10%	87%	100%	100%	87%	33%	13%	10%	3%	0%
Business as Usual	0%	0%	10%	87%	100%	100%	87%	33%	13%	10%	3%	0%
Weak Economy	0%	0%	10%	87%	100%	100%	87%	33%	13%	10%	3%	0%
Cooperative Growth	0%	0%	41%	97%	100%	100%	49%	0%	5%	8%	5%	3%
Adaptive Innovation	0%	0%	41%	97%	100%	97%	38%	0%	0%	0%	0%	0%
Hot Growth	0%	0%	41%	97%	100%	97%	38%	0%	0%	0%	0%	0%

Table 34: Percent of Months the CWCB Instream Flow Targets are Met - Yampa River, Part 5

Percent of Months Streamflow Target is Met												
Scenario	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
GREEN CREEK MSF												
Baseline	0%	0%	13%	100%	100%	87%	26%	3%	0%	3%	0%	0%
Business as Usual	0%	0%	13%	100%	100%	87%	26%	3%	0%	3%	0%	0%
Weak Economy	0%	0%	13%	100%	100%	87%	26%	3%	0%	3%	0%	0%
Cooperative Growth	0%	3%	72%	100%	100%	67%	0%	0%	0%	0%	3%	0%
Adaptive Innovation	0%	3%	59%	100%	97%	56%	0%	0%	0%	0%	3%	0%
Hot Growth	0%	3%	59%	100%	97%	56%	0%	0%	0%	0%	3%	0%
HOT SPRING CK MSF-U												
Baseline	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Business as Usual	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Weak Economy	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Cooperative Growth	100%	95%	100%	100%	100%	100%	95%	92%	97%	97%	100%	97%
Adaptive Innovation	97%	82%	100%	100%	100%	97%	95%	92%	95%	92%	97%	85%
Hot Growth	97%	82%	100%	100%	100%	95%	87%	77%	95%	90%	97%	85%
NORTH FK FISH CK MSF-L												
Baseline	0%	0%	5%	85%	100%	100%	72%	8%	5%	15%	13%	0%
Business as Usual	0%	0%	5%	85%	100%	100%	72%	8%	5%	15%	13%	0%
Weak Economy	0%	0%	5%	85%	100%	100%	72%	8%	5%	15%	13%	0%
Cooperative Growth	0%	0%	31%	97%	100%	100%	36%	0%	5%	13%	13%	0%
Adaptive Innovation	0%	0%	28%	97%	100%	97%	33%	8%	3%	5%	3%	0%
Hot Growth	0%	0%	28%	97%	100%	100%	85%	15%	8%	5%	3%	0%
OAK CREEK MSF												
Baseline	95%	100%	100%	100%	100%	100%	100%	90%	97%	79%	82%	92%
Business as Usual	95%	100%	100%	100%	100%	100%	100%	90%	97%	79%	82%	92%
Weak Economy	95%	100%	100%	100%	100%	100%	100%	90%	97%	79%	82%	92%
Cooperative Growth	90%	100%	100%	100%	100%	100%	90%	85%	97%	90%	85%	97%
Adaptive Innovation	92%	100%	100%	100%	100%	100%	90%	82%	97%	90%	87%	97%
Hot Growth	92%	100%	100%	100%	100%	100%	90%	87%	100%	90%	87%	97%

Table 35: Percent of Months the CWCB Instream Flow Targets are Met - Yampa River, Part 6

Percent of Months Streamflow Target is Met												
Scenario	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
PRIEST CREEK MSF												
Baseline	0%	0%	10%	100%	100%	87%	15%	3%	0%	3%	0%	0%
Business as Usual	0%	0%	10%	100%	100%	87%	15%	3%	0%	3%	0%	0%
Weak Economy	0%	0%	10%	100%	100%	87%	15%	3%	0%	3%	0%	0%
Cooperative Growth	0%	3%	69%	100%	100%	64%	0%	0%	0%	0%	3%	0%
Adaptive Innovation	0%	3%	56%	100%	97%	56%	0%	0%	0%	0%	3%	0%
Hot Growth	0%	3%	56%	100%	97%	51%	0%	0%	0%	0%	3%	0%
SAND CREEK MSF												
Baseline	100%	100%	100%	100%	100%	100%	100%	100%	95%	97%	100%	100%
Business as Usual	100%	100%	100%	100%	100%	100%	100%	100%	95%	97%	100%	100%
Weak Economy	100%	100%	100%	100%	100%	100%	100%	100%	95%	97%	100%	100%
Cooperative Growth	100%	100%	100%	100%	100%	100%	90%	62%	77%	90%	100%	100%
Adaptive Innovation	100%	95%	100%	100%	100%	100%	87%	77%	67%	87%	100%	87%
Hot Growth	100%	95%	100%	100%	100%	100%	95%	90%	69%	85%	100%	87%
SERVICE CREEK MSF												
Baseline	0%	0%	31%	100%	100%	87%	54%	8%	3%	3%	3%	0%
Business as Usual	0%	0%	31%	100%	100%	87%	54%	8%	3%	3%	3%	0%
Weak Economy	0%	0%	31%	100%	100%	87%	54%	8%	3%	3%	3%	0%
Cooperative Growth	3%	3%	79%	100%	100%	74%	3%	0%	3%	5%	3%	3%
Adaptive Innovation	0%	3%	79%	100%	97%	62%	0%	0%	0%	0%	3%	0%
Hot Growth	0%	3%	79%	100%	97%	62%	0%	0%	0%	0%	3%	0%
SODA CREEK MSF												
Baseline	23%	15%	74%	97%	100%	100%	64%	3%	8%	49%	54%	33%
Business as Usual	23%	15%	74%	97%	100%	100%	67%	3%	10%	49%	54%	33%
Weak Economy	23%	15%	74%	97%	100%	100%	67%	3%	10%	49%	54%	33%
Cooperative Growth	23%	21%	79%	100%	100%	97%	23%	0%	8%	44%	38%	36%
Adaptive Innovation	5%	8%	74%	100%	100%	95%	18%	0%	5%	28%	23%	15%
Hot Growth	5%	8%	74%	100%	100%	90%	15%	0%	5%	28%	23%	15%

Table 36: Percent of Months the CWCB Instream Flow Targets are Met - Yampa River, Part 7

Percent of Months Streamflow Target is Met

Scenario	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
BEAR RIVER MSF-M												
Baseline	100%	100%	92%	79%	0%	0%	0%	0%	0%	87%	82%	100%
Business as Usual	100%	100%	92%	85%	0%	0%	0%	0%	0%	87%	85%	100%
Weak Economy	100%	100%	92%	85%	0%	0%	0%	0%	0%	87%	85%	100%
Cooperative Growth	77%	64%	36%	54%	0%	0%	0%	0%	0%	74%	23%	56%
Adaptive Innovation	69%	72%	26%	44%	0%	0%	0%	0%	0%	69%	18%	36%
Hot Growth	49%	59%	15%	31%	0%	0%	0%	0%	0%	69%	8%	15%
HARRISON CR MSF-L												
Baseline	0%	0%	33%	100%	100%	90%	56%	8%	3%	5%	3%	0%
Business as Usual	0%	0%	33%	100%	100%	90%	56%	8%	3%	5%	3%	0%
Weak Economy	0%	0%	33%	100%	100%	90%	56%	8%	3%	5%	3%	0%
Cooperative Growth	3%	3%	79%	100%	100%	79%	3%	0%	3%	5%	3%	3%
Adaptive Innovation	0%	3%	82%	100%	100%	69%	0%	0%	3%	0%	3%	0%
Hot Growth	0%	3%	82%	100%	100%	69%	0%	0%	3%	0%	3%	0%
PHILLIPS CR MSF												
Baseline	62%	77%	100%	100%	92%	77%	59%	69%	49%	90%	67%	54%
Business as Usual	62%	77%	100%	100%	92%	77%	59%	69%	49%	90%	67%	54%
Weak Economy	62%	77%	100%	100%	92%	77%	59%	69%	49%	90%	67%	54%
Cooperative Growth	90%	90%	100%	100%	92%	64%	8%	15%	31%	85%	85%	74%
Adaptive Innovation	82%	87%	97%	100%	90%	56%	3%	10%	18%	74%	77%	67%
Hot Growth	85%	87%	97%	100%	90%	49%	3%	13%	13%	67%	85%	67%
WILLOW CK MSF-L												
Baseline	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Business as Usual	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Weak Economy	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Cooperative Growth	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Adaptive Innovation	100%	100%	100%	100%	100%	100%	100%	100%	100%	97%	100%	97%
Hot Growth	100%	100%	100%	100%	100%	100%	100%	100%	100%	97%	100%	97%

Table 37: Percent of Months the CWCB Instream Flow Targets are Met - Yampa River, Part 8

Percent of Months Streamflow Target is Met												
Scenario	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
HOT SPRING CK MSF-L												
Baseline	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Business as Usual	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Weak Economy	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Cooperative Growth	100%	95%	100%	100%	100%	100%	95%	92%	97%	97%	100%	97%
Adaptive Innovation	97%	82%	100%	100%	100%	97%	95%	92%	95%	92%	97%	85%
Hot Growth	97%	82%	100%	100%	100%	95%	87%	77%	95%	90%	97%	85%
HUNT CREEK MSF												
Baseline	5%	3%	36%	92%	77%	41%	15%	8%	3%	8%	10%	3%
Business as Usual	5%	3%	36%	92%	77%	41%	15%	8%	3%	8%	10%	3%
Weak Economy	5%	3%	36%	92%	77%	41%	15%	8%	3%	8%	10%	3%
Cooperative Growth	3%	8%	62%	95%	67%	13%	0%	8%	0%	0%	3%	3%
Adaptive Innovation	0%	8%	54%	95%	62%	13%	0%	3%	0%	0%	0%	3%
Hot Growth	0%	3%	51%	92%	51%	5%	0%	3%	0%	0%	0%	0%
MORRISON CREEK LOWER MSF												
Baseline	54%	72%	97%	100%	100%	100%	90%	44%	56%	46%	46%	56%
Business as Usual	54%	72%	97%	100%	100%	100%	90%	44%	56%	46%	46%	56%
Weak Economy	54%	72%	97%	100%	100%	100%	90%	44%	56%	46%	46%	56%
Cooperative Growth	64%	82%	100%	100%	100%	95%	33%	26%	51%	62%	62%	74%
Adaptive Innovation	59%	79%	100%	100%	100%	90%	21%	18%	38%	46%	64%	62%
Hot Growth	59%	79%	100%	100%	100%	90%	21%	21%	41%	46%	64%	62%
WALTON CREEK MSF-L												
Baseline	8%	3%	31%	97%	100%	100%	87%	36%	21%	46%	33%	23%
Business as Usual	8%	3%	31%	97%	100%	100%	87%	36%	21%	46%	33%	23%
Weak Economy	8%	3%	31%	97%	100%	100%	87%	36%	21%	46%	33%	23%
Cooperative Growth	13%	8%	64%	100%	100%	100%	49%	3%	10%	38%	26%	23%
Adaptive Innovation	0%	3%	56%	100%	100%	100%	38%	3%	5%	21%	15%	0%
Hot Growth	0%	3%	56%	100%	100%	100%	38%	3%	5%	21%	15%	0%

Model Caveats

The purpose of using water allocation models is to understand the range of potential impacts on the river system. The models are best used as a comparative tool, meaning that the results from the planning scenarios should be compared back to the Baseline scenario to see how a change in model assumptions causes changes in the model results.

Models are most useful to decision makers when they accurately predict how the river system will respond to changes in the future. As noted in the Basin Goals, the Basin is working on installing measurement devices on every diversion structure. Currently, diversions by structures without measurement devices are estimated using standard approaches by the water commissioners. This provides a basis for the model to estimate total diversions throughout a basin. For agricultural users, the model also calculates crop irrigation water requirement based on temperature, precipitation, crop type, irrigated acreage, and irrigation method. This approach estimates agricultural consumptive use without relying on detailed diversion records. Better diversion records will improve the model in areas without measurement devices and will reduce the amount of uncertainty associated with agricultural diversions, but the results are useful with the current level of information and are appropriate for basinwide planning efforts.

The models are run on a monthly time-step. This provides useful information for most consumptive users but provides only high-level information for non-consumptive needs. Many non-consumptive needs are evaluated on a daily time-step. The results in the BIP address non-consumptive needs by considering the daily flow rates aggregated to a monthly volume.


Photo Source: Kent Vertrees, Friends of the Yampa

SECTION 5. STRATEGIES

The previous section identifies the potential water supply, demand, and needs for the Baseline and five planning scenarios. To explore possible scenarios for meeting these needs, the BRT chose to model three alternative management strategies. Results from the model are intended to help the BRT understand the trade-offs of the alternative management strategies. The BRT has not taken a position on the effectiveness of the strategies, nor should this document be interpreted as an endorsement of any of the alternative management strategies. Instead, this document highlights the potential benefits and risks of the alternative management strategies. If stakeholders choose to pursue one or all of these alternative management strategies, this document can help guide their implementation to maximize the benefits and minimize the risks.

Alternative Management Strategy 1 - Agricultural Efficiency

The YWG BRT is interested in understanding the benefits and risks of increasing agricultural efficiency at a large scale. Agricultural efficiency is defined as the ratio between the crop consumptive use and the total amount of water diverted from the river. In the CDSS model, agricultural efficiency depends on the irrigation method (flood or sprinkler) and the conveyance infrastructure (unlined ditch or lined ditched/pipe). Note that the alternative management strategy does not consider changing the consumptive use of agriculture, which is referred to as conservation.

As shown in Section 5, Figure 1, about 92 percent of irrigated acreage in the Yampa and White Basins is flood irrigated. In most cases, water is diverted from the river and conveyed to the fields via an earthen ditch. Water is then spread across the field using a system of laterals and gravity. Water soaks into the ground, filling the soil with moisture that the crops can use. Some water percolates beyond the root zone and slowly returns to the river underground. Some water will runoff the sides or the ends of the field and quickly return to the river as surface water. Flood irrigation has the benefit of generating return flows that come back to the river later; however, flood irrigation generally has low efficiency because diversions from the river must be significantly larger than the crop irrigation requirement. In the Yampa and the White basins, the maximum flood irrigation efficiency is assumed to be 54 percent. This means that if the crops need 10 AF of water, 18.5 AF of water must be diverted from the river. Crops will consume 10 AF, and about 8.5 AF will return to the river later. Throughout the irrigation season, flood irrigation ditches operate at various levels of efficiency. During peak runoff, flood-irrigated ditches may intentionally operate inefficiently in order to increase the soil moisture. In the White Basin, fields that are located above an alluvial aquifer are increasing the soil moisture and replenishing the aquifer. The irrigators are trying to re-time the water so that it will be available later in the season, when the snowmelt has ended. During the late-irrigation season, flood-irrigated ditches will begin to operate closer to their maximum efficiency as the river levels decline. Additionally, flood irrigation can be labor intense. Less-efficient irrigation can help ensure a field is completely watered, even if water is applied unevenly.

About 8 percent of the irrigated acreage is sprinkler irrigated. Water is diverted from the river either via a ditch or a pump. Water is then pressurized by a pump and applied via a sprinkler to the field. Some sprinklers in the Yampa and White basins are center pivot, which creates circular fields. Some are side-roll sprinklers, which can move across differently shaped fields. Some are stationary or mobile guns. Sprinkler irrigation is assumed to have a maximum efficiency of 72 percent. This means that if the crops need 10 AF of water, 14 AF of water must be diverted from the river. Crops will consume 10AF, and about 4 AF of water will return to the river later. Sprinkler irrigation operates much closer to maximum efficiency at all times.

The YWG BRT is interested in understanding the benefits and risks of large-scale conversion of flood irrigation to sprinkler irrigation. For Alternative Management Strategy 1, it was assumed that 20 percent of flood-irrigated acreage under each ditch was converted to sprinkler. This allows the YWG BRT to investigate wide-spread adoption of sprinkler irrigation methods throughout the basins. Note that it is unlikely for each individual ditch to convert a portion of acreage from flood to sprinkler; however, this approach avoids picking and choosing ditches that would switch to sprinkler irrigation.

White Basin - Alternatives 1a and 1b

For the White Basin, two options for this alternative were considered. In Alternative 1a, it was assumed that the change in irrigation method did not result in a change to the headgate demand. This assumption is intended to show how a ditch might continue to divert up to the full water right, or how a ditch may put more water on lands that remain flood irrigated. Note that efficiency is defined as the ratio between the crop consumptive use and the total amount of water diverted from the river; therefore, this alternative is not a true efficiency scenario, because the amount of water diverted from the river does not change. This alternative provides useful information about potential on-farm impacts.

In Alternative 1b, it was assumed that the conversion from flood irrigation to sprinkler irrigation would reduce the demand at the headgate. It was assumed that 80 percent of the acreage would continue to operate based on the historical monthly efficiency patterns, using the wet/dry/average year-type data. Twenty percent of the acreage would be converted to sprinkler irrigation and operate at a minimum of 70 percent and a maximum of 72 percent efficiency. Take, for example, a selected ditch that has historically operated at 17 percent efficiency in the month of May. If the crop irrigation requirement is 75 AF, then the demand at the headgate is 441 AF. Under this alternative, the new efficiency for the ditch in May is 28 percent. This is calculated as (0.8)*(0.17) + (0.2)*(0.70). The crop irrigation requirement of 75 AF does not change. The new headgate demand is 268 AF.

Photo Source: Kent Vertrees, Friends of the Yampa

Alternative Management Strategy 2 - New Release from Existing Reservoirs

The YWG BRT is interested in understanding how existing reservoirs in the Yampa Basin could help supply supplemental water. Alternative Management Strategy 2 explores new releases from existing storage. This alternative was only considered in the Yampa Basin because of the extremely limited storage available in the White Basin.

With the permission and cooperation of the reservoir owners, the YWG BRT selected the following reservoirs to consider:

1. Steamboat Lake
2. Elkhead Reservoir
3. Stagecoach Reservoir

This section summarizes the changes made to existing operations for these reservoirs for Alternative Management Strategy 2. For additional details, refer to Appendix B.

Steamboat Lake

Steamboat Lake is primarily used for recreation and fisheries by CPW. The reservoir also supplies water to the State Park campground and visitor center. The intakes are located relatively high in the reservoir, which limits the ability to draw down the reservoir elevation. It also serves as extreme drought supplemental storage for Hayden Station, but water has rarely been released for this purpose. The City of Steamboat has recently purchased 1,200 AF of storage space in Steamboat Lake from the Hayden Station pool.

For Alternative Management Strategy 2, the City of Steamboat will fill its 1,200 AF pool with the conditional Juniper Reservoir rights. These rights include Steamboat Lake as an alternative point of diversion. Water must be physically and legally available at both the originally contemplated point of diversion and Steamboat Lake. Water will be released from storage as part of the future operations associated with the future Elk River diversion point (5801919) and water treatment plant. The City of Steamboat holds 8 cfs of conditional water rights as a water supply for new growth and to provide system redundancy.

Elkhead Reservoir

Elkhead Reservoir holds storage water for the City of Craig, Tri-State for use at Craig Station, the Colorado River Water Conservation District (River District), and the Recovery Program. Currently, the City of Craig, Tri-State, and the River District infrequently use water from storage.

For Alternative Management Strategy 2, the release limit to the Recovery Program's critical habitat in the Lower Yampa Reach is increased from 50 cfs to 75 cfs. Water will be released to the Lower Yampa Reach from pools in the following order:

1. CWCB: This pool is the primary pool used by the Recovery Program to supplement flows. It has a capacity of 5,000 AF.
2. Fish-Lease: The Recovery Program has the first right of refusal to lease an additional 2,000 AF.
3. Tri-State Enlargement: Tri-State has a 2,500-AF pool in the enlargement of Elkhead Reservoir.
4. Tri-State Original: Tri-State has an 8,408-AF pool in the original Elkhead Reservoir.

Releases from these four pools to the Lower Yampa Reach are limited to a combined rate of 75 cfs. This flow rate is consistent with recent operations. The YWG BRT discussed the origin of the 50 cfs maximum release restriction. The original Yampa Management Plan contemplated a maximum of 50 cfs in order to preserve the CWCB pool throughout the entire season (July through October). The Recovery Program did not want to quickly release the stored water at the beginning of July and have no water left in October. The Recovery Program and engaged stakeholders have gained experience in operating the supplemental reservoir releases. They now have the confidence to increase releases above 50 cfs for short periods to address critically low streamflow conditions. Additionally, downstream water users on Elkhead Creek need advanced notice when the reservoir operators are going to change reservoir releases. This concern is best addressed through more communication with downstream users to help ensure they have time to make adjustments to headgates, fencing, and location of their cattle.

For Alterative Management Strategy 2, the YWG BRT was interested in exploring how agricultural shortages in Water District 44 could be supplemented by releases from Elkhead Reservoir. The River District's 2,457-AF pool is made available on a first-come, first-serve basis to ditches downstream of Elkhead Reservoir. The maximum release from the River District pool is 25 cfs. This restriction prevents the pool from being completely emptied in the first month of the irrigation season.

Note that Tri-State can still access its stored water if Craig Station demand is unable to be met by direct diversions from the river. There is no maximum release limit.

There is no change to the operations for the City of Craig, which has a 4,413-AF pool in the original Elkhead Reservoir. There is no maximum release limit.

Stagecoach Reservoir

Stagecoach Reservoir is operated by Upper Yampa Water Conservancy District for water supply and recreation. The reservoir is operated to meet Federal Energy Regulatory Commission (FERC) minimum flow requirements downstream of the reservoir by bypassing up to 40 cfs of inflow, if possible. For the months of August, September, October, and November, bypassing inflow or releasing from the Preferred Remainder and then the Emergency Remainder pools up to 20 cfs. The reservoir releases supplemental supply to current contract holders, up to their annual contract amount.

Under Alternative Management Strategy 2, new releases from Stagecoach Reservoir are investigated:

- Release to future demands - After releasing to current contract holders, the reservoir releases to new future demands located in UYWCD boundaries. Releases are first made from the Municipal and Industrial Pool and second from the Augmentation Pool. The demands are for aggregate demands in Water Districts 57 and 58 for future municipal/domestic, industrial, and snowmaking that is not associated with Steamboat Resort.
- Release to Lower Yampa Reach - After releasing to current contract holders, Stagecoach Reservoir supplements the flow target by releasing up to 4,000 AF per year from the General Supply Pool. Releases from Elkhead Reservoir are made available prior to releases from Stagecoach Reservoir. Note that there currently is no legal mechanism for this release to occur. The YWG BRT and UYWCD were interested in exploring this operation from a technical perspective.

Alternative Management Strategy 3 - Additional Storage

Alternative Management Strategy 3 builds on Alternative Management Strategy 2. The model continues to show the new releases from existing storage. For Alternative Management Strategy 3, additional storage is included as well. In the White Basin, additional storage is shown at two locations:

- Enlarging Lake Avery by 2,644 AF
- Including Wolf Creek Reservoir

In the Yampa Basin, additional storage is shown at two locations:

- Rehabilitating Stillwater Reservoir so the full capacity is available for use
- Enlarging Elkhead Reservoir by 4,300 AF

This section summarizes the changes made to existing operations for these reservoirs for Alternative Management Strategy 3. For additional details, refer to Appendix B.

Lake Avery

Yellow Jacket Water Conservancy District is proposing enlarging Lake Avery. The pool created by enlarging the reservoir would be available to meet downstream demands. The reservoir would be expanded by raising the crest of the spillway. Lake Avery is currently owned and operated by CPW as a State Wildlife Area. The primary purposes of wildlife and recreation would be maintained.

For Alternative Management Strategy 3, Lake Avery releases up to 1,500 AF per year at a maximum rate of 20 cfs to supplement streamflow in the White River as part of a future leasing option. Previously, CPW participated in a “3 in 10” lease, which allowed them to release water in three years out of a ten-year period to improve river conditions for the downstream fishery. For Alternative Management Strategy 3, the model considers the streamflow in the White River from the confluence of Big Beaver Creek through the Town of Meeker. This generally approximates the historical operations of releases based on gaged flows at the White River Above Coal Creek gage and the White River Near Meeker gages. In the driest one-third of years, the reservoir will supplement streamflows in August, September, and October if the flows drop below 20 cfs.

For Alternative Management Strategy 3, Lake Avery reservoir will be enlarged by 2,644 AF. This corresponds to raising the spillway by 10 feet and is the maximum amount the reservoir could be expanded without inundating the upstream Livingston Ranch. In the model, the enlargement is represented by:

- Adding an “Enlargement” account to represent the enlarged storage pool (2,644 AF).
- Filling the “Enlargement” account with Yellow Jacket’s Sawmill Mountain conditional right. This water right was originally decreed upstream of Lake Avery on Big Beaver Creek. The storage right is for 10,000 AF with an adjudication date of December 31, 1975.
- Releasing to environmental needs and to augment future municipal and industrial demands in Yellow Jacket’s boundaries:
    - Release up to 20 cfs in the months of July, August, September, and October when the CWCB instream flow reach measured at the White River above Coal Creek (09304200) is short.

- o Future Meeker demands
- o Future domestic demands
- o Future energy development on the mainstem and exchange to future energy development on Piceance Creek

Lower White River Storage aka Wolf Creek Reservoir

Rio Blanco Water Conservancy District (RBWCD) is proposing a new reservoir in the White Basin. The assumptions used for the BIP Update are preliminary and subject to change as the project is further refined.

For Alternative Management Strategy 3, Lower White River Storage is represented by 43_WolfOC, pending an assignment of an identification number. It is an off-channel reservoir located in the Wolf Creek drainage of the White River and is referred to in this report as "Wolf Creek Reservoir." The reservoir capacity is 66,720 AF. The reservoir is filled using a 400-cfs pump station that diverts water from the White River, just downstream of the confluence of Wolf Creek and White River. The pump station is represented by model ID 43_WolfPS (Wolf Creek Pump Station). The reservoir is filled using the conditional water rights granted in 14CW3043.

The reservoir operates to meet future municipal and augmentation demands. As stipulated in the conditional water rights decree, total releases are limited to 7,000 AFY to the following uses:

- Future demands for the Town of Rangely
- Augmentation for water users within RBWCD and Yellow Jacket boundaries

Stillwater Reservoir

Stillwater Reservoir is owned by Bear River Reservoir Company, which contracts with Upper Yampa Water Conservancy District to operate the facility. It is an on-channel reservoir located on the Bear River. The reservoir water right is for 6,392 AF. The as-built capacity is 6,088 AF, but it currently has a storage restriction that limits the contents to 5,175 AF.

For Alternative Management Strategy 3, the reservoir is modeled with a capacity of 6,392 AF. This reflects future rehabilitation and a small increase in the current reservoir capacity. Stillwater Reservoir continues to release to current water users. The additional storage increases the amount of storage water available to the water users (listed in alphabetical order):

- Acton Ditch
- Big Mesa Ditch
- Bird Ditch
- Buckingham-Mandall Ditch
- Coal Creek diversions
- Fix Ditch
- Hernage & Kolbe Ditch
- Lindsey Ditch
- Mandall Ditch
- Mill No. 1 Ditch
- Pennsylvania Ditch
- Stillwater Ditch (delivering to Colorado Basin)
- Stillwater Ditch (delivering to Yampa Basin)

- Town of Yampa

Elkhead Reservoir Enlargement

As discussed above, Alternative Management Strategy 3 builds on Alternative Management Strategy 2. The model continues to show the new releases from existing storage. For Alternative Management Strategy 3, Elkhead Reservoir is enlarged by 4,300 AF. The additional storage is filled with the portion of the 2002 storage right that is conditional. The additional storage increases the size of the Fish Lease account to a total of 3,932 AF and the River District account to a total of 4,825 AF. Releases are made to the same users as Alternative Management Strategy 2. Additionally, releases are made from the River District account to future Water District 44 domestic water industrial demands.

Results

This section presents results from the original Tech Update models and the three Alternative Management Strategies described above. Results are first presented for the White Basin, then for the Yampa Basin. This report contains a summary of the general findings. These results were also presented to the BIP Committee on March 4, 2021.

White Basin

Results are presented for:

- Alternative Management Strategy 1a (20 percent of flood-irrigated acreage is converted to sprinkler irrigation, no change in headgate demand)
- Alternative Management Strategy 1b (20 percent of flood-irrigated acreage is converted to sprinkler irrigation, headgate demand is reduced due to increased efficiency)
- Alternative Management Strategy 3 (Lake Avery Enlargement, Wolf Creek Reservoir)

Note that there is no “Alternative 2” for the White Basin, which investigated new uses for existing reservoirs. The existing reservoirs in the White Basin have small storage capacities and are not able to consider additional uses at this time.

Agriculture demands, supply, and gaps are shown in Table 38. Each Alternative Management Strategy was considered under the five planning scenarios. The color coding represents the relative magnitudes. The average annual demand represents the average volume of water that the agricultural sector is trying to divert from the river. The model then limits the demands by the physical and legal water availability at each headgate. This leads to an average annual gap, or the average volume of water that was not available to meet the agricultural demand. The average annual percent gap is the ratio between the gap and the demand. The average annual consumptive use (CU) gap is the average volume of consumptive use that was not met. This directly translates into lost crop production. Agriculture in the White Basin does not have access to reservoir storage; therefore, agriculture depends on the natural “reservoirs” of soil moisture and alluvial aquifer storage. Diversions to flood irrigation are much larger than the crop irrigation requirement in order to provide extra water for the soil and alluvial aquifer.

Under Alternative 1b, the average annual demand decreases due to the increase in agricultural efficiency. In all five planning scenarios, the average annual gap and the average annual CU gap decrease slightly. The exception is Adaptive Innovation, which assumes that agriculture will become more efficient and crop irrigation water requirements will decrease due to innovations in crop hybrids. Converting 20 percent of flood-irrigated acreage to sprinkler irrigation achieves very similar average annual headgate demands.

The average annual demands are larger in Cooperative Growth and Hot Growth due to the climate-change assumptions. Warmer temperatures cause the crop irrigation requirement to increase. This increase is offset in Adaptive Innovation due to the overall decrease in crop irrigation requirement due to hybrids and increased efficiency. The average annual gaps are also larger under Cooperative Growth, Adaptive Innovation, and Hot Growth due to the decline in streamflow during the mid- and late-irrigation seasons. Under Hot Growth, Alternative 1b has a smaller average annual demand but very similar gaps. This indicates there are periods when there is no water available to agriculture, regardless of the efficiency.

Alternative 3 does not show a change to agricultural demands or gaps. This is because the increased reservoir storage at Lake Avery and the new Wolf Creek Reservoir storage are not made available to agriculture. It was assumed that the new storage would directly serve future municipal and industrial demands or augment future municipal and industrial demands.

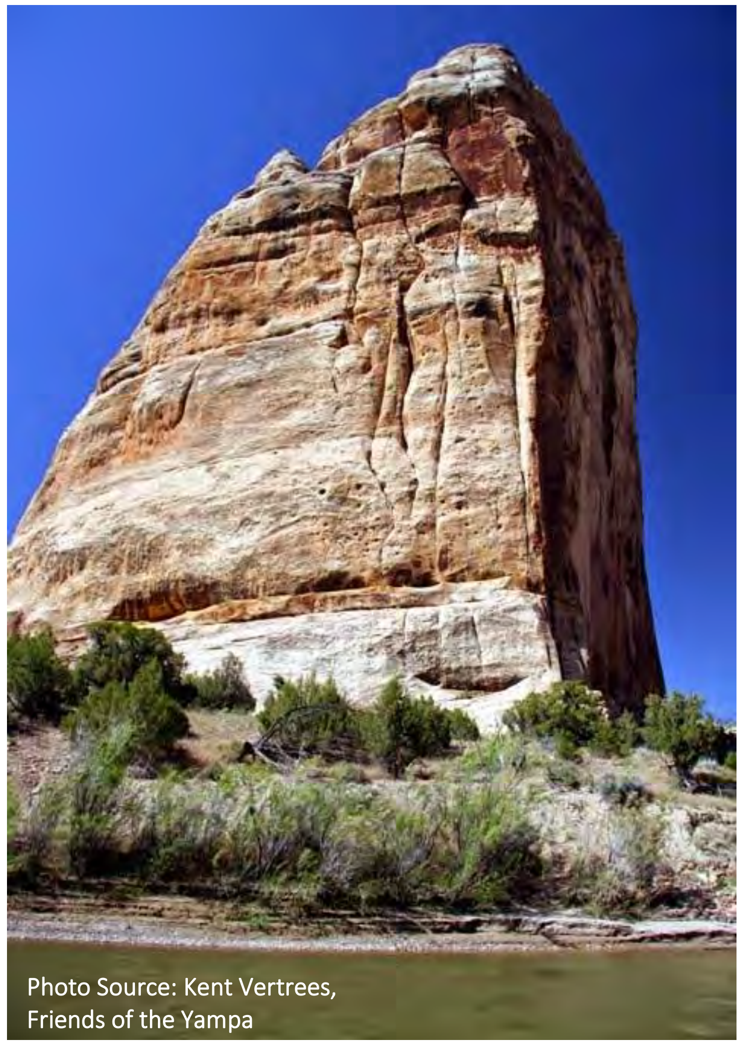


Photo Source: Kent Vertrees,
Friends of the Yampa

Table 38: White Basin Model Alternative Comparison for Agriculture

White Basin Alternative Comparison - Agriculture

Run	Average Annual Demand (AFY)	Average Annual Gap (AFY)	Average Annual Percent Gap (%)	Average Annual CU Gap (AFY)
Business as Usual				
Technical Update	243,000	1,230	1%	667
Alternative 1a	243,000	1,140	0%	654
Alternative 1b	147,000	982	1%	565
Alternative 3	243,000	1,230	1%	666
Weak Economy				
Technical Update	247,000	1,230	0%	667
Alternative 1a	247,000	1,140	0%	654
Alternative 1b	149,000	983	1%	566
Alternative 3	247,000	1,230	0%	667
Cooperative Growth				
Technical Update	294,000	3,180	1%	1,730
Alternative 1a	294,000	3,110	1%	1,690
Alternative 1b	178,000	2,780	2%	1,500
Alternative 3	294,000	3,190	1%	1,730
Adaptive Innovation				
Technical Update	178,000	3,390	2%	2,180
Alternative 1a	178,000	3,990	2%	2,300
Alternative 1b	176,000	3,910	2%	2,260
Alternative 3	178,000	3,390	2%	2,180
Hot Growth				
Technical Update	320,000	5,860	2%	3,180
Alternative 1a	320,000	5,370	2%	3,100
Alternative 1b	195,000	5,180	3%	3,000
Alternative 3	320,000	5,850	2%	3,180

Table 39 presents the results for municipal and domestic water providers in the White Basin. This includes Meeker, Rangely, and the aggregate representing the unincorporated population. Results are presented for the model year with the largest gap in supplies. This represents a worst-case condition for the municipal provider. Note that the demands are the same every year in the model simulation; therefore, the demand in the maximum gap year is the same as the other years. The gap in maximum year is the volume of water that the city could not provide. The percent gap in maximum gap year is the ratio of the gap and the demand.

For Business as Usual and Weak Economy, there are no gaps in the municipal water provider supplies. Under Cooperative Growth, Alternative 1b results in a very small gap. This is caused by a change in the return flow patterns due to the increase in agricultural efficiencies. Under Adaptive Innovation, Alterative 3 is the only result with no gap. The municipal and domestic providers have access to augmentation supplies from the Lake Avery enlargement and Wolf Creek Reservoir. Rangely can also receive supplemental supply from Wolf Creek Reservoir. The relatively modest increase in storage is capable of fully meeting the municipal demands, despite climate change. Under Hot Growth, the maximum gap is largest under Alternative 1b. Similar to Cooperative Growth, this is caused by a change in return flow timing due to the increase in agricultural efficiencies. In Alternative 3, the new reservoir storage can reduce the gap, but not completely eliminate it. If the population growth and climate change assumptions in Hot Growth occur, the basin will need additional strategies to fully meet the municipal demands.

Table 39: White Basin Model Alternative Comparison for Municipal and Domestic Water Providers

White Basin Alternative Comparison - City

Run	Demand In Maximum Gap Year (AFY)	Gap in Maximum Year (AFY)	Percent Gap in Maximum Gap Year (%)
Business as Usual			
Technical Update	3,480	0	0%
Alternative 1a	3,480	0	0%
Alternative 1b	3,480	0	0%
Alternative 3	3,480	0	0%
Weak Economy			
Technical Update	2,580	0	0%
Alternative 1a	2,580	0	0%
Alternative 1b	2,580	0	0%
Alternative 3	2,580	0	0%
Cooperative Growth			
Technical Update	3,400	0	0%
Alternative 1a	3,400	0	0%
Alternative 1b	3,400	63	2%
Alternative 3	3,400	0	0%
Adaptive Innovation			
Technical Update	4,120	348	8%
Alternative 1a	4,120	348	8%
Alternative 1b	4,120	348	8%
Alternative 3	4,120	0	0%
Hot Growth			
Technical Update	5,170	275	5%
Alternative 1a	5,170	275	5%
Alternative 1b	5,170	828	16%
Alternative 3	5,170	117	2%

For the White Basin, future industrial uses have a large amount of uncertainty. Table 40 shows the results for all industrial users, including sand and gravel, mining, golf courses, and energy development (oil and gas, and oil shale). Of these users, energy development has the greatest growth potential. The uncertainty around energy development is shown in the wide range of demands. At the low end, Weak Economy assumes combined future demands of 5,267 AFY. At the high end, Hot Growth assumes combined future demands of 37,631 AFY. The industrial sector has larger percent gaps than agriculture and municipal. Alternative 3 shows that a modest increase in storage (2,644 AF in Lake Avery and 7,000 AF in Wolf Creek Reservoir) can significantly reduce the gaps for four of the five planning scenarios. Under Hot Growth, the large future demands have large gaps that are improved by storage but are not solved. If the industrial demands and climate change assumptions in Hot Growth occur, the basin will need additional strategies to fully meet the industrial demands.

Table 40: White Basin Model Alternative Comparison for Industrial Users

White Basin Alternative Comparison - Industry

Run	Demand In Maximum Gap Year (AFY)	Gap in Maximum Year (AFY)	Percent Gap in Maximum Gap Year (%)
Business as Usual			
Technical Update	8,300	3,780	46%
Alternative 1a	8,300	3,780	46%
Alternative 1b	8,300	3,780	46%
Alternative 3	8,300	391	5%
Weak Economy			
Technical Update	5,270	739	14%
Alternative 1a	5,270	739	14%
Alternative 1b	5,270	739	14%
Alternative 3	5,260	76	1%
Cooperative Growth			
Technical Update	5,330	799	15%
Alternative 1a	5,330	799	15%
Alternative 1b	5,330	799	15%
Alternative 3	5,320	81	2%
Adaptive Innovation			
Technical Update	5,330	833	16%
Alternative 1a	5,320	833	16%
Alternative 1b	5,330	830	16%
Alternative 3	5,320	166	3%
Hot Growth			
Technical Update	37,600	33,100	88%
Alternative 1a	37,600	33,100	88%
Alternative 1b	37,600	33,100	88%
Alternative 3	37,600	26,100	69%

WHITE BASIN RESERVOIRS

Select reservoir results are presented below. The consumptive use results presented in the tables above show the impact of the three alternatives applied to the five planning scenarios. The figures below highlight trends in the reservoir storage results. Figure 16 and Figure 17 present Lake Avery simulated storage contents for Business as Usual and Hot Growth. The graphs show that the Technical Update, Alternative 1a, and Alternative 1b have almost identical results for the reservoir. The yellow and blue lines fall directly under the purple line. For Alternative 3 (green line), the reservoir has been enlarged, which causes the increase in reservoir storage to about 10,000 AF. Lake Avery is releasing up to 1,500 AF from the existing pool in one-third of the years to supplement streamflow upstream of Meeker, similar to the 3 in 10 leases. This results in storage levels that are lower than the other alternatives in dry years, such as 1977, 2002, and 2012. Additionally, the reservoir enlargement is releasing to augment downstream consumptive users and supplement streamflow. In Figure 16 (Business as Usual), the reservoir is not used every year. It is only used during dry periods. In some dry years, the reservoir is able to refill in the following year. During multi-year droughts, such as 1977/1978, and the early 2000s, the reservoir is not always able to refill.

In Figure 17 (Hot Growth), the reservoir is used every year. The enlargement pool is frequently able to refill, but the downstream demands are so large that there is no carry-over storage. Recall that Hot Growth produced shortages to consumptive users. The Lake Avery enlargement is not sufficient to fully meet the assumed future demands.

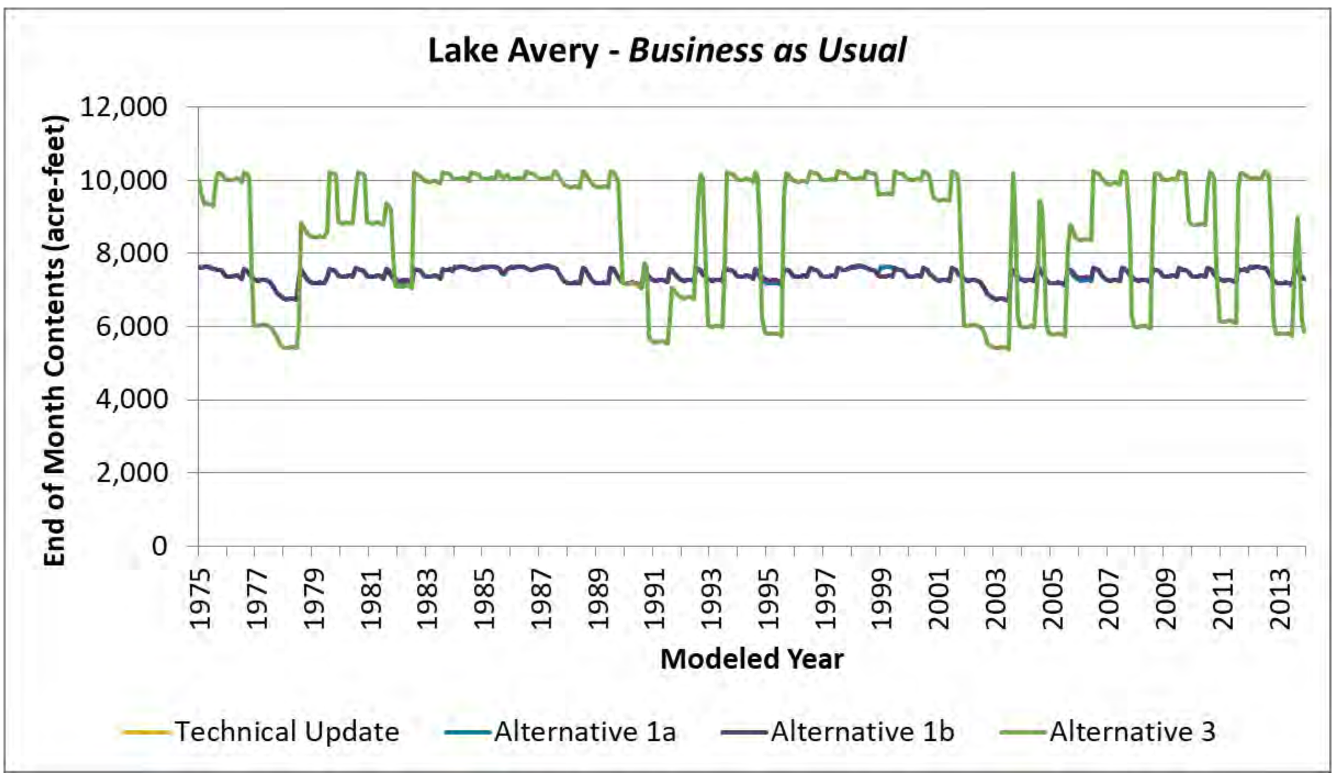


Figure 16: Comparison of Lake Avery Simulated Storage Contents for Business as Usual and the Alternatives

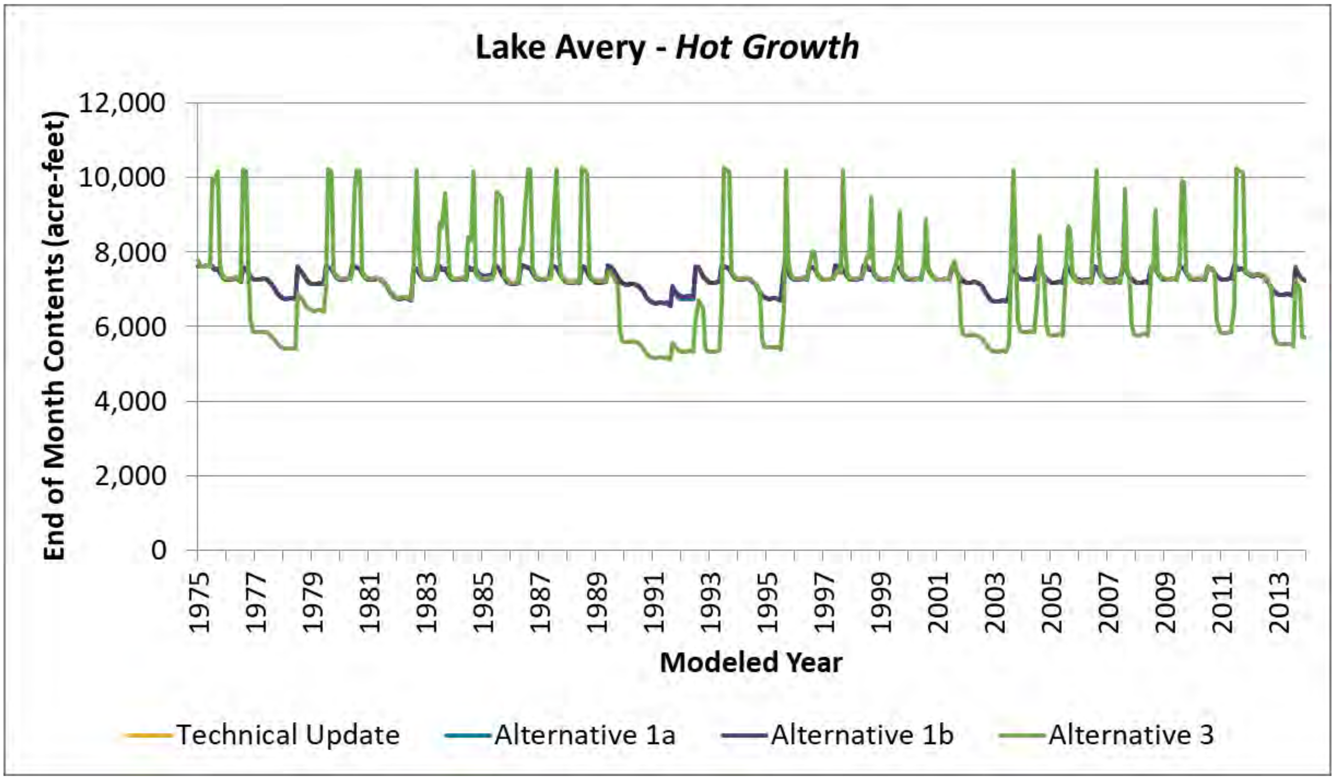


Figure 17: Comparison of Lake Avery Simulated Storage Contents for Hot Growth and the Alternatives

Figure 18 shows the simulated storage contents for Wolf Creek Reservoir. The reservoir is only included in Alternative 3. The graph compares the results from the five planning scenarios. The "saw tooth" pattern that is seen for all five planning scenarios is caused by evaporation. The reservoir fills during the peak runoff and loses water due to evaporation the rest of summer and fall. For more details, refer to Table 41, which presents the average annual evaporation volumes. Under terms of the water rights decree, releases directly to Rangely and augmentation needs are limited to 7,000 AFY. Under Business as Usual and Hot Growth, the reservoir frequently makes releases. Under Hot Growth, the reservoir is releasing 7,000 AF almost every year. When the basin experiences back-to-back dry years, the reservoir is unable to refill in the second dry year. This can be seen in 1977/1978, 1990/1991, 1994/1995, 200/2003, and 2012/2013.

