



Yampa/White/Green Basin Implementation Plan



Prepared For:
Yampa/White/Green Basin Roundtable

April 24, 2015

EXECUTIVE SUMMARY

Background

The Basin Implementation Plan (BIP) developed by the Yampa/White/Green (YWG) Basin Roundtable (BRT) addresses key issues regarding our most important natural resource - water. These issues are discussed from a policy viewpoint; the complex issues of water law and specific environmental concerns will be addressed in greater detail as individual projects and processes are implemented to meet the objectives outlined in this document. In this BIP, the BRT recognizes the significant role of the Yampa and White Rivers in meeting Colorado's compact obligations in the greater Colorado River Basin. In addition, the BIP recognizes 1) the need to retain a share of native flows for existing uses and future development, 2) the need to preserve the natural hydrology for environmental and recreational use; 3) the need for appropriately located, sized, and operated projects to protect water uses and the environment, particularly during drought; and finally, 4) the need to consider and to address all of these within the roundtable process.

The YWG River Basin has an excellent opportunity to achieve the vision of the Governor's Executive Order which seeks to balance future consumptive needs while meeting recreational and environmental needs. By respecting this balance, the State of Colorado (State) will remain true to the founding concept of the Colorado River Compact, which secured water for basins experiencing slower economic growth as others grew more swiftly.

The BIP represents the outcome of considerable dialogue on the complexities of water use and management. Much consideration is given to the importance of the Yampa, White and Green Rivers to our region and our communities as we face impending water shortages not only in Colorado, but in the entire American West.

Basin Facts, Needs and Vision

While the hope is that this BIP will provide the foundation for future policies, processes and projects that can be implemented, it should not be interpreted as an end point; rather it serves as a new beginning. Additional effort and continued dedication will be required to carry on this work. The YWG BRT process offers local communities the opportunity to have a strong voice in how water will be managed now and into the future. This unique grassroots process does not exist in other states where water planning is more commonly conducted exclusively at the state agency level.

The YWG BRT recognizes that all water development, whether categorized as an Identified Project and Process (IPP) or not, will involve complex and nuanced tradeoffs. Each project will present its own specific set of opportunities and constraints, and will likely reveal that what is a constraint for one project might be an opportunity for another. Consequently, at this time, the YWG BRT believes it is not possible to develop a comprehensive list of opportunities and constraints. Instead, this BIP sets out planning "considerations" that will serve to guide the future development and evaluation of water supply and resource projects. Although extensive, the modeling to date for this BIP is still being developed thus all results remain preliminary and do not constitute official findings by the YWG BRT.

The YWG drainages are relatively undeveloped and have limited existing storage compared to other basins in Colorado. The majority of the existing storage is for industrial and municipal use, although there are some agricultural storage supplies particularly in the upper Yampa valley. Supplies on smaller tributary streams where no storage exists are typically inadequate in the late season.

Administration has only occurred on the mainstem of the Yampa and White Rivers under special circumstances, such as protecting reservoir releases under dry conditions. This historical lack of administration speaks to the slower pace of development in this region, and a culture of neighborly consideration to share shortages voluntarily.

Constraints on water development and water management to protect flows for endangered fish species are in place in the Green and Yampa River Basins; similar constraints are being developed for the White River Basin. Consequently, this BIP calls for collaborative solutions to meet water supply challenges in order to maintain a balanced and diverse economic base.



How the YWG Basin fits into meeting Colorado's compact obligations within and beyond the state is a principal concern. The YWG Basin is part of Colorado River Basin, and is caught between the needs of the downstream states, the needs of the urbanized east slope of Colorado, and its own in-basin needs. The YWG BRT must consider these competing needs in its water planning effort. In this regard, the YWG BRT also recognizes that the overdevelopment of water in the Colorado River and its tributaries poses a serious risk that would impact all users of Colorado River Basin water.

The YWG BRT seeks through its BIP to make certain that existing consumptive, environmental and recreational uses are met, even during anticipated drought periods. This includes drought periods similar to those in the reconstructed paleo-hydrologic record and which may be exacerbated by climate change. While population growth will drive additional municipal needs and additional irrigated agricultural areas have been identified in State-funded studies, the energy sector has the potential to create the greatest additional consumptive water demands in the YWG Basin. Consumptive demand is expected to increase from 282,000¹ to 361,000 acre-feet per year by the year 2050 under a dry hydrology scenario. Non-consumptive needs including flows for endangered species, riparian plant communities, sport fisheries, white-water boating, and ecological integrity are also expected to expand.

In this BIP, recreational, environmental, agricultural, municipal and industrial stakeholders have unanimously adopted eight Goals and their associated Measurable Outcomes to meet YWG Basin needs:

- Protect the YWG Basin from compact curtailment of existing decreed water uses and some increment of future uses.
- Protect and encourage agricultural uses of water in the YWG Basin within the context of private property rights.
- Improve agricultural water supplies to increase irrigated land and reduce shortages.
- Identify and address Municipal and Industrial (M&I) water shortages
- Quantify and protect non-consumptive water uses.
- Maintain and consider the existing natural range of water quality that is necessary for current and anticipated water uses.
- Restore, maintain, and modernize water storage and distribution infrastructure.
- Develop an integrated system of water use, storage, administration and delivery to reduce water shortages and meet environmental and recreational needs.

Much of the information in this BIP regarding demand and supply was developed through a series of Statewide Water Supply Initiative (SWSI) and Basin-wide studies, particularly the 2014 Project and Methods Study (P&M Study). The 2014 P&M Study is the most recent state-funded study used to inform this BIP.

Several IPPs were developed with input from the YWG BRT and other stakeholders, taking into consideration information from previously completed studies and the considerations laid out in the preceding paragraphs. The IPPs are dynamic lists reflective of the incomplete state of the planning process. These lists will continue to be updated with new Projects and Processes as the YWG BRT continues to refine the YWG Basin hydrologic models and improves its overall understanding of how operations and proposed projects might work together to meet potential shortages. Project proponents will be encouraged to consider the goals of the BIP for success in balancing demands.

Preliminary Model Findings

The P&M Study model for the YWG Basin was modified as part of the BIP to refine demand at certain nodes and to improve operational and modeling assumptions. The results remain preliminary. The YWG BRT is committed to continue to improve this decision support tool.

The BIP focused on modeling the YWG Basin under a Baseline Scenario (historical conditions) and future scenarios that assume high demands and dry hydrology with or without IPPs. (Dry Future, Dry Future IPP).

Under the Baseline Scenario, no shortages exist for M&I and Self-Supported Industrial (SSI) demand nodes due to generally adequate water supply and augmentation from reservoirs. Agricultural shortages in the YWG Basin exist, as

¹ Projects and Methods Study StateMod Model, 2014



do shortages to the modeled In-Stream Flow reaches. For the Steamboat Recreation In-Channel Diversion (RICD), the river flows are insufficient to meet the flow targets during the entire targeted flow period under all scenarios.

Under the Dry Future Scenario, M&I and SSI shortages develop for several nodes. Significant increases to agricultural shortages occur across the YWG Basin, but especially to the eastern and southern areas. Instream flow shortages along the majority of the modeled stream reaches also increase in this Scenario, and are especially significant for the Steamboat RICD. The risk to conforming to the Yampa River Programmatic Biological Opinion (PBO) baseflow targets is greatly increased under this scenario as well.

Next Steps

This BIP has broken new ground by quantifying shortages to both consumptive and non-consumptive demands, while having conceptualized a suite of consumptive, non-consumptive and multi-purpose projects. A follow-up effort is being scoped which will more thoroughly examine in-basin shortages and produce specified, firmed up, and integrated projects to relieve those shortages. This effort will include greater attention to river flow management while turning concepts into shovel-ready projects, complimenting themes outlined in the 2016 SWSI.

After deliberations by its technical sub-committee and some clarification of the underlying modeling, the YWG BRT is proposing the following next steps to include:

- a) Indicators of shortages for meeting current and future in-basin consumptive and non-consumptive demands, and the basis for specific shortages;
- b) Further specification and development of the projects which will relieve those shortages, including quantification of the storage releases and new or re-allocated supplies;
- c) Indicators of consumptive and non-consumptive demands resulting from the implementation of projects to meet both needs; and,
- d) Collaboration on flow management and integrated projects to protect and augment flows, supporting the long-term health and substantial economic values therein.

These steps need to be reviewed and approved by the YWG BRT. The YWG BRT is also considering a thorough phase II of the Agriculture Water Needs Study specific to return-flow impacts from increasing irrigation efficiencies. This cumulative assessment of consumptive and non-consumptive needs, return-flows, river flow regimes and flow protection and management will go hand-in-hand with increased public engagement and education. It will also increase recognition of the significant role that the Yampa and White Rivers plays in providing water to meet Colorado's downstream compact obligations.



LIST OF ACRONYMS

AF: Acre Feet
AFY: Acre Feet per Year
BIP: Basin Implementation Plan
BLM: Bureau of Land Management
BO: Biological Opinion
YWG BRT: Yampa/White/Green Basin Roundtable
CCWPP: Critical Community Watershed Wildfire Protection Plan
CDPHE: Colorado Department of Public Health and Environment
CDSS: Colorado Decision Support System
CFS: Cubic Feet per Second
CRWAS: Colorado River Water Availability Study
CSFS: Colorado State Forest Service
CWCB: Colorado Water Conservation Board
CWPP: Community Wildfire Protection Plan
FERC: Federal Energy Regulatory Commission
FSA: Farm Service Agency
GIS: Geographic Information Systems
HUC: Hydrologic Unit Code
IBCC: Inter-Basin Compact Committee
IPP: Identified Project and Process
ISF: Instream Flow Right
IWR: Irrigation Water Requirement
MAF: Million Acre Feet
M&E: Monitoring and Evaluation
M&I: Municipal and Industrial
MOU: Memorandum of Understanding
NRCS: Natural Resources Conservation Service
P&M: Projects and Methods
PBO: Programmatic Biological Opinion
PEPO: Public Education, Participation and Outreach
RICD: Recreational/Recreation In-Channel Diversion
ROD: Record of Decision
SSI: Self-Supplied Industrial
SWPP: Source Water Protection Plan
SWSI: Statewide Water Supply Initiative
TMD: Transmountain Diversion
USFS: United State Forest Service



YAMPA/WHITE/GREEN BIP

List of Acronyms

USFWS: United States Fish and Wildlife Service

USGS: United States Geological Survey

UYRWG: Upper Yampa River Watershed Group

WDID: Water District Structure Identification

WFET: Watershed Flow Evaluation Tool

WUI: Wildland Urban Interface

YWG: Yampa/White/Green

YWG BIP: Yampa/White/Green Basin Implementation Plan



Table of Contents

Executive Summary..... E-1

Section 1.0 Basin Goals and Measurable Outcomes1-1

Section 2.0 Consumptive and Environmental & Recreational Needs.....2-1

Section 3.0 Evaluate Consumptive and Environmental Considerations.....3-1

Section 4.0 Projects and Methods4-1

Section 5.0 Strategies for the Projects and Methods.....5-1

Section 6.0 How the Plan Meets the Goals and Measurable Outcomes6-1

ReferencesR-1

Appendix A Projects and Methods Study OverviewA-1

Appendix B Public Education Materials and Public CommentsB-1



Table of Contents

Section 1.0	Basin Goals and Measurable Outcomes	1-1
1.1	Background	1-1
1.1.1	Basin Overview	1-1
1.1.2	Process Overview	1-3
1.1.3	Previous Studies	1-4
1.2	Description of Goals and Measurable Outcomes	1-7
1.2.1	Context for Basin Goals—Maintenance of Historical Use, Protection of Water Supplies for Future Demands, and Environmental Protection.....	1-7
1.2.2	YWG Basin Goals (Order does not indicate priority)	1-7
1.2.3	Protect the Basin from compact curtailment of existing decreed water uses and some increment of future uses.	1-7
1.2.4	Protect and encourage agricultural uses of water in the YWG Basin within the context of private property rights.	1-8
1.2.5	Improve agricultural water supplies to increase irrigated land and reduce shortages.	1-9
1.2.6	Identify and address M&I water shortages.	1-9
1.2.7	Quantify and protect non-consumptive water uses	1-10
1.2.8	Maintain and consider the existing natural range of water quality that is necessary for current and anticipated water uses.....	1-12
1.2.9	Restore, maintain, and modernize water storage and distribution infrastructure	1-12
1.2.10	Develop an integrated system of water use, storage, administration and delivery to reduce water shortages and meet environmental and recreational needs.....	1-13



List of Tables

Table 1-1 Table of Previous Studies 1-4



Section 1.0 Basin Goals and Measurable Outcomes

1.1 Background

1.1.1 Basin Overview

The Yampa/White/Green (YWG) River Basin, referred to as the YWG Basin, in the State of Colorado (State, Colorado) includes Routt, Rio Blanco, Moffat, and parts of Eagle and Garfield counties. The region has a rich agricultural heritage and a strong tourist economy based on snow sports, boating, fishing, and hunting. Environmental assets include 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.

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

Landscapes vary greatly from wet, high-mountain elevations to sagebrush steppes to downstream desert canyons. The Yampa and White Basins have headwaters in high-precipitation areas, from the Park Range in the north to the Flattop Mountains and Gore Range in the south. 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 varies greatly year to year.

The Yampa River is the largest tributary to the Green River with mean annual flow of 1.3 million acre-feet (MAF) in a broad range of 0.5 - 2.3 MAF¹. The Yampa River rises in the Park, Gore, and Flattops Ranges of Colorado and flows generally north, then west through several municipalities, the largest being Steamboat Springs and Craig. Two large coal-fired thermoelectric generating stations use water from the Yampa River and coal from large mines, in the Yampa Basin, to meet power needs in western and eastern Colorado as well as in other western states. There is irrigated agriculture throughout the Yampa Basin. The Little Snake River is a significant tributary to the Yampa River that rises from the north end of the Park Range and from the Sierra Madre of southern Wyoming and enters the Yampa River just east of Dinosaur National Monument in Colorado. 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.

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 half a MAF which varies greatly year to year. Like the Yampa, there is irrigated agriculture throughout the White Basin. There is significant energy production in the White Basin, particularly in the Piceance basin.

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 in at Echo Park - then flows generally west through the

¹ Historical observation at Maybell 1909-2002 (UYWCD 2013).



monument and into the Uinta Basin of Utah. There is agricultural activity in the bottomlands of Vermillion Creek and the Green River.

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 average historical demand in the YWG Basin for consumptive use (municipal, industrial and agricultural uses) is approximately 282,000² acre-feet per year (AFY). 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 provide flat-water recreation opportunities. For the purpose of local water planning, the Yampa, White, and Green Basins can be considered independently, as no diversions currently exist between them.

This Basin Implementation Plan (BIP) proposes measures to meet YWG Basin goals which will firm up supplies for existing uses and for future growth, while meeting recreational and environmental needs. Population growth will drive modest increases in municipal needs and additional irrigated agriculture downstream of Craig, Colorado may increase agricultural water demand. However, it is the energy sector that has the potential to create the greatest additional consumptive water demands in the YWG Basin. Non-consumptive environmental and recreational needs require flows to sustain endangered native fish, riparian plant communities, sport fisheries, whitewater boating, and ecological integrity. The Yampa/White/Green Basin Roundtable (YWG BRT) seeks to ensure that existing and anticipated future needs can be met, even during drought periods.

Balancing traditional economic activities with the demands of emerging industries, while meeting environmental and recreational needs within the YWG Basin, is the great challenge. For this reason, this BIP will examine project development and water right administration to determine how existing and future consumptive uses could be coordinated with environmental and recreational uses. For example, flow between storage and diversion points might aid in meeting low-flow needs on the river. Additionally, flows out of the YWG Basin that would aid interstate compact compliance could be timed to meet flow targets for the endangered fish recovery program. Additional storage in the YWG Basin must be balanced with high spring flows that are needed for recreation and ecological processes.

The State of Colorado is party to the 1922 Colorado River Compact and the 1948 Upper Colorado River Compact. Currently, the state is discussing methods (e.g. contingency planning, demand management, water banking) to minimize the risk of a “call” under compact administration. The role of the YWG Basin flows in meeting the state’s compact obligations is a central issue in the YWG BRT’s planning efforts. In the event of a compact deficit, the State Engineer would have to develop rules by which to curtail Colorado River water users to remedy the condition. How the state administers a curtailment could greatly affect Colorado River water rights users across the state. If administration is based upon a statewide application of the prior appropriation system in the Colorado mainstem and tributary basins, the burden would likely fall disproportionately on the YWG Basin as its water rights are relatively junior to those of other Colorado River basins. The YWG BRT’s position is that an equitable native flow allocation for all basins tributary to the Colorado River should be the basis for such a rulemaking. The YWG BRT recognizes that negotiations for allocations of Colorado River water should include all users including transmountain diversions’s (TMD’s) that have historically diverted from Colorado River tributaries.

² Projects and Methods Study , 2014



1.1.2 Process Overview

This BIP was created by the YWG BRT³ to reflect the YWG Basin's goals in the State's water planning process and to satisfy the requirements that the Colorado Water Conservation Board (CWCB) set forth in the Guidance documents for the BIPs³. BIPs are designed to bring regional water planning to the next level in each of Colorado's nine major basins. The plans build on previous work to fulfill the legislative mandate of HB05-1177 to the roundtables to propose projects or methods, both structural and non-structural, for meeting basin needs and utilizing unappropriated waters where appropriate. In addition, the plans serve as critical grassroots input to the Colorado Water Plan commissioned on May 14th, 2013 by Governor Hickenlooper's executive order D2013-005.

The YWG BRT is one of nine grassroots water policy forums created by HB05-1177. The same legislation also created the Inter-Basin Compact Committee (IBCC) as a venue for discussion of statewide water policy and management issues. The BIPs now seek to embody the intent of the legislation to "encourage locally driven collaborative solutions to water supply challenges." The YWG BRT serves as a venue for coordinating and supporting the most effective water supply solutions in the YWG Basin.

The structure of this BIP satisfies the requirements that the CWCB set forth in the Guidance document for BIPs. The BIP begins with the YWG BRT's goals and measurable outcomes described in this section. The goals identify the priorities of the YWG BRT, while the measurable outcomes describe the specific mechanisms and targets for achieving these goals. Section 2 summarizes the identified water supply needs in the YWG Basin. Section 3 then evaluates the constraints and opportunities for meeting those needs, leading to the identification of specific projects and methods in Section 4. More detailed implementation strategies for the most effective projects and methods are further explored in Section 5. Finally, Section 6 ties the selected strategies back to the YWG Basin's goals and outcomes to show how well the BIP may meet its identified priorities.

³ (CWCB 2013a)



1.1.3 Previous Studies

Table 1-1 provides a summary of the YWG Basin-wide studies conducted for the YWG Basin since the initial Statewide Water Supply Initiative (SWSI) began in 2003. These studies encompass assessments of current and future M&I, energy, agriculture, environmental and recreational needs, and the modeling exercises conducted to evaluate water supply shortages, future water supply projects, climate change and impacts to instream flows.

Table 1-1 Table of Previous Studies

Year Study Completed	Study	Referenced in document as	Summary	Study Web link	Citation
2004	SWSI	SWSI 2004	Identified Colorado's current and future water needs and examined a variety of approaches Colorado could take to meet those needs. SWSI implemented a collaborative approach to water resource issues by establishing SWSI roundtables. SWSI focused on using a common technical basis for identifying and quantifying water needs and issues.	http://cwcbweblink.state.co.us/WebLink/ElectronicFile.aspx?docid=144066&searchid=2c16c041-d0b2-4ec5-ac42-8b95aa0c04e3&dbid=0	(CWCB 2004)
2008	Energy Development Water Needs Assessment Phase I	Energy Development Water Needs Assessment Phase I	Developed future demand estimates through the 2050 planning horizon for the oil shale, natural gas, coal, and uranium energy sectors.	http://www.coloradoriverdistrict.org/conservation/wp-content/uploads/2014/12/Report-2008-Energy_Development_Water_Needs_Assessment_Phase_1.pdf	(Colorado, Yampa, White BRT 2008)
2010	Updated SWSI	SWSI 2010	Updated the original SWSI to include new data and develop projections through a future planning horizon of 2050.	http://cwcb.state.co.us/water-management/water-supply-planning/documents/swsi2010/appendix%20swsi%202010%20municipal%20and%20industrial%20water%20conservation%20strategies.pdf	(CWCB 2010d)
2010	Nonconsumptive Needs Assessment Focus Mapping Report	Nonconsumptive Needs Assessment Focus Mapping Report	Development of environmental and recreational focus maps and attribute tables to further characterize the environmental and recreational needs within the State's Basins.	http://cwcbweblink.state.co.us/weblink/0/doc/143889/Electronic.aspx?searchid=a05c7436-830c-490a-a93b-a24fe22bf46e	(CWCB 2010b)



Year Study Completed	Study	Referenced in document as	Summary	Study Web link	Citation
2011	Basin Needs Assessments (Yampa-White Report)	Yampa-White Basin Needs Assessment Report Basin Needs Assessment Report	Summarizes information developed through the SWSI process for the YWG Basin.	http://cwcb.state.co.us/water-management/basin-roundtables/documents/yampawhite/yampawhitebasinneedsassessmentreport.pdf	(CWCB 2011b)
2011	Energy Development Water Needs Assessment Phase II	Energy Development Water Needs Assessment Phase II	Updated the oil shale demand from the Phase I Energy Development Water Needs Assessment.	http://www.crwcd.org/media/uploads/Energy_Development_Water_Needs_Assessment_Phase_I_Final_Report.pdf	(Colorado, Yampa, White BRT 2011)
2011	Yampa/White Agricultural Water Needs Assessment Report	Agricultural Water Needs Study	Refined and updated previous estimates of current agricultural uses and supplies, evaluated future agricultural demands, assessed climate change and energy development sector impacts on agricultural water availability, and developed alternatives to satisfy shortages.	http://cwcbweblink.state.co.us/WebLink/0/doc/155776/Electronic.aspx?searchid=aa2fb556-c075-4ddd-bc30-ffadd57830af	(YWG BRT 2010)
2012	Colorado River Water Availability Study (CRWAS)	CRWAS	Provides a common platform to determine consumptive and non-consumptive uses throughout the western slope. StateMod models developed under the CDSS for the Colorado River main stem, Gunnison River, Dolores/San Juan/San Miguel Rivers, and the YWG Rivers were used in the development process. Current demands, operations, and historical hydrology as well as a suite of climate change demands and hydrologies were used to determine the current and potential future state of water availability along the western slope of Colorado.	http://cwcb.state.co.us/technical-resources/colorado-river-water-availability-study/Pages/main.aspx	(CWCB 2012)



Year Study Completed	Study	Referenced in document as	Summary	Study Web link	Citation
2012	Yampa-White BRT Watershed Flow Evaluation Tool (WFET) Study	WFET	Applied ecology-flow metrics to identify environmentally and recreationally significant areas and determine the risk levels associated with those areas. The associated risk metrics characterize the impacts of increased water use within the basin on trout, warm water fish, cottonwoods and boating.	http://www.conservationsgateway.org/Files/Pages/yampawhitewfet.aspx	(TNC 2012)
2013	CWCB Nonconsumptive Use Toolbox	Nonconsumptive Use Toolbox	Provides a framework to evaluate existing information and identify opportunities and challenges regarding implementation of environmental and recreational projects.	http://cwcbweblink.state.co.us/weblink/0/doc/170187/Electronic.aspx?searchid=ee0c3336-ec13-43aa-8b81-460b87f065af	(CWCB 2013b)
2014	YWG Projects and Methods Study (Draft Final February 27, 2014)	P&M Study	Evaluates the M&I, energy, agricultural and environmental and recreational needs and shortages in the YWG Basin using the StateMod model.	http://cwcb.state.co.us/water-management/basin-roundtables/Documents/YampaWhite/YampaWhiteProjectsMethodsStudy_DraftFinal02272014.pdf	(YWG BRT 2014)
2014	Yampa Basin Alternative Agricultural Water Transfer Methods Study	Alternative Transfer Methods Study	Identified several locations where alternative agricultural transfer methods meeting the needs of both the environment and consumptive uses could be implemented. These temporary water leasing arrangements could offer substantial benefit to both consumptive and non-consumptive interests if their associated challenges can be overcome.		(YWG BRT 2010)
2014	Energy Development Water Needs Assessment Update Phase III	Energy Development Water Needs Assessment Update Phase III	Assess current and projected energy water demands provided in the Phase I and Phase II Energy Development Water Needs Assessment. Where appropriate, estimates will be revised to reflect the most up-to-date data trends. Emphasis is placed on updating the natural gas and oil shale demands.	http://www.coloradoriverdistrict.org/supply-planning/studies-reports-2/	(Colorado, Yampa, White BRT 2014)



1.2 Description of Goals and Measurable Outcomes

1.2.1 Context for Basin Goals—Maintenance of Historical Use, Protection of Water Supplies for Future Demands, and Environmental Protection

The YWG BRT identified eight primary basin goals. The principal objective underlying all of the goals is the maintenance and protection of historical water use in the YWG Basin as well as the protection of water supplies for future in-basin demands. The YWG Basin goals ultimately seek to promote a healthy and diversified economy long into the future. By maintaining historical water use, residents in the YWG Basin will continue to use the YWG Basin's natural resources sustainably which will consequently maintain a balanced and diverse economic base. To effectively address future uncertainties, the YWG BRT supports the use of a scenario planning approach for regional and statewide water supply planning that recognizes that both wet and dry periods will occur in the future.

To provide a concrete measurement of success in meeting existing and future water needs, each goal is paired with measurable outcomes. Each of the goals includes a brief narrative description, a process for achieving the goal, and specific measurable outcomes. The goal processes include tasks, items for inclusion in the BIP, and other steps or mechanisms necessary to help achieve the goal. The YWG BRT has sought to define measurable outcomes that avoid arbitrary targets or unrealistic objectives. .

1.2.2 YWG Basin Goals (Order does not indicate priority)

- Protect the YWG Basin from compact curtailment of existing decreed water uses and some increment of future uses.
- Protect and encourage agriculture uses of water in the YWG Basin within the context of private property rights.
- Improve agricultural water supplies to increase irrigated land and reduce shortages. The agricultural needs study of the YWG BRT identified an additional 14,805 acres of potential new agricultural production in the future.
- Identify and address municipal and industrial (M&I) water shortages.
- Quantify and protect environmental and recreational water uses at locations identified in the non-consumptive needs study of the YWG BRT.
- Maintain and consider the existing natural range of water quality that is necessary for current and anticipated water uses.
- Restore, maintain, and modernize water storage and distribution infrastructure.
- Develop an integrated system of water use, storage, administration and delivery to reduce water shortages and meet environmental and recreational needs.

1.2.3 Protect the Basin from compact curtailment of existing decreed water uses and some increment of future uses.

The YWG BRT has identified protection of present and future uses as the most important issue in the YWG Basin. 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 obtain an equitable allocation of native flows in the Yampa, White, and Green Rivers.



In Sections 2 and 3, this BIP intends to quantify existing baseline water use and to identify important projected needs. It is important to note that even existing uses may not be static with the potential impacts of future water shortages from drought and climate change. In other words, a hotter climate could increase crop and landscape irrigation consumptive use and consequently increase demands related to historical water rights. Therefore, this report provides an assessment of water supply impacts under different hydrologic scenarios in Section 3.

To maintain existing uses, it is also critical to prevent the abandonment of pre-compact water rights. The YWG BRT will encourage water rights owners to take actions to prevent pre-compact water rights from being placed on the Colorado Division of Water Resources Division 6 abandonment list and encourage their participation in the protest process where appropriate.

Processes:

- Document existing baseline of major decrees, environmental compliance agreements including the Yampa and White Programmatic Biological Opinions (PBOs), water rights administration protocols, and related operations including documentation of permitted future depletions in basins under such PBO's.
- 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.
- Review Division 6 water rights abandonment list and educate pre-compact water rights owners on how to maintain existing decreed water rights.
- Periodically update and refine estimates for anticipated and unanticipated future water uses.

Measurable Outcomes:

- Secure an equitable allocation of native flow in the Yampa, White, and Green rivers to meet existing and future in-basin water demands including PBO depletion allowances.
- Maintain existing and future PBO depletion allowances for in-basin needs.
- Minimize and mitigate the risk of a Colorado River Compact shortage.
- Prevent pre-Compact water rights from being abandoned or placed on the Division 6 abandonment list.

1.2.4 Protect and encourage agricultural uses of water in the YWG Basin within the context of private property rights.

While it is common for agricultural areas in Colorado to be water-short, agricultural shortages represent a real need and opportunity for improvement. In addition, the YWG Basin is the only basin in the State projecting the addition of up to 14,805 irrigated acres. The analysis undertaken in the BIP seeks to better define the “ag gap” in the YWG Basin. This fits with the CWCB’s emphasis on extending the SWSI analysis to include agricultural, environmental, and recreational gaps to complement the M&I gap identified in previous studies.

Existing and proposed projects and other site-specific solutions will be matched with water availability to identify and recommend the most effective projects. An emphasis on multiple-purpose projects will be carried throughout the analysis, where applicable. 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 utilize senior agricultural water rights that may be at risk of abandonment.



Processes:

- Identify agricultural water shortages and 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, water banking, and efficiency improvements that protect and encourage continued agricultural water use. Identify projects that will bring new irrigable lands in the YWG Basin into production using new water diversions.
- Encourage and support M&I projects that have components that preserve agricultural water uses.

Measurable Outcomes:

- Preserve the current baseline of approximately 119,000 irrigated acres and expand by 12% by 2030.
- Encourage land use policies and community goals which enhance agriculture and agricultural water rights.

1.2.5 Improve agricultural water supplies to increase irrigated land and reduce shortages.**Processes:**

- 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 shortages in these analyses. Identify projects that will bring new irrigable lands in the YWG Basin into production using new water diversions.
- 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, enlargement or repair of existing reservoirs, infrastructure to improve irrigation system efficiency, etc.
- Evaluate multiple objectives of recommended solutions.
- Develop methods to assist with streamlining permitting in a cost-effective manner.

Measurable Outcomes:

- Reduce agricultural shortages basin-wide by 10 % by the year 2030.
- Preserve the current baseline of 119,000 irrigated acres and expand by 12% by 2030.

1.2.6 Identify and address M&I water shortages.

As the YWG Basin continues to grow, its M&I water needs must be identified and addressed. We reiterate that the later development of the YWG Basin and the junior status of its water rights portfolio among Colorado River Basin tributaries is of 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 certainty for these uses against curtailment is an important point in our BIP. Population growth and future anticipated and unanticipated needs are also concerns. The population of the YWG Basin is projected to nearly triple by the year 2050 (SWSI 2010). In fact, the population of the West Slope will continue to grow at a faster rate than the Front Range of Colorado (SWSI 2010). Because the major driver for additional water use in most of the State is population growth, M&I water usage is also expected to nearly double, even with savings from passive conservation. Municipal water demands in the YWG Basin are estimated to increase from 12,000 AFY to 31,000 AFY by 2050, requiring an additional 19,000 AFY to meet the YWG Basin's water municipal water needs in 2050. 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.

Self-supported industrial (SSI) water demands, largely driven by needs for energy development, are estimated to significantly exceed municipal demands, requiring between 22,080 AFY to 67,280 AFY.

This report documents the planned efforts and related water availability of major water providers in the YWG Basin to meet needs projected through the year 2050. An emphasis on multi-purpose projects is carried throughout the analysis, where applicable. Water conservation efforts are also included as an important component of meeting municipal demands in the YWG Basin. Projected population and water use data are pulled from SWSI 2010, with updated project information from water providers where available. The M&I water supply gap in the YWG Basin is not recalculated for this report, but will be updated during the forthcoming SWSI 2016 effort. These updated projections will continue to be based on refined economic modeling projects performed by the Colorado State Demography Office.

Processes:

- 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.
- Identify impacts throughout the YWG Basin in the context of water shortages (drought and climate change), wildfire and compact shortage on M&I demands.
- Identify projects and processes that can be used to meet M&I needs.
- Encourage collaborative multi-purpose storage projects.
- Support efforts of water providers to secure redundant supplies in the face of potential watershed impacts from wildfire.
- Encourage municipal entities to meet some future municipal water needs through water conservation and efficiency.

Measurable Outcomes:

- Reliably meet 100% of M&I demands in the YWG Basin through the year 2050 and beyond.

1.2.7 Quantify and protect non-consumptive 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 BIP addresses how to protect these values, along with the economic values of consumptive water use.

In 2005, the United States Fish & Wildlife Service (USFWS) issued a PBO on the Management Plan for Endangered Fishes in the Yampa River Basin⁴. It addresses the flows needed for endangered fish recovery on the lower Yampa and Little Snake rivers. Releases from Elkhead Reservoir for augmentation of endangered fish flows are sometimes necessary to supplement low natural flows. In assembling the draft SWSI 2010 YWG Basin Report, the YWG BRT deferred finalization of the sections on non-consumptive needs and projects to meet them until the completion of the 2012 Watershed Flow Evaluation Tool (WFET) and an Alternative Transfer Methods Study. These follow-up studies incorporate the YWG Environmental and

⁴ (USFWS 2005b)



Recreational Non-consumptive Focus Mapping (2010). This focus mapping and follow-up studies identified important non-consumptive needs in the YWG Basin that are referenced in this report. Additional appendices to the 2010 Statewide update of non-consumptive needs also cataloged completed, ongoing, and planned non-consumptive projects for the Yampa and White Basins.⁵ Many of these projects were then mapped along with the non-consumptive needs in Figures 3-1 through 3-4 of the SWSI 2010 Report as an initial analysis of where identified non-consumptive needs are most effectively addressed. As noted in Section 4.0, the YWG BRT inventoried and mapped a new set of environmental and recreational projects for this BIP.

This BIP intends to refine the analysis of non-consumptive needs in the YWG Basin and to examine the CWCB's new approach for assessing the gaps between non-consumptive needs and the projects and methods to meet these needs. The BIP will also include recommendations for non-consumptive projects by themselves or as components of multipurpose projects. An emphasis on multiple purpose projects is carried throughout the analysis, where applicable.

The data source is SWSI 2010, with selective updates on recreational flows and the economic benefits of non-consumptive uses.

Processes:

- 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 the nodes identified in the study.
- Recommend potential site-specific solutions and projects in collaboration with local water users. Recommended solutions may include an initial analysis of the hydrology (water flow variability); the impact of climate change and interstate compact equities and risk to the hydrology in the YWG Basin, cost, financing, and permitting.
- Perform analyses to maximize the effectiveness of recommended solutions for meeting multiple objectives (i.e. consumptive and non-consumptive). The findings will again be considered in assessing the impacts of projects to meet consumptive needs, and in optimizing projects for multiple benefits.⁶
- 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 recharge groundwater tables for slow release to the stream system later in the summer which supports low flows and helps maintain non-consumptive benefits.

Measurable Outcomes:

- To the extent that non-consumptive needs can be specified and projects can be analyzed, there will be projects for non-consumptive attributes within the existing legal and water management context.
- Multi-purpose projects and methods will be researched and designed to meet the other goals enumerated here.

⁵ See Table 15 Non-consumptive Needs Assessment Phase II Update and Appendix F Colorado's Water Supply Future.

⁶ Examples of projects include the appropriation of new in-stream flow water rights; water rights and storage leasing; diversion, headgates, structures, and river improvement to allow irrigation efficiencies; and riparian restoration and habitat improvement to improve specific and general watershed health for consumptive and non-consumptive uses alike.



- 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.
- A new PBO is agreed upon for the White Basin that provides certainty for existing and future anticipated and unanticipated depletions and that assists with endangered fish recovery.
- The flow protection and any water leasing or re-operation of projects needed for native warm water fish, cottonwoods, and recreational boating on reaches with greater and overlapping flow alteration risks are integrated with the flow protection for endangered fish recovery and with projects to meet in-basin, consumptive needs. The flow needs of these non-consumptive attributes are otherwise met, including the avoidance or offset of the loss of minimum or optimal boating days that are related to multi-purpose projects and unrelated to drier or wetter hydrology.
- The flow needs for all other non-consumptive attributes are quantified, integrated with projects to meet in-basin consumptive needs, and otherwise met through non-consumptive identified projects and processes (IPPs). Multi-purpose projects will be researched and designed 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 for existing flows while voluntarily modernizing irrigation systems.
- The economic values of the relatively natural flow regimes of the Yampa and White river systems are recognized and protected, along with the economic values of consumptive water use.
- Acres of restored riparian areas, degraded streams, and wetlands to restore natural water storage capacity and improve water quantity and quality for non-consumptive needs
- Assess and quantify impact of IPP's on peak flows and ascertain whether further non-consumptive IPP's need to be identified.

1.2.8 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.

Processes:

- 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.

Measurable Outcomes:

- Consider and maintain the existing water quality necessary for current and future water uses when reviewing IPPs.
- Support the implementation of water quality monitoring programs to create quality-controlled baseline data for all sub-basins of the YWG Basin.

1.2.9 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. In dry years, gravel pushup dams are often constructed in the riverbed to maintain agricultural diversions. Where no storage exists smaller tributary streams are typically inadequate in the late season.



It is particularly important to preserve infrastructure that enables the use of water rights that predate the Colorado River Compact. In many cases restoration or modernization efforts serve to address multiple purposes, such as improved diversion reliability and accuracy, the addition of hydropower generation, and improved fish and boat passage. There is a nexus between infrastructure improvement and watershed health which should be further explored.

Processes:

- 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.
- Identify specific locations in the YWG Basin where infrastructure requires improvement or replacement to preserve existing uses. This should include identifying locations for small scale agricultural water storage projects throughout the YWG Basin and the potential for value-added multi-purpose to be included, i.e. hydropower to finance agricultural storage; reservoir operations.
- 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 of earthen delivery systems and taking inventory of the capacities of existing reservoirs and repairing storage-limited older projects. Research opportunities and constraints to maintain and expand the existing water storage capacity in the YWG Basin.
- Research potential grant programs for infrastructure improvements.
- Identify and include collective partnerships for infrastructure improvements which may provide multi-use benefit, i.e. fish passage.
- Evaluate appropriate measuring infrastructure for improved administration of the river.
- Conduct a headgate study in all three river basins which compiles efficiency and effectiveness of existing infrastructure, accessibility to diversion point, and use.

Measurable Outcomes:

- Increased percentage of operable headgates.
- Where applicable, monitor the reduction in the loss of water through less wastage or seepage of water through leaky ditches, headgates, and storage ponds.
- Increased agricultural water storage in combination with multi-purpose opportunities when possible
- Implement at least one project every year in the YWG Basin focusing on the restoration, maintenance, and modernization of existing water infrastructure.

1.2.10 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 Basin interests and within the context of private property rights. This system can make these rivers firm for delivery of needed water for 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 utilize 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 while meeting the compact obligations of the State.



Processes:

- Colorado Decision Support System (CDSS) modeling to evaluate storage operation, delivery locations, and river flows.
- Evaluate contracting possibilities with existing and proposed storage options.
- Discuss river administration opportunities.
- Review needs for infrastructure improvements.
- Encourage cooperative partnerships.

Measurable Outcomes:

- Success in permitting and constructing in-basin storage projects
- Reduction in consumptive shortages in drought scenarios
- Reduction in identified non-consumptive shortages in drought scenarios
- Administration and infrastructure improvements making decreed amounts of water available to diversion structures with less need for seasonal gravel dams in the river
- Reduce the potential incidence of severe low flows in order for water users to exercise their water rights.



Table of Contents

Section 2.0	Consumptive and Environmental & Recreational Needs	2-4
2.1	M&I Needs	2-4
2.1.1	Current M&I Needs	2-5
2.1.2	Future M&I Needs	2-6
2.2	SSI Needs.....	2-8
2.2.1	Current SSI Needs.....	2-9
2.2.2	Future SSI Needs	2-12
2.3	Agricultural Needs.....	2-16
2.3.1	Current Agricultural Needs.....	2-16
2.3.2	Future Agricultural Needs	2-21
2.4	Environmental and Recreational Needs	2-24
2.4.1	Focus Areas and Environmental and Recreational Attributes	2-24
2.4.2	Evaluation of Environmental Needs	2-30
2.4.3	Evaluation of Recreational Needs.....	2-40



List of Figures

Figure 2-1 Population Projections through 2050	2-7
Figure 2-2 Baseline M&I and Thermoelectric Power Generation Demands	2-11
Figure 2-3 Future M&I and Thermoelectric Power Generation Demands.....	2-14
Figure 2-4 Current Irrigated Acres.....	2-17
Figure 2-5 Current Irrigated Acres by Water District.....	2-18
Figure 2-6 Baseline Headgate Agricultural Water Demands	2-20
Figure 2-7 Future Headgate Agricultural Water Demands	2-23
Figure 2-8 Current and Future Headgate Agricultural Demands (AF)	2-24
Figure 2-9 Focus Areas	2-25
Figure 2-10 Decreed and Modeled Instream Flows	2-31
Figure 2-11 Modeled Nodes for the Flow-Ecology Risks	2-38
Figure 2-12 Baseline Recreational Whitewater Boating Results	2-43



List of Tables

Table 2-1 Definitions of M&I and SSI Demand Terms	2-4
Table 2-2 Current M&I Demands, County-level	2-5
Table 2-3 Current M&I Demands, Model node	2-5
Table 2-4 Future M&I Demands, County-level	2-7
Table 2-5 Future M&I Demands, Model node	2-8
Table 2-6 Current Large Industrial Demands, County-level	2-9
Table 2-7 Current Thermoelectric Power Generation Demands, County-level	2-10
Table 2-8 Current Thermoelectric Power Generation Demands, Model Node	2-10
Table 2-9 Future Thermoelectric Power Generation Demands, County-level	2-12
Table 2-10 Future Thermoelectric Power Generation Demands, Model node	2-13
Table 2-11 Future Energy Sector Development Direct Demand Forecast	2-15
Table 2-12 Average Annual IWR in Different Model Versions (AF)	2-19
Table 2-13 Non-Irrigation Agricultural Demands	2-21
Table 2-14 Attributes of Major Stream and Lake Segments	2-26
Table 2-15 Annual Instream Flow Target and Baseline Modeled Flows	2-32
Table 2-16 Monthly Instream Flow Targets and Percentage of Modeled Years that Reached the Target	2-33
Table 2-17 Selected Endangered Fish Flow Targets Baseline Condition	2-36
Table 2-18 Risks Levels Based on the Ecology-Flow Metrics for Baseline Conditions	2-39
Table 2-19 Decreed Flow Rates for the Steamboat RICD	2-41
Table 2-20 Percentage of Modeled Year in Which the Target RICD Monthly Target is Met	2-41
Table 2-21 WFET Whitewater Boating Flows	2-42



SECTION 2.0 CONSUMPTIVE AND ENVIRONMENTAL & RECREATIONAL NEEDS

This chapter provides an overview of the YWG Basin's M&I, energy, agricultural, and environmental and recreational needs. The majority of information presented in this chapter was developed through a series of State and basin-wide studies. A summary on each of these studies is provided in Appendix A along with a comprehensive overview of the 2014 Projects and Methods Study (P&M Study), which is the most up-to-date study conducted on the YWG Basin. The P&M Study incorporates current and future water demand projections to evaluate water supply needs, shortages, in-stream flows, and impacts that IPPs may have on the YWG Basin. A large portion of information presented in this chapter and in this BIP originates from this study. This chapter summarizes the most up-to-date information on the YWG Basin's water needs while also disclosing water demands incorporated into the BIP modeling effort. Future YWG Basin planning studies will continue to assess and update water demands accordingly.

2.1 M&I NEEDS

To portray the water needs of growing populations, the M&I demand forecast reflects typical municipal system water needs. Large industrial or SSI water usage depicts economic growth within the state. M&I and SSI demand terminology used throughout this report is defined in Table 2-1 below.

Table 2-1 Definitions of M&I and SSI Demand Terms

Demand Terminology	Definition
M&I Demand	Water use of typical municipal systems: residential, commercial, light industrial, landscape irrigation and firefighting
SSI Demand	Large industrial water users that have their own water supplies or lease raw water from others: mining, manufacturing, snowmaking, thermoelectric power generation (coal and natural gas facilities) and energy development
M&I and SSI Demand	The sum of M&I and SSI demand

Source: Yampa-White Basin Needs Assessment Report, 2011

A variety of studies have been completed that analyze M&I and SSI water needs in the YWG Basin. These studies evaluate current and forecasted water use and assess water supply gaps. These studies include (citations can be found in Section 1 Table 1-1):

- SWSI 2004 and 2010
- 2011 Yampa-White Basin Needs Assessment
- 2012 CRWAS
- 2014 P&M Study
- 2011 Energy Development Water Needs Assessment Phase II and 2014 Update

Most of these studies have evaluated M&I and SSI water needs on a county or regional basis. The most recent study, the P&M Study, provides a summary of the YWG Basin's M&I and SSI consumptive needs using the previous reports, but it also evaluated M&I and SSI demands on a more detailed scale, i.e., on a model node basis rather than county level. The discussion that follows regarding M&I and SSI needs, both current and future, will focus on results of the P&M Study.



2.1.1 Current M&I Needs

The YWG Basin is characterized by large areas that are rural and agricultural in nature, with low population density. Therefore, M&I demands are smaller compared to agricultural demands in the YWG Basin. Municipal demands are focused near the population centers of Craig (Moffat County), Meeker (Rio Blanco County), and Steamboat Springs (Routt County). The SWSI 2010 county-level values that formed a basis for the P&M Study's more detailed analysis are shown in Table 2-2. These values reflect M&I demands (as of 2008).

Table 2-2 Current M&I Demands, County-level

County	Water Demand (AFY)
Moffat	3,200
Rio Blanco	2,000
Routt	6,500
Total	12,000

Source: P&M Study, 2014.

As described in more detail in Appendix A, the P&M Study used the SWSI 2010 and Basin Needs Assessment Report county-level demands and applied them to specific model nodes in the 2009 release of the Yampa and White Basins StateMod models. Table 2-3 presents current M&I demands at each model node, grouped by county¹. The demands at the model nodes for Moffat and Rio Blanco counties were used in both the P&M Study and BIP updated modeling effort. The demands in Routt County were updated for purposes of the BIP modeling per recommendations from Mt. Werner Water and Sanitation District.

Table 2-3 Current M&I Demands, Model node

Diversion Name	Current Average Annual Water Demand ¹ (Diversions) (AFY)
Moffat	
Craig Water Supply Plant (440581)	2,200
District 44 Existing M&I (44_AMY001)	740
District 55 Existing M&I (55_AMY003)	10
Moffat County Total	2,950
Rio Blanco	
Rangely Water (430889)	1,710
Meeker Demand (950810)	370
District 43 Existing M&I (43_AMW001)	1,100
Rio Blanco County Total	3,180
Routt	
District 57 Existing M&I (above Craig) (57_AMY001)	480
District 58 Existing M&I (Steamboat Springs) (58_AMY001)	1,340

¹ Amounts presented are diversion amounts.



Diversion Name	Current Average Annual Water Demand ¹ (Diversions) (AFY)
Fish Creek Municipal Intake (580642) ²	2,310
Steamboat Well A (585055) ³	300
Mt Werner Well G (586140) ³	90
Mt Werner Well H (585059) ³	210
Routt County Total	4,730
Total	10,860

Source: P&M Study, 2014. Mt. Werner Water and Sanitation District provided updated demands, since the P&M Study, at the Fish Creek Municipal Intake, Steamboat Well A, Mt Werner Well G and Mt Werner Well H nodes.

¹Amounts presented are diversion amounts.

²The Fish Creek Municipal Intake (580642) includes Fish Creek direct flow rights (1892) that are pre-1922 with Fish Creek Reservoir storage rights (1946, 1964, 1996).

³The Steamboat Well A, Mt Werner Well G and Mt Werner Well H include Yampa wellfield rights (1977, 1992) that are post-1922 and that seasonally pump about 600 AFY.

Figure 2-2 below shows a spatial representation of the current M&I demands and thermoelectric water demands on a model node basis as presented in the P&M Study and BIP modeling efforts.

2.1.2 Future M&I Needs

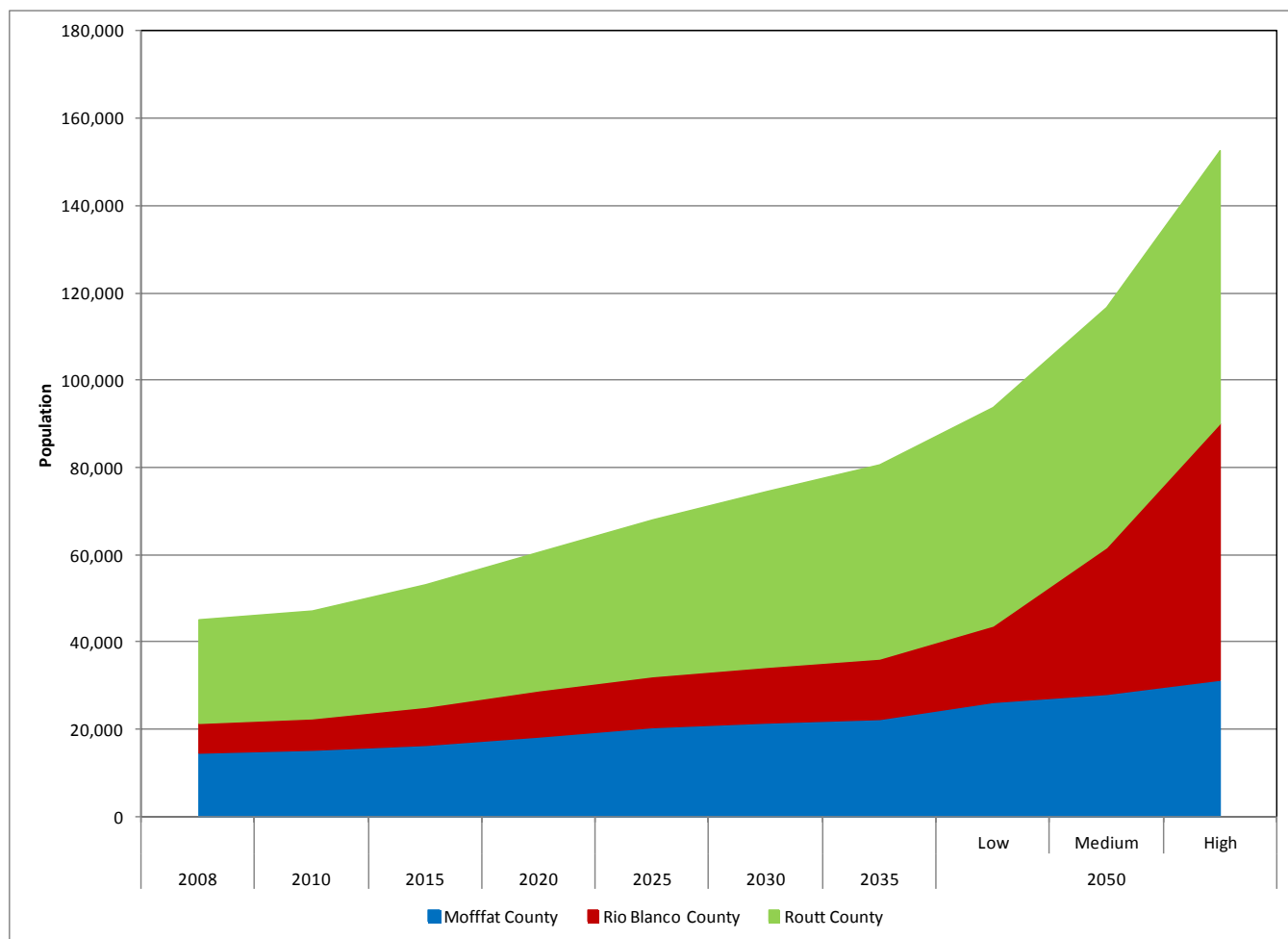
To estimate future M&I needs, SWSI 2010 used a water planning horizon extending to 2050. The SWSI 2010 and Basin Needs Assessment Report estimates also include passive conservation, and were developed for low, medium and high demand categories. Passive conservation mainly reflects water demand reductions due to policy measures such as those requiring manufacture of more efficient toilets, washing machines and dishwashers and the subsequent installation, or retrofit, of these appliances into existing housing and commercial buildings.

The YWG Basin BIP Subcommittee chose the high demand, low supply scenario from the P&M Study to be analyzed; therefore, only the future high demand analyzed; therefore, only the future high demand results are discussed below. As shown in Source: State of Colorado 2050 Municipal & Industrial Water Use Projections (CWCB 2010c)

Figure 2-1, for the high economic growth scenario, the population in the YWG Basin is expected to more than triple by the year 2050. The high population growth scenario includes a 550,000 barrel per day oil shale industry². Population growth attributed to the oil shale industry is especially evident in Rio Blanco County after 2035. The oil shale industry is discussed further in Section 2.2 SSI Needs.

² State of Colorado 2050 M&I Water Use Projections (CWCB 2010c)





Source: State of Colorado 2050 Municipal & Industrial Water Use Projections (CWCB 2010c)

Figure 2-1 Population Projections through 2050

As shown in Table 2-4 below, even with passive conservation, the M&I demands are predicted to more than triple as well.

Table 2-4 Future M&I Demands, County-level

County	Current Population	Current Water Demand (AFY) 2008	Future Population 2050 High	Water Demand with Passive Conservation (AFY) 2050 High ¹
Moffat	14,600	3,200	31,000	6,400
Rio Blanco	6,700	2,000	59,000	17,000
Routt	23,800	6,500	63,000	16,000
Total	45,100	12,000	153,000	39,400

Source: P&M Study, 2014; Yampa-White Basin Needs Assessment Report, 2011; SWSI 2010

Table 2-5 presents future M&I demands at each model node, grouped by county. The demands at the model nodes for Moffat and Rio Blanco counties were used in both the P&M Study and BIP updated modeling effort. The



demands in Routt County were updated for purposes of the BIP modeling per recommendations from Mt. Werner Water and Sanitation District.

Table 2-5 Future M&I Demands, Model node

Diversion Name	Future Water Demand (AFY) 2050 High
Moffat	
Craig Water Supply Plant (440581)	5,350
District 44 Existing M&I (44_AMY001)	740
District 55 Existing M&I (55_AMY003)	10
Moffat County Total	6,100
Rio Blanco	
Rangely Water (430889)	10,610
Meeker Demand (950810)	2,290
District 43 Existing M&I (43_AMW001)	4,120
Rio Blanco County Total	17,020
Routt	
District 57 Existing M&I (above Craig) (57_AMY001)	4,250
District 58 Existing M&I (Steamboat Springs) (58_AMY001)	6,270
Fish Creek Municipal Intake (580642) ¹	3,850
Steamboat Well A (585055) ¹	825
Mt Werner Well G (586140) ¹	250
Mt Werner Well H (585059) ¹	575
Routt County Total	16,020
Total	39,140

Source: P&M Study, 2014.

¹ Updated demands since the P&M Study were provided by Mt. Werner Water and Sanitation District at the District 58, Existing M&I, Fish Creek Municipal Intake, Steamboat Well A, Mt Werner Well G and Mt Werner Well H nodes.

Figure 2-3 below shows a spatial representation of the future M&I demands, and thermoelectric demands, on a model node basis, as used the modeling update for the BIP.

2.2 SSI NEEDS

Water is a necessary component for self-supplied industries in Colorado such as mining, manufacturing, food processing, power generation and energy development and is therefore an integral part of these important drivers of the state economy. In fact, the YWG Basin is the only basin in the state where SSI water needs exceed M&I water needs. The SSI subsectors are diverse and are categorized in the following groups for the BIP:

- large industrial
- thermoelectric power generation
- energy development



SSI needs have been analyzed in the same reports mentioned above for M&I and results indicate that currently, the largest SSI water demand in the YWG Basin is for thermoelectric power. However, due to the potential for energy resource development in northwest Colorado, and the concern that traditional water uses in the YWG Basin such as agriculture and recreation could be impacted if large energy industries develop, specific studies have been completed that analyze associated energy water needs in the area. Previous studies, found in Table 1-1, developed for the Colorado and YWG Basin include:

- Energy Development Water Needs Assessment Phase I
- Energy Development Water Needs Assessment Phase II
- Energy Development Water Needs Assessment Phase III

The P&M Study and Energy Development Water Needs Assessments represent the most recently completed analyses of current and future SSI water needs. Results from these studies are presented below

2.2.1 Current SSI Needs

Large Industrial

Large industrial demands in the YWG Basin, such as snowmaking demands for the Steamboat Springs Ski Resort, Twenty-mile Mine in Routt County, Trapper Mine in Moffat County, and golf courses in Routt County compose a sizable portion of the demands outside of the typical municipal demands and are therefore categorized separately. For example, Rollingsstone Ranch Golf Course (a.k.a. Sheraton Starwood) diverts an average of 115 AFY (max 144 AFY) under a limited lease on a fraction of the Mt. Werner Water District's 5.8 cubic feet per second (cfs) Hoyle & Knight water right (1892). Large industrial demands presented in SWSI 2010, the Basin Needs Assessment Report and the P&M Study are shown in Table 2-6 below. With exception to snowmaking at Steamboat Springs Ski Resort, the P&M Study and the BIP do not include current large industrial demands in the modeling effort.

Table 2-6 Current Large Industrial Demands, County-level

County	Water Demand (AFY)
Moffat	2,600
Rio Blanco	0
Routt	3,800
Total	6,400

Source: P&M Study, 2014.

Thermoelectric Power Generation

Despite a mandate requiring 20 percent of the state's electricity to be provided by renewable energy resources by 2020, demand for coal-fired and natural gas energy production will continue into the foreseeable future. In the YWG Basin, two thermoelectric power generation facilities exist – the Craig Station in Moffat County operated by Tri-State and the Hayden Plant in Routt County operated by Xcel Energy. The current county-level water demands for thermoelectric power generation from SWSI 2010 and the Basin Needs Assessment Report are presented in Table 2-7.



Table 2-7 Current Thermoelectric Power Generation Demands, County-level

County	Water Demand (AFY)
Moffat	17,500
Rio Blanco	0
Routt	2,700
Total	20,200

Source: P&M Study, 2014.

In the P&M Study, the county-level demands were distributed to the two existing thermoelectric power generation facilities in the basin, using a methodology similar to that used for M&I demands (described in more detail in Appendix A). These results are shown in Table 2-8 and were used in the updated BIP modeling.

Table 2-8 Current Thermoelectric Power Generation Demands, Model Node

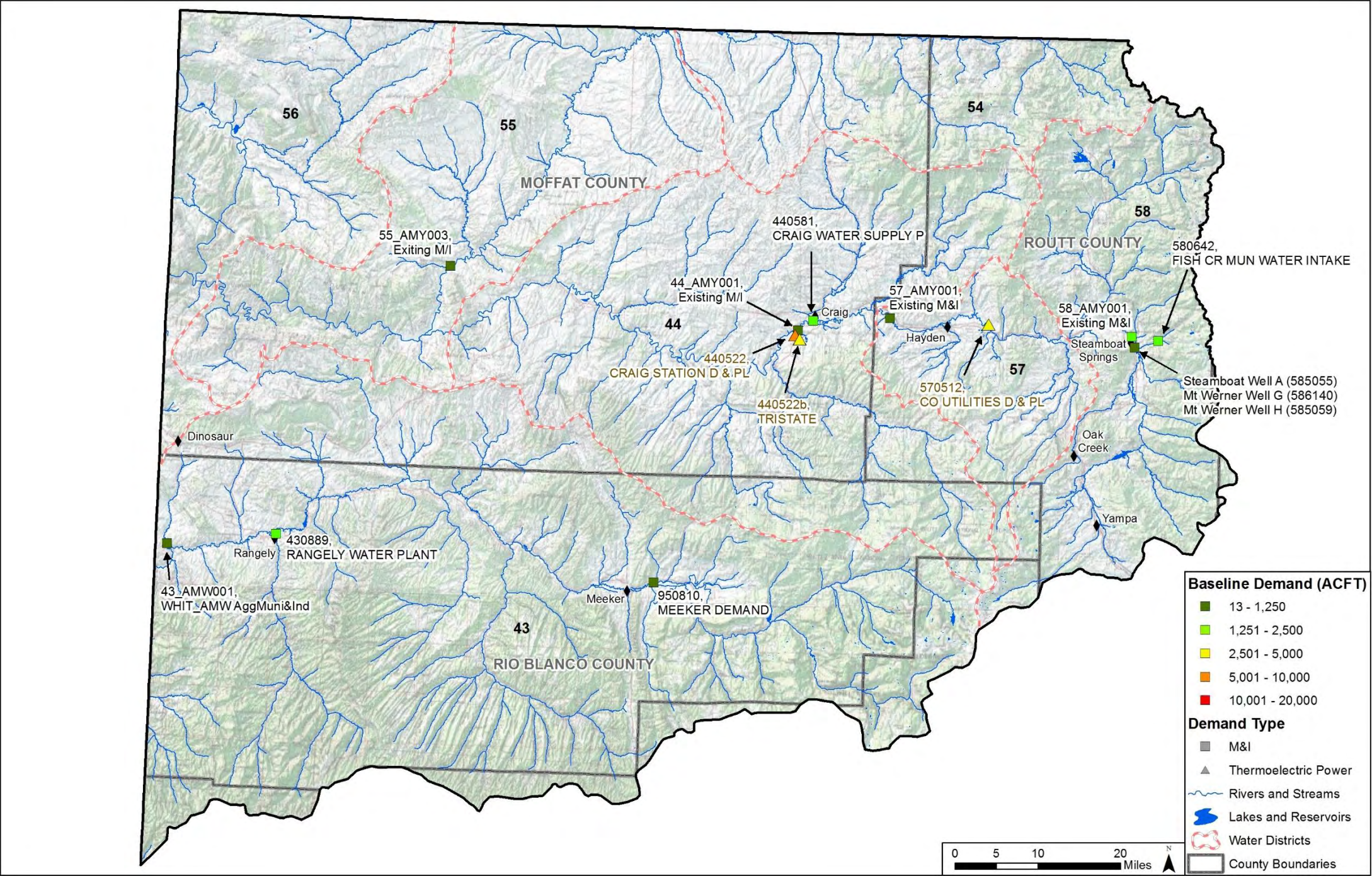
Diversion Name	Average Annual Simulated Diversion (AFY)
Moffat	
CRAIG STATION D & PL (Units 1&2) (440522) ¹	9,340
Tri-State (Unit 3) (440522b) ¹	4,670
Moffat County Total	14,010
Routt	
COLO UTILITIES D & PL (Hayden Station) (570512)	4,890
Routt County Total	4,890
Total	18,900

Source: P&M Study, 2014.

¹The water demand for the Moffat County nodes has been updated since the P&M Study per input from Tri-State.

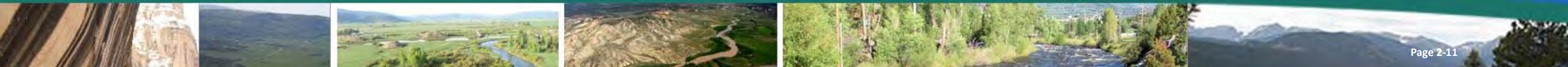
Figure 2-2 shows a spatial representation of the current M&I and thermoelectric water demands on a model node basis.





Source: P&M Study, 2014. Note: This figure has been updated to reflect the updated SSI and M&I demands provided in Tables 2-3 and 2-8.

Figure 2-2 Baseline M&I and Thermoelectric Power Generation Demands



Energy Development

Studies have been completed that evaluate the current and future water requirements of various energy development sectors in northwest Colorado, in particular for the natural gas, uranium, coal and oil shale industries. Some components of the water needs are included in the M&I and thermoelectric power generation demands discussed above, but direct demands for oil shale development, which includes the water required for construction, operation, production and reclamation, are included in a separate category.

2.2.2 Future SSI Needs

Large Industrial

The modeling effort for the P&M Study and BIP do not evaluate future large industrial need with exception to snowmaking at Steamboat Ski Resort.

Thermoelectric Power Generation

Since thermoelectric power demands are related to needs of the population served, it will trend in a similar manner to changes in population and the associated M&I demands. County-level thermoelectric future (high demand) needs from SWSI 2010 and the Basin Needs Assessment Report are shown in Table 2-9.

Table 2-9 Future Thermoelectric Power Generation Demands, County-level

County	Current Water Demand (AFY) 2008	Water Demand with Passive Conservation (AFY) 2050 High
Moffat	17,500	26,900
Rio Blanco	0	0
Routt	2,700	17,100
Total	20,200	44,000

Source: P&M Study, 2014.

Results for future thermoelectric demands from the P&M Study based on model nodes are shown in Table 2-10. These demands were used in both the P&M Study and updated modeling for the BIP.



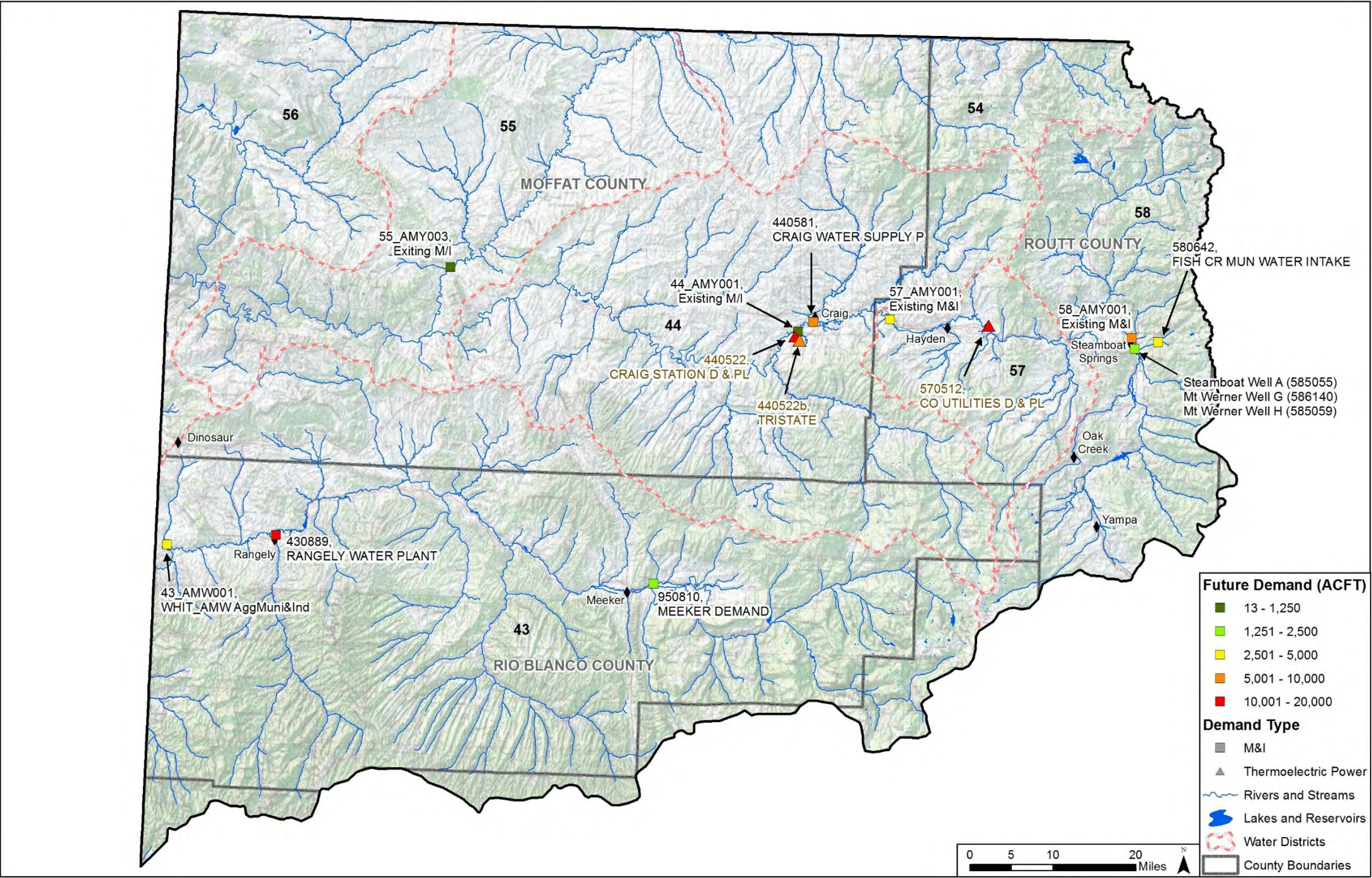
Table 2-10 Future Thermoelectric Power Generation Demands, Model node

Diversion Name	Future Water Demand (AFY) 2050 High
Moffat	
CRAIG STATION D & PL (Units 1&2) (440522)	17,930
Tri-State (Unit 3) (440522b)	8,970
Moffat County Total	26,900
Routt	
COLO UTILITIES D & PL (Hayden Station) (570512)	17,100
Routt County Total	17,100
Total	44,000

Source: P&M Study, 2014.

Figure 2-3 below shows a spatial representation of the future M&I demands and thermoelectric demands used for the BIP modeling update on a model node basis.





Source: P&M Study, 2014. Note: This figure has been updated to reflect the updated M&I demands provided in Table 2-5.

Figure 2-3 Future M&I and Thermoelectric Power Generation Demands



Energy Development

The Energy Development Water Needs Assessment Studies estimated water uses associated with the development of the four energy sectors of natural gas, oil shale, coal, and uranium. The water uses include direct demands, water supplies serving the operations, construction, processing, and reclamation purposes; indirect demands, attributed to the municipal and domestic water supplies required by the growth in population associated with the development of the resources; and water uses for thermoelectric power generation, power supplies for the new population growth and a portion of the industrial power requirements. The Energy Development SSI water uses includes only the direct uses associated with each energy sector. The indirect uses are included in the M&I estimates and the thermoelectric demands are included in SSI thermoelectric demands as discussed above.³

The recently completed Energy Development Water Needs Assessment Study Phase III reviewed and updated the direct water uses for energy development. The Phase III study carries forward the Phase I water use estimates for the coal and uranium sectors (because there is no new information or development prospects in those sectors) and updates water use estimates for the oil shale and oil and gas sectors. Since the Phase II report was published, both Chevron and Shell have ended their oil shale research projects in Colorado. The National Oil Shale Association markedly reduced water use estimates mainly because the large in situ projects proposed by Chevron and Shell were discontinued. Therefore, the Phase III reports new water use estimates for oil shale. Additionally, the Phase III report updates the direct water uses associated with oil and gas well drilling and completions since new information on drilling activity and resource development planning is available since 2008.

Table 2-11 Future Energy Sector Development Direct Demand Forecast

Energy Sector	Water Demand Levels (AFY) 2050 High Production
Natural Gas and Oil	6,000
Uranium	130
Coal*	6,000
Oil Shale	76,000
Total	88,000

Source: Energy Development Water Needs Assessment Study Phase III, 2014.

*Updated with information from Peabody Coal feasibility planning for Peabody-Trout Creek water supply project.

The P&M Study and updated BIP modeling did not include evaluation of the small and nearly insignificant water demands associated with uranium development. For the water supplies associated with oil and gas, the P&M Study indicates that “demands will not be met through direct diversion rights” and did not model those uses. Nonetheless, water supplies for drilling and well completion will, in part, come from tributary sources⁴.

The P&M Study and updated BIP modeling included a water supply project for the coal energy sector based on updated information developed in the Peabody-Trout Creek water supply feasibility studies⁵. The work focused on a water storage project on Trout Creek upstream of the confluence with the Yampa River. This project will be developed to help Peabody Energy meet 6,000 AFY of energy development demands as part of the Peabody-Trout Creek Project.

³ Oil shale development direct demands include water supplies for electrical generation as required for the electrical heating in situ commercial technologies.

⁴ Energy Development Water Needs Assessment Update Phase III, 2014

⁵ (Peabody 2014)



The P&M Study and updated BIP modeling did not re-evaluate direct water demands associated with a commercial oil shale industry yet carried forward the evaluations of oil shale water supplies developed in the Energy Development Water Needs Assessment Phase II report.

2.3 AGRICULTURAL NEEDS

2.3.1 Current Agricultural Needs

Irrigated Acreage

Irrigated acreage in the YWG Basin has varied over the past several decades, fluctuating between approximately 86,000 and 119,600⁶ acres in the Yampa and Green Basins while irrigation in the White Basin has remained relatively stable. Figure 2-4, shows the total irrigated acres in the YWG Basin. The most recent estimates of irrigated acreage indicates that there is a total of 100,900 irrigated acres in the YWG Basin, of which 27,500 acres are in the White Basin, and 73,400 acres are in the Yampa and Green Basins.⁷ Almost all of the acreage is irrigated with surface water; groundwater pumping in the YWG Basin is minor relative to surface water diversions. The irrigation demands in the Agricultural Water Needs Study, the P&M Study and updated BIP modeling were based on the irrigated acreage from 1993 totaling 119,607 acres, however.

⁶ Agricultural Water Needs Study, 2010.

⁷ This is based on the CDSS 2005 spatial Geographic Information Systems (GIS) coverage of the irrigated areas in the Basin. (CDSS 2005)



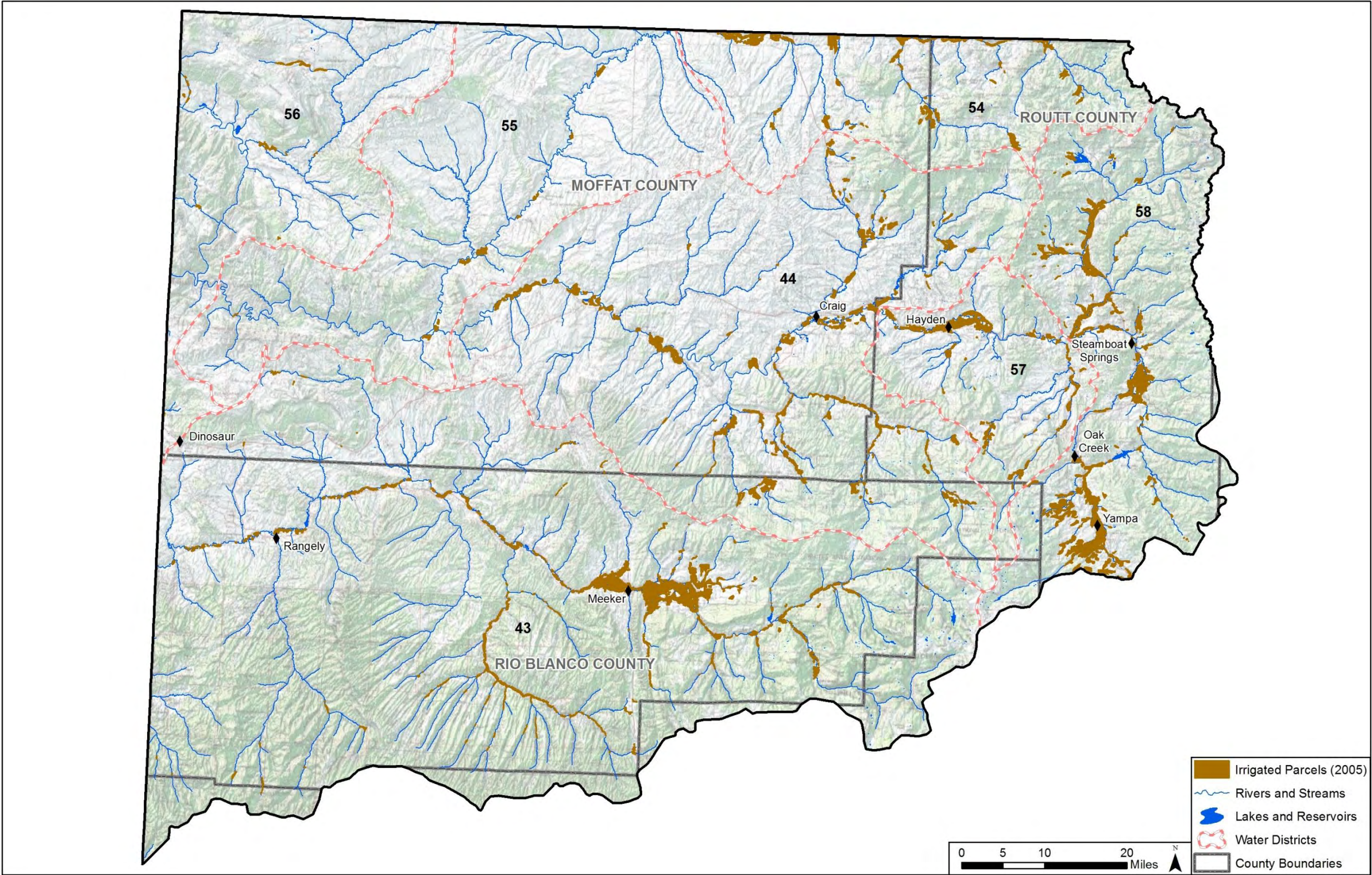
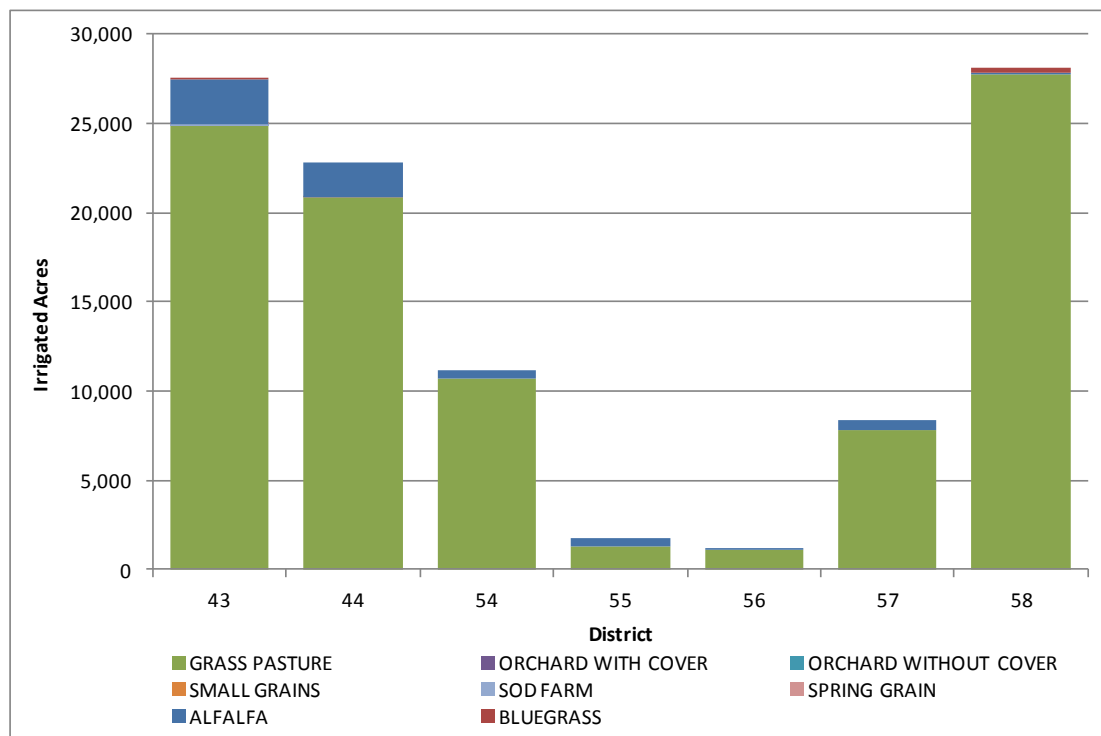


Figure 2-5 shows the irrigated acres by crop type for each water district. District 58 has the greatest amount of irrigated acres followed by District 43 and District 44. The majority of crops grown in the YWG Basin are grass/pasture and hay. A small amount of alfalfa is grown in District 43, 44, 54, 55 and 57 while District 58 grows a small amount of bluegrass.



Source: (CDSS 2005). GIS irrigated acres.

Note: The bluegrass component represents the acreage of golf courses and recreational parks.

Figure 2-5 Current Irrigated Acres by Water District

Current Irrigation Demands

The current irrigation headgate demands are shown in Figure 2-6. These irrigation demands account for estimates of irrigation system efficiency, representing the amount of water diverted from the stream to meet the irrigation water requirement (IWR) by hydrologic unit code (HUC).⁸ The largest amount of irrigation water diverted from the stream at the ditch headgate (this includes water used to meet the consumptive IWR in addition to diversions and irrigation losses) occurs in District 58 upstream of Steamboat Springs in the Yampa Basin and in District 43 upstream of Meeker in the White Basin. These areas are shown as red in Figure 2-6.

The current average annual consumptive IWR for the YWG Basin used for this BIP is taken from the Agricultural Water Needs Study and is 229,018 AF. This total consumptive demand in irrigation is broken down by sub-basin and compared with other recent estimates in Table 2-12.

⁸ The IWR is defined as the potential crop evapotranspiration minus effective precipitation (amount of precipitation that is used by the crop). The IWR does not include losses incurred through ditch seepage and through application onto the field.



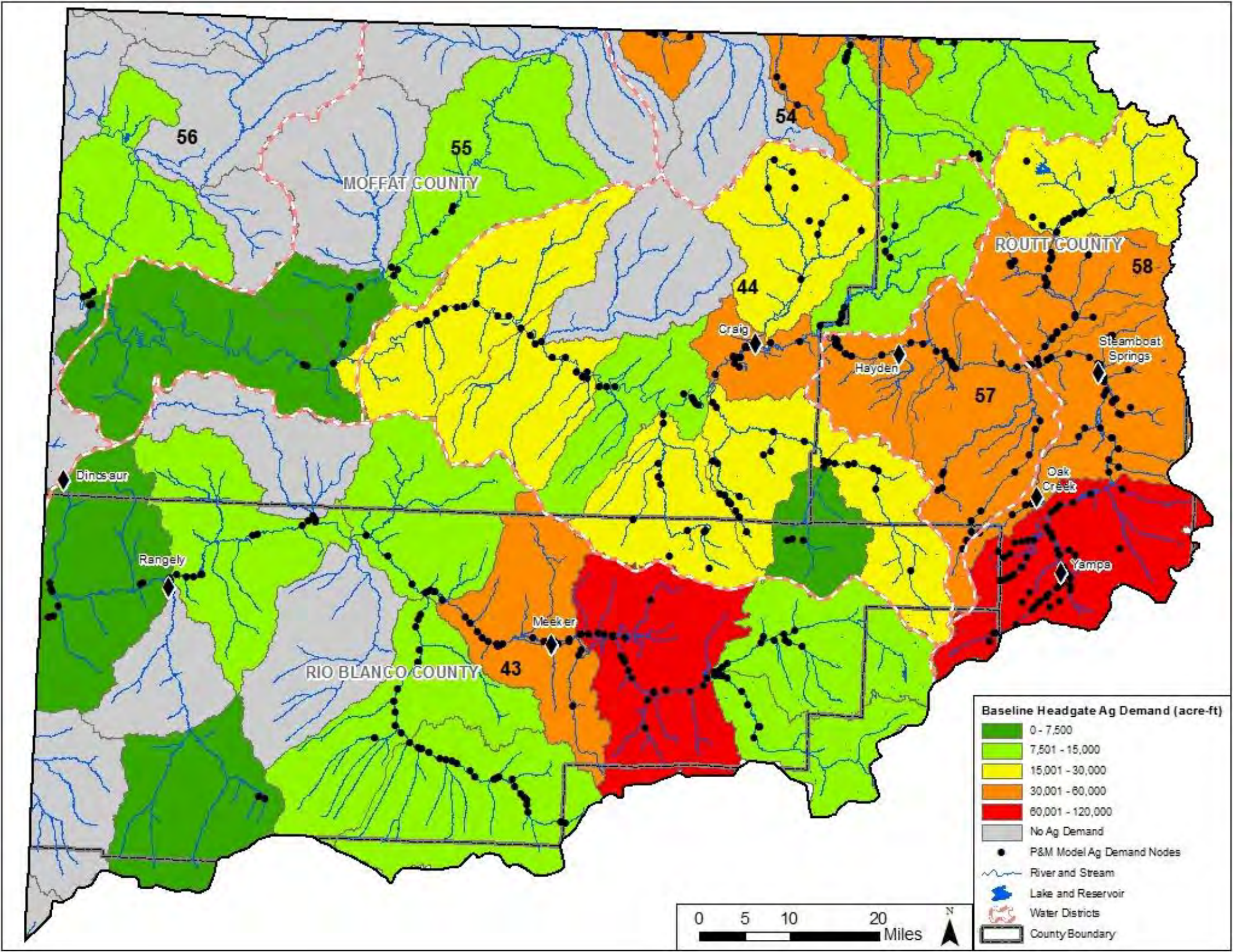
Table 2-12 Average Annual IWR in Different Model Versions (AF)

Basin/Stream (Water District)	SWSI	CDSS 2008	Agriculture Needs and P&M Study*
White (43)	32,634	39,465	45,740
Green (56)	2,878	2,759	3,516
Yampa (<i>Sub-basins in italics below</i>)	104,248	170,207	179,762
Study Area	139,760	212,431	229,018
<i>Lower Yampa (44)</i>	<i>37,924</i>	<i>49,828</i>	<i>55,003</i>
<i>Slater/Timberlake (54)</i>	<i>19,673</i>	<i>32,160</i>	<i>33,401</i>
<i>Little Snake (55)</i>	<i>2,529</i>	<i>2,407</i>	<i>2,869</i>
<i>Middle Yampa (57))</i>	<i>10,136</i>	<i>14,449</i>	<i>16,556</i>
<i>Upper Yampa (58)</i>	<i>33,986</i>	<i>71,364</i>	<i>71,933</i>

Source: Yampa/White Basin Needs Assessment Report, 2010.

Note: The demands presented in this table are IWR demands which do not include system losses from the headgate diversion to the field. Figure 2-6 provides the headgate diversions for the 2014 P&M Study.





Source: P&M Study, 2014. Modeling Results.

Figure 2-6 Baseline Headgate Agricultural Water Demands



Other Current Agricultural Water Demands

In addition to irrigation water demands, statewide planning efforts (SWSI 2010) have estimated non-irrigation agricultural demands. These include livestock consumptive use and stockpond evaporation⁹ and are provided in Table 2-13. These non-irrigation agricultural demands are relatively minor when compared to the irrigation demands discussed above and were not incorporated into the P&M Study or updated BIP modeling effort.

Table 2-13 Non-Irrigation Agricultural Demands

Water District	Livestock Consumptive Use (AF)	Stockpond Evaporation (AF)*	Total (AF)
Lower Yampa (44)	306	2,493	6,728
Slater/Timberlake Crks (54)	102	not provided	2,921
Little Snake River (55)	186	619	1,072
Green River (56)	121	not provided	418
Middle Yampa (57)	65	not provided	1,422
Upper Yampa (58)	149	not provided	5,485
Total	929	3,112	18,046

Source: SWSI, 2010*Estimates of stockpond evaporation were not provided for Water Districts 54, 56, 57, and 58 in SWSI 2010.

2.3.2 Future Agricultural Needs

Future Irrigated Acreage

SWSI 2010 lists a variety of factors that could impact the future development and/or reduction of irrigated acres in the YWG Basin. These include the following:

- Urbanization and transfers from agricultural to M&I
- Water management decisions
- Demographic factors
- Biofuels production
- Climate change
- Farm programs
- Subdivision of agricultural lands and lifestyle farms
- Yield and productivity
- Open space and conservation easements
- Economics of agriculture

SWSI 2010 developed estimates of the decrease in irrigated acres as a result of urbanization and municipal to agricultural transfers, assuming 119,000 acres of current irrigation.¹⁰ These estimates indicate that in the YWG Basin 1,000 to 2,000 acres (approximately 2%) may be removed from irrigation as a result of land acquisition and development in urban centers throughout the regions. This is relatively low when compared to other basins in the State. SWSI 2010 also indicated that an additional 3,000 to 64,000 acres may be taken out of agricultural production in the YWG Basin due to in-basin agricultural to municipal water transfers needed to meet growing M&I water

⁹ SWSI 2010 also provided estimates of incidental losses which occur along canals and tailwater areas. These losses are incorporated in the irrigation water demands at the model models in the P&M Study and therefore are not included in Table 2-13.

¹⁰ This based on CDSS's 1993 irrigated acres GIS coverage. (CDSS 1993)



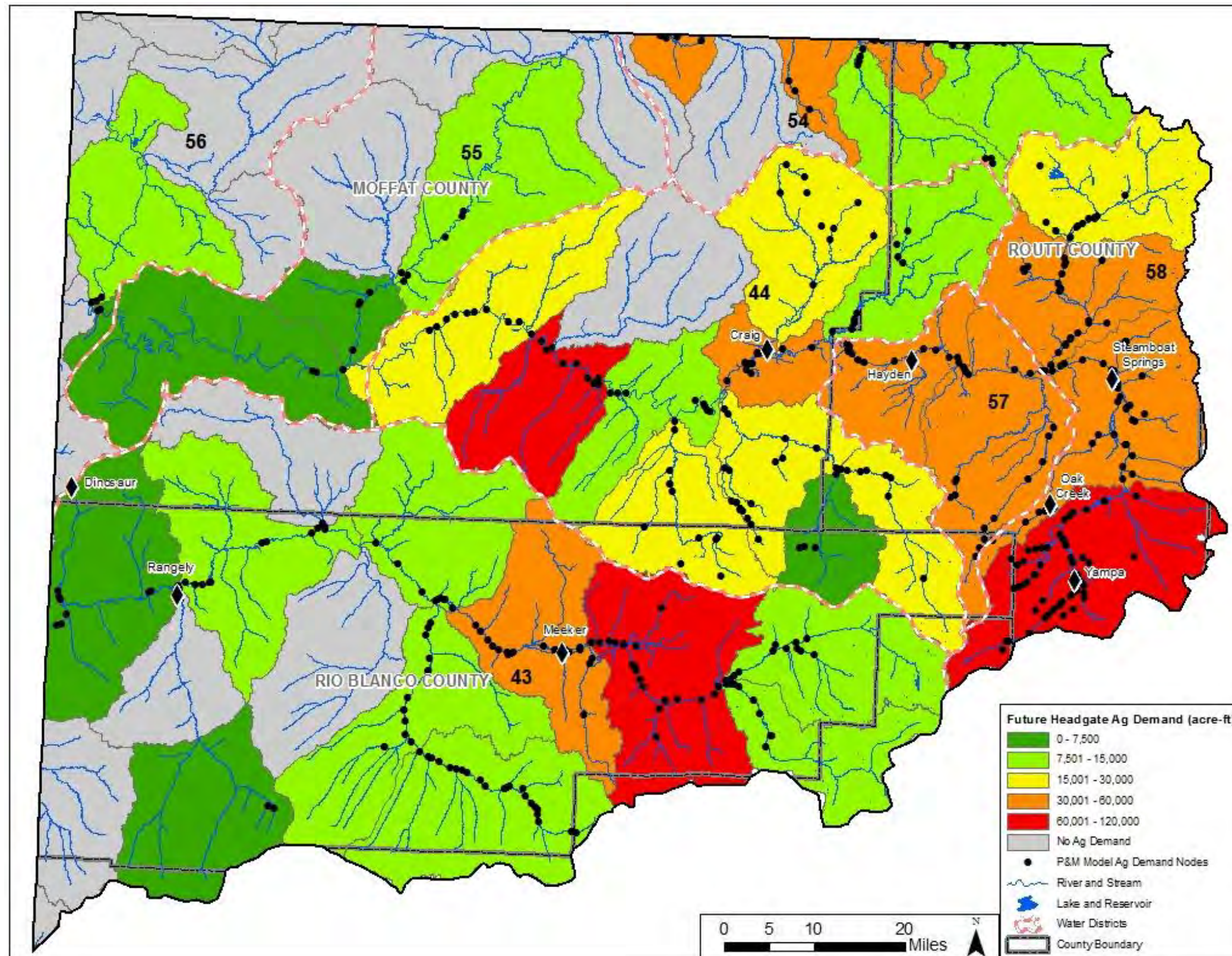
demands, but some of the growing demands may be supplied by new appropriations. These results suggest that the total irrigated acres in the YWG Basin could range from 53,000 to 115,000 acres by 2050. Irrigated acres are also anticipated to increase in certain areas of the YWG Basin. The P&M Study and Agricultural Water Needs Study estimate that 7,400 to 14,805 acres may be developed along the oxbows of the Yampa River, yet does not assume any reduction in irrigated acres. This is further described in the next section.

Future Irrigation Demands

The YWG Basin's future irrigation demands at the ditch headgate are shown in Figure 2-7 by HUC. These demands were developed using the StateCU model for the Agricultural Water Needs Study, P&M Study and updated BIP modeling effort. Figure 2-8 shows the future irrigation demands relative to current demands. The demand projections assume that 14,805 acres¹¹ of irrigation is developed on the Yampa oxbows and the remainder of the YWG Basin continues to irrigate at current levels based on the acreage reported by CDSS in 1993. The reduction of 1,000 to 2,000 irrigated acres due to urbanization or the reduction of 3,000 to 64,000 acres due the transfers to meet a municipal gap estimated for SWSI 2010 was not included in this estimate, given the uncertainty on the amount of reductions and where they would occur in the YWG Basin. This is reflected in Figure 2-7 and Figure 2-8, where the irrigation demand increases in the downstream portion of District 44, yet no additional changes occur elsewhere in the YWG Basin.

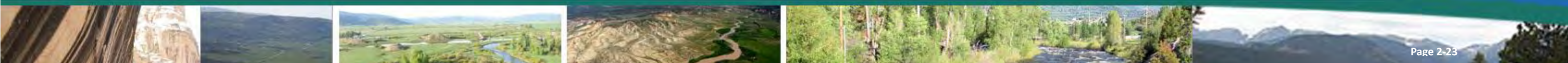
¹¹ As part of the Agricultural Needs Assessment, SWSI identified a total of 14,805 acres of potentially irrigable acreage that can be developed in the future along the oxbows of the Yampa River.

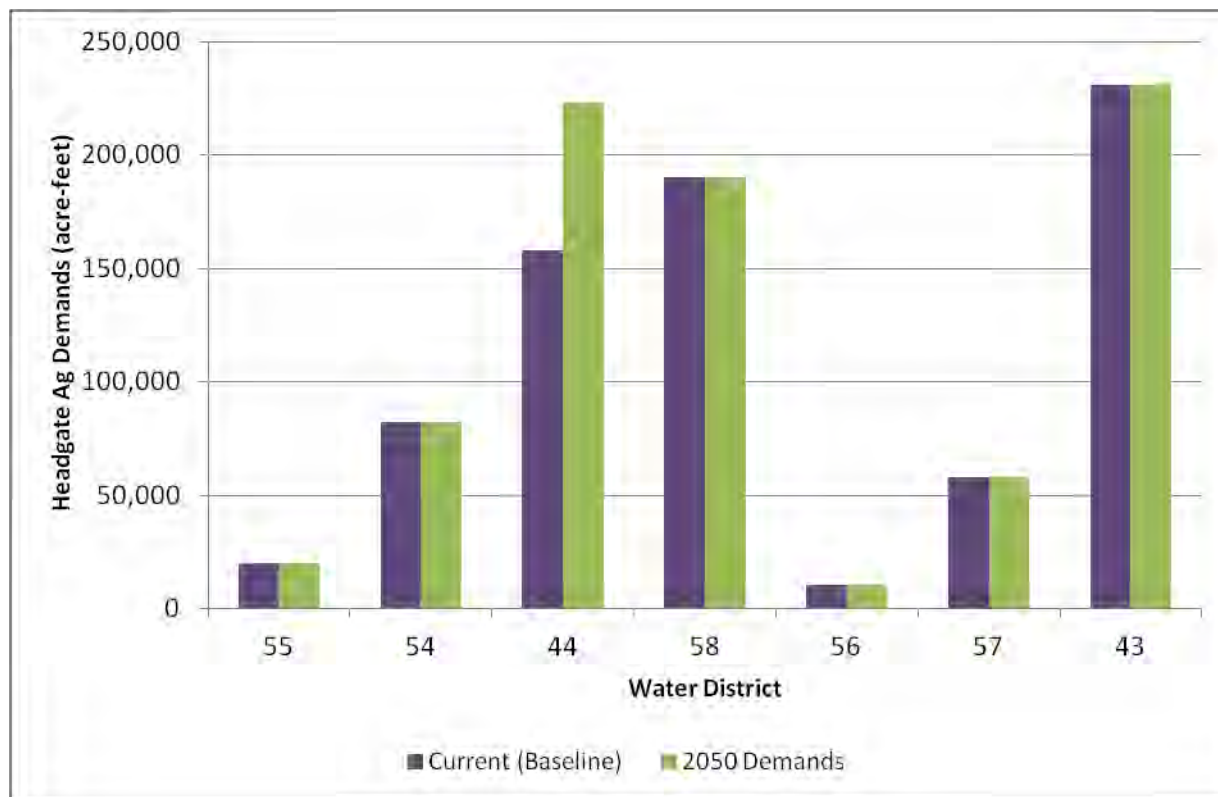




Source: P&M Study, 2014. Modeling Results.

Figure 2-7 Future Headgate Agricultural Water Demands





Source: P&M Study, 2014. Modeling Results.