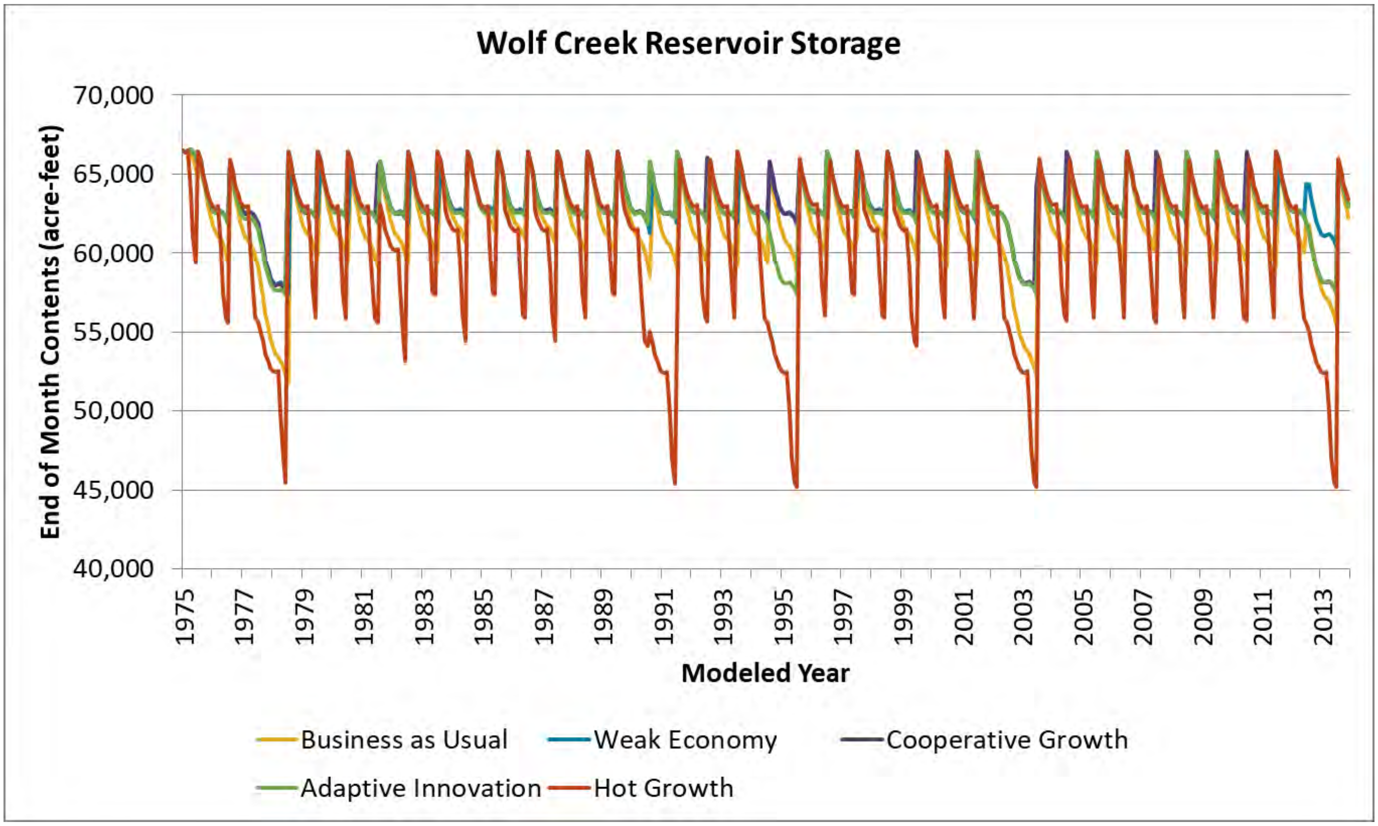


Figure 18: Comparison of Wolf Creek Reservoir Simulated Storage Contents for Alternative 3 and the five planning scenarios

Table 41 reports the average annual evaporation for reservoirs in the White Basin for Business as Usual. Lake Avery has the lowest evaporation due to its higher elevation. Taylor Draw and Wolf Creek Reservoir are located at similar elevations. Wolf Creek Reservoir will have a larger capacity and surface area than Taylor Draw, which will result in a larger volume of evaporation.

Table 41: Average Annual Evaporation (AFY) for Reservoir in the White Basin, Business as Usual.

White Evaporation Table

Reservoir	Technical Update	Alternative 1a	Alternative 1b	Alternative 3	Capacity
Lake Avery	529	529	529	522	10,322
Taylor Draw Reservoir	1,209	1,209	1,210	1,210	3,400
Wolf Creek Reservoir	NA	NA	NA	3,846	66,720

WHITE BASIN STREAMFLOW

Monthly streamflow volumes are shown for two locations in the White River Basin. Results are only shown for Business as Usual because the impacts of the three alternatives are similar across the planning scenarios. The streamflow results are primarily driven by hydrology, which is discussed in Section 5. Figure 19 and Figure 20 present results for the White River Near Coal Creek gage location for 2010 through 2013. These years are selected to show a range of hydrological conditions. 2010 is an average year, 2011 is a wet year, 2012 is a very dry year, and 2013 is a moderately dry year. Figure 19 shows the full range of streamflow. Figure 20 focuses on the low flow levels.

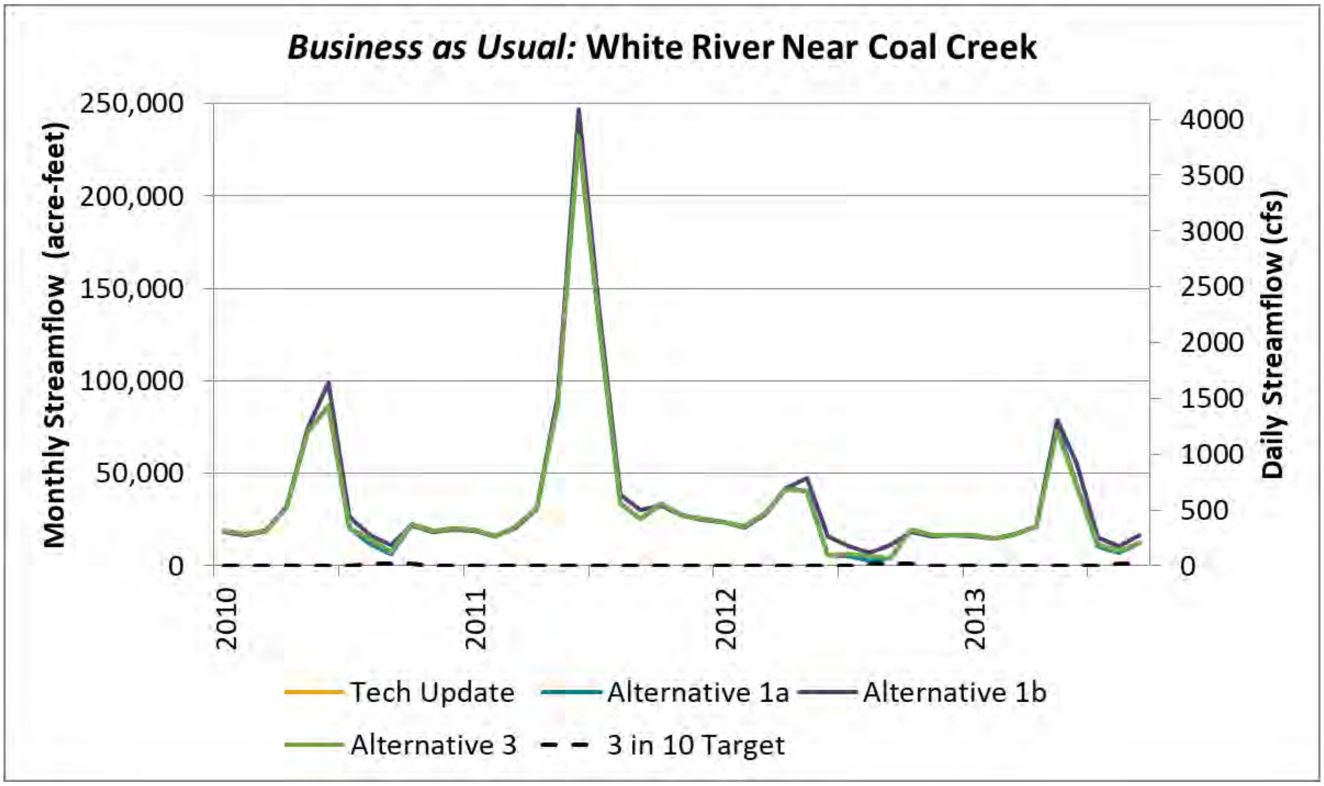


Figure 19: Comparison of Monthly Streamflow Volume for the White River Near Coal Creek, Business as Usual

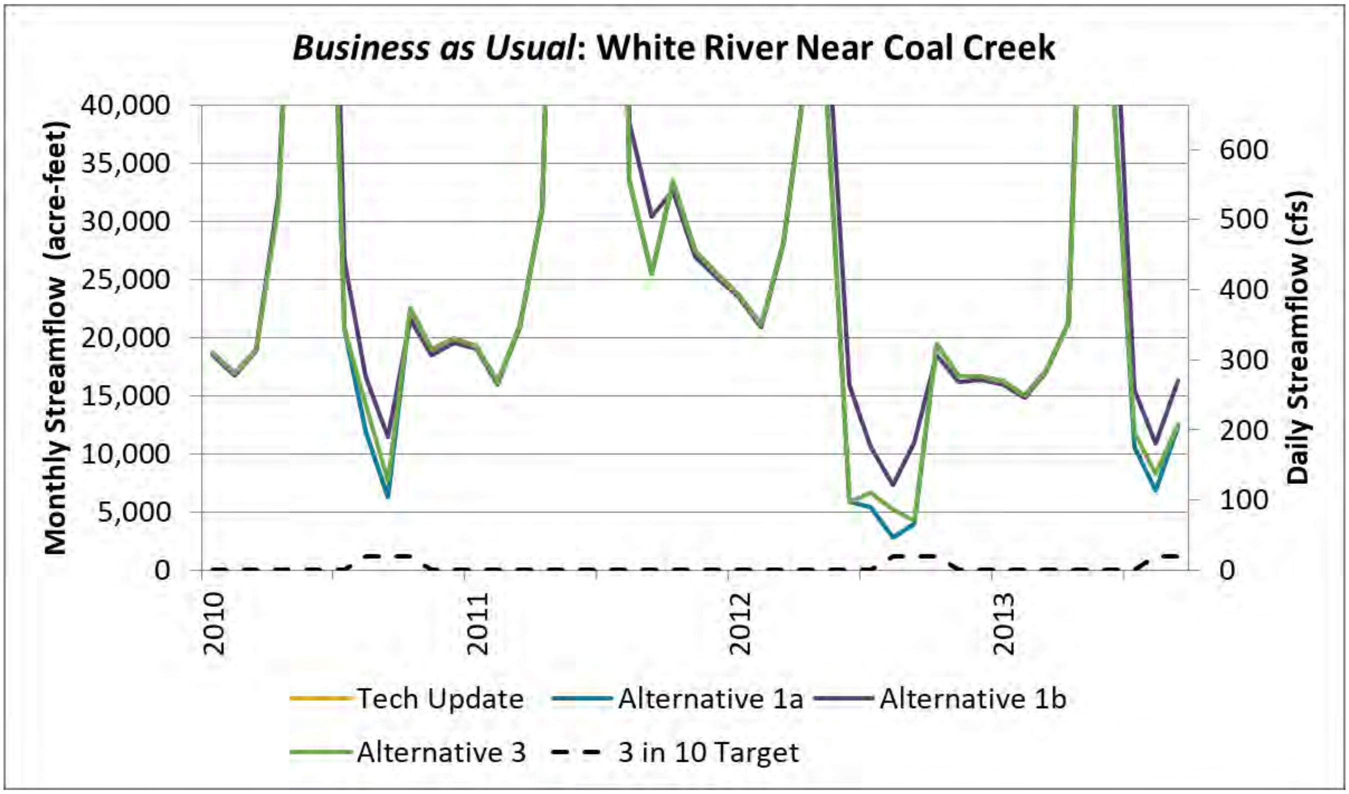


Figure 20: Detailed Comparison of Monthly Streamflow Volume for the White River Near Coal Creek, Business as Usual

The White River Near Coal Creek gage is a unique location in the basin because several large irrigation ditches divert water above the gage and the return flows come back to the river below the gage. This gage is also located downstream of Lake Avery but upstream of the users to which Lake Avery is releasing in Alternative 3. Key observations from these results are:

- The streamflow volume for the Technical Update and Alternative 1a are the same.
- The streamflow volume is slightly higher in Alternative 1b during the irrigation season. The increase in agricultural efficiency due to the conversion of 20 percent of the flood-irrigated acreage to sprinkler irrigation causes the headgate demand to decrease. This water is left in the river and is seen at this gage location.
- For Alternative 3, the streamflow volume is slightly lower during the runoff as the enlarged Lake Avery diverts more water into storage. During the late-irrigation season in 2010, 2012, and 2013, the streamflow is higher as water is released from storage to supplement the supply of downstream users.

Figure 21 and Figure 22 present results for the White River Near Watson gage location for 2010 through 2013. Figure 21 shows the full range of streamflow. Figure 22 focuses on the low-flow levels. Note the altered order of the alternatives done to make visual comparisons easier. The red circles highlight periods when the streamflow is lower in Alternative 1b. The green arrows point to periods when the streamflow is higher in Alternative 3.

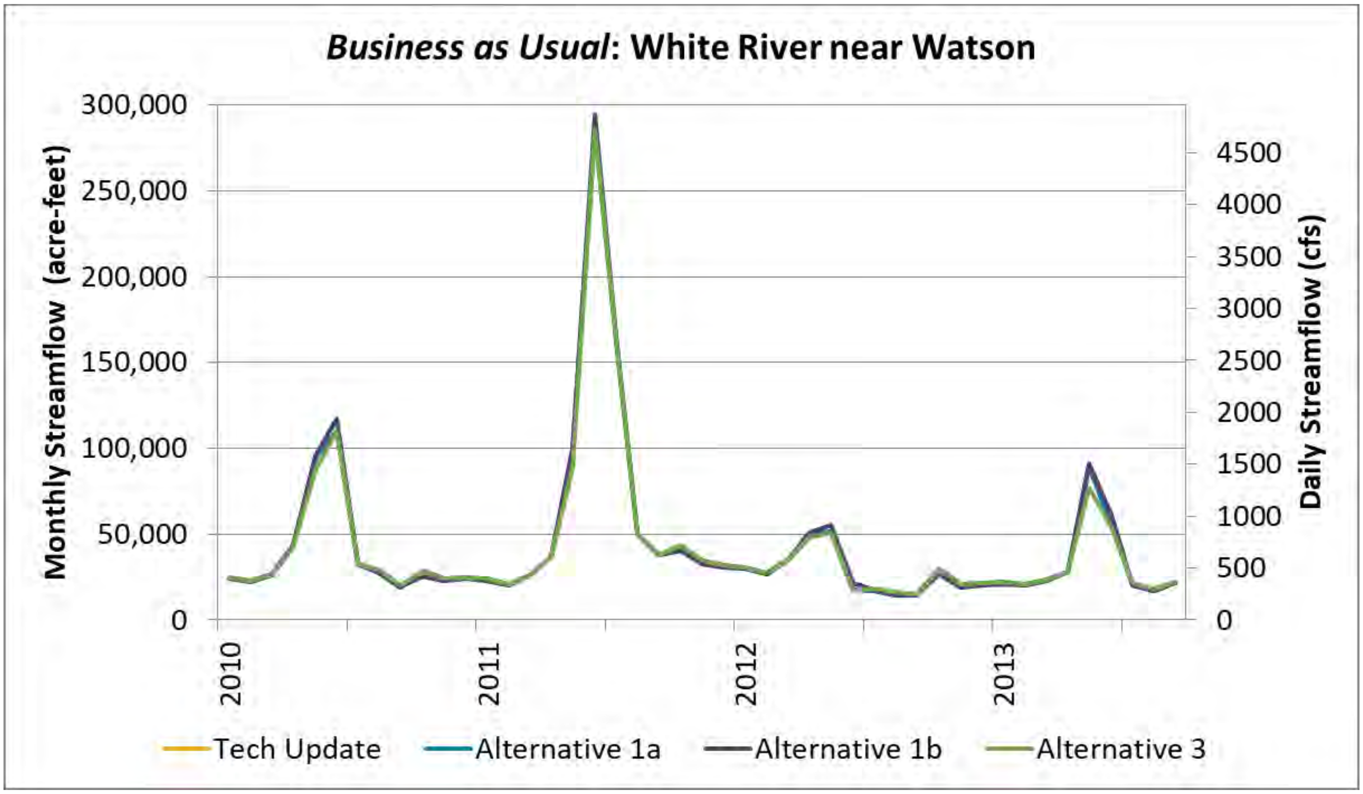


Figure 21: Comparison of Monthly Streamflow Volume for the White River Near Watson, Business as Usual

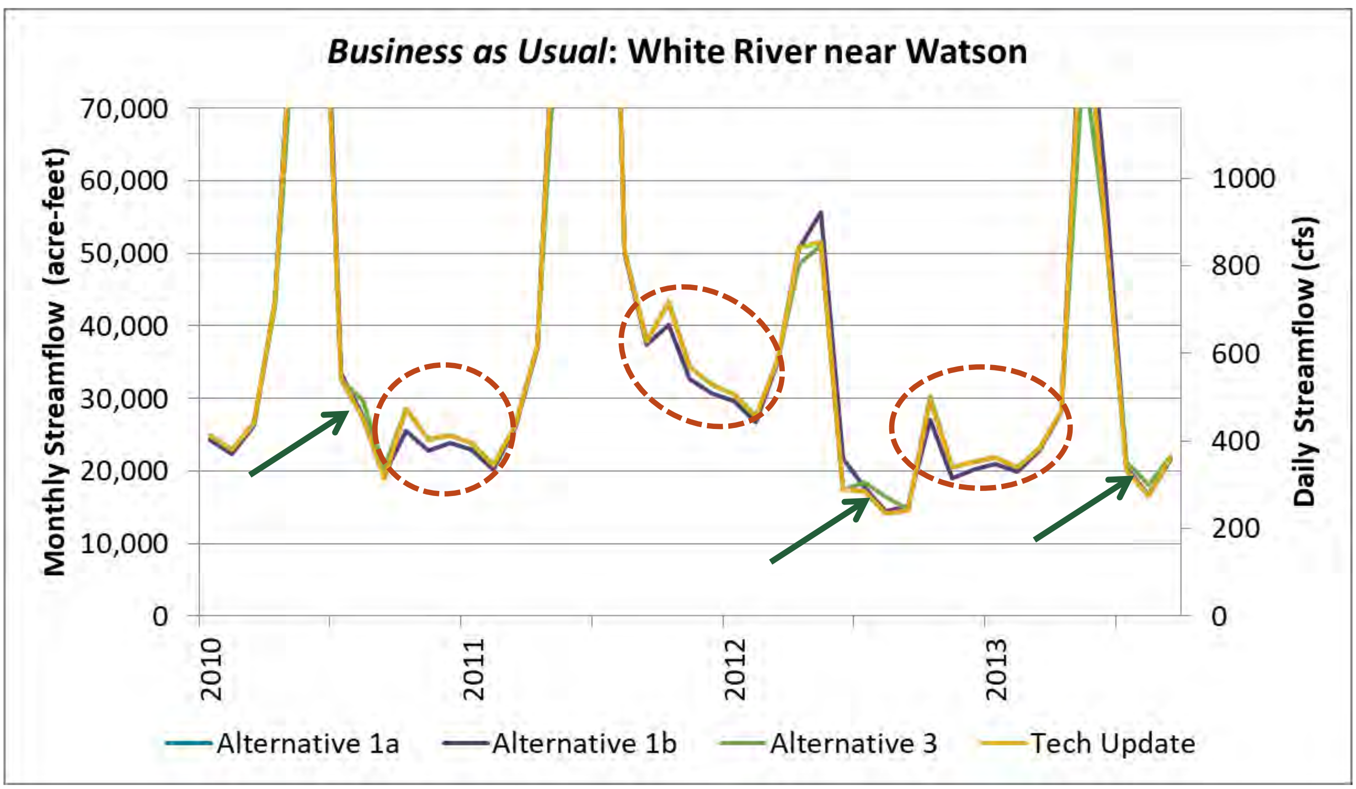


Figure 22: Detailed Comparison of Monthly Streamflow Volume for the White River Near Watson, Business as Usual

The White River at Watson gage is located in Utah, just beyond the Colorado-Utah state line. This gage is being used by the Recovery Program to develop recommended flow targets as part of the on-going White River Programmatic Biological Opinion and Management Plan efforts. At time of publication, the flow targets are still in "interim" form and are not ready for use in the BIP Update. The gage location is downstream of all activities in the State of Colorado; therefore, the streamflow shows the impacts of consumptive use, reservoir releases, and change in return flow amounts and timing.

Key observations are:

1. The streamflow volume for the Technical Update and Alternative 1a are the same.
2. For Alternative 1b, the streamflow volume is slightly higher than during the peak runoff. The increase in agricultural efficiency due to the conversion of 20 percent of the flood-irrigated acreage to sprinkler irrigation causes the headgate demand to decrease. This water is left in the river and is seen at this gage location
3. As shown in the red circles, the streamflow volume is slightly lower in the fall and winter. This is caused by a decrease in return flow volume. The higher-efficiency sprinklers generate less return flow water than flood irrigation.
4. For Alternative 3, the streamflow volume is slightly lower during the runoff as the enlarged Lake Avery and the new Wolf Creek Reservoir divert water into storage.
5. As shown in the green arrows, during the late-irrigation season in 2010, 2012, and 2013, the streamflow is higher due to water released from storage.

Yampa Basin

Results are presented for:

1. Alternative 1: Agriculture Efficiency
    a. 20 percent of flood-irrigated acreage is converted to sprinkler irrigation. Headgate demand is reduced due to increased efficiency

2. Alternative 2: New Releases from Existing Storage
    a. Steamboat Lake has a 1,200-AF pool for City of Steamboat
    b. Elkhead Reservoir increases Lower Yampa Reach release limit from 50 cfs to 75 cfs. Allow releases from Tri-State's pools to the Lower Yampa Reach. Release up to 25 cfs from River District's pool to agricultural diversions.
    c. Stagecoach Reservoir releases to future municipal/domestic water providers and industrial users in UYWCD boundaries. Release up to 4,000 AF to the Lower Yampa Reach (after Elkhead releases)

3. Alternative 3: Enlarge Existing Storage
    a. Continue to make releases as described in Alternative 2.
    b. Increase Stillwater Reservoir storage to 6,392 AF.
    c. Increase Elkhead Reservoir storage by 4,300 AF, for a total capacity of 29,956 AF. New storage is shared among the Lower Yampa Reach and agricultural users.

YAMPA BASIN CONSUMPTIVE USES

Agriculture demands, supply, and gaps are shown in Table 42. As with the White Basin, each alternative management strategy was considered under the five planning scenarios. The color coding represents the relative magnitudes. The average annual demand represents the volume of water that the agricultural sector is trying to divert from the river. The model then limits the demands by the physical and legal water availability at each headgate. This leads to an average annual gap, or the average volume of water that was not available to meet the agricultural demand. The average annual percent gap is the ratio between the gap and the demand. The average annual CU gap is the average volume of consumptive use that was not met. This directly translates into lost crop production. As shown in Section 4, agriculture in the Yampa River has limited access to reservoir storage. Agriculture has access to Stillwater Reservoir, Allen Basin Reservoir, Yamcolo Reservoir, and Stagecoach Reservoir. These structures are located in south Routt County. Agriculture could contract water out of Elkhead Reservoir, but currently, there are no releases to agriculture. Traditionally, agriculture depends on the natural "reservoir" of soil moisture storage. Diversions to flood irrigation are larger than the crop irrigation requirement in order to provide extra water for the soil.

Under Alternative 1, the average annual demand decreases due to the increase in agricultural efficiency. In all five planning scenarios, the average annual gap and the average annual CU gap increase slightly. This does not produce the desired result of efficiency increases, which are intended to improve conditions for agricultural users. The large-scale change in return flows decreases water availability.

The average annual demands are larger in Cooperative Growth, Adaptive Innovation, and Hot Growth due to the climate change assumptions and new agricultural acreage. Warmer temperatures cause the crop irrigation requirement to increase. This increase is partially offset in Adaptive Innovation due to the overall decrease in crop irrigation requirements due to hybrids and increased efficiency. The average annual gaps are also larger under Cooperative Growth, Adaptive Innovation, and Hot Growth due to the decline in climate-adjusted streamflow during the mid- and late-irrigation seasons.

Under Alternative 2 and 3, water from the River District's pool in Elkhead Reservoir is made available to agricultural users downstream of the reservoir. Recall that under Alternative 3, the River District's pool is enlarged. Releases from storage cause a modest decrease in the average annual gap and the average annual CU gap for the entire basin. In the planning scenarios that incorporate climate change, the releases from Elkhead Reservoir are not sufficient to full satisfy the designated agricultural diversions. In all five planning scenarios, storage would be needed at additional locations in the basin, specifically on tributaries that are physically short during the late-irrigation season.

Table 42: Yampa Basin Model Alternative Comparison for Agricultural

Yampa Basin Alternative Comparison - Agriculture

Run	Average Annual Demand (AFY)	Average Annual Gap (AFY)	Average Annual Percent Gap (%)	Average Annual CU Gap (AFY)
Business as Usual				
Technical Update	404,000	13,900	3%	7,740
Alternative 1	332,000	14,200	4%	7,900
Alternative 2	404,000	13,500	3%	7,520
Alternative 3	404,000	13,200	3%	7,400
Weak Economy				
Technical Update	404,000	13,900	3%	7,740
Alternative 1	332,000	14,100	4%	7,890
Alternative 2	404,000	13,500	3%	7,520
Alternative 3	404,000	13,200	3%	7,390
Cooperative Growth				
Technical Update	522,000	36,500	7%	20,100
Alternative 1	425,000	36,700	9%	20,200
Alternative 2	522,000	34,700	7%	19,100
Alternative 3	522,000	33,100	6%	18,200
Adaptive Innovation				
Technical Update	461,000	50,500	11%	32,600
Alternative 1	490,000	52,500	11%	33,800
Alternative 2	461,000	47,900	10%	30,900
Alternative 3	461,000	45,900	10%	29,600
Hot Growth				
Technical Update	684,000	77,200	11%	42,100
Alternative 1	544,000	78,500	14%	42,900
Alternative 2	684,000	74,300	11%	40,500
Alternative 3	684,000	71,900	10%	39,300

Table 43 presents results for municipal and domestic water providers in the Yampa Basin. This includes the City of Steamboat, Mount Werner Water and Sanitation District, the City of Craig, and the aggregates representing towns and unincorporated population by water district. Results are presented for the model year with the largest gap in supplies. This represents a worst-case condition for the municipal provider. Note that the demands are the same every year in the model simulation. The “Gap in Maximum Year” is the volume of water that the city could not provide. The “Percent Gap in Maximum Gap Year” is the ratio of the gap and the demand.

For Business as Usual and Weak Economy, there are small gaps in the municipal water provider supplies. These are located at the aggregate nodes. The model does not contain details regarding the smaller water providers that are serving this population. A more detailed representation of these water providers could help inform the Yampa Basin about the true nature of the water supply gap.

The gaps increase for the planning scenarios that incorporate climate change (Cooperative Growth, Adaptive Innovation, and Hot Growth). New reservoir releases in Alternatives 2 and 3 help reduce the gaps. Some gaps remain in areas that are not easily served by reservoir releases. If the population growth and climate change assumptions in Hot Growth occur, the Yampa Basin will need additional strategies to fully meet the municipal demands.

Table 43: Yampa Basin Model Alternative Comparison for Municipal and Domestic Water Providers

Yampa Basin Alternative Comparison - City

Run	Demand In Maximum Gap Year (AFY)	Gap in Maximum Year (AFY)	Percent Gap in Maximum Gap Year (%)
Business as Usual			
Technical Update	9,430	91	1%
Alternative 1	9,430	91	1%
Alternative 2	9,430	91	1%
Alternative 3	9,430	50	1%
Weak Economy			
Technical Update	6,270	1	0%
Alternative 1	6,270	1	0%
Alternative 2	6,270	1	0%
Alternative 3	6,270	1	0%
Cooperative Growth			
Technical Update	9,280	224	2%
Alternative 1	9,280	163	2%
Alternative 2	9,280	184	2%
Alternative 3	9,280	91	1%
Adaptive Innovation			
Technical Update	11,700	959	8%
Alternative 1	11,700	959	8%
Alternative 2	11,700	445	4%
Alternative 3	11,700	222	2%
Hot Growth			
Technical Update	15,000	2,060	14%
Alternative 1	15,000	2,060	14%
Alternative 2	15,000	785	5%
Alternative 3	15,000	394	3%

For the Yampa River, future industrial uses have a large amount of uncertainty. Table 44 shows results for all industrial users, including thermoelectric generation, sand and gravel, mining, golf courses, energy development, and snowmaking. It is anticipated that the thermoelectric generation and supporting coal mines will no longer be in operation by 2050 in their current configuration. At this time, it is unknown if a different large industry will move into the basin, perhaps pump-storage hydropower, solar generation, or an industry not yet identified. This is an on-going topic of conversation in the basin. For the purposes of the BIP Update, the YWG BRT assumed that the current level of water consumption associated with Hayden Station and Craig Station would continue into 2050. This is a conservative approach to water resources planning.

The consistent gap of 192 AF in the maximum gap year for industrial users is caused by physical and legal shortages to aggregate industrial users in Water District 55 - Little Snake River. As discussed in Section 4, the aggregate industrial users represent anticipated future uses but lack the detailed information about water rights and diversion infrastructure. For Alternatives 2 and 3, the additional reservoir releases are not positioned to provide supplemental water to this region. If future industrial uses develop outside of the main river corridor, the basin will need additional strategies to fully meet these demands. Under Hot Growth, aggregate industrial users in Water District 55 and Water District 44 experience a gap. The gap is smaller in Alternative 3 because additional releases from Elkhead Reservoir supply Water District 44 industrial aggregate users. This highlights the usefulness of the existing storage in the basin.

Table 44: Yampa Basin Model Alternative Comparison for Industrial Users

Yampa Basin Alternative Comparison - Industry

Run	Demand In Maximum Gap Year (AFY)	Gap in Maximum Year (AFY)	Percent Gap in Maximum Gap Year (%)
Business as Usual			
Technical Update	24,100	192	1%
Alternative 1	24,100	192	1%
Alternative 2	24,100	192	1%
Alternative 3	24,100	192	1%
Weak Economy			
Technical Update	20,900	192	1%
Alternative 1	20,900	192	1%
Alternative 2	20,900	192	1%
Alternative 3	20,900	192	1%
Cooperative Growth			
Technical Update	23,000	192	1%
Alternative 1	23,000	192	1%
Alternative 2	23,000	192	1%
Alternative 3	23,000	192	1%
Adaptive Innovation			
Technical Update	23,000	192	1%
Alternative 1	23,000	192	1%
Alternative 2	23,000	192	1%
Alternative 3	23,000	192	1%
Hot Growth			
Technical Update	31,500	1,080	3%
Alternative 1	31,500	1,080	3%
Alternative 2	31,500	1,080	3%
Alternative 3	31,500	585	2%

YAMPA BASIN RESERVOIRS

Select reservoir results are presented below for Stagecoach Reservoir and Elkhead Reservoir. The figures below highlight trends in the reservoir storage results. Figures for Stillwater Reservoir and Steamboat Lake can be found in Appendix C. The Stillwater Reservoir expansion in Alternative 3 allows the reservoir to provide additional supplemental supply to the existing agricultural users. Under Alternative 1, there are some years when the reservoir can keep more water in storage because the demands are lower due to the increased efficiency. Modeling the 1,200-AF account for the City of Steamboat Springs in Steamboat Lake produces minor changes in the total storage.

Figure 23 and Figure 24 present Stagecoach Reservoir simulated storage contents for Business as Usual and Hot Growth. The graphs show that the Technical Update and Alternative 1 have almost identical results. The change in agricultural efficiency does impact the storage in Stagecoach. Alterative 2 and Alternative 3 are almost identical to each other. They show lower reservoir storage levels in some years due to additional releases to downstream users, primarily the Lower Yampa Reach. In Figure 23 (Business as Usual), the additional releases are not needed every year. The reservoir is generally able to refill every year, which the exception of the drought in the early 2000s. The ability to refill is due to both the amount of available inflow and the relatively low volume of water that is being released from storage. If additional water was released, the reservoir would refill in fewer years.

In Figure 24 (Hot Growth), the additional releases are made almost every year. The lower streamflows caused by climate change result in shortages to the Lower Yampa target, and supplemental water is needed from Elkhead Reservoir and Stagecoach Reservoir. With the lower streamflows, Stagecoach Reservoir frequently is operated and refills frequently.

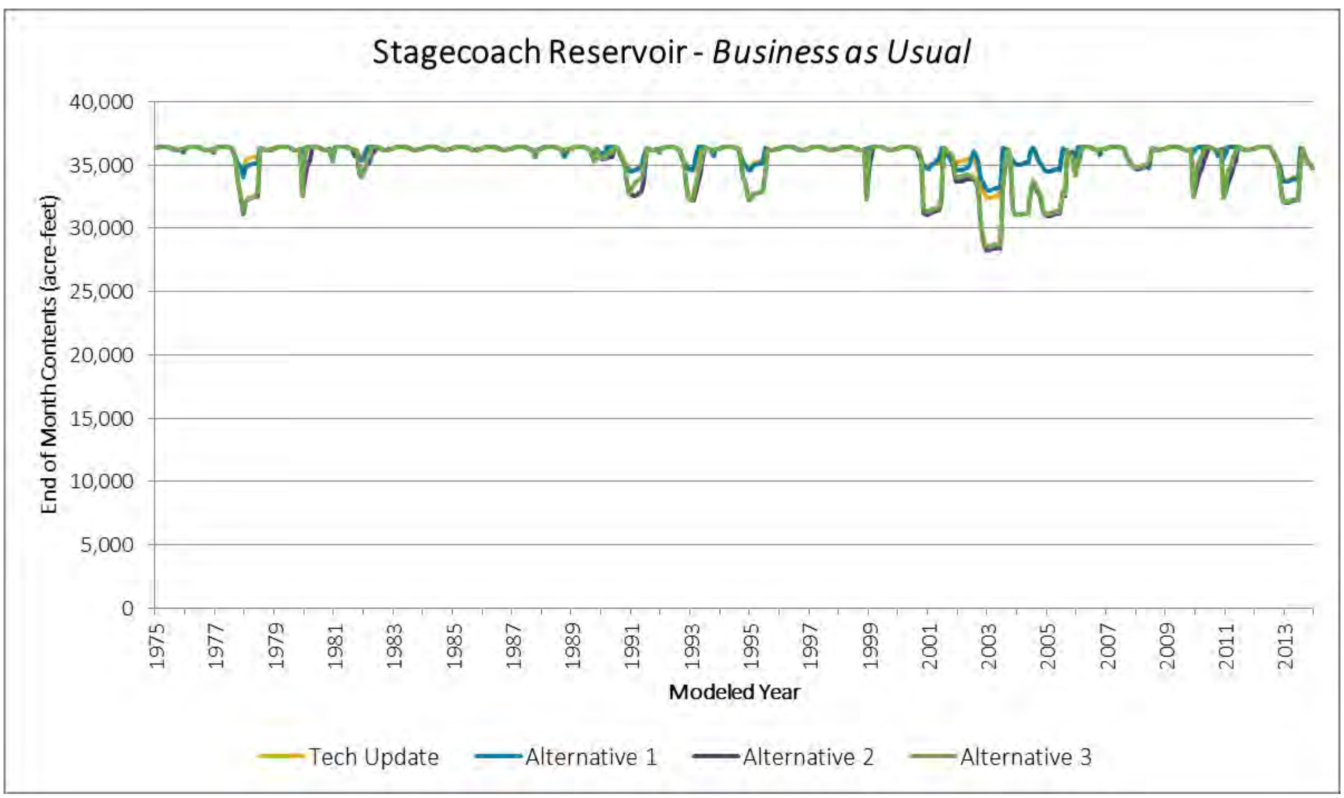


Figure 23: Comparison of Stagecoach Reservoir Storage Contents for Business as Usual and the Alternatives

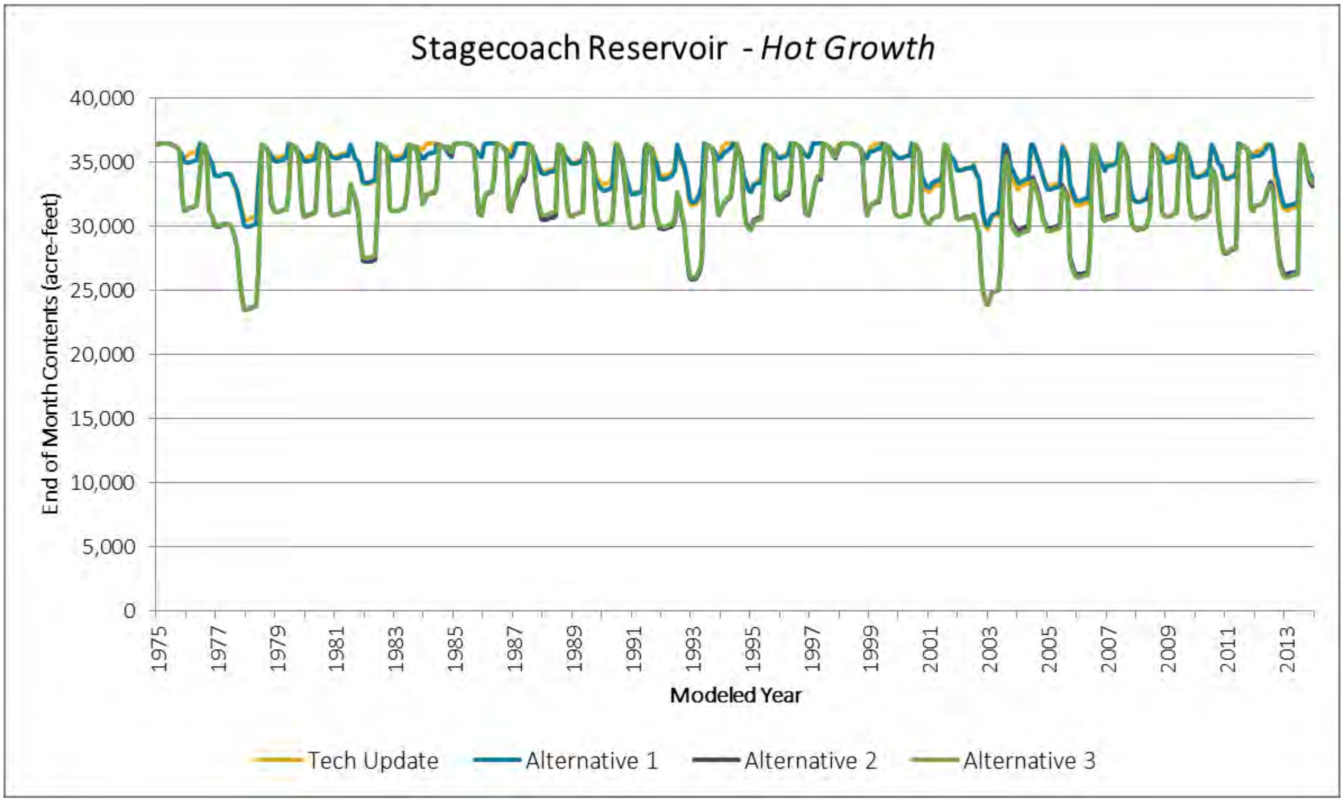


Figure 24: Comparison of Stagecoach Reservoir Storage Contents for Hot Growth and the Alternatives

Figure 25 and Figure 26 present Elkhead Reservoir simulated storage contents for Business as Usual and Hot Growth. The graphs show that the Technical Update and Alternative 1 have almost identical results for the reservoir. Similar to Stagecoach Reservoir, the change in agricultural efficiency does impact the storage in Elkhead Reservoir. Alternative 2 departs from the Technical Update because the reservoir is making additional releases to the Lower Yampa Reach. The release limit has been increased to 75 cfs, and the available storage has increased by allowing releases from Tri-State's pools. Additionally, new releases are made to agricultural users from the River District pool. In Figure 25 (Business as Usual), the reservoir storage is not needed in wet periods, such as the mid-1980s. In average or moderately dry years, the reservoir releases about the same amount of water from storage in the Technical Update, Alternative 1, and Alternative 2. The additional storage water made available in Alternative 2 is only needed in dry years, such as 1977, 2000 through 2003, and 2012. The enlarged reservoir in Alternative 3 helps meet agricultural shortages in the dry years. The reservoir can refill every year.

In Figure 26 (Hot Growth), reservoir storage is used every year. The lower streamflows caused by climate change result in shortages to the Lower Yampa Reach targets, and supplemental water is needed from Elkhead Reservoir and Stagecoach Reservoir. Shortages also increase to the agricultural users. Despite the lower streamflows, Elkhead Reservoir refills every year.

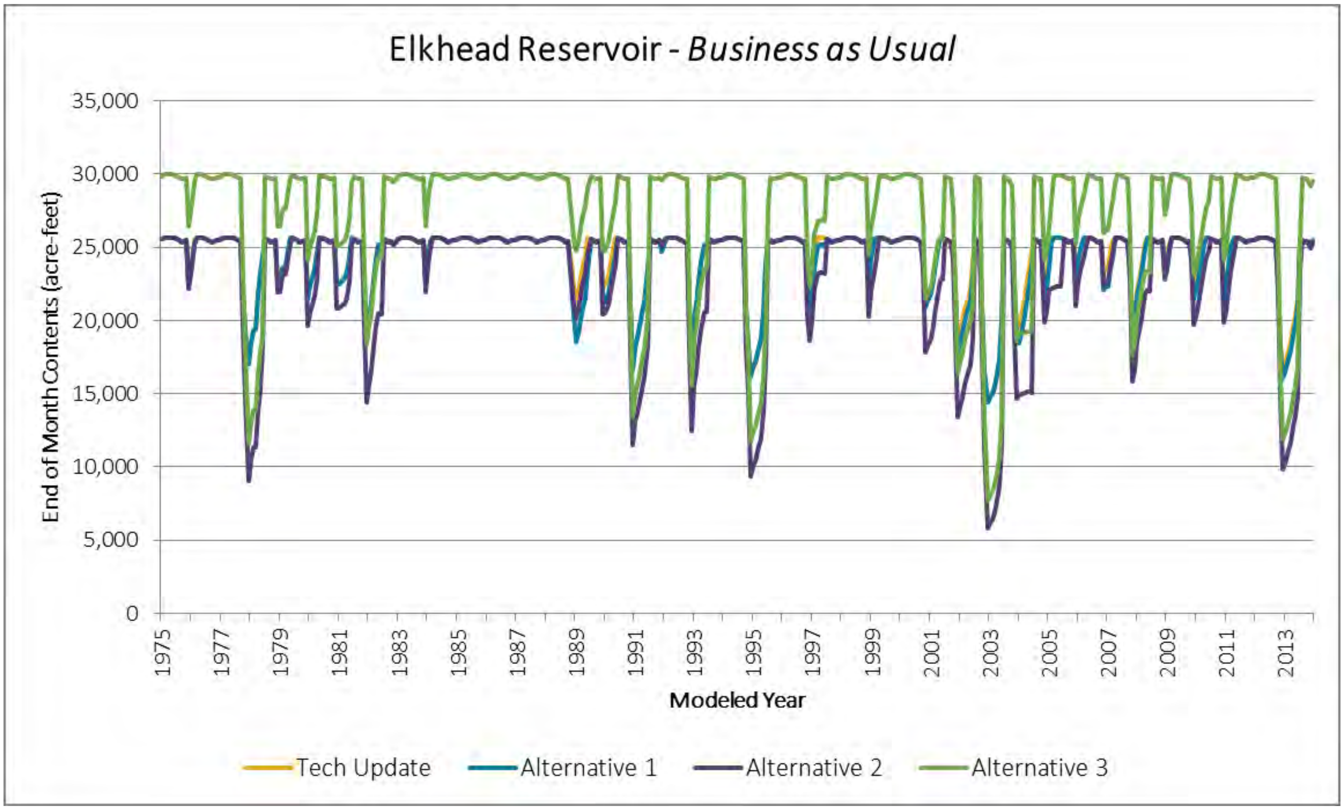


Figure 25: Comparison of Elkhead Reservoir Storage Contents for Business as Usual and the Alternatives

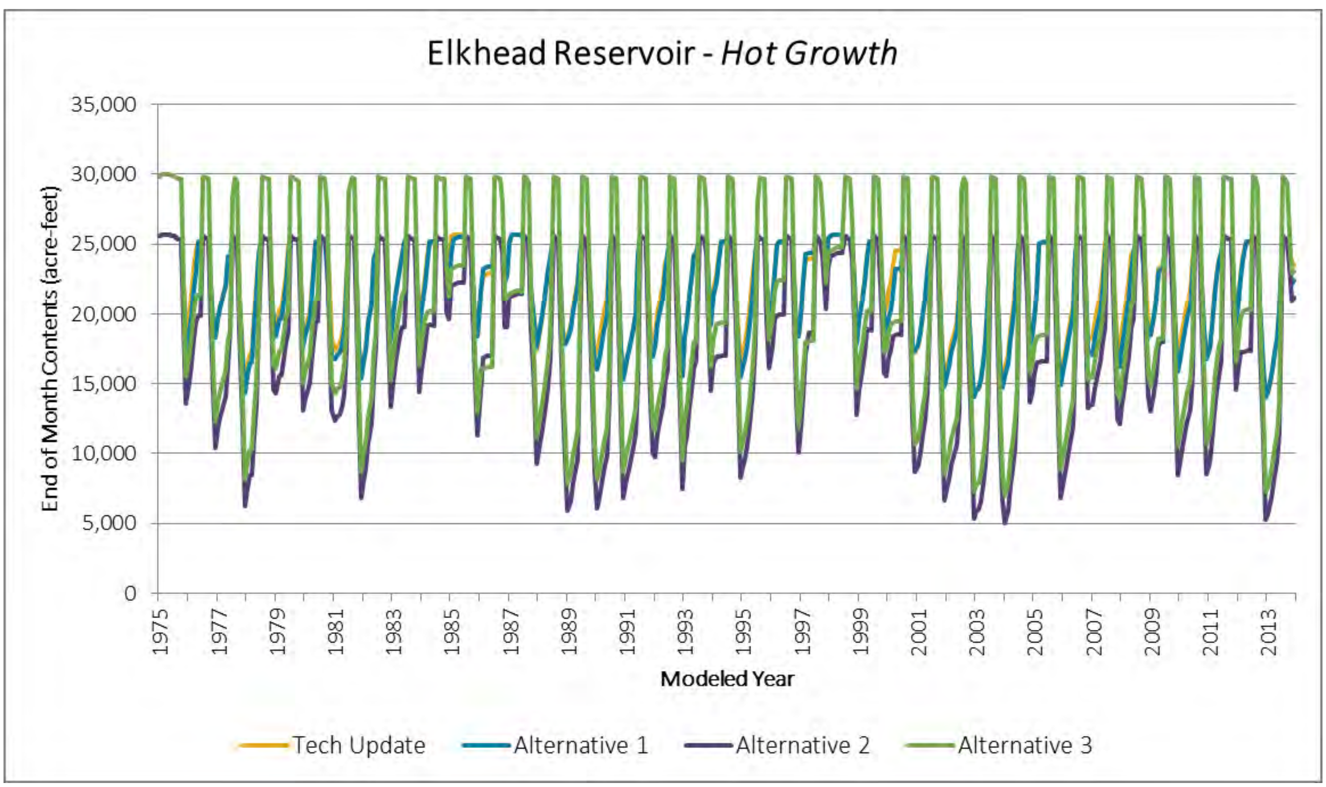


Figure 26: Comparison of Elkhead Reservoir Storage Contents for Hot Growth and the Alternatives

Table 45 reports the average annual evaporation for reservoirs in the Yampa River for Business as Usual. Reservoirs with larger capacities generally have a larger volume of evaporation due to the surface area. Note that High Savery Reservoir is located in the Little Snake Basin in Wyoming. Operations for this reservoir could be refined in future efforts.