Figure 2-8 Current and Future Headgate Agricultural Demands (AF)

2.4 ENVIRONMENTAL AND RECREATIONAL NEEDS

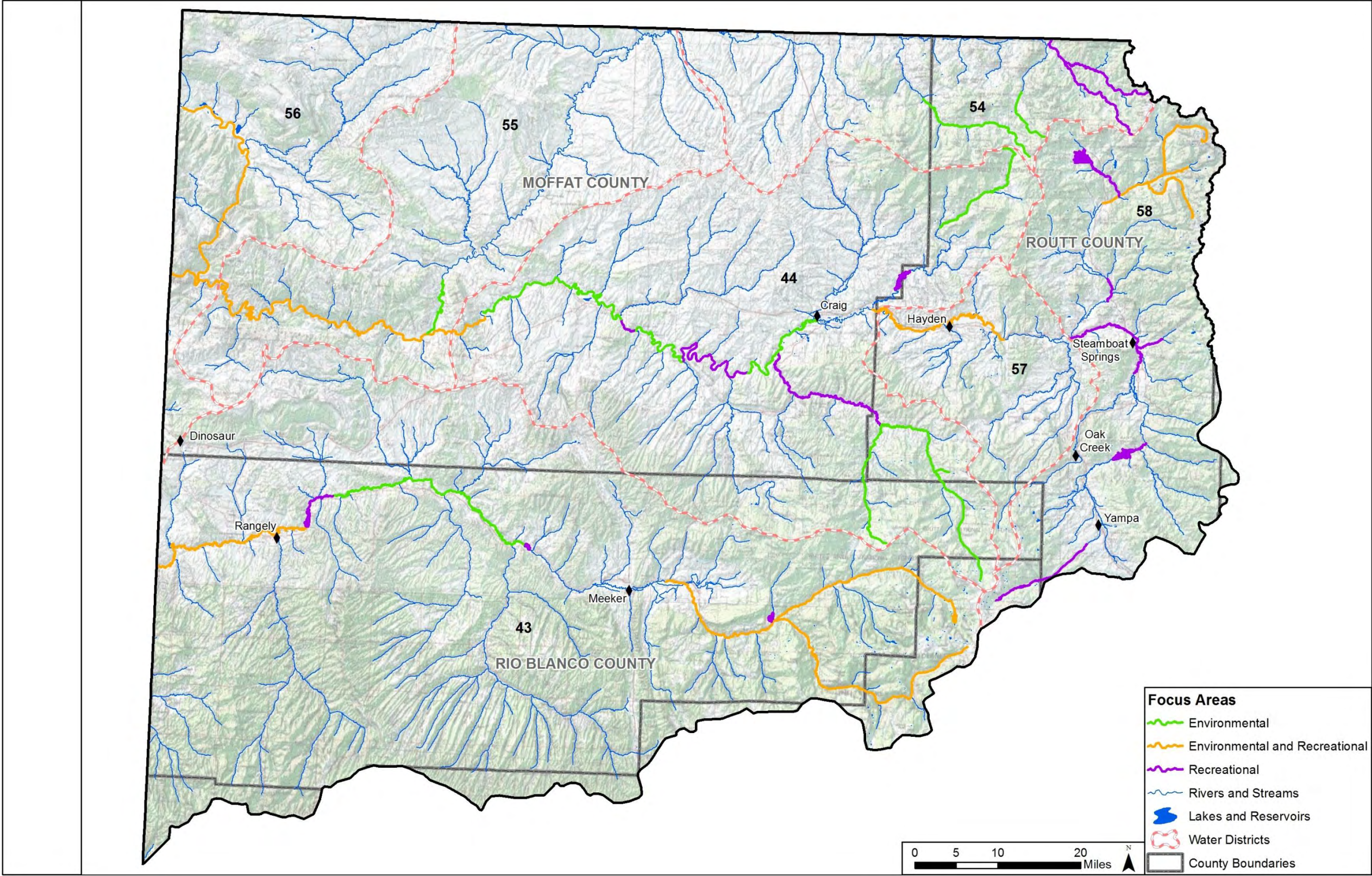
One of the many attractive attributes of the YWG Basin is the outdoor environment and recreational opportunities. Many popular recreational activities including skiing, hunting, bicycling, camping, hiking, reservoir-based recreation, fishing, wildlife viewing and boating depend on the health of the environment and/or are water based activities. The recreational and environmental needs identified in this BIP are intended to maintain or improve the natural flows supporting environmental attributes and recreational activities.

2.4.1 Focus Areas and Environmental and Recreational Attributes

Through a variety of State and Basin-wide planning efforts, the YWG Basin developed a map of environmental and recreational focus areas.¹² These focus areas are depicted in Figure 2-9 and can be used as a planning tool when identifying needs and potential future projects. However, while these focus areas are located in areas with key environmental and recreational attributes; environmental attributes exist on virtually all streams and lakes. New IPPs can be advantageous in the designated focus areas as well as in other stream reaches within the YWG Basin. For instance attributes associated with major stream reaches are commonly dependent on conditions in upstream tributary reaches. The achievement or maintenance of attributes depends upon achieving or maintaining necessary values in upstream reaches in addition to the subject main reach. Table 2-14 provides the environmental and recreational attributes associated with each focus area. This table was developed through the non-consumptive needs focus mapping and are presented in the WFET study.

¹² Non-consumptive Needs Focus Mapping Report, 2010





Source: SWSI 2010 and 2016. GIS shapefiles produced in support of BIP.

Figure 2-9 Focus Areas



Table 2-14 Attributes of Major Stream and Lake Segments

No.	Stream or Lake Segment (Based Upon Segment Maps)	ATTRIBUTE CATEGORY	1. Federal Threatened & Endangered Fish	2. State Threatened and Endangered Species	3. Important Riparian Habitat	4. Instream Flows and Natural Lake Levels	5. Fishing	6. Boating	7. Waterfowl Hunting	Rationale for Consideration as a Major Segment
Major Environmental & Recreational Segments										
1	Yampa River - from entrance of Cross Mountain Canyon (East Cross Mountain) to confluence with Green River		a,b,c,d,e	a,b,c,f,e	a,b		c	a	a	Multiple environmental values including critical habitats for endangered fish plus Yampa's most sought after white water and overnight rafting destination including Dinosaur National Monument
2	Yampa River - from Pump Station to confluence of Elkhead Creek			a,c,e,f	a,c		c	a	a	Multiple environmental values plus high use boating and fishing includes TNC's the Carpenter Ranch
3	Green River - from Utah State line (Browns Park Wildlife Refuge) to the Utah State line		a,b,d	a,c,e,f	a,b,c		c	a	a	Multiple environmental and recreational values includes Browns park National Wildlife Refuge and rafting in Dinosaur National Monument
4	Elk River - from headwaters to the County Road 129 bridge at Clark; including the North, Middle and South Fork as well as the mainstem of the Elk			d,f,g	b	a	c	a		Multiple environmental and recreational values including high levels of recreation and significant fisheries use, multiple/critical environmental values
5	White River - from headwaters to Meeker; including the North and South Fork and mainstem of the White			c,d,f	a,b	a	c	a	a	Multiple environmental and recreational values including most extensive, valuable connectivity of Colorado Cutthroat Trout populations in the Yampa/White/Green basin; G1-G3 plant/wetland communities; valuable private and public water fisheries providing significant economic benefits for the upper White basin
6	White River - below Kenney Reservoir dam to Utah State line		b,d,e	a,b,c,f			c	a	a	Multiple environmental and recreational values including critical habitat for endangered fish
Major Environmental Segments										
7	White River - from Rio Blanco Lake Dam to Kenney Reservoir		b,e	a,b,c				a		Multiple environmental and recreational values including critical habitat for Federal endangered species, multiple state aquatic species of concern
8	Slater Creek - from headwaters to the Beaver Creek confluence			d	b		c	a		Valuable connectivity of Colorado Cutthroat Trout populations, with G1-G3 plant communities and multiple recreational opportunities

No.	Stream or Lake Segment (Based Upon Segment Maps)	ATTRIBUTE CATEGORY	1. Federal Threatened & Endangered Fish	2. State Threatened and Endangered Species	3. Important Riparian Habitat	4. Instream Flows and Natural Lake Levels	5. Fishing	6. Boating	7. Waterfowl Hunting	Rationale for Consideration as a Major Segment
9	Elkhead Creek - from headwaters to confluence of North Fork of Elkhead Creek			a,d	b	a		a		Valuable connectivity of Colorado Cutthroat Trout populations, Boreal toad as well as G1-G3 plant communities and recreational opportunities
10	South Fork of the Little Snake - from headwaters to confluence of Johnson Creek			a,d		a				Valuable connectivity of Colorado Cutthroat Trout populations
11	South and East Fork of the Williams Fork - from headwaters to the confluence of the Forks			d,f	b	a	c			Valuable connectivity of Colorado Cutthroat Trout populations
12	Little Snake River - from Moffat County Road 10 to confluence of the Yampa River		c,d	b	a,b					Significant environmental values including occurrences of Colorado Pikeminnow and rare collections of Humpback Chub, populations of Roundtail Chub and valuable riparian plant communities
13	Yampa River - from Craig (Hwy 394 Bridge) to mouth of Cross Mountain Canyon		d,e	b,e,f	b		c	a	a	Critical habitat for Federal endangered species, multiple state aquatic species of concern
Major Recreational Segments										
14	Yampa River - from Stagecoach Reservoir "Tailwaters" to northern boundary of Sarvis Creek State Wildlife area			a,c	a	a	c		a	High recreation and fisheries use
15	Fish Creek - from Fish Creek Falls to confluence of the Yampa River				a	a		a		Most significant, highest use kayaking "creek run" in basin
16	Yampa River - from Chuck Lewis Wildlife Area to Pump Station			a,c,e,f	b		c	a,b	a	Highest recreation use along entire Yampa River allowing for multiple recreational opportunities; only RICD in entire Yampa/White/Green Basin
17	Elk River - at Christina State Wildlife Area			c		a	c			Highest public fishery use on Lower Elk River
18	Willow Creek - below Steamboat Lake to confluence with the Elk				a		c	a		Valuable kayaking creek and fisheries use
19	Bear River - from headwaters to USFS boundary			d			c			Cutthroat Trout habitat and significant recreational fishing
20	Stagecoach Reservoir			a			c	a	a	High recreation and fisheries use

No.	Stream or Lake Segment (Based Upon Segment Maps)	ATTRIBUTE CATEGORY	1. Federal Threatened & Endangered Fish	2. State Threatened and Endangered Species	3. Important Riparian Habitat	4. Instream Flows and Natural Lake Levels	5. Fishing	6. Boating	7. Waterfowl Hunting	Rationale for Consideration as a Major Segment
21	Elkhead Reservoir						c	a	a	High recreation and fisheries use
22	Steamboat Lake			d	a		a,b	a	a	High recreation and fisheries use including only Gold Medal Water in basin
23	Little Snake River - from headwaters of Middle Fork of the Little Snake River and King Solomon Creek to Wyoming border			a,c,d	b	a	c	a		Important fishery including public access and private waters; significant environmental values
24	Williams Fork - from South Fork to confluence of the Yampa River				a,b	a	c			Important Fishery
25	Avery Lake						c		a	Important recreational destination
26	Rio Blanco Reservoir				b		c		a	Important recreational destination
27	Kenny Reservoir						c	a	a	Important recreational destination
28	Yampa River - Duffy Canyon		d,e	b,e,f	b		c	a	a	Important recreational canyon
29	Yampa River - Little Yampa Canyon		d,e	b,e,f	b		c	a	a	Important recreational canyon
30	Yampa River - Juniper Canyon		d,e	b,e,f	b		c	a	a	Important recreational canyon

¹ The CWC's Statewide Water Supply Initiative Report (<http://cwcb.state.co.us/WATER-MANAGEMENT/WATER-SUPPLY-PLANNING/Pages/SWSI2010.aspx>) provides further detail on the data sources used to generate this map.



KEY TO ATTRIBUTE CODES**Attribute 1 - Federal Threatened & Endangered Fish**

- a. Bonytail Chub
- b. Razorback Sucker
- c. Humpback Chub
- d. Colorado Pikeminnow
- e. Federally Listed Critical Habitat

Attribute 2 - State Threatened and Endangered Species

- a. Bluehead Sucker
- b. Roundtail Chub
- c. Flannelmouth Sucker
- d. Colorado River Cutthroat Trout
- e. River Otter
- f. Northern Leopard Frog
- g. Boreal Toad

Attribute 3 - Important Riparian Habitat

- a. Riparian/Wetland - Dependent Rare Plants
- b. Significant Riparian/Wetland Plant Communities
- c. Audubon Important Bird Areas

Attribute 4 - Instream Flows and Natural Lake Levels

- a. CWCBC Instream Flow Water Rights
- b. CWCBC Natural Lake Level Water Rights

Attribute 5 - Fishing

- a. Gold Medal Trout Streams
- b. Gold Medal Trout Lakes
- c. Significant Fishing Waters (based on local knowledge)

Attribute 6 - Boating

- a. Rafting/kayaking/flatwater Reaches
- b. Recreational In-Channel Diversion Structures

Attribute 7 - Waterfowl Hunting

- a. Waterfowl Hunting

Notes (disclaimer verbiage):

1. Nonconsumptive environmental and/or recreational attributes exist on virtually all stream and lake segments, whether such attributes are identified herein or not. Exclusion of a segment from this chart does not indicate absence of non-consumptive attributes.
2. Attributes associated with the major segments are commonly dependent on conditions in upstream tributary segments. Therefore, the achievement or maintenance of non-consumptive attributes depends upon achieving or maintaining necessary values in upstream segments as well as within the major segment itself.

Important Riparian Habitats were considered based on the following CNHP rankings:

- G/51 Critically imperiled globally/state because of rarity (5 or fewer occurrences in the world/state, or 1,000 or fewer individuals), or because some factor of its biology makes it especially vulnerable to extinction.
- G/52 Imperiled globally/state because of rarity (6 to 20 occurrences, or 1,000 to 3,000 individuals), or because other factors demonstrably make it very vulnerable to extinction throughout its range.
- G/53 Vulnerable through its range or found locally in a restricted range (21 to 100 occurrences, or 3,000 to 10,000 individuals).

Source: WFET, 2012



2.4.2 Evaluation of Environmental Needs

The YWG Basin evaluated the recreational and environmental needs in the YWG Basin through the P&M Study and WFET. The WFET provides series of criteria to quantitatively measure and compare environmental and recreational risks based on existing and modeled flow conditions in the Yampa and White Basins. This methodology is incorporated into the P&M Study to assess risk to environmental and recreational uses indicated by the P&M Study model runs.

The P&M Study specifically addresses the target at the Maybell gage for augmenting existing base flows to assist in endangered fish recovery¹³ and instream flow shortages and incorporates a series of risk-based ecology and flow relationship metrics to assess how current and potential future flows could impact the ecology and boating at specific locations within the YWG Basin. This section focuses on the results of the modeled current condition in the P&M Study and also provides an overview of the Green River PBO. Future environmental and recreation needs will depend on a multitude of factors including future water development and climate conditions. These future needs are addressed in Chapter 3.

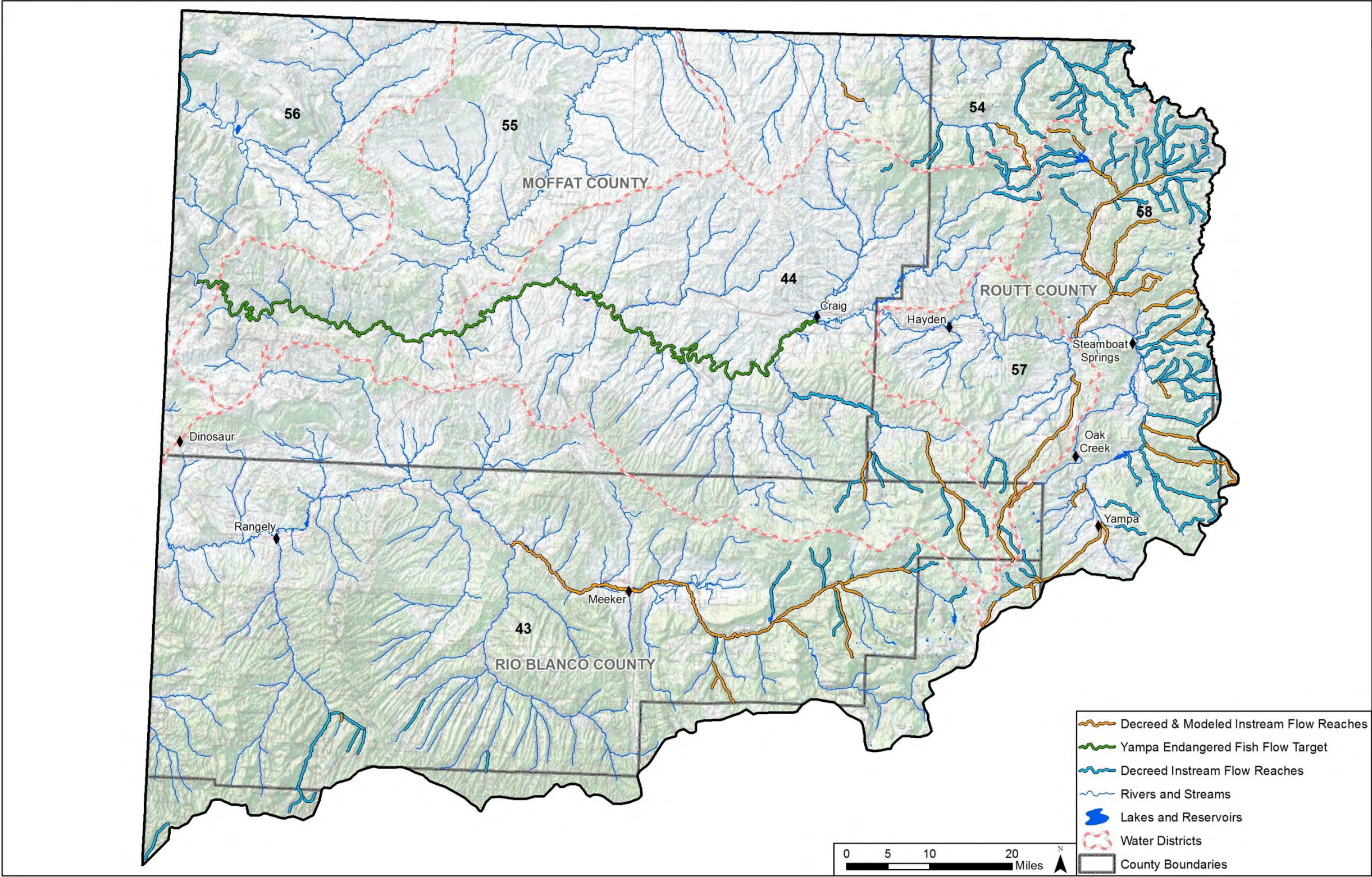
Instream Flows

CWCB instream flow reaches are decreed water rights used to protect flow levels in delineated stream reaches throughout the State. The instream flows protect diverse environments including cold water and warm water fisheries, as well as critical habitat for threatened or endangered native fish in the Yampa and White Basins. These instream flows have decreed water rights and therefore provide flow protection in the designated reaches. Upstream and intervening junior water users are not able to divert water from the stream which could result in flows less than the decreed flow rates. It is noted that the targeted decreed flow rates for instream flows are often developed based on the minimum flows necessary to sustain natural conditions. The aquatic health of many streams can often be improved through flows that exceed the minimum decreed limits.

Figure 2-10 shows the decreed instream flows within the YWG Basin and the instream flows modeled for the P&M Study. Some instream flows were not included in the model because they are in headwaters areas or do not have direct relation, or impact, to demand nodes. Table 2-15 shows the average annual flow target and how much of that average annual target flow is met at a minimum along the modeled reach (i.e. the average annual flow target minus the instream flow shortage). Table 2-17 provides the monthly flow targets and percentage of modeled years that attained the target. A number of decreed instream flows in Figure 2-10 could not be modeled and are not included in Table 2-15 and Table 2-16.

¹³ The P&M Study did not address the rest of the flow regime that may be necessary for endangered fish recovery on this reach of the Yampa River, on the lower Little Snake River, on the Yampa River in Dinosaur National Monument, and on the Green River. These flow needs were addressed for the WFET report by replicating the full flow assessment of the existing and future depletions covered by the Yampa PBO.





Source: P&M Study, 2014.
Figure 2-10 Decreed and Modeled Instream Flows



Table 2-15 Annual Instream Flow Target and Baseline Modeled Flows

Diversion Name	WDID*	Average Annual Target Flow (cfs)	Modeled Average Annual Flow Along Reach (cfs)
Bear River (Middle)	582404	7.9	4.1
Bear River (Lower)	582202	12	5.8
Big Creek	582206	15	10.7
Coal Creek	582214	5	3.4
Dome Creek	582216	2	0.3
East Fork Williams Fork	441452	14.2	12.2
Elk River (Lower)	581355	65	26.9
Elk River (Upper)	582219	65	27.3
Green Creek	582245	5	2.1
Hunt Creek	582519	5	2.4
Marvine Creek	432334	40	39
Miller Creek	432337	10	8.4
North Fork Fish Creek	582287	5	4.3
North Fork White River	432339	70	69.7
North Fork White River	432338	120	117.5
Oak Creek	582290	2	1.9
Phillips Creek	582409	6	2.4
Service Creek	582306	6	3.9
Slater Creek	542076	3	2.9
Soda Creek	582311	5	4.1
South Fork White River	432344	80	74.8
South Fork Williams Fork	441456	5.9	5.4
Trout Creek (Lower)	571009	5	3.8
Ute Creek	432372	6	6
White River	431845	200	190.8
Williams Fork River	441448	20.7	20.3
Willow Creek	582332	7	4
Willow Creek	581461	5	3
Willow Spring & Pond	582162	13	6.7
Yampa River	582164	56.9	52.5

* Water District Structure Identification (WDID)



Table 2-16 Monthly Instream Flow Targets and Percentage of Modeled Years that Reached the Target

Node	Name	ISF State Mod Demand & % of Yrs Met Target	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
582404	Bear River (Middle)	ISF Demand	5.0	5.0	5.0	5.0	12.0	12.0	12.0	12.0	12.0	5.0	5.0	5.0
		% of years above	71%	59%	66%	86%	0%	0%	0%	0%	0%	89%	38%	55%
582202	Bear River (Lower)	ISF Demand	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
		% of years above	66%	52%	61%	75%	52%	59%	18%	4%	4%	9%	34%	50%
582206	Big Creek	ISF Demand	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
		% of years above	0%	2%	13%	86%	100%	100%	95%	41%	14%	13%	5%	0%
582214	Coal Creek	ISF Demand	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
		% of years above	0%	2%	7%	80%	100%	100%	95%	39%	13%	7%	2%	0%
582216	Dome Creek	ISF Demand	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
		% of years above	0%	0%	0%	0%	7%	0%	0%	0%	0%	0%	0%	0%
441452	East Fork Williams Fork	ISF Demand	10.0	10.0	10.0	10.0	20.0	20.0	20.0	20.0	20.0	10.0	10.0	10.0
		% of years above	23%	9%	57%	98%	100%	98%	70%	5%	5%	64%	71%	46%
581355	Elk River (Lower)	ISF Demand	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0
		% of years above	0%	0%	2%	21%	100%	98%	48%	0%	13%	2%	0%	0%
582219	Elk River (Upper)	ISF Demand	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0
		% of years above	0%	0%	2%	21%	100%	100%	48%	0%	0%	0%	0%	0%
582245	Green Creek	ISF Demand	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
		% of years above	0%	0%	5%	100%	100%	84%	11%	0%	0%	2%	0%	0%
582519	Hunt Creek	ISF Demand	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
		% of years above	0%	2%	13%	82%	98%	93%	34%	2%	2%	5%	7%	0%
432334	Marvine Creek	ISF Demand	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
		% of years above	48%	34%	38%	100%	100%	100%	95%	84%	75%	71%	73%	57%
432337	Miller Creek	ISF Demand	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
		% of years above	50%	73%	82%	93%	95%	77%	89%	80%	86%	86%	64%	45%



Node	Name	ISF State Mod Demand & % of Yrs Met Target	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
582287	North Fork Fish Creek	ISF Demand	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
		% of years above	0%	9%	7%	96%	100%	100%	100%	100%	100%	16%	18%	0%
432339	North Fork White River	ISF Demand	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0
		% of years above	84%	86%	86%	100%	100%	100%	96%	98%	96%	95%	96%	88%
432338	North Fork White River	ISF Demand	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0
		% of years above	50%	39%	43%	100%	100%	100%	96%	91%	88%	80%	75%	59%
582290	Oak Creek	ISF Demand	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
		% of years above	84%	79%	100%	100%	100%	100%	98%	75%	63%	89%	86%	91%
582409	Phillips Creek	ISF Demand	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
		% of years above	0%	0%	5%	57%	23%	7%	14%	13%	2%	2%	2%	0%
582306	Service Creek	ISF Demand	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
		% of years above	5%	7%	48%	100%	100%	91%	70%	14%	7%	14%	9%	5%
542076	Slater Creek	ISF Demand	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
		% of years above	100%	100%	100%	100%	100%	100%	89%	68%	73%	96%	100%	100%
582311	Soda Creek	ISF Demand	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
		% of years above	57%	70%	77%	100%	100%	100%	93%	41%	38%	43%	64%	57%
432344	South Fork White River	ISF Demand	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0
		% of years above	16%	14%	18%	79%	100%	100%	96%	88%	66%	61%	34%	16%
441456	South Fork Williams Fork	ISF Demand	5.0	5.0	6.5	8.0	8.0	8.0	8.0	3.5	3.5	5.0	5.0	5.0
		% of years above	66%	70%	71%	98%	100%	98%	50%	52%	38%	46%	46%	48%
571009	Trout Creek (Lower)	ISF Demand	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
		% of years above	61%	66%	82%	100%	100%	100%	45%	13%	13%	36%	79%	70%
432372	Ute Creek	ISF Demand	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
		% of years above	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
431845	White River	ISF Demand	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0
		% of years above	96%	100%	100%	100%	100%	96%	80%	59%	54%	91%	100%	82%



YAMPA / WHITE / GREEN BIP

Consumptive and Environmental & Recreational Needs

Node	Name	ISF State Mod Demand & % of Yrs Met Target	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
441448	Williams Fork River	ISF Demand	14.0	14.0	14.0	14.0	30.0	30.0	30.0	30.0	30.0	14.0	14.0	14.0
		% of years above	100%	100%	100%	100%	100%	100%	89%	93%	63%	100%	100%	100%
582332	Willow Creek	ISF Demand	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
		% of years above	4%	13%	30%	88%	100%	100%	100%	98%	82%	5%	0%	2%
581461	Willow Creek	ISF Demand	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
		% of years above	5%	18%	36%	88%	100%	100%	100%	100%	100%	14%	2%	5%
582162	Willow Spring & Pond	ISF Demand	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0
		% of years above	4%	5%	46%	100%	100%	93%	82%	14%	7%	14%	7%	5%
582164	Yampa River	ISF Demand	47.5	47.5	47.5	72.5	72.5	72.5	72.5	60.0	47.5	47.5	47.5	47.5
		% of years above	57%	46%	86%	100%	98%	91%	84%	84%	70%	73%	57%	55%



Yampa PBO - Endangered Species Fish Flow Target

In the late 1990's, a Management Plan for Endangered Fishes in the Yampa River Basin (Management Plan) was developed by the USFWS to assist with the recovery of four endangered fish species on the Yampa River¹⁴. These species include the humpback chub, bonytail chub, Colorado pike minnow and razorback sucker. The Management Plan proposes to implement the following measures to minimize negative impacts to the listed fish and critical habitats:

- Provide and protect instream flows
- Reduce negative impacts of nonnative fishes
- Restore habitat (habitat development and maintenance)
- Manage genetic diversity/augment or restore populations
- Monitor populations and habitat
- Provides for future consumptive depletions

The Management Plan included an assessment of the flow impacts of existing storage and of increasing depletions by 30,104 AFY on the Yampa River above the Little Snake in Colorado and by 23,428 AFY on the Little Snake River in Wyoming. An important component of the Management Plan was to augment the remaining base flows in the critical habitat reach of the Yampa River above the Little Snake River by making storage releases from an enlarged Elkhead Reservoir that were decreed for instream use down to the confluence with the Green River. This reach is shown as the Endangered Fish Flow Reach in Figure 2-10. These augmentation releases were targeted to the flows at the Maybell gage that remained after existing irrigation in this reach and all upstream depletions and existing storage. Water can be released up to a rate of 50 cfs and added to the remaining base flows to meet the monthly targeted flows at Maybell. While these flow targets are not decreed, the PBO relied on the availability of the remaining base flows in setting these targets with access to only 7,000 AF of storage at Elkhead Reservoir. The PBO also relied on the adjudication of the releases for instream use that is protected from even the most senior diversions. A permanent water storage account of 5,000 AF was funded up-front and is reserved in Elkhead Reservoir for maintaining flows throughout the Endangered Fish Flow Reach. In addition, another 2,000 AF may be released from Elkhead Reservoir for flow augmentation under a long-term (20 years), renewable lease with an annual fixed rate of \$50 per acre-foot for the first 20 years. The water released from storage for instream augmentation can vary by year. In wet years, the program may not need its full storage allotment given that the natural flows at the Maybell gage may often be high enough to meet the targeted monthly flows without necessitating releases.

Table 2-17 Selected Endangered Fish Flow Targets Baseline Condition¹⁵

Month	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Flow Target (cfs)	120	169	169	169	169	0	0	0	0	138	120	120
Average Minimum Simulated Flows Along the Reach (cfs)	117	168	153	164	158	0	0	0	0	120	57	88
Years Met of Exceeded Target	91%	89%	77%	75%	89%	N/A	N/A	N/A	100%	95%	70%	68%

Source: P&M Study, 2014.

¹⁴ (Rochm 2004)

¹⁵ Originally the PBO targeted 138 cfs at the Maybell gage from July-October and 169 cfs from November-March for the combined underlying flows and storage releases. The USFWS has since requested operations at a lower target of 120 cfs for August-October. The P&M Study mixed that lower target with those in the PBO as shown in this table. The FWS has also since requested operations at a higher target of 134 cfs for July-October.



Table 2-17 also shows the average minimum simulated flow along the reach and the percentage of modeled years in which the targeted flows were met for the baseline condition. Shortages occurred if the native flows and 50 cfs release from Elkhead Reservoir could not achieve the targeted flows. Additionally, releases from Elkhead Reservoir only occurred if the native flows at the Maybell gage were below the target.¹⁶

Green River Biological Opinion

The Green River PBO provides a list of operational criteria for the Flaming Gorge Dam to assist in the recovery of the four endangered fish. These releases impact instream flows in the Green River reach that runs through Colorado and provides habitat for the fish. The action alternative in the Flaming Gorge Dam Final Environmental Impact Statement¹⁷ calls for a peak release magnitude of sufficient duration in April through July to achieve flow targets in the Green River upstream and immediately downstream of the confluence with the Yampa River. With exception for cases when the Flaming Gorge minimum release rate requirement is 800 cfs, the flow objectives for Green River from the Flaming Gorge Reservoir to the confluence with the Yampa River (specified as Reach 1 in the BO) and immediately downstream of the confluence (specified as Reach 2 in the BO) are the same. These flow objectives include the following:

- Achieve peak of 26,400 cfs for at least 1 day in 10% of all years
- Sustain peak of 22,700 cfs for at least 2 weeks in 10% of all years
- Sustain peak of 18,600 cfs for at least 4 weeks in 10% of all years
- Sustain peak of 20,300 cfs for at least 1 day in 30% of all years
- Sustain peak of 18,600 cfs for at least 2 weeks in 40% of all years
- Sustain peak of 18,600 cfs for at least 1 day in 50% of all years
- Sustain peak of 8,300 cfs for at least 1 week in 90% of all years
- Sustain peak of 8,300 cfs for at least 2 days in 98% of all years
- Sustain peak of 8,300 cfs for at least 1 day in 100% of all years

The Green River PBO followed closely on the heels of the Yampa PBO and therefore relied on the flow regime for the Yampa River resulting from that programmatic opinion to help meet these targets for Reach 2 of the Green River.

Fisheries and Cottonwood Flow-Ecology Relationship Risks

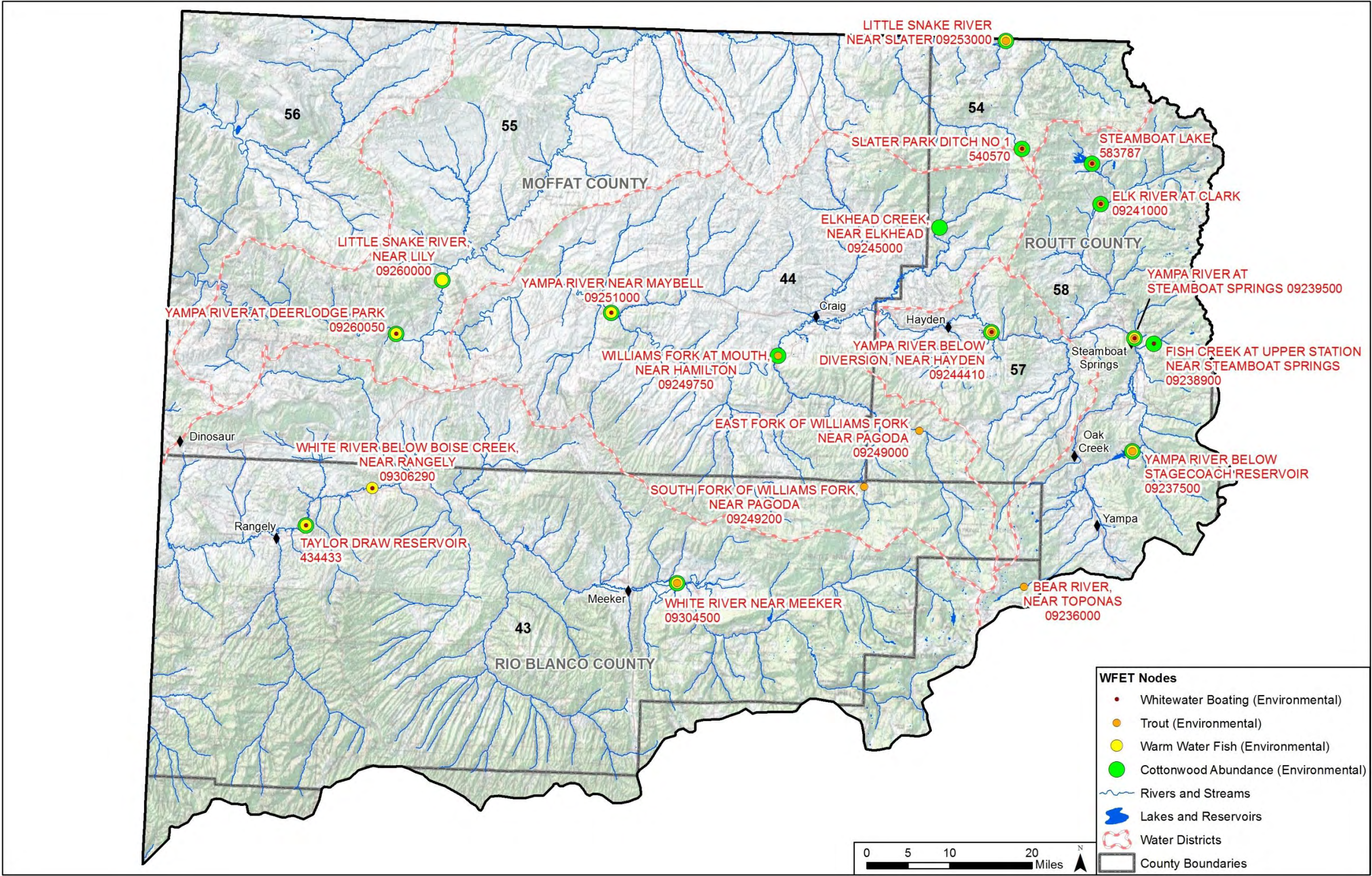
The WFET (Sanderson 2012) developed a series of flow-ecology metrics to measure the ecological risk associated with decreased flows in the Yampa and White Basins. These metrics were originally applied as a pilot study in the Roaring Fork and Fountain Creek watersheds and have been updated for the Yampa and White Basins. The metrics are applied to the 19 P&M Study nodes shown in Figure 2-11. These metrics were developed using the Ecological Limits of Hydrologic Alteration framework (Framework) which was publicized in 2006 by an international group of river scientists¹⁸. The Framework is used for evaluating and managing environmental flows in large regions where time and resources (i.e. intensive field studies) are not available. The Framework applies information from rivers that have been studied intensively to rivers that have not yet been studied without needing site-specific detailed information.

¹⁶ This accounting will mask shortages to the endangered fish flows in this reach under future conditions if the native flows at Maybell on which the PBO relied, are not maintained. That is, if these native base flows are reduced under future conditions, then the starting point for reporting such shortages is also reduced. On the other hand, if the native flows below Maybell were reduced by existing depletions and were not relied upon by the PBO, that should not constitute a shortage to the endangered fish flows.

¹⁷ (USFWS 2005b)

¹⁸ (Arthington et al. 2006)





Source: P&M Study, 2014.
Figure 2-11 Modeled Nodes for the Flow-Ecology Risks



The metrics provide a means to assess the stream's ability to support trout, warm water fish and cottonwood populations by relating modeled streamflows to the natural flows of the stream prior to human development. A summary of each metric is provided below. Additional details on each metric, including the equations used for each metric is provided in Appendix A.

- Trout flow-ecology relationship –Compares modeled monthly flows in August and September (spawning season) relative to the annual natural flows.
- Warm water fish flow-ecology relationship – Represents the reduction in potential biomass of warm water fish based on 30-day minimum flows in a stream under modeled flow conditions for July through November.
- Cottonwood flow-ecology relationship¹⁹ – Relationship between high peak flows under natural conditions relative to modeled flow conditions in April through June.

Each of the metrics above was used to assess the current ecological risk to trout, warm water fish and cottonwood riparian habitat relative to natural conditions. The results for the P&M modeled baseline conditions are presented in Table 2-18. Additional information on how each of the risk levels were developed for each flow-ecology metric is provided in Appendix A.

These results indicate that the modeled cottonwood areas are least impacted by current human river depletions whereas trout followed by warm water fish are more impacted. Areas of high risk for trout include the South Fork of the Little Snake from the headwaters to the confluence of Johnson Creek (9245000) and from the South Fork of the Williams Form from the headwaters to the confluence of the Forks (9249200). Warm water fish are assessed to be at high risk in the Little Snake River from Moffat County Road 10 to the confluence of the Yampa River (9260000) and cottonwoods are assessed to be at high risk on the Yampa River from Stagecoach Reservoir tailwaters to the northern boundary of Sarvis Creek State Wildlife Area (9237500).

Table 2-18 Risks Levels Based on the Ecology-Flow Metrics for Baseline Conditions

	Reach Name	Evaluation Node	Trout Flow-Ecology Relationship	Warm Water Fish Flow-Ecology Relationship	Cottonwood Abundance
1	Yampa River from entrance of Cross Mountain Canyon East Cross Mountain to confluence with Green River	9260050	n/a	Moderate Risk	Low Risk
2	Yampa River from Pump Station to confluence of Elkhead Creek	9244410	Moderate Risk	Low Risk	Low Risk
4	Elk River from headwaters to the County Road 129 bridge at Clark including the North Middle and South Fork as well as the mainstem of the Elk	9241000	Minimal Risk	n/a	Low Risk
5	White River from headwaters to Meeker including the North and South Fork and mainstem of the White	9304500	Minimal Risk	Low Risk	Low Risk
6	White River below Kenney Reservoir dam to Utah State line	434433	n/a	Low Risk	Moderate Risk
7	White River from Rio Blanco Lake Dam to Kenney Reservoir	9306290	n/a	Low Risk	n/a
8	Slater Creek from headwaters to the Beaver Creek confluence	540570	Moderate Risk	n/a	Low Risk

¹⁹ The WFET and P&M Study refer to the “cottonwood flow-ecology” metric as the “riparian flow-ecology” metric. This metric has been renamed to reflect that the metric exclusively assesses cottonwood as opposed to other riparian species.



	Reach Name	Evaluation Node	Trout Flow-Ecology Relationship	Warm Water Fish Flow-Ecology Relationship	Cottonwood Abundance
9	Elkhead Creek from headwaters to confluence of North Fork of Elkhead Creek	9245000	n/a	n/a	Low Risk
10	South Fork of the Little Snake from headwaters to confluence of Johnson Creek	9253000	High Risk	Low Risk	Low Risk
11a	East Fork of the Williams Fork from headwaters to the confluence of the Forks	9249000	Minimal Risk	n/a	n/a
11b	South Fork of the Williams Fork from headwaters to the confluence of the Forks	9249200	High Risk	n/a	n/a
11c	Williams Fork from the South Fork to the confluence with the Yampa River	9249750	Moderate Risk	n/a	Low Risk
12	Little Snake River from Moffat County Road 10 to confluence of the Yampa River	9260000	n/a	High Risk	Low Risk
13	Yampa River from Craig Hwy 394 Bridge to mouth of Cross Mountain Canyon	9251000	n/a	Moderate Risk	Low Risk
14	Yampa River from Stagecoach Reservoir Tailwaters to northern boundary of Sarvis Creek State Wildlife area	9237500	Minimal Risk	Low Risk	High Risk
15	Fish Creek from Fish Creek Falls to confluence of the Yampa River	9238900	n/a	n/a	Low Risk
16	Yampa River from Chuck Lewis Wildlife Area to Pump Station	9239500	Moderate Risk	Low Risk	Low Risk
18	Willow Creek below Steamboat Lake to confluence with the Elk	583787	Low Risk	n/a	Low Risk
19	Bear River from headwaters to U.S. Forest Service (USFS) boundary	9236000	Low Risk	n/a	n/a

Source: P&M Study, 2014. Note: Errors have been identified with the node locations and metrics.

2.4.3 Evaluation of Recreational Needs

Steamboat Recreational In-Channel Diversion (RICD)

The City of Steamboat Springs has an absolute recreational instream channel diversion water right for the Steamboat Springs boating park. When in priority, this junior water right may be used to protect flows through the Steamboat Springs boating park at the specified rates shown in Table 2-19. These claimed flows are limited to the hours of 8:00 am to 8:00 pm with exception of 10 days between April 15 and July 15 for nighttime competitive events. The RICD was modeled in the P&M Study. In order to conduct the modeling, the decrees flow rates were modified to fit within a monthly timestep. The surrogate modeled flows are shown in Table 2-19.



Table 2-19 Decreed Flow Rates for the Steamboat RICD

Time Period	April 15-20	May 1-15	May 16-31	June 1-15	June 16-30	July 1-15	July 16-31	Aug 1-15
Decreed Flow Rates (cfs)	400	650	1000	1400	650	250	100	95
StateMod Surrogate Flow Rates (cfs)	200	825		1025		175		47.5

Source: P&M Study, 2014.

The modeled baseline results, shown in Table 2-20, indicate that the RICD is currently met in April yet experiences shortages 21% and 37% of the modeling period for June and July, respectively. The majority of these shortages occur in drier years.

Table 2-20 Percentage of Modeled Year in Which the Target RICD Monthly Target is Met

Time Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
StateMod Surrogate Flow Rates (cfs)	0	0	0	200	825	1,025	175	47	0	0	0	0
Years Met or Exceeded Target	100%	100%	100%	100%	98%	79%	63%	95%	100%	100%	100%	100%

Source: P&M Study, 2014.

Boating Flow-Usability Relationship

The WFET also developed a means to characterize the usability of flows along key recreational reaches for whitewater recreation. A survey was conducted by American Whitewater to determine recommended flow ranges for the eleven locations shown in Table 2-21. The P&M Study integrated the survey information in Table 2-20 with modeled flows to determine the percentage of months with usable flows. Figure 2-12 presents the percentage of months under which the flows are characterized as minimal, optimal and highest for boating purposes for 10 segments within the modeled timeframe²⁰. These data are based on the P&M Study which incorporated the information from Table 2-20 into monthly flows for the purposes of modeling. Flow conditions are considered usable for boating under the optimal and highest flow conditions. These results indicate that the Yampa River from the entrance of Cross Mountain Canyon to the confluence with the Green River and the Little Yampa Canyon have the greatest percentage of usable months during the baseline modeling period. Four of the reaches in Figure 2-12 do not have usable boating flows.

²⁰ Figure 2-12 presents baseline results only for modeled boating segments and not for all the segments listed in Table 2-21.



Table 2-21 WFET Whitewater Boating Flows

	Segment	Measurement Gage	Minimum (cfs)	Optimal (cfs)	Highest (cfs)	Season
15	Fish Creek	9238900	400	800-1,000	1,400	April through July
16	Steamboat Town	9239500	700	1,500-2,700	5,000+	April through July
4a	Elk River Box	9242500 ¹	700	1,000-2,100	5,000+	April through July
4b	Elk River – Clark	9241000	700	1,300-4,000	5,000+	April through July
18	Willow Creek	583787	300	700-800	1,250	April through July
	Mad Creek	Visual	400	400-1,000	2,000+	April through July
	MF Little Snake	Visual	500	800-1,100	2,000+	April through July
8	Slater Creek	540570 ²	600	1,100-2,100	3,000+	April through July
2	Yampa - Lower Town	9244410	900	1,500-1,500	4,000	April through July
13/29	Little Yampa Canyon	9247600	1,100	1,700-2,500	10,000+	April through July
1	Cross Mountain Gorge	9251000	700	1,500-3,500	5,000	April through July
1	Yampa Canyon	9260050	1,300	2,700-20,000	20,000+	April through July
3	Gates of Lodore	9234500 ³	1,100	1,900-15,000	20,000+	April through July
5	SF White River	No Defined Gage ⁴	700	2,500-3,500	10,000	April through July
6	White River below Kenney Reservoir	434433	700	1,500-2,500	10,000+	March through October
7	White River Rangely to Bonanza	9306290	700	1,500-5,000	10,000+	April through July

¹ Gage not in the StateMod Model

² Not evaluated in the WFET, due to insufficient data

³ Gage not in the StateMod Model

⁴ No defined location in the WFET study to evaluate whitewater boating flows

Source: P&M Study, 2014.



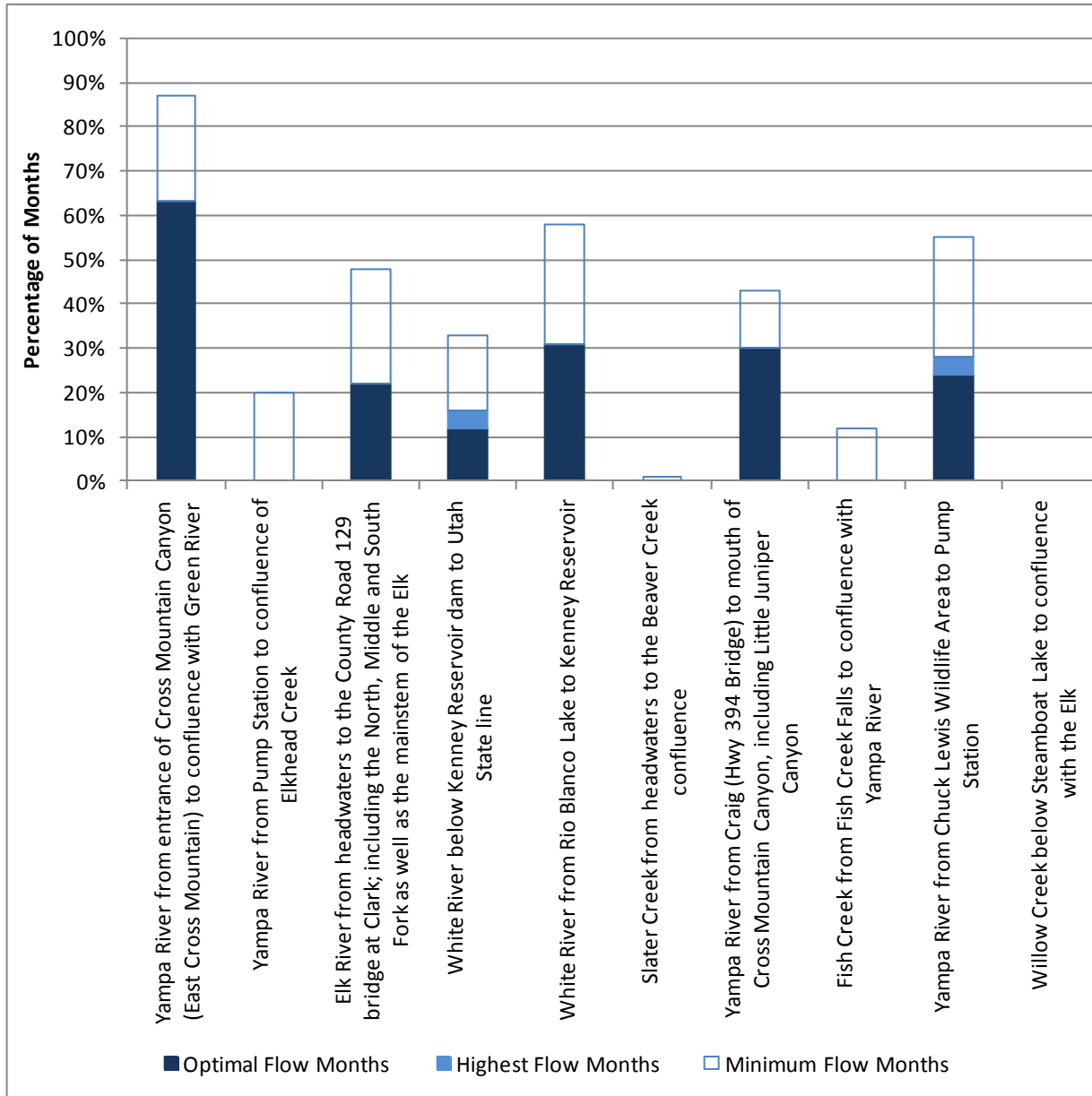


Figure 2-12 Baseline Recreational Whitewater Boating Results

Source: P&M Study, 2014.

Note: The frequency of months with high and low flows days are averaged in the P&M Study because the model is based on a monthly timestep. This reduces variability.



Table of Contents

Section 3.0	Evaluate Consumptive and Environmental and Recreational Considerations	3-4
3.1	Overview of Considerations	3-4
3.2	Water Management and Water Administration	3-6
3.3	Hydrologic modeling	3-7
3.4	Changes to the YWG BASIN Statemod Model	3-9
3.5	Current and Future Shortages Analysis	3-9
3.5.1	Environmental and Recreational Shortages	3-15



List of Figures

Figure 3-1 Elements of the Model Scenarios.....	3-8
Figure 3-2 DD&E Ditch	3-11
Figure 3-3 Deer Creek and Morapos Ditch	3-12
Figure 3-4 Haughey Irrigation Ditch	3-13
Figure 3-5 McDonald Ditch	3-14
Figure 3-6 Elk River Lower MSF.....	3-16
Figure 3-7 Trout Creek Lower MSF.....	3-17
Figure 3-8 Upper Yampa ISF.....	3-18
Figure 3-9 Yampa PBO Fish Reach.....	3-20
Figure 3-10 Steamboat RICD	3-22
Figure 3-11 Flow Ecology Relationship Risks for Modeled Baseline Conditions	3-30
Figure 3-12 Flow Ecology Relationship Risks for Modeled Dry Future IPP Scenario	3-31
Figure 3-13 Flow Ecology Relationship Risks for Modeled Dry Future Scenario.....	3-32



List of Tables

Table 3-1 Considerations for Water Supply Planning in the YWG Basin.....	3-4
Table 3-2 Volume of Conditional Storage Rights by Priority in the YWG Basin*	3-6
Table 3-3 Model Scenarios.....	3-8
Table 3-4 Steamboat RICD and Modeled Percentage of Years from 1950-2005 There is a Shortage	3-23
Table 3-5 Modeled Results of the Flow-Ecology Relationship Risks for Trout.....	3-25
Table 3-6 Modeled Results of the Flow-Ecology Relationship Risks for Warm Water Fish	3-26
Table 3-7 Modeled Results of the Flow-Ecology Relationship Risks for Cottonwood	3-27
Table 3-8 Modeled Results for the Recreational Whitewater Boating Flow Risk Metric.....	3-29



SECTION 3.0 EVALUATE CONSUMPTIVE AND ENVIRONMENTAL AND RECREATIONAL CONSIDERATIONS

This section provides an overview of considerations that the BIP will use to assess the water needs, shortages and potential future supplies of the YWG Basin. The majority of information presented in this chapter was developed through a series of SWSI and Basin-wide studies. This includes the 2014 P&M Study, which is the most recently completed study conducted by the YWG BRT. This section includes an overview of considerations, a summary of water management and administration, a discussion of the recently completed hydrologic modeling in the P&M Study, and a description of water shortages specific to the M&I, SSI, agricultural, environmental, and recreational sectors.

It is important to note that the M&I, SSI, agricultural, environmental, and recreational results presented in this section are based on the P&M Study and additional modeling completed since submission of the first draft BIP in July 2014. This second “final” draft includes the demand updates noted in Section 2, additional IPPs recommended for modeling by the BIP Committee, and more reliable indicators of shortages. As the BIP process moves forward, refinements to the model will continue and discussions will ensue on how best to meet the shortages throughout YWG Basin.

3.1 OVERVIEW OF CONSIDERATIONS

The YWG BRT recognizes that almost any water supply, whether it is categorized as an IPP or not, will involve complex and nuanced tradeoffs. Each project will present its own specific set of opportunities and constraints; and what is a constraint for one project might be an opportunity for another. Consequently, at this time, the YWG BRT believes it is not possible to develop a comprehensive list of opportunities and constraints. Instead, the BIP sets out planning “considerations” to guide the future development and evaluation of water supply and resource projects. An overview of the current considerations are summarized in Table 3-1 and discussed below.

Table 3-1 Considerations for Water Supply Planning in the YWG Basin

Summary of Considerations for the YWG Basin	
Less developed relative to other basins in the State	
Relatively junior water rights relative to other basins in the State	
Limited storage	
Less developed diversion infrastructure	
No history of mainstem administration	
Numerous large conditional water rights	
Flow requirements for endangered species protection	
<ul style="list-style-type: none"> ▪ Yampa PBO <ul style="list-style-type: none"> ○ Increase in irrigated lands ○ Increase in agricultural consumptive use ▪ Green River Record of Decision (ROD) ▪ Prospective White River PBO 	

Balancing the uses and needs for water in the YWG Basin first requires coordination within YWG Basin and amongst its stakeholders to ensure the long-term viability of its current water supplies and some future development of its native water supplies. Other parties within the State have expressed interest in diversions from the Yampa, and downstream States have delivery needs that are partially met from the Yampa and White Rivers. This BIP serves as a



YAMPA/WHITE/GREEN BIP

Evaluate Consumptive and Environmental and Recreational Considerations

forum to address the need to protect existing uses, to enable future growth, and to retain the recreational and environmental values important to the YWG Basin and to the State. These are the core outcomes that the YWG Basin is seeking. Through this BIP, the YWG BRT strives to balance the current and future needs of the YWG Basin while integrating these important considerations into the statewide planning process.

Development. The YWG Basin drainages are relatively less developed compared to other basins in the State. Economic and population growth came later to the YWG Basin, with the result that the YWG Basin has lower levels of water use relative to average annual flows compared to more developed basins in the State. This is an opportunity for further in-basin development and for preservation of environmental and recreational values, but it also makes the YWG Basin an attractive target of proposals for new TDMs, which could impose significant constraints on opportunities for IPPs and on our ability to meet the goals of the YWG Basin.

Junior water rights. Another consideration for the YWG Basin is that, due to the later development and growth in the YWG Basin, particularly for M&I uses, appropriation dates for water rights in the YWG Basin are more junior relative to other Colorado River tributaries. This causes concern because Colorado River Compact administration could lead to a more severe curtailment of existing uses in the YWG Basin than in basins with a more senior water rights portfolio.

Limited storage. The YWG Basin drainages have less storage relative to average flow than do other basins. Although there is some existing storage for agricultural supplies, particularly in the upper Yampa Basin, most of the storage is reserved for dry-year supplies for M&I uses. The small amount of storage coupled with relatively junior water rights in the YWG Basin presents a concern about reduced physical and legal reliability of its water resources, particularly during drought periods. Flows on the mainstem and on tributary streams without storage are often inadequate in the late season. On the other hand, riverine systems in the YWG Basin are unique because they are some of the few in the State that exhibit a more natural hydrograph due to the lack of large on-channel storage capacity. This BIP recognizes that the more natural hydrograph provides valuable benefits to endangered species, riparian habitat, and recreationists.

Diversion infrastructure. Diversion structures are not well developed. Irrigators often construct gravel pushup dams to divert water, but these dams cannot sweep the river. Numerous diversions do not have measuring devices.

Administration. Administration has only occurred on the mainstem Yampa and White Rivers in special circumstances, such as protecting reservoir releases in dry conditions. This historical lack of administration is not solely due to the relatively lesser development on these basins (water shortages are common during dry seasons); it is also due to a neighborly culture of a willingness to share shortages voluntarily and the presence of undeveloped diversion infrastructure. The Division engineer will not allow calls to be placed at diversions that do not have measuring devices or that cannot sweep the river.

Conditional water rights. As shown in Table 3-2 there are a number of conditional storage water rights, particularly in the lower White Basin (District 43) and lower Yampa Basin (District 44). This presents both an opportunity and a constraint for the long-term water resource development of these sub-basins. For example, conditional senior water rights held by energy companies in the White Basin can discourage the development of new projects relying on junior water rights. The yield of these junior water supply projects could be reduced to infeasible levels if senior conditional water rights are developed and made absolute at a later date. Conversely, these senior conditional water rights provide the potential for development of relatively firm IPPs with senior priority. This situation illustrates the need for careful collaboration and cooperation in order to reach the best outcome for the YWG Basin.



YAMPA/WHITE/GREEN BIP

Evaluate Consumptive and Environmental and
Recreational Considerations

Table 3-2 Volume of Conditional Storage Rights by Priority in the YWG Basin*

Water District	Stream Name	1900-1920 (AF)	1920-1940 (AF)	1940-1960 (AF)	1960-1980 (AF)	1980-2002 (AF)	Total (AF)
43	White River	204	0	12,548	1,018,918	266,128	1,297,798
44	Williams Fork/Yampa River	0	0	844,294	638,662	1,179,449	2,662,405
54	Slater Creek/Little Snake River	0	0	0	323,580	166,898	490,478
55	Little Snake River	0	0	0	0	46,426	46,426
56	Green River	0	0	0	1,200	500	1,700
57	Yampa River	0	0	0	111,010	52,616	163,626
58	Elk/Yampa River	0	0	34	201,579	97,449	299,062
Total		204	0	856,876	2,294,949	1,809,466	4,961,495

Source: Water Supply and Needs Report for the YWG Basin, (CDNR 2006)

* Note that this table is current as of 2006; additional water rights have likely been filed and abandoned since that time, e.g., the abandonment of the Juniper-Cross water right in Water District 44 exceeded 1 MAF.

Endangered species. Constraints on water development and water management to protect habitat for endangered species are in place in the Green and Yampa Basins, and similar constraints are being contemplated for the White Basin. Accordingly, the BIP addresses how the YWG Basin's water needs must be developed in ways that provide collaborative solutions to water supply challenges while maintaining a balanced and diverse economic base long into the future. Existing flow protections for endangered species must be also considered in this process.

In particular, the Yampa PBO is based on existing storage and a current depletion of 125,271 AF above the Little Snake River with a projected increase in depletion of 30,104 acre feet by 2045¹. The estimates of current and future depletions above the Little Snake River in the P&M Study are significantly higher than this. One of the major reasons is that the StateCU and StateMod models were refined to include the Denver Water High Altitude crop coefficients for pasture grass/hay fields above 6,500 feet. In order to be consistent with CRWAS and common State Engineer Office practices, an elevation adjustment of 10% per 1,000 meters above sea level was made for all crops. When compared to previous SWSI IWR estimates, the IWR requirement increased by 54 percent basin-wide when the high-altitude coefficient for the grass/hay was included and by 65% when the elevation adjustment and high altitude crops were incorporated². The Yampa PBO was based on un-adjusted consumptive use, which leads to an “apples-to-oranges” comparison. Additional modeling efforts and coordination will be necessary to incorporate updated depletions and determine the amount of flow that could be sustainably maintained in the Yampa River for protection of endangered species.

3.2 WATER MANAGEMENT AND WATER ADMINISTRATION

The YWG Basin is one of the few areas in Colorado where a large part of the YWG Basin is not over appropriated and regularly under administration. Nonetheless, certain tributaries are frequently administered at certain times of the year (e.g., the Elk River and the Yampa River mainstem upstream of the Town of Yampa). Still, significant portions of the YWG Basin have not experienced a call due in part to water users within the YWG Basin coordinating diversions and avoiding a formal call.

¹ The cooperative agreement implementing the management plan for the PBO also provides: “When the first increment of depletions in Colorado [of 30,104 acre feet] approaches full development, the impacts of developing a second increment [of 20,000 AF] and the status of the endangered fish species at that time will be re-evaluated pursuant to the PBO for this Agreement to implement the Management Plan.”.

² Agricultural Water Needs Assessment Report, 2011



YAMPA/WHITE/GREEN BIP

Evaluate Consumptive and Environmental and Recreational Considerations

The majority of historical calls in the YWG Basin, other than in the Elk River, are attributed to irrigation uses. Occasional calls have been made by CWCW to maintain instream flows in the Elk River. In addition to calls, certain stream reaches have been administered to ensure that reservoir releases are conveyed to the designated downstream use. Streams that are commonly administered include:

- Green River Basin - Talamantes Creek, Vermillion Creek, Beaver Creek and Pot Creek
- Yampa River Basin – Bear Creek, Phillips Creek, Hunt Creek tributaries, Fish Creek,³ Soda Creek, Elk River, Trout Creek, Elkhead Creek, Fortification Creek, Deer Creek and Morapos Creek
- White River Basin – Piceance Creek.

Pot Creek, a tributary to the Green River that flows between Colorado and Utah, is administered based on the Pot Creek Memorandum of Understanding (MOU). This MOU includes a schedule of priorities for use in both states and defines a period before which direct flow diversion cannot be exercised.

3.3 HYDROLOGIC MODELING

The 2014 P&M Study was the primary study used to inform the BIP regarding future water supplies, demands, and shortages including projections of demands and alternative hydrologic conditions.⁴ The P&M Study used the StateMod modeling platform which is Colorado's water allocation model maintained by CDSS. StateMod is the water allocation model in CDSS that is used for the primary purpose of modeling water rights and allocating water to those rights. StateMod uses strict prior appropriations (i.e., first in time, first in right) to model diversions. The model was initially developed in 1994 and has been continually updated as new studies and data becomes available. The 2009 release for both the Yampa and White Basins was used for this study. The model uses a monthly time-step. A variety of previous studies discussed in Appendix A were used to inform the modeling effort. The P&M study was conducted by the YWG BRT to:

- Develop a common understanding of consumptive, recreational, and environmental water needs in the YWG Basin.
- Analyze Yampa River and White River operations, including alternative model scenarios.
- Evaluate water right priorities of SWSI Alternatives relative to those of the YWG Basin.

The P&M Study evaluated Baseline Conditions and six modeling scenarios. As shown in Figure 3-1 these scenarios consist of a combination of demands, hydrology and supply projects (IPPs). The demand inputs include the current and future year (2050) water needs for the M&I, energy, agriculture, environment and recreation sectors at specific modeling nodes in the StateMod model. Information on how the demands were developed for each of these sectors is provided in Chapter 2. The P&M Study results present the percentage of average annual water shortages at each of the respective StateMod nodes and for each of the sectors both in tables and spatial figures.

³ Administration of this reach is becoming less frequent. CWCW has historically placed an instream flow right call on Fish Creek, however, the Mt. Werner Water District is leaving more flows in the Creek which lessens the need for an instream flow call.

⁴ The YWG BIP Committee decided on March 5th, 2014 that the P&M Study would serve as the major study informing the BIP.



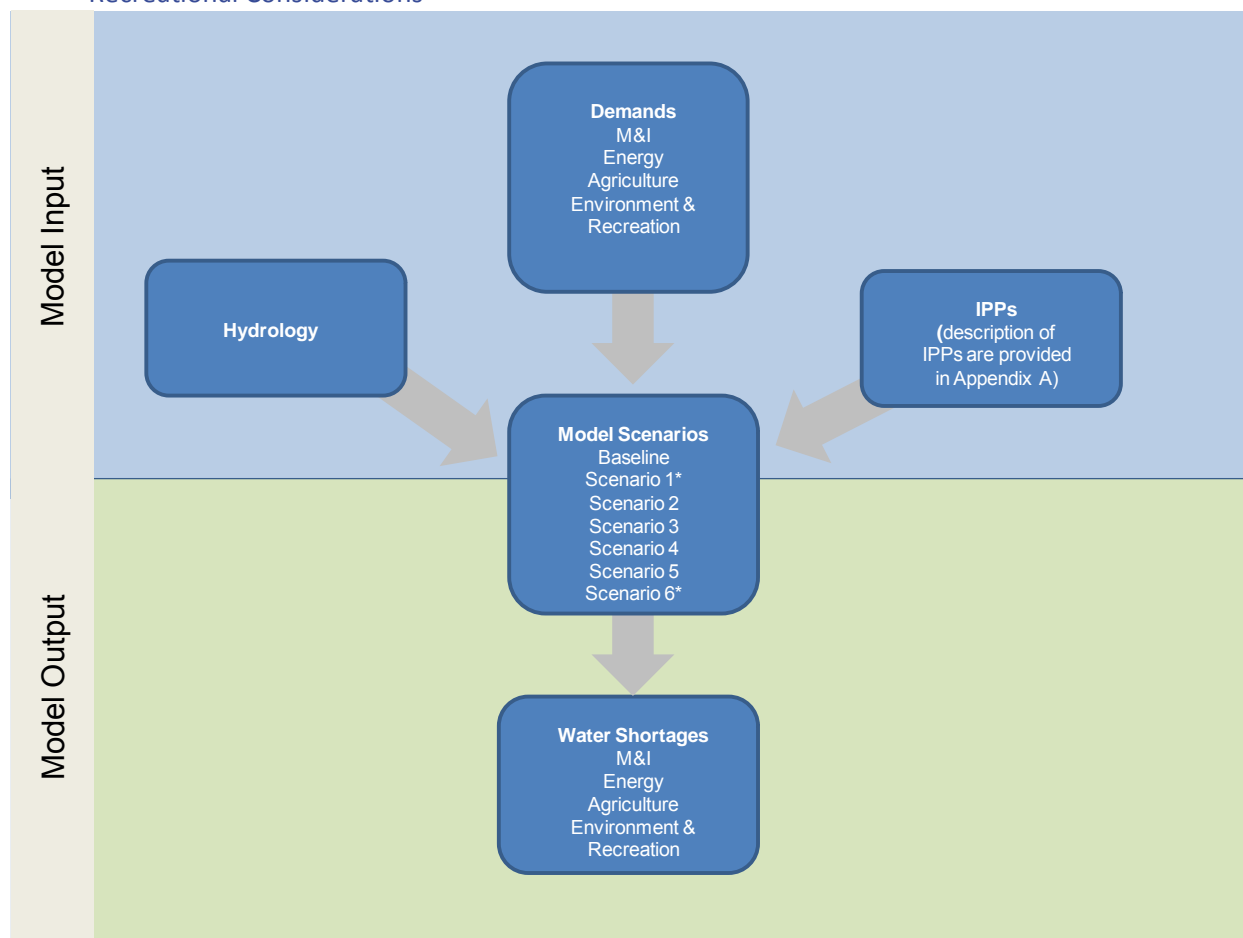


Figure 3-1 Elements of the Model Scenarios

Table 3-3 shows the elements for each of the respective scenarios incorporated into the BIP. The modeled baseline represents current conditions and operations. This includes all existing reservoirs, water rights, imports, diversions, and return flows while incorporating the historical hydrology and climate over the period 1950 through 2005. It provides a means to compare the other scenarios (e.g., supply projects, climate change, new demands, etc.). The Dry Future IPP Scenario and Dry Future Scenario entail high demands and dry hydrology which provides a conservative planning framework to best guarantee that the YWG Basin's future water needs can be met. These scenarios are referred to as Scenario 1 and Scenario 6, respectively, in the 2014 P&M Study.

Table 3-3 Model Scenarios

BIP Scenario	Nomenclature in the P&M Study	Hydrology	Demands	IPPs
Baseline	Baseline	Historical	Existing demands	No IPPs Selected
Dry Future IPP Scenario	Scenario 1	Dry	High	All IPPs Selected
Dry Future Scenario	Scenario 6	Dry	High	No IPPs Selected



3.4 CHANGES TO THE YWG BASIN STATEMOD MODEL

During the second phase of the BIP development, the P&M Study StateMod model for the YWG Basin was modified to refine some of the model nodes' demands and refine operations and model assumptions under the Baseline Scenario and future scenarios (Dry Future IPP Scenario and Dry Future Scenario). These updates were requested by stakeholders in the YWG Basin. Updating the modeling is still in progress and its completion will be an important next step. The preliminary results described in this section are based on the updated modeling that has been done so far, unless indicated otherwise. Several examples of shortages to consumptive and non-consumptive needs are also presented for the 2000-2005 period using the updated modeling, but no new assessments of flow alteration risks to fisheries, cottonwoods, or recreational boating have been updated to reflect the updated modeling. As stated above, all of the modeling remains preliminary and a work in progress. Updates to the YWG Basin StateMod model will continue in the future after the State Water Plan has been finalized.

The primary changes made to the YWB Basin StateMod model during the development of the BIP are summarized below.

- The total demand for the three units of Craig Station was increased under the baseline scenario from approximately 12,000 AFY to 14,000 AFY.
- An operating rule was added to the model to simulate a release from Stagecoach Reservoir to meet a minimum of 20 cfs flow in the Yampa River downstream of Stagecoach Reservoir from August to November to reflect Federal Energy Regulatory Commission (FERC) environmental requirements.
- A release from Stagecoach Reservoir was modeled under the Dry Future IPP Scenario to meet remaining shortages at the Upper Yampa ISF. This release is not modeled under the Baseline and Dry Future Scenarios.
- The unlimited filling of reservoirs was turned off for all of the modeling scenarios. A start date for administering annual fill was implemented for all the reservoirs based upon the intended use (i.e.: irrigation, municipal, industrial, etc.) for the reservoirs and any requirements enforced by the Division Engineer.
- All reservoirs were modeled to start empty.
- An augmentation plan was modeled for Stagecoach Reservoir under the Dry Future IPP Scenario. Under this augmentation plan, 2,000 AF of fully consumptive water would leave Stagecoach Reservoir each year.
- The modeled releases from Steamboat Lake to Willow Creek ISF and Elk River ISF were deactivated for all three modeling scenarios.
- The modeled water rights for Stagecoach Reservoir were modified to conform to a StateMod model that was previously developed by the Upper Yampa Water Conservancy District.
- The modeled M&I demands for Routt County were adjusted for all three modeling scenarios. The changes to the M&I demands were based on feedback from Mt. Werner Water and Sanitation District and the City of Steamboat Springs. The M&I demands for the following model nodes were adjusted: 57_AMY001, 58_AMY001, Fish Creek Municipal Intake, Steamboat Well A, Mt Werner Well H and Mt Werner Well G.

3.5 CURRENT AND FUTURE SHORTAGES ANALYSIS

The updated P&M Study Statemod model was used to analyze shortages in the YWG Basin. As discussed in Section 3.3, this BIP focuses on the modeled Baseline Conditions and future scenario assuming high demands and dry hydrology. Both the Dry Future IPP Scenario and the Dry Future Scenario are based on dry hydrology. The Dry Future IPP Scenario includes a series of supply and storage IPPs while the Dry Future Scenario does not include these IPPs. The specific IPPs included in the Dry Future IPP Scenario are discussed in Chapter 4. Appendix A provides further information on the scenarios and IPPs.

M&I Shortages

As discussed in Chapter 2, M&I demands are small compared to agricultural demands in the YWG Basin. Under the Baseline Scenario, no shortages exist to M&I demand nodes due to generally adequate water supply and augmentation



from reservoirs. M&I shortages exist under the high-demand, low-water supply scenarios of the Dry Future IPP Scenario and the Dry Future Scenario but remain insignificant. As an example, under both the Dry Future IPP Scenario and the Dry Future scenarios, District 43 Existing M&I in Rio Blanco County (Rangely Water, Meeker Demand) begin to exhibit shortages, whereas Moffat County municipal nodes do not show M&I shortages under either scenario. If IPPs are developed that include M&I use, shortages would likely decrease in locations with supply augmentation.

SSI Shortages

Under the Baseline Scenario, no shortages exist for SSI which is primarily related to thermoelectric power generation. Slight shortages exist for the Hayden Station and Craig Station under the Dry Future IPP Scenario and the Dry Future Scenario. These scenarios meet thermoelectric demands with redundant water supplies from Steamboat Lake for Hayden Station and Elkhead and Stagecoach Reservoirs for Craig Station. Using historical data, hypothetical shortages would have occurred for the Hayden Station in the dry months of August 1961 March 1962, September 1977, and September 2002) and for the Craig Station in the dry months of November 1963, September 1977, December 2002, and a few months in 1949.

However, SSI water users consider their water supply short at any time when they must rely upon redundant water supplies. For example, the years 2002, 2003, 2012, and 2013 were considered water supply short or borderline short by some SSI water users due to reliance on redundant supplies.

Agricultural Shortages

The P&M Study and Agricultural Water Needs Study highlight the following areas of shortage under modeled Baseline Conditions:

- The Piceance Creek watershed has the highest agricultural shortages in the White Basin. This watershed is important for future energy development.
- Fortification and Morapos Creeks have some of the highest agricultural shortages in the Yampa Basin.
- Many of the diversions in the upper tributaries have low irrigation efficiencies and small drainage areas which result in unreliable irrigation supplies.

The percentages of agricultural shortages significantly increase in the eastern and southern portions of the YWG Basin under the simulated high-demand, dry-hydrology conditions for the Dry Future IPP and Dry Future scenarios. Agricultural shortages significantly increase for the Dry Future IPP Scenario and the Dry Future Scenario in Districts 43, 44, 54, 57 and 58; minimal changes are observed in Water Districts 55 and 56 in the northwest portion of the YWG Basin.

The simulated increase in shortages for the Dry Future IPP and Dry Future scenarios are largely attributed to the drier hydrology and a shift to earlier season runoff as a result of warmer temperatures with climate change. The simulated late season shortages tend to increase unless there is storage available. Modeled shortages are common in the upper tributaries without existing storage or an IPP.

Comparison of the Dry Future IPP Scenario and the Dry Future Scenario for the 1950-2005 period indicate that the development of IPPs would significantly reduce agricultural shortages in District 44: shortages totaling approximately 56,000 AF would be reduced to approximately 22,000 AF with the development of the modeled IPP reservoirs in the headwaters of this District. Additional information on these IPPs is provided in Chapter 4. Shortages are also reduced in Water Districts 54 and 57 as a result of the IPPs.

Figures 3-2 through Figure 3-5, which are based on the updating modeling, show examples of monthly shortages in selected irrigation ditches for the period 2000-2005.



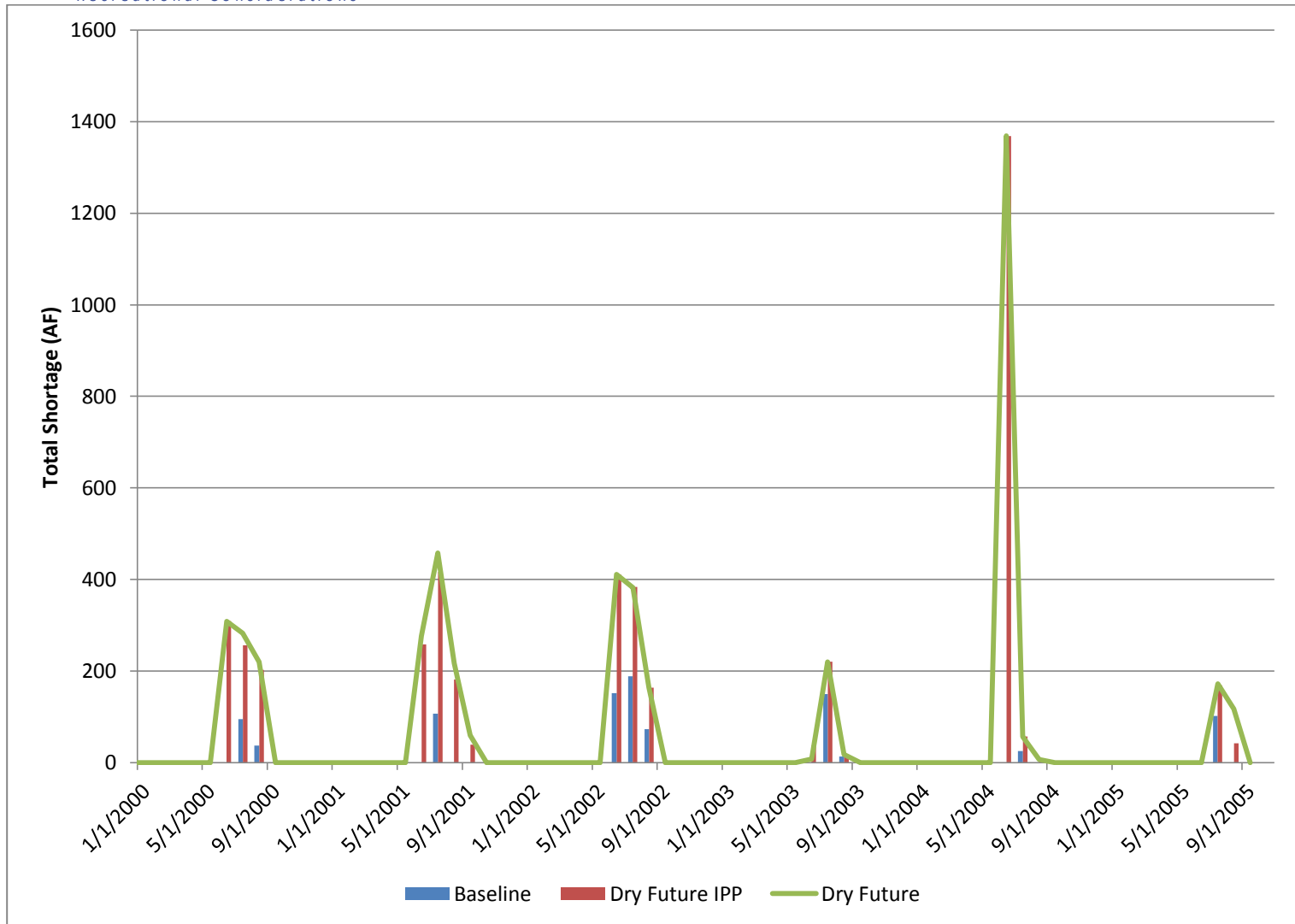


Figure 3-2 DD&E Ditch



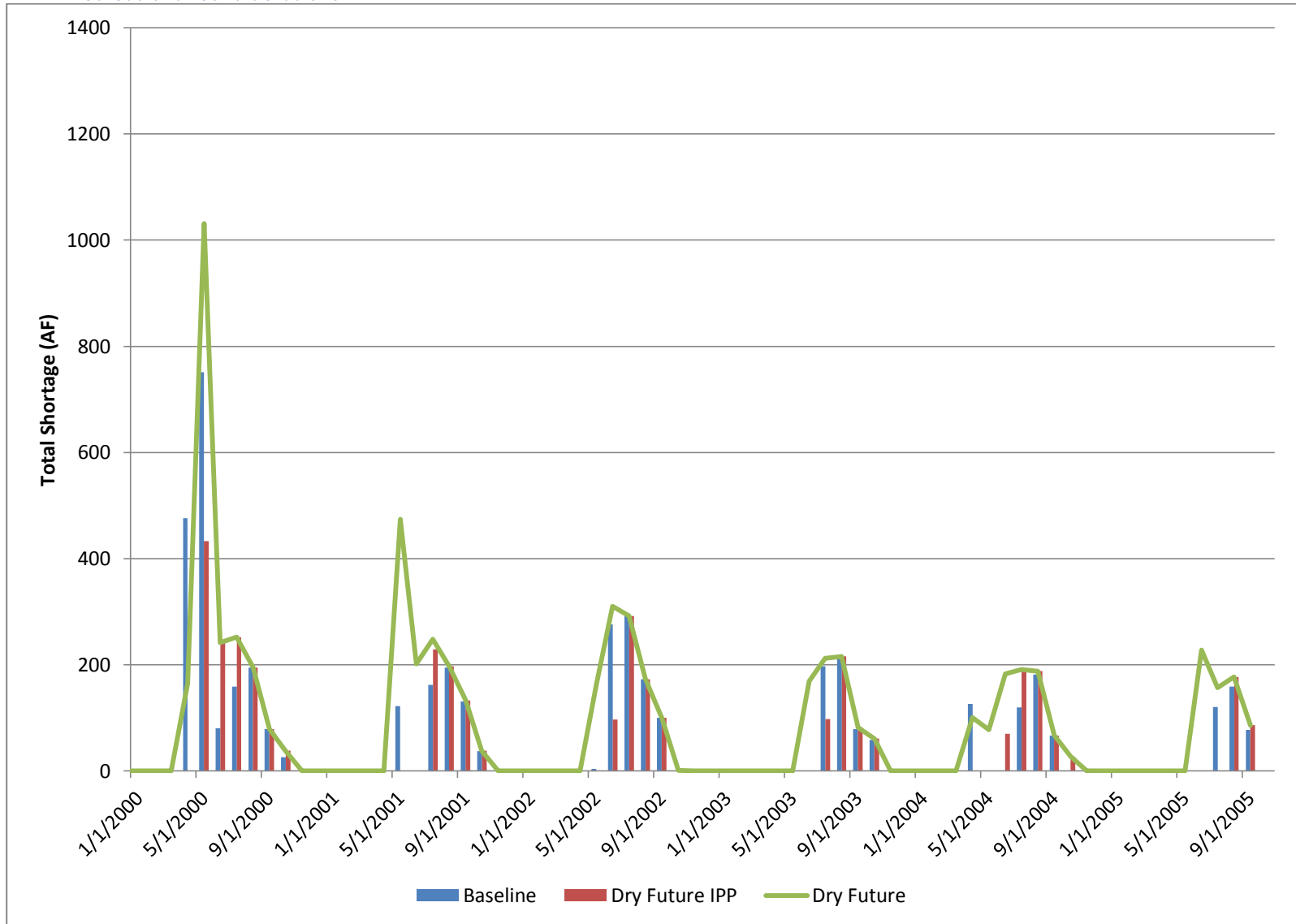


Figure 3-3 Deer Creek and Morapos Ditch



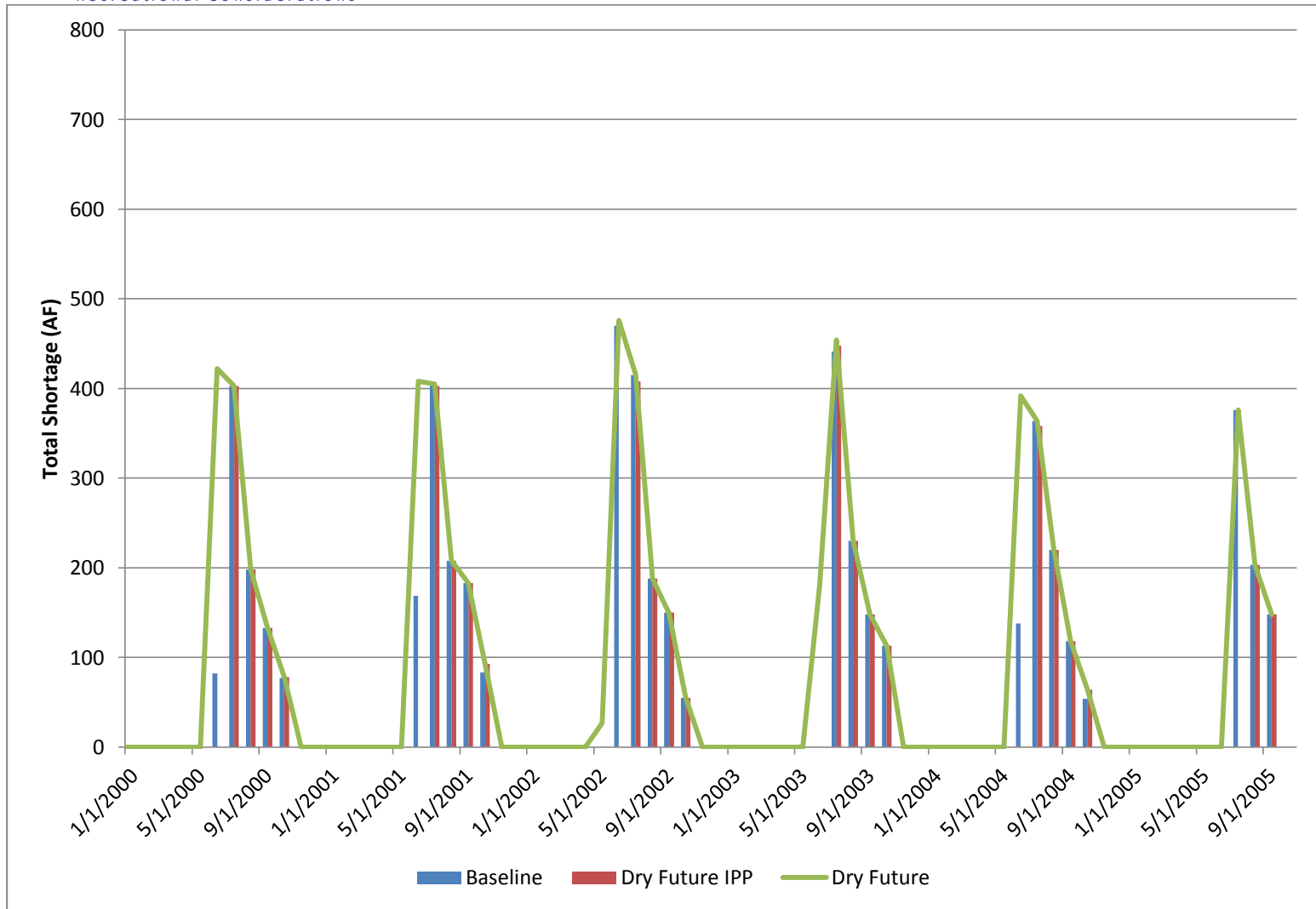


Figure 3-4 Haughey Irrigation Ditch



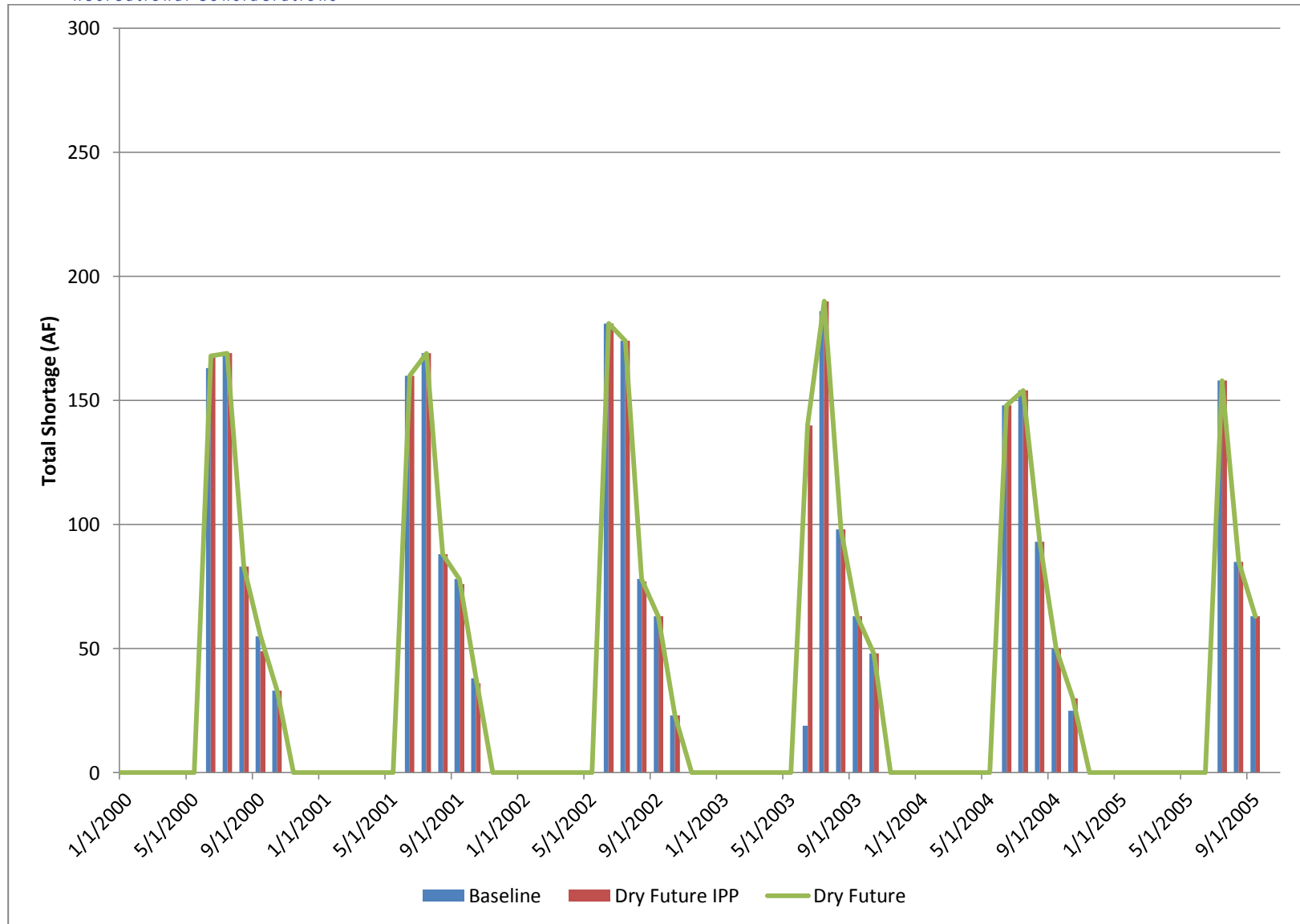


Figure 3-5 McDonald Ditch



3.5.1 Environmental and Recreational Shortages

Instream Flows

In the P&M Study, thirty-five (35) ISFs were modeled for the YWG Basin. In the headwaters of the Yampa River, several of the modeled streams demonstrated significant shortages under the Baseline Scenario. The Elk River (node 581355), Green Creek (node 582245), Hunt Creek (582519), and Bear River-Lower (node 582202) show some of the greatest shortages. This suggests that these streams are not meeting the minimum flows needed to sustain ecological health. In many upper Yampa tributaries protected by ISFs are often not met even during runoff or in low-water conditions during the late summer and winter.⁵

In the White River, model runs indicate that instream flow shortages will increase on the majority of the modeled streams under the Dry Future Scenario. Some of stream reaches most impacted include the East Fork of the Williams Fork River (node 441452), Marvine Creek (node 432334), North Fork of the White River (node 432339), South Fork of the White River (node 432344), and the mainstem of the White River (node 431845).

The comparison of the Dry Future IPP Scenario and the Dry Future Scenario for the 2000-2005 period suggests that the implementation of the modeled IPPs under high demand/dry conditions will have little impact on improving flows for the majority of the modeled ISF reaches. In some cases, the implementation of IPPs would increase instream flow shortages significantly (eg. Trout Creek).

The 2000-2005 monthly shortages for a few example ISFs are provided in Figures 3-6 through 3-8. These figures, which are based on the updated modeling, show the extent to which modeled stream flows do not meet the decreed instream flows on a monthly basis from 2000-2005

⁵ P&M Study, 2014



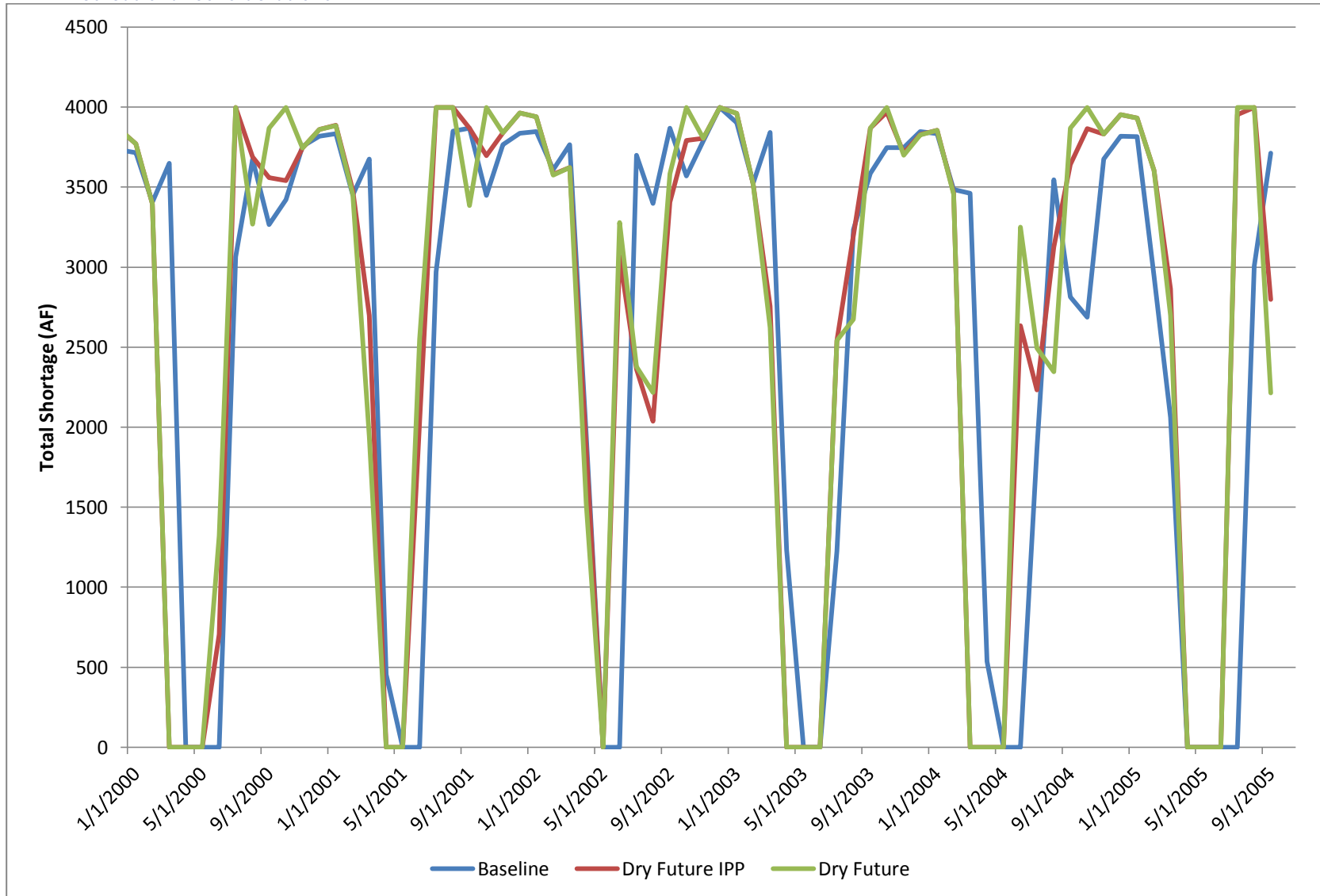


Figure 3-6 Elk River Lower MSF



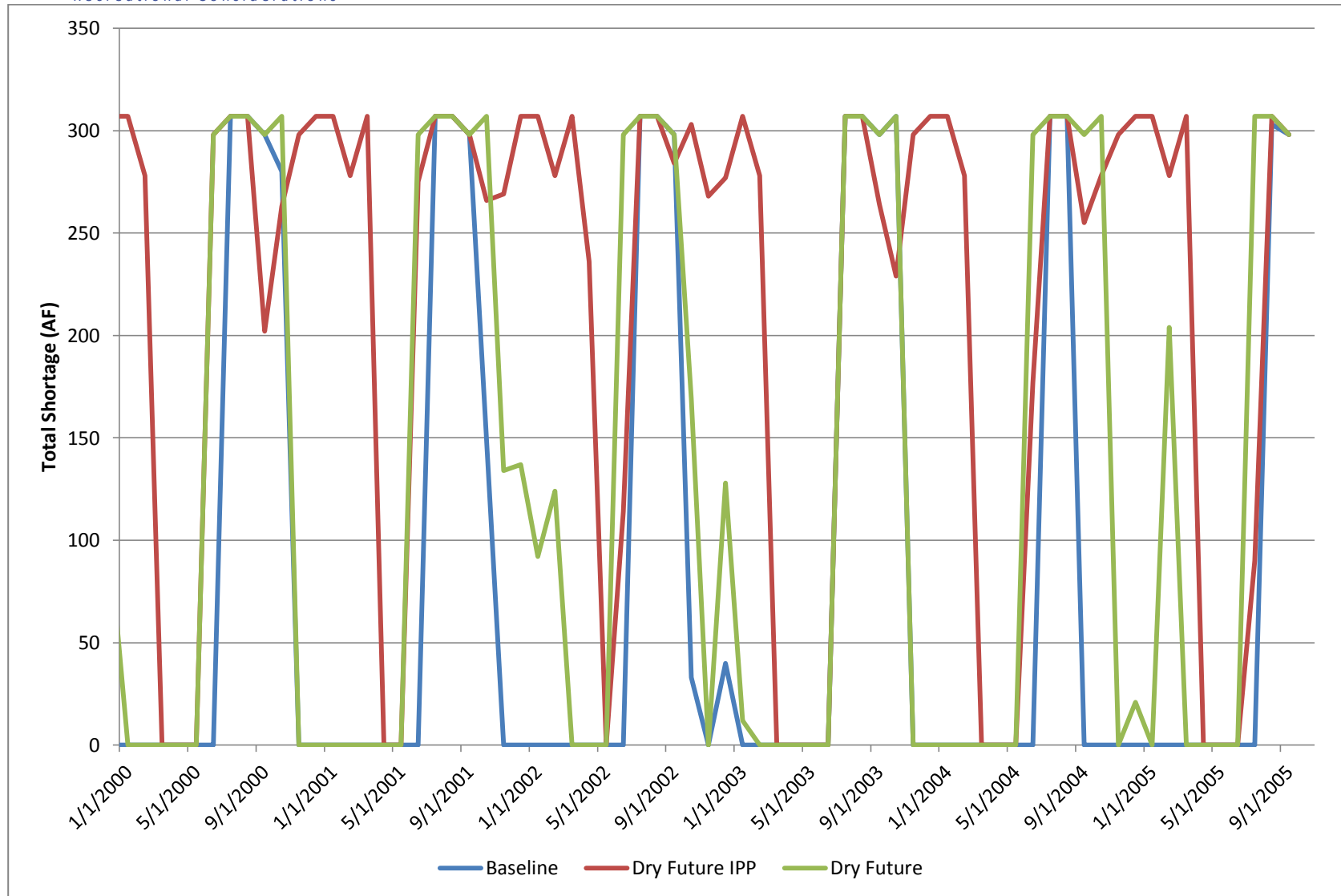


Figure 3-7 Trout Creek Lower MSF



YAMPA / WHITE / GREEN BIP

Evaluate Consumptive and Environmental and
Recreational Considerations

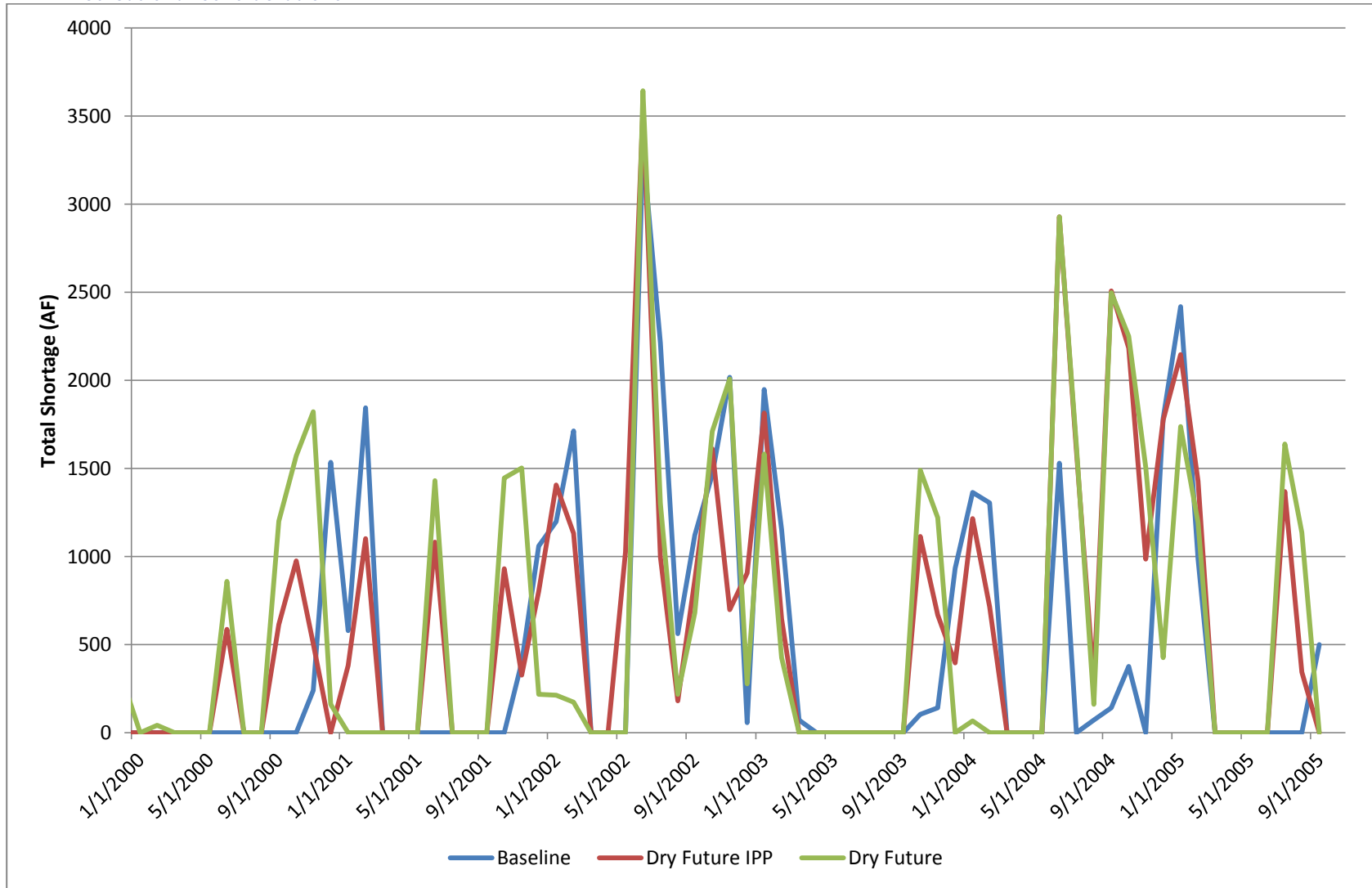


Figure 3-8 Upper Yampa ISF



Yampa PBO – Endangered Species Fish Flow Target

Figure 3-9 shows the monthly shortages at the Yampa PBO stream reach for the endangered fish recovery⁶ under Baseline Scenario and under the Dry Future scenarios. The location and extents of this stream reach is shown in Figure 2-10. The 2000-2005 monthly shortages in Figure 3-9, that are based on the updated modeling described in Section 3.4, indicate that the modeled instream flows do not meet the instream flow targets under baseline conditions or the dry future scenarios.