Table 45: Average Annual Evaporation (AFY) for Reservoirs in the Yampa Basin, Business as Usual

Yampa Evaporation Table

Reservoir	Technical Update	Alternative 1	Alternative 2	Alternative 3	Capacity
Allen Basin Reservoir	136	143	136	136	2,250
Elkhead Reservoir	1,333	1,322	1,292	1,419	29,956
Fish Creek Reservoir	228	228	228	228	4,268
High Savery Reservoir	162	219	162	162	22,433
Lake Catamount	879	879	879	879	7,422
Lester Creek Reservoir	293	293	293	293	5,657
Long Lake Reservoir	112	112	112	112	396
Stagecoach Reservoir	1,502	1,503	1,469	1,475	36,460
Steamboat Lake	1,984	1,983	1,990	1,990	26,364
Stillwater Reservoir	215	219	215	225	6,392
Wilson Reservoir	9	9	9	9	499
Yamcolo Reservoir	353	364	352	356	9,621

YAMPA BASIN STREAMFLOW

Monthly streamflow volumes are shown for two locations in the Yampa Basin. Results are only shown for Business as Usual because the impacts of the three alternatives are similar across the planning scenarios. The streamflow results are primarily driven by hydrology, which is discussed in Section 4.

Figure 27 and Figure 28 present results for the Yampa River at the Steamboat RICD for 2009 through 2012. These years are selected to show a range of hydrological conditions. 2009 and 2010 are average years, 2011 is a wet year, and 2012 is a dry year. Figure 27 shows the full range of streamflow. Figure 28 focuses on the low-flow levels. An approximation of the monthly streamflow volume needed to meet the daily streamflow targets associated with the RICD is shown with the dashed black line. There are no reservoir operations associated with meeting the target flow.

The Steamboat RICD is located in the upper portion of the basin for recreational purposes. Incidentally, it also provides habitat for cold-water and sport fish species. It reflects the impacts of upstream agriculture and releases from Stagecoach Reservoir. This location is important for environmental and recreational needs. Key observations from these results are:

- The RICD flow targets are met during average and wet years. During the dry year of 2012, the runoff volume was small and ended early. There was not enough flow in the river to meet the targets in June, July, and August.
- The streamflow volumes for the Technical Update and Alternative 1 are similar. The improved agricultural efficiencies cause minor changes on the streamflow volumes. For more details, refer to Table 46, which quantifies the average change in monthly streamflow volume caused by the improvements in agricultural efficiencies. The streamflow is slightly larger in April, May, and June. This corresponds to a portion of the irrigation season that generally has sufficient water supplies. July is almost the same. Depending on the year, July may or may not have sufficient water supplies. The flows are smaller in August, September, October, November, and December. This corresponds to a period when return flow generated by flood irrigation are returning to the stream. The flows are about the same in January, February, and March. The third column of the table reports the average change in daily streamflow if the change in monthly volume is evenly distributed across the month.
- The streamflow volumes for Alternative 2 and 3 are higher in September of 2009 and 2010, and August and September of 2012. This is caused by the releases from Stagecoach Reservoir to the Lower Yampa Reach.

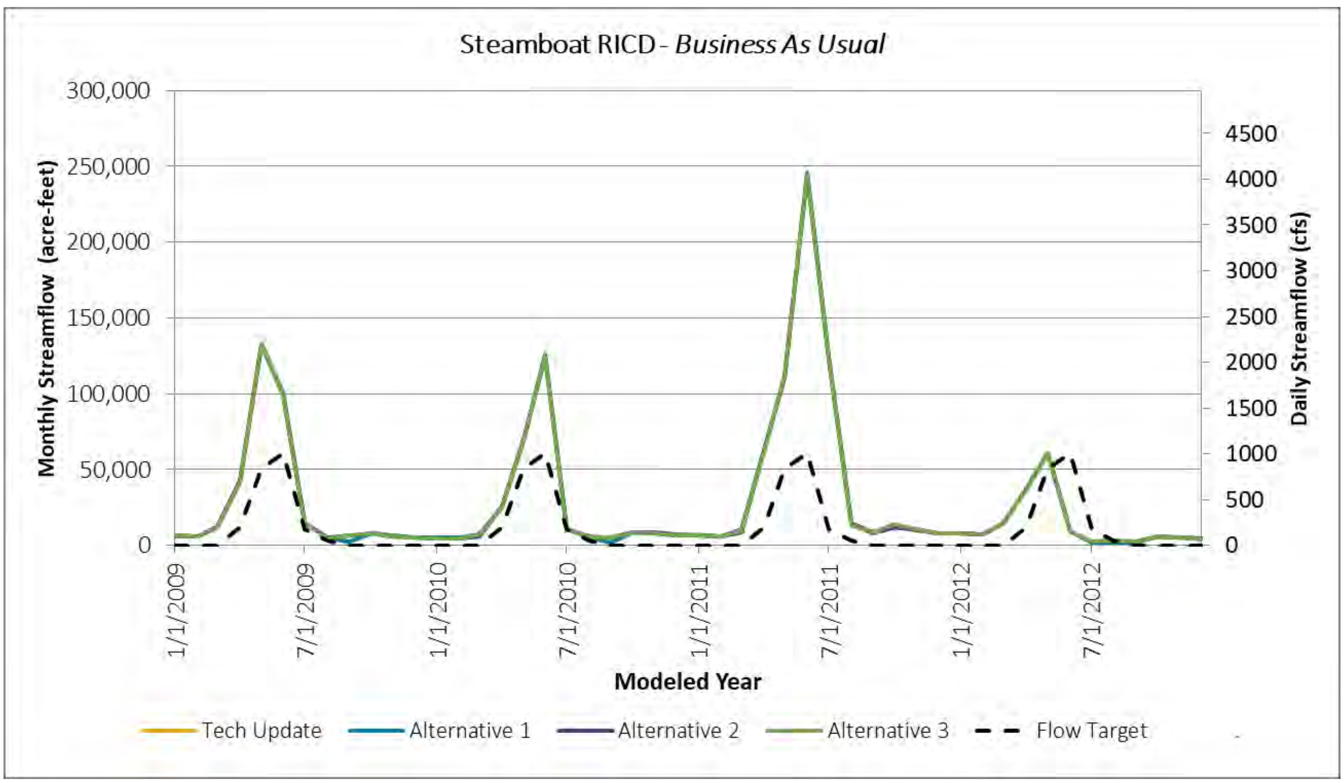


Figure 27: Comparison of Monthly Streamflow Volume for the Yampa River at the Steamboat RICD, Business as Usual

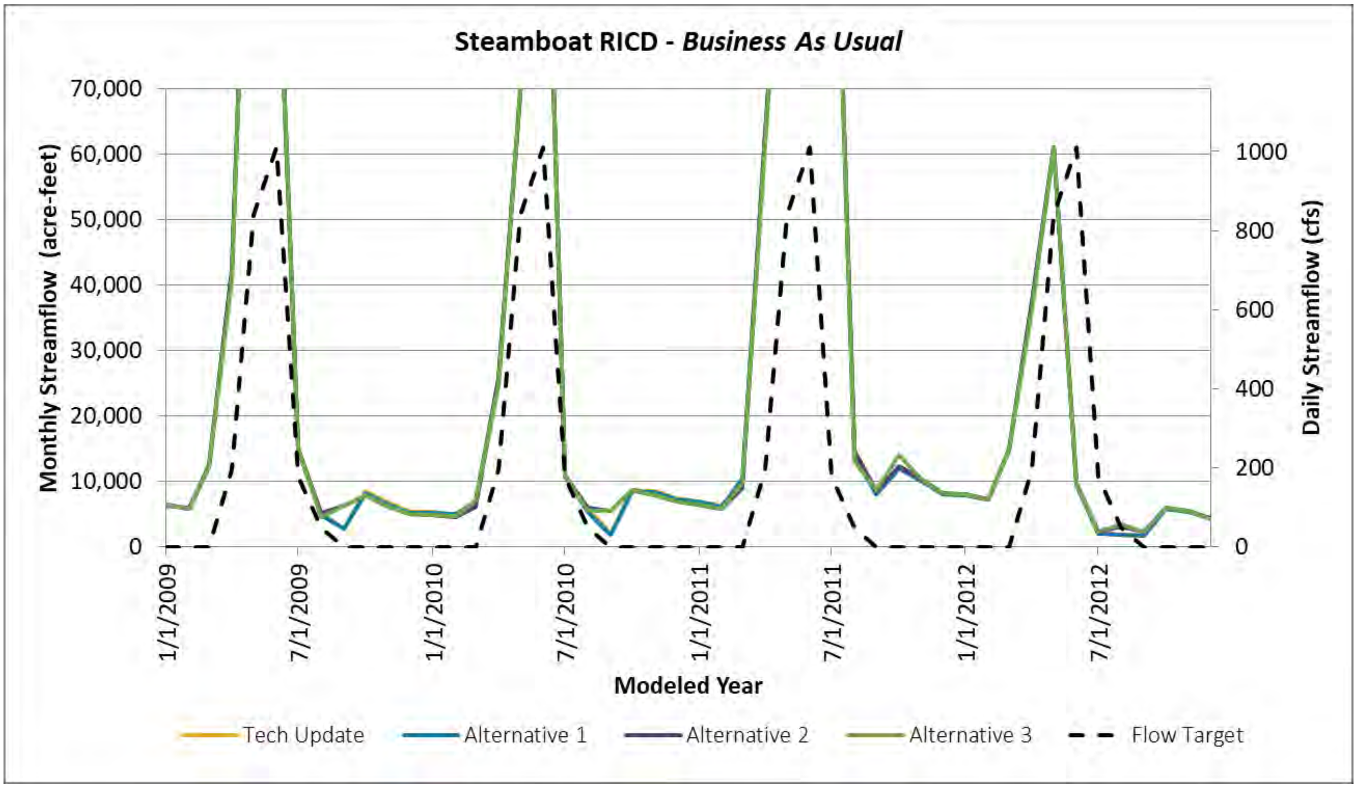


Figure 28: Detailed Comparison of Monthly Streamflow Volume for the Yampa River at the Steamboat RICD, Business as Usual

Table 46 quantifies the average change in monthly streamflow volume caused by the improvements in agricultural efficiencies. The streamflow is slightly larger in April, May and June. This corresponds to portion of the irrigation season that generally has sufficient water supplies. July is almost the same. Depending on the year, July may or may not have sufficient water supplies. The flows are smaller in August, September, October, November, and December. This corresponds to a period when return flow generated by flood irrigation are returning to the stream. The flows are about the same in January, February, and March. The third column of the table reports the average change in daily streamflow if the change in monthly volume is evenly distributed across the month. The benefit of inefficient diversions during the peak flow months is increased returns flows, which bolsters streamflow in the late season.

Table 46: Average Change in Streamflow Volume (Alternative 1 - Technical Update) for the Yampa River at the Steamboat RICD, Business as Usual

Month	Average Change in Streamflow Volume (AF)	Average Change in Daily Flows (cfs)
Jan	-63	-1.0
Feb	-29	-0.5
Mar	39	0.6
Apr	164	2.8
May	238	3.9
Jun	1,157	18.2
Jul	-55	-0.9
Aug	-498	-8.1
Sep	-172	-2.9
Oct	-221	-3.6
Nov	-129	-2.2
Dec	-102	-1.7

Figure 29 and Figure 30 present results for the USGS gage 09251000 Yampa River near Maybell for 2009 through 2012. Results from the gage are reported because of the importance of this location. The gage is representative of the Lower Yampa Reach, which provides critical habitat for the endangered fish species. The Lower Yampa Reach starts at the confluence with Elkhead Creek and stretches to the confluence with the Green River. This large geographic area includes diversions to Craig Station, the City of Craig, and agricultural users. The reach also hosts multiple areas of high recreational value for fishing, rafting, and kayaking, and the proposed Craig Whitewater Park. In addition to the endangered fish species, the reach has significant riparian plant communities and provides habitat for the roundtail chub and river otter. Historically, the mainstem of the Yampa River has not experienced water administration because the native streamflow has been sufficient to meet the needs of the users, or water users have made the decision not to request a call. This changed in 2018 and 2020 due to the extremely low streamflow in the Lower Yampa Reach in August and September. A mainstem call was placed by agricultural users near Lily Park, which is located just upstream of the confluence with the Little Snake River.

As part of the Yampa River Management Plan and PBO, streamflow is supplemented by releases from Elkhead Reservoir. The target streamflow for July through October is the black dashed line. The levels vary based on the year type (wet/average/dry). Releases are generally dependent on the flow levels recorded at the USGS gage near Maybell. Figure 29 shows the full range of streamflow at this gage location. Figure 30 focuses on the low-flow levels.

Key observations from these results are:

- The flow targets are only met during wet years. For the Technical Update and Alternative 1, the flow targets are not met during the average and dry years. For Alternative 2 and 3, additional supplies from Elkhead Reservoir and Stagecoach Reservoir provide sufficient water to meet the flow targets.
- The streamflow volume for the Technical Update and Alternative 1 are similar. The improved agricultural efficiencies cause minor changes on the streamflow volumes. For more details, refer to Table 47, which shows the average monthly change in streamflow.

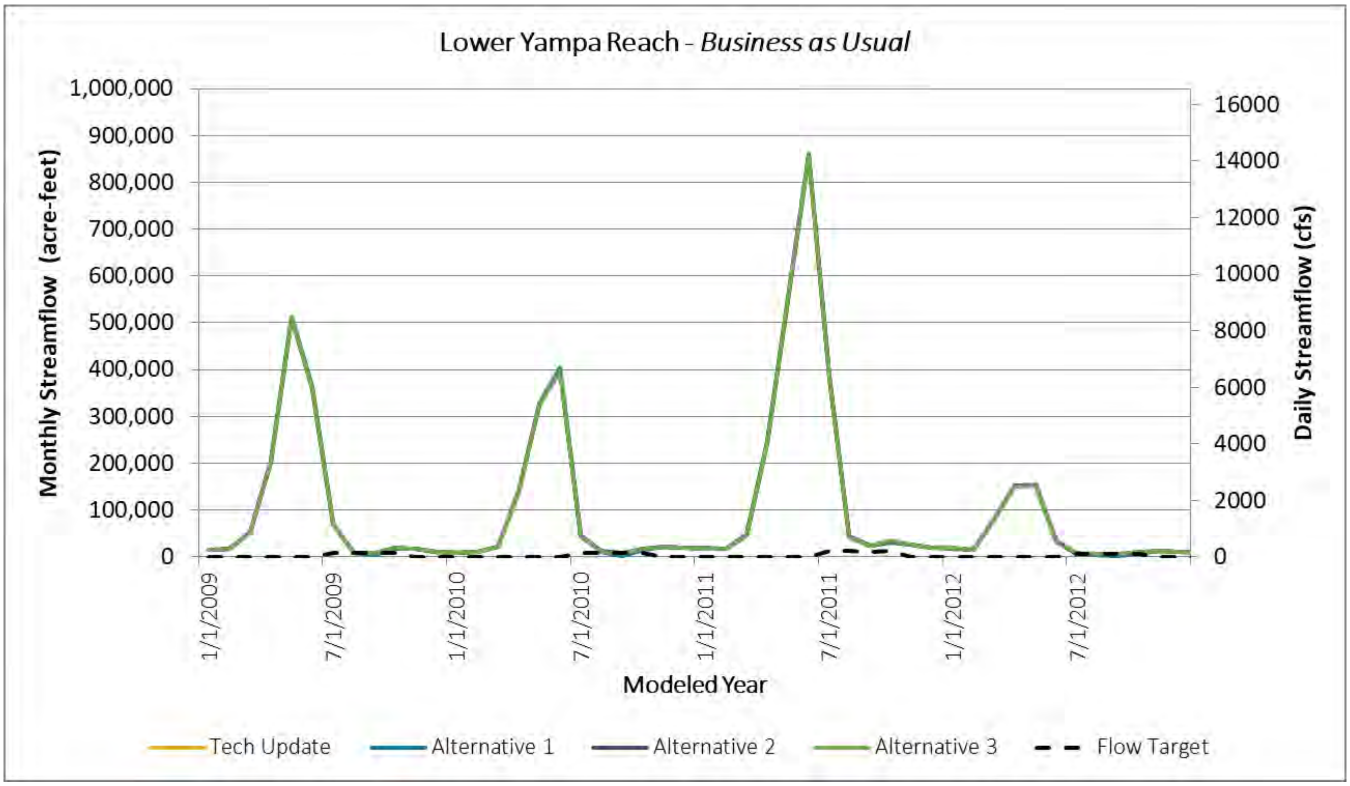


Figure 29: Comparison of Monthly Streamflow Volume for the Lower Yampa Reach, Business as Usual

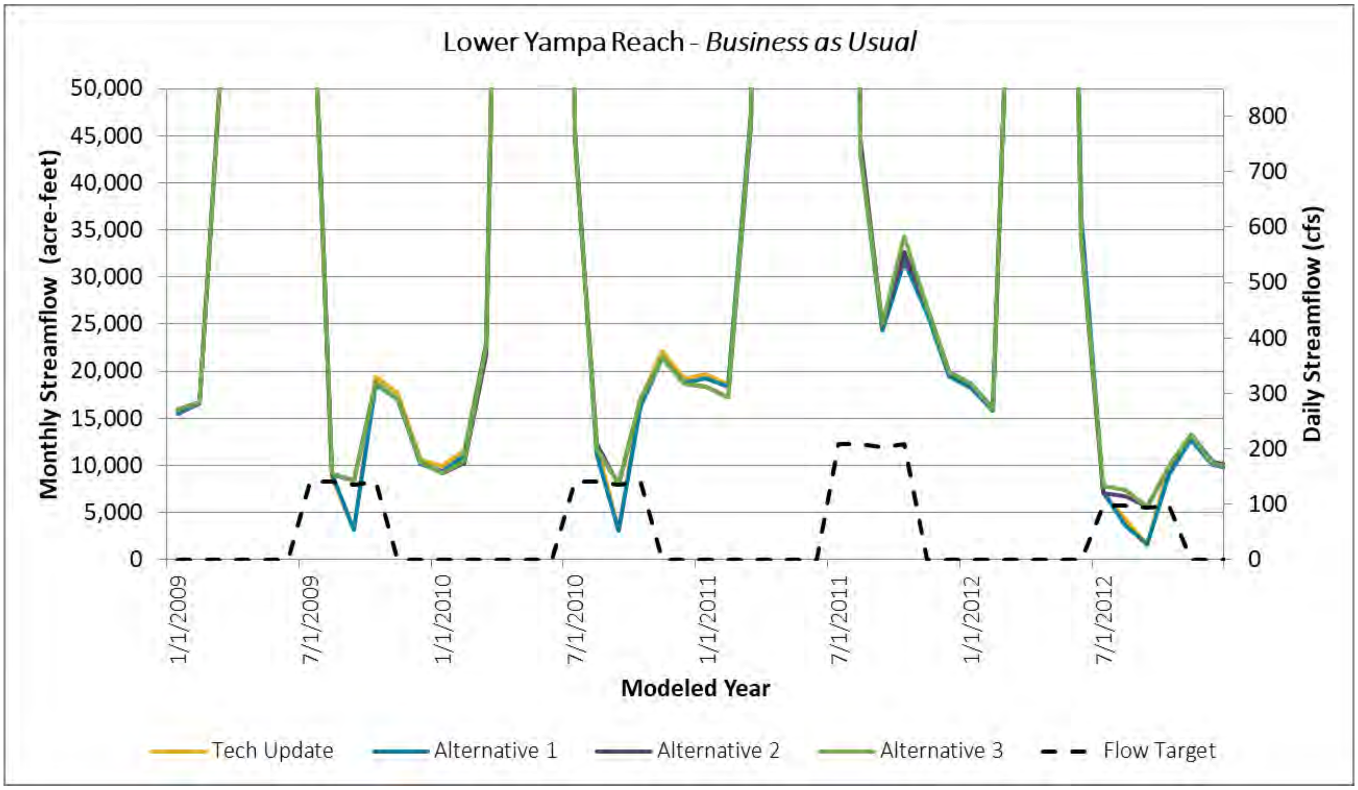


Figure 30: Detailed Comparison of Monthly Streamflow Volume for the Lower Yampa Reach, Business as Usual

Table 47 quantifies the average change in monthly streamflow volume caused by the improvements in agricultural efficiencies. The streamflow is larger in May and June. This corresponds to a portion of the irrigation season that generally has sufficient water supplies. July shows slightly higher flows at the Lower Yampa Reach. Depending on the year, July may or may not have sufficient water supplies. The flows are smaller in August, September, October, November, December, January, and February. This corresponds to the period when return flows generated by flood irrigation are returning to the stream. The flows are about the same in March and April. The third column of the table reports the average change in daily streamflow if the change in monthly volume is evenly distributed across the month. The benefit of inefficient diversions during the peak flow months is increased returns flows, which bolsters streamflow in the late season.

Table 47: Average Change in Streamflow Volume (Alternative 1 - Technical Update) for the Yampa River near Maybell gage, Business as Usual

Month	Average Change in Streamflow Volume (AF)	Average Change in Daily Flows (cfs)
Jan	-309	-5.0
Feb	-211	-3.8
Mar	-96	-1.6
Apr	8	0.1
May	2,073	33.7
Jun	4,493	70.8
Jul	711	11.6
Aug	-564	-9.2
Sep	-264	-4.4
Oct	-792	-12.9
Nov	-562	-9.4
Dec	-423	-6.9

Figure 31 and Figure 32 illustrate the sources of water in the Lower Yampa Reach for Business as Usual, Alternative 3. Figure 31 shows the monthly streamflow volume from 2008 through 2012. Each year tells a slightly different story.

- 2008 is a wet year, but the streamflow drops below the flow target of 200 cfs in September. Releases from the CWCB pool in Elkhead Reservoir are sufficient to reach the target.
- 2009 and 2010 are average years, but the streamflow drops below the flow target of 134 cfs in September. In fact, there is almost no native flow in the reach. Releases from the CWCB pool in Elkhead Reservoir are made up to the maximum release rate of 75 cfs. Additional water is released from Stagecoach Reservoir to meet the target.
- 2011 is a wet year, and native flow is sufficient to meet the streamflow targets
- 2012 is a dry year. Releases from Elkhead Reservoir start in July from the CWCB pool in order to meet the flow target of 93 cfs. Additionally, Elkhead Reservoir is releasing to agricultural users in the reach. Releases from the CWCB pool and the Fish Lease pool continue in August, up to the 75 cfs maximum release limit. Water is released from Stagecoach Reservoir to reach the target. In September, water is released from the Fish Lease pool and Tri-State's second pool in Elkhead Reservoir, up to the maximum release limit. Water is released from Stagecoach Reservoir to reach the target. In October, native flow is sufficient to meet the target.

In the average years of 2009 and 2010, the 75-cfs release limit on Elkhead Reservoir prevents water from other pools in Elkhead from being released to the Lower Yampa Reach. Instead, water is released from Stagecoach Reservoir. This operation may be desirable to increase streamflow through a longer portion of the Yampa River; however, there is no legal mechanism for Stagecoach Reservoir to release to needs outside of UYWCD boundaries. Additionally, transit losses were not accounted for in the model and could reduce the usefulness of Stagecoach releases. Anecdotal information from previous reservoir releases suggests transit losses below Stagecoach Reservoir could be inordinate.

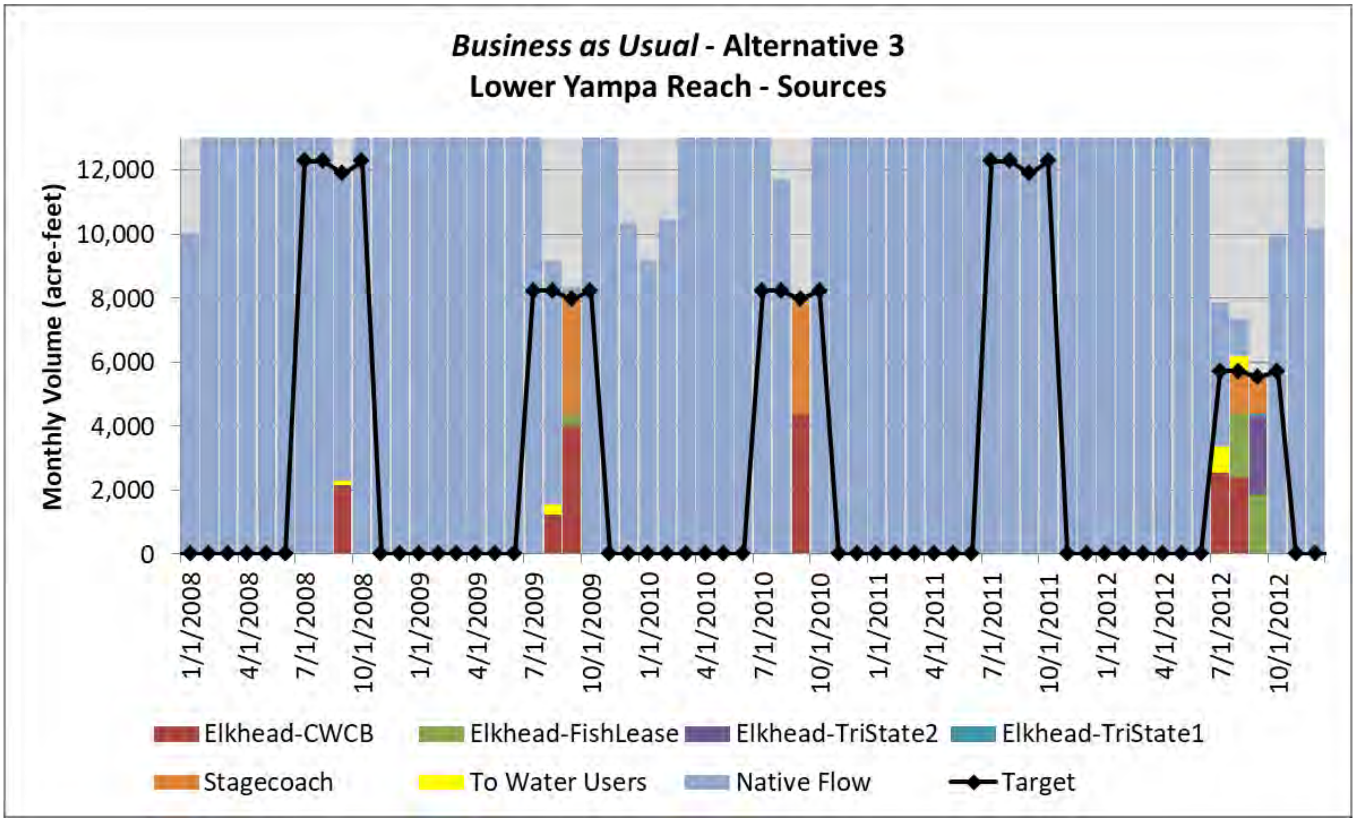


Figure 31: Monthly Lower Yampa Reach Sources of Water for Alternative 3, Business as Usual

Figure 32 shows the annual volume of water released by different reservoir sources to the Lower Yampa Reach. The black boxes show the shortage to the flow target. For Business as Usual, Alternative 3, there are only two years with storages.

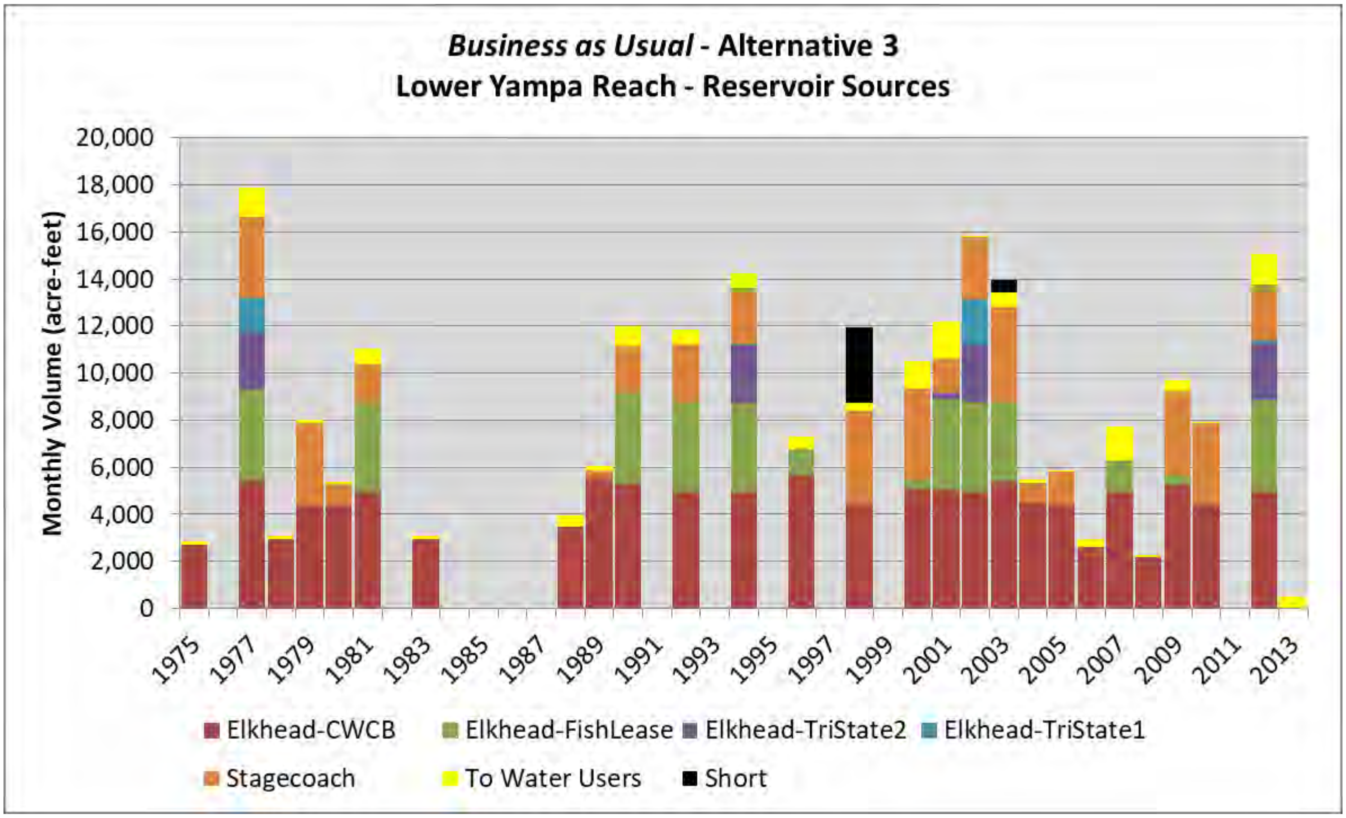


Figure 32: Annual Lower Yampa Reach Reservoir Sources of Water for Alternative 3, Business as Usual

Summary

The YWG BRT explored three alternative management strategies in the models:

- Alternative 1: Agricultural Efficiencies
  - White River 1a - no change in headgate demands
  - White River 1b - decreased headgate demands
- Alternative 2: New Releases from Existing Storage (Yampa only)
- Alternative 3: Enlarged/New Reservoirs

Alternative 1: Agricultural Efficiencies assumed that 20 percent of the flood-irrigated acreage is converted to sprinkler acreage. The results do not improve agricultural gaps. There are impacts to streamflow. Generally, flows increase during the runoff and decrease at other times of the year. If the basin pursues a large-scale agriculture efficiency improvement, it may also be beneficial to consider small-scale agricultural storage. Off-channel reservoirs could be filled during the runoff and used to supplement supply during the low-flow season. This could reduce the need for diversions from the river or be used to supplement streamflow. Alternatively, the YWG Basin could consider a hybrid method of irrigation. Irrigators could flood irrigate during the runoff, generating the benefits of late-season return flows. Once streamflow levels are declining, irrigators could switch to a more efficient method of irrigation, thereby leaving more water in the stream. These results also indicate that the YWG Basin would benefit from a more detailed return flow study to better understand variations in local return flow parameters. Once these details are known, the YWG Basin could consider site-specific efficiency improvements. Instead of pursuing large-scale agricultural efficiency improvements throughout the YWG Basin, the YWG BRT could target specific areas with favorable return-flow characteristics.

Alternative 2: New Releases from Existing Storage helped reduce gaps to existing and future users in the basin, and the impacted reservoirs generally were able to refill. This suggests that reservoirs can provide reliable supply in the future. The YWG BRT may consider working with water users and reservoir owners to help facilitate additional contracting for reservoir water in the future.

Alternative 3: Enlarge/New Reservoirs helped reduce gaps, especially in the White River. Additional storage in the White River would provide flexibility in operations and more resilient supplies to municipal and industrial uses.

SECTION 6. FUTURE BASIN PROJECTS

Overview and Methodology

Future basin projects are projects and processes that will help the YWG Basin address gaps between water needs and availability and meet the YWG BRT's Goals and Objectives. Projects are self-identified, meaning they are put forth voluntarily by a project proponent, or in some instances are put forth by the YWG BRT itself. Project proponents are not obligated to include a project on the YWG BRT's list. It is expected that there will be projects that help fulfill the aims of the BIP that are not included on the list. Further, inclusion on the list does not equate to a YWG BRT endorsement of the project. The YWG BRT recognizes that projects may or may not come to fruition depending on a variety of factors, including securing funding and obtaining needed permits.

The list of projects is not intended to be comprehensive; it is intended to be dynamic and evolve over time. New projects will be identified, projects will be completed, and some projects may drop off. It is expected that the YWG BRT will review the list and make changes periodically, perhaps annually. For this BIP Update, representatives from the YWG BRT reviewed and updated projects from the 2015 BIP. The BIP Update included adding new data for 38 projects, including information on cost, capacity, and water yield.

In this BIP Update, new projects were identified based on information brought forth from YWG BRT members as well as outreach to a variety of stakeholders, including small municipalities, major industrial water users (most notably the coal-fired power plants), and major environmental and recreational water users, including The Nature Conservancy, Trout Unlimited, CPW, and cities and towns in the YWG Basin. The BIP Update added 52 projects to the list.

As of publication, there are 90 projects in the database. Several of the projects have multiple phases, which are nested under a primary project. In addition, new for this BIP Update was the "tiering" of each project to reflect how far along it is in the planning process. This ranges from Tier 1 projects, which are considered shovel ready, to Tier 4 projects, which are in the very early, conceptual stages. Of the 90 projects, 73 have been assigned a tier. Projects from 2015 that have been completed (four) or are no longer being pursued (nine) are not assigned a tier. Additionally, four projects did not have enough information to assign a tier. The YWG BRT will continue to work with project proponents to gather and enter project information into the database.

A summary of the projects is presented below. Table 48 presents the number of projects in each tier located in the Yampa and White basins, or projects that address basinwide challenges. There are 47 projects specific to the Yampa Basin, 16 specific to the White Basin, and 10 that cover both areas, for a total of 73 projects. Note that the table only includes projects that have been assigned a tier.

Table 49 summarizes cost estimates by tier and location. 53 projects have cost estimates. While there are more projects in the Yampa Basin, the cost of projects in the Yampa and the White basins is almost the same. The total cost is about $665 million. This number is likely an underestimate because cost estimates were not available for 20 of the 73 tiered projects. Project proponents will have the opportunity to provide updated cost estimates in the future.

Table 48: Number of Projects in Each Tier by Location

Projects by Tier	Yampa	White	Basinwide	Total
Tier 1	20	5	2	**27**
Tier 2	5	6	1	**12**
Tier 3	21	4	4	**29**
Tier 4	1	1	3	**5**
Total	**47**	**16**	**10**	**73**

* Includes only projects that have been tiered

Table 49: Cost of Projects in Each Tier by Location

Cost by Tier	Yampa	White	Basinwide	Total
Tier 1	$38,002,000	$2,387,000	$125,000	**$40,514,000**
Tier 2	$15,040,000	$325,876,000	$0	**$340,916,000**
Tier 3	$276,523,000	$100,000	$6,640,000	**$283,263,000**
Tier 4	$0	$0	$250,000	**$250,000**
Total	**$329,565,000**	**$328,363,000**	**$7,015,000**	**$664,943,000**

In addition to assigning tiers to projects, proponents were asked to assign a status to their respective projects. The options were:

- Completed - applied to projects from 2015 that have been fully implemented.
- Not pursuing - applied to projects from 2015 that are no longer being moved forward by the project proponent.
- Concept - the project is in the earliest stages of being developed.
- Planned - the project proponent has a clearly defined project.
- Implementing - the project is actively being executed.

Figure 33 shows the percent of the projects with a status of "Concept," "Planned," or "Implementing." This figure shows that the YWG Basin is actively implementing about 32 percent of the projects in the database. Stakeholders in the YWG Basin are actively working on projects that help advance the eight Basin Goals. About 38 percent have a status of planned. These projects are clearly defined by a project proponent. Many of these projects are either seeking permits or funding before they can be implemented. Finally, about 30 percent are concepts. These projects are in the early stages of development. This division of project status shows that the YWG Basin has a healthy division of projects that are underway, projects that are preparing for implementation, and projects that are just beginning to be explored.

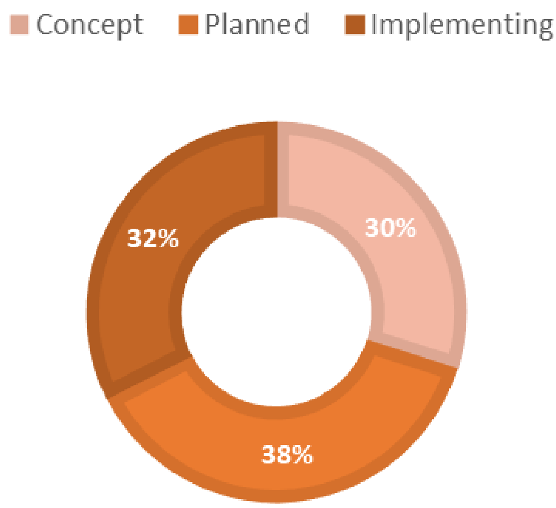


Figure 33: Projects by Status (Concept, Planned, Implementing)

Figure 34 shows the different types of projects that are documented in the project database. The categories refer to the primary beneficiary of the project or the primary challenge that is addressed by project, as follows:

- Agriculture – Projects related to rehabilitating agricultural diversion structures, measuring agricultural diversions, addressing shortages, and return flow studies
- Colorado River – Projects related to Colorado Big River issues, such as DM
- Education – Projects related to public education, outreach, and participation
- Measurement – Projects related to installing new streamflow gages, automated reservoir measurements, or weather stations
- M&I – Projects related to municipal and industrial supply projects, water treatment plan improvements, or conservation
- Recreation – Projects related to new in-river recreational infrastructure or improving river access
- Reservoirs – Projects related to building new storage projects, rehabilitating existing reservoirs and ponds, and reservoir management options
- Watershed – Projects related to watershed/forest/rangeland health, water quality, instream flows, land use planning, and PBOs

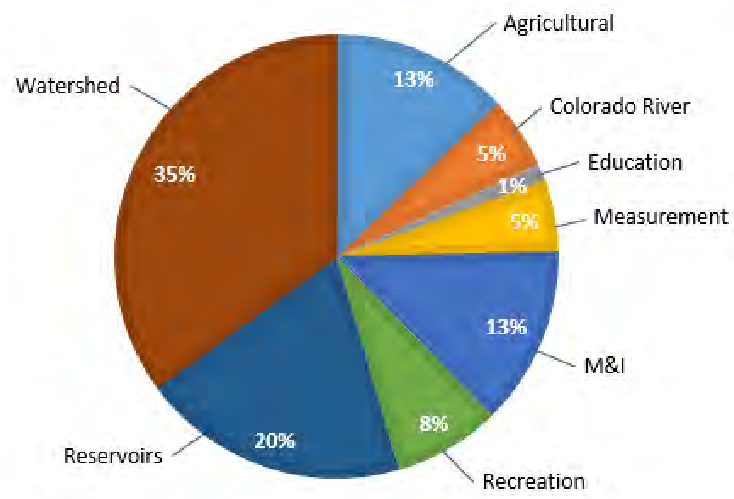


Figure 34: Projects by Category

To complement this figure, Table 50 shows the number of multi-use projects by location. Over half of the projects' assigned tiers are for multi-purpose benefits.

Table 50: Number of Multi-Use Projects by Location

Yampa	White	Basinwide	Total
32	11	2	**45**

The full list of projects is shown in Appendix D.

SECTION 7. PUBLIC EDUCATION, PARTICIPATION, AND OUTREACH

Introduction and Overview

When the Colorado General Assembly established the Basin Roundtables and the Interbasin Compact Committee in 2005, it provided for public education, participation, and outreach (PEPO). Each Roundtable has a PEPO effort that works to inform the public about the Roundtable's activities as well as other State activities, like the CWP. Roundtables receive financial support from the CWCB to help further the educational efforts of local watershed and water education groups.

The YWG BRT recognizes it needs the support of the water community and general public to accomplish the Basin's Goals and successfully implement the BIP. This includes educating and engaging the community about the impact of water on their lives, the water challenges facing the Basin, and proposed solutions. It also means providing opportunities for members of the public to become more connected with the Basin's water and watershed. The vision of the YWG BRT's PEPO Committee is to:

- Develop and implement [the Basin's Education and Action Plan] that facilitates educational opportunities about Colorado and YWG Basin water challenges.
- Forward [Colorado's statewide water planning] process by facilitating inclusive discussions on water issues and enhancing participation
- Encourage locally driven collaborative solutions
- Increase collaborations and partnerships with other YWG Basin organizations that wish to promote water education
- Encourage YWG BRT members to actively participate with the Education sub-committee

The YWG BRT annually updates and implements an Education Action Plan (EAP)[15] through a volunteer BRT Committee that seeks to represent the diverse agriculture, municipal, industrial, recreational, and environmental interests of the YWG Basin. The YWG BRT affirms the value of the Colorado Water Plan's educational goals and the Statewide Water Education Action Plan (SWEAP) vision and framework and the importance of achieving its outcomes in collaboration with CWCB. The PEPO Committee and EAPs are listed on the BRT's Committee[16] and Resources[17] pages.

Since 2015, the YWG BRT has made significant strides in education, outreach, and public participation. As discussed below, the YWG BRT has provided grant funding to support the Community Agricultural Alliance (CAA) through a three-year grant to develop and implement a water education and outreach program. Grant funding was also awarded to the John McConnell Math and Science Center to advance K-12 water education in Western Colorado. This grant helped construct a 400-square-foot hydrology exhibit that includes an interactive water table with multiple hands-on tanks that demonstrate principles of hydrology, river dynamics, water cycles, agriculture and municipal uses, conservation, and water law for kids and parents of all ages to enjoy and learn from. The Yampatika Outdoor Awareness Association received grant funding to develop Yampa White Green Rivers K-12 curriculum for the YWG BRT. This youth water education program will focus on increasing general water education, which includes highlighting the importance of water in the YWG Basin to all relevant stakeholders, including agriculture, municipalities, recreation, businesses, community members, and the environment.

[15] https://drive.google.com/file/d/14wAO_YWKIi2fSA6PCdXrhwct2o9amjC0/view
[16] https://yampawhitegreen.com/committees/
[17] https://yampawhitegreen.com/resources/

The YWG Basin's current goals and strategies for education and outreach (as detailed in the YWG Basin's 2021 Education Action Plan) are set forth below.

GOAL 1	**Raise public awareness of YWG Roundtable activities**
a. The PEPO Liaison will assure that regional news agencies are notified of BRT meeting dates, times, and locations. b. The PEPO Liaison will assure that regional news agencies are timely notified of BRT vacancies. c. Update to the YWG BRT website to make it educational for the general public at the same time YWG BRT members can get the information they need to be effective on the Roundtable. b. Use Facebook to promote YWG BRT communications and education on water issues in the YWG Basin.	
GOAL 2	**Raise public awareness of the YWG Basin BIP and the CWP**
a. The PEPO Liaison will develop and implement a newspaper and radio information campaign about issues within the YWG Basin and State. b. Plan, implement, and facilitate a series of water education forums or workshops in Craig, Meeker, Rangely, and Steamboat. c. Develop other media as needed or identified by the Education Sub-committee or the liaison. d. Reference SWEAP (Statewide Water Education and Action Plan) and use where applicable.	
GOAL 3	**Support Integrated Water Management Plan development in the YWG Basin**
a. Provide education opportunities on Steam Management Plans/Integrated Water Management Plans. b. Provide education/support of the YWG BRT Yampa Integrated Water Management Plan c. Provide education/support for the White River Integrated Water Management Plan	
GOAL 4	**Education Sub-committee will identify writers and topics; the liaison will submit these articles to regional news agencies**
GOAL 5	**BIP and CWP updates**
a. Using forums, surveys, newspaper, and radio ads, provide a way for the public to give feedback and committee to the BRT. b. Promote CWCB outreach efforts, such as surveys and forums, among others.	
GOAL 6	**Other identified water education opportunities as identified by the YWG BRT and partners**
a. Support and promote youth water education in the Yampa and White Basins (currently through Yampatika)	
GOAL 7	**Provide financial assistance to BRT members who wish to attend BIP/CWP-related conferences**
GOAL 8	**YWG PEPO chair will participate in CWCB education-related meetings**
GOAL 9	**The PEPO liaison will participate in CWCB education-related training**

Critical education/outreach issues

Topics that the PEPO Committee identified in the EAP as critical to its 2021 education and outreach planning included:

- Colorado River Basin issues*
- Compact compliance
- Powell/Mead structural deficit
- Colorado River drought contingency plans
- BIP (and State Plan) update
- Yampa IWMP and White River IWI (and projects/initiatives coming out of them)*

** Colorado River Basin issues are discussed in Section 3 (Basin Challenges), and the Yampa IWMP and White River IWI are discussed in Section 4 (Goals, Objectives, and Accomplishments).*

Additional critical efforts for ongoing education and outreach are likely to include, among other topics:

- BRT collaborative process
- Water supply gaps and State Water Plan
- Drought and how to adapt
- Watershed health

The PEPO Committee intends to expand its public outreach efforts and continue with the development of educational resources.

Outreach

Using local media outlets, including newspaper and radio and the YWG BRT's education/outreach contractor (currently CAA, or Community Agriculture Alliance), the PEPO Committee will try to inform 75 percent of full-time local basin residents about YWG BRT issues and its BIP goals. The number of tourists and second homeowners who hear about the YWG BRT is impossible to estimate. Historically there have been close to 500 people attending the forums put on and/or sponsored by CAA. Because of COVID-19, CAA will work with local partners to find ways that meet Colorado health requirements to reach stakeholders.

YWG BRT PEPO Structure

Basin partners working with the BRT to implement the EAP plan include:

City of Steamboat Springs
Colorado Mountain College
Colorado First Conservation District
Colorado Parks and Wildlife
Community Agriculture Alliance
Douglas Creek Conservation District
Friends of the Yampa
National Park Service at Dinosaur
Rio Blanco Water Conservancy District
Rio Blanco County CSU Extension
Routt County CSU Extension
Routt County Conservation
Water Center at Mesa University
Upper Yampa Water Conservancy District
Water Education Colorado
White River Conservation District
Yampatika

BRT members and other YWG stakeholders are encouraged to provide input and suggestions to the PEPO sub-committee. The sub-committee seeks to represent fully the agriculture, municipal, industrial, recreational, and environmental interests of the YWG Basin.

CAA received a three-year WSRF grant in 2020 to implement and facilitate education and outreach activities for the YWG BRT. CAA provides updates and get direction from the PEPO Committee at the bimonthly meetings. CAA has been the YWG BRT PEPO Liaison since 2016 and is the current Liaison at the time of this update.

Yampatika received a three-year WSRF grant in 2019 from the YWG BRT to develop and provide K-12 water education to all the school districts within the Yampa and White basins. Yampatika created curriculum in the spring of 2020 and will look at ways to implement that curriculum within the COVID-19 health requirements. CAA will follow up with Yampatika and provide status updates to the PEPO Committee at the bimonthly meetings.

PEPO Achievements

One of the central goals of the YWG BRT has been to increase awareness of water issues and water fluency in the YWG Basin, as well as increase the engagement of diverse interest groups in basin water planning and water discussions. Since 2016, CAA has been the PEPO Liaison for the YWG BRT with the aim of furthering these goals. CAA, on behalf of the YWG BRT, has achieved the following with the support of PEPO funds and a WSRF grant:

- YWG BRT meeting notices in regional newspapers
- YWG BRT website and Facebook page
- Developed YWG BRT logo

- Developed a series of six videos covering a variety of water topics: Yampa River Hydrograph; Municipal and Industrial Water Use; Storage: Our Place in the Water Cycle; Agriculture in the Basin; Recreation and Wildlife; and White River Basin[18].
- Partnered with Yampatika to develop a youth education program
- Developed and published 13 water education ads in regional newspapers for each summer of 2017, 2018, 2019, and 2020 covering topics ranging from YWG BRT process, BIP, YWG Basin facts and model finings, water users, IWMP, and the Colorado Compact
- Developed 16 radio ads that ran on regional radio stations
- Developed or supported 24 water education events within the YWG Basin with a total yearly average of 350 attendees

[18] https://yampawhitegreen.com/water_table_videos/

SECTION 8. CONCLUSIONS

The YWG BRT has developed this updated Basin Implementation Plan as part of the State's process to update the CWP. The original 2015 BIP provides a strong foundation for Basin-wide planning efforts. This Update identifies new and on-going challenges to YWG Basin water users and explores potential strategies for addressing these issues. Five areas have emerged as the key challenges for the YWG Basin:

- Climate change
- Colorado River Compact issues
- Recovery of the four endangered fish species
- Water-energy nexus
- Water quality concerns

These five challenges occur across a wide range of geographies and scales. Climate change is a global challenge with the potential for significant local impacts. Already the YWG Basin may be experiencing warmer and drier conditions due to a shift in climatic conditions. A warmer and drier future will place more demands on the YWG Basin's water resources to sustain its people, plants, and animals, and require increasingly adaptive strategies and long-term resiliency.

Colorado River Compact issues present challenges that link the seven YWG Basin states (Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming), the United States government, and Mexico. While the YWG BRT is not directly involved in interstate-level negotiations about operation of Lakes Powell and Mead consistent with the Compact and the Law of the River, the YWG BRT is a key stakeholder as the State of Colorado strives to represent the interests of Colorado water users. At the time of the BIP Update, there is still significant uncertainty about whether or how the State of Colorado will pursue a DM program. Nonetheless, the topic of DM is now at the forefront of water planning for the YWG Basin. It will be important for the YWG Basin to participate in and pay close attention to negotiations and discussions that will take place within Colorado and the Upper Basin states, and among the seven YWG Basin states, particularly with regard to DM and the renegotiation of the 2007 Interim Guidelines, which establish operations for Lakes Powell and Mead.

Recovery of the four endangered fish species is a challenge across all four Upper Basin states of the Colorado River Compact. While significant strides have been made to recover the species, more work is needed before they can be no longer be considered endangered or threatened. The Yampa River Management Plan and PBO currently provide a framework for planning in the Yampa Basin. Water users in the White Basin are also working with the Recovery Program to develop a Management Plan and PBO for the White River. Ongoing efforts by Recovery Program partners are working to extend the Recovery Program beyond 2023.

Energy and water are inextricably linked in the YWG Basin. Rapid changes and uncertainties within the energy industry have led to water resources challenges. In the Yampa Basin, the national trend away from coal-fired power plants has led to the closure of the Hayden and Craig Stations. The future of the water rights associated with the power plants is uncertain at this time. In the White Basin, uncertainty regarding fossil-fuel extraction is a major challenge for water resources planning.

The challenge of water quality is increasingly impacting water resources planning. In the past, the YWG Basin may have taken the naturally occurring water quality for granted. Recent water quality problems are forcing YWG Basin planners to consider ways to address the challenge of water quality. There are aspects of water quality that can be maintained or improved through local actions, such as point-source and non-point source controls on nutrient inputs to the stream, and preparation for wildfires. Others, such as warming air temperatures and an extended late-irrigation season, require an adaptive approach.

In the face of these emerging and on-going challenges, the YWB BRT continues to make progress on its eight Basin Goals. For this BIP Update, the YWG BRT determined the eight Basin Goals will continue to guide the YWG BRT's efforts while refining its objectives and documenting its achievements for each Goal. To achieve the eight Basin Goals, the BRT is working to address the YWG Basin's water needs through outreach, education, and collaboration throughout the YWG Basin, with a focus on developing and funding multi-benefit projects and initiatives.

A common theme of the challenges facing the basin is uncertainty. One tool to help water planners address uncertainty is water allocation modeling. Modeling helps show the relative impacts of different assumptions about future conditions and management strategies. The 2019 Technical Update quantifies water demands and gaps for five planning


Photo Source: Kent Vertrees, Friends of the Yampa


Photo Source: Kent Vertrees, Friends of the Yampa

scenarios. The five planning scenarios consider a range of climatic and hydrologic conditions in combination with a range of assumptions for agricultural, municipal, and industrial water demands. In this Update, the YWG BRT explored three alternative management scenarios to understand potential benefits and risks of different options. The alternative management scenarios provide useful information to water planners and should not be taken as an endorsement of any strategy or project. The key take-away points of the modeling results are:

- There currently are agricultural consumptive use shortages, especially in the tributaries, which will be aggravated in the future particularly in the face of climate change. Existing agricultural storage supplies can help alleviate only a small portion of the shortages; to do more, targeted and dedicated supplies, particularly on the tributaries, are needed.
- Currently, municipal and industrial demands are generally met. Larger municipal water providers are generally able to meet future demands in the five planning scenarios. Smaller domestic water providers have shortages in some planning scenarios. There is a high level of uncertainty regarding future industrial demands. In the Yampa Basin, industrial users without reservoir supplies have shortages in some planning scenarios. In the White Basin, a large increase in energy development demands causes very large shortages.
- Streamflow for non-consumptive needs is primarily impacted by climate change conditions.
- The alternative management scenarios provide insight into the benefits and risks of different management strategies.

For the BIP Update, the YWG BRT reached out to stakeholders to catalogue future and on-going water projects in the projects database. All of the projects advance the Basin Goals in some way. The YWG Basin has identified 90 projects or processes. Several of the 90 projects include multiple phases. Of the 90 projects, four have been completed, nine are not being pursued at this time, 23 are concepts, 29 are planned, and 25 are actively being implemented. New for this BIP Update was the process of "tiering" the projects. This categorization is primarily based on their level of readiness. The Basin has 27 Tier 1 projects. Of these, 23 projects provided an estimated cost, for a total of $40,513,422. There are 12 Tier 2 projects. Of these, 9 projects provided an estimated cost, for a total of $340,915,725. The total estimated cost for all projects is $664,942,151; however, additional work is needed to gather cost estimates for some projects, as is working with some project proponents to refine cost estimates for projects that are early in the planning effort. The updated project database will help inform the Colorado Water Plan.

Photo Source: Kent Vertrees, Friends of the Yampa

APPENDIX A

Analysis for Basin Implementation Plans

Technical Memorandum

Prepared for:

Colorado Water Conservation Board

Project Title:

Yampa and White Basins
Current and 2050 Planning Scenario
Water Supply and Gap Revised Results

Date: June 14, 2021

Prepared by: Wilson Water Group
Reviewed by: Brown & Caldwell

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Section 1: Introduction

This technical memorandum summarizes changes to modeling inputs and results from the 2019 Technical Update that were conducted during the Basin Implementation Plan update process. The original model approach and results as well as other water supply related analyses were documented in Volume 2 of the Technical Update in a memo entitled "Current and 2050 Planning Scenario Water Supply and Gap Results".

The approach and results were presented to stakeholders throughout the State and to the Basin Roundtables and feedback was obtained regarding areas where the approaches to developing the agricultural, municipal, and industrial demands or the modeling could be improved or refined. This technical document summarizes these revisions and the impact to the overall water supply and gap results that affect the Yampa and White Basins.

The following should be noted regarding this effort:

- The revisions were based on stakeholder input and may not include every aspect of the Technical Update. For example, one basin may only have revised M&I demands whereas another basin may only have revisions to modeling operations.
- Revisions to West Slope basins also impact the transbasin import supply gap estimated for basins that receive imports; revised import supply gaps are also included in the sections below if applicable.
- This document provides only a summary of the revisions; review specific spreadsheets and modeling datasets available on the Colorado Water Plan website for further information on revisions.
- The revised information herein supersedes any previously developed information. Documentation and reports relying on the information from September 2019 will reflect a note to this effect, but the documentation will not be updated.
- The revised information will be used in the Basin Implementation Plan Volume 1 and 2 reports and the Update to the Colorado Water Plan.

1.1 DELIVERABLES

The revised model results are provided both within this document and in separate Excel spreadsheets for each basin. The General Contractor Team for the Technical Update has developed several spreadsheets of more localized results at the Water District level for basins that have requested this detail. These spreadsheets have also been updated and provided to the Local Experts in each of those basins. Additionally, revised streamflow results were loaded into the Flow Tool and made available to the Local Experts. Lastly, the model input and output files were delivered to the General Contractor and made available to the public via the Colorado Water Plan website. These spreadsheets, modeling datasets, the revised Flow Tool, and this documentation serve as the deliverables for this effort.

1.2 DISCLAIMER

The technical data and information generated are intended to help inform decision making and planning regarding water resources at a Statewide or Basin-wide planning level. The information made available is not intended to replace projections or analyses prepared by local entities for specific project or planning purposes. The information or datasets provided are from a snapshot in time and cannot reflect actual or exact conditions in any given basin or the State at any given time. While this Technical Update strives to reflect the Colorado Water Conservation Board's (CWCB) best estimates of future water supply and demands under various scenarios, the reliability of these estimates is affected by the availability and reliability of data and the current capabilities of data evaluation. Moreover, the Technical Update cannot incorporate the varied and complex legal and policy considerations that may be relevant and applicable to any particular basin or project; therefore, nothing in the Technical Update or the associated Flow Tool or Costing Tool is intended for use in any administrative, judicial or other proceeding to evince or otherwise reflect the State of Colorado's or the CWCB's legal interpretations of state or federal law.

Furthermore, nothing in the Technical Update or any subsequent reports generated from these datasets is intended to, nor should be construed so as to, interpret, diminish, or modify the rights, authorities, or obligations of the State of Colorado or the CWCB under state law, federal law, administrative rule, regulation, guideline or other administrative provision.

Section 2: Yampa and White Basins Revised Results

The following sections reflect the revisions implemented in the Yampa and White Basins and the resulting agricultural and M&I demands, water supply, and gaps modeled results. As discussed above, refer to the original 2019 Technical Update documentation for more information on the demands and gaps in each basin.

2.1 YAMPA AND WHITE BASIN M&I REVISIONS

At the request of the Yampa-White Basin Roundtable, in January 2021, ELEMENT updated the industrial baseline and projected water demands that were initially prepared for the Colorado Water Plan Technical Update analyses completed in 2019 (Technical Update). The updated analysis incorporates new information related to Thermoelectric and Large Industry demands provided by the Roundtable in December 2020. The explicitly modeled demands for Craig, Hayden, and ColoWyo facilities were also updated. No changes were made to Energy Development nor Snowmaking demands. The updates affected the following baseline and projected demands:

- Thermoelectric demands in Moffat and Routt Counties, and
- Large Industry demands in Moffat, Rio Blanco, and Routt Counties.

The following sections provide additional detail regarding the analysis and the results, which should supersede the initial results provided with the Technical Update.

2.1.1 CALIFORNIA CO PUMP STATION

An additional industrial diversion location has been added to the White Basin to meet the Chevron Oil industrial demand near Rangley and the refinement of future sand, gravel, and golf course demands. In the 2019 Technical Update, the Chevron Oil demand received water supplies via the California Co Pipeline. The California Co Pump Station has been used more frequently in recent years and was added to the White River water allocation model as an additional point of diversion to meet the industrial demand.

2.1.2 THERMOELECTRIC

The Roundtable provided direction to assume that the Craig (Moffat County) and Hayden (Routt County) thermoelectric facilities would be decommissioned in the future and the Baseline (2015) demands for these facilities would become an additional future Large Industry demand associated with a yet-to-be-determined industrial use; this is described further in the following section. To reflect the Roundtable's direction, Baseline (2015) demands for the Craig and Hayden facilities were unchanged from what was presented in the Technical Update analyses completed in 2019. Future (2050) demands for these facilities were set to zero for all planning scenarios. A summary of the Thermoelectric demand data from the 2019 analysis and the updated analysis is presented in Table 1, in units of acre-feet per year (AFY).

Table 1: Thermoelectric Baseline and Future Demand Comparison for Moffat & Routt Counties (AFY)

County	Analysis	Baseline (2015)	Business as Usual	Weak Economy	Cooperative Growth	Adaptive Innovation	Hot Growth
Moffat	2019 Analysis	14,010	26,900	25,560	24,210	25,560	29,590
	Jan 2021 Update	14,010	0	0	0	0	0
	Difference	0	(26,900)	(25,560)	(24,210)	(25,560)	(29,590)
Routt	2019 Analysis	5,340	5,340	5,070	4,810	5,070	5,870
	Jan 2021 Update	5,340	0	0	0	0	0
	Difference	0	(5,340)	(5,070)	(4,810)	(5,070)	(5,870)
Total	2019 Analysis	19,350	32,240	30,630	29,020	30,630	35,460
	Jan 2021 Update	19,350	0	0	0	0	0
	Difference	0	(32,240)	(30,630)	(29,020)	(30,630)	(35,460)

2.1.3 LARGE INDUSTRY

The 2019 analysis included Large Industry demands related to mining and golf courses in Moffat and Routt Counties based on information from SWSI 2010. The Roundtable provided a summary of the number of golf courses and sand and gravel mining operators in Moffat, Rio Blanco, and Routt Counties along with the planning demand values recommended for each use category. Per the Roundtable, demands for coal mining were also adjusted to reflect the future closure of the ColoWyo mine located in Moffat county; with that update, the only remaining future (2050) demand for coal mining under the Large Industry category is associated with the Twentymile mine. Lastly, it was assumed that the Baseline demand for the Craig and Hayden Thermoelectric facilities would become an additional future Large Industry demand associated with a yet-to-be-determined industrial use in the same county; these demands continued to be represented at the Hayden and Craig explicit locations per direction from the Roundtable. Moffat and Routt county demand projections increased due to adding demands that were previously in the Thermoelectric category but also decreased due to the mining, golf, and ColoWyo changes described above. A summary of Large Industry demand data from the 2019 analysis and the updated analysis is presented in Table .

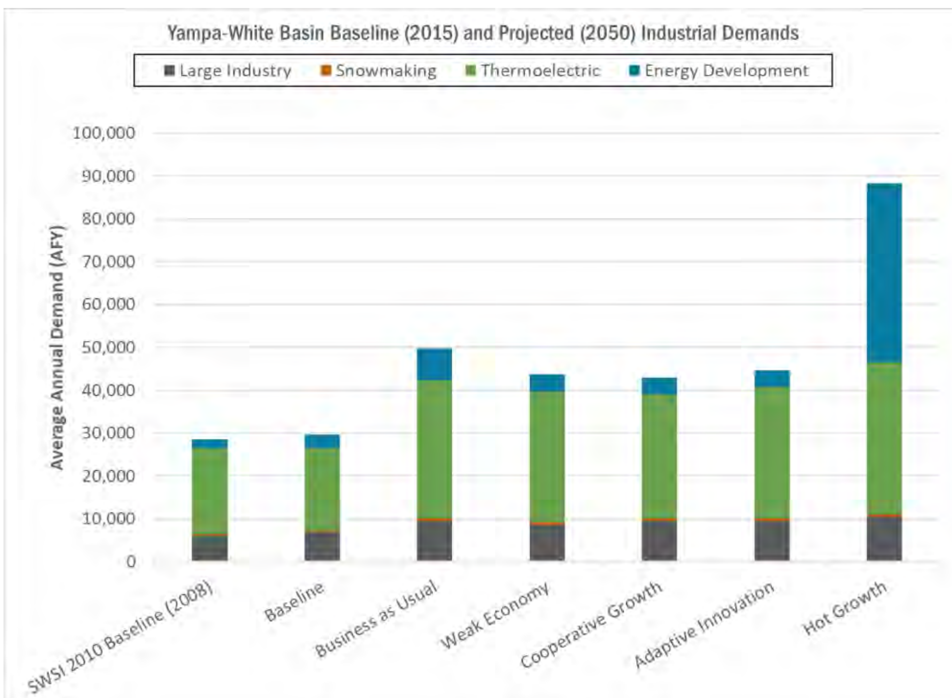
Table 2. Large Industry Baseline and Future Demand Comparison for Moffat, Rio Blanco, and Routt Counties (AFY).

County	Analysis	Baseline (2015)	Business as Usual	Weak Economy	Cooperative Growth	Adaptive Innovation	Hot Growth
Moffat	2019 Analysis	2,900	3,900	3,510	3,900	3,900	4,290
	Jan 2021 Update	910	14,370	12,930	14,370	14,370	15,810
	Difference	(1,990)	10,470	9,420	10,470	10,470	11,520
Rio Blanco	2019 Analysis	0	0	0	0	0	0
	Jan 2021 Update	750	750	680	750	750	830

County	Analysis	Baseline (2015)	Business as Usual	Weak Economy	Cooperative Growth	Adaptive Innovation	Hot Growth
	Difference	750	750	680	750	750	830
Routt	2019 Analysis	4,000	5,600	5,040	5,600	5,600	6,160
	Jan 2021 Update	1,360	6,700	6,030	6,700	6,700	7,370
	Difference	(2,640)	1,100	990	1,100	1,100	1,210
Total	2019 Analysis	6,900	9,500	8,550	9,500	9,500	10,450
	Jan 2021 Update	3,020	21,820	19,640	21,820	21,820	24,010
	Difference	(3,880)	12,320	11,090	12,320	12,320	13,560

2.1.4 TOTAL INDUSTRIAL DEMANDS

Below is a comparison of Figure 4.10.12 from the Colorado Water Plan Technical Update Volume 1, Section 4.10: Yampa White Green Results of the Colorado Water Plan Technical Update final documentation. The comparison shows the changes in industrial water demands by projection scenario based on the January 2021 updates. For each scenario, the basin-scale industrial demands have decreased substantially due to the elimination of future increases in Thermoelectric demands, as the 2019 analysis showed Thermoelectric demands being 1.7 to 2.1 times the baseline in Moffat County. Mining and golf course demands were also reduced as compared to the 2019 analysis.



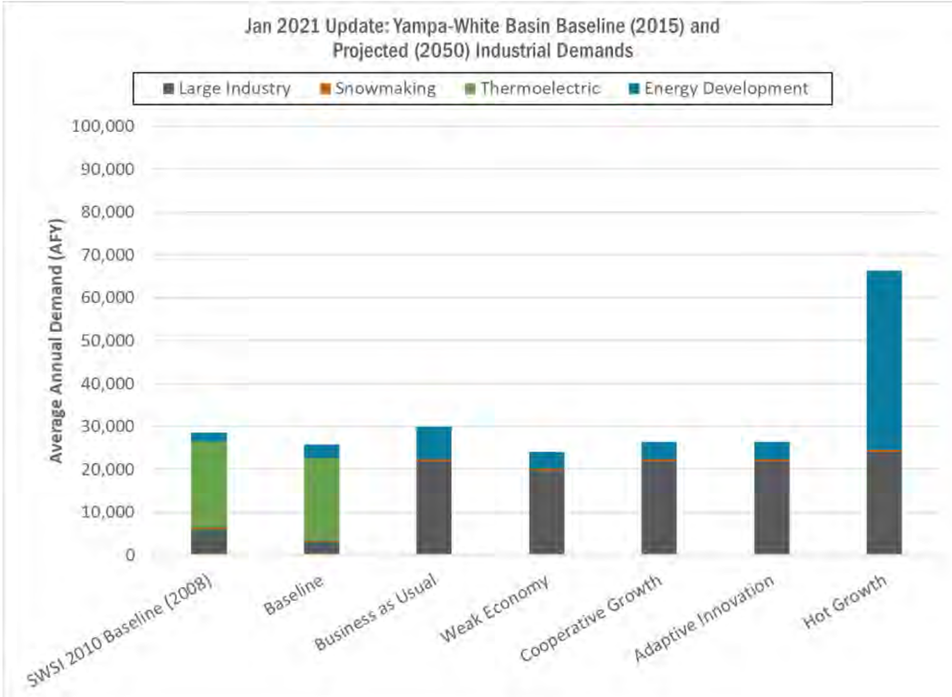


Figure 1: 2019 Analysis vs. 2021 Update: Total Yampa-White Basin SSI Baseline and Projected Demand

2.2 YAMPA AND WHITE BASIN OPERATION REVISIONS

The following revisions were implemented in the Yampa and White River water allocation model to better represent current and future reservoir operations in the basin.

2.2.1 LONG LAKE RESERVOIR

The reservoir, located on Fish Creek, was added to the model to better reflect municipal supplies and operations in the basin. The reservoir is owned by the City of Steamboat Springs and serves as a supply to meet current and future municipal growth.

2.2.2 STAGECOACH RESERVOIR

Operations and users in the reservoir were revised to be consistent with the 2021 Stagecoach Reservoir Fill and Release Policies document; remove releases to Tri-State industrial demands as they are no longer leasing supplies; and charge evaporation against only the Emergency Remainder Pool. Reservoir contents generally remain higher due to these revisions, as reflected in the following graphic of the simulated reservoir contents under Current conditions.

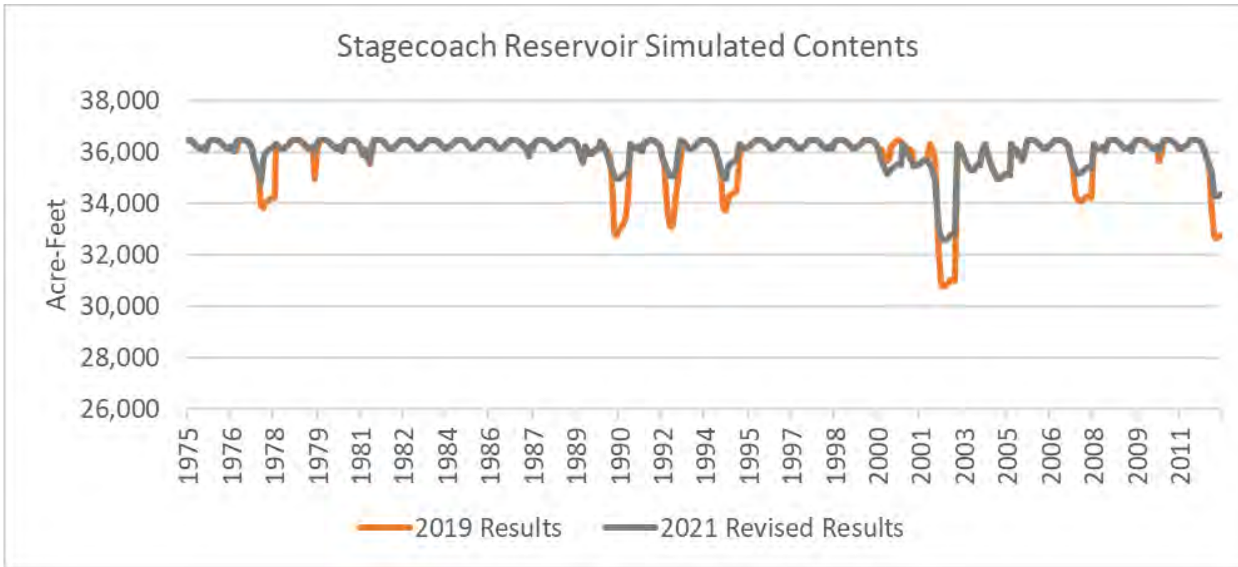


Figure 2: Stagecoach Reservoir Simulated Contents - Current Conditions

2.2.3 RECOVERY PROGRAM CRITICAL REACH

The Recovery Program currently manages available supplies to try to meet endangered fish flow targets in the Yampa River at the Maybell gage from July through October, with operations that vary across hydrological year type, as described in the "Procedures for Releasing and Administering Water from Elkhead Reservoir to Augment Yampa River Flows for Endangered Fish" (October 3, 2017). These fish flow targets are reflected in the model and were revised to align with the current demands during wet, average, and dry year types. Figure 3 reflects the change in the demand and Figure 4 reflects the annual change in Elkhead Reservoir storage supplies in response to this revised demand.

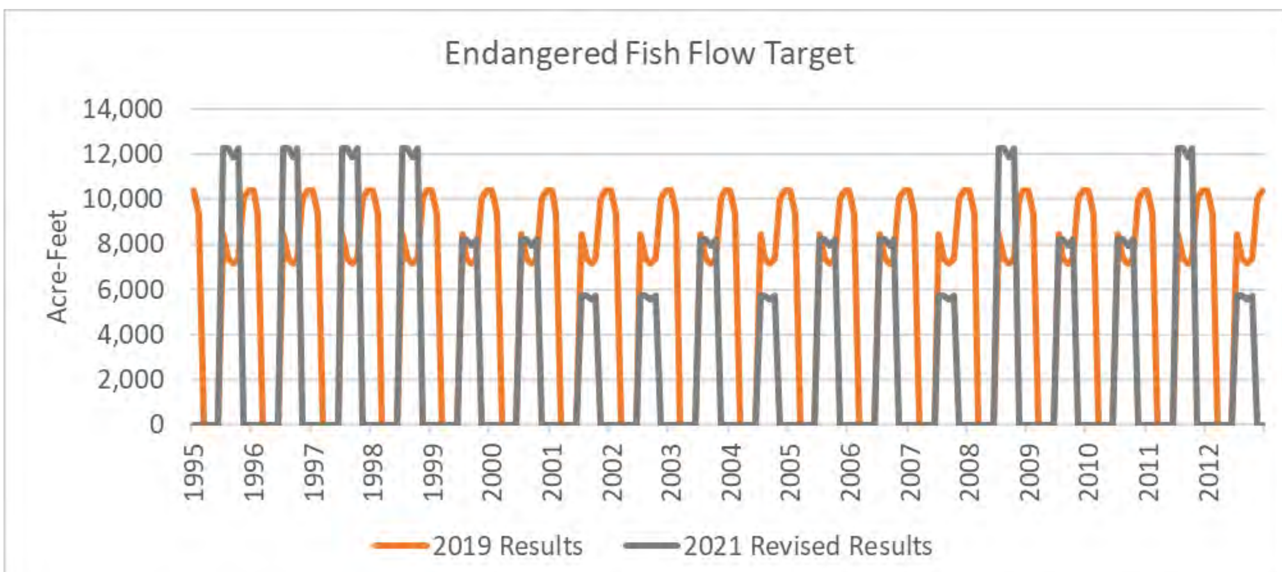


Figure 3: Endangered Fish Flow Target at the Maybell Gage

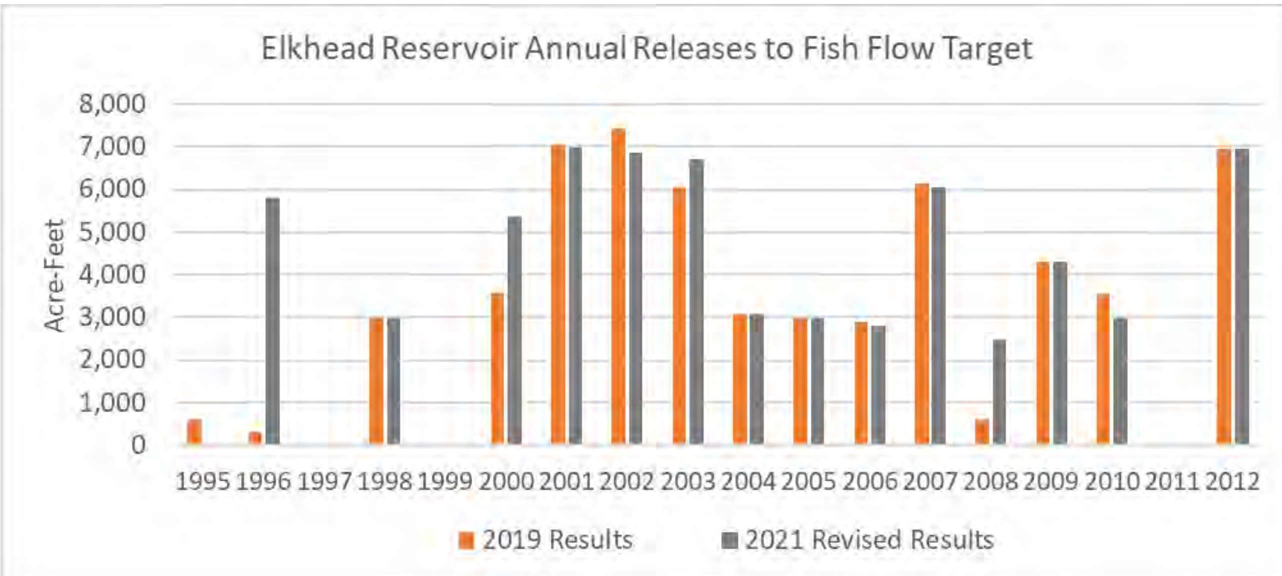


Figure 4: Elkhead Reservoir Annual Releases to Endangered Fish Flow Target

2.2.4 MODELED CONSUMPTIVE USE

The water allocation models used to develop the Technical Update results rely on one of two methods to estimate the crop consumptive use demand: a time series of irrigation water requirements or an average monthly or annually efficiency. The 2019 Technical Update Yampa water allocation models for the Baseline, Business as Usual, and the Weak Economy scenarios were relying on the time series of irrigation water requirement, however an error in the input files resulted in the models for the Cooperative Growth, Adaptive Innovation, and the Hot Growth scenarios to rely on a fixed monthly efficiency. This error was identified and corrected in this effort, however the correction led to a substantial reduction in the crop consumptive use (CU) gap in the basin, which in turn led to a similar reduction in the agricultural gap for these three scenarios. This agricultural gap reduction was primarily associated with the planned agricultural projects (i.e. Oxbows) as their fixed monthly efficiency resulted in crop consumptive use that was much greater than the estimates in irrigation water requirement time series. This revision affected nearly every agricultural structure in these three scenarios, however to a much smaller degree than the planned agricultural projects. Note that the agricultural demand, estimated based on the irrigation water requirement divided by the system efficiency of each ditch, was developed using the correct methodology and, therefore, remained unchanged for this effort.

2.3 WHITE BASIN REVISED WATER SUPPLY AND GAP RESULTS

The following tables reflect the revised demand, water supply, and gap results based on the revised M&I demand in the basin. The revisions did not impact the agricultural demand but did result in a slight increase to the agricultural gap because the revisions impact on water availability in the basin. The revisions led to an increase of approximately 1,900 acre-feet of annual M&I demand, although it varies across the Planning Scenarios. There was generally water available to meet the increased M&I demands and the M&I gap remained relatively similar to the 2019 Technical Update results.

Table 3: White Basin Agricultural Water Supply and Gap Summary

	Agricultural Results	Baseline	Business as Usual	Weak Economy	Coop. Growth	Adaptive Innovation	Hot Growth
Average	Average Annual Demand (ac-ft)	246,744	242,917	246,744	293,889	177,755	319,741
Average	Average Annual Demand Increase from Baseline (ac-ft)	-	-	-	47,146	-	72,998
Average	Average Annual Gap (ac-ft)	1,229	1,234	1,234	3,184	3,395	5,858
Average	Average Annual Gap Increase from Baseline (ac-ft)	-	6	6	1,956	2,166	4,629
Average	Average Annual Percent Gap	0%	1%	1%	1%	2%	2%
Average	Average Annual CU Gap (ac-ft)	664	667	667	1,726	2,179	3,178
Critically Dry Maximum	Demand In Maximum Gap Year (ac-ft)	242,254	238,492	242,254	281,374	174,299	307,552
Critically Dry Maximum	Increase from Baseline Demand (ac-ft)	-	-	-	39,120	-	65,298
Critically Dry Maximum	Gap In Maximum Gap Year (ac-ft)	6,049	6,070	6,070	9,553	8,575	12,291
Critically Dry Maximum	Increase from Baseline Gap (ac-ft)	-	20	20	3,504	2,526	6,242
Critically Dry Maximum	Percent Gap In Maximum Gap Year	2%	3%	3%	3%	5%	4%

Table 4: White Basin M&I Water Supply and Gap Summary

	M&I Results	Baseline	Business as Usual	Weak Economy	Coop. Growth	Adaptive Innovation	Hot Growth
Average	Average Annual Demand (ac-ft)	7,153	11,783	7,842	8,728	9,450	42,800
Average	Average Annual Demand Increase from Baseline (ac-ft)	-	4,630	689	1,575	2,297	35,647
Average	Average Annual Gap (ac-ft)	0	2,927	573	606	682	27,436
Average	Average Annual Gap Increase from Baseline (ac-ft)	-	2,927	573	606	681	27,436
Average	Average Annual Percent Gap	0%	25%	7%	7%	7%	64%
Critically Dry Maximum	Demand In Maximum Gap Year (ac-ft)	7,153	11,783	7,842	8,728	9,450	42,800
Critically Dry Maximum	Increase from Baseline Demand (ac-ft)	-	4,630	689	1,575	2,297	35,647
Critically Dry Maximum	Gap In Maximum Gap Year (ac-ft)	0	3,775	739	799	1,181	33,378
Critically Dry Maximum	Increase from Baseline Gap (ac-ft)	-	3,775	739	799	1,181	33,378
Critically Dry Maximum	Percent Gap In Maximum Gap Year	0%	32%	9%	9%	13%	78%

Table 5: White Basin Water Supply and Gap Summary

	Agricultural and M&I Results	Baseline	Business as Usual	Weak Economy	Coop. Growth	Adaptive Innovation	Hot Growth
Average	Average Annual Demand (ac-ft)	253,897	254,700	254,586	302,617	187,205	362,541
	Average Annual Gap (ac-ft)	1,229	4,161	1,807	3,790	4,076	33,294
	Average Annual Percent Gap	0%	2%	1%	1%	2%	9%
Critically Dry Max	Demand In Maximum Gap Year (ac-ft)	249,407	250,275	250,096	290,102	183,749	350,352
	Gap In Maximum Gap Year (ac-ft)	6,050	9,845	6,809	10,352	9,757	45,669
	Percent Gap In Maximum Gap Year	2%	4%	3%	4%	5%	13%

2.4 YAMPA BASIN REVISED WATER SUPPLY AND GAP RESULTS

The following tables reflect the revised demand, water supply, and gap results based on the revised demands and operations. The revisions led to a reduction of approximately 20,000 acre-feet annually of M&I demand in the basin in each of the Planning Scenarios. This reduction in demand then led to a reduction in the M&I gap with revised maximum gaps ranging from 200 to 3,100 acre-feet in critically dry years. The revisions to the agricultural crop consumptive use information did not impact the agricultural demand, however the CU gap and the agricultural gap were substantially reduced in the Cooperative Growth, Adaptive Innovation, and the Hot Growth scenarios. Average CU gap was reduced between 5,200 to 39,400 acre-feet (15 to nearly 50 percent) across the three scenarios, which led to a reduction in the average agricultural gap of 8,400 to 72,800 acre-feet. Similar magnitudes of reductions occurred to the CU gap and agricultural gap during critically dry years.

Table 6: Yampa Basin Agricultural Water Supply and Gap Summary

	Agricultural Results	Baseline	Business as Usual	Weak Economy	Coop. Growth	Adaptive Innovation	Hot Growth
Average	Average Annual Demand (ac-ft)	402,488	403,627	403,627	522,453	460,985	684,260
	Average Annual Demand Increase from Baseline (ac-ft)	-	1,139	1,139	119,965	58,497	281,772
	Average Annual Gap (ac-ft)	13,635	13,897	13,881	36,541	50,543	77,207
	Average Annual Gap Increase from Baseline (ac-ft)	-	262	246	22,906	36,908	63,572
	Average Annual Percent Gap	3%	3%	3%	7%	11%	11%
	Average Annual CU Gap (ac-ft)	7,599	7,743	7,733	20,058	32,581	42,075
Critically Dry	Demand In Maximum Gap Year (ac-ft)	448,870	450,513	450,513	532,972	452,639	667,456
	Increase from Baseline Demand (ac-ft)	-	1,643	1,643	84,102	3,769	218,586

	Agricultural Results	Baseline	Business as Usual	Weak Economy	Coop. Growth	Adaptive Innovation	Hot Growth
	Gap In Maximum Gap Year (ac-ft)	64,885	63,934	63,672	95,837	104,140	154,343
	Increase from Baseline Gap (ac-ft)	-	-	-	30,952	39,255	89,458
	Percent Gap In Maximum Gap Year	14%	14%	14%	18%	23%	23%

Table 7: Yampa Basin M&I Water Supply and Gap Summary

	M&I Results	Baseline	Business as Usual	Weak Economy	Coop. Growth	Adaptive Innovation	Hot Growth
Average	Average Annual Demand (ac-ft)	32,826	33,503	27,173	32,286	34,727	46,496
	Average Annual Demand Increase from Baseline (ac-ft)	-	677	-	-	1,901	13,670
	Average Annual Gap (ac-ft)	50	96	20	151	765	2,006
	Average Annual Gap Increase from Baseline (ac-ft)	-	46	-	101	715	1,956
	Average Annual Percent Gap	0%	0%	0%	0%	2%	4%
Critically Dry Maximum	Demand In Maximum Gap Year (ac-ft)	32,826	33,503	27,173	32,286	34,727	46,496
	Increase from Baseline Demand (ac-ft)	-	677	-	-	1,901	13,670
	Gap In Maximum Gap Year (ac-ft)	310	474	210	416	1,151	3,134
	Increase from Baseline Gap (ac-ft)	-	164	-	106	841	2,824
	Percent Gap In Maximum Gap Year	1%	1%	1%	1%	3%	7%

Table 8: Yampa Basin Water Supply and Gap Summary

	Agricultural and M&I Results	Baseline	Business as Usual	Weak Economy	Coop. Growth	Adaptive Innovation	Hot Growth
Average	Average Annual Demand (ac-ft)	435,314	437,130	430,800	554,739	495,712	730,756
	Average Annual Gap (ac-ft)	13,685	13,993	13,901	36,692	51,307	79,213
	Average Annual Percent Gap	3%	3%	3%	7%	10%	11%
Critically Dry Max	Demand In Maximum Gap Year (ac-ft)	481,696	484,016	477,686	565,258	487,366	713,952
	Gap In Maximum Gap Year (ac-ft)	65,195	64,408	63,882	96,253	105,290	157,477
	Percent Gap In Maximum Gap Year	14%	13%	13%	17%	22%	22%

APPENDIX B

Elkhead Reservoir

Baseline, Alternative #2 and #3 assumptions

Project Description: Elkhead Reservoir holds storage water for the City of Craig, Tri-State Generation and Transmission Association for use at Craig Station, the Colorado River Water Conservation District (River District), and for the Recovery Program, held by the Colorado Water Conservation Board and an option to lease from the River District. Currently, the City of Craig, Tri-State, and the River District infrequently use water from storage. Under Alternative #2, new releases from Elkhead Reservoir will be investigated. Under Alternative #3, Elkhead Reservoir will be enlarged.

Table 1: Storage Contents and Surface Area

Storage Contents (ACFT)	Surface Area (Acre)
0	0
626	81
1,287	147
1,947	180
2,724	207
3,598	228
4,531	246
5,564	272
6,120	289
6,709	308
7,360	341
8,057	357
8,783	373
9,537	385
11,954	435
18,186	602
21,982	670
24,778	724
26,241	754
30,987	833

Model Structure Information: Elkhead Reservoir is represented by the State's identifier 4403902 in the model. It is an on-channel reservoir located on Elkhead Creek. The current reservoir capacity is 25,656 acre-feet. The active capacity is 24,778 acre-feet. The reservoir is modeled with the accounts listed in Table 2.

Table 2: Elkhead Reservoir Accounts

Account	Storage Amount (ACFT)
Dead Storage	878

Tri-State 1	8,408
City of Craig	4,413
CWCB	5,000
Fish-Lease	2,000
Tri-State 2	2,500
River District	2,457
Total	**25,656**

The Dead Storage account is not available for release. The Tri-State 1 and City of Craig account represent the original reservoir pools. The reservoir was enlarged in 2005 - 2006, creating four additional accounts. The CWCB account represents the 5,000 acre-feet of storage available on an annual basis to the Recovery Program to supplement streamflow in the Lower Yampa Critical Habitat Reach. The Fish-Lease account represents the 2,000 acre-feet of storage available for leasing to the Recovery Program from the River District from the enlargement. Tri-State 2 account represents the purchase of 2,500 acre-feet of storage in the enlargement. CRWCD account represents the remainder of the River District enlargement account.

Structures Water Rights: The Dead Storage, Tri-State 1, and City of Craig pools are filled with the original absolute rights (5,389 acre-feet with a 1966 priority and 8,310 acre-feet with a 1972 priority). The enlargement accounts (CWCB, Fish-Lease, Tri-State 2, and River District) accounts are filled with a 2002 water right priority. The CWCB account can be partially refilled with a 1,000 acre-foot water right with a 2002 priority. Conditional and alternative point water rights are not represented.

Table 3: Elkhead Water Rights

Admin Number	Priority Date	Volume (ACFT)	1st or 2nd fill
42642.00000	10/1/1966	5,389	1
44925.44731	6/20/1972	8,310	1
55806.00000	2002/10/16	11,957	1
55806.00001	2002/10/16	1000	2

Current Operations: The current operations of Elkhead Reservoir are driven by releases to the reservoir owners.

- If City of Craig's direct flow rights are insufficient to meet demand, release water from the City of Craig account.
- If Tri-State's direct flow rights are insufficient to meet demand, release water from the Tri-State 2 account, then from the Tri-State 1 account.
- If flows in the Lower Yampa Critical Habitat Reach, as measured at the USGS streamflow gage Yampa River near Maybell, drop below the streamflow target, release water from the CWCB account, then from the Fish-Lease account. Releases are limited to 50 cfs.

- Note that the Lower Yampa Critical Habitat Reach streamflow targets are for the months of July through October. The flow rates depend on the year type as shown in Table 4, with wet years being the wettest 25%, dry years being the driest 25%, and average being all others.

Table 4: Lower Yampa Critical Habitat Reach Flow Targets

Year Type	Streamflow (cfs) from July - October
Dry	93
Average	134
Wet	200

Alternative #2 and #3 Operations: Elkhead Reservoir will continue to release to current owners as described above. The following releases will occur in the *New Releases from Existing Reservoir Alternative* and the *New/Enlarged Reservoir Alternative*, as part of the BIP Update.

- *New Releases from Elkhead:* Increase release limit to Lower Yampa Critical Habitat Reach to 75 cfs
  - Release to the Lower Yampa Critical Habitat Reach from pools in the following order:
    - CWCB
    - Fish-Lease
    - Tri-State 2
    - Tri-State 1
  - Release to agricultural users with shortages on the mainstem of the Yampa downstream of the confluence with Elkhead Creek from the River District account.
- *Enlarged Elkhead*: Expand the current capacity by 4,300 acre-feet. The new storage will be available to the current users of Elkhead Reservoir, future municipal & industrial demands, and agricultural users.
  - The future enlargement is filled with the portion of the 2002 storage right that is conditional.

Lake Avery Reservoir

Baseline, Alternative #3 assumptions

Project Description: Yellow Jacket Water Conservancy District (YJWCD) is proposing enlarging Lake Avery. The pool created by enlarging the reservoir would be available to meet downstream demands. The reservoir would be expanded by raising the crest of the spillway. Lake Avery is currently owned and operated by Colorado Parks and Wildlife as a State Wildlife Area. The primary purposes of wildlife and recreation would be maintained, with only the enlargement pool available to meet future demands.

Table 1: Storage Contents and Surface Area

Storage Contents (ACFT)	Surface Area (Acre)
511	46
1,021	73
1,532	95
2,042	115
2,553	133
3,063	150
3,574	166
4,084	181
4,595	196
5,105	210
5,616	223
6,126	236
6,637	249
7,147	262
7,658	274

Model Structure Information: The state has assigned WDID (4303633) to Lake Avery. The reservoir has one account for 7,658 acre-feet, the current capacity of the reservoir.

Structure Water Right: Lake Avery currently has a water right for 7,658 acre-feet with a 1962 priority date and several smaller, more senior water rights that are used to replace evaporation.

Current Operations: CPW has an operational practice to bypass 2 cfs when filling the reservoir.

Alternative #3 Operations: Lake Avery reservoir will be enlarged by 2,644 acre feet. This corresponds to raising the spillway by 10 feet and is the maximum amount the reservoir could be expanded without inundating the upstream Livingston Ranch.

- Add an “Enlargement” account to represent the enlarged storage pool (2,644 acre-feet).
- Fill the “Enlargement” account with the YJWCD’s Sawmill Mountain conditional right. This water right was originally decreed upstream of Lake Avery on Big Beaver Creek. The storage right is for 10,000 acre-feet with an adjudication date of December 31, 1975.

- The enlargement pool releases to help maintain flow in the White River for environmental purposes, specifically to help meet the CWCB instream flow right as measured at the White River above Coal Creek (09304200) The enlargement pool is available to augment future municipal and industrial demands in YJWCD boundaries.

Stagecoach Reservoir

Baseline, Alternative #2 and #3 assumptions

Project Description: Stagecoach Reservoir is operated by Upper Yampa Water Conservancy District for water supply and recreation. Under Alternatives #2 and #3, new releases from Stagecoach Reservoir will be investigated.

Table 1: Storage Contents and Surface Area

Storage Contents (ACFT)	Surface Area (Acre)
16,882	498
20,395	575
21,325	590
22,255	605
23,185	621
24,115	636
25,045	652
25,975	667
27,055	676
28,142	689
29,230	706
30,317	724
31,405	742
32,492	759
33,604	776
34,776	790
35,974	804
37,193	818

Model Structure Information: Stagecoach Reservoir is represented by the State's identifier 5804213 in the model. It is an on-channel reservoir located on the Yampa River. The reservoir capacity is 36,439 acre-feet and it is modeled with the six accounts listed in Table 2.

Table 2: Stagecoach Reservoir Accounts

Account	Storage Amount (ACFT)
Municipal/Industrial Pool	9,000
Augmentation Pool	2,000
General Supply Pool	4,000
Raise Pool	3,164
Preferred Remainder	3,275
Emergency Remainder	15,000

Total	36,439

Structure Water Rights: The reservoir will be filled using its current water rights portfolio, listed in Table 3. Alternative points and conditional rights are not included. The pools in the reservoir are filled in the following order: Municipal/Industrial Pool, Augmentation Pool, General Supply Pool, Raise Pool, Preferred Remainder, and Emergency Remainder Pool.

Table 3: Stagecoach Water Rights

Admin Number	Priority Date	Volume (ACFT)	1st or 2nd fill
14175.00000	10/22/1888	49	1
14563.00000	11/14/1889	297	1
20450.19968	12/28/1905	9	1
33782.24988	6/29/1942	85	1
33782.25353	6/29/1942	116	1
40815.00000	9/30/1961	11614	1
41727.39991	3/30/1964	20854	1
53691.53386	12/31/1996	6670	2

Current Operations: The current operations of Stagecoach Reservoir represent typical operations as of January 2021:

- Meet FERC minimum flow requirement downstream of the reservoir by bypassing up to 40 cfs of inflow, if possible. For the months of August, September, October, and November, bypassing inflow or releasing from the Preferred Remainder and then the Emergency Remainder pools up to 20 cfs.
- Release to existing contract holders from the General Supply Pool or the Municipal/Industrial Pool, depending on the contract type, as shown in Table 4.

Table 4: Stagecoach Releases

Destination WDID	Destination Name	Account Name
57_AMY001	Town of Hayden	M&I
5800897	Suttle Ditch	General Supply
5800561	Brumback Ditch	General Supply
5800756	Lyon 2 Ditch	General Supply
58_StmbMW	Mt. Werner via 5805066	M&I
58_StmbMW	Mt. Werner via 5805059_D	M&I
58_StmbMW	Steamboat via 5805055	M&I

5802374	Steamboat Resort Snowmaking	M&I
5800628	Excelsior Ditch	General Supply
58_ADY005	Agriculture Aggregate	General Supply
58_AMY001	Unincorporated Aggregate (Morrison Ck. Metro W&S, Tree Haus Metro District, Dakota Ridge HOA, Priest Creek Ranch, Alpine Mt. Ranch Metro District, Agate Cr. HOA, Sidney Peak Ranch)	M&I

Alternative #2 and #3 Operations: Stagecoach Reservoir will continue to release to current contract holders up to their annual contract amount. The following releases will occur in the *New Releases from Existing Reservoir Alternative* and the *New/Enlarged Reservoir Alternative*, as part of the BIP Update.