The ability to meet the Yampa PBO base flow augmentation targets significantly decreases when both Future Dry scenarios are compared to Baseline Scenario. Based upon the updated modeling for the 1950-2005 period, during fall and winter months shortages occurred 20%, 52%, and 67% under the Baseline Scenario, Dry Future Scenario, and Dry Future IPP Scenario, respectively. Based upon the updated modeling for the 1950-2005 period, during the summer months shortages occurred 11%, 48%, and 49% under the Baseline Scenario, Dry Future Scenario, and Dry Future IPP Scenario, respectively.

⁶ The P&M Study did not address the rest of the flow regime that may be necessary for endangered fish recovery on this reach of the Yampa River, on the lower Little Snake River, on the Yampa River in Dinosaur National Monument, and on the Green River. These flow needs were addressed for the WFET report by replicating the full flow assessment of the existing and future depletions covered by the Yampa PBO.



YAMPA / WHITE / GREEN BIP

Evaluate Consumptive and Environmental and
Recreational Considerations

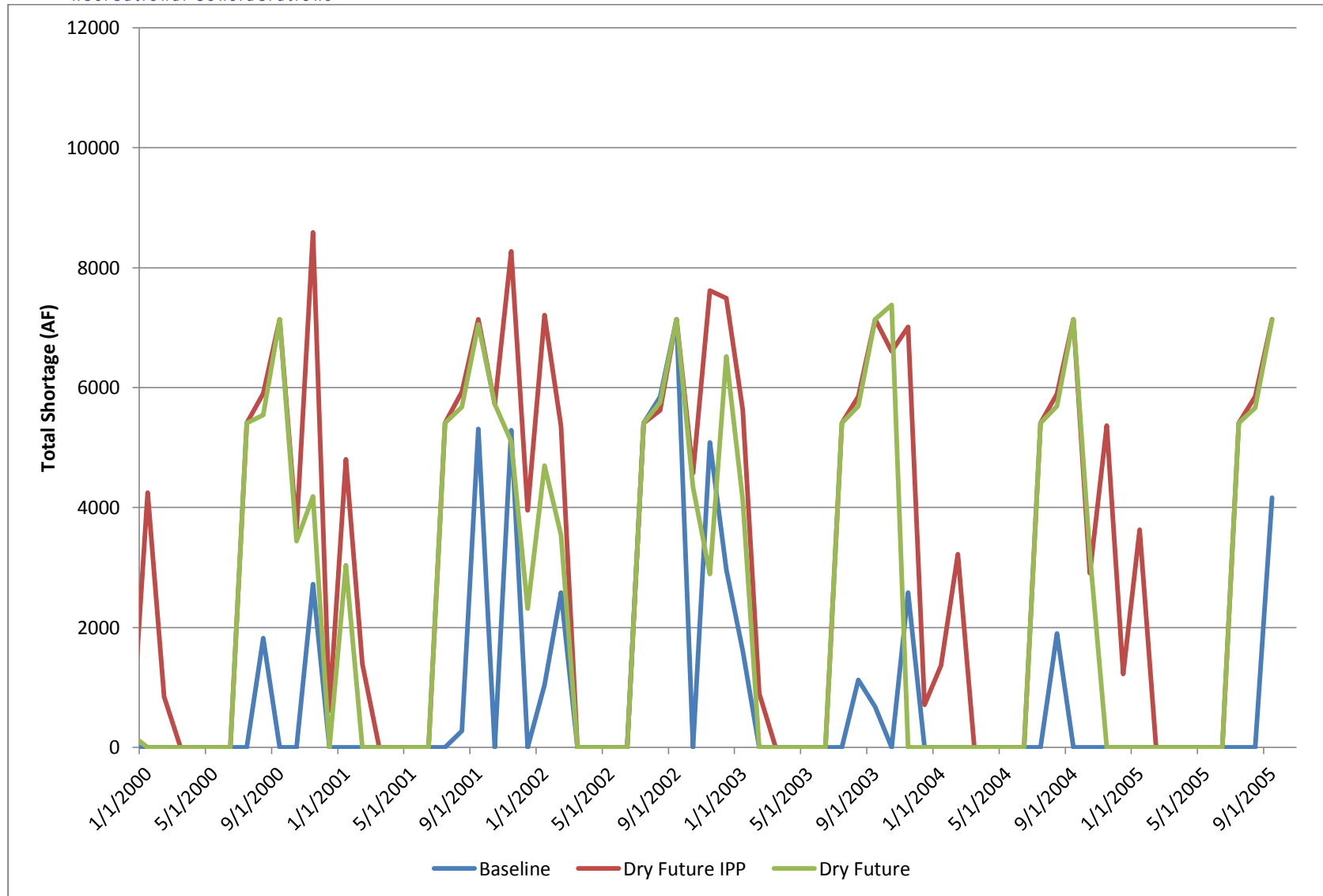


Figure 3-9 Yampa PBO Fish Reach



Steamboat RICD

Figure 3-10 shows the monthly shortages for the Steamboat RICD under the Baseline Scenario and the Dry Future IPP and Dry Future Scenarios for the 2000-2005 period with the updated modeling. The RICD has flow targets in the following months: April, May, June, July, and August. Over the entire modeling period from 1950-2005 and on average during these months, the flow target for the RICD was not met for 9% of the time, 37% of the time, and 33% of the time, under the Baseline Scenario, DryFuture Scenario, and DryFutureIPP Scenario, respectively.

Table 3-7 shows the Steamboat RICD flow targets and the modeled percentage of years from 1950-2005 there is a shortage under the Baseline Scenario, Dry Future Scenario, and Dry Future IPP Scenario. The most significant impacts occur in June and July followed by August. Comparison of the Baseline Scenario against the Dry Future Scenario and Dry Future IPP Scenario over the the 1950-2005 period indicates that flows within the RICD reach decrease significantly under the Dry Future scenarios during the period of April to August. Comparison of the Dry Future IPP Scenario and Dry Future Scenario over the 1950-2005 period indicates that the IPPs increase the flows slightly within the RICD reach in June and July and more significantly in August.



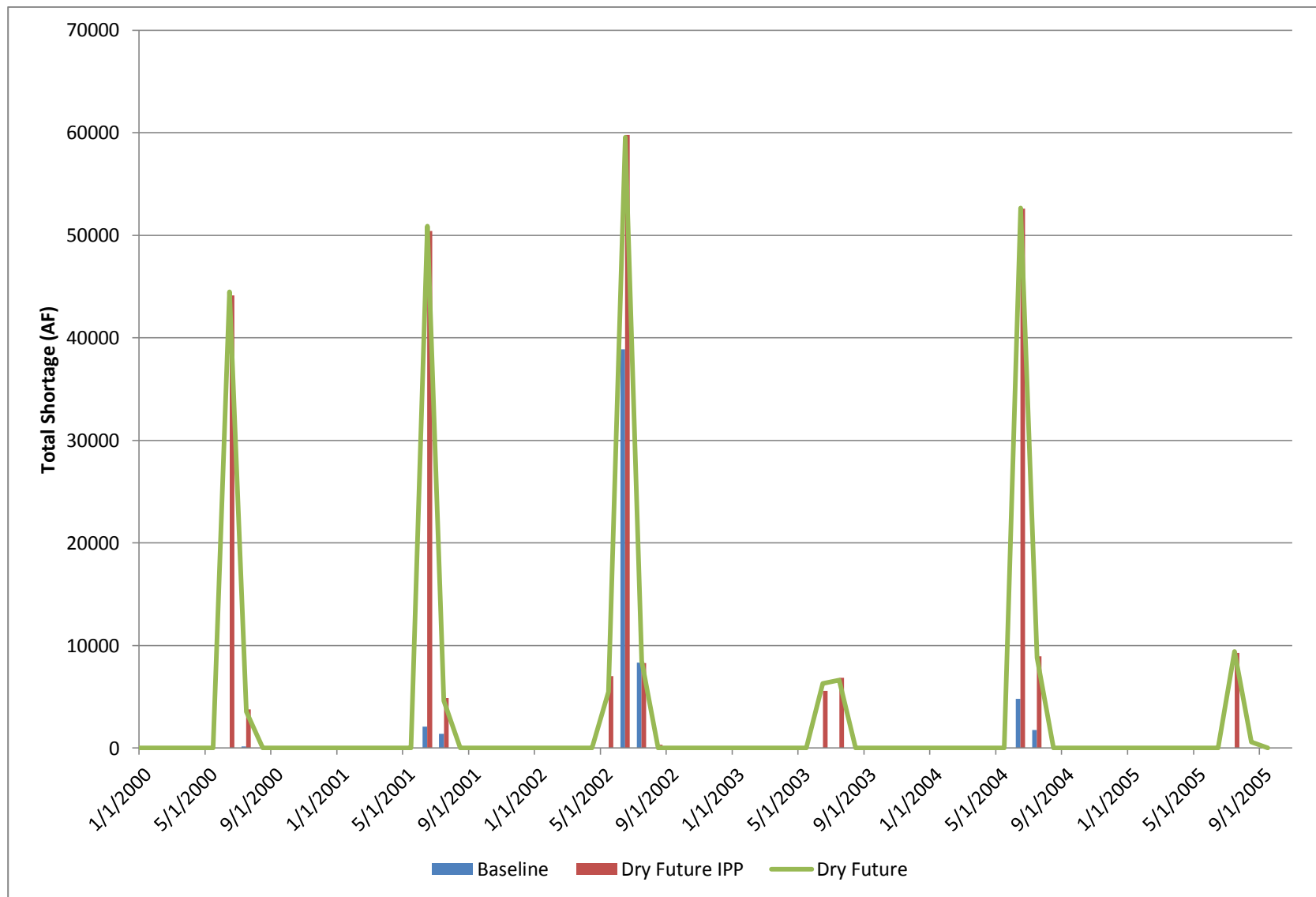


Figure 3-10 Steamboat RICD



YAMPA/WHITE/GREEN BIP

Evaluate Consumptive and Environmental and
Recreational Considerations

Table 3-4 Steamboat RICD and Modeled Percentage of Years from 1950-2005 There is a Shortage

Model Scenario	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Flow Target (cfs)	n/a	n/a	n/a	n/a	n/a	n/a	200	825	1025	175	47.5	0
Baseline	n/a	n/a	n/a	n/a	n/a	n/a	0%	2%	20%	21%	0%	0%
Dry Future IPP Scenario	n/a	n/a	n/a	n/a	n/a	n/a	0%	9%	48%	95%	11%	0%
Dry Future Scenario	n/a	n/a	n/a	n/a	n/a	n/a	0%	7%	50%	98%	29%	0%

Fisheries and Cottonwood Flow-Ecology Relationship Risks

No new assessments of flow alteration risks to fisheries or cottonwoods have been generated using the updated model. The assessment and results described under this section of the report are based upon the P&M Study (i.e. these results do not reflect the changes to the model described in Section 3.4). Questions about the modeling and other details of the prior flow assessments will be addressed in the modeling still to be completed.

The results for the P&M Study model Baseline Scenario, the Dry Future IPP Scenario and the Dry Future Scenario are presented in Table 3-5 through Table 3-7. Figures 3-11 through Figure 3-13 show the flow-ecology relationships for the trout, warm water fish and cottonwood. Chapter 2 and Appendix A provide detailed information on the development of these flow-ecology relationships.

Generally the most vulnerable reaches for trout are streams with low flows in the upper tributaries. Some of the upper tributaries in the YWG Basin have low or zero flow in late summer/early fall, which can make these tributaries “high risk” even when there is no significant development. Table 3-5 indicates that an increase in demands and dry conditions for the Dry Future IPP Scenario and Dry Future Scenario do not increase the level of risk observed for trout under Baseline Conditions for the following reaches: Slater Creek (node 540570), Willow Creek below Steamboat Lake (node 583787), and the Yampa River from Stagecoach Reservoir to the northern boundary of Sarvis Creek State Wildlife area (node 9237500). The remaining reaches reflect an increased magnitude of risk under both the Dry Future IPP Scenario and the Dry Future Scenario conditions. Comparison of the Dry Future IPP Scenario with the Dry Future Scenario indicate that the development of IPPs do not significantly affect the level of ecological risk to trout within the modeled reaches



YAMPA/WHITE/GREEN BIP

Evaluate Consumptive and Environmental and
Recreational Considerations

Table 3-5 Modeled Results of the Flow-Ecology Relationship Risks for Trout

	Reach Name	Model Node	Trout Flow Risk (Aug and Sept)		
			Baseline	Dry Future IPP Scenario	Dry Future Scenario
			Existing Demand Historical	High Demand Dry (with IPPs)	High Demand Dry (no IPPs)
2	Yampa River from Pump Station to confluence of Elkhead Creek	9244410	Moderate Risk	Very High Risk	Very High Risk
4	Elk River from headwaters to the County Road 129 bridge at Clark; including the North, Middle and South Fork as well as the mainstem of the Elk	9241000	Minimal Risk	Moderate Risk	Moderate Risk
5	White River from headwaters to Meeker; including the North and South Fork and mainstem of the White	9304500	Minimal Risk	Very High Risk	Very High Risk
8	Slater Creek from headwaters to the Beaver Creek confluence	540570	Moderate Risk	Moderate Risk	Moderate Risk
10	South Fork of the Little Snake from headwaters to confluence of Johnson Creek	9253000	High Risk	Very High Risk	Very High Risk
11a	East Fork of the Williams Fork from headwaters to the confluence of the Forks	9249000	Minimal Risk	High Risk	Moderate Risk
11b	South Fork of the Williams Fork from headwaters to the confluence of the Forks	9249200	High Risk	Very High Risk	Very High Risk
11c	Williams Fork - from South Fork to confluence of the Yampa River	9249750	Moderate Risk	High Risk	High Risk
14	Yampa River from Stagecoach Reservoir "Tailwaters" to northern boundary of Sarvis Creek State Wildlife area	9237500	Minimal Risk	Minimal Risk	Minimal Risk
16	Yampa River from Chuck Lewis Wildlife Area to Pump Station	9239500	Moderate Risk	High Risk	High Risk
18	Willow Creek below Steamboat Lake to confluence with the Elk	583787	Low Risk	Low Risk	Low Risk
19	Bear River from headwaters to USFS boundary	9236000	Low Risk	Minimal Risk	Minimal Risk

Table 3-6 shows that the overall level of ecological risk for warm water fish is less than for trout. Areas of high risk are generally associated with water development. The majority of warm water fish reaches show an increase in risk under both the Dry Future IPP Scenario and Dry Future Scenario (high demand dry hydrology) with the exception to the Little Snake River extending from Moffat County Road 10 to the confluence with the Yampa River (node 9260000) which is consistently at high risk.

Comparison of the Dry Future IPP and Dry Future Scenarios indicates that the development of IPPs do not significantly affect the level of ecological risk for warm water fish within the modeled reaches with an exception for the South Fork of the Little Snake from its headwaters to its confluence with Johnson Creek (node 9253000) and for the Yampa River from Craig (Hwy 394 Bridge) to the mouth of Cross Mountain Canyon (node 9251000).



YAMPA/WHITE/GREEN BIP

Evaluate Consumptive and Environmental and
Recreational Considerations

Table 3-6 Modeled Results of the Flow-Ecology Relationship Risks for Warm Water Fish

	Reach Name	Model Node	Warm Water Flow Risk (July - Nov)		
			Baseline	Dry Future IPP Scenario	Dry Future Scenario
			Existing Demand Historical	High Demand Dry (with IPPs)	High Demand Dry (no IPPs)
1	Yampa River from entrance of Cross Mountain Canyon (East Cross Mountain) to confluence with Green River	9260050	Moderate Risk	High Risk	High Risk
2	Yampa River from Pump Station to confluence of Elkhead Creek	9244410	Low Risk	Moderate Risk	Moderate Risk
5	White River from headwaters to Meeker; including the North and South Fork and mainstem of the White	9304500	Low Risk	High Risk	High Risk
6	White River below Kenney Reservoir dam to Utah State line	434433	Low Risk	High Risk	High Risk
7	White River from Rio Blanco dam to Kenney Reservoir	9306290	Low Risk	High Risk	High Risk
10	South Fork of the Little Snake from headwaters to confluence of Johnson Creek	9253000	Low Risk	Moderate Risk	High Risk
12	Little Snake River from Moffat County Road 10 to confluence of the Yampa River	9260000	High Risk	High Risk	High Risk
13	Yampa River from Craig (Hwy 394 Bridge) to mouth of Cross Mountain Canyon	9251000	Moderate Risk	Moderate Risk	Very High Risk
14	Yampa River from Stagecoach Reservoir "Tailwaters" to northern boundary of Sarvis Creek State Wildlife area	9237500	Low Risk	Moderate Risk	Moderate Risk
16	Yampa River from Chuck Lewis Wildlife Area to Pump Station	9239500	Low Risk	Moderate Risk	Moderate Risk

Table 3-7 shows that the overall level of ecological risk for cottonwood is relatively low for the majority of modeled scenarios with the following exceptions: the White River from its headwaters to Meeker (node 9304500), the White River below Kenney Reservoir (node 434433), and the Yampa River from Stagecoach Reservoir to the northern boundary of the Sarvis Creek State Wildlife Area (node 9237500). The reach of the Yampa River below Stagecoach Reservoir is at high risk under Baseline Conditions and would currently benefit the most from an IPP that increases high flows from April to June.

Comparison of the Dry Future IPP Scenario and the Dry Future Scenario indicates that the development of the modeled IPPs would not significantly impact the high-flow conditions occurring in April to June. As shown in Table 3-7, the cottonwood abundance metric is generally low risk regardless of the presence of IPPs with exception to the White River below Kenney Reservoir (node 43433). IPPs could significantly reduce the risk to cottonwood within this reach.



YAMPA/WHITE/GREEN BIP

Evaluate Consumptive and Environmental and
Recreational Considerations

Table 3-7 Modeled Results of the Flow-Ecology Relationship Risks for Cottonwood

	Reach Name	Model Node	Cottonwood Abundance Risk (April - June)		
			Baseline	Dry Future IPP Scenario	Dry Future Scenario
			Existing Demand Historical	High Demand Dry (with IPPs)	High Demand Dry (no IPPs)
1	Yampa River from entrance of Cross Mountain Canyon (East Cross Mountain) to confluence with Green River	9260050	Low Risk	Low Risk	Low Risk
2	Yampa River from Pump Station to confluence of Elkhead Creek	9244410	Low Risk	Low Risk	Low Risk
4	Elk River from headwaters to the County Road 129 bridge at Clark; including the North, Middle and South Fork as well as the mainstem of the Elk	9241000	Low Risk	Low Risk	Low Risk
5	White River from headwaters to Meeker; including the North and South Fork and mainstem of the White	9304500	Low Risk	Moderate Risk	Moderate Risk
6	White River below Kenney Reservoir dam to Utah State line	434433	Moderate Risk	Very High Risk	Low Risk
8	Slater Creek from headwaters to the Beaver Creek confluence	540570	Low Risk	Low Risk	Low Risk
9	Elkhead Creek from headwaters to confluence of North Fork of Elkhead Creek	9245000	Low Risk	Low Risk	Low Risk
10	South Fork of the Little Snake from headwaters to confluence of Johnson Creek	9253000	Low Risk	Low Risk	Low Risk
11c	Williams Fork - from South Fork to confluence of the Yampa River	9249750	Low Risk	Low Risk	Low Risk
12	Little Snake River from Moffat County Road 10 to confluence of the Yampa River	9260000	Low Risk	Low Risk	Low Risk
13	Yampa River from Craig (Hwy 394 Bridge) to mouth of Cross Mountain Canyon	9251000	Low Risk	Low Risk	Low Risk
14	Yampa River from Stagecoach Reservoir "Tailwaters" to northern boundary of Sarvis Creek State Wildlife Area	9237500	High Risk	High Risk	High Risk
15	Fish Creek from Fish Creek Falls to confluence of the Yampa River	9238900	Low Risk	Low Risk	Low Risk
16	Yampa River from Chuck Lewis Wildlife Area to Pump Station	9239500	Low Risk	Low Risk	Low Risk
18	Willow Creek below Steamboat Lake to confluence with the Elk	583787	Low Risk	Low Risk	Low Risk



Recreational Whitewater Boating Flow Risk Metric

No new assessments of flow alteration risks to recreational boating have been generated using the updated model. The assessment and results described under this section of the report are based upon the P&M Study (i.e. these results do not reflect the changes to the model described in Section 3.4). Questions about the modeling and other details of the prior assessments of the flow alteration risks to recreational boating will be addressed in the modeling still to be completed.

Table 3-8 presents the percentage of the boating season with usable flows at designed modeled nodes for the modeled Baseline Scenario, Dry Future IPP Scenario, and Dry Future Scenario.⁷ These results indicate that there is a significant variability in usable days throughout the YWG Basin. Slater Creek (node 540570) and Willow Creek (node 583787) have very few usable days for all three modeled scenarios, whereas the percentage of usable days on the Yampa River from Cross Mountain Canyon to the Green River (node 9260050) is 87% under Baseline Conditions and 70% for the Dry Future IPP and Dry Future Scenarios. The number of usable days increases slightly for the following nodes from Baseline Conditions to the Dry Future Scenario: Fish Creek (node 9238900), Yampa River from Chuck Lewis Wildlife Area to Pump Station (node 9239500) and Willow Creek (node 583787). This is due to the timing and duration of the flows resulting in a slightly larger percent of usable days, but not necessarily higher flows.

⁷ The timing and duration of the whitewater boating season is customized to each individual model node. Additional information on the boating seasons may be found in the WFET.



YAMPA/WHITE/GREEN BIP

Evaluate Consumptive and Environmental and
Recreational Considerations

Table 3-8 Modeled Results for the Recreational Whitewater Boating Flow Risk Metric

	Reach Name	Model Node	Percentage of Boating Season with Usable Flows (Seasons of Use Varies by Node)		
			Baseline	Dry Future IPP Scenario	Dry Future Scenario
			Existing Demand Historical	High Demand Dry (with IPPs)	High Demand Dry (no IPPs)
1	Yampa River from entrance of Cross Mountain Canyon (East Cross Mountain) to confluence with Green River	9260050	87%	69%	70%
2	Yampa River from Pump Station to confluence of Elkhead Creek	9244410	20%	7%	7%
4	Elk River from headwaters to the County Road 129 bridge at Clark; including the North, Middle and South Fork as well as the mainstem of the Elk	9241000	48%	48%	48%
6	White River below Kenney Reservoir dam to Utah State Line	434433	33%	25%	26%
7	White River from Rio Blanco Lake dam to Kenney Reservoir	9306290	58%	25%	47%
8	Slater Creek from headwaters to the Beaver Creek confluence	540570	1%	1%	1%
13	Yampa River from Craig (Hwy 394 Bridge to mouth of Cross Mountain Canyon, including Little Juniper Canyon	9251000	43%	29%	28%
15	Fish Creek from Fish Creek Falls to confluence with Yampa River	9238900	12%	18%	18%
16	Yampa River from Chuck Lewis Wildlife Area to Pump Station	9239500	55%	57%	57%
18	Willow Creek below Steamboat Lake to confluence with the Elk	583787	0%	3%	3%

Figures 3-11 through 3-13 show the flow alteration risks to fisheries, cottonwoods, and recreational boating under the Baseline, Dry Future IPP, and Dry Future Scenarios.



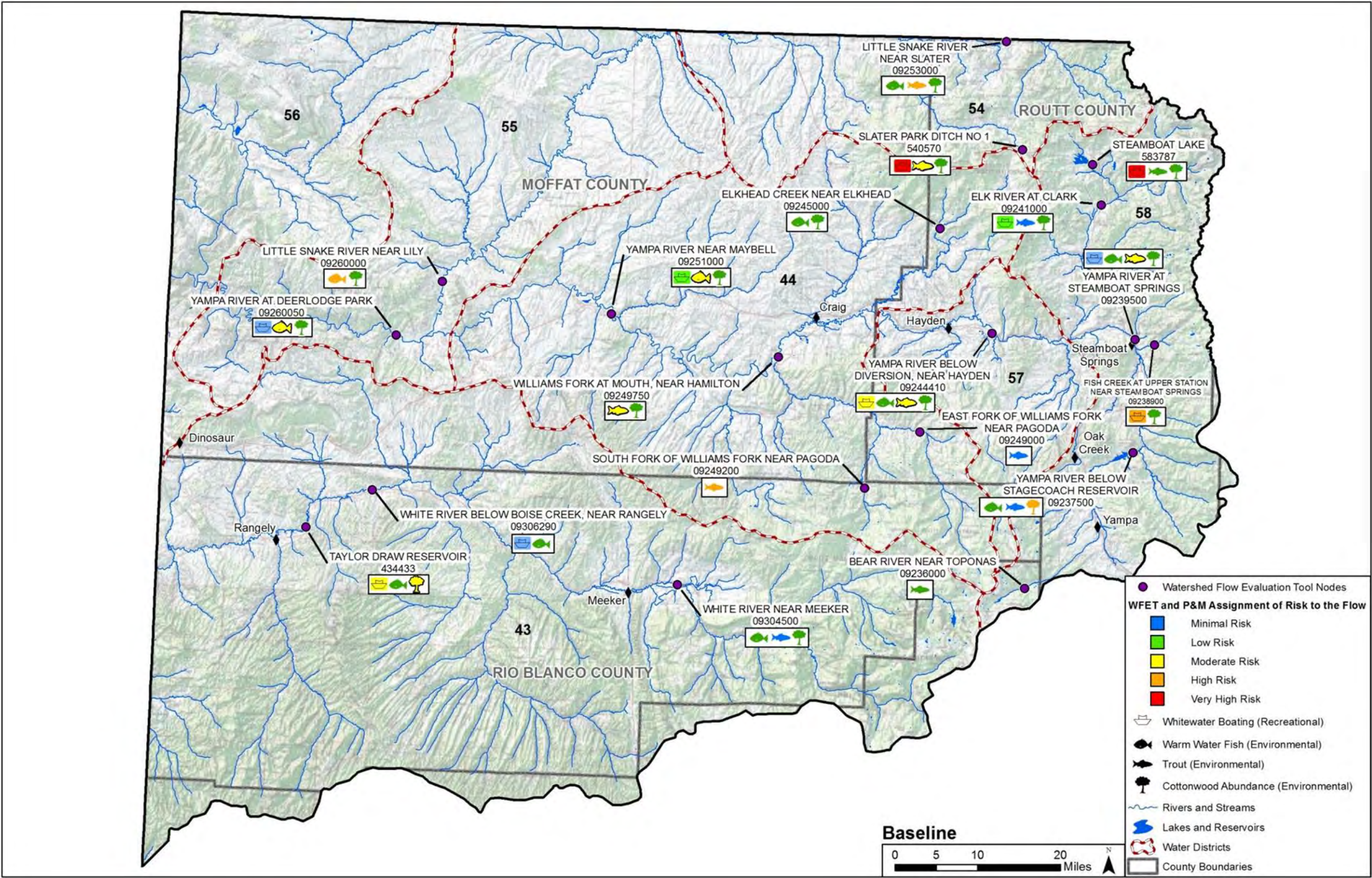
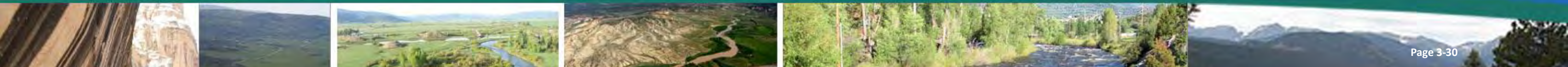


Figure 3-11 Flow Ecology Relationship Risks for Modeled Baseline Conditions



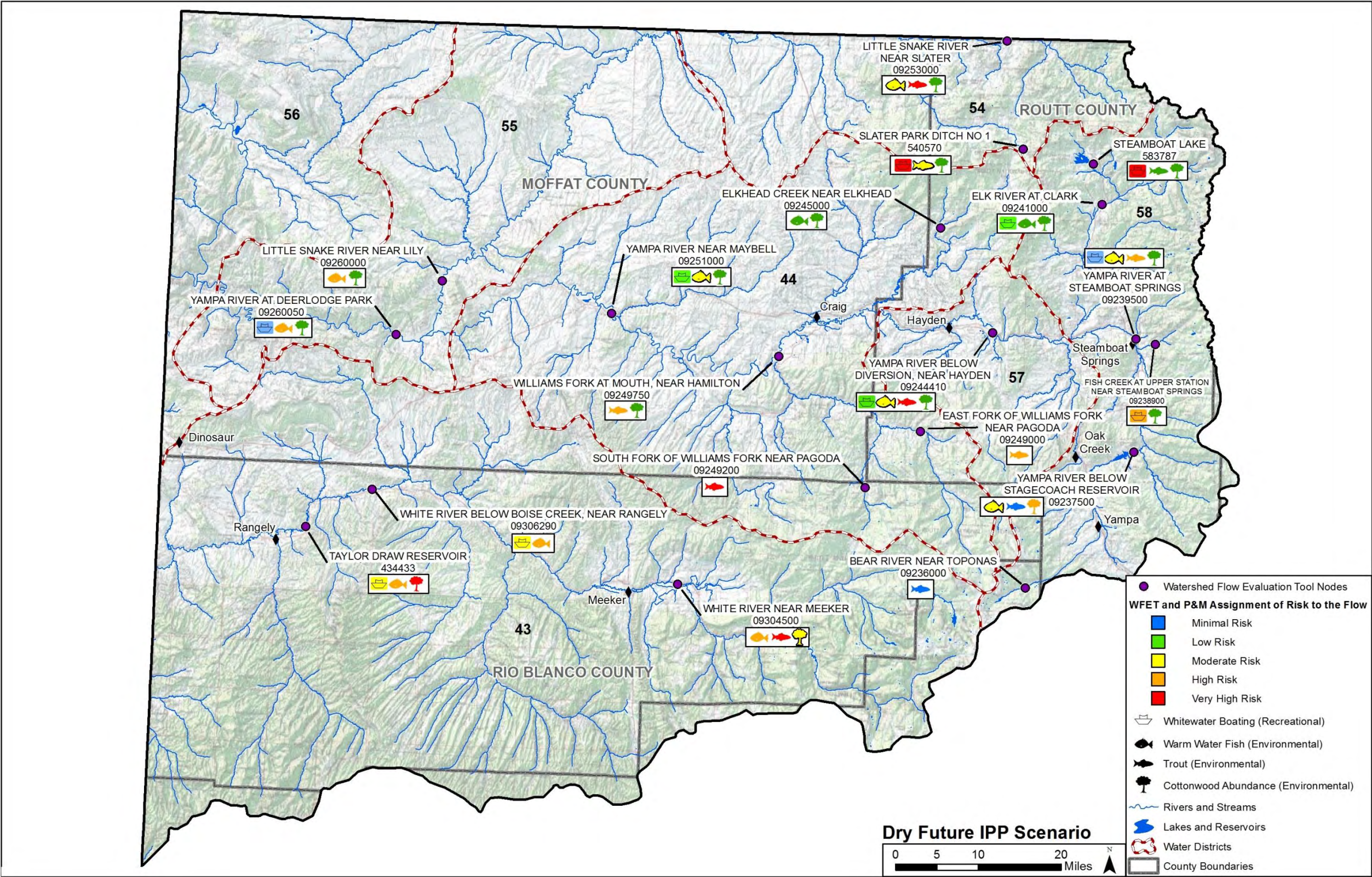


Figure 3-12 Flow Ecology Relationship Risks for Modeled Dry Future IPP Scenario



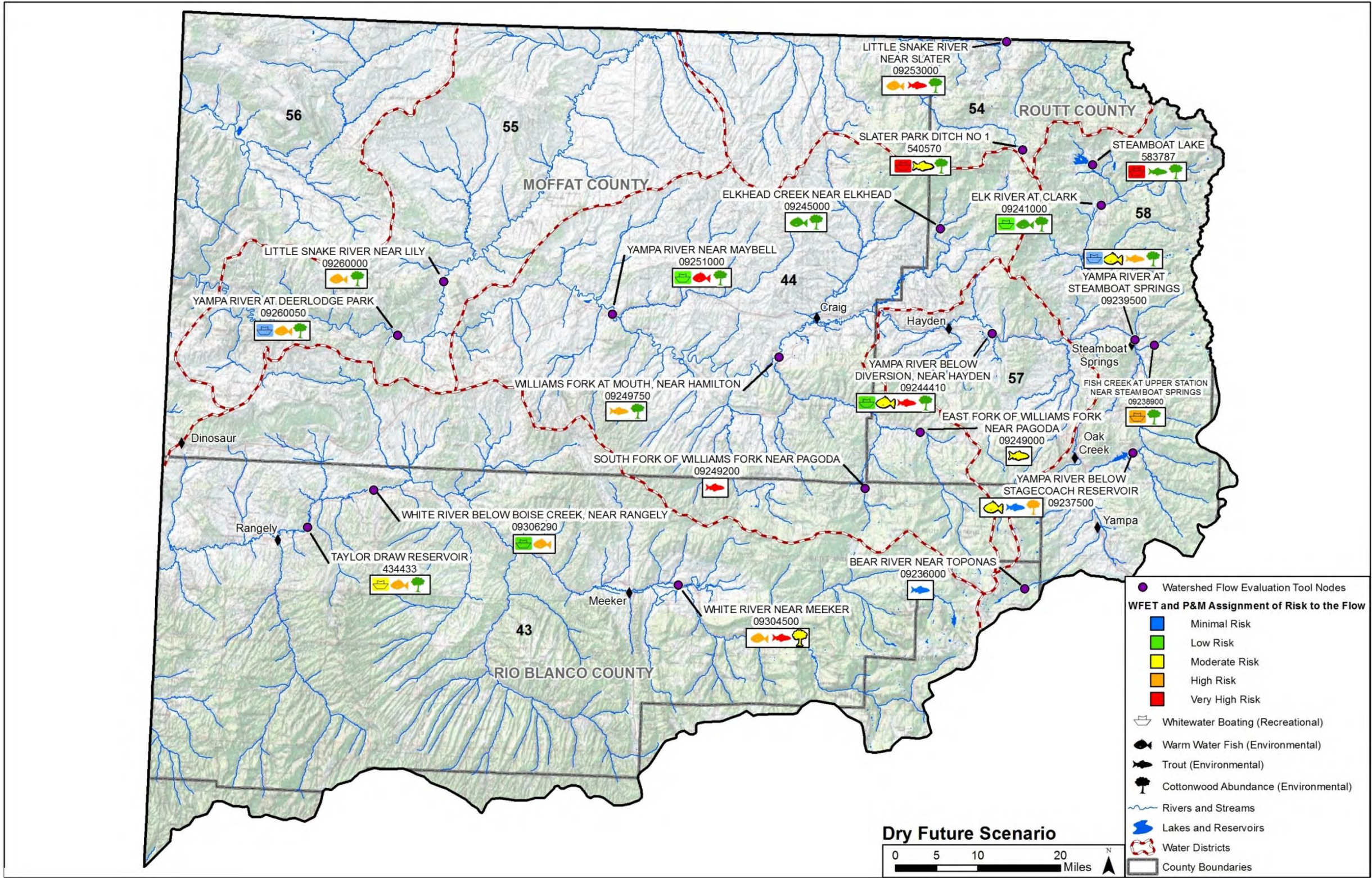


Figure 3-13 Flow Ecology Relationship Risks for Modeled Dry Future Scenario

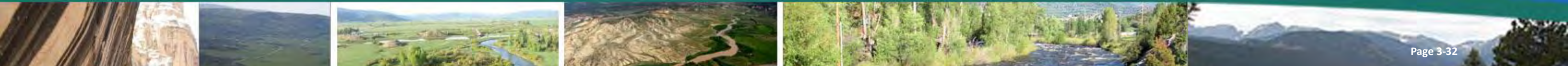


Table of Contents

Section 4.0	Projects and Methods	4-3
4.1	Education, Participation and Outreach	4-3
4.1.1	Advertisement.....	4-3
4.1.2	Meetings	4-4
4.1.3	Surveys	4-6
4.1.4	Stakeholder Collaboration.....	4-6
4.2	Watershed Health	4-6
4.3	Forest Health and Wildfires.....	4-10
4.4	M&I, SSI, Agriculture and Multi-purpose IPPs	4-13
4.5	Environmental and Recreational IPPs	4-22



List of Figures

Figure 4-1 Drinking Water Risk.....	4-12
Figure 4-2 Drinking Water Importance Areas	4-12
Figure 4-3 Location of M&I, SSI, Agriculture and Multi-Purpose IPPs	4-21
Figure 4-4 Environmental and Recreational IPPs	4-28

List of Tables

Table 4-1 Summary of YWG Public Outreach Meetings	4-5
Table 4-2 Demographic Results of BIP Public Outreach Meetings	4-5
Table 4-3 Water Quality Studies of the YWG Basin.....	4-8
Table 4-4 Summary of Current M&I, SSI, Agriculture and Multi-Purpose IPPs.....	4-15
Table 4-5 Environmental and Recreational IPPs.....	4-23



SECTION 4.0 PROJECTS AND METHODS

This chapter provides an overview of the YWG Basin's watershed health; forest health and wildfires; IPPs; and the education and public outreach component necessary to ensure that the BIP planning process represents the values and community needs of the Basin. The IPPs presented in this chapter are dynamic lists reflective of the current planning process. These lists will continue to be updated with new IPPs as the Basin continues to refine its water needs and its overall understanding of IPPs. The majority of information presented in this chapter was developed through stakeholder input and the 2014 P&M Study. The following bullets summarize consumptive and environmental and recreational IPPs and public outreach.

- Education and outreach strategies for the YWG BIP included advertisements, meetings, surveys, and stakeholder collaboration. The YWG BIP was advertised through various channels to inform as many residents of Northwest Colorado of the YWG BIP and to encourage them to attend outreach meetings, learn about the BIP process and respond to the YWG BRT. The purpose of the meetings was to inform water stakeholders about the Colorado Water Plan, the YWG BIP and their right/responsibility to provide input to the YWG BRT for the YWG BIP. Additional input was sought using two surveys distributed throughout the YWG Basin to gather details on existing or proposed consumptive and environmental/recreational IPPs. The draft report was posted for review using similar methods.
- Consumptive IPPs consist of projects that will address agricultural, M&I, and SSI water needs. Examples include reservoir enlargements, new storage projects, municipal water conservation, and expansion of municipal supply well fields. In addition to IPPs previously identified through the SWSI and the P&M Study, new projects were identified through surveys distributed throughout the Basin, and through additional discussions with the BIP Committee. The consumptive IPPs provide means to meet consumptive needs agricultural, M&I, and SSI needs, oftentimes in a collaborative manner. The YWG BRT will continue to explore additional multi-purpose opportunities where they may exist through future planning efforts.
- Seventeen environmental and recreational IPPs were identified to help meet environmental and recreational water supply needs. The environmental and recreational IPPs were also identified through surveys. These IPPs include studies, agreements, constructed projects, ecological improvements and other legal mechanisms that can be used to meet the environmental and recreational needs of the Basin.

4.1 EDUCATION, PARTICIPATION AND OUTREACH

Education, participation, and outreach efforts were essential for informing stakeholders and decision-makers of the existence and goals of the YWG BIP and Colorado Water Plan. These efforts also informed YWG Basin residents of the Colorado Water Plan and provided a mechanism to comment on the YWG BIP's content. Existing and new IPPs were identified during the outreach process through the use of surveys. The surveys and the results are discussed in further detail in Section 4.1.3 and Section 4.2. Appendix B contains the public outreach reports, public comments, and a summary table of those comments.

4.1.1 Advertisement

Advertising for the YWG BIP was approached in a variety of venues with the intent to inform as many residents of Northwest Colorado of the pending plan and to encourage them to attend an outreach meeting, learn about the YWG BIP process and respond to the YWG BRT. All advertising was done during February prior to the meetings.

- 2000 flyers were inserted into a weekly edition of *The Rio Blanco Herald Times*. The flyer was two sided: the front side explained the Colorado Water Plan, and the back side informed people of meetings in northwest Colorado and of response opportunities.
- 747 postcards were mailed to residents in Rio Blanco County and 353 to residents in Moffat County informing them of meeting dates and response opportunities.



- 150 postcards were hand-distributed at various meetings in Steamboat Springs.
- Email postcards (for further outreach distribution) were sent to almost 60 organizations, agencies, and groups informing them of the meeting dates and encouraging them to spread the word, have board members attend a meeting and submit recommendations to the YWG BRT. A summary of the groups contacted is provided below.
 - YWG BRT members
 - Commissioners Offices for Routt, Rio Blanco, Moffat Counties
 - Administrative Offices for the towns of Yampa, Oak Creek, Steamboat, Hayden, Craig, Dinosaur, Meeker, and Rangely
 - Chambers of Commerce in Steamboat Springs, Craig, and Meeker
 - Economic Development Councils in South Routt, Steamboat Springs, Craig
 - Colorado State University Extension Offices in Routt, Rio Blanco and Moffat Counties
 - Conservation District Offices in Routt, Rio Blanco and Moffat Counties
 - Regional offices of federal government agencies: NRCS, USFS, Farm Service Agency (FSA)
 - Local organizations in Routt, Rio Blanco and Moffat: Agriculture Groups, Habitat Programs, Environmental Groups,
 - Health Care Groups, and Tourism/Recreation Groups
- Five print advertisements were placed in *The Steamboat Pilot* and two in the *Craig Daily Press* informing people of the meeting dates.
- Flyers were posted in “gathering spots” in Steamboat Springs, Craig and Meeker. The flyer was two sided: the front side explained the Colorado Water Plan, and the back side informed people of meetings in northwest Colorado and response opportunities. In addition the flyer was sent to all of the above-listed organizations, agencies and groups asking them to post the notice.
- Personal invitations were extended by Community Agriculture Alliance staff and board, YWG BRT Members, Colorado State University Extension staff and Conservation District staff.