- *Stagecoach release to future demands* - The reservoir releases to the new future demands located in the Upper Yampa Water Conservancy District boundaries. These releases are from the Municipal and Industrial Pool 1st and the Augmentation Pool 2nd. Current contract holders have 1st priority to the water.
    - Future municipal/domestic demands and future industrial demands in Water District 57
        - 57_AMY001
        - 57_ASI_EL
    - Future municipal/domestic demands, future industrial demands and future snowmaking in Water District 58
        - 58_AMY001
        - 58_ASI_EL
        - 58_ASI_SM
- *Stagecoach release to the Lower Yampa Critical Habitat Reach* - The reservoir supplements the flow target by releasing from the General Supply Pool. Current contract holders have 1st priority to the water. This operations works in tandem with releases from Elkhead Reservoir.

Steamboat Lake

Baseline, Alternative #2 and #3 assumptions

Project Description: Steamboat Lake primarily is used for recreation and fisheries by Colorado Parks and Wildlife. The reservoir supplies water to the State Park campground and visitor center. The intakes are located relatively high in the reservoir, limiting the ability to draw down the reservoir elevation. It also serves as extreme drought supplemental storage for Hayden Station, but water has rarely been released for this purpose. Recently, the City of Steamboat leased 1,200 acre-feet from Xcel Energy. This will be used in combination with the future Elk River diversion point and water treatment plant. For the BIP Update, this operation will be considered under Alternative #2 and #3.

Table 1: Storage Contents and Surface Area

Storage Contents (ACFT)	Surface Area (Acre)
1,538	126
3,075	215
4,613	296
6,150	370
7,688	440
9,226	508
10,763	572
12,301	635
13,838	696
15,376	756
16,914	814
18,451	872
19,989	928
21,526	983
23,064	1,037
26,364	1,151

Model Structure Information: Steamboat Lake is represented by the State's identifier 5803787 in the model. It is an on-channel reservoir located on Willow Creek. The current reservoir capacity is 26,364 acre-feet. The reservoir is modeled with the accounts listed in Table 2.

Table 2: Steamboat Lake Accounts

Account	Storage Amount (ACFT)
Hayden Station	5,000
Conservation	18,209
Instream Flow Pool	3,155
Total	**26,364**

Structures Water Rights: The reservoir is primarily filled by CPW and Xcel Energy water rights with a combined storage volume of 23,064 acre-feet and a priority of March 1964. The enlargement right of 3,300 acre-feet has a priority of December 1989. Finally, storage water to benefit the instream flow has a volume of 3,155 acre-feet and a priority of December 1995. Xcel Energy also holds several smaller, senior water rights that are used to replace evaporation.

Current Operations: Up to 5,000 acre-feet of water can be released to supplement supplies for Hayden Station when their direct diversion rights are out of priority.

Alternative #2 and #3 Operations: The following describes the new operations related to releases for the City of Steamboat, as part of the BIP Update.

- Reduce the Hayden Station account by 1,200 acre-feet, for an updated total storage of 3,800 acre-feet
- Add a new account for the City of Steamboat with a capacity of 1,200 acre-feet.
- Fill the City of Steamboat account with the conditional Juniper Reservoir rights. These rights include Steamboat Lake as an alternative point of diversion and are only available when in-priority at the original contemplated point of diversion.
- Release from the City of Steamboat account to the future Elk River diversion point (5801919) when the 8 cfs direct diversion right with a 1999 priority date is out of priority.

Stillwater Reservoir

Baseline and Alternative #3 assumptions

Project Description: Stillwater Reservoir is owned by Bear River Reservoir Company, which contracts Upper Yampa Water Conservancy District to operate the facility. Under Alternative #3, increased storage in Stillwater Reservoir will be investigated.

Table 1: Storage Contents and Surface Area

Storage Contents (ACFT)	Surface Area (Acre)
426	58
852	74
1,278	86
1,705	95
2,131	102
2,557	109
2,983	115
3,409	121
3,835	126
4,261	130
4,687	135
5,114	139
5,540	143
5,966	147
6,392	150

Model Structure Information: Stillwater Reservoir is represented by the State's identifier 5803540 in the model. It is an on-channel reservoir located on the Bear River. The reservoir water right is for 6,392 acre-feet. The as-built capacity is 6,088 acre-feet, but it currently has a storage restriction limiting the contents to 5,175 acre-feet. It is modeled with the eight accounts listed in Table 2. Note that the Town of Yampa can receive up to 100 acre-feet of water from Stillwater Reservoir. However, the Town is not explicitly represented in the model.

Table 2: Stillwater Reservoir Accounts

Number	Account	Storage Amount (ACFT)
1	Big Mesa	444
2	Coal Creek	435
3	Lindsey	394
4	Mandall	386
5	Stillwater - Colorado	979
6	Stillwater - Yampa	1,352

7	Aggregate Pool	1,185
8	Unallocated	1,217
	Total	**6,392**

Structure Water Rights: The reservoir fills with a June 29, 1942 water right for 6,392 acre-feet. The accounts fill on a pro-rata basis.

Current Operations: During the runoff, Stillwater Reservoir starts to fill up to 6,088 acre-feet. The reservoir users divert under their direct rights. When their rights are out of priority, then water is released from Stillwater Reservoir, as shown in Table 3. If the reservoir storage is above 3,000 acre-feet at the end of August, water is released from Stillwater to reach 3,000 acre-feet by the end of September. This is due to icing concerns during the winter.

Table 3: Stillwater Releases

Destination WDID	Destination Name	Account Name
5800738	Lindsey	Lindsey
5800539	Big Mesa	Big Mesa
5804686	Stillwater in Colorado Basin	Stillwater - Colorado
5804685_D	Stillwater in Yampa Basin	Stillwater - Yampa
5800643	Fix	Aggregate Pool
5800821	Pennsylvania	Aggregate Pool
5800500	Acton	Aggregate Pool
5800541	Bird	Aggregate Pool
5800564	Buckingham-Mandall	Aggregate Pool
5800763	Mandall	Mandall
5800684	Hernage & Kolbe	Aggregate Pool
5800777	Mill No. 1	Aggregate Pool
58_ADY001	Coal Creek Users	Coal Creek

Alternative #3 Operations: Stillwater Reservoir will continue to release to current water users. It is assumed that the storage restrictions are lifted and improvements will be made to allow the reservoir to fill up the water rights. The "Unallocated" pool will be distributed to the existing users, as shown in Table 4. The Future Muni Pool will release to future municipal demands located in Water District 58.

Table 4: Revised Stillwater Accounts

Number	Account	Storage Amount (ACFT)
1	Big Mesa	540

2	Coal Creek	529
3	Lindsey	479
4	Mandall	469
5	Stillwater - Colorado	1,190
6	Stillwater - Yampa	1,644
7	Aggregate Pool	1,441
8	Future Muni	100
	Total	**6,392**

Wolf Creek Reservoir

Alternative #3 assumptions

Project Description: Rio Blanco Water Conservancy District (RBWCD) is proposing a new reservoir in the Lower White River Basin. The assumptions used for the BIP Update are preliminary and subject to change as the project is further refined.

Table 1: Storage Contents and Surface Area

Storage Contents (ACFT)	Surface Area (Acre)
468	80
1,499	126
3,617	298
7,022	383
12,067	626
19,190	799
20,000	826
28,765	1,116
41,018	1,335
56,944	1,851
66,720	2,025

Model Structure Information: The Lower White River Storage is represented by Wolf Creek Reservoir at 43_WolfOC, pending an assignment of a WDID. It is an off-channel reservoir located in the Wolf Creek drainage of the White River. The reservoir capacity is 66,720 acre-feet and it is modeled with one account. The reservoir is filled using a 400 cfs pump station diverting water from the White River, just downstream of the confluence of Wolf Creek and White River. The pump station is represented by model ID 43_WolfPS (Wolf Creek Pump Station).

Structure Water Rights: The reservoir will be filled using the conditional water right granted in 14CW3043.

Alternative #3 Operations: Wolf Creek Reservoir will operate to meet demands in the *New/Enlarged Reservoir Alternative*, as part of the BIP Update.

- Future demands for the Town of Rangely
- Augmentation for water users within the Rio Blanco Water Conservancy District boundaries and within the Yellow Jacket Water Conservancy District boundaries.
- Total releases for municipal and augmentation uses will be limited to 7,000 acre-feet per year.

APPENDIX C

Technical Update
Yampa and White Basins Alternative Management Modeling Results

Presentation to the YWG BIP Update Committee

Lisa Brown
Local Expert Team
3/4/2021

Outline

- White then Yampa
- Review of Modeling Assumptions
- Basin Overview Results:
- Key Structure Results: Demand/Supply/Shortage
- Reservoir Contents
- Streamflow

Modeling Assumptions - White Basin

- Alternative 1a:
  - Convert 20% of all flood irrigated acreage to sprinkler
  - No change to headgate demand
- Alternative 1b:
  - Convert 20% of all flood irrigated acreage to sprinkler
  - Reduce headgate demand to reflect increased efficiency
- Alternative 3:
  - Enlarge Lake Avery by 2,644 acre-feet
    - Pool releases to augment future muni and industrial demands, supplement streamflow
  - Add Wolf Creek Reservoir – off channel with 66,720 acre-feet capacity
    - Up to 7,000 acre-feet/year to Rangely, augment future uses

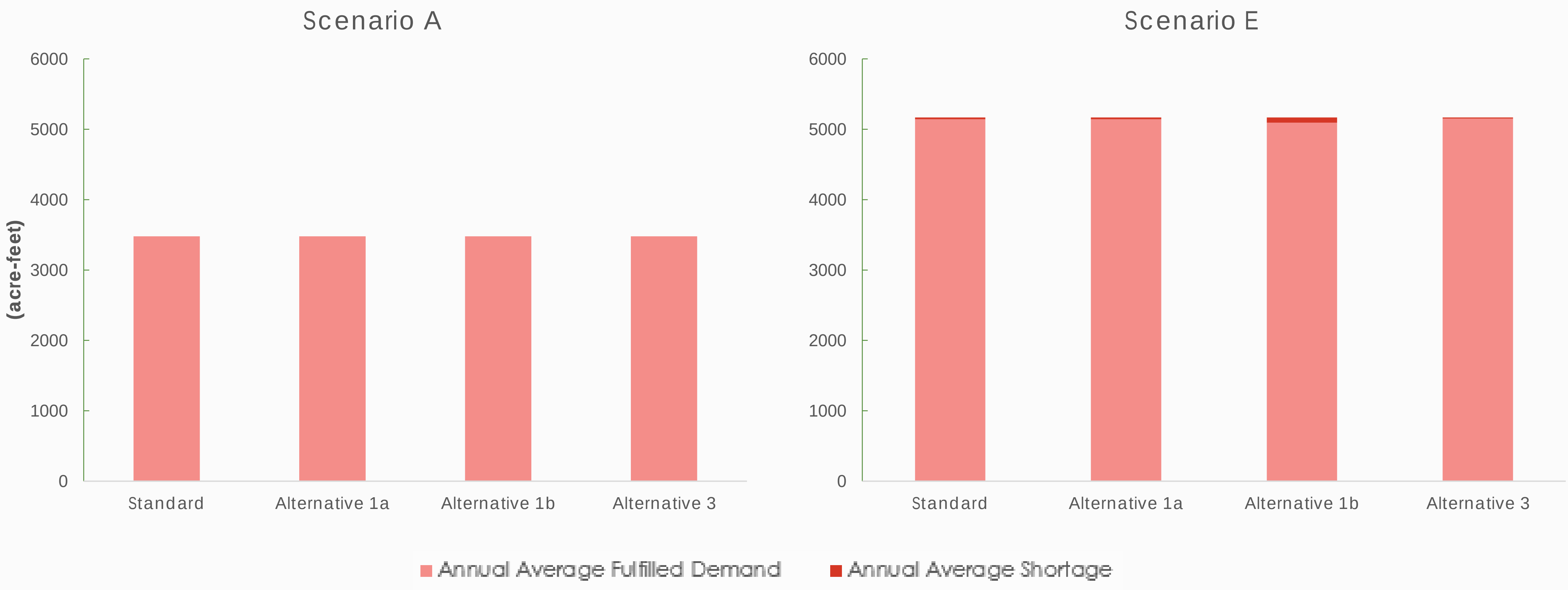
White Agriculture

Run	Average Annual Demand	Average Annual Demand Increase from Baseline	Average Annual Gap	Average Annual Gap Increase from Baseline	Average Annual Percent Gap	Average Annual CU Gap
Baseline						
Standard	246,744	NA	1,229	NA	0%	664
Alternative 1a	246,744	NA	1,129	NA	0%	651
Alternative 1b	149,299	NA	978	NA	1%	563
Alternative 3	246,744	NA	1,229	NA	0%	664
Business as Usual						
Standard	242,917	NA	1,234	6	1%	667
Alternative 1a	242,917	NA	1,135	6	0%	654
Alternative 1b	147,233	NA	982	3	1%	565
Alternative 3	242,917	NA	1,233	4	1%	666
Weak Economy						
Standard	246,744	NA	1,234	6	1%	667
Alternative 1a	246,744	NA	1,135	6	0%	654
Alternative 1b	149,299	NA	983	4	1%	566
Alternative 3	246,744	NA	1,234	6	1%	667
Cooperative Growth						
Standard	293,889	47,146	3,184	1,956	1%	1,726
Alternative 1a	293,889	47,146	3,111	1,982	1%	1,686
Alternative 1b	177,878	28,579	2,778	1,799	2%	1,501
Alternative 3	293,889	47,146	3,186	1,958	1%	1,727
Adaptive Innovation						
Standard	177,755	NA	3,395	2,166	2%	2,179
Alternative 1a	319,741	72,998	5,367	4,237	2%	3,103
Alternative 1b	195,376	46,077	5,181	4,203	3%	2,997
Alternative 3	177,755	NA	3,390	2,162	2%	2,176
Hot Growth						
Standard	319,741	72,998	5,858	4,629	2%	3,178
Alternative 1a	319,741	72,998	5,367	4,238	2%	3,103
Alternative 1b	195,376	46,077	5,183	4,205	3%	2,997
Alternative 3	319,741	72,998	5,854	4,625	2%	3,176

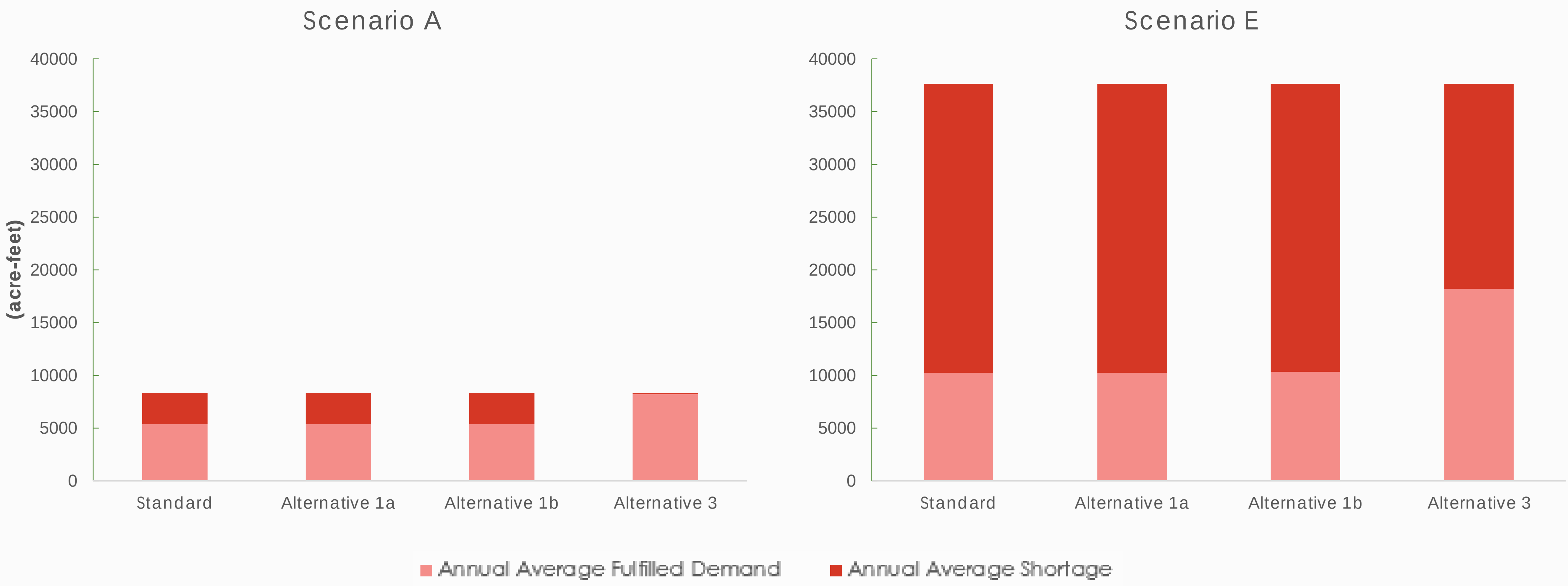
White Muni & Industry

Run	Demand In Maximum Gap Year	Increase from Baseline Demand	Gap in Maximum Year	Increase from Baseline Gap	Percent Gap in Maximum Gap Year
Baseline					
Standard	7,153	NA	0	NA	0%
Alternative 1a	7,153	NA	0	NA	0%
Alternative 1b	7,153	NA	0	NA	0%
Alternative 3	7,151	NA	0	NA	0%
Business as Usual					
Standard	11,783	4,630	3,775	3,775	32%
Alternative 1a	11,783	4,630	3,775	3,775	32%
Alternative 1b	11,783	4,630	3,775	3,775	32%
Alternative 3	11,781	4,630	391	391	3%
Weak Economy					
Standard	7,842	689	739	739	9%
Alternative 1a	7,842	689	739	739	9%
Alternative 1b	7,842	689	739	739	9%
Alternative 3	7,840	689	76	76	1%
Cooperative Growth					
Standard	8,728	1,575	799	799	9%
Alternative 1a	8,728	1,575	799	799	9%
Alternative 1b	8,728	1,575	862	862	10%
Alternative 3	8,726	1,575	81	81	1%
Adaptive Innovation					
Standard	9,450	2,297	1,181	1,181	13%
Alternative 1a	9,450	2,297	1,020	1,020	11%
Alternative 1b	9,450	2,297	1,501	1,501	16%
Alternative 3	9,448	2,297	166	166	2%
Hot Growth					
Standard	42,800	35,647	33,378	33,378	78%
Alternative 1a	42,800	35,647	33,378	33,378	78%
Alternative 1b	42,800	35,647	33,931	33,930	79%
Alternative 3	42,798	35,647	26,220	26,220	61%

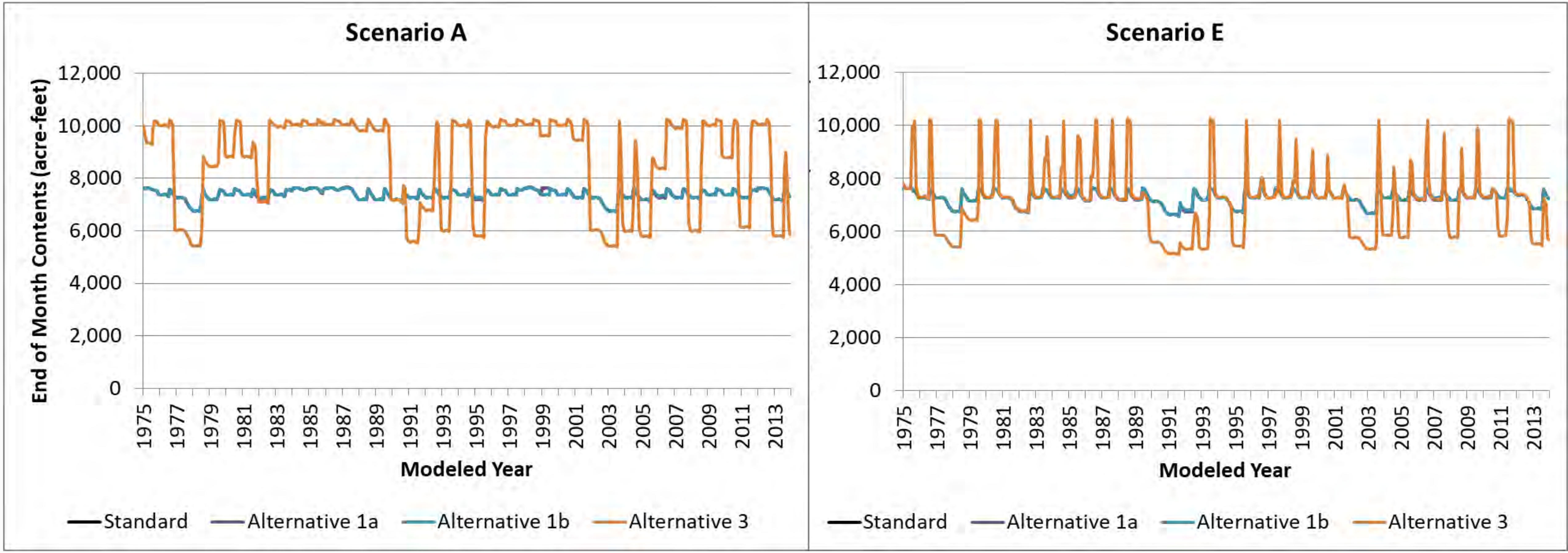
Key Structure:
White - Municipal



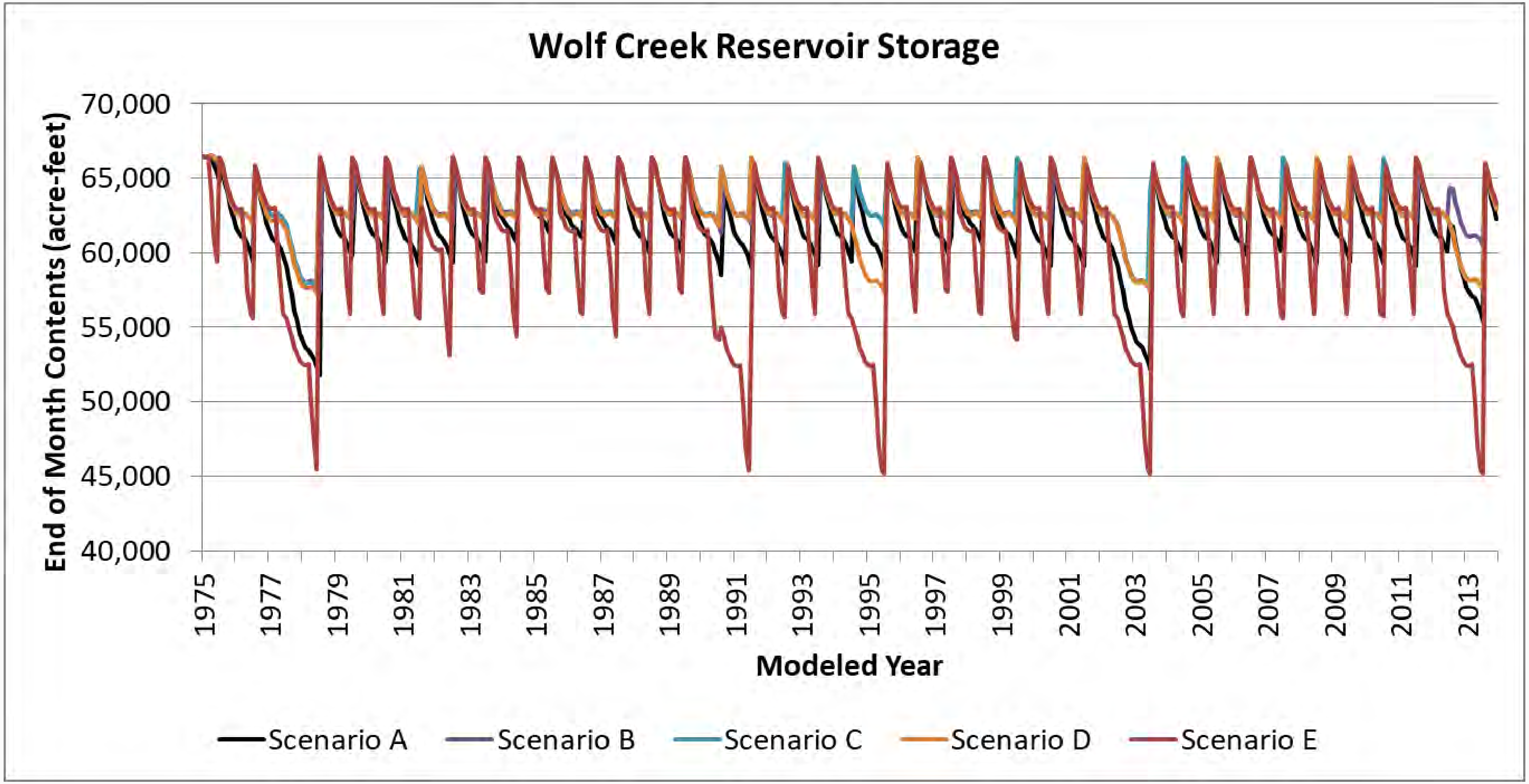
Key Structure:
White - Industrial



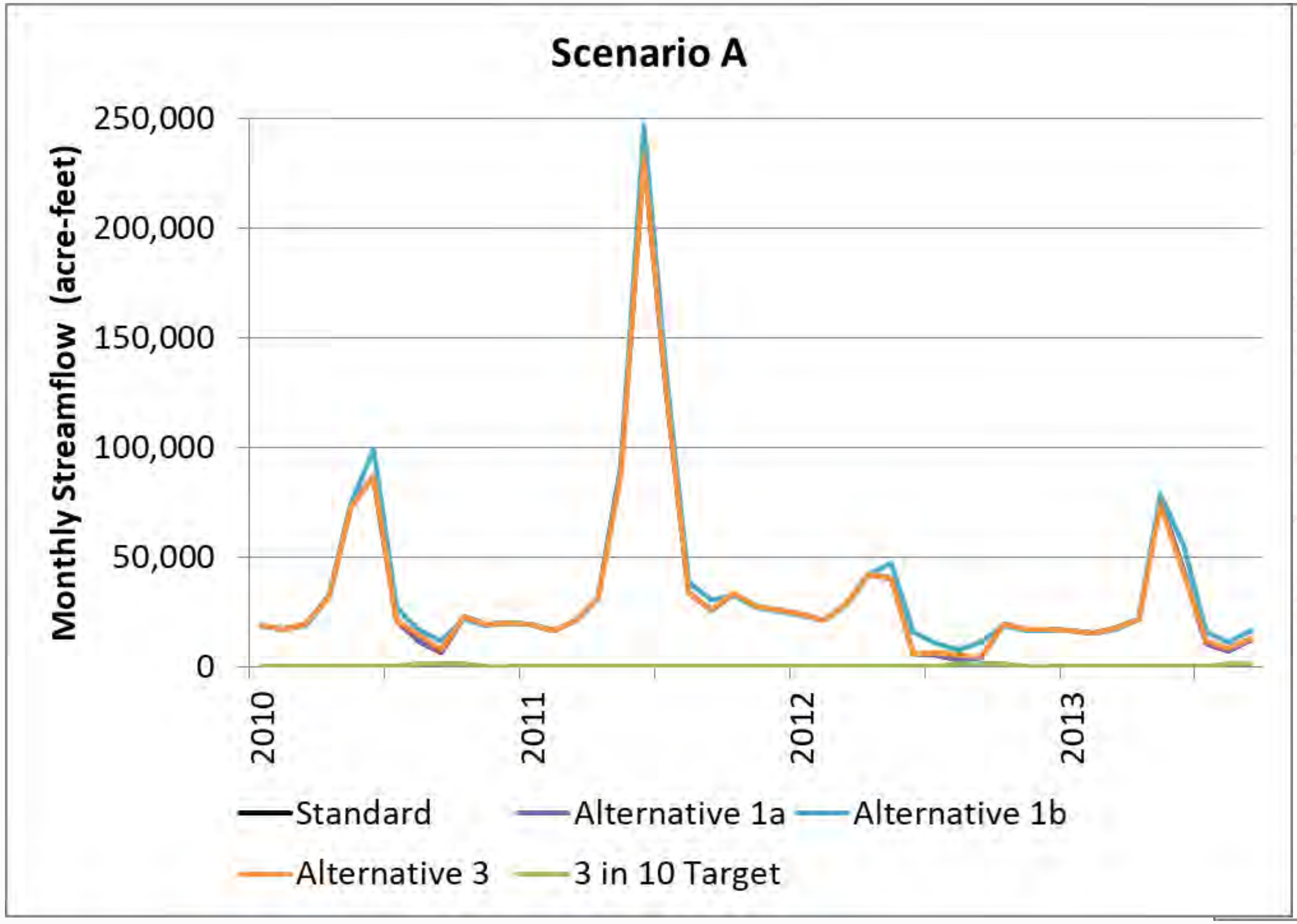
Reservoir Storage: Lake Avery

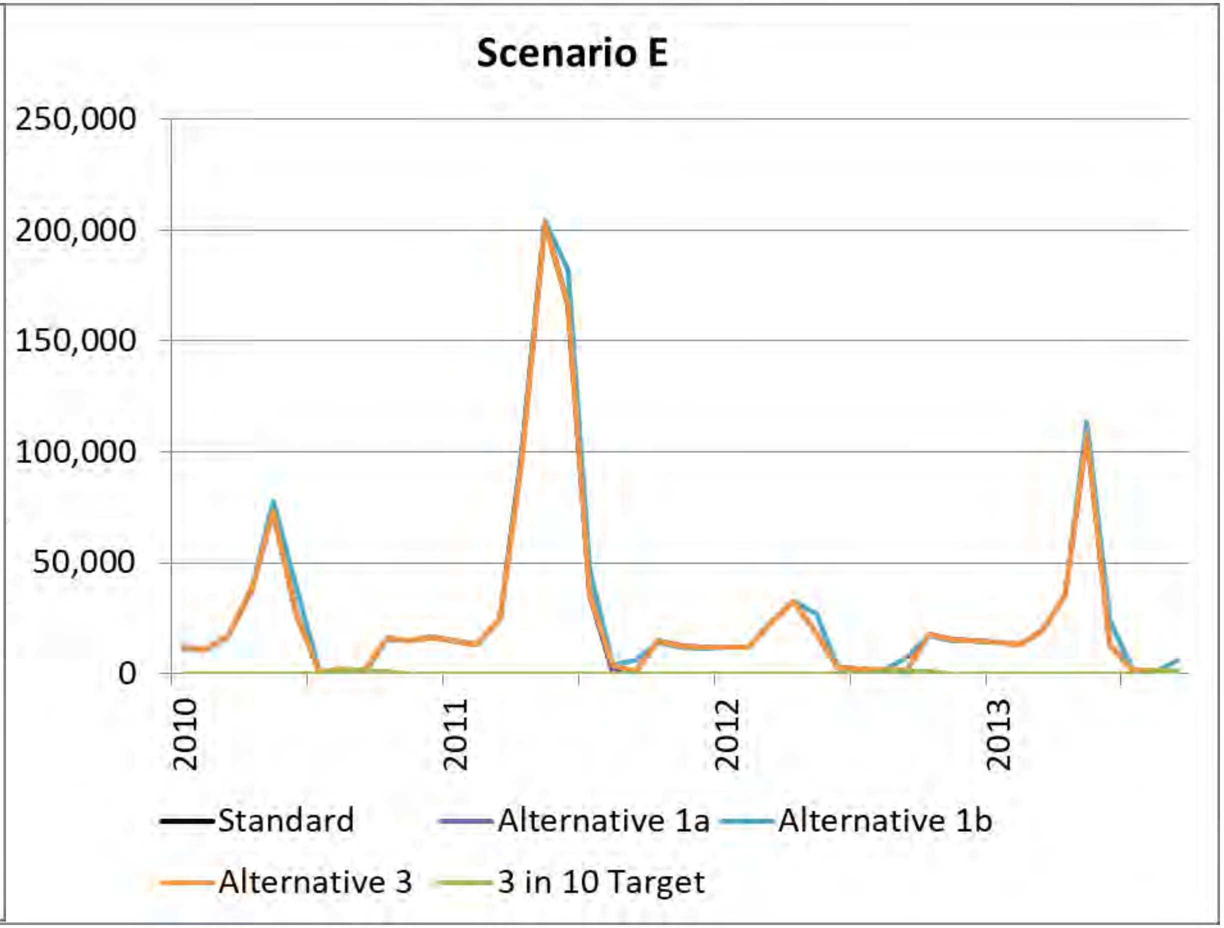


Reservoir Storage: Wolf Creek

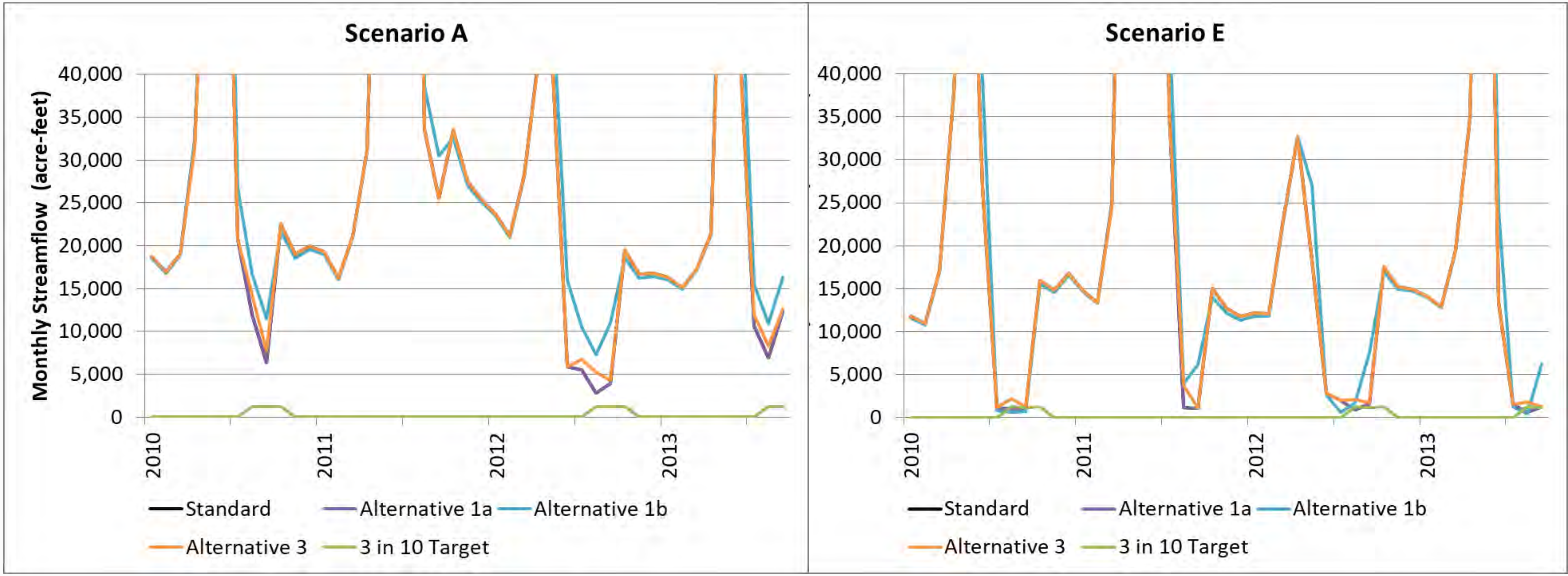


Streamflow:
White River Near Coal Creek

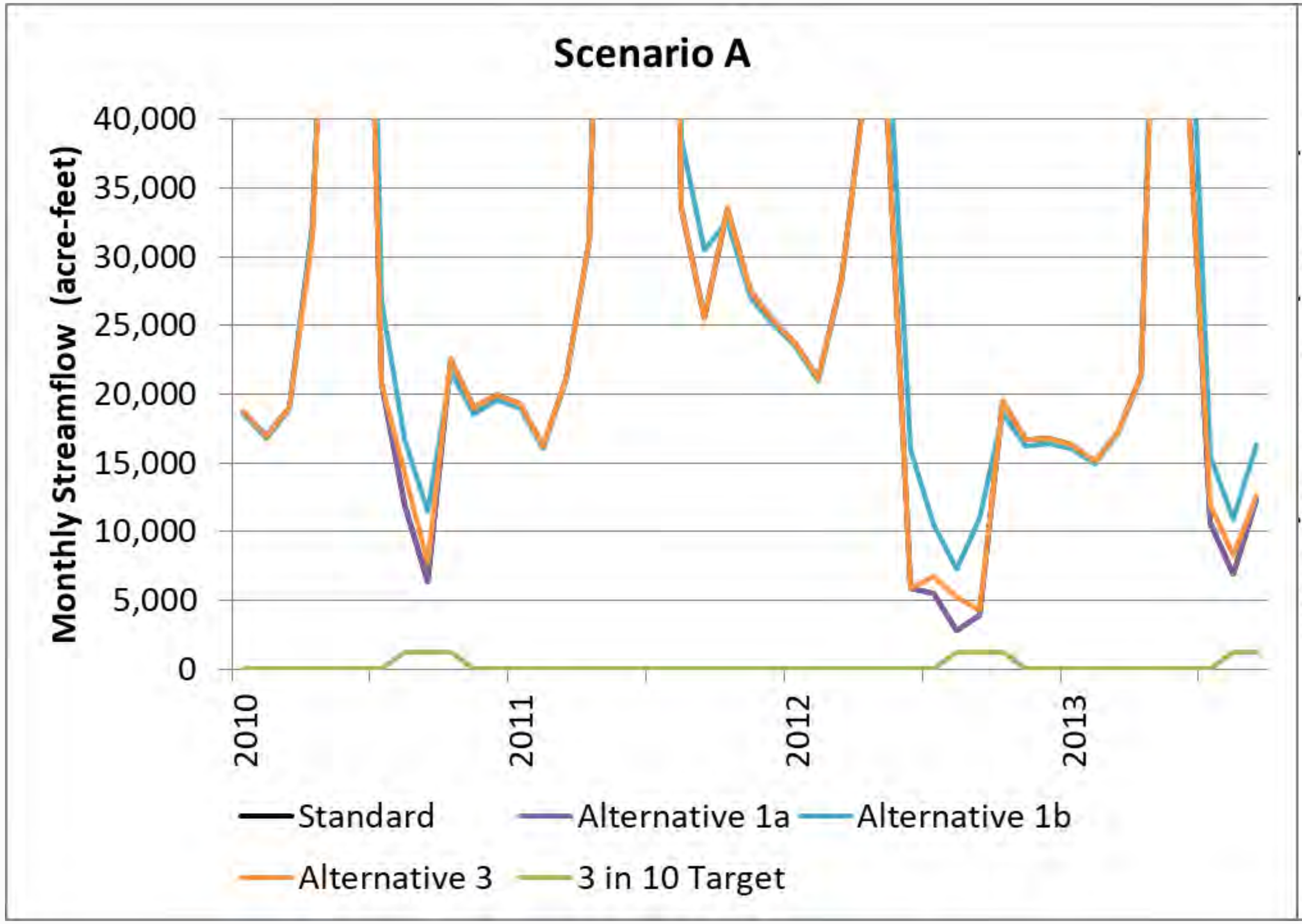


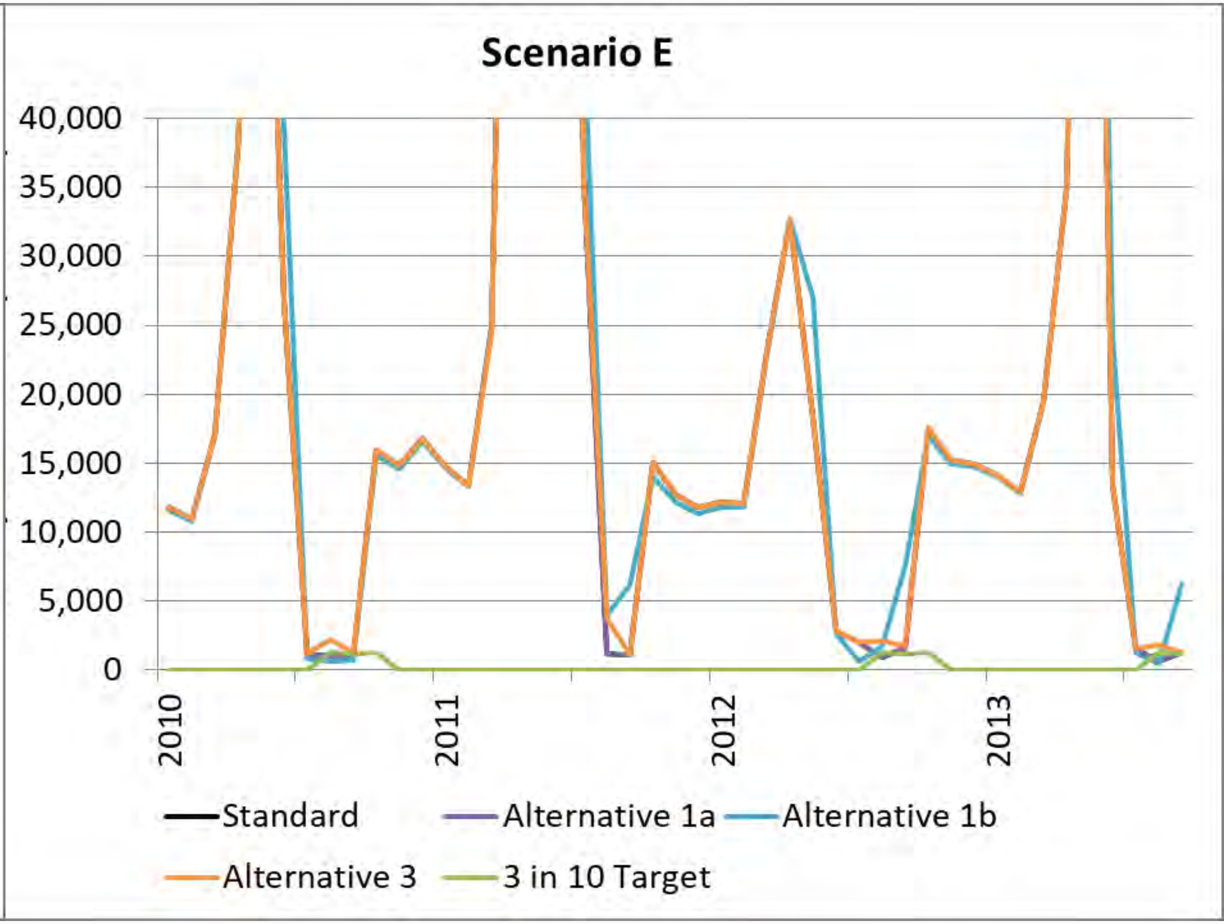


Streamflow:
White River Near Coal Creek

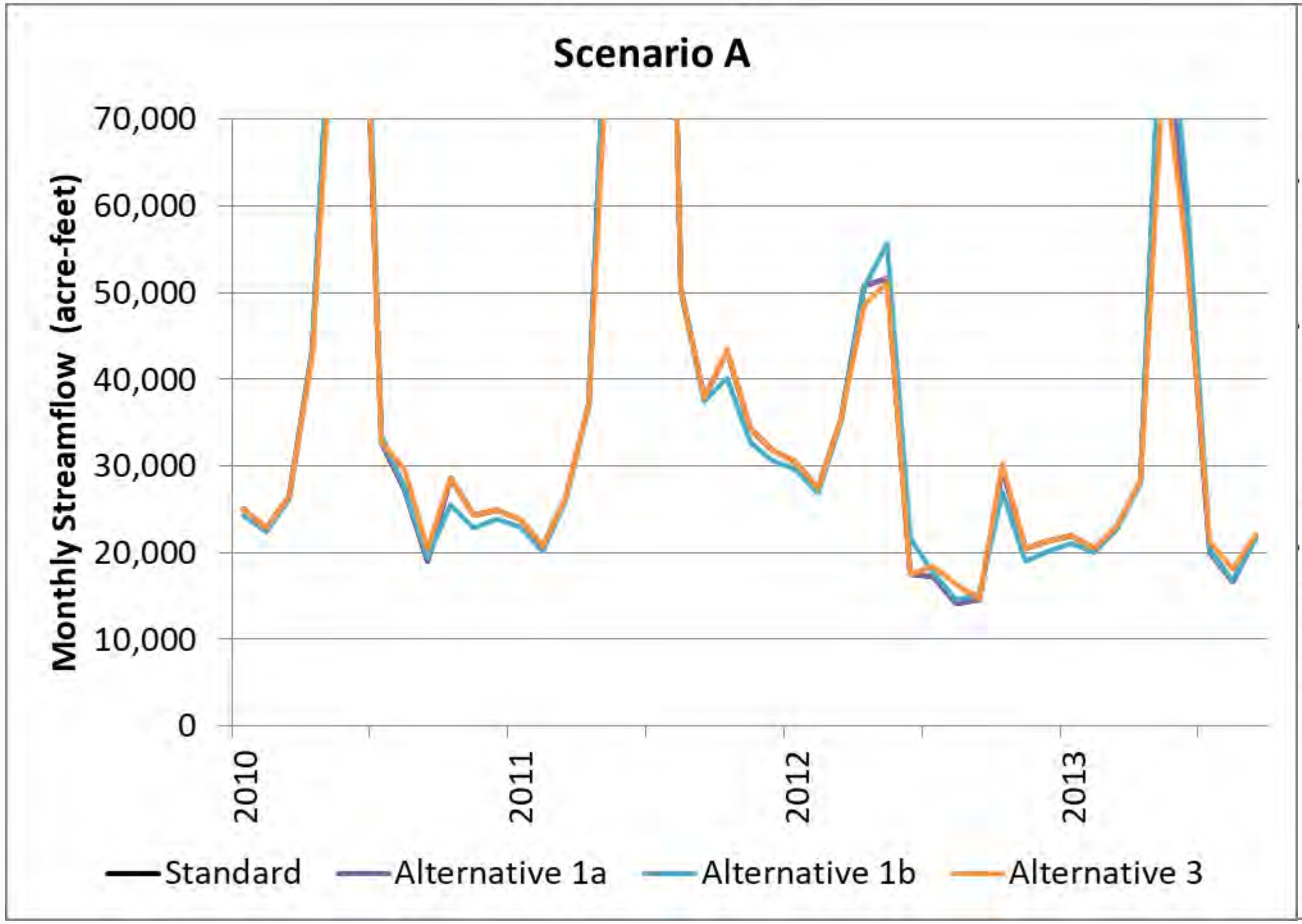


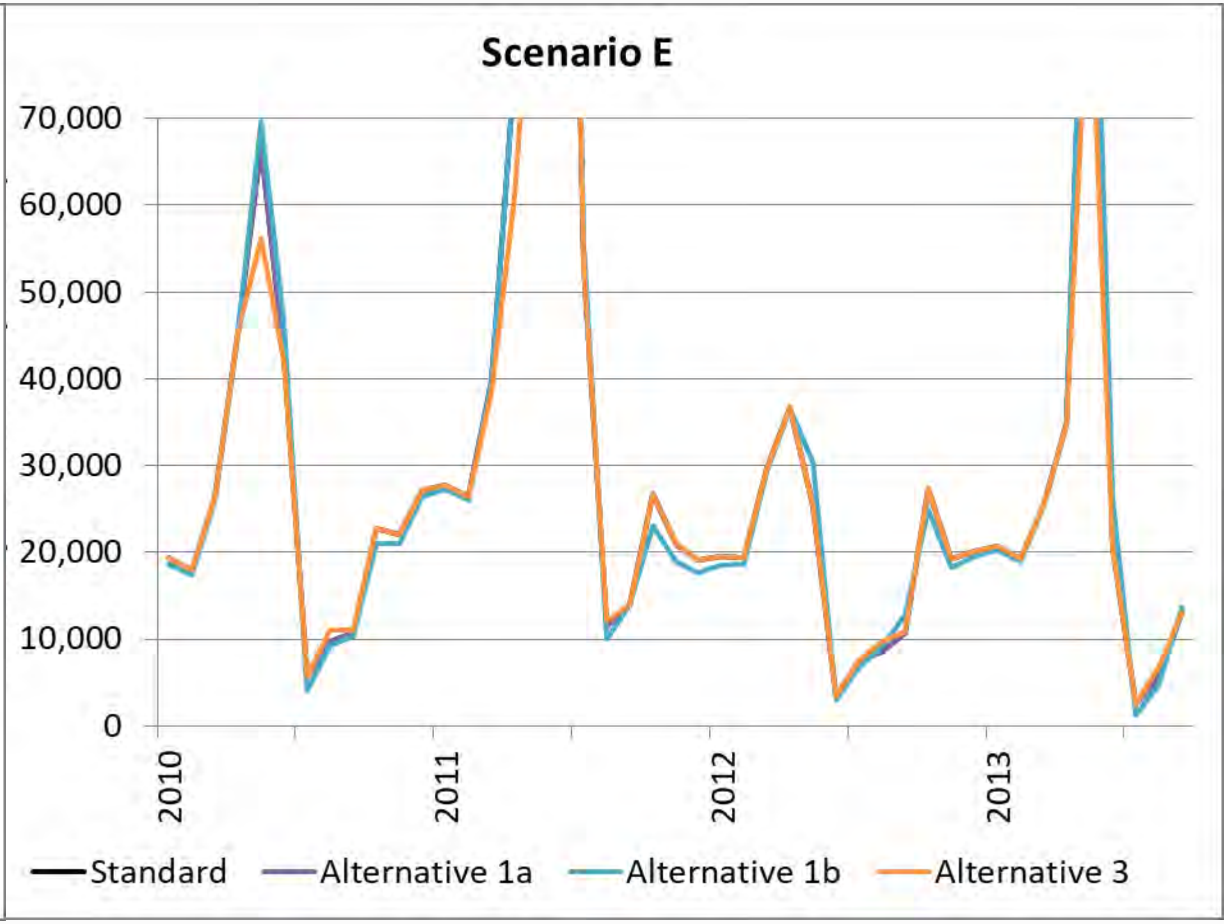
Streamflow:
White River Near Watson





Streamflow:
White River Near Watson





Modeling Assumptions - Yampa Basin

- Alternative 1:
  - Convert 20% of all flood irrigated acreage to sprinkler
  - No change to headgate demand

- Alternative 2:
  - Steamboat Lake – 1,200 AF pool for City of Steamboat
  - Stagecoach Reservoir – Release to future M&I in UYWCD and up to 4,000 acre-feet to Maybell Fish Reach
  - Elkhead Reservoir – Increase release to Lower Yampa Reach from 50 cfs to 75 cfs. Allow releases from Tri-State’s pools to Lower Yampa Reach. Release to DS ditches (25 cfs max)

- Alternative 3: Layer changes on top of Alt 2
  - Stillwater Reservoir – Storage restrictions are lifted
  - Elkhead Reservoir – enlarged by 4,300 acre-feet. Extra water available to Lower Yampa Reach (75 cfs max) and Ag users (50 cfs max)

Standard Agriculture

Scenario	Average Annual Demand	Average Annual Demand Increase from Baseline	Average Annual Gap	Average Annual Gap Increase from Baseline	Average Annual Percent Gap	Average Annual CU Gap
WD44-Irr						
Baseline	128,467	NA	9,494	NA	7%	5,325
Business as Usual	136,244	7,777	9,894	400	7%	5,540
Weak Economy	136,244	7,777	9,879	386	7%	5,533
Cooperative Growth	194,294	65,828	22,441	12,948	12%	12,458
Adaptive Innovation	205,187	76,720	34,590	25,096	17%	22,466
Hot Growth	317,658	189,191	49,017	39,524	15%	26,912
WD54/55/56-Irr						
Baseline	79,063	NA	2,301	NA	3%	1,281
Business as Usual	79,063	NA	2,313	12	3%	1,288
Weak Economy	79,063	NA	2,310	9	3%	1,286
Cooperative Growth	95,473	16,409	5,112	2,810	5%	2,846
Adaptive Innovation	73,184	NA	5,192	2,891	7%	3,412
Hot Growth	108,219	29,155	8,439	6,137	8%	4,706
WD57-Irr						
Baseline	42,363	NA	198	NA	0%	107
Business as Usual	40,371	NA	192	NA	0%	104
Weak Economy	40,371	NA	192	NA	0%	104
Cooperative Growth	48,472	6,109	1,095	897	2%	592
Adaptive Innovation	36,736	NA	1,443	1,245	4%	925
Hot Growth	54,209	11,846	2,143	1,944	4%	1,161
WD58-Irr						
Baseline	152,594	NA	1,642	NA	1%	885
Business as Usual	147,949	NA	1,502	NA	1%	813
Weak Economy	147,949	NA	1,509	NA	1%	816
Cooperative Growth	184,214	31,620	7,893	6,251	4%	4,161
Adaptive Innovation	145,878	NA	9,318	7,675	6%	5,777
Hot Growth	204,174	51,580	17,608	15,966	9%	9,297

Alternative 1 Agriculture

Scenario	Average Annual Demand	Average Annual Demand Increase from Baseline	Average Annual Gap	Average Annual Gap Increase from Baseline	Average Annual Percent Gap	Average Annual CU Gap
WD44-Irr						
Baseline	128,467	NA	8,909	NA	7%	5,008
Business as Usual	136,244	7,777	9,307	398	7%	5,222
Weak Economy	136,244	7,777	9,292	383	7%	5,213
Cooperative Growth	194,294	65,828	21,757	12,848	11%	12,087
Adaptive Innovation	317,658	189,191	40,527	31,618	13%	26,318
Hot Growth	317,658	189,191	48,177	39,268	15%	26,455
WD54/55/56-Irr						
Baseline	79,063	NA	2,031	NA	3%	1,130
Business as Usual	79,063	NA	2,041	10	3%	1,135
Weak Economy	79,063	NA	2,035	5	3%	1,132
Cooperative Growth	95,473	16,409	4,721	2,690	5%	2,627
Adaptive Innovation	108,219	29,155	6,546	4,516	6%	4,304
Hot Growth	108,219	29,155	7,833	5,803	7%	4,368
WD57-Irr						
Baseline	42,363	NA	151	NA	0%	82
Business as Usual	40,371	NA	147	NA	0%	80
Weak Economy	40,371	NA	145	NA	0%	78
Cooperative Growth	48,472	6,109	986	835	2%	533
Adaptive Innovation	54,209	11,846	1,664	1,513	3%	1,067
Hot Growth	54,209	11,846	1,990	1,839	4%	1,078
WD58-Irr						
Baseline	152,594	NA	1,499	NA	1%	807
Business as Usual	147,949	NA	1,368	NA	1%	739
Weak Economy	147,949	NA	1,376	NA	1%	743
Cooperative Growth	184,214	31,620	7,089	5,590	4%	3,724
Adaptive Innovation	204,174	51,580	13,698	12,198	7%	8,450
Hot Growth	204,174	51,580	16,223	14,724	8%	8,542

Alternative 2 Agriculture

Scenario	Average Annual Demand	Average Annual Demand Increase from Baseline	Average Annual Gap	Average Annual Gap Increase from Baseline	Average Annual Percent Gap	Average Annual CU Gap
WD44-Irr						
Baseline	128,467	NA	9,333	NA	7%	5,237
Business as Usual	136,244	7,777	9,491	157	7%	5,321
Weak Economy	136,244	7,777	9,481	147	7%	5,316
Cooperative Growth	194,294	65,828	20,599	11,266	11%	11,459
Adaptive Innovation	205,187	76,720	32,009	22,675	16%	20,810
Hot Growth	317,658	189,191	46,199	36,866	15%	25,383
WD54/55/56-Irr						
Baseline	79,063	NA	2,292	NA	3%	1,275
Business as Usual	79,063	NA	2,308	16	3%	1,284
Weak Economy	79,063	NA	2,306	13	3%	1,283
Cooperative Growth	95,473	16,409	5,110	2,817	5%	2,845
Adaptive Innovation	73,184	NA	5,184	2,892	7%	3,406
Hot Growth	108,219	29,155	8,435	6,143	8%	4,704
WD57-Irr						
Baseline	42,363	NA	194	NA	0%	105
Business as Usual	40,371	NA	192	NA	0%	104
Weak Economy	40,371	NA	192	NA	0%	104
Cooperative Growth	48,472	6,109	1,087	894	2%	587
Adaptive Innovation	36,736	NA	1,414	1,220	4%	906
Hot Growth	54,209	11,846	2,083	1,890	4%	1,128
WD58-Irr						
Baseline	152,594	NA	1,656	NA	1%	892
Business as Usual	147,949	NA	1,501	NA	1%	810
Weak Economy	147,949	NA	1,507	NA	1%	813
Cooperative Growth	184,214	31,620	7,899	6,243	4%	4,164
Adaptive Innovation	145,878	NA	9,307	7,652	6%	5,770
Hot Growth	204,174	51,580	17,582	15,926	9%	9,282

Alternative 3 Agriculture

Scenario	Average Annual Demand	Average Annual Demand Increase from Baseline	Average Annual Gap	Average Annual Gap Increase from Baseline	Average Annual Percent Gap	Average Annual CU Gap
WD44-Irr						
Baseline	128,467	NA	9,271	NA	7%	5,200
Business as Usual	136,244	7,777	9,324	53	7%	5,229
Weak Economy	136,244	7,777	9,320	50	7%	5,227
Cooperative Growth	194,294	65,828	19,504	10,233	10%	10,860
Adaptive Innovation	205,187	76,720	30,440	21,169	15%	19,800
Hot Growth	317,658	189,191	44,406	35,135	14%	24,411
WD54/55/56-Irr						
Baseline	79,063	NA	2,294	NA	3%	1,276
Business as Usual	79,063	NA	2,306	12	3%	1,283
Weak Economy	79,063	NA	2,303	9	3%	1,281
Cooperative Growth	95,473	16,409	5,104	2,810	5%	2,842
Adaptive Innovation	73,184	NA	5,180	2,886	7%	3,403
Hot Growth	108,219	29,155	8,432	6,138	8%	4,702
WD57-Irr						
Baseline	42,363	NA	192	NA	0%	104
Business as Usual	40,371	NA	192	NA	0%	104
Weak Economy	40,371	NA	192	NA	0%	104
Cooperative Growth	48,472	6,109	1,083	891	2%	585
Adaptive Innovation	36,736	NA	1,405	1,212	4%	900
Hot Growth	54,209	11,846	2,059	1,866	4%	1,114
WD58-Irr						
Baseline	152,594	NA	1,556	NA	1%	838
Business as Usual	147,949	NA	1,421	NA	1%	781
Weak Economy	147,949	NA	1,421	NA	1%	780
Cooperative Growth	184,214	31,620	7,432	5,876	4%	3,951
Adaptive Innovation	145,878	NA	8,886	7,330	6%	5,546
Hot Growth	204,174	51,580	16,965	15,409	8%	9,041

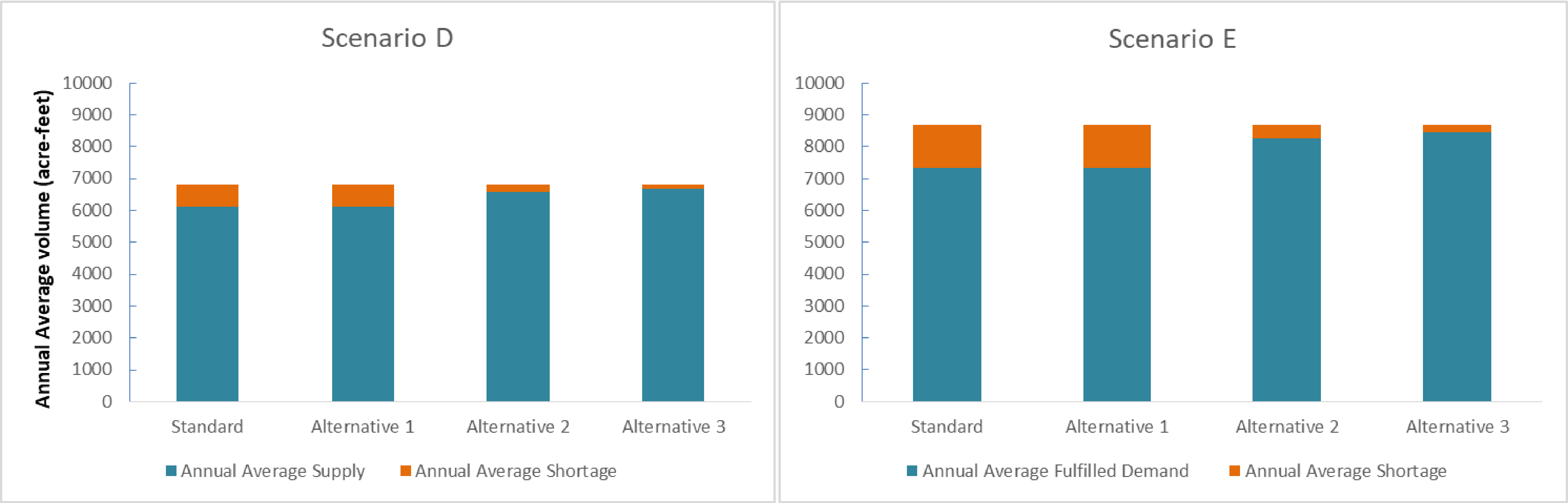
Yampa Agriculture All

Run	Average Annual Demand	Average Annual Demand Increase from Baseline	Average Annual Gap	Average Annual Gap Increase from Baseline	Average Annual Percent Gap	Average Annual CU Gap
Baseline						
Standard	402,488	NA	13,635	NA	3%	7,599
Alternative 1	402,488	NA	12,590	NA	3%	7,026
Alternative 2	402,488	NA	13,475	NA	3%	7,509
Alternative 3	402,488	NA	13,312	NA	3%	7,418
Business as Usual						
Standard	403,627	1,139	13,901	266	3%	7,745
Alternative 1	403,627	1,139	12,863	273	3%	7,176
Alternative 2	403,627	1,139	13,492	17	3%	7,520
Alternative 3	403,627	1,139	13,243	NA	3%	7,397
Weak Economy						
Standard	403,627	1,139	13,891	256	3%	7,738
Alternative 1	403,627	1,139	12,847	257	3%	7,167
Alternative 2	403,627	1,139	13,486	11	3%	7,516
Alternative 3	403,627	1,139	13,236	NA	3%	7,392
Cooperative Growth						
Standard	522,453	119,965	36,541	22,906	7%	20,058
Alternative 1	522,453	119,965	34,552	21,962	7%	18,972
Alternative 2	522,453	119,965	34,696	21,220	7%	19,056
Alternative 3	522,453	119,965	33,123	19,810	6%	18,238
Adaptive Innovation						
Standard	460,985	58,497	50,543	36,908	11%	32,581
Alternative 1	684,260	281,772	62,434	49,844	9%	40,140
Alternative 2	460,985	58,497	47,914	34,439	10%	30,893
Alternative 3	460,985	58,497	45,910	32,598	10%	29,650
Hot Growth						
Standard	684,260	281,772	77,207	63,572	11%	42,075
Alternative 1	684,260	281,772	74,223	61,633	11%	40,443
Alternative 2	684,260	281,772	74,300	60,824	11%	40,497
Alternative 3	684,260	281,772	71,862	58,550	11%	39,267

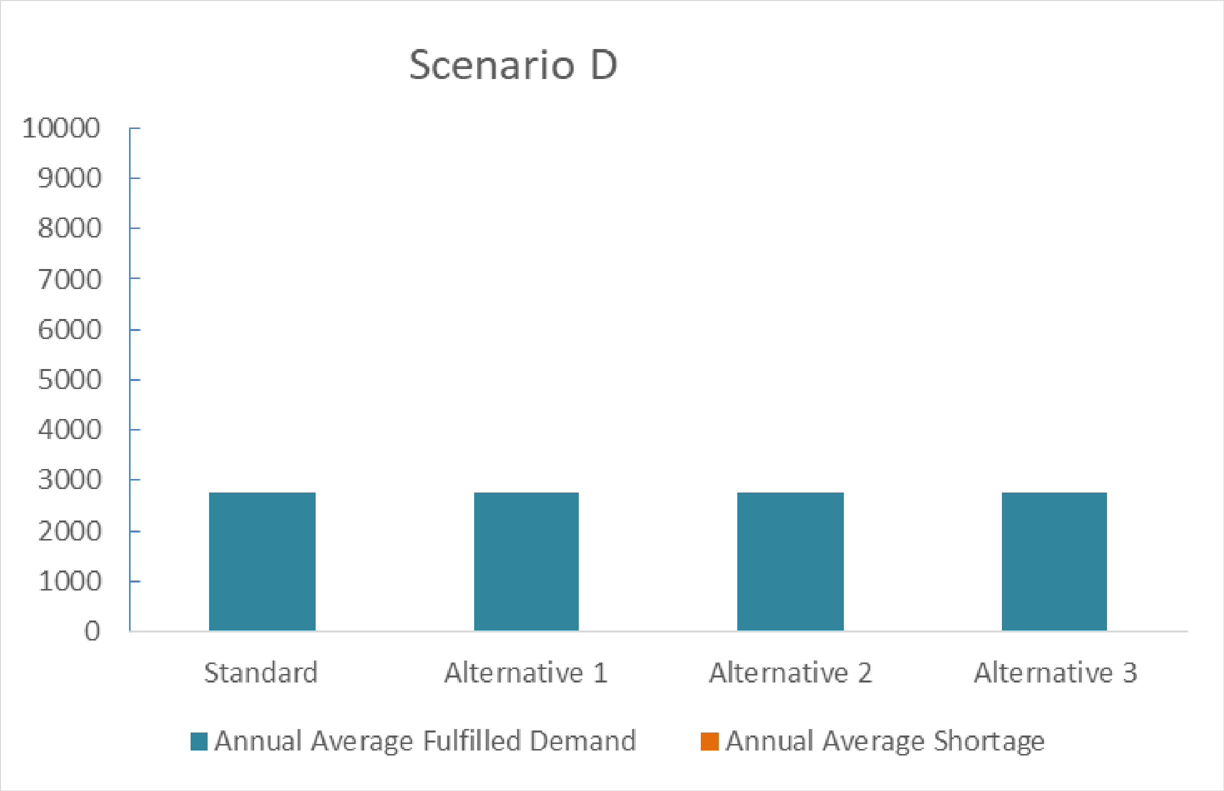
Yampa Muni & Industry

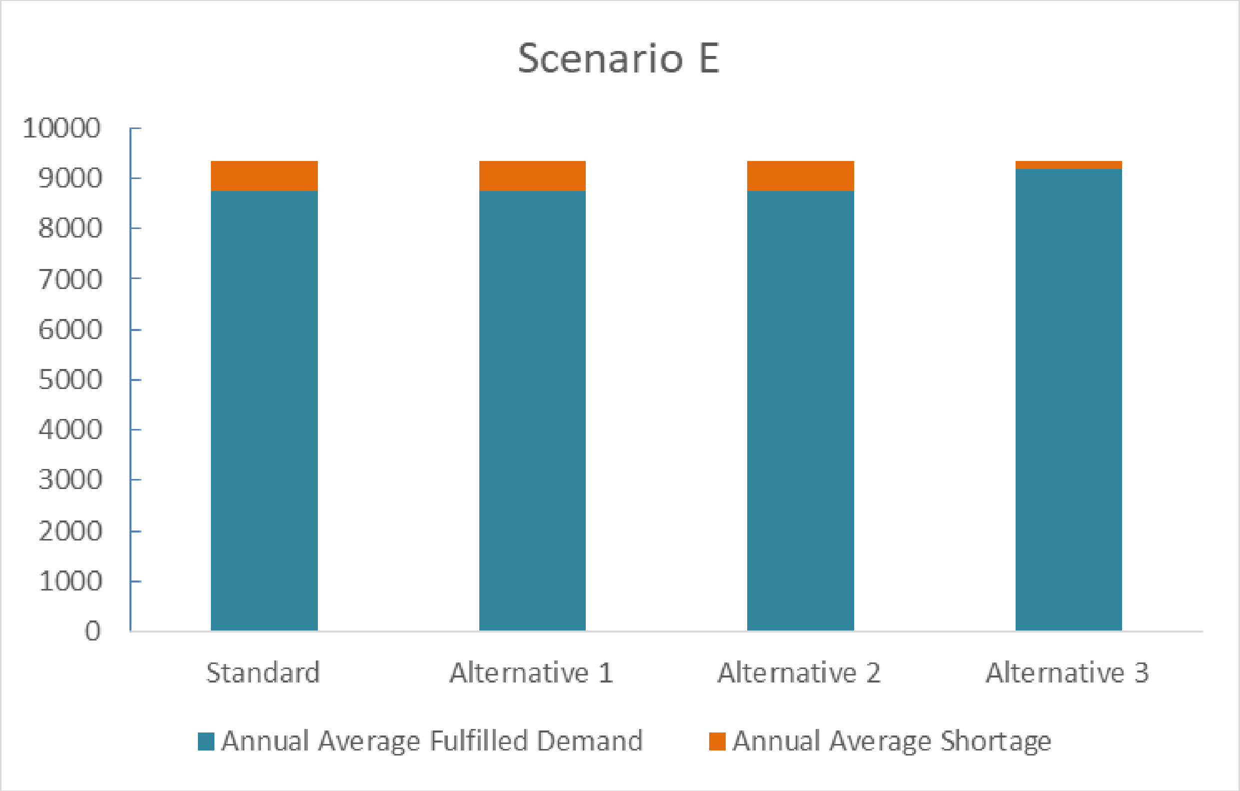
Run	Demand In Maximum Gap Year	Increase from Baseline Demand	Gap in Maximum Year	Increase from Baseline Gap	Percent Gap in Maximum Gap Year
Baseline					
Standard	32,826	NA	310	NA	1%
Alternative 1	32,826	NA	310	NA	1%
Alternative 2	32,826	NA	310	NA	1%
Alternative 3	32,826	NA	310	NA	1%
Business as Usual					
Standard	33,503	677	283	NA	1%
Alternative 1	33,503	677	283	NA	1%
Alternative 2	33,503	677	283	NA	1%
Alternative 3	33,503	677	242	NA	1%
Weak Economy					
Standard	27,173	NA	193	NA	1%
Alternative 1	27,173	NA	193	NA	1%
Alternative 2	27,173	NA	193	NA	1%
Alternative 3	27,173	NA	193	NA	1%
Cooperative Growth					
Standard	32,286	NA	416	106	1%
Alternative 1	32,286	NA	416	106	1%
Alternative 2	32,286	NA	376	66	1%
Alternative 3	32,286	NA	283	NA	1%
Adaptive Innovation					
Standard	34,727	1,901	1,151	841	3%
Alternative 1	34,727	1,901	1,151	841	3%
Alternative 2	34,727	1,901	637	327	2%
Alternative 3	34,727	1,901	414	104	1%
Hot Growth					
Standard	46,496	13,670	3,134	2,824	7%
Alternative 1	46,496	13,670	3,134	2,824	7%
Alternative 2	46,496	13,670	1,860	1,550	4%
Alternative 3	46,496	13,670	979	669	2%

Key Structures:
Yampa – Other Municipal/Domestic Providers
(not Steamboat/Mount Werner or Craig)

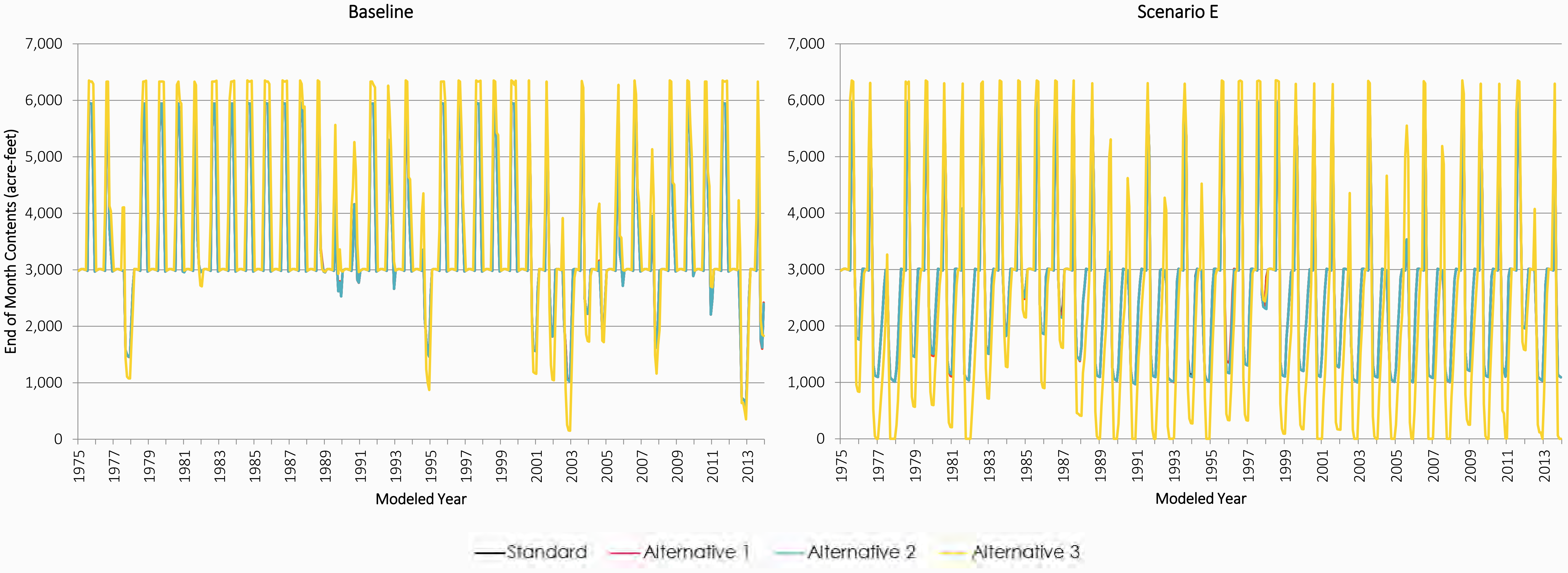


Key Structure:
Yampa – Other Industrial Users
(not Hayden Station, Craig Station, or Steamboat Resort Snowmaking)