4.1.2 Meetings

Five outreach meetings were held in the YWG Basin in February and early March 2014, reaching a total attendance of 267 people. The purpose of the meetings was to inform water stakeholders about the Colorado Water Plan, the BIPs and their right/responsibility to provide input to the YWG BRT for the YWG BIP. The meetings (Presentations were also made to the annual meetings of the following conservation districts:

- | | |
|--|----------------------------|
| ▪ White River Conservation District | Meeker, January 10, 2015 |
| ▪ Colorado First Conservation District | Craig, February 17, 2015 |
| ▪ Douglas Creek Conservation District | Rangely, February 28, 2015 |

Table 4-1) were structured using the same format and were facilitated by YWG BRT members from each respective area. A PowerPoint presentation, which originated from the CWCB, was revised to contain pertinent information about the three river basins in northwest Colorado. Demographic questions asked at each meeting allowed the YWG BRT to ascertain which river basin people called home, which county they lived in, their primary use of water and what they considered the most important use of water. A comment/question/answer period concluded each meeting. Meeting highlights are summarized in Table 4-2. Presentations were also made to the annual meetings of the following conservation districts:

- | | |
|--|----------------------------|
| ▪ White River Conservation District | Meeker, January 10, 2015 |
| ▪ Colorado First Conservation District | Craig, February 17, 2015 |
| ▪ Douglas Creek Conservation District | Rangely, February 28, 2015 |



Table 4-1 Summary of YWG Public Outreach Meetings

Date Completed	Location	Participation	BRT Members Involved
Feb 6, 2014 Thursday	Rangely CNCC	41 Attended 37 Registered 24 Used Public Poll	Jeff Devere Jon Hill Dan Eddy Alden Vanden Brink Ren Martyn
Feb 13, 2014 Wednesday	Steamboat Springs Community Center	98 Attended 88 Registered	Kevin McBride Jay Gallagher Doug Monger Tom Sharp Geoff Blakeslee Dan Craig Steve Colby Jackie Brown Ren Martyn Tom Gray Don Jones
Feb 19, 2014 Wednesday	Craig American Legion	50 People Attended 46 Registered 43 Used Public Poll	Tom Gray Don Jones Burt Clements Doug Monger
Feb 24, 2014 Monday	Meeker Rio Blanco Fairgrounds	58 People Attended 56 People Registered 48 Used Public Poll	Jeff Devere Jon Hill Al Vanden Brink Ren Martyn
March 11, 2014 Tuesday	Browns Park Browns Park School	20 People Attended 18 People Registered 16 Used Public Poll	T Wright Dickinson Ren Martyn

Table 4-2 Demographic Results of BIP Public Outreach Meetings

Outreach Meeting	"Home Basin"	County Live In	Primary Use of Water	Most Important Use of Water
Rangely (24 respondents)	2 Yampa 22 White	3 Moffat 21 Rio Blanco	17 Agriculture 4 Municipal/Industrial 3 Recreation	#1 Agriculture #2/3 Tie: Energy & Municipal/Industrial #4 Environment #5 Recreation
Steamboat Springs (52 respondents) **	51 Yampa 1 Out of Region	49 Routt 1 Moffat 2 Out of State	19 Agriculture 11 Municipal/Industrial 11 Environment 10 Recreation 1 Energy	Not identified
Craig (43 respondents)	42 Yampa 1 White	40 Moffat 1 Rio Blanco 1 Routt 1 Out of State	25 Agriculture 6 Municipal/Industrial 5 Recreation 5 Environment 2 Energy	#1 Agriculture #2 Environment #3 Municipal/Industrial #4 Energy #5 Recreation
Meeker (48 respondents)	11 Yampa 37 White	3 Moffat 43 Rio Blanco 2 Routt 1 Out of State	40 Agriculture 7 Municipal/Industrial 1 Environment	#1 Agriculture #2 Municipal/Industrial #3 Energy #4 Environment #5 Recreation



Outreach Meeting	"Home Basin"	County Live In	Primary Use of Water	Most Important Use of Water
Browns Park (16 respondents)	16 Green	12 Moffat 4 Out of State	9 Agriculture 5 Municipal/Industrial 2 Environment	#1/2 Tie: Agriculture and Energy #3 Municipal #4 Environment #5 Recreation
Total 267 attended 183 responses**	106 Yampa = 58% 60 White = 33% 16 Green % = 9 1 Out of Region	58 Moffat = 32% 65 Rio Blanco = 36% 52 Routt = 28% 8 Out of State = 4%	110 Agriculture = 60% 33 Municipal/Industrial = 18% 19 Environment = 10% 18 Recreation = 10% 3 Energy = 2%	

** Technical Problems at Steamboat Springs: only 59% (52 actual count) of the 88 respondents' data was stored

4.1.3 Surveys

The public outreach included a survey regarding consumptive IPPs and one regarding environmental and recreational IPPs. The purpose of the surveys was to gather details on existing or proposed IPPs not previously identified in the SWSI or P&M Study. The surveys were developed with input from the YWG BIP Committee to refine the questions and make them more targeted. The surveys were distributed on April 14, 2014 to Committee members and YWG BRT members, who were given an opportunity to fill them out and distribute it to other stakeholders as they saw fit. The surveys resulted in 3 new IPPs for consumptive use projects and 17 additional IPPs for environmental and recreational projects. These IPPs, and others, are discussed in further detail in Section 4.2.

4.1.4 Stakeholder Collaboration

The YWG Public Education, Participation and Outreach (PEPO) Workgroup and Community Agriculture Alliance engaged the Colorado State University Extension Offices in Routt and Rio Blanco Counties and the conservation districts in Routt, Moffat and Rio Blanco Counties as advertising liaisons. Each of these groups has working relationships with various water users in their counties and was willing to encourage people to attend a meetings, learn about the YWG BIP and respond with written comments to the YWG BRT. The Community Agricultural Alliance worked with the conservation districts to contact their constituencies and provide input to the process.

4.2 WATERSHED HEALTH

Overview of Watershed Health in the Yampa, White, and Green Basins

Watershed health is influenced by both natural processes and human activities and is important for drinking water, agriculture, recreation, and ecological integrity.¹ As water moves through a watershed the surface and sub-surface conditions affect the quality of the water. Water quality refers to the chemical, physical and biological characteristics of water. It is a measure of the condition of water relative to the requirements of aquatic and human need or purpose. The YWG Basin is largely comprised of headwater tributary streams that support relatively high water quality, but are not without impairments to watershed health. Water quality is vitally important to local and regional economies in the YWG Basin. The dominant employment industries in the Basin are: construction (15% of total jobs); education, health and social services (15%); arts, entertainment, recreation, lodging and food services (13%); retail trade (12%); and agriculture, forestry, hunting and mining (10%).² The last three industries in that list account for 35% of total jobs in the YWG Basin, meaning that over one-third of the jobs in the YWG Basin are dependent on water quality that supports tourism, recreation, and agriculture.

¹ (Brown 2014)

² [US](#) Census 2012)



In most subbasins within the YWG Basin, many government (USFS, USFWS, Bureau of Reclamation, National Park Service, Colorado Parks & Wildlife, municipalities, and Water Conservancy Districts), and non-government organizations (The Nature Conservancy, Trout Unlimited, Colorado Water Trust, local grassroots organizations) work both individually and collaboratively to actively support efforts that protect and improve water quality and watershed health. The Upper Yampa River Watershed Group (UYRWG) represents a collaboration to protect and enhance the health of the Upper Yampa River Watershed from the headwaters of the Yampa River to the confluence of and including Elkhead Creek. The [2014 State of the Watershed Report](#) is the first step in the local watershed planning process and serves to document existing conditions. There are other examples of watershed protection efforts on agricultural lands (riparian fencing and riparian habitat protection), within municipalities (water body setbacks and floodplain regulations), stormwater management programs, and more. Many efforts and partnerships are built upon the simple concept that water quality and water quantity must be considered holistically in order to maintain a balance between properly functioning river systems and successful water supply projects. All future proponents of IPPs will be encouraged to work with the respective organizations to develop comprehensive components that consider all of these important aspects of watershed health.

The Colorado Department of Public Health and Environment's (CDPHE) narrative standards describe goals and numeric standards set maximum acceptable concentrations of specific pollutants. Many constituents that are issues of concern for aquatic life, human health or suitability of water for various uses include those on the CDPHE [Regulation 93](#) 2012 303(d) list (303(d) list) of impaired waters or the Monitoring & Evaluation (M&E) List. Impaired waters remain listed until sufficient monitoring shows the stream is no longer impaired. Eighteen stream segments are on the 303(d) list for sediment, metals (iron, copper, and selenium), aquatic life, pH, and E. coli. There are twenty-five segments on the M&E List for metals (lead, mercury, iron, copper, selenium, zinc, and manganese), dissolved oxygen, sediment, E. coli, aquatic life, pH, and temperature (CDPHE Regulation 93. March 2012). The US Geological Survey (USGS) has produced reports that analyze water quality data in many of the river subbasins located within the YWG Basin:

- USGS, Water-Quality Assessment and Macroinvertebrate Data for the Upper Yampa River Watershed, Colorado, 1975 through 2009 [USGS Scientific Investigations Report 2012-5214](#)
- Characterization and Data-Gap Analysis of Surface-Water Quality in the Piceance Study Area, Western Colorado, 1959–2009 [USGS Investigations Report 2013–5015](#)
- USGS, Baseline characterization of water quality and mass loading in Piceance Creek, Rio Blanco County, Colorado, December 2000 [USGS Water-Resources Investigations Report: 2002-4134](#)
- [Comparison of 2011–12 water years and historical water-quality data, White River Basin, Colorado](#)
- Specific Conductance and Dissolved-Solids Characteristics for the Green River and Muddy Creek, Wyoming, Water Years 1999–2008 [USGS Scientific Investigations Report 2009–5168](#)

There are six locations as part of the [Yampa River Basin Monitoring Program](#) (Program) that the USGS monitors each year as of 2010 that will be used to define baseline conditions. Partners sponsoring the Program and the UYRWG will help determine if and where additional monitoring sites are needed. The USGS is conducting water quality baseline monitoring in the [White River Basin](#). [Lower Yampa](#) sediment monitoring through USGS Grand Canyon Monitoring and Research Center is also ongoing in and above Dinosaur National Monument as well as on the Green River above [Gates of Lodore](#). USGS also performs water quality monitoring for the [lower Yampa Basin](#) below Craig, Colorado, to the border with Utah. Further water quality sampling and monitoring occurs in the YWG Basin through various other agencies.

Soil disturbance activities are among the primary sources of sedimentation in the Yampa Basin. These activities include channel modifications, impoundments, and bank degradation which can stem from many different land use activities and natural occurrences. (Wildfires also impact sedimentation. This is discussed in further detail in the next subsection.) Several USGS products have been released regarding sedimentation on the lower Yampa and Green



River basins; Characterization of Hydrodynamic and Sediment Conditions in the Lower Yampa River at Deerlodge Park, East Entrance to Dinosaur National Monument, Northwest Colorado, 2011 [Scientific Investigations Map: 3273](#)³ and Summary of Sediment Data from the Yampa River and Upper Green River Basins, Colorado and Utah, 1993–2002 [Scientific Investigations Report 2004–5242](#)⁴.

Updated and informed reservoir and flow management is critical to sustaining aquatic life and ecosystem function while balancing consumptive demands. A [PBO](#) is performed by the USFWS and is a consultation process with other federal agencies to avoid jeopardizing listed species. These consultations are under Section 7 of the [Endangered Species Act](#) of 1973. Agencies also consult to avoid harming critical habitat. Whenever possible, programmatic consultations address multiple (typically small) projects and require that applicants take specific steps to protect endangered species.

A [PBO](#) is also performed by the USFWS and occurs when another federal agency asks USFWS to concur that their project will not jeopardize the species. After formal consultation, a [PBO](#) is written which determines whether a listed species will be jeopardized or critical habitat adversely modified. It is the basis for actions that need to be taken to minimize impact to the species. As part of the [Upper Colorado River Endangered Fish Recovery Program](#) effort, the USFWS have submitted both types of opinions regarding river operations:

- Green River: Bureau of Reclamation, [Record of Decision Operation of Flaming Gorge Dam Final Environmental Impact Statement](#), February 2006
- Green River: US Fish & Wildlife Service, [Operation of Flaming Gorge Dam Final Environmental Impact Statement, Final Biological Opinion](#), September 2005
- Yampa River: US Fish & Wildlife Service, [Final Programmatic Biological Opinion on the Management Plan for Endangered Fishes in the Yampa River Basin](#), January 2005
- White River: US Fish & Wildlife Service, [COLORADO RIVER RECOVERY PROGRAM Project #:168 FY 13-15 SCOPE OF WORK for White River Management Plan](#), August 2013
- White River: Information on the forthcoming [USFWS Programmatic Biological Opinion for the White River](#) accessed July 9, 2014

Though the above planning documents focus primarily on federally endangered fish, there are numerous aquatic and terrestrial species that depend on the YWG Basin for habitat and require attention when planning for projects. Information on State threatened and endangered species can be found on the [Colorado Parks and Wildlife website](#), and information on the status of federally threatened and endangered species is available on the [USFWS website](#).

Several other studies on water quality in the YWG Basin are available online. Table 4-3 lists these studies and their web addresses.

Table 4-3 Water Quality Studies of the YWG Basin

Study Name	Web Address
Colorado Department of Public Health and Environment Water Quality Control Commission, Regulation 93, March 2012	https://www.colorado.gov/pacific/sites/default/files/Regulation-93.pdf
US Geological Survey WaterSMART—The Colorado River Basin Focus-Area Study Fact Sheet 2012-3114, September 2012	http://pubs.usgs.gov/fs/2012/3114/
Routt & Moffat Counties, Yampa River Watershed 208 Plan, 2002	http://routtcountycd.com/wp-content/uploads/2012/04/208-Plan-Final.pdf

³ (USGS 2011)

⁴ (USGS 2004)



Study Name	Web Address
USGS, Water-Quality Assessment and Macroinvertebrate Data for the Upper Yampa River Watershed, Colorado, 1975 through 2009; USGS Scientific Investigations Report 2012-5214	http://pubs.usgs.gov/sir/2012/5214/
Characterization and Data-Gap Analysis of Surface-Water Quality in the Piceance Study Area, Western Colorado, 1959–2009; USGS Scientific Investigations Report 2013–5015	http://pubs.usgs.gov/sir/2013/5015/
Brown, Jackie. Routt County Conservation District, Upper Yampa River Watershed Group. State of the Upper Yampa River Watershed Report, August 2014	www.routtcountycd.com/Watershed
USGS, Baseline characterization of water quality and mass loading in Piceance Creek, Rio Blanco County, Colorado, December 2000; USGS Water-Resources Investigations Report: 2002-4134	http://pubs.er.usgs.gov/publication/wri024134
Comparison of 2011–12 water years and historical water-quality data, White River Basin, Colorado	http://co.water.usgs.gov/infodata/white_summaries/index.html
Specific Conductance and Dissolved-Solids Characteristics for the Green River and Muddy Creek, Wyoming, Water Years 1999–2008; U.S. Geological Survey Scientific Investigations Report 2009–5168	http://pubs.usgs.gov/sir/2009/5168/
USGS, Characterization of Hydrodynamic and Sediment Conditions in the Lower Yampa River at Deerlodge Park, East Entrance to Dinosaur National Monument, Northwest Colorado, 2011; Scientific Investigations Map: 3273	http://pubs.usgs.gov/sim/3273/
USGS, Summary of Sediment Data from the Yampa River and Upper Green River Basins, Colorado and Utah, 1993–2002. Scientific Investigations Report 2004–5242	http://pubs.usgs.gov/sir/2004/5242/pdf/SIR2004-5242.pdf
Bureau of Reclamation, Record of Decision Operation of Flaming Gorge Dam Final Environmental Impact Statement, February 2006	https://www.usbr.gov/uc/envdocs/rod/fgFEIS/final-ROD-15feb06.pdf
US Fish & Wildlife Service, Operation of Flaming Gorge Dam Final Environmental Impact Statement, Final Biological Opinion, September 2005	http://www.riversimulator.org/Resources/USFWS/BOflamingGorge2005.pdf
US Fish & Wildlife Service, Final Programmatic Biological Opinion on the Management Plan for Endangered Fishes in the Yampa River Basin, January 2005	http://www.riversimulator.org/Resources/USFWS/BOyampa.pdf
US Fish & Wildlife Service, COLORADO RIVER RECOVERY PROGRAM Project #:168 FY 13-15 SCOPE OF WORK for White River Management Plan, August 2013	http://www.coloradoriverrecovery.org/documents-publications/work-plan-documents/sow/14-15/isf/168.pdf
Information on the forthcoming USFWS Programmatic Biological Opinion for the White River accessed July 9, 2014	http://www.onthecolorado.org/articles.cfm?mode=detail&id=1383319405772
USGS Colorado Water Science Center, Comparison of 2011-12 water years and historical water-quality data, Yampa River Basin, Colorado	http://co.water.usgs.gov/infodata/yampa_summaries/
USGS Colorado Water Science Center, Comparison of 2011-12 water years and historical water-quality data, White River Basin, Colorado	http://co.water.usgs.gov/infodata/white_summaries/index.html
USGS Grand Canyon Monitoring Research Center, Green River above Gates of Lodore, Colorado	http://co.water.usgs.gov/infodata/white_summaries/index.html
USGS Colorado Water Science Center, Comparison of 2011-12 water years and historical water-quality data, White River Basin, Colorado, Sampling locations by Station number and Station name in lower Yampa Basin	http://co.water.usgs.gov/infodata/yampa_summaries/html/Sites.html



4.3 FOREST HEALTH AND WILDFIRES

Forest health is integral to water quality, and many population centers in the YWG Basin are vulnerable to water quality issues caused by severe wildfires. High intensity wildfires increase the potential for soil erosion and sedimentation by removing vegetation that anchors the soil and slows runoff and rainwater, and by causing soil to become hydrophobic. The loss of vegetation and creation of hydrophobic soils creates prime conditions for erosion, landslides, and mudflows in post-wildfire areas. Sediment, soil, and mud infiltrate water supplies in post-burn areas, decreasing water quality and water storage.

Although Colorado's most severe wildfires have primarily occurred along the Front Range, the YWG Basin is susceptible to large wildfire incidents. In fact, Northwest Colorado, and Moffat County is particular, is the second most likely place in the nation for fires caused by lightning strikes⁵. BLM monitoring systems show that thousands of lightning strikes can happen during a single thunderstorm in the County. Most of these strikes do not evolve into wildland fire starts, but the potential for a large wildland fire to occur is still a major concern. The Moffat County Wildfire and Fuels Management Plan was developed between 2001 and 2003 to address this risk, identify wildfire suppression priority zones in the County, and recommend wildfire mitigation activities. The Routt County Community Wildfire Protection Plan identified three large wildfires including the Mt. Zirkel Complex in 2002 (approximately 30,000 acres burned), Green Creek Fire (4,400 acres), and the Lost Lakes Fire Use (5,536 acres).⁶ Other major fires in the Basin include the Big Fish Fire of 2002, which burned 17,000 acres in the Flat Tops Wilderness Area roughly 34 miles southwest of Steamboat Springs. The 2012 Rio Blanco County Community Wildfire Protection Plan listed 17 fires over 1,000 acres in size between 1993 and 2011. The occurrence of another severe wildfire in the YWG Basin is generally considered to be a matter of "when," not "if."

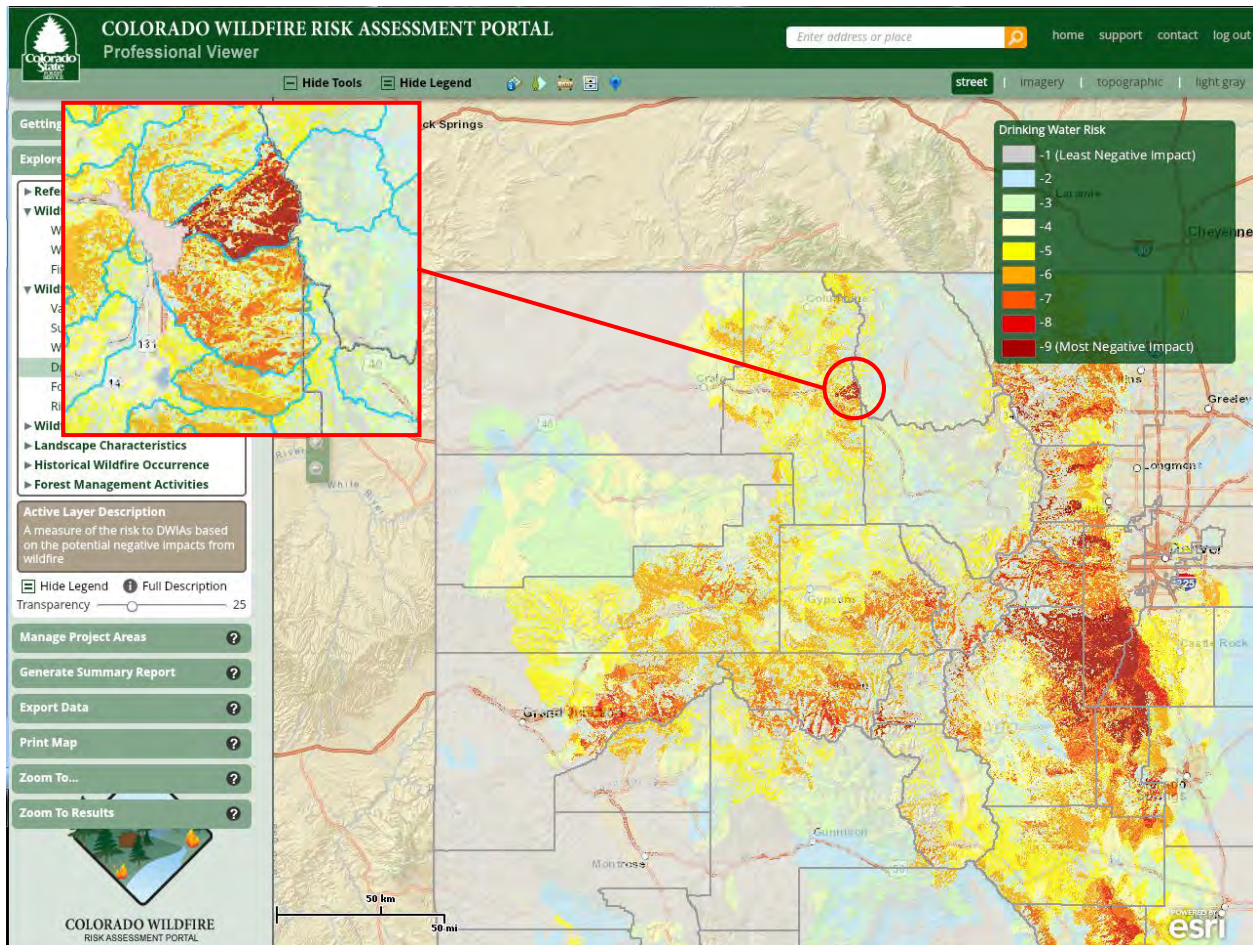
Several communities in the YWG Basin are dependent on forest water supply, as noted in each county's Community Wildfire Protection Plan. Landowners in the YWG Basin have noted that major wildfires in the area have caused erosion issues, sedimentation, landslides, and water quality chemistry issues during spring runoff and following rainstorms. The City of Steamboat Springs is particularly at risk for wildfire impacts to drinking water. The Steamboat Springs surface water supply comes from Fish Creek and Fish Creek Reservoir, both of which are supplied by runoff from forested lands. Fish Creek is one of the higher risk areas for wildfire-water quality issues, as illustrated in Figure 4-2 and Figure 4-3 from the Colorado Wildfire Risk Assessment Portal⁷. These figures show that the Fish Creek watershed is ranked highest in the Yampa Basin for both drinking water importance areas and drinking water risk. To mitigate this risk, Steamboat Springs is trying to secure additional water sources, such as alluvial wells on the Yampa River. The Town of Yampa has an underground infiltration gallery, and thus wouldn't be as affected by erosion and sedimentation issues caused by wildfires. The Town also has the option to pump out of the Yampa River if needed. The City of Craig also has less wildfire-water quality risk compared to Steamboat Springs given that there is less wildfire fuel in the vicinity. However, because of the sedimentary soils in the area, Craig could still potentially

⁵ (Hamilton 2012)

⁶ (Routt 2010)

⁷ (CO-WRAP 2014)

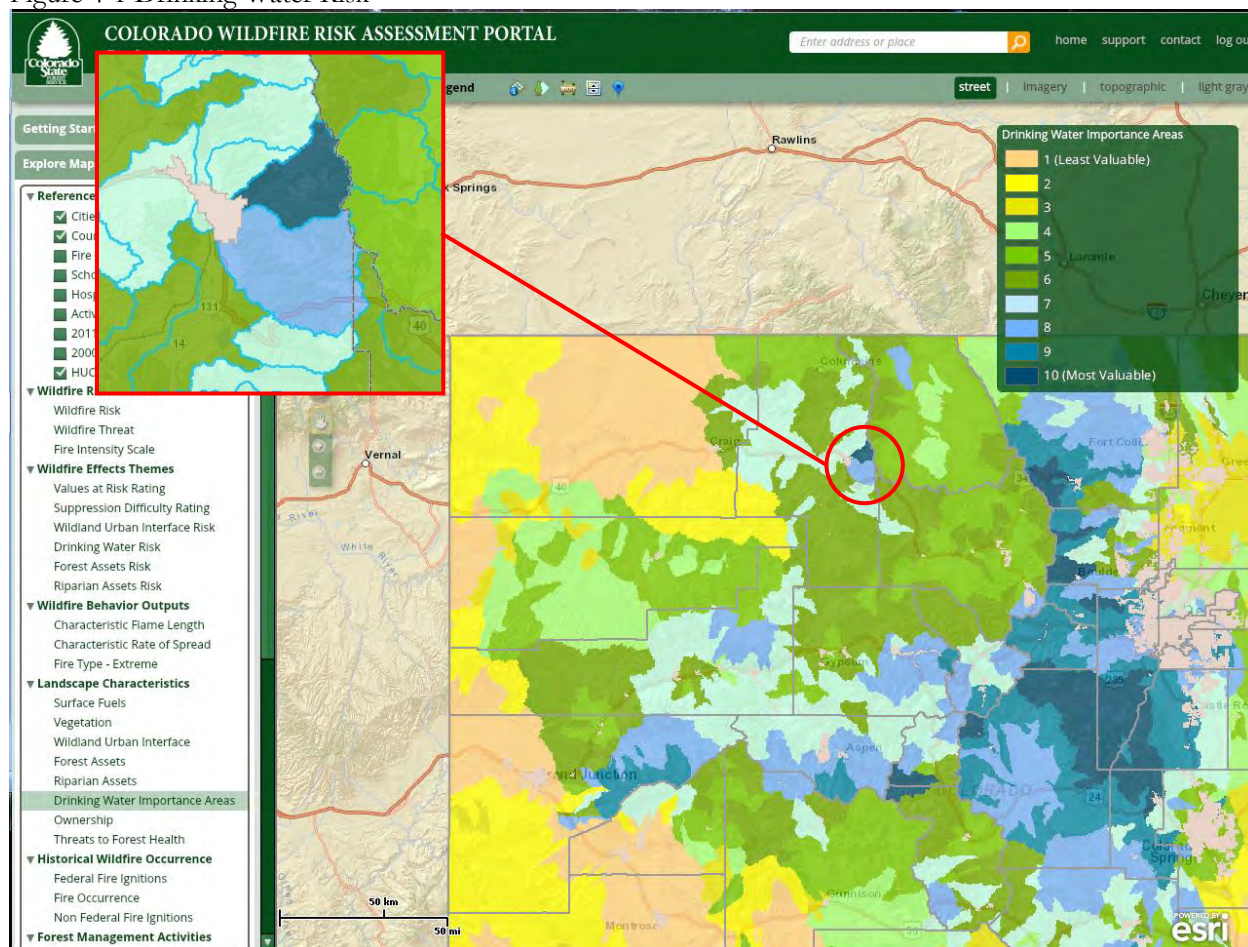




Source: Colorado Wildfire Risk Assessment Portal 2014



Figure 4-1 Drinking Water Risk



Source: Colorado Wildfire Risk Assessment Portal 2014

Figure 4-2 Drinking Water Importance Areas

Source Water Protection Plans

Since roughly 2009, Colorado communities have been encouraged to develop Critical Community Watershed Wildfire Protection Plans (CCWWPPs) as part of Source Water Protection Plans (SWPPs). The CCWWPPs resemble CWPPs but focus on watershed protection rather than on the wild land urban interface (WUI). Projects from CWPPs may be located in watersheds though, and those projects should be incorporated into the CCWWPPs. Representatives from local fire protection districts, USFS, Colorado State Forest Service (CSFS), Bureau of Land Management (BLM), and other wildfire mitigation stakeholders should be included in source water and watershed protection planning efforts⁸.

JW Associates, Inc. completed a report in 2010 titled “Upper Yampa Phase 1 Watershed Assessment: Prioritization of watershed-based hazards to water supplies.”⁹ This report follows the CCWWPP model, examining post-wildfire hazards in watersheds including flooding, debris flow, and increased sediment yields. The report generated a composite hazard ranking of the Upper Yampa watersheds based on three components: wildfire hazard, flooding/debris flow hazard, and soil erodability. The results of the composite hazard ranking indicated that the

⁸ More information on the CCWWPP initiative can be found on www.colorado.gov by searching for “Critical Community Watershed Wildfire Protection Plans.”

⁹ (USFS 2010)



highest ranked sixth-level watersheds include outlet of Mad Creek, Middle Fork Elk River, Upper Trout Creek, Bunker Creek, headwaters of Oak Creek, and Harrison Creek. The Phase 1 report does not make specific recommendations for protecting watershed health in relation to the impacts from wildfires.

Moffat, Rio Blanco, and Routt¹⁰ counties all have county-level CWPPs. All three plans identify watersheds as critical assets in their planning areas and note the importance of protecting watershed quality as part of wildfire mitigation. Watershed protection is taken into account for each CWPP's mitigation projects.

The Routt County CWPP identifies “maintaining healthy watersheds” as one of its primary goals. The Routt County CWPP specifically identifies several municipal watersheds within the CWPP planning area. Surface water and wells provide the water supply for the majority of these communities. The need to protect watersheds is stated several times throughout this CWPP. The Moffat County CWPP evaluates potential watershed issues in Appendix F Fuel Reduction Project Plans. None of the proposed wildfire mitigation projects in the plan were found to threaten a water source.

Although wildfire mitigation is necessary to help reduce the likelihood of a severe wildfire occurring, the mitigation activities themselves can be a source of water contamination. Mechanical treatments that involve disturbing the soil can increase sediment loads in surface waters. Herbicide treatments can cause water contamination.¹¹ Methods for mitigating water contamination from wildfire mitigation activities include installing erosion control devices around source water intakes during wildfire mitigation projects. Communities should work with the BLM, USFS, CSFS, Natural Resources Conservation Service (NRCS), and conservation districts to protect water sources while undertaking wildfire mitigation projects.

4.4 M&I, SSI, AGRICULTURE AND MULTI-PURPOSE IPPS

The YWG BRT is developing a collection of IPPs through the YWG BIP planning effort. These IPPs consist of projects previously identified through SWSI and the P&M Study in addition to new projects identified through the surveys distributed to the YWG BRT in April of 2014. These surveys were distributed as a component of the BIP planning effort, asking the YWG BRT members and other stakeholders within the Basin to provide information on M&I, SSI, and/or agricultural projects that have previously not been identified as IPPs.

Table 4-4 provides a summary of these IPPs while Figure 4-3 shows the locations. The IPPs are categorized by whether or not they were modeled in the P&M Study. The ten IPPs that were modeled in the P&M Study are denoted with black crosses and contained the following elements:

- Project Proponent
- Location
- Physical Characteristics
- Operations
- Water Rights – Either conditional water rights, or an undecreed water right, is assumed as a proxy

IPPs that did not contain these elements were not modeled in the P&M Study and are identified in Figure 4-3 with red crosses. It is important to note that while these projects are the currently foreseeable IPPs, Table 4-4 is not an inclusive list. The table may be modified to include additional new IPPs as regional and local planning efforts continue throughout the YWG Basin. To accommodate this potential change, placeholders have been added at the end of the list, e.g., water conservation efforts by additional municipal water providers and other generic IPPs to meet future needs. Current planning processes also have not identified all of the IPPs necessary to address all of the

¹⁰ (Moffat 2004), (Rio Blanco 2012), and (Routt 2010), respectively

¹¹ (Garfield 2012)



consumptive shortages presented in Chapters 2 and 3. As recommended in Chapter 5, additional analysis and follow-up studies will provide the YWG Basin a better picture of how various IPPs can be used to meet shortages to both consumptive and environmental/recreational needs. As planning efforts continue, the YWG BRT will explore how projects and processes can provide multi-purpose benefits, an approach that is advantageous for all interests and is a goal of SWSI and the IBCC. These opportunities will be further refined as projects are carried through the permitting phase. To highlight this approach, Table 4-4 denotes IPPs that may include benefits to other sectors that are not currently identified.



Table 4-4 Summary of Current M&I, SSI, Agriculture and Multi-Purpose IPPs

Map ID	Name of Project	Project Location	M&I	SSI	Ag	Env/ Rec	Modeled/ Not Modeled	Primary Purpose of Project	Project Status	Projected Completion	Proponents	Storage Right	Project Yield	Project Capacity	Project Cost	Funding Sources	Challenges
1	Elkhead Reservoir Enlargement Project						Not Modeled				Colorado River Water Conservation District		4,300 AF				
2	Fish Creek direct flow and storage	Fish Creek Drainage in Buffalo Pass area	X				Not Modeled	Releases from Long Lake (396 AF) and Fish Creek Reservoirs (4167 AF) are used to augment native flows when they fall below 7 cfs; MWW & City hold the most senior pre- compact rights 8.3 cfs. Future M&I needs	Existing infrastructure	DNA	Mt. Werner Water / City of Steamboat Springs						
3	Lake Avery Enlargement ⁶	Expansion to Big Beaver Reservoir (Avery Lake)		X			Modeled	The only operation for the Lake Avery Enlargement is making direct releases to meet oil shale production demands.				The purpose of the Scenario 2 and 3 models of the Energy Development Water Needs Assessment were to reliably meet oil shale production demands with rights junior to all other diversions in the basin. That methodology was also used in the P&M Study. Therefore it is modeled with an undecreed water right. --The Lake Avery Enlargement is filled both by a pipeline diverting water from the White River upstream of Big Beaver Creek and a direct storage right on Big Beaver Creek.	48,274 AF + 7,658 AF (original capacity of Big Beaver Res)				
4	Little Bear 1 Reservoir ¹	Fortification Creek Basin			X	Possible secondary benefit	Modeled	Releases are made to three aggregate diversions (WDID 440511, 440612, and 440688), which were identified as the three diversions to which Little Bear				No conditional storage rights, junior right assumed		800 AF			



Map ID	Name of Project	Project Location	M&I	SSI	Ag	Env/ Rec	Modeled/ Not Modeled	Primary Purpose of Project	Project Status	Projected Completion	Proponents	Storage Right	Project Yield	Project Capacity	Project Cost	Funding Sources	Challenges
								I Reservoir could release water as described in the Agricultural Water Needs Study.									
5	Milk Creek Reservoir ³	Milk Creek Reservoir upstream of the confluence with the Yampa River		X	X	Possible secondary benefit	Modeled	Similar to Rampart Reservoir, Milk Creek Reservoir cannot release to any water short diversions on upper Milk Creek; however, releases are made to the Yampa River oxbows diversion. Milk Creek Reservoir also exchanges to all diversions upstream on Milk Creek if exchange capacity exists on the creek. No operations were defined for the industrial storage account				An existing conditional water right with a 1976 date of decree of 70,000 AF; however, this is only for industrial beneficial uses. At the request of the BRT subcommittee, Milk Creek Reservoir was modeled for agricultural and industrial uses. For the P&M Study, this conditional right maintained its 1976 water right date, but the industrial storage was reduced to 35,000 AF. --The remaining 35,000 AF of storage is filled using an undecreed water right for agricultural uses.		70,000 AF			
6a 6b 6c	Lower White River Storage Project	Possible off-channel storage sites near the White River: -Wolf Creek -Spring Creek -Gilliam	X	X	X	X	Modeled with junior water rights	Water Storage, M&I, Recreation, Supplemental Flows, Energy, Augmentation	Ongoing Feasibility Study	To be defined in Feasibility Study	Town of Rangely, Rio Blanco County, Colorado River Water Conservation District (potentially), CWCB (potentially), USFWS (potentially), Energy Companies (potentially)		To be defined in the Feasibility Report		To be defined in the Feasibility Report	Rio Blanco Water Conservancy District revenues and mill levy, CWCB, Town of Rangely, Rio Blanco County, USFWS, Colorado Parks and Wildlife, Colorado Water Resources and Power Development Authority, Various Energy Companies (Sources to be determined in Phase II of the Feasibility Study)	Developing a viable financing plan and completing Federal NEPA documentation will be challenging, but are not considered to be insurmountable
7	Monument Butte Reservoir ¹	Morapos Creek Basin			X	Possible secondary benefit	Modeled	Releases are made to four aggregate diversions (WDID				No conditional storage rights, junior right		4,390 AF			



Map ID	Name of Project	Project Location	M&I	SSI	Ag	Env/ Rec	Modeled/ Not Modeled	Primary Purpose of Project	Project Status	Projected Completion	Proponents	Storage Right	Project Yield	Project Capacity	Project Cost	Funding Sources	Challenges
								440590, 440651, 440814, and aggregate diversion 44_ADY016A), which were identified as the diversions to which Monument Butte Reservoir could release water to as described in the Agricultural Water Needs Study.				assumed					
8	Morrison Creek Project ⁴	Morrison Creek	X	X	X	X	Modeled ⁷ (turned on)	Firming Stagecoach Reservoir			Upper Yampa Water Conservancy District	There are two storage rights for Morrison Creek Reservoir, a first fill and a second fill. The first fill right has a 4,965 AF conditional water right (administration number = 41272.39991) and the second fill has a 5,655 AF conditional water right (administration number = 57676.00000).	Approximately 3,000 to 5,000 AF				
9	Oil Shale Production Pipelines/Diversions (new diversions) ⁶	White		X			Modeled										
10	Peabody-Trout Creek Reservoir ²	Trout Creek upstream of the confluence with the Yampa River		X	Possible secondary benefit	Possible secondary benefit	Modeled	The sole purpose of the Peabody-Trout Creek Reservoir is to meet the 6,000 AFY energy development demands (which do not have a direct diversion water right) that are also part of the Peabody-Trout Creek Project				A first fill water right with administration number 43575.00000 and conditional storage of 15,000 AF		11,720 AF			
11	Rampart Reservoir ¹	Lower Fortification Creek upstream of Wisconsin Ditch			X	Possible secondary benefit	Modeled	Since Rampart Reservoir is only located upstream of two potentially short water diversions (the oxbows aggregate diversion and WDID 440511), releases are made to the oxbows aggregate				- A first fill water right with administration number 41126.00000 and conditional storage of 12,133 AF -A second fill water right with administration number		12,133 AF			



Map ID	Name of Project	Project Location	M&I	SSI	Ag	Env/ Rec	Modeled/ Not Modeled	Primary Purpose of Project	Project Status	Projected Completion	Proponents	Storage Right	Project Yield	Project Capacity	Project Cost	Funding Sources	Challenges
								diversion and WDID 440511. The second set of operations for Rampart Reservoir is to exchange water upstream to South Fork II and Little Bear I. The last set of operations for Rampart Reservoir is to exchange water upstream to each individual diversion on Fortification Creek				47905.00000 and conditional storage of 11,692 AF					
12	South Fork II Reservoir ¹	Fortification Creek Basin			X	Possible secondary benefit	Modeled	Releases are made to seven aggregate diversions (WDID 440511, 440612, 440647, 440650, 440681, 440688 and 440998), which were identified as the seven diversions to which South Fork II Reservoir could release water as described in the Agricultural Water Needs Study.				No conditional storage rights, junior right assumed		1,700 AF			
13	Upper Morrison Diversion	Section 14, Township 3N, Range 84W	X	X	Possible secondary benefit	Possible secondary benefit	Modeled ⁷ (turned off)	Firming of Stagecoach Reservoir (part of Morrison Creek Reservoir (IPP #8) as an alternate point of diversion)			Upper Yampa Water Conservancy District		Approximately 5,000 to 10,000 AF	50 cfs diversion water rights with a 15 cfs bypass requirement (Case 01CW0041 App. Date 12-30-1994)			
14	Steamboat Springs Conservation	Steamboat area water provider districts	X				Not Modeled	Program to realize a 15% passive conservation savings over time equal to 800 AF by 2035 by implementing measures such as leak detection programs, fixture rebate programs, and reducing landscape irrigation needs.	On-going		Steamboat Springs		720 AF			CWCB, Area Water Providers	
15	Wolf Creek Reservoir ⁶	White River downstream of the confluence with		X			Modeled	Water from Wolf Creek Reservoir is				The purpose of the Scenario 2 and 3		162,400 AF			



Map ID	Name of Project	Project Location	M&I	SSI	Ag	Env/ Rec	Modeled/ Not Modeled	Primary Purpose of Project	Project Status	Projected Completion	Proponents	Storage Right	Project Yield	Project Capacity	Project Cost	Funding Sources	Challenges
		Piceance Creek						transported upstream via carrier to directly meet oil shale production demands.				models of the Energy Development Water Needs Assessment were to reliably meet oil shale production demands with rights junior to all other diversions in the basin. That methodology was also used in the P&M Study; therefore, it is modeled with a 2013 water right. --The only water right Wolf Creek Reservoir uses to store water is an undecreed water right on the White River					
16	Rangely Raw/Irrigation	White River			X	X	Not Modeled	Agriculture and Recreation	Planning/feasibility	Study to begin May 2014	Colorado Northwest Community College, Rio Blanco Water Conservancy District, Town of Rangely, Western Rio Blanco Metropolitan Recreation District.		250 AF				
17	Morrison Creek District Yampa River Water Treatment Plant	Yampa River just upstream of Stagecoach Reservoir	X				Not Modeled	Municipal water supply for Stagecoach development	Planned	Unknown			9 cfs		unknown		Need for project dependent on growth in Stagecoach which is a designated growth area in Routt County
18	Elk River Project	On the east bank of the Elk River on the SE1/4 of the SW1/4 of Section 22, Township 7North, Range 85 West of the 6 th P.M., Routt County, Colorado.	X				Not Modeled	Future M&I needs and redundant supply in the event of supply interruption or wildfire.	Conceptual		Steamboat Springs		3,000 AF	Reservoir capacity TBD		TBD	
19	Expansion of Yampa River Wells	On both sides of Yampa River south of Steamboat Springs in vicinity of Dougherty Rd and US 40	X				Not Modeled	Expand Yampa River Wells from 1.8 MGD to 3.5 MGD to: -provide for future M&I needs -provide redundancy in case of wildfire above	Developing hydrologic model		City of Steamboat Springs Mt. Werner Water and Sanitation District		Current operating yield = 500 AF during 90-day seasonal operation	Year round operation at current sustainable 1.8 MGD capacity = up to 2016 AFY Year		City of Steamboat Springs Mt. Werner Water and Sanitation District	



Map ID	Name of Project	Project Location	M&I	SSI	Ag	Env/ Rec	Modeled/ Not Modeled	Primary Purpose of Project	Project Status	Projected Completion	Proponents	Storage Right	Project Yield	Project Capacity	Project Cost	Funding Sources	Challenges
								WTP on Fish Creek, i.e., production can be moved to Fish Creek wells						round operation at expanded 3.5 MGD capacity = up to 3930 AFY all depending on fall and winter yields			
20a 20b 20c 20d 20e 20f 20g 20h	Yellow Jacket Water Conservancy District Reservoir Feasibility Study	White River and drainages; possible sites include: -Lost Park -Mahogany -Ripple Creek -Sawmill Mountain -Strawberry Creek -Thornburgh -Tom Little Gulch -Wray Gulch	X	X	X	X	Modeled with junior water rights	M&I, agriculture, recreation, environmental, other beneficial uses	Study completed								
	Colorado River Compact Water Bank	Colorado River Basin				X	Not Modeled	1. Prevent curtailment 2. Protect certain critical post- compact (i.e. junior) uses in the event of curtailment.	Feasibility study in progress	2007	Southwestern Water Conservation District, The Nature Conservancy, Front Range Water Council, State of Colorado		N/A			Proponent funding and CWCB ATM grant funding	A large number of technical, legal, economic, and administrative challenges will need to be addressed ultimately
	Other Municipal Water Conservation																
	Other IPPs to Meet Future Needs																

¹Originally identified in the Yampa River Basin Small Reservoir Study - Phase 2 (CRWCD 2000)

²Described in Modeling for the Peabody-Trout Creek Reservoir Supply Project (Peabody 2014)

³Identified by Tri-State Generation & Transmission Association (Chartrand, 2013)

⁴Evaluated in Upper Yampa WCD (UYWCD) Supply Plan Model (UYWCD 2013)

⁵Originally identified in the Steamboat Supply Master Plan (Steamboat 2008); re-evaluated in UYWCD Supply Plan Model

⁶Identified in the Energy Development Water Needs Assessment Phase II report (Colorado, Yampa, White BRT 2011)

-Note that Oil Shale Production Pipelines/Diversion is a conceptual supply system rather than an actual system with physical components. The three elements include:
-White River direct diversion to meet oil shale production demands on Piceance Creek
-White River pipeline used to fill the Lake Avery enlargement
-As part of Wolf Creek Reservoir operations, oil shale production demands are augmented by water delivered via a carrier from Wolf Creek Reservoir

⁷ For purposes of the BIP modeling effort the Morrison Creek Project (#8) is “turned on” while the Upper Morison Diversion (#13) is “turned off.” Both projects are included in the modeling, however, only one of the projects can be “turned on” for a given modeling run.



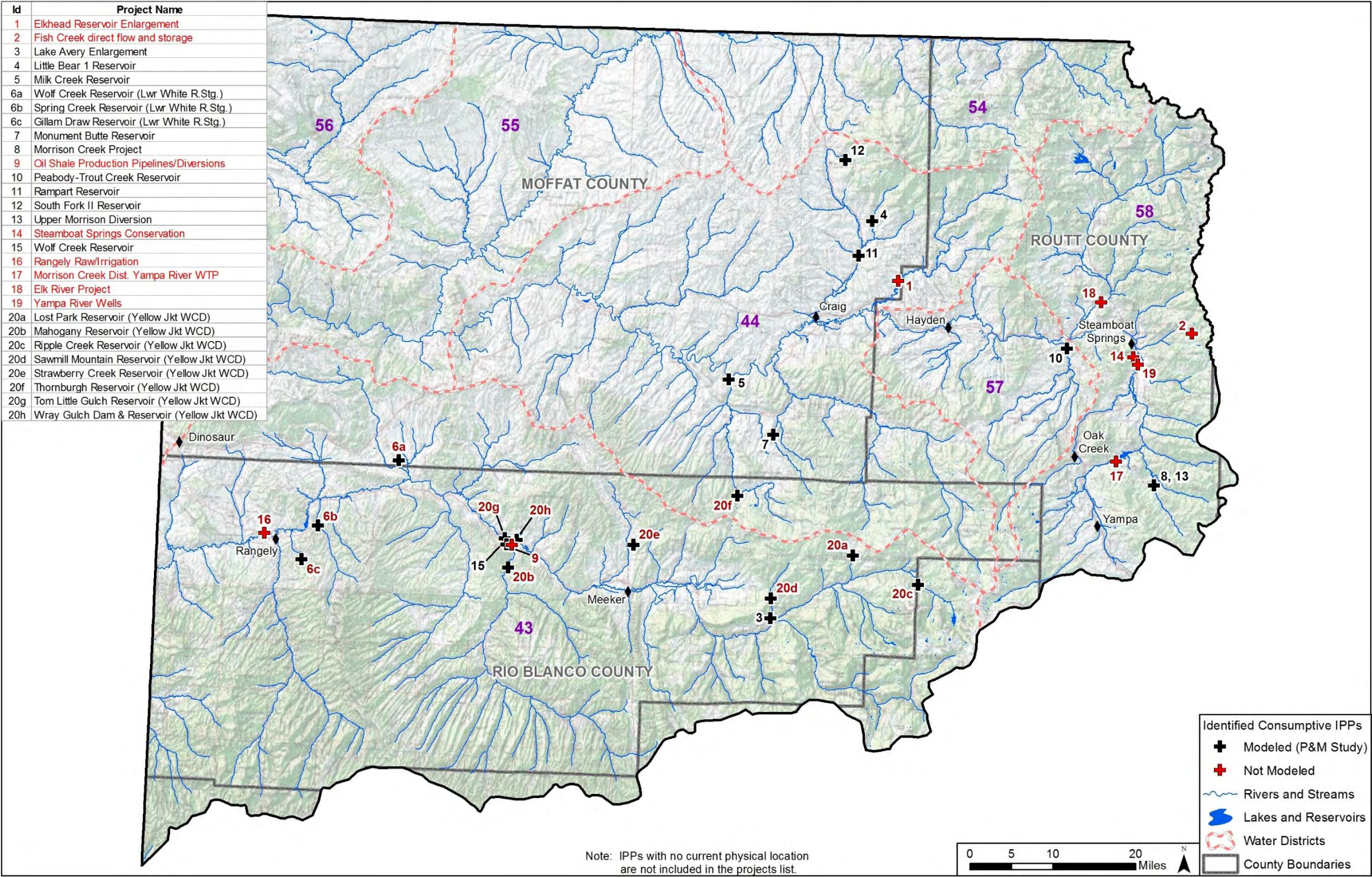


Figure 4-3 Location of M&I, SSI, Agriculture and Multi-Purpose IPPs

4.5 ENVIRONMENTAL AND RECREATIONAL IPPS

The YWG BRT identified a collection of IPPs that exclusively focus on environmental and recreational water needs and benefits. This collection of environmental and recreational IPPs was developed through a survey distributed to the YWG BRT and other stakeholders in the Basin in April and May of 2014.¹² The IPPs are highlighted in Table 4-5 while the locations of the IPPs are shown in Figure 4-4.

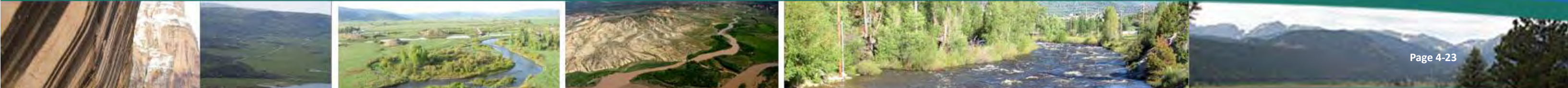
The majority of these IPPs are located in the environmental and recreational focus areas discussed in Chapter 2. It is important to note that while these projects are the currently foreseeable IPPs, Table 4-5 is not an inclusive list and does not address all of the environmental and recreational needs and shortages discussed in Chapters 2 and 3. The table will be modified to include additional IPPs as regional and local planning efforts continue throughout the Basin. Future projects will be developed for the existing focus areas, shown in Figure 4-4, as well as in other tributaries who demonstrate a need for environmental and recreational improvements.