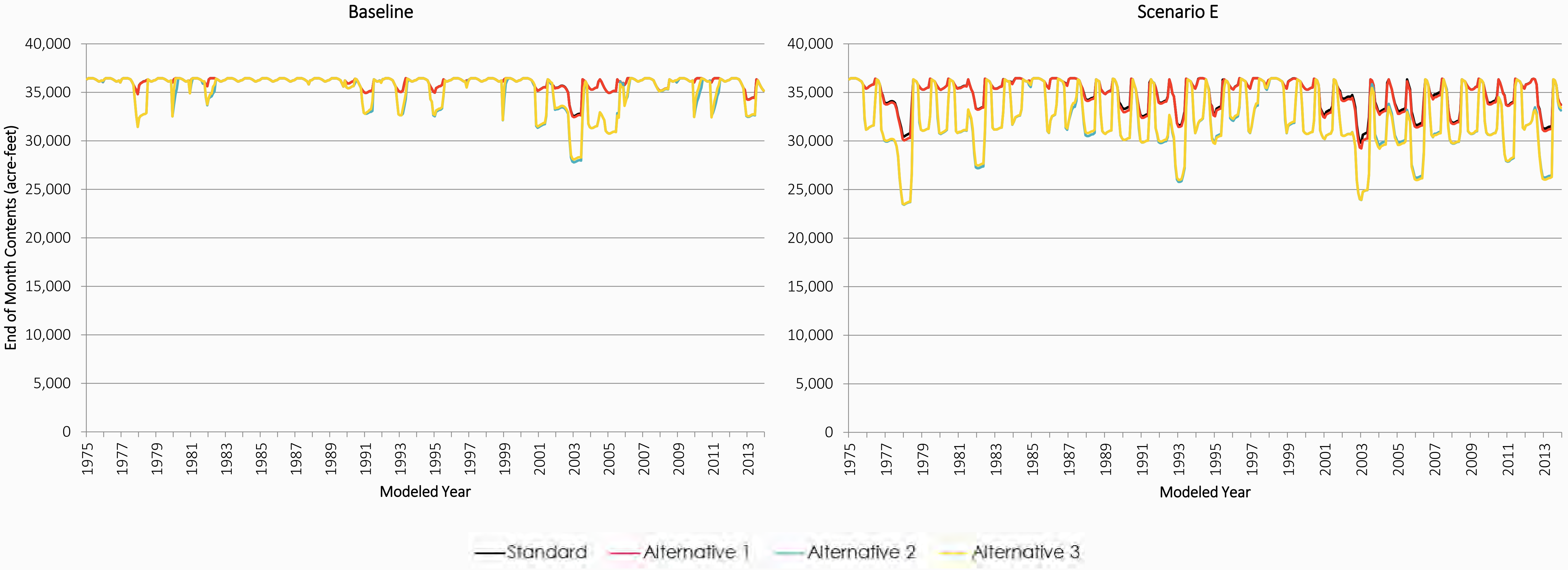




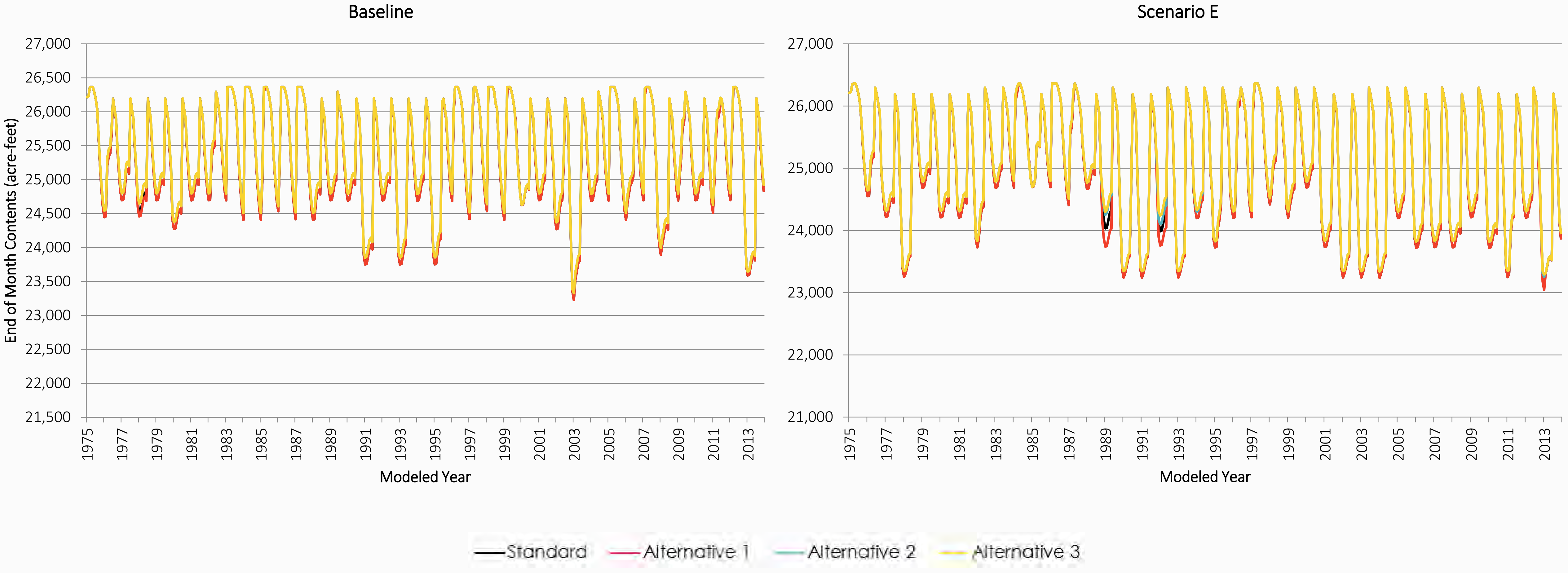
Key Structure: Stillwater Reservoir



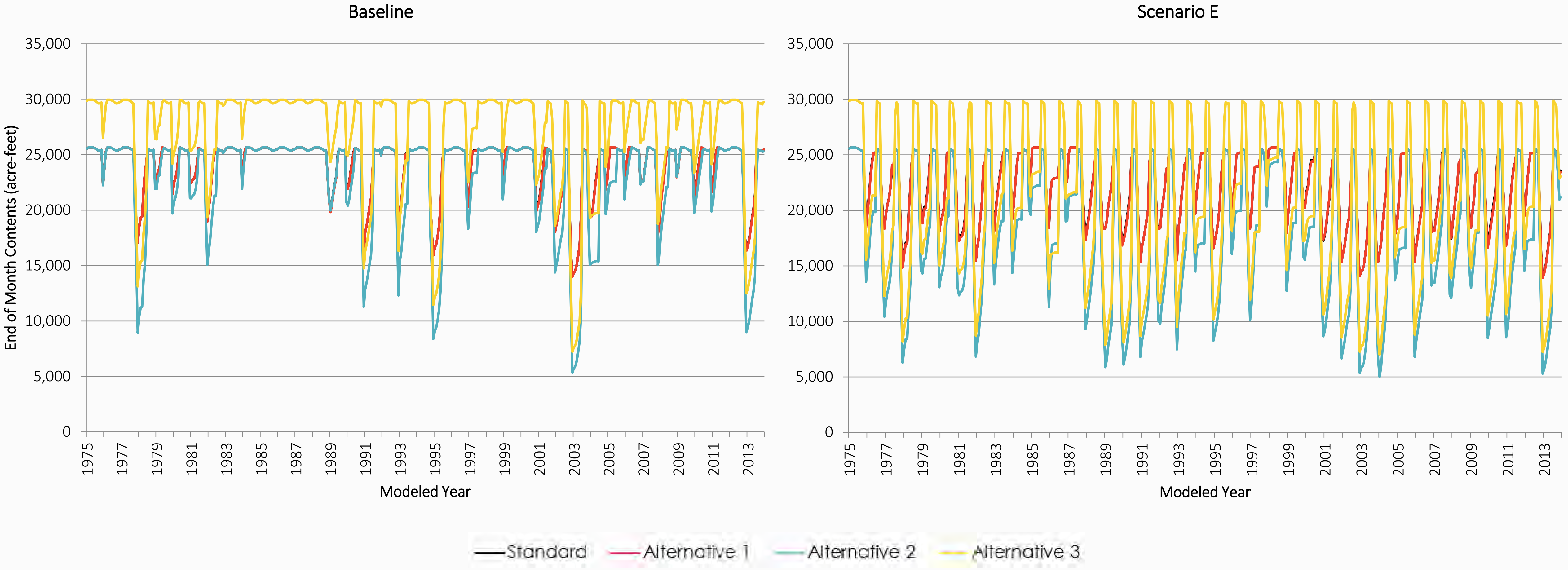
Key Structure: Stagecoach Reservoir



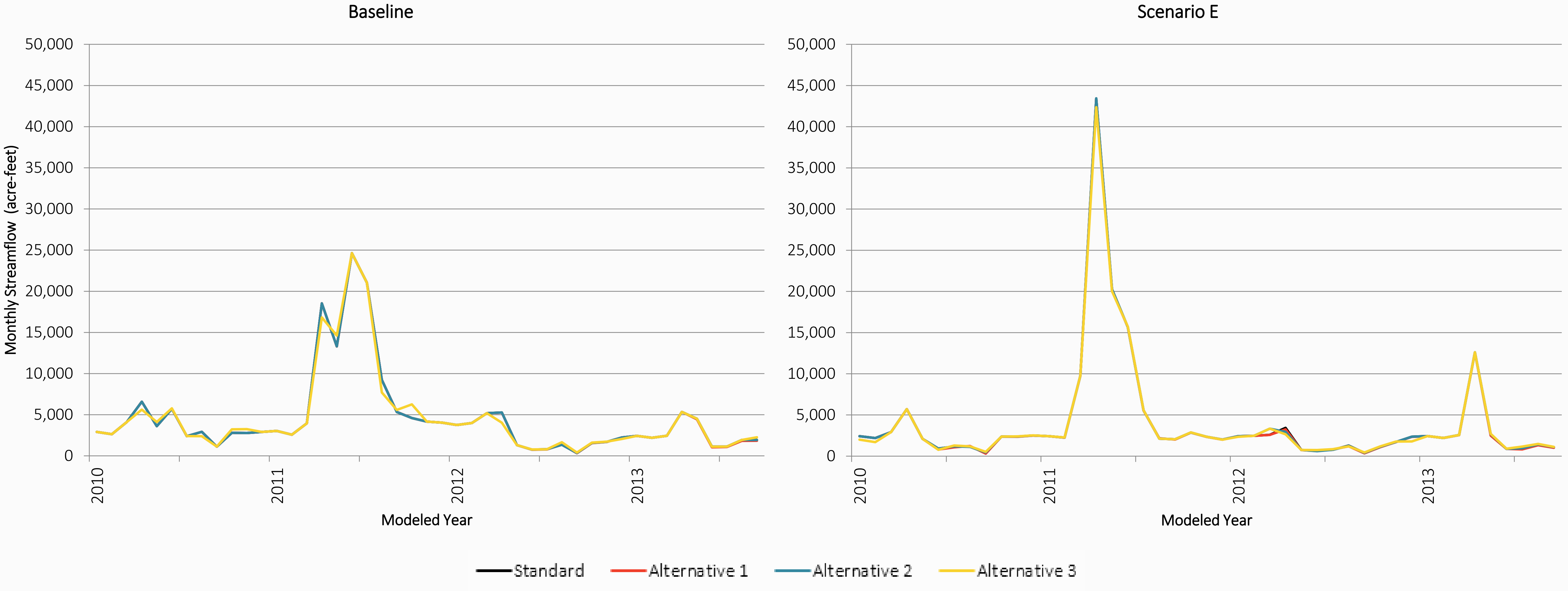
Key Structure: Steamboat Reservoir



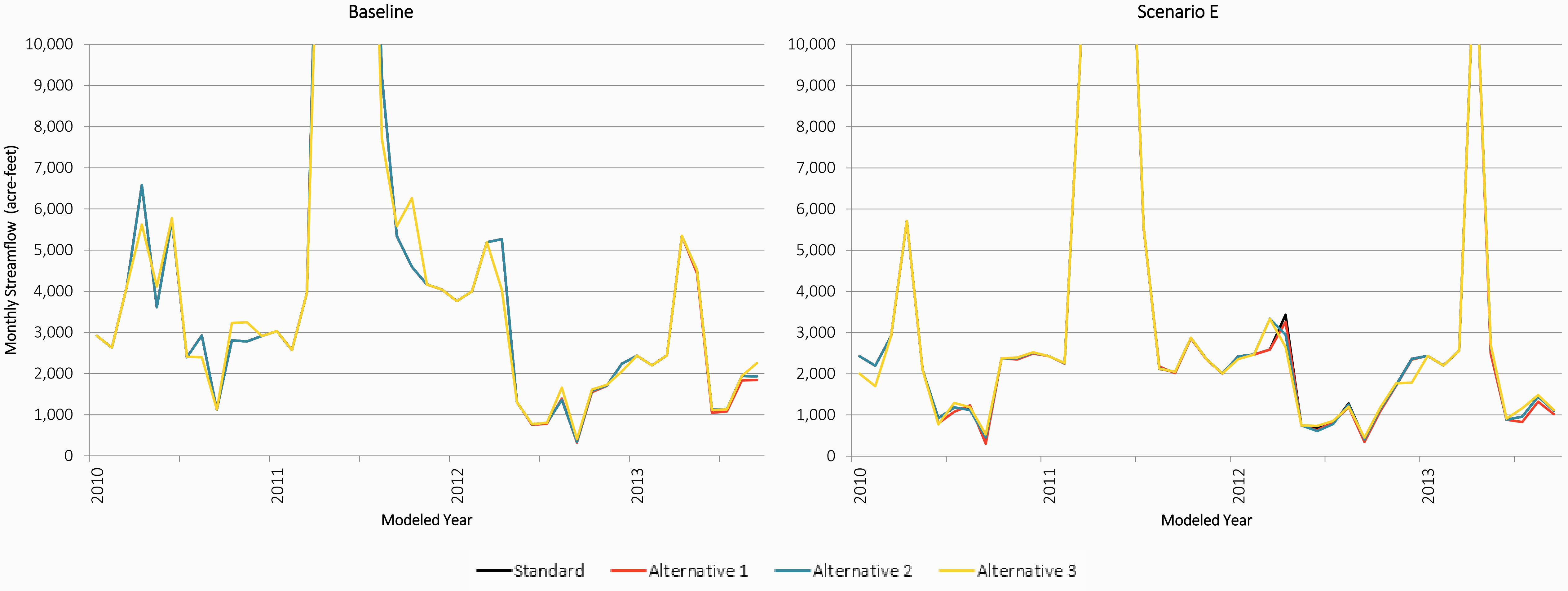
Key Structure: Elkhead Reservoir



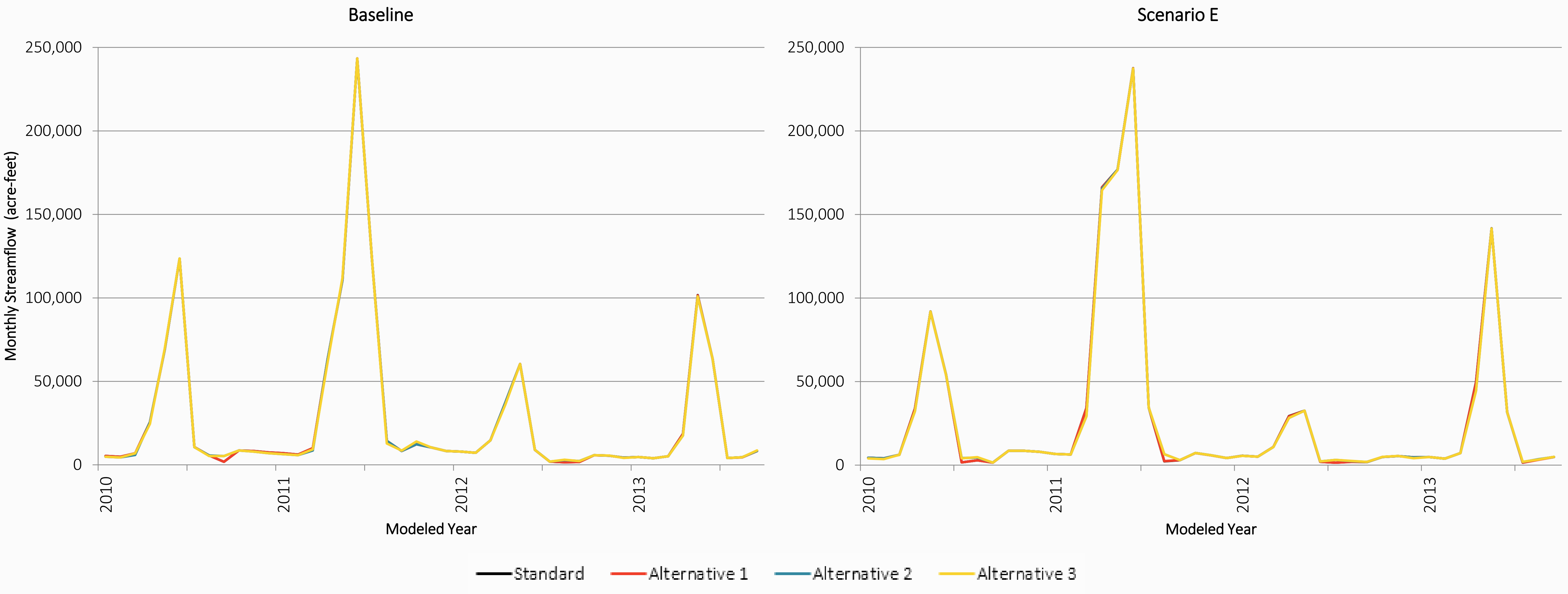
Streamflow: Stagecoach Inflow



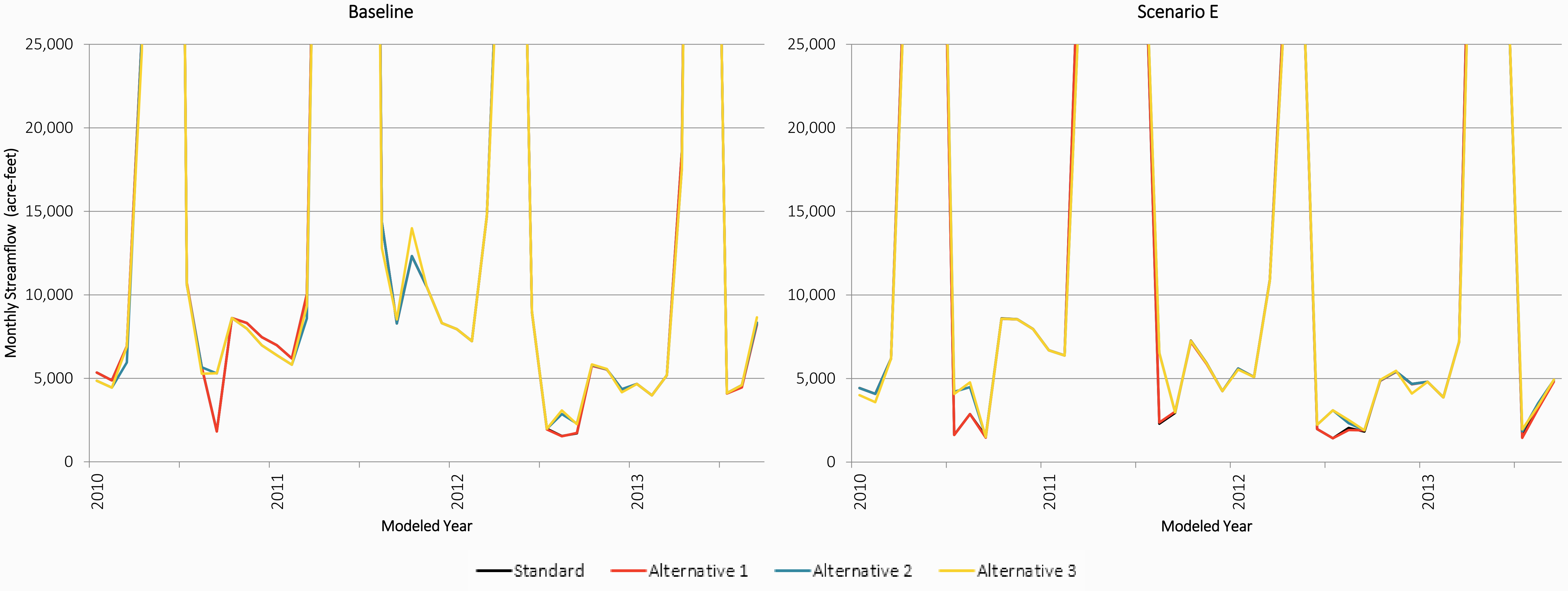
Streamflow: Stagecoach Inflow



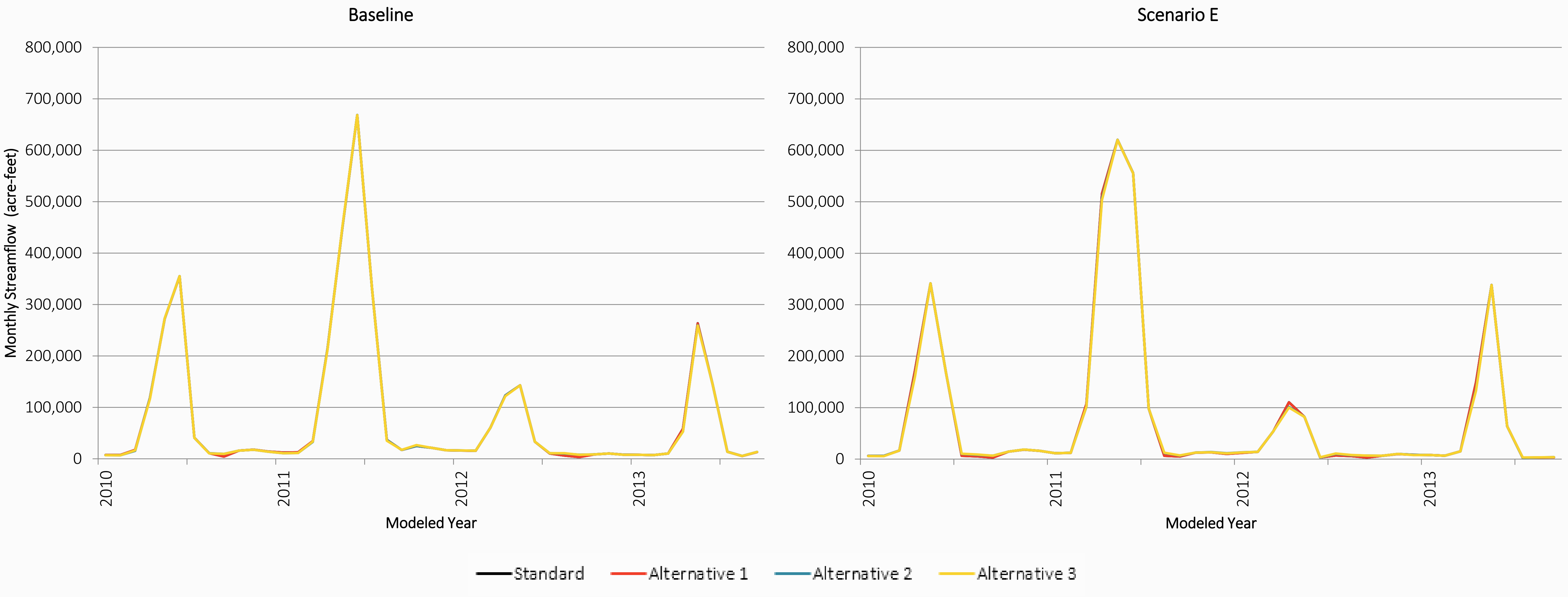
Streamflow:
Yampa at Steamboat Gage



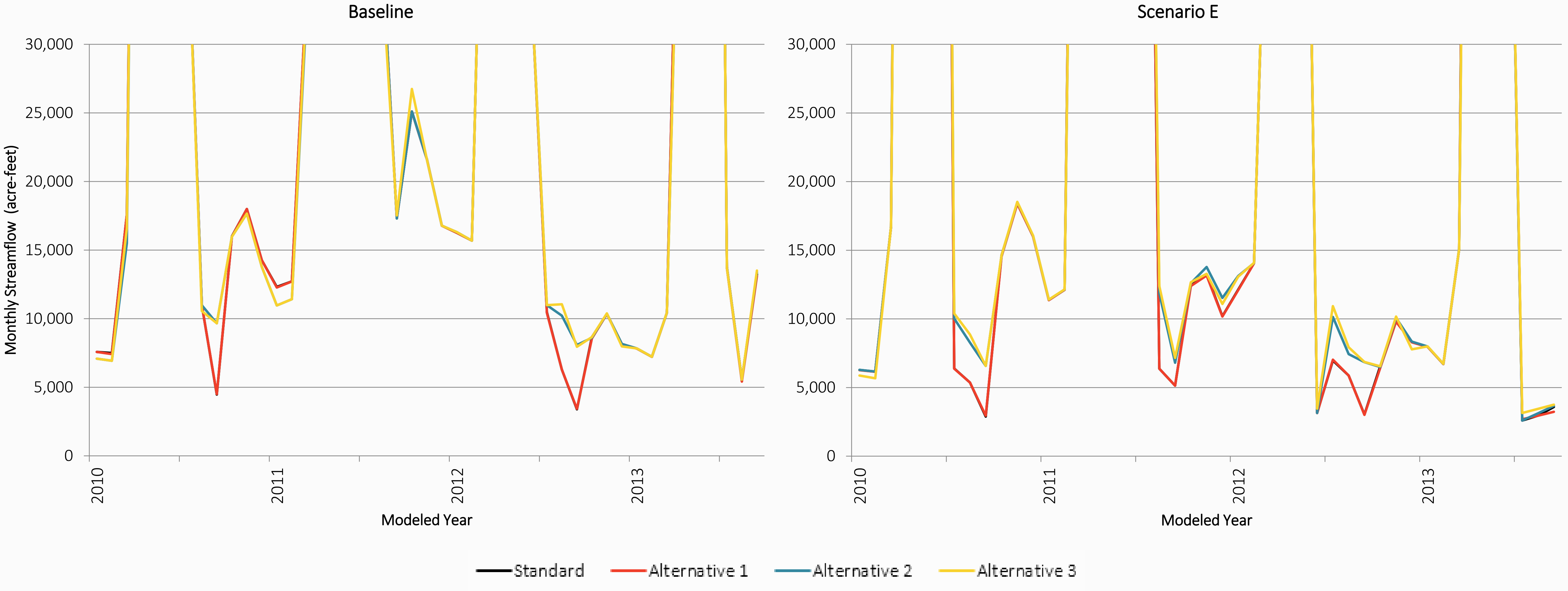
Streamflow: Yampa at Steamboat Gage



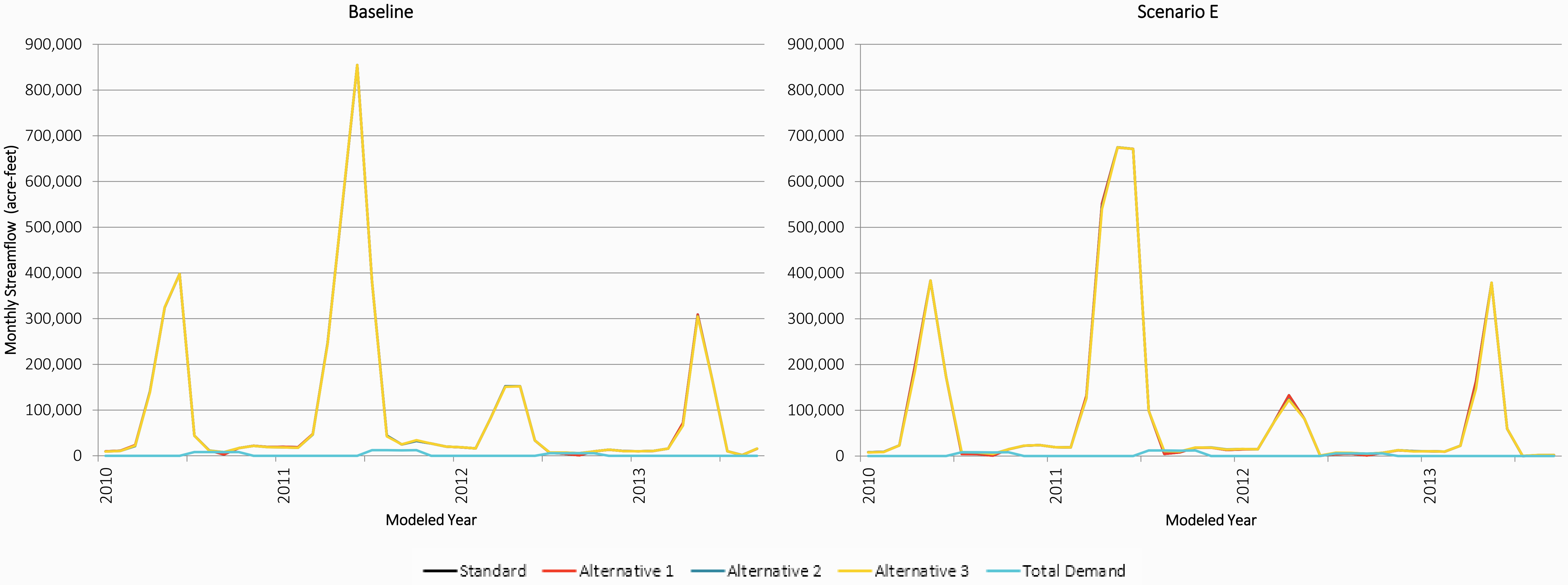
Streamflow: Craig Whitewater Park



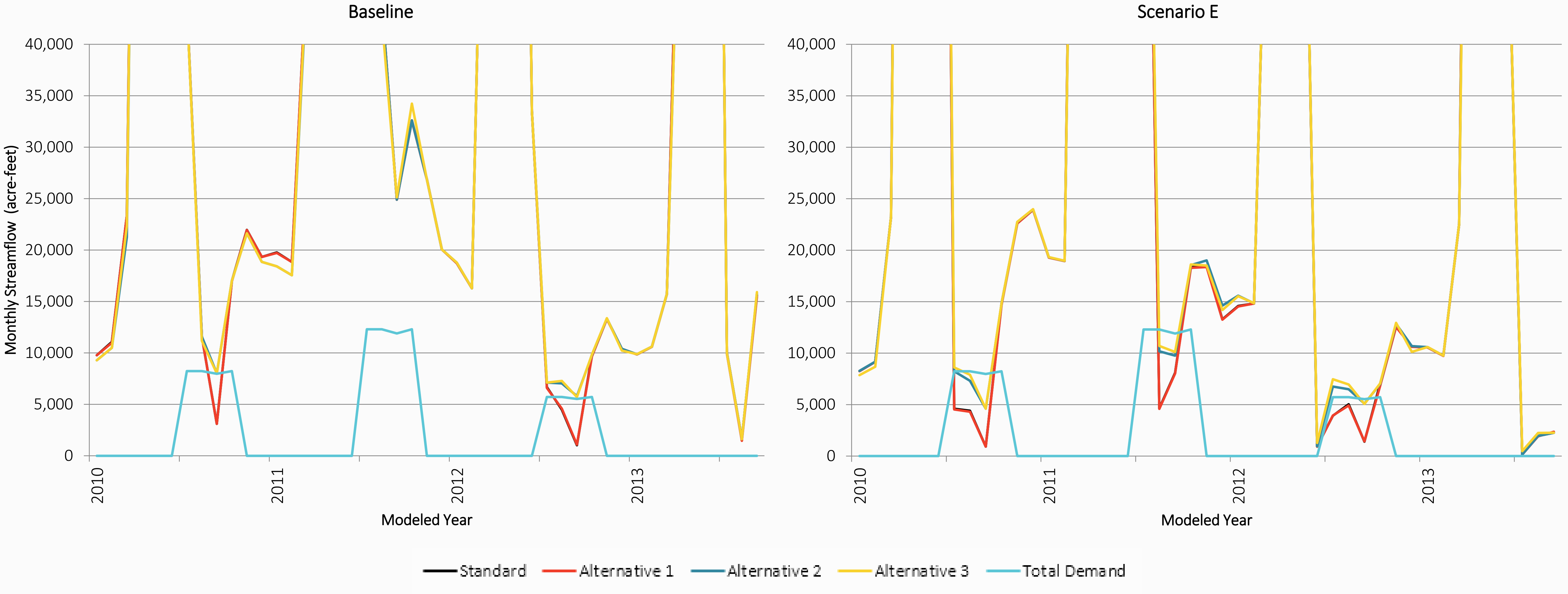
Streamflow: Craig Whitewater



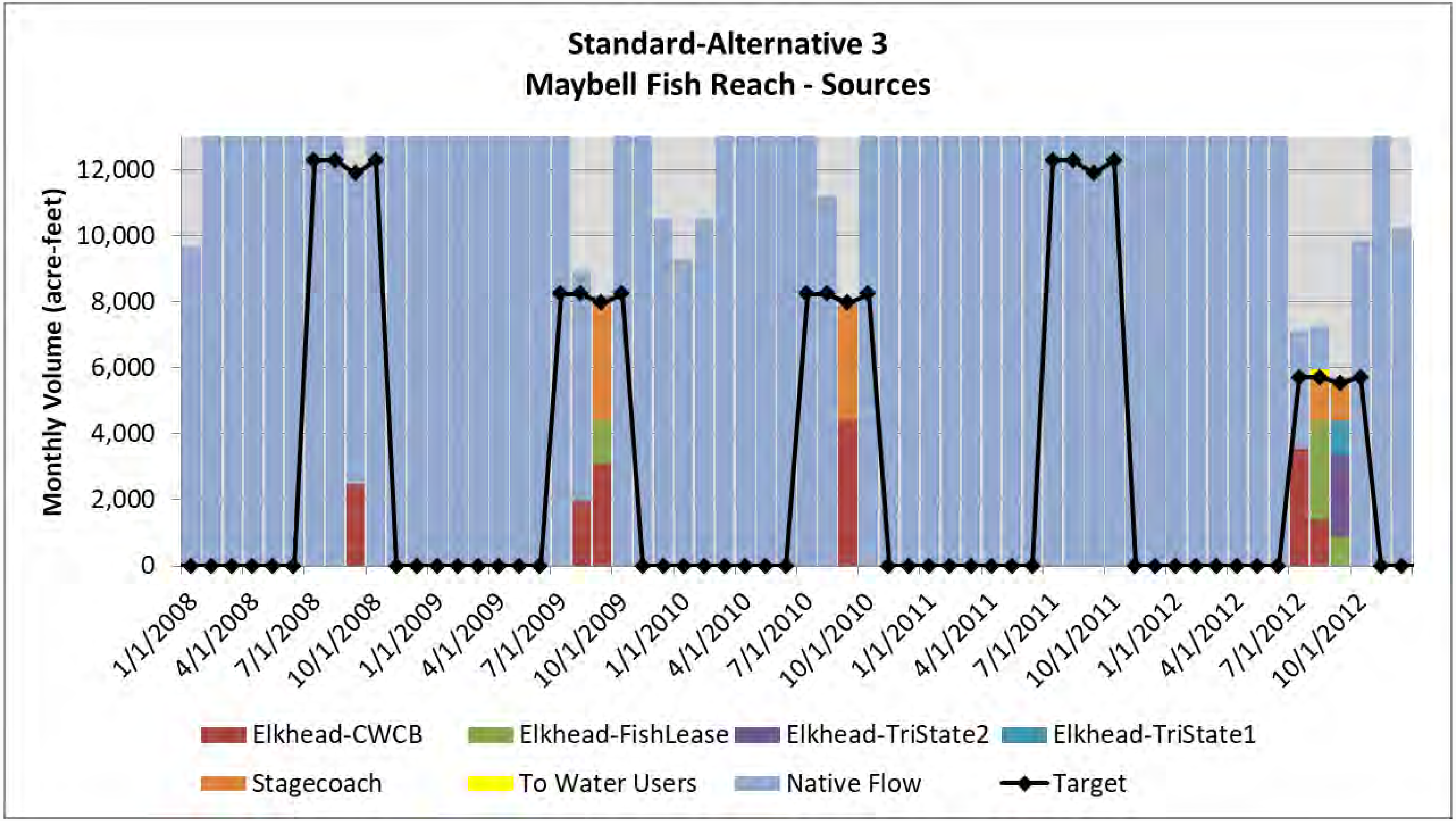
Streamflow:
Lower Yampa Reach at the Maybell Gage



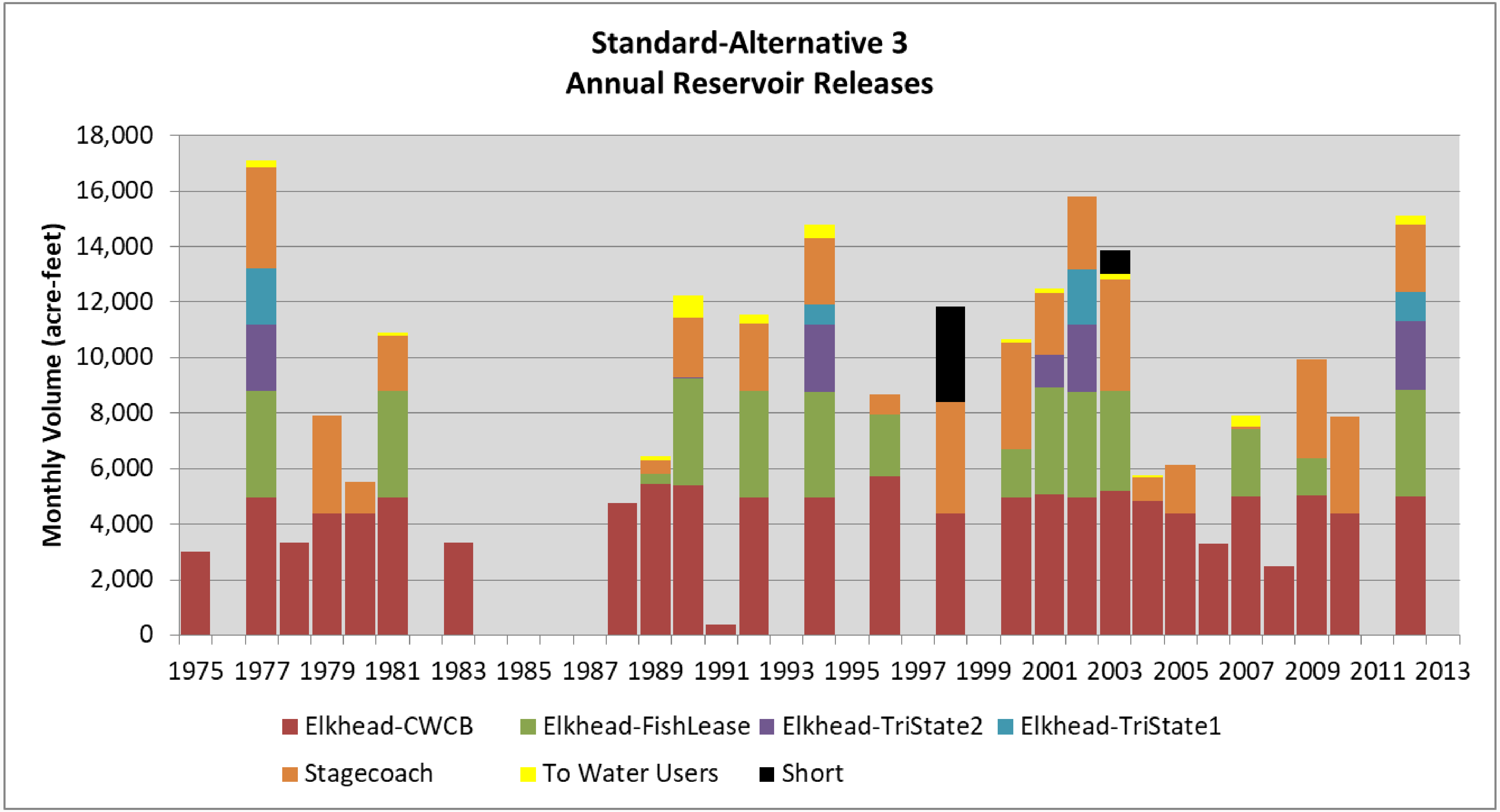
Streamflow:
Lower Yampa Reach at the Maybell Gage



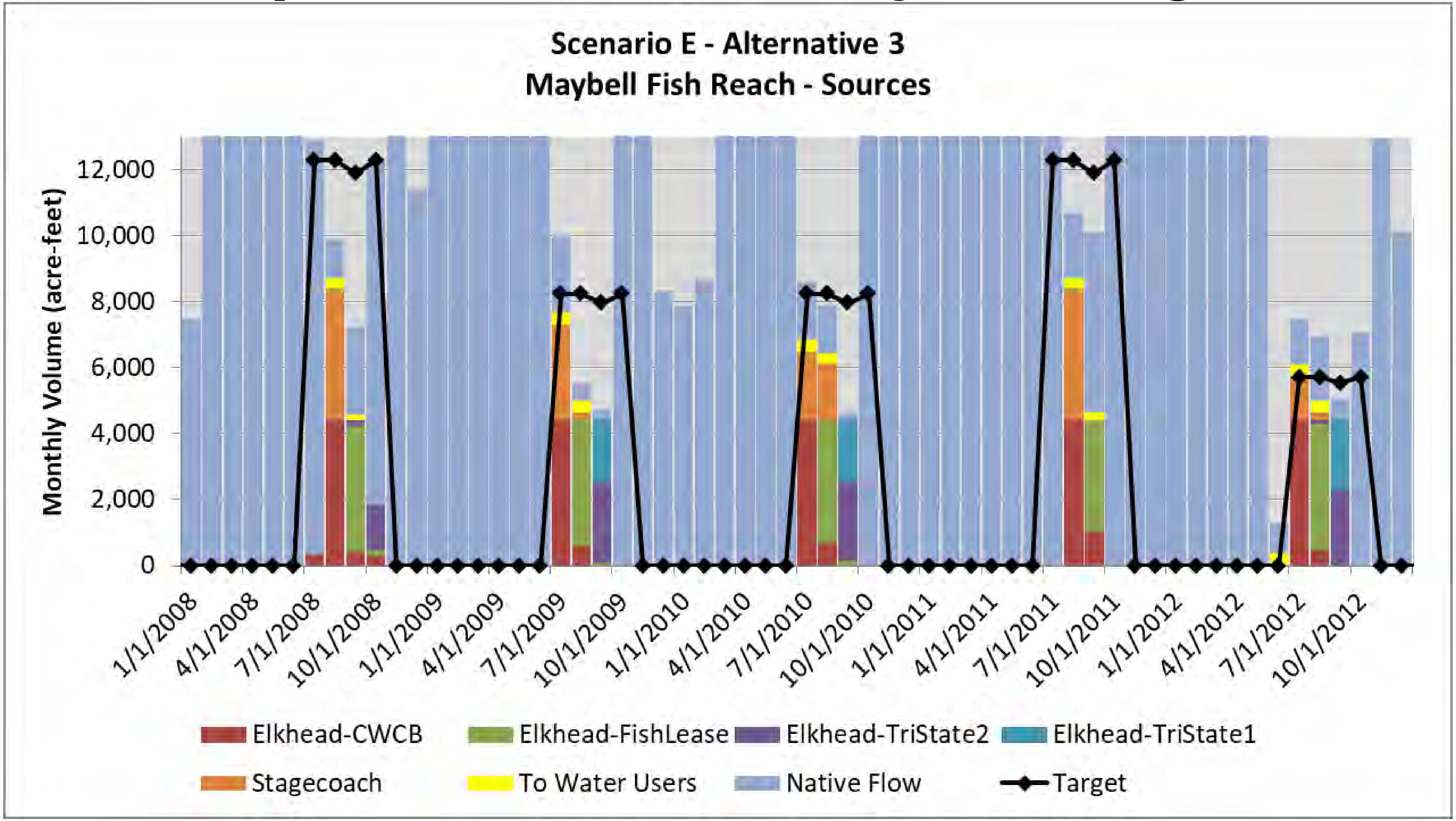
Lower Yampa Reach at the Maybell Gage



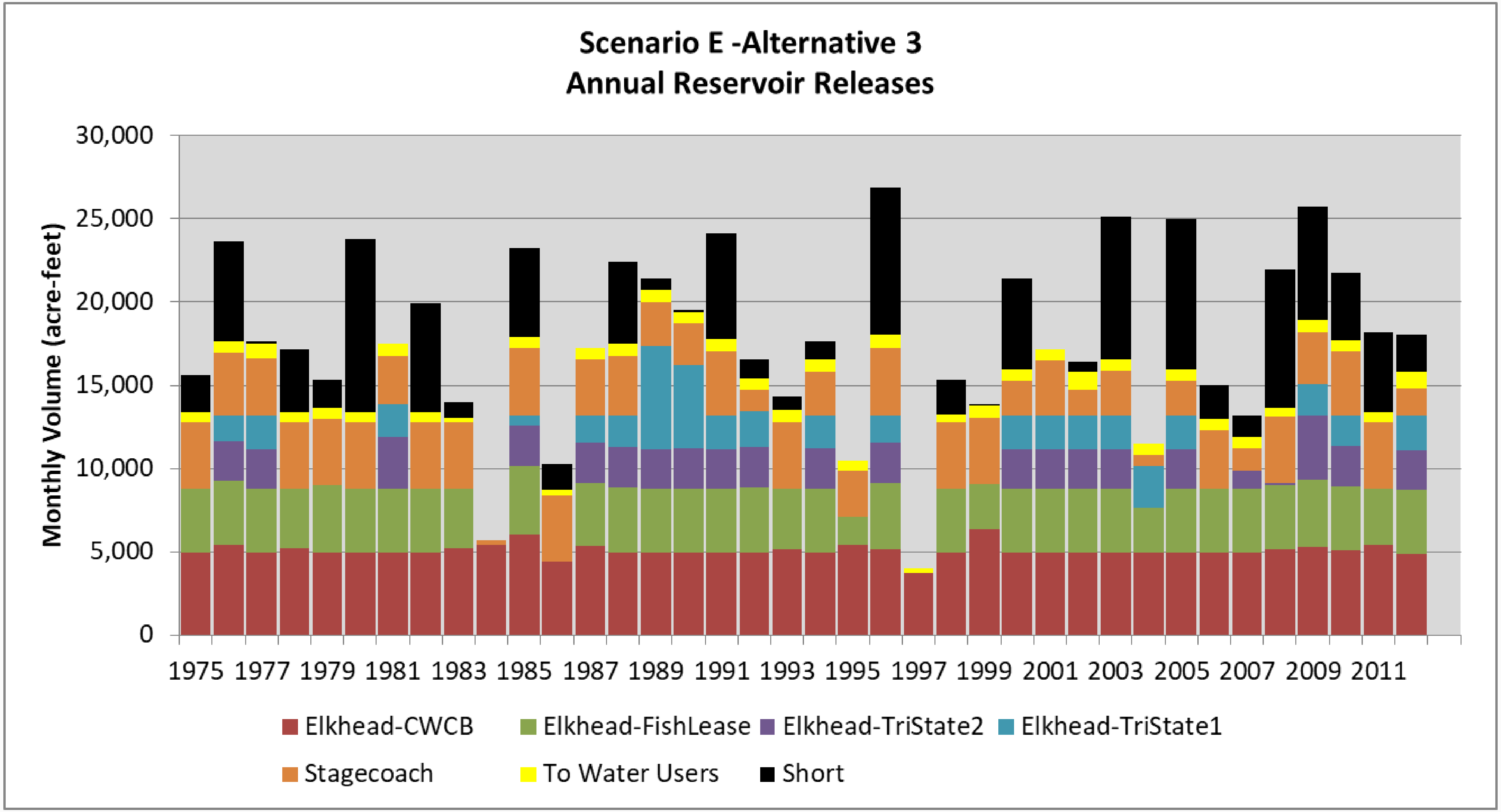
Lower Yampa Reach at the Maybell Gage



Lower Yampa Reach at the Maybell Gage



Lower Yampa Reach at the Maybell Gage



Questions?

Time Line

- Today → Last Meeting
- April → Local Expert Team writes BIP (text, graphs, figures maps)
- May → BIP Committee Deep Dive Review
- June → BIP Report goes to General Contractor for beautification
- July → CWCB Review
- Aug 10 – Sep 13 → BIP Committee Fine Tune Review (engagecwcb.org)
- Oct 13 – Nov 15 → BRT and Public Comment Period
- January 31, 2022 → Publication

Standard: Agriculture by Water District

Scenario	Average Annual Demand	Average Annual Demand Increase from Baseline	Average Annual Gap	Average Annual Gap Increase from Baseline	Average Annual Percent Gap	Average Annual CU Gap
WD54-Irr						
Baseline	64,686	NA	2,273	NA	4%	1,263
Business as Usual	64,686	NA	2,283	11	4%	1,269
Weak Economy	64,686	NA	2,282	9	4%	1,268
Cooperative Growth	78,869	14,183	5,071	2,798	6%	2,821
Adaptive Innovation	61,911	NA	5,033	2,761	8%	3,297
Hot Growth	89,478	24,792	8,309	6,036	9%	4,626
WD55-Irr						
Baseline	9,624	NA	28	NA	0%	18
Business as Usual	9,624	NA	30	1	0%	19
Weak Economy	9,624	NA	28	NA	0%	18
Cooperative Growth	11,086	1,462	41	13	0%	25
Adaptive Innovation	7,430	NA	159	131	2%	115
Hot Growth	12,756	3,132	130	101	1%	79
WD56-Irr						
Baseline	4,753	NA	0	NA	0%	0
Business as Usual	4,753	NA	0	NA	0%	0
Weak Economy	4,753	NA	0	NA	0%	0
Cooperative Growth	5,518	764	0	NA	0%	0
Adaptive Innovation	3,843	NA	0	NA	0%	0
Hot Growth	5,985	1,231	0	NA	0%	0

Alternative 1: Agriculture by Water District

Scenario	Average Annual Demand	Average Annual Demand Increase from Baseline	Average Annual Gap	Average Annual Gap Increase from Baseline	Average Annual Percent Gap	Average Annual CU Gap
WD54-Irr						
Baseline	64,686	NA	2,002	NA	3%	1,111
Business as Usual	64,686	NA	2,009	7	3%	1,115
Weak Economy	64,686	NA	2,006	4	3%	1,114
Cooperative Growth	78,869	14,183	4,676	2,674	6%	2,600
Adaptive Innovation	89,478	24,792	6,457	4,455	7%	4,241
Hot Growth	89,478	24,792	7,691	5,689	9%	4,281
WD55-Irr						
Baseline	9,624	NA	29	NA	0%	18
Business as Usual	9,624	NA	32	3	0%	20
Weak Economy	9,624	NA	29	0	0%	19
Cooperative Growth	11,086	1,462	45	16	0%	28
Adaptive Innovation	12,756	3,132	90	61	1%	63
Hot Growth	12,756	3,132	143	114	1%	87
WD56-Irr						
Baseline	4,753	NA	0	NA	0%	0
Business as Usual	4,753	NA	0	NA	0%	0
Weak Economy	4,753	NA	0	NA	0%	0
Cooperative Growth	5,518	764	0	NA	0%	0
Adaptive Innovation	5,985	1,231	0	NA	0%	0
Hot Growth	5,985	1,231	0	0	0%	0

Alternative 2: Agriculture by Water District

Scenario	Average Annual Demand	Average Annual Demand Increase from Baseline	Average Annual Gap	Average Annual Gap Increase from Baseline	Average Annual Percent Gap	Average Annual CU Gap
WD54-Irr						
Baseline	64,686	NA	2,270	NA	4%	1,261
Business as Usual	64,686	NA	2,283	13	4%	1,268
Weak Economy	64,686	NA	2,282	12	4%	1,268
Cooperative Growth	78,869	14,183	5,069	2,800	6%	2,820
Adaptive Innovation	61,911	NA	5,031	2,761	8%	3,296
Hot Growth	89,478	24,792	8,306	6,036	9%	4,625
WD55-Irr						
Baseline	9,624	NA	23	NA	0%	14
Business as Usual	9,624	NA	26	3	0%	16
Weak Economy	9,624	NA	24	1	0%	15
Cooperative Growth	11,086	1,462	40	18	0%	25
Adaptive Innovation	7,430	NA	153	131	2%	111
Hot Growth	12,756	3,132	130	107	1%	79
WD56-Irr						
Baseline	4,753	NA	0	NA	0%	0
Business as Usual	4,753	NA	0	NA	0%	0
Weak Economy	4,753	NA	0	NA	0%	0
Cooperative Growth	5,518	764	0	NA	0%	0
Adaptive Innovation	3,843	NA	0	NA	0%	0
Hot Growth	5,985	1,231	0	NA	0%	0

Alternative 3: Agriculture by Water District

Scenario	Average Annual Demand	Average Annual Demand Increase from Baseline	Average Annual Gap	Average Annual Gap Increase from Baseline	Average Annual Percent Gap	Average Annual CU Gap
WD54-Irr						
Baseline	64,686	NA	2,273	NA	4%	1,263
Business as Usual	64,686	NA	2,283	10	4%	1,268
Weak Economy	64,686	NA	2,282	9	4%	1,268
Cooperative Growth	78,869	14,183	5,066	2,793	6%	2,818
Adaptive Innovation	61,911	NA	5,028	2,756	8%	3,294
Hot Growth	89,478	24,792	8,304	6,032	9%	4,624
WD55-Irr						
Baseline	9,624	NA	21	NA	0%	13
Business as Usual	9,624	NA	23	2	0%	15
Weak Economy	9,624	NA	21	0	0%	13
Cooperative Growth	11,086	1,462	38	17	0%	24
Adaptive Innovation	7,430	NA	151	130	2%	109
Hot Growth	12,756	3,132	128	107	1%	78
WD56-Irr						
Baseline	4,753	NA	0	NA	0%	0
Business as Usual	4,753	NA	0	NA	0%	0
Weak Economy	4,753	NA	0	NA	0%	0
Cooperative Growth	5,518	764	0	NA	0%	0
Adaptive Innovation	3,843	NA	0	NA	0%	0
Hot Growth	5,985	1,231	0	NA	0%	0

APPENDIX D

Project_ID	Project_Name	Project_Description	Key_Word_1	Key_Word_2	Key_Word_3	Key_Word_4	Status	Lead_Proponent	Lead_Contact	Municipal_Ind_Need	Agricultural_Need	Envr_Rec_Need	Admin_Need	Latitude	Longitude	Lat_Long_Flag	County
YW-2015-0001	Elkhead Reservoir Enlargement Project	When Elkhead Reservoir was enlarged in 2005, it was designed to accommodate a 4 foot enlargement. The increased storage could be used to meet any number of water demands in the basin. The costing tool was used to estimate costs for this project. The cost assumed a 4 foot enlargement and included construction, engineering, legal, and permitting costs.	Storage	Supply & Demand Gap	Agriculture	Conservation	Planned	Colorado River Water Conservation District	Hunter Causey	50	50	0	0	40.558465	-107.382864	G = coordinates are good; provided by the consultant in either an Excel datasheet or GIS shapefiles	Moffat
YW-2015-0002	Fish Creek Filtration Plant Expansion	Capacity increase from 7.5 to 12 mgd (2030-2040)	Supply & Demand Gap				Planned	Mt Werner Water / City of Steamboat Springs	Frank Alfone, MWWD	50	50	0	0	40.474968	-106.690705	G = coordinates are good; provided by the consultant in either an Excel datasheet or GIS shapefiles	Routt
YW-2015-0003	Lake Avery Enlargement	Enlargement of Lake Avery by up to 5,000 af	Supply & Demand Gap	Conservation			Planned	Yellow Jacket Water Conservancy District	Scott Grosscup	15	25	60	0	39.970424	-107.647635	G = coordinates are good; provided by the consultant in either an Excel datasheet or GIS shapefiles	Rio Blanco
YW-2015-0004	Little Bear 1 Reservoir						Not Pursuing			50	50	0	0	40.710606	-107.421731	G = coordinates are good; provided by the consultant in either an Excel datasheet or GIS shapefiles	Moffat
YW-2015-0005	Milk Creek Reservoir						Not Pursuing	Juniper WCD		50	50	0	0	40.249974	-107.745547	G = coordinates are good; provided by the consultant in either an Excel datasheet or GIS shapefiles	Moffat
YW-2015-0006	Lower White River Storage Project/Wolf Creek Reservoir	The Project addresses and meets or helps meet a wide variety of Agricultural, Environmental & Recreational, Municipal and Industrial water needs. It supports a number of other listed IPP's including 15-0016, 20-0007, 0008, 0020, 0022, 0026, 0028, 0030, 0040, 0050. The preferred alternative is a reservoir on Wolf Creek and a White River reservoir is still an alternative.	Storage	Supply & Demand Gap	Agriculture	Environmental	Planned	Rio Blanco Water Conservancy District	Al VandenBrink	25	25	25	25	40.205896	-108.481635	G = coordinates are good; provided by the consultant in either an Excel datasheet or GIS shapefiles	Rio Blanco
YW-2015-0007	Monument Butte Reservoir						Not Pursuing			50	50	0	0	40.251776	-107.611452	G = coordinates are good; provided by the consultant in either an Excel datasheet or GIS shapefiles	Moffat
YW-2015-0008	Stagecoach Reservoir Augmentation -- Morrison Creek Reservoir Alternate						Planned	Upper Yampa Water Conservancy District		50	50	0	0	40.248164	-106.787152	G = coordinates are good; provided by the consultant in either an Excel datasheet or GIS shapefiles	Routt

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YW-2015-0009	Oil Shale Production Pipelines/Diversion (new Diversions)						Not Pursuing			50	50	0	0			M1 = coordinates not determined because general location cannot be determined from IPP name or description	
YW-2015-0010	Energy Fuel Reservoir #2, pka Peabody Trout Creek Reservoir	Multi-use reservoir facility located on Trout Creek. Conditional water rights originally held by Peabody Energy, sold to a new entity in 2019. Intent is to move forward with multi-use storage components. 20 year planning horizon.	Storage	Additional	Additional	multi-use	Planned	Private Anonymous Entity	Matt Brown at Confluence Water (matt@confluencewater.com)	30	30	30	10	40.424249	-106.972174	G = coordinates are good; provided by the consultant in either an Excel datasheet or GIS shapefiles	Routt
YW-2015-0011	Rampart Reservoir						Not Pursuing			50	50	0	0	40.614027	-107.469761	G = coordinates are good; provided by the consultant in either an Excel datasheet or GIS shapefiles	Moffat
YW-2015-0012	South Fork II Reservoir						Not Pursuing			50	50	0	0	40.785453	-107.487236	G = coordinates are good; provided by the consultant in either an Excel datasheet or GIS shapefiles	Moffat
YW-2015-0013	Stagecoach Reservoir Augmentation -- Upper Morrison Diversion Alternate	Diversion along upper portion of Morrison Cr and delivery into Stagecoach Res eother via Little Morrison Creek or pipeline along CR 16					Planned	Upper Yampa Water Conservancy District		50	50	0	0	40.224965	-106.782295	G = coordinates are good; provided by the consultant in either an Excel datasheet or GIS shapefiles	Routt
YW-2015-0014	Steamboat Springs Water Conservation Program	Reduce average gpd/EQR average by 10% in 2030. Cost was estimated using the Steamboat Springs 2020 Water Conservation Plan.	Conservation	Education, Outreach & Innovation			Implementing	Mt Werner Water / City of Steamboat Springs		50	50	0	0	40.47769663	-106.8243216	g2 = coordinates based on centroid of municipal boundary	Routt
YW-2015-0014-A	Foundational	Improved metering and billing, water loss management and control, integrate land use and conservation															
YW-2015-0014-B	Technical Assistance and Incentives	Reduce water use at City facilities, reduce customer water use, integrate technical assistance and incentives with land use planning															
YW-2015-0014-C	Regulations and Ordinances	Update water use regulations, incorporate water conservation into policy, Code and CDC															
YW-2015-0014-D	Education	Website, training, rain barrels, etc.															
YW-2015-0015	Wolf Creek Reservoir						Not Pursuing							40.193374	-108.497654	G = coordinates are good; provided by the consultant in	Rio Blanco
YW-2015-0016	Rangely Raw/Irrigation		Supply & Demand Gap	Additional	Watershed Health,		Planned	Colorado Northwest		50	50	0	0	40.08609128	-108.7794598	g2 = coordinates	Rio Blanco
YW-2015-0016-A	Raw Water Pump Station Improvements & Raw Water Bulk Filling Station (Town of Rangely)																
YW-2015-0016-B	White River Public Access Points (Town of Rangely &Western Rio Blanco County Recreation District)																
YW-2015-0016-C	Flood Retention Ponds (Town of Rangely)																

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YW-2015-0016-D	Biological Ponds (Town of Rangely, CNCC, Western Rio Blanco County Rec. District)																
YW-2015-0016-E	Surf Park, Splash Park, Side Channel Recreation Park (Town of Rangely, Western Rio Blanco County Rec. District)																
YW-2015-0017	Yampa River Water Treatment Plant	New surface water treatment plant from Yampa River. Dependent on possible development of Stagecoach ski area and/or new golf course development. The costing tool was used to estimate the cost of a new WTP. A peak of 12 cfs and an average of 9 cfs was used.					Planned	Morrison Creek WSD		100	0	0	0	40.26932	-106.880842	G = coordinates are good; provided by the consultant in either an Excel datasheet or GIS shapefiles	Routt
YW-2015-0018	Elk River Project	Steamboat L. storage supply and Elk R. WTP (3-5MGD). The costing tool was used to estimate the cost of a new WTP. A peak of 5 MGD, and a an average of 4 MGD was assumed.					Planned	City of Steamboat Springs		50	50	0	0	40.545757	-106.908046	G = coordinates are good; provided by the consultant in either an Excel datasheet or GIS shapefiles	Routt
YW-2015-0019	Yampa River Wells	New infiltration gallery, additional treament and vertical wells (2020-2022). Cost estimate is for a new infiltration gallery, and does not include the cost of new wells.					Planned	Mt Werner Water & City of Steamboat	Frank Alfone/Kelly Romero-Heaney	50	50	0	0	40.445847	-106.818911	G = coordinates are good; provided by the consultant in either an Excel datasheet or GIS shapefiles	Routt
YW-2015-0020	Yellow Jacket Water Conservancy District Reservoir Feasibility Study						Completed	Yellow Jacket Water Conservancy District		50	50	0	0	40.094338	-107.463346	G = coordinates are good; provided by the consultant in either an Excel datasheet or GIS shapefiles	Rio Blanco
YW-2015-0021	Demand Management, fka Colorado River Compact Water Bank						Planned	Colorado River Water Conservation District, Southwestern Water Conservation District, The Nature Conservancy, State of Colorado, GVWUA		50	50	0	0	40.4807	-107.75717	g15 = coordinates based on centroid of basin	Routt, Moffat, Rio Blanco
YW-2015-0022	Upper Yampa backwater modifications	Stakeholders would develop multi-faceted projects implementing habitat modifications/restoration activities to alleviate unnatural backwater habitats to minimize non-native species recruitment and improve ecological functions of the riverine system, e.g. Walton Creek. Multiple recreational benefits would be realized as well.					Not Pursuing	No proponent identified		0	0	100	0	40.453301	-106.81747	G = coordinates are good; provided by the consultant in either an Excel datasheet or GIS shapefiles	Routt
YW-2015-0023	Loudy-Simpson/Yampa River Corridor Project	Diversion Improvement, Whitewater Park and related improvements, including boat ramp and access trail					Planned	City of Craig/Moffat County	Peter Brixius-CIty Manager	25	0	75	0	40.499972	-107.552893	G = coordinates are good; provided by the consultant in either an Excel datasheet or GIS shapefiles	Moffat

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YW-2015-0024	Upper Elkhead Creek Stream Restoration	Indirect benefits to consumptive uses include a reduction in sediment entering Elkhead Reservoir.	Watershed Health, Environment & Recreation	Storage			Implementing	Forest Service	Rick Henderson	10	0	90	0	40.724235	-107.123612	g9 = coordinates based on general location on stream	Routt
YW-2015-0025	Implementation of projects that improve instream and riparian habitat, irrigation infrasturcture and/or flows						Not Pursuing	Trout Unlimited		0	0	100	0	0	0	M2 = coordinates not determined because IPP is an E&R IPP	
YW-2015-0026	Yampa River Structures Project	Objectives: - To enhance/preserve the natural character of the Yampa River in downtown Steamboat Springs through river rehabilitation improvements. - Improve upon and create additional recreational boating and fishing opportunities in the Yampa River in downtown Steamboat Springs. - To enhance the value of the River as a community amenity through access points and recreational use opportunities. - Improve public safety by rebuilding the D-Hole which was built with outdated methodology and isn't functioning properly.					Completed	Friends of the Yampa		0	0	100	0	0	0	M2 = coordinates not determined because IPP is an E&R IPP	
YW-2015-0027	Diversion and riparian restoration on the Yampa River through Morgan Bottom Creek	Watershed planning and implementation of riparian restoration, bank and channel restoration and irrigation infrastructure improvement projects through the Morgan Bottom reach. Stakeholders are developing multi- purpose projects that will restore riparian habitat, upgrade irrigation infrastructure and control erosion along this reach of the Yampa River.	Agriculture	Watershed Health, Environment & Recreation	Land Use		Implementing	The Nature Conservancy	Jennifer Wellman	0	50	50	0	40.51216	-107.20476	g9 = coordinates based on general location on stream	Routt
YW-2015-0028	Optimize flow protection and augmentation	Optimize flow protection , ecosystem needs, recovery of endangered fish species and other non-consumptiove attributes. In the context of the Yampa PBO and development of the White River PBO, consider updated calculations of existing and new depletions; potential storage obligations and opportunities; aquatic habitat resilience; and non-native fish and invasive vegetation proliferation.	Watershed Health, Environment & Recreation				Implementing	The Nature Conservancy, Fish & Wildlife Service		0	0	100	0	0	0	M2 = coordinates not determined because IPP is an E&R IPP	Routt Moffat
YW-2015-0029	Assess flow regime for endangered fish recovery	Assess the flow regime for endangered fish recovery in conjunction with new, in-basin consumptive IPPs, protect or augment flows, and control non-native fish, all as needed for a PBO. A PBO is needed to provide certainty for new, inbasin consumptive IPPs and to assist with endangered fish recovery	Watershed Health, Environment & Recreation				Implementing	The Nature Conservancy, Fish & Wildlife Service, Recovery Program.		0	0	100	0	0	0	M2 = coordinates not determined because IPP is an E&R IPP	Routt Moffat
YW-2015-0030	Flow protection and augmentation for warm-water fish and cottonwood	Optimize flow protection augmentation in conjunction with new in-basin consumptive IPPs to reduce flow alteration risks to warm-water fish survival and cottonwood abundance	Watershed Health, Environment & Recreation				Planned	The Nature Conservancy		0	0	100	0	0	0	M2 = coordinates not determined because IPP is	Routt Moffat
YW-2015-0031	Yampa Preferred Target Flow Through Steamboat Springs	Supplement flows on the Yampa River through the City for a variety of municipal uses, including, but not limited to, recreation, water quality, enhanced fishery and other purposes. These enhanced flows during low periods will reduce temperature and increase D.O. for other nonconsumptive attributes in the same reach. This reach of the Yampa is on the 303D Monitoring and Evaluation List for temperature. Morphed into 2020-0001 & 0002	Watershed Health, Environment & Recreation				Implementing	City of Steamboat Springs		0	0	100	0	40.47769663	-106.8243216	g2 = coordinates based on centroid of municipal boundary	Routt
YW-2015-0032	Recreational, habitat and managemnt strategy improvements	Implement recreational and habitat improvements and management strategies to support ecosystem function as well as recreational needs within the Yampa River stream corridor through Steamboat Springs. Update the Steamboat Springs Yampa River Management Plan and Structures Master Plan as needed. Implementation of the Yampa River Management Plan and Structures Master Plan has been on-going since 2003. Implementation of remaining projects and/or re-evaluation of plans are warranted. Other uses: support recreational access.					Completed	Potentially City of Steamboat Springs, Friends of the Yampa, CPW		0	0	100	0	40.485918	-106.837429	G = coordinates are good; provided by the consultant in either an Excel datasheet or GIS shapefiles	Routt
YW-2015-0033	Augment instream flow shortages to Elk River and Willow Ck through releases from Steamboat or Pearl Lakes. Implement as needed or in the future conjunctively with City's Elk River Project (YW-2015-0018 and YW-2020-0002-A) as 'stream flow management'.	Willow Ck ISF (5.0 cfs) currently augmented late summer by releases from Steamboat Lake whenver possible; 65 cfs ISF on Elk River have also been met w/ releases from Steamboat or Pearl Lakes.	Watershed Health, Environment & Recreation				Implementing	CPW, CWCB	David Graf	0	0	100	0	0	0	M2 = coordinates not determined because IPP is an E&R IPP	Routt
YW-2015-0034	Cross Mountain Canyon Ranch - habitat and recreational improvements	BLM's 2013 acquisition of the Cross Mountain Canyon Ranch includes 2.5 miles of riverside property where river access is proposed. The BLM is now the property's long-term conservation steward and will look to install visitor facilities on the property among other maintenance and improvement work for recreational and habitat needs.	Watershed Health, Environment & Recreation				Implementing	BLM		0	0	100	0	40.490331	-108.335052	G = coordinates are good; provided by the consultant in either an Excel datasheet or GIS shapefiles	Moffat

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YW-2015-0035	Yamps River Habitat & Recreation Improvement at Pleasant Valley, fka Sarvis Creek habitat and recreational access improvements	Improve stream health, function and recreational opportunties on abouit 4300 fl Yampa River near Sarvis Creek					Implementing	Yampa Valley Stream Improvement Charitable Trust	Drew Johnroe	0	0	100	0	40.299483	-106.8033	G = coordinates are good; provided by the consultant in either an Excel datasheet or GIS shapefiles	Routt
YW-2015-0036	Duffy Canyon river access and riverside camping	Project established on-river camping opportunities for float boaters that is currently lacking and additional improvements to river access within Duffy Canyon					Completed	BLM		0	0	100	0	40.420681	-107.867563	G = coordinates are good; provided by the consultant in either an Excel datasheet or GIS shapefiles	Moffat
YW-2015-0037	Wolery Ditch diversion structure rebuild	Friends of the Yampa has been working with the owners of the Woolery Ditch to prepare for a structural project that would rectify the need to build a push up dam for the ditch every few years. Location would be optimal for an agricultural/recreational partnership as diversion structure would be built to accommodate both attributes. For the cost estimate, it was assumed that the headgate had a max capacity of 33 cfs and only the diversion dam was rebuilt. The costing tool was used for this estimate.					Planned	Friends of the Yampa/Wolery Ditch owners	Kent Vertrees	0	0	100	0	40.496951	-106.859428	G = coordinates are good; provided by the consultant in either an Excel datasheet or GIS shapefiles	Routt
YW-2015-0038	New decreed instream flows	This includes all newly decreed instream flow adjudications applied for by the CWCB (i.e. Red Creek instream flow is currently going through the water court process). Note while these junior decreed reaches may provide protection from future development, regional/system-wide solutions are needed to meet existing instream flow shortages.	Watershed Health, Environment & Recreation				Implementing	Stakeholders who sponsor an instream flow for CWCB review		0	0	100	0	0	0	M2 = coordinates not determined because IPP is an E&R IPP	NA
YW-2015-0039	Watershed Planning Process						Concept	Routt County Conservation District		0	0	100	0	0	0	M2 = coordinates not determined because IPP is an E&R IPP	
YW-2020-0001	Steamboat Springs Water Quality Trading Program	Flow and riparian restoration for temperature management and WWTP comliance					Planned	City of Steamboat Springs	Kelly Romero-Heaney	50	0	50	0	40.47769663	-106.8243216	g2 = coordinates based on centroid of municipal boundary	Routt
YW-2020-0002	Yampa River Health Assessment & Streamflow Management Plan	See descriptions below under sub- projects. (https://steamboatsprings.net/587/Yampa-River-Health-Streamflow-Management)	Watershed Health, Environment & Recreation	Land Use	Education		Planned	City of Steamboat Springs & Partners	Kelly Romero-Heaney	0	0	100	0	0	0	M2 = coordinates not determined because IPP is an E&R IPP	Routt
YW-2020-0002-A	Stream Flow Management	Seek water contracts to meet instream flow objectives, identify owned water rights that coudl be used for flow augmentation, explore other market-based flow restoration projects, improve diversion structures															
YW-2020-0002-B	Land and Stream Restoration	Native vegetation restoration, watershed health projects, nutrient source evaluation, evaluate other identifeid restoration projects, conduct wetlands construction or enhancement feasibility assessment															
YW-2020-0002-C	Land Use and Planning	Review existing regulations and plans, integrate Green infrastructure concepts into City standards, policies and procedures, establish ID "Stream Team", ID high priority parcels for aquisition															
YW-2020-0002-D	Education and Outreach	Develop K-12 curriculum, improve awareness about river health, establish long-term funding sources for Yampa River management															
YW-2020-0003	Fish Creek Critical Community Wildfire Watershed Protection Plan (CWP)2	http://co-steamboatsprings.civicplus.com/DocumentCenter/View/20031/FishCreek_CWP2	Watershed Health, Environment & Recreation	Education, Outreach & Innovation			Planned	City of Steamboat Springs & Mount Werner Water & Sanitation District	Frank Alfone/Kelly Romero-Heaney	100	0	0	0	40.475058	-106.784564	g9 = coordinates based on general location on stream	Routt
YW-2020-0003-A	Create a more FIre Resistant Landscape	Create defensible space at Fish Creek WTP, evaluate/complete Sanctuary and Burgess Cr. CWPP recommendations, work with USFS to evaluate/maintain fuels treaments, assess, monitor and maintain riparian corridors, assess and monitor forest condition. Note that the cost is per acre.															
YW-2020-0003-B	Post-fire Hydrologic and Sediment Controls	Rain gage installation, BAER support, infrastructure protection															

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YW-2020-0003-C	Educate Communicty and Guests	Signage in high use areas, watershed walks, volunteer days															
YW-2020-0003-D	Preemptive Mitigation, Wildfire Response, Post-Fire Emergency Stabilization, Recovery/Restoration	Collaborate with key stakeholders, partner on mitigation and coordinate outreach															
YW-2020-0003-E	Water Supply System Resiliency	Complete near-term action items, plan for mid-size/range improvements, evaluate and determine course of action for large scale, long range improvements. Facilities Master Plan for FIsh Creek Water Treatment Plant in process.					Implementing										
YW-2020-0004	Stagecoach Reservoir Augmentation -- Morrison Creek Siphon Alternate	Siphon that would deliver water into Stagecoach Reservoir					Concept	Upper Yampa WCD		50	50	0	0	40.285594	-106.83228	g4 = coordinates based on location of reservoir	Routt
YW-2020-0005	White River Integrated Water Initiative	Community-based initiative to identify actions promoting a healthy river that ensures a vibrant agricultural community and maintains healthy fisheries while protecting water rights, quantity, and quality with respect for the local customs, cultures, and property rights.	Watershed Health, Environment & Recreation	Agriculture			Implementing	White River CD, Douglas Creek CD	Callie Hendrickson	0	50	50	0	40.015	-108.4585	g15 = coordinates based on centroid of basin	Rio Blanco
YW-2020-0006	White River Partnership	The White River Partnership consists of a collection of private and public entities working together to develop and implement a comprehensive approach toward the conservation of a healthy riparian ecosystem for the White River in both Colorado and Utah.	Watershed Health, Environment & Recreation				Implementing	Rivers Edge West		0	0	100	0	0	0	M2 = coordinates not determined because IPP is an E&R IPP	Rio Blanco
YW-2020-0007	White River Management Plan and Programmatic Biological Opinion	The White River Management Plan will characterize current and reasonably foreseeable future water use within the basin and its possible impacts to endangered fish, including impacts to endangered fish life stages and habitat in the White basin. The Management Plan will help identify necessary Recovery Program activities that will provide Endangered Species Act compliance for water depletion impacts in the basin.	Watershed Health, Environment & Recreation	Education, Outreach & Innovation			Implementing	Recovery Program with Rio Blanco WCD, The Nature Conservancy, CWCB, State of Utah, Ute Tribe	Jojo La P 303-866-3441, ext. 3233 jojo.la@state.co.us	0	0	100	0	0	0	M2 = coordinates not determined because IPP is an E&R IPP	Rio Blanco
YW-2020-0008	White River Water Quality		Watershed Health, Environment &	Additional			Implementing	See below		0	0	100	0	0	0	M2 = coordinates not determined	Rio Blanco
YW-2020-0008-A	Algae and Nutrient Study						Implementing	Douglas Creek and White River Conservation	Callie Hendrickson								Rio Blanco
YW-2020-0008-B	White River Stream Temperature	Stream temperature monitoring to complement the White River Water Quality Study					Implementing	Trout Unlimited	Brian Hodge			100					Rio Blanco
YW-2020-0008-C	White River Benthic Macroinvertebrates	Benthic macroinvertebrate study to complement the White River Water Quality Study					Implementing	Trout Unlimited	Brian Hodge			100					Rio Blanco
YW-2020-0009	White River Seasonal Waterfowl Projects	Projects have been implemented by CPW near Rio Blanco Lake, including one used as compensatory mitigation for Circle Park Pond. Others in planning phase with Partners for Wildlife (FWS) and Ducks Unlimited including some projects in the Yampa with DU	Watershed Health, Environment & Recreation				Implementing	CPW, DU, Partners in Wildlife				100		0	0	M2 = coordinates not determined because IPP is an E&R IPP	Rio Blanco
YW-2020-0010	Morrison Cr Well Development	Addition of 10-12 new wells to municipal water system serving Stagecoach area	Supply & Demand Gap				Implementing	Morrison Creek WSD		100	0	0	0	40.289404	-106.816	g5 = other; based on a location described in the IPP name, such as a school or the Shoshone Plant	Routt
YW-2020-0011	Riparian and Fisheries Improvements Stewardship	Program to provide ongoing maintenance of various riparian and fisheries projects. Project proponents will vary depending on nature of projects and who owns underlying property.						CPW(?) TU(?) Friends of Yampa (?)		0	0	0	0	0	0	M2 = coordinates not determined because IPP is an E&R IPP	
YW-2020-0012	Maybell Diversion Restoration and Headgate Modernization	Develop final engineering of new Maybell Diversion & Headgate in partnership with shareholders. Protect agricultural uses of water; improve water supply and reduce shortages; quantify and protect recreational water uses; maintain water quality; develop an integrated system of water use, storage, administration and delivery to reduce water shortages and meet agricultural, environmental and recreational needs. Improve fish and boat passage.	Watershed Health, Environment & Recreation	Agriculture			Implementing	Maybell Irrigation District, The Nature Conservancy, Friends of the Yampa, USFWS Recovery Program	Jennifer Wellman	0	50	50	0	40.472445	-107.991208	g12 = coordinates based on ditch's diversion structure	Moffat
YW-2020-0013	Coal Cr. Diversion to Yamcolo	Project diverts water into Yamcolo to help attenuate diurnal peak flows during runoff. For the cost estimate it was assumed that a 5 cfs diversion was needed along with a 2,160 ft ditch and permitting fees, legal fees, and engineering fees were included with the cost estimate. The costing tool was used for this estimate	Storage	Agriculture			Planned	Upper Yampa WCD		0	100	0	0	40.055933	-107.04824	g4 = coordinates based on location of reservoir	

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YW-2020-0014	Yampa River Fund Projects	Identify conservation projects and programs that enhance and benefit the agricultural, industrial, environmental and recreational users of the Yampa River Basin and secure sustainable funding for such projects and programs.	Funding	Watershed Health, Environment & Recreation	Conservation	Agriculture, Industrial	Implementing	Yampa River Fund Board of Directors: City of Craig, City of Steamboat Springs, CO First Conservation District, CO River District, CO Water Trust, Community Ag Alliance, Friends of the Yampa, Juniper Conservation District, Moffat County, Moffat County Cattlemen's Association, Mount Werner Water and Sanitation District, Northwest Colorado Chapter of	Andy Baur	0	0	100	0	0	0	M2 = coordinates not determined because IPP is an E&R IPP	Moffat/Routt
YW-2020-0015	Lower Elkhead Cr. Improvements	Instream and riparian restoration, securing irrigation infrastructure and water rights	Watershed Health, Environment & Recreation	Agriculture			Implementing	TU	Brian Hodge	0	40	60	0	40.530995	-107.436122	g9 = coordinates based on general location on stream	Moffat
YW-2020-0016	Bear River Park Steamboat Springs Boat Trailer Access	The project creates river access at Bear River Park in Steamboat Springs that would provide trailered river access for both private and commercial entities to enter and exit the river for recreational activities. This access will also, incorporate space for trailered vehicle parking. The 2016 Bear River Park Master Plan Update from the City of Steamboat Springs outlines the need for this project and many other details for this project. The cost estimate for this project was developed from the 2016 Master Plan and includes the cost of asphalt, signage, crushed fines and bank stabilization.	Watershed Health, Environment & Recreation				Concept	City of Steamboat Springs, Friends of the Yampa, Yampa Valley Fly Fishers, American Whitewater	TBD	0	0	100	0	40.47769663	-106.8243216	g2 = coordinates based on centroid of municipal boundary	Routt
YW-2020-0017	Yampa River Leafy Spurge Project	Project is engaged in research, identification of best management practices, and control measures to address urrent dramatic increase in infestation of Leafy Spurge. Agricultural diversions help spread the weed and then agricultural lands can be severely impacted.	Watershed Health, Environment & Recreation	Agriculture	Land Use		Implementing	Yampa River Leafy Spurge Project Committee: Ben Beall, Tamara Nauman, John Husband (FOP's)	Tamara Nauman	0	50	50	0	0	0	M2 = coordinates not determined because IPP is an E&R IPP	NA
YW-2020-0018	Lake Catamount Outlet and Spillway FIsh Screen and Net	Screen over outlet and net across spillway at Catamount Lake to help prevent downstream movement of Northern Pike and other non-native fish species that hinder recovery of endangered native populations. Project completion expected by 2023.	Watershed Health, Environment & Recreation	Storage			Planned	Recovery Program		0	0	100	0	40.359245	-106.803898	g4 = coordinates based on location of reservoir	Routt
YW-2020-0019	Yampa River Integrated Water Management Plan		Watershed Health, Environment & Recreation	Supply & Demand Gap	Agriculture	Storage	Implementing		Nicole Seltzer	33	33	33		40.61604	-107.78834	g15 = coordinates based on centroid of basin	Routt Moffat
YW-2020-0020	Piceance Creek Water Shortages						Concept	Rio Blanco Water Conservancy District and unnamed other partners	Al					39.941399	-108.287423	g9 = coordinates based on general location on stream	

Project_ID	Project_Name	Project_Description	Key_Word_1	Key_Word_2	Key_Word_3	Key_Word_4	Status	Lead_Proponent	Lead_Contact	Municipal_Ind_Need	Agricultural_Need	Envr_Rec_Need	Admin_Need	Latitude	Longitude	Lat_Long_Flag	County
YW-2020-0021	Head gate, diversion structure, streambank restoration and flow measurement updates/modification/replacement/addition.	The cost estimate includes 10 headgate and diversion structure improvement projects. It was assumed that all headgates diverted 15 cfs, and the costing tool was used.					Concept	Rio Blanco WCD, Yellow Jacket WCD, White River CD, & Douglas Creek CD, Pothook WCD (Little Snake)		0	100	0	0			M1 = coordinates not determined because general location cannot be determined from IPP name or description	
YW-2020-0022	Rio Blanco County Augmentation, Compact Risk, and Demand Management						Concept	Rio Blanco WCD, Yellow Jacket WCD, Rio Blanco County		50	50	0	0	39.993375	-108.184474	g6 = coordinates based on centroid of county boundary, then offset by 0.02 (or 0.04, 0.06, etc.) degrees longitude to allow for visibility on map	
YW-2020-0023	Identification, cleaning, & rehabilitation of agricultural water reservoirs	This project will involve identifying private agricultural reservoirs and working with the owner to return the reservoir to its original capacity, either because of the result of reduced storage limits or sedimentation. It was assumed that 10 reservoirs would be updated and that the cost per reservoir was $50,000.					Concept	Rio Blanco WCD, White River CD, Douglas Creek		0	100	0	0	40.4807	-107.75717	g15 = coordinates based on centroid of	
YW-2020-0024	Forest and Range Health						Concept	White River CD, Douglas Creek CD, Yellow Jacket CD, Rio Blanco WCD)		33	33	34	0	40.4807	-107.75717	g15 = coordinates based on centroid of basin	
YW-2020-0025	Circle Park river frontage, recreation, riparian health, access, and stream bank stabilization	Fishing pond project using fishing is fun grant. Stream bank staibilization is first phase. Cost Estimate was provided by Town of Meeker.	Watershed Health, Environment & Recreation				Implementing	Town of Meeker		0	0	100	0	40.034313	-107.911701	g5 = other; based on a location described in the IPP name, such as a school or the Shoshone Plant	Rio Blanco
YW-2020-0026	New Ag lands of significant value determination						Concept	Rio Blanco WCD		0	100	0	0	40.4807	-107.75717	g15 = coordinates based on centroid of basin	
YW-2020-0027	Cleaning of upland stock ponds/sedimentation basins	The cost estimate includes cleaning up 50 stock ponds/sedimentation basins at a cost of $5000 per each.					Concept	Rio Blanco WCD, White River CD, Douglas Creek CD		0	100	0	0	40.4807	-107.75717	g15 = coordinates based on centroid of basin	
YW-2020-0028	Lower White River Rural Water System						Planned	Rio Blanco WCD, Town of Rangely, Rio Blanco County		100	0	0	0	40.015	-108.4585	g15 = coordinates based on centroid of basin	
YW-2020-0029	COMBINED INTO 2020-0032 Lower White River Riparian Restoration						Concept	Lower White River Weed and Pest District, Town of Rangely, Rio Blanco WCD, Douglas Creek CD, and others						40.015	-108.4585	M1 = coordinates not determined because general location cannot be determined from IPP name or description	

Project_ID	Project_Name	Project_Description	Key_Word_1	Key_Word_2	Key_Word_3	Key_Word_4	Status	Lead_Proponent	Lead_Contact	Municipal_Ind_Need	Agricultural_Need	Envr_Rec_Need	Admin_Need	Latitude	Longitude	Lat_Long_Flag	County
YW-2020-0030	Ag return flows	For the cost estimate it was assumed that an Ag return Flow study would cost $100,000.					Planned	Rio Blanco Water CD, Yellow Jacket WCD, White River CD, Douglas Creek CD		0	50	50	0	40.015	-108.4585	M1 = coordinates not determined because general location cannot be determined from IPP name or description	
YW-2020-0031	DELETED (redundant w/ 2020-0015													40.015	-108.4585	M1 = coordinates not determined because general location cannot be determined from IPP name or description	
YW-2020-0032	White River Riparian Restoration	Instream and riparian restoration, securing irrigation infrastructure and water rights	Watershed Health, Environment & Recreation	Agriculture			Implementing	Trout Unlimited (More proponents will likely be added)	Brian Hodge	0	40	60	0	0	0	M2 = coordinates not determined because IPP is an E&R IPP	Rio Blanco
YW-2020-0033	White River Stream Temperature -- Moved as subproject to 2020 -0008															M2 = coordinates not determined because IPP is an E&R IPP	
YW-2020-0034	White River Benthic Macroinvertebrates -- Moved as subproject to 20020 -0008															M2 = coordinates not determined because IPP is an E&R IPP	
YW-2020-0035	Williams Ditch Irrigation Delivery and Habitat Enhancement	Improve irrigation water delivery and restore river function. Remove barriers to fish and recreational water craft. Conduct riparian restoration and support globally rare riparian forest vegetation. Increase reliability of water supply to benefit ditch users and the river. For the cost estimate it was assumed that a new diversion and headgate would be installed, as well as level 1 river restoration. The costing tool was used to estimate the cost of this project and does not include permitting and engineering services.	Watershed Health, Environment & Recreation	Agriculture			Implementing	The Nature Conservancy, Carpenter Ranch	Jennifer Wellman	0	50	50	0	40.493	-107.1618	g12 = coordinates based on ditch's diversion structure	Routt
YW-2020-0036	Planning/restoration on the Yampa River through Morgan Bottom Creek. Estimated cost is for planning and design only.	Identify opportunities for restoration of river channel and mesic meadows to meet agricultural needs and reduce bank erosion. Improve biodiverse habitats and channel complexity while protecting irrigation structures & maintaining recreation and fish passage.	Watershed Health, Environment & Recreation	Agriculture			Planned	The Nature Conservancy	Jennifer Wellman	0	50	50	0	40.51216	-107.20476	g9 = coordinates based on general location on stream	Routt
YW-2020-0037	REMOVED 7/20															M1 = coordinates not determined because general location cannot be determined from IPP name or description	
YW-2020-0038	Kellog Gulch Reservoir	Water storage project on the White River below Meeker	Compact Compliance	Storage	Augmentation	Watershed Health	Planned	Yellow Jacket WCD	Scott Grosscup	25	25	25	25	40.072299	-108.171323	g5 = other; based on a location described in the IPP name, such as a school or the Shoshone Plant	Rio Blanco

Project_ID	Project_Name	Project_Description	Key_Word_1	Key_Word_2	Key_Word_3	Key_Word_4	Status	Lead_Proponent	Lead_Contact	Municipal_Ind_Need	Agricultural_Need	Envr_Rec_Need	Admin_Need	Latitude	Longitude	Lat_Long_Flag	County
YW-2020-0039	Oak Ridge Park Ditch -- Off Channel Small Reservoirs	Small -- <5kaf -- Reservoirs in Little Beaver Creek drainage that could be developed to help meet ag uses with reduced direct flow diversions being used to help meet instream flows.	Compact Compliance	Storage	Augmentation	Watershed Health	Planned	Yellow Jacket WCD	Scott Grosscup	25	25	25	25	40.03452	-107.792997	g5 = other; based on a location described in the	Rio Blanco
YW-2020-0040	Pumped Hydropower Storage Feasibility Study						Concept			100	0	0	0	40.4807	-107.75717	g15 = coordinates based on centroid of basin	
YW-2020-0041	West Fork Project						Concept	Pot Hook WCD (?)								M1 = coordinates not determined because general location cannot be determined from IPP name or description	
YW-2020-0042	Little Snake RCPP						Concept									M1 = coordinates not determined because general location cannot be determined from IPP name or description	
YW-2020-0043	COMBINED INTO 20-0024						Concept	Little Snake WCD (?) and others to be named								M1 = coordinates not determined because general location cannot be determined from IPP name or description	
YW-2020-0044	Yampa White Green Basin BRT Education Action Plan Implementation	The Public Education, Participation, and Outreach (PEPO) Workgroup is a legislatively created committee of the IBCC. This group is tasked with: creating a process to inform, involve, and educate the public on the IBCC's activities and the progress of the interbasin compact negotiations; creating a mechanism by which public input and feedback can be relayed to the IBCC and compact negotiators; and educating IBCC and roundtable members on water issues. Note that the cost is per year.	Education, Outreach & Innovation				Implementing	Yampa/White Green Basin Roundtable with potential partners Community Agriculture Alliance, Yampatika,	Kelly Romero-Heaney, PEPO Committee Chair	0	0	0	100	40.4807	-107.75717	g15 = coordinates based on centroid of basin	NA
YW-2020-0045	Sheriff Reservoir Spillway Improvement	Two significant potential dam failure modes have been identified by the Division 6 Dam Safety Engineer at Sheriff Dam. These failure modes include erosion of the glacial moraine dam foundation and inadequate spillway capacity. If the dam were to fail there is a potential for loss of life downstream of the dam that the Town of Oak Creek would be liable for. Dam failure would also limit the Town's ability to provide safe drinking water during periods of low flows in Oak Creek. The loss of the resource would also adversely impact a key U.S. Forest recreational resource that is provided by Sheriff Reservoir. In addition, the outlet works gate is old and is getting harder to operate. In response a Feasibility Study for Modifications to Sheriff Dam, completed in 2021 by W.W. Wheeler, recommends two alternative solutions to reduce the dam failure risks and make the dam reliable for the next 50 years. The cost projection in 2022 dollars range from $10.4mil - $13mil. The Town of Oak Creek's population is approximately 944 with a median household income of $50,144.	Storage			Public safety	Planned	Town of Oak Creek	Tom Holliday	100	0	0	0	40.148647	-107.137035	g4 = coordinates based on location of reservoir	Routt
YW-2020-0046	Stream Gauge Installation - Yampa Basin	Install stream gauges on important tributaries to the Yampa River to improvement measurement and modeling. Consider adding paramaters, such as temperature. For the cost estimate, it was assumed that four new streamgages would be installed. The cost includeds the cost to purchase the equipment and install it, but does not include the cost of annual maintenance.	Supply & Demand Gap	Conservation	Watershed Health, Environment & Recreation	Public safety	Concept	TBD - USGS/DWR?		25	25	25	25	40.61604	-107.78834	g15 = coordinates based on centroid of basin	
YW-2020-0046	Yampa Basin Geodatabase	Sent msg reeq info 12/17					Concept	TBD - UYWCD?		25	25	25	25	40.61604	-107.78834	g15 = coordinates based on centroid of basin	

Project_ID	Project_Name	Project_Description	Key_Word_1	Key_Word_2	Key_Word_3	Key_Word_4	Status	Lead_Proponent	Lead_Contact	Municipal_Ind_Need	Agricultural_Need	Envr_Rec_Need	Admin_Need	Latitude	Longitude	Lat_Long_Flag	County
YW-2020-0047	Reservoir Measurement & Early Warning- Yampa Basin	Improve reservoir instrumentation to improve water resource management and early warning systems.	Supply & Demand Gap	Conservation	Watershed Health, Environment & Recreation	Public safety	Concept	TBD - DWR? ROEM?		25	25	25	25	40.61604	-107.78834	g15 = coordinates based on centroid of basin	
YW-2020-0048	Precipitation Gauge Measurement - Yampa Basin	Install precipitation gauges throughout the basin (likely adjacent to reservoirs) to water supply planning as it correlates with summer precip, to improve hydraulic modeling (i.e. NOAA Atlas), and to improve flood early warning systems. For the cost estimate It was assumed each gauge cost $500 and 13 gauges would be installed.					Concept	TBD - NWS?		25	25	25	25	40.61604	-107.78834	g15 = coordinates based on centroid of basin	
YW-2020-0049	Yampa River Return-Flow Study	Implement Yampa River Return-Flow Study per CSU proposal. For the cost estimate it was assumed that this study would cost $100,000.					Concept	TBD -		0	50	50	0	40.61604	-107.78834	g15 = coordinates based on centroid of basin	
YW-2020-0050	Water Quality Data Collection, Aggregation and Distribution	Water quality data is collected sporatically and is not easy to access. This project would set up a water quality monitoring network and work with other entities that collect water quality information to combined data and distribute in a user-friendly format.	Watershed Health, Environment & Recreation				Concept	TBD - USGS/DWR/UYWCD?		0	0	100	0	0	0	M2 = coordinates not determined because IPP is an E&R IPP	Moffat, Routt
YW-2020-0051	Small Reservoir Study Update	In August 2000, the Yampa River Basin Small Reservoir Study - Phase 2 Final Report was published. The report identified locations for potential reservoirs with storage volumes between 200 and 2,000 acre-feet. This IPP would revisit the recommendations in the report and update with new information.	Storage, Agriculture, Supply and Demand Gap				Planned	UYWCD	Andy Rossi	33	34	33	0	40.4807	107.75717	g15 = coordinates based on centroid of basin	Moffat, Routt
YW-2020-0052	Imperiled Post-Compact Water Rights	Previously, the BRT has worked to keep post-compact water rights off of the DWR abandonment list. This IPP would work to identify post-compact water rights that are in danger of being placed on the abandonment list and work with water rights holders to find ways to exercise their water right. The goal is to maintain water rights and water use that could be important for a demand management program.	Additional				Concept	TBD - River District? UYWCD? BRT?		25	25	25	25	40.4807	107.75717	g15 = coordinates based on centroid of basin	
YW-2020-0053	Stillwater Ditch Repair and Measuring Device Upgrades	The Stillwater Ditch is in need of structural and flow measurement upgrades and repairs. The planned upgrades will increase the efficiency of both direct flow right and storage water conveyance to agricultutral users.	Agriculture				Implementing	UYWCD	Andy Rossi	0	100	0	0	40.053307	-107.045302	g12 = coordinates based on ditch's diversion structure	Garfield, Routt
YW-2020-0054	River Health Scorecard	The Friends of the Yampa has initiated a planning process to implement a long-term year-to-year river health monitoring program of the Yampa River that results in a Yampa River Scorecard for different segments of the basin	Watershed Health, Environment & Recreation	Conservation	Agriculture	Land use	Planned	Friends of the Yampa	Lindsey Marlow	25	25	25	25	0	0	M2 = coordinates not determined because IPP is an E&R IPP	Routt and Moffat
YW-2020-0055	Town of Hayden Water System Improvements	12/1 -- waiting for detailed information from proponent					Planned	Town of Hayden	Bryan Richards	100	0	0	0	40.488986	-107.263227	g2 = coordinates based on centroid of municipal boundary	
YW-2020-0056A	Reservoir Bulk Water Contract - Phase 1	Water users combine their resources to lease water from Elkhead Reservoir. The release lifts the call on the river and allows water users to finish the irrigation season, while supporting flows in the critical Maybell reach. This would operate similar to the release in August/September of 2020.	Supply & Demand Gap				Concept	Colorado River Water Conservation District, Tri-State, Colorado Water Trust	Hunter Causey	0	50	50	0	40.55804	-107.383	g4 = coordinates based on location of reservoir	Moffat
YW-2020-0056B	Reservoir Bulk Water Contract - Phase 2	Include releases from Stagecoach Reservoir to supplement streamflow from Stagecoach Reservoir to the critical Maybell reach.	Supply & Demand Gap				Concept	Colorado River Water Conservation District, Tri-State, Colorado Water Trust	Hunter Causey	0	50	50	0	40.2852	-106.832	g4 = coordinates based on location of reservoir	Routt and Moffat
YW-2020-0057	North Elk Creek Fish Barrier	Construct a migration obstacle to protect native Colorado River Cutthroat Trout (a State species of Special Concern) from an invasion of pathogens and nonnative trout.	Watershed Health, Environment & Recreation			Shovel-ready	Planned	Trout Unlimited/Colorado Parks and Wildlife	Brian Hodge	0	0	100	0	39.87514	-107.661295	g9 = coordinates based on general location on stream	Rio Blanco

Project_ID	Water_District	Estimated_Yield	Yield_Units	Estimated_Capacity	Capacity_Units	Estimated_Cost	Water_Rights_Needs	Timeline_Tier	Basin_Plan_Align	Local_Plan_Align	Water_Plan_Align	Criticality	Core_Data_Num	Overall_priority	Review_Flag	State_Funding	Funding_Type_1	Funding_Type_2	Funding_Type_3	Funding_Amt	CWCB_Grant	CWCB_Loan	Funding_Secured
YW-2015-0001	44	4300	AF	4300	AF	$ 9,100,000.00	Yes	Tier 4	Tier 1	Tier 3	Tier 1	Tier 3	21	Tier 3									
YW-2015-0002	58			4.5	mgd	#############	No	Tier 4	Tier 1	Tier 1	Tier 2	Tier 2	19	Tier 3									
YW-2015-0003	43	5000	af	5000	af	#############		Tier 3	Tier 1	Tier 2	Tier 1	Tier 2	21	Tier 2									
YW-2015-0004	44												12	Not applicable									
YW-2015-0005	44												13	Not applicable									
YW-2015-0006	43	67600	kaf	67600	kaf	#############		Tier 3	Tier 1	Tier 1	Tier 1	Tier 2	21	Tier 2									
YW-2015-0007	44												12	Not applicable									
YW-2015-0008	58	5000	af	5000	af	#############	No	Tier 3	Tier 1	Tier 2	Tier 2	Tier 2	18	Tier 3									

Project_ID	Water_District	Estimated_Yield	Yield_Units	Estimated_Capacity	Capacity_Units	Estimated_Cost	Water_Rights_Needs	Timeline_Tier	Basin_Plan_Align	Local_Plan_Align	Water_Plan_Align	Criticality	Core_Data_Num	Overall_priority	Review_Flag	State_Funding	Funding_Type_1	Funding_Type_2	Funding_Type_3	Funding_Amt	CWCB_Grant	CWCB_Loan	Funding_Secured
YW-2015-0009													8	Not applicable									
YW-2015-0010	57			15000	af	#############	No	Tier 4	Tier 1	Tier 3	Tier 1	Tier 3	21	Tier 3									
YW-2015-0011	44												12	Not applicable									
YW-2015-0012	44												12	Not applicable									
YW-2015-0013	58	3500	af			$ 6,600,000.00		Tier 3	Tier 1	Tier 2	Tier 2	Tier 2	17	Tier 3									
YW-2015-0014	58	0	0	0	0	$ 247,600.00	No	Tier 1	Tier 1	Tier 1	Tier 1	Tier 2	20	Tier 1									
YW-2015-0014-A													3	Need to assign tiers									
YW-2015-0014-B													3	Need to assign tiers									
YW-2015-0014-C													3	Need to assign tiers									
YW-2015-0014-D													3	Need to assign tiers									
YW-2015-0015	43												11	Not applicable									
YW-2015-0016	43	0	0	0	0			Tier 2	Tier 1	Tier 2	Tier 2	Tier 2	18	Tier 2									
YW-2015-0016-A													2	Need to assign tiers									
YW-2015-0016-B													2	Need to assign tiers									
YW-2015-0016-C													2	Need to assign tiers									

Project_ID	Water_District	Estimated_Yield	Yield_Units	Estimated_Capacity	Capacity_Units	Estimated_Cost	Water_Rights_Needs	Timeline_Tier	Basin_Plan_Align	Local_Plan_Align	Water_Plan_Align	Criticality	Core_Data_Num	Overall_priority	Review_Flag	State_Funding	Funding_Type_1	Funding_Type_2	Funding_Type_3	Funding_Amt	CWCB_Grant	CWCB_Loan	Funding_Secured
YW-2015-0016-D													2	Need to assign tiers									
YW-2015-0016-E													2	Need to assign tiers									
YW-2015-0017	58	9	cfs	9	cfs	#############	No	Tier 4	Tier 1	Tier 2	Tier 2	Tier 2	19	Tier 3									
YW-2015-0018	58					#############		Tier 4	Tier 2	Tier 1	Tier 2	Tier 2	15	Tier 3									
YW-2015-0019	58			1-1.5	mgd	$ 3,000,000.00		Tier 2	Tier 1	Tier 1	Tier 2	Tier 2	18	Tier 2									
YW-2015-0020	43												13	Not applicable									
YW-2015-0021	43, 44, 54, 55, 56, 57, 58							Tier 3	Tier 1	Tier 1	Tier 1	Tier 1	13	Tier 3									
YW-2015-0022	58												14	Not applicable									
YW-2015-0023	44					$ 2,500,000.00		Tier 2	Tier 1	Tier 1	Tier 2	Tier 1	16	Tier 1									

Project_ID	Water_District	Estimated_Yield	Yield_Units	Estimated_Capacity	Capacity_Units	Estimated_Cost	Water_Rights_Needs	Timeline_Tier	Basin_Plan_Align	Local_Plan_Align	Water_Plan_Align	Criticality	Core_Data_Num	Overall_priority	Review_Flag	State_Funding	Funding_Type_1	Funding_Type_2	Funding_Type_3	Funding_Amt	CWCB_Grant	CWCB_Loan	Funding_Secured
YW-2015-0024	44	4	AF/year	1	mile	$ 1,000,000.00	No	Tier 1	Tier 1	Tier 1	Tier 3	Tier 2	21	Tier 1									
YW-2015-0025													11	Not applicable									
YW-2015-0026													12	Not applicable									
YW-2015-0027	NA	0	0	0	0	$ 750,000.00		Tier 1	Tier 1	Tier 1	Tier 2	Tier 2	21	Tier 1									
YW-2015-0028	NA	NA	NA	NA	NA	$ 50,000.00		Tier 1	Tier 1	Tier 1	Tier 1	Tier 1	20	Tier 1									
YW-2015-0029	NA	NA	NA	NA	NA	$ 150,000.00		Tier 1	Tier 1	Tier 1	Tier 1	Tier 1	20	Tier 1									
YW-2015-0030	NA	0	0	0	0	$ 20,000.00		Tier 2	Tier 1	Tier 2	Tier 2	Tier 2	20	Tier 2									
YW-2015-0031		0	0	0	0			Tier 1	Tier 1	Tier 1	Tier 1	Tier 2	18	Tier 1									
YW-2015-0032	58												14	Not applicable									
YW-2015-0033	NA	0	0	0	0			Tier 1	Tier 1	Tier 1	Tier 1	Tier 1	20	Tier 1									
YW-2015-0034	44	0	0	0	0			Tier 1	Tier 1	Tier 1	Tier 3	Tier 2	19	Tier 1									

Project_ID	Water_District	Estimated_Yield	Yield_Units	Estimated_Capacity	Capacity_Units	Estimated_Cost	Water_Rights_Needs	Timeline_Tier	Basin_Plan_Align	Local_Plan_Align	Water_Plan_Align	Criticality	Core_Data_Num	Overall_priority	Review_Flag	State_Funding	Funding_Type_1	Funding_Type_2	Funding_Type_3	Funding_Amt	CWCB_Grant	CWCB_Loan	Funding_Secured
YW-2015-0035	58	0	0	0	0	$ 255,000.00		Tier 1	Tier 1	Tier 1	Tier 3	Tier 2	20	Tier 1									
YW-2015-0036	44	0	0	0	0								18	Not applicable									
YW-2015-0037	58	0	0	0	0	$ 705,000.00		Tier 3	Tier 2	Tier 2	Tier 2	Tier 3	20	Tier 3									
YW-2015-0038	NA	0	0	0	0		Yes	Tier 1	Tier 2	Tier 3	Tier 3	Tier 2	19	Tier 2									
YW-2015-0039		NA	NA	NA	NA			Tier 4	Tier 4	Tier 4	Tier 4	Tier 4	15	Tier 4									
YW-2020-0001	58	NA	NA	NA	NA			Tier 3	Tier 1	Tier 2	Tier 2	Tier 2	19	Tier 3									
YW-2020-0002	58	NA	NA	NA	NA			Tier 1	Tier 1	Tier 1	Tier 1	Tier 2	20	Tier 1									
YW-2020-0002-A													3	Need to assign tiers									
YW-2020-0002-B													3	Need to assign tiers									
YW-2020-0002-C													3	Need to assign tiers									
YW-2020-0002-D													3	Need to assign tiers									
YW-2020-0003	58	NA	NA	NA	NA	#############		Tier 1	Tier 1	Tier 1	Tier 2	Tier 2	21	Tier 1									
YW-2020-0003-A						$ 3,250.00							4	Need to assign tiers									
YW-2020-0003-B						$ 1,500,000.00							4	Need to assign tiers									

Project_ID	Water_District	Estimated_Yield	Yield_Units	Estimated_Capacity	Capacity_Units	Estimated_Cost	Water_Rights_Needs	Timeline_Tier	Basin_Plan_Align	Local_Plan_Align	Water_Plan_Align	Criticality	Core_Data_Num	Overall_priority	Review_Flag	State_Funding	Funding_Type_1	Funding_Type_2	Funding_Type_3	Funding_Amt	CWCB_Grant	CWCB_Loan	Funding_Secured
YW-2020-0003-C						$ 100,000.00							4	Need to assign tiers									
YW-2020-0003-D						$ 250,000.00							4	Need to assign tiers									
YW-2020-0003-E						$ 140,000.00							5	Need to assign tiers									
YW-2020-0004	58	0	0	0	0	$ 8,200,000.00		Tier 3	Tier 1	Tier 2	Tier 2	Tier 2	19	Tier 3									
YW-2020-0005		NA	NA	NA	Na	$ 194,800.00		Tier 1	Tier 1	Tier 1	Tier 1	Tier 1	20	Tier 1									
YW-2020-0006	NA	NA	NA	NA	NA			Tier 2	Tier 1	Tier 1	Tier 2	Tier 2	19	Tier 2									
YW-2020-0007	43	NA	NA	NA	NA	$ 296,000.00		Tier 2	Tier 1	Tier 1	Tier 1	Tier 1	21	Tier 1									
YW-2020-0008	43	NA	NA	NA	NA		No	Tier 1	Tier 1	Tier 2	Tier 1	Tier 1	19	Tier 1									
YW-2020-0008-A	43						No						8	Need to assign tiers									
YW-2020-0008-B	43					$ 20,000.00	No						10	Need to assign tiers									
YW-2020-0008-C	43					$ 20,000.00	No						10	Need to assign tiers									
YW-2020-0009	43	NA	NA	NA	NA		No	Tier 1	Tier 3	Tier 3	Tier 3	Tier 3	16	Tier 3									
YW-2020-0010	58	1200	af	NA	NA	$ 6,000,000.00	No	Tier 1	Tier 1	Tier 1	Tier 3	Tier 2	20	Tier 1									
YW-2020-0011		0	0	0	0			Tier 3	Tier 2	Tier 3	Tier 3	Tier 2	15	Tier 3									
YW-2020-0012	NA	0	0	0	0	$ 2,800,000.00		Tier 1	Tier 1	Tier 1	Tier 2	Tier 2	21	Tier 1									
YW-2020-0013		0	0	0	0	$ 600,000.00		Tier 4	Tier 2	Tier 2	Tier 3	Tier 3	18	Tier 3									

Project_ID	Water_District	Estimated_Yield	Yield_Units	Estimated_Capacity	Capacity_Units	Estimated_Cost	Water_Rights_Needs	Timeline_Tier	Basin_Plan_Align	Local_Plan_Align	Water_Plan_Align	Criticality	Core_Data_Num	Overall_priority	Review_Flag	State_Funding	Funding_Type_1	Funding_Type_2	Funding_Type_3	Funding_Amt	CWCB_Grant	CWCB_Loan	Funding_Secured
YW-2020-0014	NA	0	0	0	0	$ 350,000.00	No	Tier 1	Tier 1	Tier 1	Tier 1	Tier 2	21	Tier 1									
YW-2020-0015	44	0	0	0	0	$ 1,500,000.00	No	Tier 1	Tier 1	Tier 1	Tier 2	Tier 2	21	Tier 1									
YW-2020-0016		0	0	0	0	$ 232,503.75	No	Tier 3	Tier 2	Tier 1	Tier 3	Tier 2	20	Tier 3									
YW-2020-0017	NA	0	0	0	0	$ 165,572.00	No	Tier 1	Tier 1	Tier 1	Tier 1	Tier 2	21	Tier 1		$89,000	$30,000	$38,000					
YW-2020-0018	NA	0	0	0	0	$ 2,500,000.00	No	Tier 1	Tier 1	Tier 1	Tier 1	Tier 2	20	Tier 1									
YW-2020-0019	NA	NA	NA	NA	NA	$ 654,750.00		Tier 1	Tier 1	Tier 1	Tier 1	Tier 1	18	Tier 1									
YW-2020-0020		0	0	0	0			Tier 4	Tier 1	Tier 3	Tier 3	Tier 3	12	Tier 4									

Project_ID	Water_District	Estimated_Yield	Yield_Units	Estimated_Capacity	Capacity_Units	Estimated_Cost	Water_Rights_Needs	Timeline_Tier	Basin_Plan_Align	Local_Plan_Align	Water_Plan_Align	Criticality	Core_Data_Num	Overall_priority	Review_Flag	State_Funding	Funding_Type_1	Funding_Type_2	Funding_Type_3	Funding_Amt	CWCB_Grant	CWCB_Loan	Funding_Secured
YW-2020-0021		0	0	0	0	$ 6,140,000.00		Tier 2	Tier 1	Tier 2	Tier 2	Tier 2	15	Tier 3									
YW-2020-0022		0	0	0	0			Tier 4	Tier 1	Tier 3	Tier 1	Tier 1	15	Tier 3									
YW-2020-0023		0	0	0	0	$ 500,000.00		Tier 3	Tier 1	Tier 2	Tier 3	Tier 2	17	Tier 3									
YW-2020-0024		0	0	0	0			Tier 3	Tier 2	Tier 3	Tier 2	Tier 2	15	Tier 4									
YW-2020-0025	NA	0	0	0	0	$ 855,700.00		Tier 1	Tier 1	Tier 1	Tier 1	Tier 2	20	Tier 1									
YW-2020-0026		0	0	0	0			Tier 4	Tier 1	Tier 2	Tier 3	Tier 2	15	Tier 3									
YW-2020-0027		0	0	0	0	$ 250,000.00		Tier 3	Tier 2	Tier 3	Tier 3	Tier 3	17	Tier 4									
YW-2020-0028		0	0	0	0			Tier 4	Tier 1	Tier 3	Tier 3	Tier 3	15	Tier 3									
YW-2020-0029													7	Need to assign tiers									

Project_ID	Water_District	Estimated_Yield	Yield_Units	Estimated_Capacity	Capacity_Units	Estimated_Cost	Water_Rights_Needs	Timeline_Tier	Basin_Plan_Align	Local_Plan_Align	Water_Plan_Align	Criticality	Core_Data_Num	Overall_priority	Review_Flag	State_Funding	Funding_Type_1	Funding_Type_2	Funding_Type_3	Funding_Amt	CWCB_Grant	CWCB_Loan	Funding_Secured
YW-2020-0030		0	0	0	0	$ 100,000.00		Tier 3	Tier 2	Tier 3	Tier 3	Tier 3	17	Tier 3									
YW-2020-0031													5	Need to assign tiers									
YW-2020-0032	43	0	0	6.7	miles	$ 1,000,000.00	No	Tier 1	Tier 1	Tier 2	Tier 2	Tier 2	21	Tier 1									
YW-2020-0033													3	Need to assign tiers									
YW-2020-0034													3	Need to assign tiers									
YW-2020-0035	NA	0	0	0	0	$ 889,000.00		Tier 1	Tier 1	Tier 1	Tier 2	Tier 2	21	Tier 1									
YW-2020-0036	NA	NA	NA	NA	NA	$ 100,000.00		Tier 2	Tier 1	Tier 1	Tier 2	Tier 2	21	Tier 1									
YW-2020-0037													3	Need to assign tiers									
YW-2020-0038	43	12500	af	12500	af	#############	Yes	Tier 3	Tier 1	Tier 2	Tier 1	Tier 2	21	Tier 2									

Project_ID	Water_District	Estimated_Yield	Yield_Units	Estimated_Capacity	Capacity_Units	Estimated_Cost	Water_Rights_Needs	Timeline_Tier	Basin_Plan_Align	Local_Plan_Align	Water_Plan_Align	Criticality	Core_Data_Num	Overall_priority	Review_Flag	State_Funding	Funding_Type_1	Funding_Type_2	Funding_Type_3	Funding_Amt	CWCB_Grant	CWCB_Loan	Funding_Secured
YW-2020-0039	43	5,327	af	5,327	af	#############	Yes	Tier 3	Tier 1	Tier 2	Tier 1	Tier 2	21	Tier 2									
YW-2020-0040		NA	NA	NA	NA			Tier 2	Tier 2	Tier 3	Tier 3	Tier 2	14	Tier 4									
YW-2020-0041		0	0	0	0								9	Need to assign tiers									
YW-2020-0042		0	0	0	0								9	Need to assign tiers									
YW-2020-0043													5	Need to assign tiers									
YW-2020-0044	NA	NA	NA	NA	NA	$ 75,000.00	No	Tier 1	Tier 1	Tier 1	Tier 1	Tier 1	21	Tier 1									
YW-2020-0045		0		986.5	sf	#############	No	Tier 2	Tier 1	Tier 1	Tier 2	Tier 2	20	Tier 2									
YW-2020-0046		0	0	0	0	$ 100,000.00		Tier 2	Tier 1	Tier 2	Tier 1	Tier 2	21	Tier 3									
YW-2020-0046		0	0	0	0								20	Need to assign tiers									

Project_ID	Water_District	Estimated_Yield	Yield_Units	Estimated_Capacity	Capacity_Units	Estimated_Cost	Water_Rights_Needs	Timeline_Tier	Basin_Plan_Align	Local_Plan_Align	Water_Plan_Align	Criticality	Core_Data_Num	Overall_priority	Review_Flag	State_Funding	Funding_Type_1	Funding_Type_2	Funding_Type_3	Funding_Amt	CWCB_Grant	CWCB_Loan	Funding_Secured
YW-2020-0047		0	0	0	0			Tier 3	Tier 1	Tier 2	Tier 1	Tier 2	21	Tier 3									
YW-2020-0048		0	0	0	0	$ 6,500.00		Tier 2	Tier 1	Tier 2	Tier 2	Tier 2	20	Tier 3									
YW-2020-0049		0	0	0	0	$ 100,000.00		Tier 2	Tier 2	Tier 2	Tier 1	Tier 2	20	Tier 3									
YW-2020-0050	57,58	NA	NA	NA	NA		No	Tier 2	Tier 1	Tier 2	Tier 1	Tier 2	19	Tier 3									
YW-2020-0051	57,58	NA	NA	NA	NA	$ 20,000.00	TBD	Tier 2	Tier 1	Tier 3	Tier 3	Tier 2	21	Tier 2									
YW-2020-0052		NA	NA	NA	NA		No	Tier 2	Tier 1	Tier 2	Tier 1	Tier 1	17	Tier 3									
YW-2020-0053	58	0	0	0	0	$ 300,000.00	No	Tier 2	Tier 1	Tier 3	Tier 3	Tier 2	21	Tier 2									
YW-2020-0054		NA	NA	NA	AN		No	Tier 1	Tier 1	Tier 1	Tier 1	Tier 2	19	Tier 1									
YW-2020-0055		0	0	0	0								17	Need to assign tiers									
YW-2020-0056A	44, 55	0	ACFT	0	ACFT	$ 70,000.00	No	Tier 1	Tier 1	Tier 2	Tier 2	Tier 1	21	Tier 3									
YW-2020-0056B	44, 55, 57, 58	0	ACFT	0	ACFT	$ 140,000.00	No	Tier 2	Tier 1	Tier 2	Tier 2	Tier 1	21	Tier 3									
YW-2020-0057	43	0	NA	12	miles	$ 410,000.00	No	Tier 1	Tier 1	Tier 2	Tier 3	Tier 2	21	Tier 1									