¹² The environmental and recreational IPP list previously developed through SWSI and the Nonconsumptive Needs Assessments was not reviewed and approved by the YWG BRT prior to publishing. During the BIP planning process, the YWG BRT decided to develop a new updated IPP list based on input from YWG Basin stakeholders.



Table 4-5 Environmental and Recreational IPPs

ID	Name of Project	Project Location	Study	Monitoring	Instream flow appropriation	Restoration	Species reintroduction	Structure improvement	Habitat restoration	Water quality	Stewardship	Water lease acquisition	Voluntary flow agreements	Management plan	Conservation easement	Non-native species management	Reservoir operations	Biological opinion	RICD	Other	Additional Details	Project Status	Projected Completion	Proponents	Partners	Project Cost	Funding Sources	Challenges
1	Upper Yampa backwater modifications	Initial projects located within Chuck Lewis SWA and within Steamboat Springs on the south end of city limits. However, multiple sites throughout the Upper Yampa River corridor could benefit from alterations of backwater habitats. Benefits to the Upper Colorado Endangered Fish Recovery Program by implementing one element of the program's non-native fish control strategy. Also benefits other environmental attributes of the riverine ecosystem. All other elements of the non-native fish control strategy are part of keeping the Yampa River Basin PBO in place below.	x	x		x		x	x	x	x					x					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. Multiple recreational benefits would be realized as well.	Ongoing	By 2020	CPW and USFWS per table 3a of the non-native fish control strategy.	Potential partners include: City of Steamboat Springs and Ski Corps	\$150,000 - \$750,000 depending on project	Potentially Colorado Parks and Wildlife, City of Steamboat Springs, Endangered Fish Recovery Program, Ski Corps, GOCO	Unknown
2	Loudy Simpson access and recreational river enhancements	Yampa River at Loudy Simpson Park in Craig, Colorado.																		x	Provide improved access to river and restoration/rebuild of riffle for non-consumptive needs specific to increasing recreational opportunities and float boating in the Yampa River at the park.	Ongoing (There is a project being worked on at a preliminary planning stage at the moment).	By 2018	Possible project proponent is Moffat County Tourism Association. Melody Villard, Tourism Director is a good contact: mvillard@moffatcounty.net	Possible partners are the Board of Moffat County Commissioners and the Craig City Council, Friends of the Yampa, American Whitewater	Unknown	YWG Basin Roundtable	Permitting
3	Upper Elkhead Creek Stream Restoration	Stream restoration will occur on approximately 16 miles of Elkhead Creek and its tributaries from the southern end of California Park upstream to the headwaters.		x		x			x	x											Indirect benefits to consumptive uses include a reduction in sediment entering Elkhead Reservoir.	Ongoing (The project began on Armstrong Creek, a tributary of Elkhead Creek, in 2012).	Beyond 2020 (The project is expected to take 15 years).	Forest Service	Trout Unlimited, Routt County Conservation District, and Colorado Parks and Wildlife	4 million dollars	Current funding has been provided by the partners, YWG BRT, CWCB, and several other donors.	Unknown



ID	Name of Project	Project Location	Study	Monitoring	Instream flow appropriation	Restoration	Species reintroduction	Structure improvement	Habitat restoration	Water quality	Stewardship	Water lease acquisition	Voluntary flow agreements	Management plan	Conservation easement	Non-native species management	Reservoir operations	Biological opinion	RICD	Other	Additional Details	Project Status	Projected Completion	Proponents	Partners	Project Cost	Funding Sources	Challenges
4	Implementation of projects that improve instream and riparian habitat, irrigation infrastructure, and/or flows	Upper East Fork Williams Fork sub-basin, from the headwaters to the confluence with Poose Creek (and including Poose Creek)						x	x	x		x										Planned	By 2020	Trout Unlimited	Trout Unlimited, Forest Service	Up to \$500k	Unknown	Unknown
5	Yampa River Structures Project	Downtown Steamboat Springs, Colorado from 9th Street at the foot bridge over the river then downstream to approximately above where Soda Creek enters the Yampa. This reach of river is approximately ¼ of a mile in river length.						x													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.	Ongoing (Currently finalizing our plans that will be submitted to the Army Corps of Engineers).	By 2015	Friends of the Yampa	City of Steamboat Springs YWG BRT	\$100,000	Friends of the Yampa, City of Steamboat Springs, YWG BRT	Potential for permit denial
6	Planning/restoration on the Yampa River through Morgan Bottom Creek	Yampa River from the Marshall-Roberts headgate to the Town of Hayden. (Morgan Bottom)				x		x													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.	Ongoing	Through 2020	The Nature Conservancy	Potential partners include 5 major ditch diverters, Colorado Parks and Wildlife, NRCS, UYRWG, The Nature Conservancy	Partially Funded	Shell, CPW, Packard, UYWCD and other funding pending	



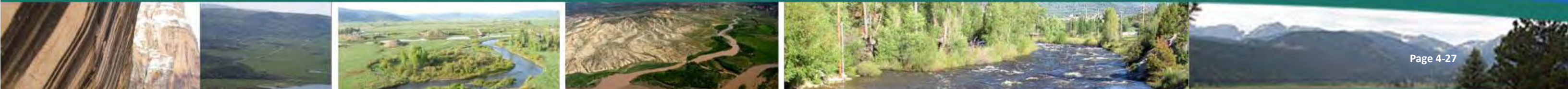
ID	Name of Project	Project Location	Study	Monitoring	Instream flow appropriation	Restoration	Species reintroduction	Structure improvement	Habitat restoration	Water quality	Stewardship	Water lease acquisition	Voluntary flow agreements	Management plan	Conservation easement	Non-native species management	Reservoir operations	Biological opinion	RICD	Other	Additional Details	Project Status	Projected Completion	Proponents	Partners	Project Cost	Funding Sources	Challenges
7	Optimize flow protection and augmentation	Yampa and Little Snake rivers endangered fish flow reaches for the Yampa from Craig to its mouth and for the lower Little Snake to the confluence with the Yampa. Some non-native fish control occurs above these reaches and is not shown in Figure 4-2.	x		x							x				x	x	x			Optimize flow protection and augmentation for endangered fish recovery and other non-consumptive attributes for the same reaches in conjunction with new, in-basin consumptive IPPs and keep the Yampa PBO in place. The depletions and storage assumptions for the Yampa River PBO are out of date and the flow impacts of new, in-basin consumptive IPPs need to be re- assessed. The non-native fish control for this PBO also needs to be updated.	Ongoing	By 2020	The Nature Conservancy, Fish & Wildlife Service	USFWS, CPW, and other Endangered Fish Recovery Program partners. See table 3a of the non-native fish control strategy.	Partially funded	Partners in endangered fish recovery program (partially funded).	Unknown
8	Assess the flow regime for endangered fish recovery	White River from Rio Blanco Lake to the state line	x		x							x				x	x	x			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, in-basin consumptive IPPs and to assist with endangered fish recovery	Ongoing	By 2015	The Nature Conservancy, Fish & Wildlife Service	USFWS, CPW, and other Endangered Fish Recovery Program partners. See table 5a of the non-native fish control strategy.	Funded	Partners in endangered fish recovery program	Unknown
9	Flow protection & augmentation for warm-water fish & cottonwood	These reaches are the same as the endangered fish reaches above for IPP 7 and 8	x		x							x					x				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	Proposed	By 2020	The Nature Conservancy	USFWS, CPW, TNC	Not funded	Not funded	Unknown
10	Yampa Preferred Target Flow Through Steamboat Springs	Stagecoach Reservoir to the City of Steamboat Springs' Waste Water Treatment Plant Outfall (including ISF 582164 and RICD)	x						x	x	x	x	x			x	x		x		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 non-consumptive attributes in the same reach. This reach of the Yampa is on the 303D Monitoring and Evaluation List for temperature.	Proposed	Unknown	City of Steamboat Springs	Colorado Water Trust, Upper Yampa Water Conservancy District	Not funded	Currently not funded.	To be determined



			Study	Monitoring	Instream flow appropriation	Restoration	Species reintroduction	Structure improvement	Habitat restoration	Water quality	Stewardship	Water lease acquisition	Voluntary flow agreements	Management plan	Conservation easement	Non-native species management	Reservoir operations	Biological opinion	RICD	Other								
ID	Name of Project	Project Location																			Additional Details	Project Status	Projected Completion	Proponents	Partners	Project Cost	Funding Sources	Challenges
11	Recreational, habitat & management strategy improvements	Yampa River within Steamboat Springs	x			x		x												x	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.	On-going	Potentially City of Steamboat Springs, Friends of the Yampa, CPW	Potentially City of Steamboat Springs, Friends of the Yampa, CPW	Potentially City of Steamboat Springs, Friends of the Yampa, CPW	Partially funded	Potentially City of Steamboat Springs, Friends of the Yampa, CPW, GoCo, American Rivers, American Whitewater (partially funded)	Unknown
12	Augment instream flow shortages (Elk). Other instream flow water rights could be augmented wherever they are not fully supplied.	ISF 581355 & 582219	x									x					x				Both of these water rights face shortages and could be augmented by the same upstream supply	Proposed	Potentially CPW and CWT or TU	Potentially CPW and CWT or TU	Potentially CPW and CWT or TU	Not funded	Not currently funded. Potentially CPW and CWT or TU	Unknown
13	Cross Mountain Canyon Ranch - habitat and recreational improvements	Yampa River at Cross Mountain Canyon Ranch				x			x		x									x	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.	On-going	Unknown	BLM	Possibly Colorado Parks and Wildlife, Friends of the Yampa			
14	Sarvis Creek habitat and recreational access improvements	Yampa River below Sarvis Creek confluence						x	x		x									x	Establish new public fishing access and habitat improvements within and along a prime 1/8th of a mile stretch of the Yampa River.	On-going		Western Rivers Conservancy	BLM, Forest Service, Colorado Parks and Wildlife, Yampa River Stream Improvement Charitable Trust, Friends			



ID	Name of Project	Project Location	Study	Monitoring	Instream flow appropriation	Restoration	Species reintroduction	Structure improvement	Habitat restoration	Water quality	Stewardship	Water lease acquisition	Voluntary flow agreements	Management plan	Conservation easement	Non-native species management	Reservoir operations	Biological opinion	RICD	Other	Additional Details	Project Status	Projected Completion	Proponents	Partners	Project Cost	Funding Sources	Challenges
																									of the Yampa			
15	Duffy Canyon river access and riverside camping	Duffy Canyon																		x	Project would establish on-river camping opportunities for float boaters that is currently lacking and additional improvements to river access within Duffy Canyon	Proposed		BLM	Friends of the Yampa, Colorado Parks and Wildlife			
16	Wolery Ditch diversion structure rebuild	Yampa River at Wolery Ditch below James Brown Bridge					x	x												x	Friends of the Yampa has been working with the owners of the Wolery 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.	Proposed	Unknown	Friends of the Yampa/Wolery Ditch owners	Trout Unlimited			
17	New decreed instream flows	Stream reaches throughout the Basin			x																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.	On-going	not applicable	stakeholders who sponsor an instream flow for CWCB review	not applicable			
18	Watershed Planning Process	Upper Yampa River and potentially lower Yampa and White River.	x	x		x		x	x	x												Ongoing	Ongoing	Routt County Conservation District	UYCWD, City of Steamboat, Routt County, the Nature Conservancy, others.			



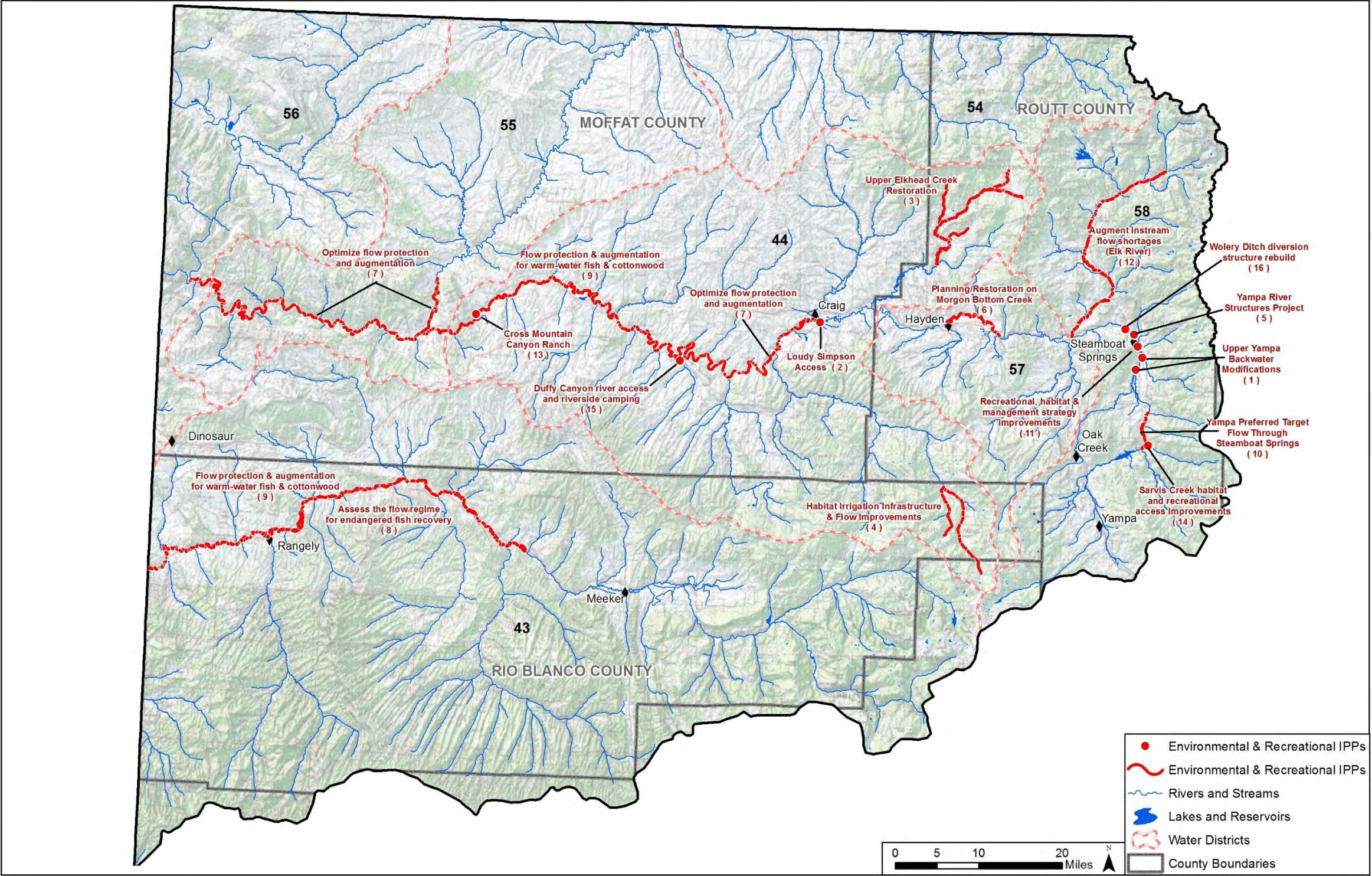


Figure 4-4 Environmental and Recreational IPPs



Table of Contents

Section 5.0	Strategies for the Projects and Methods	5-2
5.1	Facilitation of Public Participation and Consensus Building	5-2
5.2	Funding Mechanisms and Partnerships/Sponsors.....	5-2
5.3	Additional Studies, Recommendations and Next Steps.....	5-3



SECTION 5.0 STRATEGIES FOR THE PROJECTS AND METHODS

This chapter provides an overview of the YWG Basin's strategies related to the projects and methods. The information presented in this chapter includes:

- The approach for engaging the public and building consensus among the project sponsors, residents, and other stakeholders in the YWG Basin as projects and methods are developed and implemented;
- Identification of funding mechanisms and partnerships/sponsors; and
- Identification of additional studies, recommendations and next steps that will help facilitate the BIP goals moving forward.

Highly specific timelines and deadlines are not included to allow the YWG BRT the flexibility needed to successfully build consensus among stakeholders, encourage public participation, and assist in implementing projects and methods. It is important to note again that development of the BIP is an ongoing process. It is a document representing a snapshot in time with no true finalization date. With the ongoing process of water supply planning, the YWG BRT will continue to strive to balance the future needs of the region while integrating important considerations such as addressing certainty of existing uses, enabling modest future growth and retaining important recreational and environmental values. These core ideas will be considered throughout the process as projects and methods are developed and implemented to ensure reliable water supplies for the region now and in the future. An additional consideration is that parties on the east slope have expressed interest in diversions from the YWG Basin. Downstream states have delivery needs that are partially met from the YWG Basin. This interest, coupled with the river basin's desire for a negotiated equitable apportionment of its native flow for in-basin use and future development, forms an extremely important consideration for the YWG BRT as it moves forward with long-term water supply planning. The YWG BRT will continue its willingness to discuss the preservation of environmental and recreational flows that also deliver needed water to downstream obligations, but also stresses the importance of assuring non-curtailement of its existing water use and protecting water for future uses in state-wide discussions.

5.1 FACILITATION OF PUBLIC PARTICIPATION AND CONSENSUS BUILDING

The ultimate responsibility for completing the IPPs falls with the project sponsors and will therefore be a locally-driven process. However, the YWG BRT will serve as a facilitator of the IPPs to assist in moving projects and methods forward, but it will not be a decision-making body. The YWG BRT recognizes the importance of including constituents and stakeholders in the YWG Basin in the process of developing and implementing IPPs and will therefore serve as a forum for this process and a source for information exchange. Participation in the public process will be encouraged at the YWG BRT level to provide transparent information and open dialogue amongst all involved parties.

The Basin Roundtable can also facilitate public awareness of the projects and help to build consensus among all parties considering that some IPPs can present water management challenges as well as opportunities. For example, IPPs can impact stream flows both upstream and downstream of the project location. The YWG BRT can address these types of challenges and how impacts may be felt outside of the immediate project location by educating stakeholders and bringing all affected parties together.

5.2 FUNDING MECHANISMS AND PARTNERSHIPS/SPONSORS

While development of IPPs and identification of funding is up to the project proponent, the YWG BRT will facilitate funding discussions at the Roundtable level where it is feasible and appropriate. Additionally, identification of partnerships and sponsors will also be the project proponents' responsibility but the YWG BRT can assist by providing a forum for open discussions related to developing these interactions.



5.3 ADDITIONAL STUDIES, RECOMMENDATIONS AND NEXT STEPS

This BIP is breaking new ground by systematically quantifying shortages to both consumptive demands and instream flow water rights, assessing other flow alteration risks, and conceptualizing a new suite of consumptive and non-consumptive projects. A follow-up effort is now needed in which these in-basin shortages are more closely examined and the projects to relieve these shortages are better specified, firmed up, and integrated. This follow-up effort will include greater attention to river flow management and will connect this BIP to the next SWSI scheduled for 2016. This follow-up effort will aim to turn project concepts into projects on the ground.

After deliberations by its technical sub-committee and some clarification of the underlying modeling,¹ the YWG BRT is proposing Next Steps for the Yampa sub-basin that include:

- a) Indicators of shortages for meeting current and future in-basin consumptive and non-consumptive demands, and the basis for specific shortages;
- b) Further specification and development of the projects which will relieve those shortages, including quantification of the storage releases and new or re-allocated supplies;
- c) Indicators of impacts on consumptive and non-consumptive demands resulting from the implementation of projects to meet both needs; and,
- d) Collaboration on flow management and integrated projects to protect and augment base flows, supporting the long-term health and substantial economic values therein.

These steps have been reviewed and approved by the YWG BRT. The YWG BRT is also proposing a thorough phase II of the Agriculture Water Needs Study specific to return-flow impacts from increasing irrigation efficiencies through various means (i.e. automated diversion structures, lining or piping of delivery canals, and installation of sprinklers). This cumulative assessment of consumptive and non-consumptive needs, return-flows, river flow regimes and flow protection and management will go hand-in-hand with increased public engagement and education. It will also increase recognition of the significant role that the Yampa and White Rivers plays in providing water to meet Colorado's downstream compact obligations.

A great amount of additional effort and continued dedication will be required to add to and refine this work. This BIP lays the foundation for understanding and articulating the policies, processes and projects that can occur in the future to maintain and enhance the region's water supplies. These next steps will facilitate a greater understanding related to the future water supply planning needs of the YWG Basin.

¹ Although extensive, the modeling to date for this BIP is still being developed so that all results remain preliminary and do not constitute official findings by the YWG BRT.



SECTION 6.0 HOW THE PLAN MEETS THE GOALS AND MEASURABLE OUTCOMES

This section informs SWSI and the Colorado Water Plan on how the YWG BRT plans to meet our M&I, agricultural, environmental, and recreational gaps in a meaningful way. Where applicable, specific IPPs are identified, while in other cases plans for further refinement of conceptual solutions are described. The IPPs and conceptual solutions are dynamic and will be refined in SWSI and future YWG Basin studies as demands are updated, but this summary provides an initial benchmark against which measurable progress can be determined.

Table 6-1 How the BIP meets the Goals

Goals	How met
Protect existing decreed and anticipated future water uses in the YWG Basin	<p>Section 4 describes 21 multi-purpose IPPs and 17 environmental and recreational IPPs that will help reduce shortages to decreed uses and protect anticipated future water uses.</p> <p>A Colorado River Compact water bank is identified as an IPP to provide an alternative transfer mechanism to protect existing senior agricultural water supplies.</p> <p>Section 1 requests a negotiated equitable apportionment of water use in the YWG basins to protect relatively junior decreed uses and future uses.</p>
Protect and encourage agricultural uses of water in the YWG Basin within the context of private property rights	Current and future agricultural needs are identified in Section 2.3
Improve agricultural water supplies to increase irrigated land and reduce shortages	<p>Agricultural shortages are discussed in Section 3.4.1</p> <p>IPPs described in Chapter 4 include reservoir enlargements, new storage projects, municipal water conservation, and expansion of municipal supply well fields. These will supply growing M&I and SSI needs and reduce pressure for transfer of agricultural water rights. Ten IPPs have agricultural supplies identified as a primary use, and an additional two IPPs have agricultural supplies identified as a possible secondary benefit.</p>
Identify and address municipal and industrial water shortages.	<p>Current and future M&I and SSI shortages are analyzed in Section 3.4</p> <p>IPPs described in Chapter 4 include reservoir enlargements, new storage projects, municipal water conservation, and expansion of municipal supply well fields. Nine IPPs have municipal water supplies as a primary purpose. An additional nine IPPs have SSI water supply as a primary purpose.</p>
Quantify and protect non-consumptive water uses	<p>Environmental and recreational needs are identified in Section 2.4</p> <p>To help meet environmental and recreational water supply needs 17 environmental and recreational IPPs are identified in Chapter 4. In addition, five of the</p>



Goals	How met
	<p>consumptive IPPs identified in Chapter 4 include non-consumptive purposes and an additional seven include non-consumptive purposes as a possible secondary benefit.</p> <p>The YWG BRT will continue to explore additional multi-purpose opportunities where they may exist through future planning efforts.</p>
Maintain and consider the existing natural range of water quality that is necessary for current and anticipated water uses	No measures yet identified.
Restore, maintain, and modernize water storage and distribution infrastructure	<p>20 of 21 consumptive IPPs involve improvements to storage or distribution infrastructure.</p> <p>Environmental and recreational IPP #4 includes "Implementation of projects that improve...irrigation infrastructure."</p> <p>Environmental and recreational IPP #6 includes "watershed planning and implementation of...irrigation infrastructure improvement projects through the Morgan Bottom reach."</p>
Develop an integrated system of water use, storage, administration and delivery to reduce water shortages and meet environmental and recreational needs	<p>Water management and water administration in the YWG Basin are discussed in Section 3.2, and some of the challenges in the YWG Basin are recognized there.</p> <p>The YWG Basin has identified a number of measures to improve administration and will refine these through SWSI.</p>



ACKNOWLEDGEMENTS

The YWG BIP was developed to inform the Colorado Water Plan, using a grant from the CWCB. The YWG BRT is grateful for the opportunity to be a part of the development of Colorado's first Water Plan to incorporate a holistic approach to preparing for a secure water future for the entire State. To facilitate development of the BIP, the YWG BRT engaged the use of a committee (Committee) to work with AMEC and Hydros Consulting, Inc. The committee was open to anyone who wished to participate whether on the YWG BRT or simply an interested member of the public. The Committee worked closely with the YWG BRT and the stakeholders to define the policy initiatives and positions that are presented in the BIP. The Committee also kept the greater YWG BRT informed of progress by providing summaries at monthly YWG BRT meetings held throughout the BIP process.

The Committee worked diligently in compiling a document that reflects positions, desires and needs across varied interests throughout the entire YWG Basin. However, given the accelerated timeframe of the process, this document does not entirely address all of the issues facing the YWG Basin in great detail; neither do the current projects and methods portray a complete picture of water supply options. As a result, this draft BIP can be considered a foundation for future water supply planning in the YWG Basin. As the planning process continues, additional refinements will occur and conversations will persist amongst all parties, all with a goal of providing an attainable and sensible water future for municipal, industrial, agricultural, environmental and recreational needs.

In addition to the Committee and YWG BRT, further input was received from interested citizens and stakeholders at YWG BRT meetings and at a variety of public outreach efforts organized throughout the YWG Basin. Without the efforts of so many individuals and organizations, preparation of this document would not have been possible. Sincere thanks are extended to all BIP participants, and encouragement is extended to continue this important work.

Members of the YWG BRT include the following:

Alden Vanden Brink	Jeff Comstock
Bill Badaracca	Jeff Devere
Burt Clements	Jon Hill
Charles G. Grobe	Kelly Heaney
Chris McCourt	Kelly Sheridan
Dan Birch	Kent Vertrees
Dan Craig	Kevin McBride
Dan Eddy	Mary Brown
David Smith	Mike Sorenson
Don Jones	Ren Martyn
Doug Monger	Steve Colby
Forrest Luke	T. Wright Dickinson
Geoff Blakeslee	Tom Gray
Jackie Brown	Tonia Folks
Jay Gallagher	Vince Wilczek
Jean Stetson	



REFERENCES

- (Arthington et al. 2006). Arthington, A.H., S.E. Bunn, N.L.Poff, and R.J. Naiman. 2006. "The challenge of providing environmental flow rules to sustain river ecosystem." *Ecological Application*. 16[4]: 311-1318.
- (Brown 2014). Brown, Jackie. Routt County Conservation District, Upper Yampa River Watershed Group. State of the Upper Yampa River Watershed Report, August 2014: www.routtcountycd.com/Watershed (link to be live by August 1, 2014)
- (Bureau of Reclamation 2005). Bureau of Reclamation. 2005. Operation of Flaming Gorge Dam Final Environmental Impact Statement. Access from: <http://www.usbr.gov/uc/envdocs/eis/fgFEIS/index.html>. Accessed on: April 7, 2014.
- (Bureau of Reclamation 2006). Bureau of Reclamation, Record of Decision Operation of Flaming Gorge Dam Final Environmental Impact Statement, February 2006: <https://www.usbr.gov/uc/envdocs/rod/fgFEIS/final-ROD-15feb06.pdf>
- (CDNR 2006). Colorado Department of Natural Resources, CDM, CWCB. 2006. Water Supply and Needs Report for the Yampa/White/Green Basin, July.
- (CDPHE 2011). Colorado Department of Public Health and Environment. 2011. Statewide Water Quality Management Plan.
- (CDPHE 2012). Colorado Department of Public Health and Environment Water Quality Control Commission, Regulation 93, March 2012: <https://www.colorado.gov/pacific/sites/default/files/Regulation-93.pdf>
- (CDSS 1993). Colorado Decision Support System (CDSS). 1993. Division 6 Irrigated Lands 1993 Geospatial Data. Access from: <http://cdss.state.co.us/GIS/Pages/Division6YampaWhite.aspx>
- (CDSS 2005). CDSS. 2005. Division 6, Dist 47 Irrigated Lands 2005 Geospatial Data. Access from: <http://cdss.state.co.us/GIS/Pages/Division6YampaWhite.aspx>
- (Colorado, Yampa, White BRT 2008). Colorado, Yampa, and White River Basin Roundtables, Energy Subcommittee. 2008. Energy Development Water Needs Assessment Phase I. Prepared by URS. September. Access from: http://www.coloradoriverdistrict.org/conservypress/wp-content/uploads/2014/12/Report-2008-Energy_Development_Water_Needs_Assessment_Phase_1.pdf
- (Colorado, Yampa, White BRT 2011). Colorado River Basin Roundtable and Yampa/ White River Basin Roundtable. 2011. Energy Development Water Needs Assessment Phase II Final Report. Prepared by AMEC. February.
- (Colorado, Yampa, White BRT 2014). Colorado, and Yampa/White River Basin Roundtables Energy Subcommittee. 2014. Energy Development Water Needs Assessment Update Phase III Final Report. Prepared AMEC. June.
- (CO-WRAP 2014). Colorado Wildfire Risk Assessment Portal (CO-WRAP). 2014. <http://www.coloradowildfirerisk.com/>
- (CRWCD 2000). Colorado River Water Conservation District. 2000. Yampa River Basin – Small Reservoir Study Phase 2 Report. Prepared by Montgomery Watson. August.
- (CWCB 2003). Colorado Water Conservation Board. 2003. Statewide Water Supply Initiative (SWSI).
- (CWCB 2004). Colorado Water Conservation Board. 2004. Statewide Water Supply Initiative (SWSI). November . Prepared by CMD. Access from: <http://cwcbweblink.state.co.us/WebLink/ElectronicFile.aspx?docid=144066&searchid=2c16c041-d0b2-4ec5-ac42-8b95aa0c04e3&dbid=0>
- (CWCB 2010a). Colorado Water Conservation Board. 2010. Memorandum to Eric Hecox and Jacob Bornstein (CWCB). Regarding Nonconsumptive Needs Assessment Phase II Update. Prepared by CDM.



- (CWCB 2010b). Colorado Water Conservation Board. 2010. Nonconsumptive Needs Assessment Focus Mapping Report. July. Access from: <http://cwcbweblink.state.co.us/weblink/0/doc/143889/Electronic.aspx?searchid=a05c7436-830c-490a-a93b-a24fe22bf46e>
- (CWCB 2010c). Colorado Water Conservation Board. 2010. State of Colorado 2050 Municipal & Industrial (M&I) Water Use Projections. July.
- (CWCB 2010d). Colorado Water Conservation Board. 2010. Updated Statewide Water Supply Initiative (SWSI).
- (CWCB 2011a). Colorado Water Conservation Board. 2011. Basin Needs Assessments.
- (CWCB 2011b). Colorado Water Conservation Board. 2011. Yampa-White Basin Needs Assessment Report.
- (CWCB 2011c). Colorado Water Conservation Board. 2011. SWSI 2010 Municipal and Industrial Water Conservation Strategies. January. Access from: <http://cwcb.state.co.us/water-management/water-supply-planning/documents/swsi2010/appendix%20lswsi%202010%20municipal%20and%20industrial%20water%20conservation%20strategies.pdf>
- (CWCB 2012). Colorado Water Conservation Board. 2012. Colorado River Water Availability Study (CRWAS), Phase I Report. March. Access from: <http://cwcb.state.co.us/technical-resources/colorado-river-water-availability-study/Pages/main.aspx>
- (CWCB 2013a). Colorado Water Conservation Board. 2013. Basin Implementation Plan DRAFT Guidance.
- (CWCB 2013b). Colorado Water Conservation Board. 2013. Non-consumptive Use Toolbox. March.
- (Garfield 2012). Garfield County. 2012. Garfield County Community Wildfire Protection Plan. Prepared by Walsh Environmental Scientists and Engineers, LLC. 2012. pg 63
- (Hamilton 2003). Hamilton, Amy. "Moffat County continues discussions over fire plan". August 18, 2003. Access from: http://www.craigdailynews.com/news/2003/aug/18/moffat_county_continues
- (Moffat 2004). Moffat County. 2004. Moffat County Community Wildfire Protection Plan. Prepared by ResourceLogic, LLC.
- (Peabody 2014). Peabody Trout Creek Reservoir, LLC. 2014. Peabody Trout Creek Reservoir Project, Routt County Colorado, FERC Project No. P-14446, Initial Study Report. June. Access at: <http://peabodytroutcreekreservoir.com/Documents.html>
- (RioBlanco 2012). Rio Blanco County. 2012. Rio Blanco County Community Wildfire Protection Plan Update. Prepared by Alpenfire, LLC.
- (Routt 2002). Routt & Moffat Counties, Yampa River Watershed 208 Plan, 2002: <http://routtcountycd.com/wp-content/uploads/2012/04/208-Plan-Final.pdf>
- (Routt 2010). Routt County. 2010. Routt County Community Wildfire Protection Plan (CWPP).
- (Steamboat 2008). City of Steamboat. 2008. Steamboat Water Supply Master Plan. Prepared by Stantec. November.
- (TNC 2012) Sanderson, J., B. Bledsoe, L. Poff, T. Wilding and N. Fey. 2012. Yampa-White Basin Roundtable Watershed Flow Evaluation Tool (WFET) study. Prepared by CDM Smith for The Nature Conservancy. – Access from: <http://www.conservationgateway.org/Files/Pages/yampawhitewfet.aspx>
- (US Census 2012). United States Census American FactFinder. 2012. Access from: <http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml>
- (USFS 2010). USDA Forest Service. 2010. Upper Yampa Phase 1 Watershed Assessment: Prioritization of Watershed-Based Hazards to Water Supplies. Prepared by JW Associates, Inc. May.



- (USFWS 2004). Roehm, G. W. 2004. Management plan for endangered fishes in the Yampa River Basin and environmental assessment. U.S. Fish and Wildlife Service, Mountain-Prairie Region (6). Denver. Accessed at: <http://www.coloradoriverrecovery.org/documents-publications/technical-reports/isf/yampa/YampaPlan.pdf> Access on: April 2, 2014.
- (USFWS 2005a). US Fish and Wildlife Service. 2005. Final Programmatic Biological Opinion on the Management Plan for Endangered Fishes in the Yampa River Basin. Memorandum to: Assistant Regional Directors, Ecological Services, Region 6. From: Regional Director, Region 6 Fish and Wildlife Service.
- (USFWS 2005b). US Fish & Wildlife Service. 2005. Final Programmatic Biological Opinion on the Management Plan for Endangered Fishes in the Yampa River Basin. January. Access from: <http://www.riversimulator.org/Resources/USFWS/BOyampa.pdf>
- (USFWS 2005c). US Fish & Wildlife Service. 2005. Operation of Flaming Gorge Dam Final Environmental Impact Statement, Final Biological Opinion, September. Accessed at: <http://www.riversimulator.org/Resources/USFWS/BOflamingGorge2005.pdf>
- (USFWS 2013a). US Fish & Wildlife Service. 2013. Information on the forthcoming USFWS Programmatic Biological Opinion for the White River accessed July 9, 2014: <http://www.onthecolorado.org/articles.cfm?mode=detail&id=1383319405772>
- (USFWS 2013b). US Fish & Wildlife Service. 2013. COLORADO RIVER RECOVERY PROGRAM Project #:168 FY 13-15 SCOPE OF WORK for White River Management Plan, August: <http://www.coloradoriverrecovery.org/documents-publications/work-plan-documents/sow/14-15/isf/168.pdf>
- (USGS 2002). USGS. Baseline characterization of water quality and mass loading in Piceance Creek, Rio Blanco County, Colorado, December 2000, USGS Water-Resources Investigations Report: 2002-4134, <http://pubs.er.usgs.gov/publication/wri024134>
- (USGS 2004). USGS. Summary of Sediment Data from the Yampa River and Upper Green River Basins, Colorado and Utah, 1993–2002. Scientific Investigations Report 2004–5242, <http://pubs.usgs.gov/sir/2004/5242/pdf/SIR2004-5242.pdf>
- (USGS 2009). Clark, M.L., and Davidson, S.L., 2009, Specific conductance and dissolved-solids characteristics for the Green River and Muddy Creek, Wyoming, water years 1999–2008: U.S. Geological Survey Scientific Investigations Report 2009–5168, 18 p.
- (USGS 2009). USGS. Specific Conductance and Dissolved-Solids Characteristics for the Green River and Muddy Creek, Wyoming, Water Years 1999–2008, U.S. Geological Survey Scientific Investigations Report 2009–5168, <http://pubs.usgs.gov/sir/2009/5168/>
- (USGS 2011). USGS. Characterization of Hydrodynamic and Sediment Conditions in the Lower Yampa River at Deerlodge Park, East Entrance to Dinosaur National Monument, Northwest Colorado, 2011, Scientific Investigations Map: 3273, <http://pubs.usgs.gov/sim/3273/>
- (USGS 2012a). USGS Colorado Water Science Center, Comparison of 2011-12 water years and historical water-quality data, White River Basin, Colorado, http://co.water.usgs.gov/infodata/white_summaries/index.html
- (USGS 2012b). USGS Colorado Water Science Center, Comparison of 2011-12 water years and historical water-quality data, White River Basin, Colorado, Sampling locations by Station number and Station name in lower Yampa Basin, http://co.water.usgs.gov/infodata/yampa_summaries/html/Sites.html
- (USGS 2012c). USGS Grand Canyon Monitoring Research Center, Green River above Gates of Lodore, Colorado, http://co.water.usgs.gov/infodata/white_summaries/index.html
- (USGS 2012d). USGS WaterSMART—The Colorado River Basin Focus-Area Study Fact Sheet 2012-3114, September 2012: <http://pubs.usgs.gov/fs/2012/3114/>
- (USGS 2012e). USGS, Water-Quality Assessment and Macroinvertebrate Data for the Upper Yampa River Watershed, Colorado, 1975 through 2009; USGS Scientific Investigations Report 2012-5214: <http://pubs.usgs.gov/sir/2012/5214/>



- (USGS 2012f). USGS. 2012. Comparison of 2011–12 water years and historical water-quality data, White River Basin, Colorado, http://co.water.usgs.gov/infodata/white_summaries/index.html
- (USGS 2013). Thomas, J.C., Moore, J.L., Schaffrath, K.R., Dupree, J.A., Williams, C.A., and Leib, K.J., 2013, Characterization and data-gap analysis of surface-water quality data in the Piceance study area, western Colorado, 1959–2009: USGS Scientific Investigations Report 2013–5015, 74 p. <http://pubs.usgs.gov/sir/2013/5015/>
- (UYWCD 2013). Upper Yampa Water Conservancy District. 2013. Basin Hydrology Report, Upper Yampa River Basin Master Plan Modeling Study. Prepared by AMEC. January. Historical observation at Maybell 1909–2002: p A-5, Table C.1.
- (YWG BRT 2010). Yampa/White/Green Basin Roundtable. 2010. Agricultural Water Needs Assessment Study. Study conducted by CDM. December. Access from: <http://cwcbweblink.state.co.us/WebLink/0/doc/155776/Electronic.aspx?searchid=aa2fb556-c075-4ddd-bc30-ffadd57830af>
- (YWG BRT 2014). Yampa/White/Green Basin Roundtable. 2014. Yampa/White/Green Projects and Methods (P&M) Study. Study conducted by CDM. Access from: http://cwcb.state.co.us/water-management/basin-roundtables/Documents/YampaWhite/YampaWhiteProjectsMethodsStudy_DraftFinal02272014.pdf



APPENDIX A

PROJECTS AND METHODS STUDY OVERVIEW



Table of Contents

Appendix A	PROJECTS AND METHODS Study overview	A-4
A.1	Overview of YWG Studies	A-4
A.2	Introduction to the P&M Study	A-5
A.3	Hydrology	A-7
A.4	Sector Demands and Shortages	A-7
A.4.1	M&I	A-7
A.4.2	SSI	A-9
A.4.3	Agriculture	A-11
A.4.4	Environmental and Recreational	A-13
A.5	Summary of IPPs in the P&M Study	A-15



List of Figures

Figure A-1 Elements of the Model Scenarios	A-6
--	-----

List of Tables

Table A-1 Previous Studies	A-4
Table A-2 Model Scenarios	A-6
Table A-3 Baseline and Future M&I Demands	A-7
Table A-4 Node-based M&I Demand Locations	A-8
Table A-5 Example of Scaling Approach to Develop Future M&I Demands by Node	A-8
Table A-6 Risk Levels for the Flow-Ecology Metrics	A-15
Table A-7 IPPs modeled in the P&M Study	17



APPENDIX A PROJECTS AND METHODS STUDY OVERVIEW

The State and YWG Basin has conducted a series of recent studies to develop a better understanding of their consumptive, environmental and recreational needs in the basin. The BIP draws from these planning efforts to provide a comprehensive overview of the YWG Basin's current and future water needs and the actions necessary to meet such needs. This appendix introduces the previous studies conducted and provides a comprehensive overview of the P&M Study, which is the most recent study conducted by the YWG Basin and the primary study used to inform the BIP.

A.1 Overview of YWG Studies

Table A-1 provides a summary of the basin-wide studies conducted for the YWG Basin since the initial SWSI in 2003. These studies encompass assessments of current and future M&I, energy, agriculture, environmental and recreational needs, and the modeling exercises conducted to evaluate water supply shortages, future water supply projects, climate change and impacts to instream flows.

Table A-1 Previous Studies

Year Study Completed	Study	Summary
2004	SWSI	Identified Colorado's current and future water needs and examined a variety of approaches Colorado could take to meet those needs. SWSI implemented a collaborative approach to water resource issues by establishing SWSI roundtables. SWSI focused on using a common technical basis for identifying and quantifying water needs and issues.
2008	Energy Development Water Needs Assessment Phase I	Developed future demand estimates through the 2050 planning horizon for the oil shale, natural gas, coal, and uranium energy sectors.
2010	Updated SWSI	Updated the original SWSI to include new data and develop projections through a future planning horizon of 2050.
2010	Nonconsumptive Needs Focus Mapping Report	Development of environmental and recreational focus maps and attribute tables to further characterize the environmental and recreational needs within the State's Basins.
2011	Basin Needs Assessments	Summarizes information developed through the SWSI process for the YWG Basin.
2011	Energy Development Water Needs Assessment Phase II	Updated the oil shale demand from the Phase 1 Energy Development Water Needs Assessment.
2011	Yampa/White Agricultural Water Needs Assessment Report	Refined and updated previous estimates of current agricultural uses and supplies, evaluated future agricultural demands, assessed climate change and energy development sector impacts on agricultural water availability, and developed alternatives to satisfy shortages.
2012	Colorado River Water Availability Study	Provides a common platform to determine consumptive and nonconsumptive uses throughout the western slope. StateMod models developed under the CDSS for the Colorado River main stem, Gunnison River, Dolores/San Juan/San Miguel Rivers, and the YWG Rivers were used in the development process. Current demands, operations, and historical hydrology as well as a suite of climate change demands and hydrologies were used to determine the current and potential future state of water availability along the western slope of Colorado.



Year Study Completed	Study	Summary
2012	Yampa-White Basin Roundtable Watershed Flow Evaluation Tool Study	Applied ecology-flow metrics to identify environmentally and recreationally significant areas and determine the risk levels associated with those areas. The associated risk metrics characterize the impacts of increased water use within the basin on trout, warm water fish, cottonwoods and boating.
2013	CWCB Nonconsumptive Use Toolbox	Provides a framework to evaluate existing information and identify opportunities and challenges regarding implementation of environmental and recreational projects.
2014	YWG Projects and Methods Study (Draft Final February 27, 2014)	Evaluates the M&I, energy, agricultural and environmental and recreational needs and shortages in the YWG Basin using the StateMod model.
2014	Yampa Basin Alternative Agricultural Water Transfer Methods Study	Identified several locations where alternative agricultural transfer methods meeting the needs of both the environment and consumptive uses could be implemented. These temporary water leasing arrangements could offer substantial benefit to both consumptive and nonconsumptive interests if their associated challenges can be overcome.
2014	Energy Development Water Needs Assessment Update Phase III	Assess current and projected energy water demands provided in the Phase I and Phase II Energy Development Water Needs Assessment. Where appropriate, estimates will be revised to reflect the most up-to-date data trends. Emphasis is placed on updating the natural gas and oil shale demands.

A.2 Introduction to the P&M Study

The P&M Study was the primary study used to inform the BIP regarding future water supplies, demands, and shortages including projections of demands and alternative hydrologic conditions. It was conducted by the YWG BRT to:

- Develop a common understanding of consumptive, recreational and environmental water needs in the Yampa-White Basin.
- Analyze river operations of the Yampa and White Basins, including alternative model scenarios.
- Evaluate water right priorities of Statewide SWSI Alternatives relative to those of the YWG Basin.

The study used the StateMod modeling platform which is Colorado's water allocation model maintained by CDSS. StateMod is the water allocation model in CDSS that is used for the primary purpose of modeling water rights and allocating water to those rights. StateMod uses strict prior appropriations (i.e., first in time, first in right) to model diversions. The model was initially developed in 1994 and has been continually updated as new studies and data becomes available. The 2009 release for both the Yampa and White basins were used for this study. The model uses a monthly time-step. A variety of previous studies were used to inform the modeling effort.

The P&M Study evaluated baseline conditions and six modeling scenarios. As shown in Figure A-1, these scenarios consist of a combination of demands, hydrology and the presence of IPPs. The demand inputs include the current and future 2050 water needs for the M&I, energy, agriculture, environment and recreation sectors at specific modeling nodes in the StateMod model. Information on how the demands were developed for each of these sectors is summarized below. The P&M Study results present the average annual water shortages or flow risks at each of the respective StateMod nodes and for each of the sectors both in tables and spatial figures.



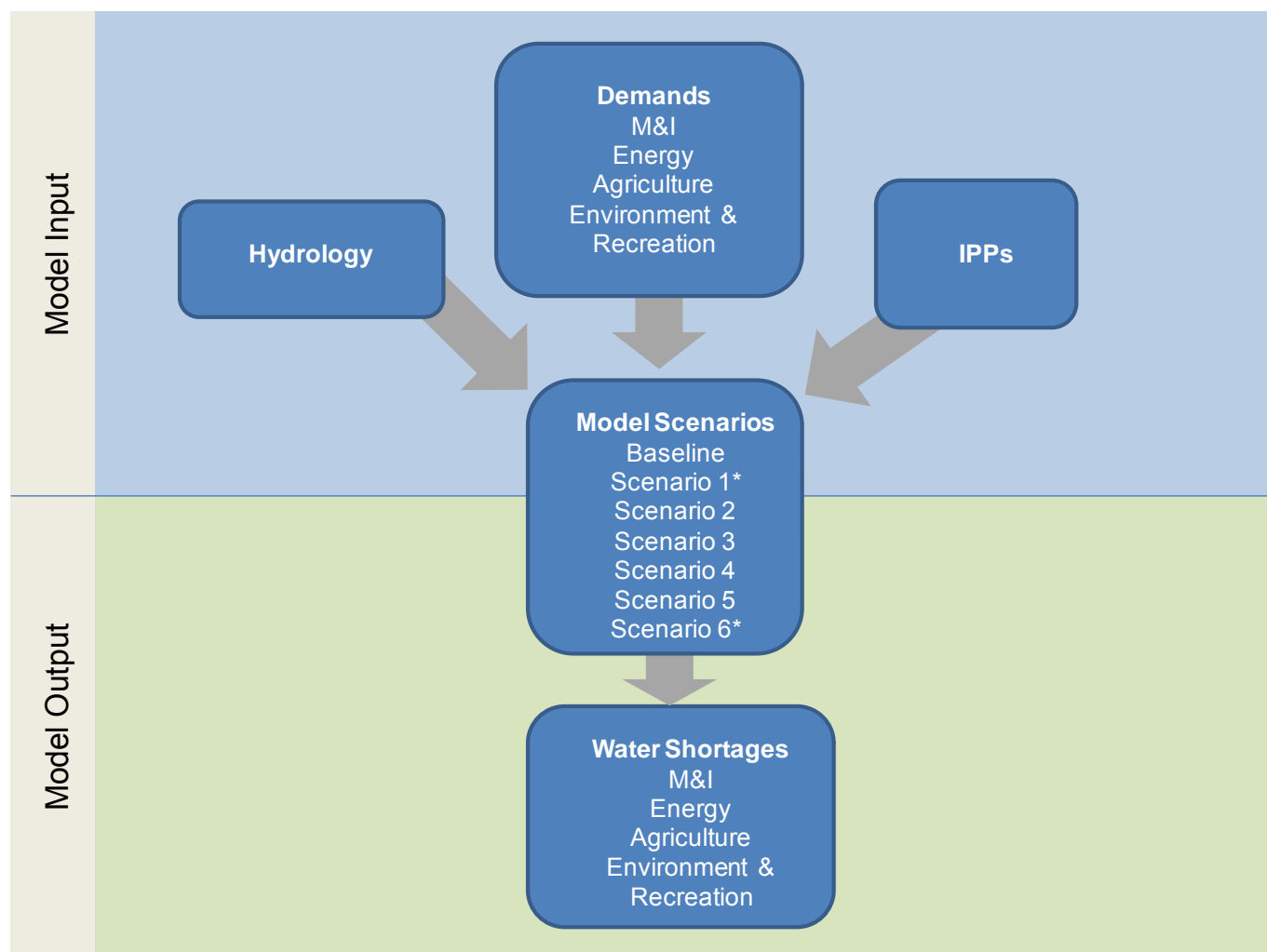


Figure A-1 Elements of the Model Scenarios

Table A-2 shows the elements for each of the respective scenarios. The modeled baseline (current) represents current conditions and operations. This includes all existing reservoirs, water rights, imports, diversions, and return flows while incorporating the historical hydrology and climate over the period 1950 through 2005. It provides a means to compare the other scenarios (e.g., supply projects, climate change, new demands, etc.). Scenarios 1, 2, and 3 were selected during the July 17, 2013 YWG BRT technical subcommittee meeting. Scenarios 4, 5, and 6 were selected after the results from the first three scenarios were presented during the October 3, 2013 YWG BRT subcommittee meeting. These scenarios incorporate a range of demands, hydrology types and means to assess the implications of whether new IPPs are implemented.

Table A-2 Model Scenarios

BIP Scenario	Nomenclature in the P&M Study	Hydrology	Demands	IPPs
Baseline	Baseline	Historical	Existing demands	No IPPs Selected
Dry Future IPP Scenario	Scenario 1	Dry	High	All IPPs Selected
Dry Future Scenario	Scenario 6	Dry	High	No IPPs Selected



The baseline condition and Dry Future IPP Scenario and Dry Future Scenario were selected for further evaluation in the BIP. These scenarios entail high demands and the dry hydrology which provides a conservative planning framework to best guarantee that the YWG Basin can meet their future water needs. The remainder of this appendix provides detailed information on the demands, hydrology and IPPs used in both the P&M Study and BIP.

A.3 Hydrology

Three 56-year sequences of climate adjusted hydrology (based on the historical records from 1950 to 2005) were selected for both the Yampa and White Basin StateMod P&M modeling effort. The CRWAS final report provides details on the development of these hydrology sequences. The hydrology sequences were selected from seven of the original ten climate change hydrology scenarios used in the CRWAS study.^{1,2} For both the Yampa and White Basins, a wet, average and dry-year hydrology was selected for simulation using the YWG Basin's StateMod models. These three hydrology sequences represent the following scenarios:

- Wet hydrology - more water exists in the future than historically
- Average hydrology - average annual flows most similar to historical flows
- Dry hydrology - less water exists in the future than historically.

The hydrology sequences were selected based on the mean annual volume of water at the Maybell (USGS ID 09304500) and Meeker (USGS ID 09251000) gages for the Yampa and White Basins, respectively. The hydrology with the greatest volume of water was selected as the wet hydrology, the hydrology with the smallest total volume was selected as the dry hydrology and the hydrology closest to historical conditions was selected as the average hydrology.

A.4 Sector Demands and Shortages

A.4.1 M&I

Baseline and Future Needs

The YWG Basin BIP Subcommittee chose the high demand, low supply scenario from the P&M Study to be analyzed for the BIP. Table A-3 presents the SWSI 2010 and Basin Needs Assessment Report county-level M&I population and needs for baseline conditions and the future high demand level which reflects expected increases in population. The high economic growth scenario includes a 550,000 barrel per day oil shale industry; therefore, the population in the YWG Basin is expected to more than triple by the year 2050 under this scenario.

Table A-3 Baseline and Future M&I Demands

County	Baseline Population	Baseline Water Demand (AFY) 2008	Future Population 2050 High	Water Demand with Passive Conservation (AFY) 2050 High
Moffat	14,600	3,200	31,000	6,400
Rio Blanco	6,700	2,000	59,000	17,000
Routt	23,800	6,500	63,000	16,000
Total	45,100	12,000	153,000	39,000

Source: Yampa-White Basin Needs Assessment Report, 2011; SWSI, 2010

¹ This did not include paleo records because such records were not available for the White River.

² CRWAS, 2012



To evaluate baseline conditions and the six modeling scenarios for M&I demands in StateMod, the P&M Study took these county-level demands projected out to 2050 and applied them to specific model nodes using a variety of methods depending upon data availability. In general, the follow approach was taken:

- Major M&I demand areas: demands and water rights, historical use and reservoir data for population centers were explicitly modeled , e.g., Craig
- Minor M&I demand areas: demands were aggregated together for the entire basin into one location, e.g., existing M&I demand for Water District 55 (Little Snake River) was grouped and modeled on the Little Snake River in Moffat County (55_AMY003)

This methodology resulted in 9 aggregate M&I nodes in the YWG Basin as shown in Table A-4.

Table A-4 Node-based M&I Demand Locations

Diversion Name	Basin/Stream (Water District)
	Moffat County
Craig Water Supply Plant (440581)	Lower Yampa (44)
District 44 Aggregate Existing M&I (44_AMY001)	Lower Yampa (44)
District 55 Aggregate Existing M&I (55_AMY003)	Little Snake (55)
	Rio Blanco County
Rangely Water (430889)	White (43)
Meeker Demand (950810)	White (43)
District 43 Aggregate Existing M&I (43_AMW001)	White (43)
	Routt County
District 57 Aggregate Existing M&I (above Craig) (57_AMY001)	Middle Yampa (57)
District 58 Aggregate Existing M&I (Steamboat Springs) (58_AMY001)	Upper Yampa (58)
Fish Creek Municipal Intake (580642)	Upper Yampa (58)

Source: P&M Study, 2014

To represent baseline conditions on a monthly basis, the P&M Study indicates it used a 12-month demand pattern reflecting average demands from historical periods, e.g., demands from the Town of Craig are averaged over the period 1999 to 2004. However, it is not clear how this approach relates to the SWSI 2010 and the Basin Needs Assessment Report data, or if demands for other M&I nodes were developed from other historical periods. To evaluate future consumptive M&I demands for 2050, low, medium, and high demands were split up by county into their respective existing M&I demand nodes. A “driver multiplied rate of use” approach was used to develop the low, medium and high demands which considered factors from SWSI such as job growth and estimated population. Node demands were scaled up in proportion to the projected growth of basin-wide, or county-wide demands. An example of this scaling approach is provided in Table A-5.

Table A-5 Example of Scaling Approach to Develop Future M&I Demands by Node

Node	Baseline Demands (AFY)	Future Demands* (AFY)
1	100	200
2	900	1,800

*Future total county demands = 2,000 AFY (node 1 = 10% or 200 AFY; node 2 = 90% or 1,800 AFY)



The future M&I demand estimates include passive conservation which mainly reflects water demand reductions due to policy measures such as those requiring manufacture of more efficient toilets, washing machines and dishwashers and the subsequent installation, or retrofit, of these appliances into existing housing and commercial buildings.

Shortages

Future M&I shortages are evaluated in the BIP by assessing the Dry Future IPP and Dry Future Scenarios which both reflect high demand, low water supply scenarios. The results for the updated BIP modeling effort are presented Chapter 3.. The IPPs presented in the P&M Study do not include augmentation for existing M&I demands.

A.4.2 SSI

Similar to previous reports, the P&M Study evaluated consumptive water demands for thermoelectric power generation and energy development separately. However, it did not evaluate large industrial as a separate category as previous reports have. A discussion for each of these categories follows based on results from the P&M Study.

Thermoelectric Power Generation

Baseline and Future Needs

Since thermoelectric power demands are related to needs of the population served, it will trend in a similar manner to changes in population, i.e., M&I demands. The BIP presents the high demand, low supply scenario results from the P&M Study.

Using a methodology similar to the M&I demands, thermoelectric power generation demands were modeled explicitly in the P&M Study by representing each existing thermoelectric power generation facility - Craig Station in Moffat County and Hayden Plant in Routt County - as a specific model node. All thermoelectric demand for Moffat County was applied to Craig Station and similarly all demand for Routt County applied to Hayden Plant since only one plant exists in each county. Consequently, this approach assumes these facilities will meet all future power generation needs and that no new plants will be required. Both plants have redundant water supplies in addition to their more junior water rights with in the form of releases from Steamboat Lake (Hayden Plant), Stagecoach Reservoir (Craig Station), and Elkhead Reservoir (Craig Station), and since no flows return back to the stream, both plants are modeled as fully consumptive.

Since Craig Station has three units that are supplied by both Stagecoach Reservoir (unit 1) and Elkhead Reservoir (units 1 and 2), the P&M Study modeling effort split Craig Station into two separate nodes; one representing units 1 and 2 and the other representing unit 3. This was done due to limitations with the model in order to accurately reflect the even split in demand that each unit has, i.e., each unit comprises one-third of the total Craig Station demand. In the model, Elkhead Reservoir makes releases to the first node with two-thirds of the demand (units 1 and 2) and Stagecoach Reservoir makes releases to the second node with one-third of the demand (unit 1).

Shortages

To evaluate future shortages, the Dry Future IPP and Dry Future Scenarios model thermoelectric power generation demand using redundant water supplies from Steamboat Lake for the Hayden Plant and Elkhead and Stagecoach Reservoirs for Craig Station. Updated modeling results for the BIP are presented in Chapter 3.



Energy Development

Baseline and Future Needs

The potential for energy resource development in northwest Colorado has driven specific studies to be completed to analyze the baseline and future water requirements of the industry. As mentioned in Chapter 2, three phases of the Energy Development Water Needs Assessment have been completed. Water needs related to the coal, oil shale, natural gas and uranium mining energy sectors have been developed for the following three components:

- Direct Water Demands: include the water required for the construction, operation, production, and reclamation needed to support the energy extractions and development processes
- Indirect Water Demands: water demands that result from the increase in the region's population due to the energy development and production
- Thermoelectric Power Generation Demands: energy development direct water demands are tied closely to increases in thermoelectric power generation demands, i.e., increased mining typically requires an increase in electrical needs and subsequently an increase in thermoelectric power generation water demands.

Indirect water demands have already been considered in the M&I demands discussed above from SWSI 2010 and the Basin Needs Assessment Report because they reflect the demands associated with an area's population, i.e., population growth directly attributable to the energy sector workforce. Similarly, the related impact on thermoelectric power generation demands due to increased energy workforce population are included in the demands for Craig Station and the Hayden Plant. Direct water demands associated with energy demand are in a separate category and were evaluated in Phase I and II of the Energy Development Water Needs Assessments. Phase II continued the work performed in Phase I of the study and calculated low, medium, and high demand projections for short-term, mid-term, and long-term planning horizons.

The recently completed Energy Development Water Needs Assessment Study Phase III reviewed and updated the direct water uses for energy development. The Phase III study carries forward the Phase I water use estimates for the coal and uranium sectors (because there is no new information or development prospects in those sectors) and updates water use estimates for the oil shale and oil and gas sectors. Since the Phase II report was published, both Chevron and Shell have ended their oil shale research projects in Colorado. The National Oil Shale Association markedly reduced water use estimates mainly because the large in situ projects proposed by Chevron and Shell were discontinued. Therefore, the Phase III reports new water use estimates for oil shale. Additionally, the Phase III report updates the direct water uses associated with oil and gas well drilling and completions since new information on drilling activity and resource development planning is available since 2008.

Natural Gas

The majority of natural gas related water demands are due to the hydraulic fracturing process (fracking). However, the P&M Study indicates that because water for fracking is typically sourced from areas that would not affect existing or future direct diversions, e.g., water from another state, leased or purchased irrigation water, treated or raw water leased or purchased from a municipal water provider, etc., water demands related to natural gas production was not included in the P&M Study. Further, the process only occurs at the beginning of natural gas well installation; therefore permanent water rights are not necessary. However, water supplies for drilling and well completion will in part be sourced via direct diversions. The Energy Development Water Needs Assessment Phase III updated the natural gas estimates and added additional oil demands.

Uranium

Coupled with small water demands even at the high production level and uncertain future locations, uranium mining was not included in the P&M Study or updated BIP modeling.



Coal

Water demands associated with coal mining are difficult to estimate because they are economically driven and therefore may occur in varying levels at existing locations or at a completely new location. As a result, locations for coal development were indistinct in the Energy Development Water Needs Assessment. More refined information was since made available, and subsequently used in the P&M Study, in the Peabody-Trout Creek Project Study. This study evaluated a water supply project on Trout Creek upstream of the confluence with the Yampa River to help Peabody Energy meet 6,000 AFY of energy development demands as part of the Peabody-Trout Creek Project³.

Oil Shale

The Phase II Energy Development Water Needs Assessment focused on the supply availability of oil shale development, with production mainly occurring in the Piceance Creek area in the White Basin. For the 110,000 AFY demand level for the high production scenario, Piceance Creek cannot reliably provide enough water to consistently meet the demand. As a result, water would need to be sourced elsewhere, including from storage and undecreed water right diversions. Three StateMod water allocation modeling scenarios were developed as part of the Phase II study to determine feasible supply options and are discussed further in the IPP section below.

Recently, the certainty of oil shale development in northwest Colorado has changed with research activities slowing and even completely stopping, e.g., Shell Energy in Rio Blanco County. Due to the lower likelihood that an oil shale industry will develop in the area, at least at the previously projected level, the Energy Development Water Needs Assessment Phase III updated the oil shale water demands.

Shortages

The P&M Study and updated BIP modeling does not assess shortages to the energy development industry.

A.4.3 Agriculture

Irrigation Demands

The YWG Basin's P&M Study and Agricultural Water Needs Study relied upon the same estimates of irrigation demands in the YWG Basin. The irrigation demands were developed using the CDSS 1993 coverage,⁴ historical diversion data and the CDSS consumptive use model called StateCU. Groundwater use for irrigation is relatively minor when compared to surface water diversions in the YWG Basin and is not considered in the modeling. The StateCU model was used to estimate the IWR using the modified Blaney-Criddle method. For application with StateMod, the IWR was divided by the irrigation efficiency corresponding to each respective diversion structure (i.e. model node) to determine the irrigation water demand diverted from the stream at the diversion structure.^{5,6} The irrigation water efficiencies were limited to a minimum of 30 percent and a maximum of 50 percent which were assumed to be reasonable efficiencies in the rugged mountain environment. This approach allows IWR to drive demands instead of historical diversions and enables various levels of irrigation demands to be modeled. The

³ It is being clarified how these demands were modeled and if they are in addition to those scaled up from SWSI 2010.

⁴ The State of Colorado developed a year 2000 irrigated acreage coverage, but CWCB staff indicated that this coverage is not as reliable as the 1993 coverage and recommended using only the 1993 acreage (meeting with CWCB staff, May 2009). Additionally, a 2005 irrigated acreage coverage has also been developed by CWCB, however, since the period of record of the study ends in 2005, this coverage has not been included in the CDSS models at the time of this study.

⁵ Average monthly structure efficiencies were calculated using the baseline scenario where the diversion structure efficiencies equaled the historical IWR divided by the historical water demand at the diversion structure ($IWR/Demand_{historical}$).

⁶ The irrigation demands for the baseline scenario were calculated as the maximum of the recorded historical diversion at the diversion structure or the StateCU generated IWR divided by the irrigation efficiency. Irrigation demands for all other scenarios were simply based on the IWR divided by efficiency.



irrigation demands presented in Chapter 2 of the BIP represent the irrigation demands at the diversion structure/model node.

For StateMod modeling purposes, the P&M Study used 43 nodes to represent all of the agricultural demands in the YWG Basin. Diversions greater than 5 cfs in the Yampa and 4.8 cfs in the White, were explicitly modeled. Diversions with decreed rates less than the aforementioned rates were aggregated with other diversions of a similar rate that were in the same drainage upstream of the nearest baseflow node. Nodes were also disaggregated where necessary to differentiate diversions specifically located on a modeled stream (A- aggregates) and tributaries (B- aggregates) to the modeled stream. Conceptually the irrigation demand at the B-aggregate nodes is limited to the amount of water physically available in the tributary. For purposes of modeling, this was assumed to be the maximum historical diversions at these nodes. Therefore it was assumed that the irrigation demands at the B-aggregates could not exceed the historical diversions at each respective node.

The high demand scenarios (Dry Future IPP and Dry Future) include the development of 14,805 acres of irrigation land on the Oxbow of the Yampa River. The oxbow diversions were treated as an aggregated agricultural diversion at the downstream end of the modeled reach with a 2013 junior water right.⁷ These additional demands were estimated using the StateCU model. However, the SWSI estimates of irrigation reductions discussed in Section 2.3.2, were not included in the P&M Study, given the uncertainty on the magnitude and location of reductions. Such estimates include a reduction of 1,000 to 2,000 acres as a result of urbanization in 2050 and a reduction in 3,000 to 64,000 acres due to transfers to address the M&I gap.

The StateCU and StateMod models were refined to include the Denver Water High Altitude crop coefficients for pasture grass/hay fields above 6,500 feet. In order to be consistent with CRWAS and common State Engineer Office practices, an elevation adjustment of 10% per 1,000 meters above sea level was made for all crops. When compared to previous SWSI IWR estimates, the IWR requirement increased by 54 percent basin-wide when the high –altitude coefficient for the grass/hay was included and by 65% when the elevation adjustment and high altitude crops were incorporated.

Irrigation Shortages

StateMod calculates the following types of irrigation shortages:

- Total/diversion shortages (at the headgate) - Difference between the irrigation demand at the diversion structure (model node) and the amount of water physically and legally available in the stream.
- Consumptive use shortage at the place-of- use - Difference between IWR and the amount of water actually diverted and multiplied by the diversion's maximum application efficiency. This represents the difference between the amount of water required to meet the crop irrigation requirement and the amount of water delivered to the crops.

For purposes of this BIP, the shortages are reported at the diversion point on the stream as opposed to the P&M Study which presented the shortages at the place-of-use. These shortages include losses and inefficiencies incurred from the point of diversion to the user end use. This provides a more direct means in evaluating the need for new IPPs by showing the demand/shortage directly incurred on the stream.

⁷ The Agricultural Water Needs Study modeled the base flows resulting from existing irrigation and storage as senior to any new water rights for diversions to supply this expanded acreage (p. 5-28). This modeling was consistent with the hydrologic analysis for the Yampa PBO that relied on the continued availability of such existing base flows in setting the targets at the Maybell gage with access to only 7,000 AF of augmentation releases from an enlarged Elkhead Reservoir. The P&M Study did not use this approach. This is discussed in further detail below.



A.4.4 Environmental and Recreational

The YWG Basin evaluated the recreational and environmental needs in the YWG Basin through the P&M Study and WFET. The WFET provides series of criteria to quantitatively measure and compare environmental and recreational flow risks based on existing and modeled flow conditions in the Yampa and White Basins. This methodology is incorporated into the P&M Study to assess environmental and recreational risks associated with the P&M Study model runs.

The P&M Study specifically addresses the target at the Maybell gage for augmenting existing base flows to assist in endangered fish recovery,⁸ and instream flow shortages, and incorporates a series of risk-based ecology and flow relationship metrics to assess how current and potential future flows could impact the ecology and boating at specific locations within the YWG Basin.

Instream Flows and RICDS

The instream flows and Steamboat RICD is operated in very similar manner in the StateMod model. Figure 2-10 shows the decreed instream flows within the YWG Basin and the instream flows modeled for the P&M Study. Only 30 of the 38 decreed instream flow reaches are modeled using the existing StateMod Yampa and White models. Instream flow and RICD rights are generally administered at a designated DWR or USGS gage. StateMod simulates instream flows and RICDs using the following criteria.

- Flows are calculated at the upstream and downstream terminus of the instream flow/RICD reach as well as at each intervening structure between the two ends.
- If the instream flow/RICD is in priority, it calls out junior diversion(s) upstream of the lower terminus and the model recalculates flows.
- If the instream flow is short, but has access to storage in a reservoir, releases are made (i.e. Steamboat Lake makes late season releases to Elk River and Willow Creek).

RICD and instream flow shortages are calculated as the difference between the decreed instream flow water right and the lowest flow within the reach.

Yampa Endangered Species Fish Flow Target

The P&M Study modeled the ability to meet the instream flow targets presented in Table 2-16. When flows at Maybell were below the targeted streamflows presented in Table 2-16, up to 50 cfs was released from the 5,000 acre-feet Elkhead Reservoir storage pool to meet the monthly flow targets at Maybell. In the modeling, releases from Elkhead Reservoir are dictated by flows at Maybell. If the flow target is being met at Maybell, but not along other areas of the reach, the model did not release more water from Elkhead Reservoir even though the flows are lower at other location(s) along the reach. This is consistent with how the PBO is currently operated for existing irrigation and storage. The specific operational criteria used by the model are summarized below.

- Releases are made from Elkhead Reservoir at a rate of up to 50 cfs until the permanent 5,000 acre-feet of CWCB storage is depleted.
- The model does not release water from Elkhead Reservoir if the flow target is being met at Maybell without releases. This occurs even if an existing diversion made downstream of Maybell causes the flow somewhere within the reach to fall below the target. This consistent with the way the operations of Elkhead Reservoir are written in the Yampa PBO for existing irrigation and storage. Releases are based upon the flow targets being met at the Yampa River gage at Maybell, CO.

⁸ The P&M Study did not address the rest of the rest of the flow regime that may be necessary for endangered fish recovery on this reach of the Yampa River, on the lower Little Snake, on the Yampa River in Dinosaur National Monument, and on the Green River. These flow needs were addressed by the WFET by replicating the full flow assessment of the existing and future depletions covered by the Yampa PBO.



- The model does not include the 2,000 acre-feet pool under the long-term, renewable lease.
- The model operates in such a manner where releases from Elkhead Reservoir are not diverted by any intervening water rights within the endangered species fish flow reach.⁹
- This flow augmentation in the Yampa PBO is based on existing storage and a current depletion of 125,271 acre-feet above the Little Snake River with a projected increase in depletion of 30,104 acre feet by 2045¹⁰. The P&M Study depletions estimates and new storage above the Little Snake River are significantly higher than this. Unlike the Agricultural Water Needs Study, the P&M Study awards new water rights and assumes the perfection of conditional water rights for diversions of base flows that the PBO relied on to meet the endangered fish flow targets at Maybell. Additional information on this topic is provided in Chapter 4.

Fisheries and Cottonwood Flow-Ecology Relationship Risks

The WFET developed a series of flow-ecology metrics to measure the ecological risk associated with decreased flows in the Yampa and White Basins. These metrics were originally applied as a pilot study in the Roaring Fork and Fountain Creek watersheds and have been updated for the Yampa and White Basins. The metrics are applied to 19 nodes shown in Figure 2-11 which encompass the focus areas shown in Figure 2-9. The metrics provide a means to assess the stream's ability to support trout, warm water fish and cottonwood populations using modeled streamflows relative to the natural flows of the stream prior to human development.¹¹

Trout Flow-Ecology Relationship

This relationship compares modeled monthly flows in August and September relative to the annual natural flows. The lower the percentage of average August and September flows, the higher the risk of a particular location. The relationship estimates the ability for a stream to support trout based on the following equation:

$$\text{Trout Flow – Ecology Relationship} = \frac{\frac{\text{Mean August } Q_{\text{Existing}} + \text{Mean September } Q_{\text{Existing}}}{2}}{\text{Mean Annual } Q_{\text{natural}}}$$

Warm Water Fish Flow-Ecology Relationship

The flow-ecology metric for native bluehead sucker and flannelmouth sucker fish is represented by the following equation:

$$\% \text{ maximum native sucker potential biomass} = 0.1025 \times 30 - \text{day min flow}^{0.3021}$$

The risk associated with Warm Water Fish Flow-Ecology metric is calculated as a relative percent change from natural conditions to existing conditions. This equation below represents the relative reduction in maximum native sucker potential biomass due to the impacts of development. The greater the relative reduction in maximum native sucker potential biomass, the higher the risk.

$$\text{Warm Water Fish Flow – Ecology Relationship} = \frac{\% \text{ maximum potential biomass}_{\text{Natural}} - \% \text{ maximum potential biomass}_{\text{Existing}}}{\% \text{ maximum potential biomass}_{\text{Natural}}}$$

⁹ As storage releases decreed for instream use, such releases cannot be diverted even by senior water rights, as noted above. Senior water rights can divert the underlying base flows, but have an established pattern of historic use that was factored into the hydrologic analysis for the PBO. Diversion of the underlying base flows by new water rights would undercut the hydrologic assumptions for the PBO, however, and make it difficult to keep the PBO in place.

¹⁰ The cooperative agreement implementing the management plan for the PBO also provides: “When the first increment of depletions in Colorado [of 30,104 acre feet] approaches full development, the impacts of developing a second increment [of 20,000 acre-feet] and the status of the endangered fish species at that time will be re-evaluated pursuant to the PBO for this Agreement to implement the Management Plan.”

¹¹ Source: Arthington et al, 2006.



Cottonwood Flow-Ecology Relationship

The WFET and P&M Study refer to the “cottonwood flow-ecology” metric as the “riparian flow-ecology” metric. This metric has been renamed for purposes of the BIP to reflect that the metric exclusively assesses cottonwood as opposed to other riparian species.

The cottonwood flow-ecology metric expresses the relationship between high peak flows under natural conditions relative to modeled flow conditions in April through June. The P&M Study assessed cottonwood abundance in unconfined settings in moderate-energy confined geomorphic settings and at elevations less than 8,700 feet. The flow metric for unconfined settings is based on the change in the 90 maximum flow in wet years between current and natural flows and is expressed as:

$$\% \text{ abundance} = 1.038 \times \% \text{ flow alteration} + 1.005$$

The WFET evaluated cottonwoods for two riparian types: 1) cottonwoods on low and moderate grade, meandering unconfined rivers and 2) moderate-gradient rivers in confined valleys or high-gradient rivers in unconfined valleys. The P&M Study does not incorporate the second riparian type because the metric relies upon daily flows which are not available using the StateMod model that is based on a monthly time step. Cottonwood abundance for unconfined conditions was used as a proxy for all locations evaluated for the cottonwood flow-ecology relationship.

Each of the metrics above produce a percentage which provides means to assess the risk levels of trout, warm water fish and cottonwood riparian habitat relative to natural conditions. The WFET assigned risk levels to the range of percentages shown in Table A-6. These risk levels were developed by The Nature Conservancy and members of the YWG Basin BRT.

Table A-6 Risk Levels for the Flow-Ecology Metrics

Metric	Low Risk	Minimal Risk	Moderate Risk	High Risk	Very High Risk
Trout Flow - Ecology Relationship	>55%	25% - 55%	15% - 25%	10% - 15%	<10%
Warm Water Fish Flow - Ecology Relationship	<10%		10% - 25%	25% - 50%	50% - 100%
Cottonwood Flow-Ecology Relationship	0% - 15%		15% - 30%	30% - 50%	50% - 100%

A.5 Summary of IPPs in the P&M Study

IPPs are strategies developed by water providers to assist in meeting future water supply needs that have been identified in previous studies for the YWG Basin. IPPs are grouped into the following categories:

- Permanent agricultural water transfers
- Reuse of existing fully consumable supplies
- Growth into existing supplies
- Regional in-basin projects
- New transbasin projects
- Firming in-basin water rights
- Firming transbasin water rights

The IPPs that were modeled as part of the P&M Study contained the following elements:

- Project Proponent – Acts as a source of information, i.e., reports, project stakeholder, etc.
- Location



- Physical Characteristics
- Permanent Operations
- Water Rights – Either conditional water rights, or new yet to be decreed water rights, were assumed as a proxy for new consumptive uses but not for new instream flow protection or restoration.

If the IPPs did not possess all of these elements, they were not modeled. These criteria excluded short or long-term water leases, other alternative transfer methods, and some optimized operations to avoid buying out and permanently drying up irrigated land and to improve stream flows. A summary of the IPPs modeled in the P&M Study is presented in Table A-7 below.



Table A-7 IPPs modeled in the P&M Study

Name	Type	Description	Location	Capacity	Storage Right	Operations	Additional Source
Little Bear 1 Reservoir	Reservoir	Little Bear I Reservoir was originally identified as part of the Yampa River Basin Small Reservoir Study – Phase 2 (Montgomery Watson 2000). It was one of three reservoirs carried forward from the Phase 2 study as a need was determined and upon a field visit, no fatal flaws were found. A location, capacity, and yield were determined as part of the study.	Yampa: Fortification Creek Basin	800 AF	No conditional storage rights, junior right assumed	Releases are made to three aggregate diversions (Node ID 440511, 440612, and 440688), which were identified as the three diversions to which Little Bear I Reservoir could release water as described in the Agricultural Water Needs Study.	
South Fork II Reservoir	Reservoir	South Fork II Reservoir was originally identified as part of the Yampa River Basin Small Reservoir Study – Phase 2. It was one of three reservoirs carried forward from the Phase 2 study as a need was determined and upon a field visit, no fatal flaws were found. A location, capacity, and yield were determined as part of the study.	Yampa: Fortification Creek Basin	1,700 AF	No conditional storage rights, junior storage right assumed	Releases are made to seven aggregate diversions (Node ID 440511, 440612, 440647, 440650, 440681, 440688 and 440998), which were identified as the seven diversions to which South Fork II Reservoir could release water as described in the Agricultural Water Needs Study.	
Monument Butte Reservoir	Reservoir	Monument Butte Reservoir was originally identified as part of the Yampa River Basin Small Reservoir Study	Yampa: Morapos Creek Basin	4,390 AF	No conditional storage rights, junior storage right assumed	Releases are made to four aggregate diversions (Node ID 440590, 440651, 440814, and	



Name	Type	Description	Location	Capacity	Storage Right	Operations	Additional Source
		– Phase 2 (Montgomery Watson 2000). It was one of three reservoirs carried forward from the Phase 2 study as a need was determined and upon a field visit, no fatal flaws were found. A location, capacity, and yield were determined as part of the study.				aggregate diversion 44_ADY016A), which were identified as the diversions to which Monument Butte Reservoir could release water to as described in the Agricultural Water Needs Study.	
Rampart Reservoir	Reservoir	Rampart Reservoir was originally identified as part of the Yampa River Basin Small Reservoir Study – Phase 2. Based upon preliminary field reconnaissance and subsequent screening, Rampart Reservoir was not recommended for further analysis due to being a historical area ¹² , sediment load, extent of dam, need to relocate Highway 13, and location on federal land (Bureau of Land Management). During the October 3, 2013 subcommittee meeting, Tom Gray suggested that due diligence was recently	Yampa: Lower Fortification Creek upstream of Wisconsin Ditch	12,133 AF	<ul style="list-style-type: none"> A first fill water right with administration number 41126.00000 and conditional storage of 12,133 AF A second fill water right with administration number 47905.00000 and conditional storage of 11,692 AF 	<ul style="list-style-type: none"> Since Rampart Reservoir is only located upstream of two potentially short water diversions (the oxbows aggregate diversion and Node ID 440511), releases are made to the oxbows aggregate diversion and Node ID 440511 The second set of operations for Rampart Reservoir is to exchange water upstream to South Fork II and Little Bear I The last set of 	

¹² Fortification Rocks are a historic landmark and were used as fortresses by Native Americans.



Name	Type	Description	Location	Capacity	Storage Right	Operations	Additional Source
		performed on a conditional storage right for Rampart Reservoir and that it should be considered as an IPP.				operations for Rampart Reservoir is to exchange water upstream to each individual diversion on Fortification Creek	
Peabody Trout Creek Reservoir	Reservoir	Peabody-Trout Creek Reservoir was identified as part of a supply project to meet energy development demands for the Peabody energy development demands described in Section 3.2.1.4. Modeling for the Peabody-Trout Creek Reservoir supply project was performed by ERC. A model was received from ERC and details of the modeling were clarified through personal communications (Thompson 2013).	Yampa: Trout Creek upstream of the confluence with the Yampa River	11,720 AF	A first fill water right with administration number 43575.00000 and conditional storage of 15,000 AF	The sole purpose of the Peabody-Trout Creek Reservoir is to meet the 6,000 AFY energy development demands (which do not have a direct diversion water right) that are also part of the Peabody-Trout Creek Project	
Milk Creek Reservoir	Reservoir	Details for Milk Creek Reservoir were discussed through personal communications with Tri-State Generation & Transmission Association (Chartrand 2013). Milk Creek Reservoir is part of a potential industrial supply project to meet future	Yampa: Milk Creek Reservoir upstream of the confluence with the Yampa River	70,000 AF	<ul style="list-style-type: none"> An existing conditional water right with a 1976 date of decree of 70,000 AF; however, this is only for industrial beneficial uses. At the request of the BRT subcommittee, Milk 	<ul style="list-style-type: none"> Similar to Rampart Reservoir, Milk Creek Reservoir cannot release to any water short diversions on upper Milk Creek; however, releases are made to the Yampa River oxbows 	<ul style="list-style-type: none"> Additional Source – Yampa River - Milk Creek Pipeline <ul style="list-style-type: none"> The Yampa River - Milk Creek Pipeline is also part of the Milk Creek Project. The Yampa River - Milk Creek Pipeline is used to fill Milk Creek Reservoir using water from the Yampa River.



Name	Type	Description	Location	Capacity	Storage Right	Operations	Additional Source
		energy development demands. Although Milk Creek Reservoir currently has storage rights for industrial beneficial uses only, the BRT subcommittee requested that Milk Creek Reservoir be modeled for both industrial uses and agricultural uses.			<p>Creek Reservoir was modeled for agricultural and industrial uses. For the Projects and Methods Study, this conditional right maintained its 1976 water right date, but the industrial storage was reduced to 35,000 AF.</p> <ul style="list-style-type: none"> The remaining 35,000 AF of storage is filled using an undecreed water right for agricultural uses. 	<p>diversion.</p> <ul style="list-style-type: none"> Milk Creek Reservoir also exchanges to all diversions upstream on Milk Creek if exchange capacity exists on the creek. No operations were defined for the industrial storage account 	<ul style="list-style-type: none"> The following characteristics were determined from case number 08CW86: the pipeline has a 400 cfs conditional water right (administration number = 45923.00000). However, this water right is for industrial beneficial uses only (similar to the storage right for Milk Creek Reservoir). The pipeline water right was also split in half to fill both storage accounts (industrial and agricultural). The industrial half retained its water right seniority, but the rate was reduced to 200 cfs. The agricultural portion uses an undecreed water right also with a 200 cfs rate.
Morrison Creek Reservoir	Reservoir	Details for Morrison Creek Reservoir were discussed through personal communications with UYWCD through their modeling team from AMEC (Musleh 2013). The modeling approach used to include Morrison Creek	Yampa: Morrison Creek	4,965 AF	There are two storage rights for Morrison Creek Reservoir, a first fill and a second fill. The first fill right has a 4,965 AF conditional water right (administration number = 41272.39991) and the second fill has a 5,655 AF	<ul style="list-style-type: none"> Releases to augment Stagecoach reservoir supplies Releases to Craig Releases to Walker Irrigation Ditch Releases to Mount Werner Water Releases are made 	<ul style="list-style-type: none"> Additional Source – Morrison Creek Pipeline <ul style="list-style-type: none"> A 50 cfs conditional water right (administration number = 52959.00000) above Morrison Creek Reservoir was studied by the UYWCD. The modeling received from AMEC that



Name	Type	Description	Location	Capacity	Storage Right	Operations	Additional Source
		Reservoir into the Projects and Methods model was directly derived from the modeling used in the UYWCD model sent via email (dated 7/26/2013). Morrison Creek Reservoir is part of a potential supply project to meet future demands in a similar manner to Stagecoach Reservoir.			conditional water right (administration number = 57676.00000).	<p>to Steamboat Wells A, G, and H from the "First Fill" pool</p> <ul style="list-style-type: none"> A bypass to the Willow Spring & Pond ISF 	was used in this study did not have any operations assigned and did not transfer water within the model.
Lake Avery Enlargement	Enlargement	The Lake Avery Enlargement was identified in the Energy Development Water Needs Assessment as part of the oil shale production supply system. The Lake Avery Enlargement is the secondary source of supply used in the oil shale production supply system (after direct diversions from the White River).	Expansion to Big Beaver Reservoir (Avery Lake)	48,274 AF + 7,658 AF (original capacity of Big Beaver Reservoir)	<ul style="list-style-type: none"> The purpose of the Scenario 2 and 3 models of the Energy Development Water Needs Assessment was to reliably meet oil shale production demands with rights junior to all other diversions in the YWG Basin. That methodology was also used in the Projects and Methods Study. Therefore it is modeled with an undecreed water right. The Lake Avery Enlargement is filled 	The only operation for the Lake Avery Enlargement is making direct releases to meet oil shale production demands	



Name	Type	Description	Location	Capacity	Storage Right	Operations	Additional Source
					both by a pipeline diverting water from the White River upstream of Big Beaver Creek and a direct storage right on Big Beaver Creek.		
Wolf Creek Reservoir	Reservoir	Wolf Creek Reservoir was identified in the Energy Development Water Needs Assessment as part of the oil shale production supply system. The Energy Development Water Needs Assessment recognized that under current conditions, oil shale production demands can be met using the other elements in the oil shale production supply system (Lake Avery Enlargement, Diversion from White River to fill Lake Avery, Direct Diversion from the White River (above Piceance Creek) to meet Oil Shale Demands). However, Wolf Creek Reservoir was used as an IPP in the model to demands under some of the Modeling Scenarios with drier hydrologies.	On the White River downstream of the confluence with Piceance Creek	162,400 AF	<ul style="list-style-type: none"> The purpose of the Scenario 2 and 3 models of the Energy Development Water Needs Assessment was to reliably meet oil shale production demands with rights junior to all other diversions in the YWG Basin. That methodology was also used in the Projects and Methods Study; therefore, it is modeled with a 2013 water right. The only water right Wolf Creek Reservoir uses to store water is an undecreed water right on the White River 	Water from Wolf Creek Reservoir is transported upstream via carrier to directly meet oil shale production demands.	



APPENDIX B

PUBLIC EDUCATION MATERIALS

AND PUBLIC COMMENTS



Table of Contents

Appendix B PUBLIC EDUCATION MATERIALS AND PUBLIC COMMENTS	B-2
Basin Implementation Plan Outreach Report July 2014 B-3.....	B-3
Public Review Press Release.	B-4
Public Comments Log	B-5
Future of Colorado Water Comments B-12.....	B-12
How to Save Water Comments.	B-14
Statewide Water Supply Initiative Comments	B-16
USGS Report on Sediment Transport and Water Quality Characteristics and Loads, White River, Northwestern Colorado, Water Years 1975-99.....	B-17
Input Document, Item #10 Public Comments to the YWG River Basins Roundtable	B-19
Input Document, Item #12 Public Comments from Yampa River System Legacy Partnership/America's Great Outdoors.....	B-22
Input Document, Item #48 Public Comments from Upper Yampa Water Conservancy District	B-28
Input Document, Item #74 Public Comments from Colorado Trout Unlimited.....	B-30
2014 Community Agriculture Alliance Water Policy Statement.....	B-35



To: Hanna Sloan
Engineer, AMEC

From: Marsha Daughenbaugh, Executive Director
Community Agriculture Alliance

Subject: Yampa-White-Green Rivers BIP Outreach Report

July 24, 2014

Basin Implementation Plan Outreach for Public Review and Input

Notification Included:

Print Ads in Craig Press and Steamboat Pilot

Radio Ads and PSAs on KRAI

Email postcards (for further outreach distribution) to:

Round Table members, three county + eight community governments, chambers of commerce,
CSU Extension offices, 36 different organizations in Moffat, Rio Blanco and Routt Counties

**YAMPA-WHITE-GREEN RIVERS BASIN ROUND TABLE
IS SEEKING PUBLIC INPUT ON THE
BASIN IMPLEMENTATION WATER PLAN**

The document can be found on the Colorado Water Conservation Board (CWCB) website at:
<http://www.colorado.gov/pacific/cowaterplan/yampa-white-green-river-basin>

Written comments may be submitted in any of the following ways:

1. Add comments to the documents from the CWCB website and email to hillary.king@amec.com by July 21 (preferable way)
2. Print, mark-up the documents, scan and email to hillary.king@amec.com by July 21
3. Email comments to hillary.king@amec.com by July 21
4. In Person: Round Table Meeting, Wednesday July 23, American Legion Hall, Craig; 6PM

The Yampa-White-Green Basin Implementation Plan will become a part of the Colorado Water Plan.
Information about the Colorado Water Plan can be obtained at the CWCB web link:
www.coloradowaterplan.com

Public review and input is encouraged and will be reviewed by the Yampa-White-Green Round Table at their October 15, 2014 meeting.

**YAMPA-WHITE-GREEN RIVERS BASIN ROUND TABLE
IS SEEKING INPUT ON THE BASIN
IMPLEMENTATION WATER PLAN**

The document can be found on the Colorado Water
Conservation Board (CWCB) website at:
www.colorado.gov/pacific/cowaterplan/yampa-white-green-river-basin

Written Comments may be submitted in any of the following ways:

1. Add comments to the documents from the CWCB website and email to hillary.king@amec.com by July 12 (preferred).
2. Print, mark-up the documents, scan and email to hillary.king@amec.com by July 21.
3. Email comments to hillary.king@amec.com by July 21
4. In Person: Round Table Meeting, Wednesday July 23, American Legion Hall, Craig; 6pm

The Yampa-White-Green Basin Implementation Plan will become a part of the Colorado Water Plan. Information about the Colorado Water Plan can be obtained at the CWCB weblink: www.coloradowaterplan.com

Yampa-White-Green BIP
Response to Public Comments Matrix

Commenter Name	Organization	Date received	Comment	Response to Comments	Change in Plan? Y/N	e-mail address
S. Foi		2/18/2014	Employ "trickle irrigation" around Routt Co.; create "run-off reservoirs" in areas in need of water; develop "greywater systems for underdeveloped areas"; create wetlands for migrating waterfowl and wildlife.			
Allen Hischke		2/20/2014	Attended Roundtable Meeting February 19, 2014. The best way to assure that Moffat Co. will have a good supply of water: 1) "conserve every drop that we can"; 2) eliminate the USFWS programs; 3) build Juniper Cross Mountain Reservoir			
John Ayer		2/21/2014	Attended Roundtable Meeting February 13, 2014. As a Routt County Planning Commissioner, would encourage each county and municipality to review its Master and Land-Use Plans to ensure that it is aligned with the Colorado Water Plan. This would encourage grassroots participation and buy-in to the CWP.			
Robert L. Tobin	USGS Hydrologist (retired)	2/24/2014	Plans for effective and optimal water management for the beneficial uses by residents within a river basin should include water quality and quantity information. The YWG BIP does not address these issues. A USGS summary report of water quality characteristics and variations for a 15 year period for the White River was included with the comment.			
Anthony D'Aquila		3/12/2014	GOAL #1: No new inter-basin transfers or withdrawals from the Yampa/White/Green River Basin unless all reasonable alternatives have been fully implemented, to include water conservation programs, demand management programs, tiered water pricing policies, and reclaim / re-use programs.			adaquila@tampabay.rr.com
			GOAL #2: The Colorado Legislature to establish and approve mandatory daily water consumption goals for every public and otherwise regulated water utility in the state to strive to achieve. Recommended goal is 120 gallons per person per day or less.			
			GOAL #3: That Colorado's state and federal legislators will represent these goals in their negotiations with our neighboring states, the federal government, and the various regional and national planning and water regulatory commissions and agencies. State and federal legislators should object to additional out-of-state water supply commitments from Colorado unless receiving entities have likewise adopted more stringent water conservation and demand reduction measures.			
			GOAL #4: Water policy and planning in our Yampa-White-Green Basin and preferably state-wide must be integrated and holistic, considering the full spectrum of impacts and benefits to ecosystems, communities, and businesses.			
Ben Beall	Yampa River System Legacy Partnership / America's Great Outdoors	3/14/2014	GENERAL PRINCIPLES: Protect the flows in the Yampa River and its tributaries, all of which support agriculture and the outdoor and water-based recreation economies of communities found throughout the Yampa River Basin. (Requirement One of Gov. Hickenlooper's Executive Order for the CWP.)			

Yampa-White-Green BIP
Response to Public Comments Matrix

Commenter Name	Organization	Date received	Comment	Response to Comments	Change in Plan? Y/N	e-mail address
			Protect the flows of the Yampa River and its tributaries in order to protect the natural resources and ecology of Northwest Colorado for future generations. (Requirement Three of Gov. Hickenlooper's Executive Order for the CWP.)			
			Protect current and future flows of the Yampa River in light of the potential effects of Compact Calls or climate change.			
			SPECIFIC PRINCIPLES: Protect agricultural water in order to preserve agricultural lands. ● Encourage preservation of irrigated agricultural lands through voluntary, incentive-based programs such as conservation easements and alternative agricultural water transfer methods (interruptible supply agreements).			
			Protect the flows of the Yampa River to preserve the native riparian habitat that supports native (and non-invasive, non-native) fish and native birds and native wildlife. ● This includes protection of the globally rare riparian habitat found along certain reaches of the Yampa.			
			Protect the flows of the Yampa River in order to ensure the survival of the four endangered fish. ● Support the goals of the Endangered Fish Recovery Program and the agreement captured in the Yampa River Programmatic Biological Opinion (1999-2000).			
			Protect the flows of the Yampa River to ensure both existing and future recreational opportunities will be viable throughout the entire reach of the Yampa River, including opportunities for boaters, hunters, anglers and wildlife watchers. ● The rapidly expanding outdoor recreation industry based around the Yampa River (recreation, retail, manufacturing and travel-related businesses) is a significant component of the Northwest Colorado economy.			
Kevin McBride	Upper Yampa Water Conservancy District	4/15/2014	April 15, 2014 Letter from John V. Redmond approving of the process of the Upper Yampa Water Conservancy District, Yampa-White-Green Basin Roundtable's White Paper. Identified need for equitable apportionment, opposes trans-mountain diversions from CO River Basin			
Stephanie Scott	Colorado Trout Unlimited	5/2/2014	Proposed 4 guiding principles for the State of Colorado as a whole: 1. The Colorado Water Plan must include meaningful efforts to protect and restore healthy rivers and streams and environmental and recreation uses of water.			
			2. Basin implementation plans need to help refine the municipal supply "gap" at a local level.			
			3. Filling the municipal water supply gap requires a balanced strategy emphasizing efficient use of Colorado's limited water supplies. 3.a. High water conservation targets should be reflected in basin implementation plans. 3.b. Water re-use should be an increasing part of meeting future water needs. 3.c. Alternative transfer mechanisms and improved agricultural efficiency should be used to meet growing needs while maintaining agriculture and protecting Colorado's environment. 3.d. Better integration of water supply systems can help increase efficient use of Colorado's water. 3.e. Structural projects to bolster water supply should avoid harmful effects to rivers and local communities. 3.f. A new large trans-basin diversion from the Colorado River is not the answer for meeting Front Range needs.			

Yampa-White-Green BIP
Response to Public Comments Matrix

Commenter Name	Organization	Date received	Comment	Response to Comments	Change in Plan? Y/N	e-mail address
			4. Laws and policies to facilitate creative water management should be encouraged.			
Marsha Daughenbaugh	Community Agriculture Alliance	6/18/2014	Agricultural water rights in Northwest Colorado should be protected and enhanced by the CWP. Existing agricultural water rights, both pre-Colorado River and post Compact water rights, must be protected.			
			Agriculture in Northwest Colorado must be viewed equally with agriculture and industry throughout the state of Colorado. The agricultural interests in one part of the state should never be elevated over the agricultural interests in another part of the state.			
			Agriculture water rights in Northwest Colorado proved a cornerstone of all other economies in the region; recreation, environment, retail, social, municipal, residential and industrial. Agriculture water must be protected and enhanced for the other sectors to succeed.			
			Future agricultural needs in Northwest Colorado must be considered and planned for in the CWP.			
			The principal of equal apportionment of water resources throughout the state must be a corner stone of the CWP to protect the Yampa, White and Green basin in Northwest Colorado from disproportionate impacts of a Colorado river Compact call.			
			Any consideration of the "New Supply" in the form of transmountain diversions from the West Slope to the East Slope should not threaten western slope water rights, including increasing the chances of a Colorado River Compact call.			
			The CWP should promote water conservation in each basin to fully utilize the available water supply within each basin before any "new supply" trans-basin diversions are considered. Under no circumstances should agriculture be penalized for more efficient water use methods.			
			The importance of non-consumptive benefits provided by flood irrigation should not be underestimated in the CWP. The historic use of agriculture water rights provides a river flow regime that helps maintain wetlands, recharge alluvial aquifers, provide late season flows to downstream users and augment minimal stream flows which help mitigate environmental concerns, including threatened and endangered species.			
			Water quality and quantity are inextricably linked. Therefore, water quality as well as quantity must be considered a fundamental goal of the CWP. The health of all stakeholders can only be served if the quality of the water continues to support healthy agriculture and ecosystems through which it flows.			
			Future municipal and industrial water supply projects that incorporate agricultural and non-consumptive water supplies must be prioritized over single- or limited-use water supply projects.			
			The stewardship that agriculture continues to provide to wildlife and riparian habitat through the use of Best Management Practices (BMPs) by maintaining open space through authentic working landscapes and conservation easements must be protected and enhanced in the CWP.			

Yampa-White-Green BIP
Response to Public Comments Matrix

Commenter Name	Organization	Date received	Comment	Response to Comments	Change in Plan? Y/N	e-mail address
John Adams (submitted by Thomas Korver)		7/21/2014	In summary, the Morrison Creek Reservoir is inconsistent with the goals of preserving agriculture and agricultural water use and no demonstrable need for Morrison Creek Reservoir should be fully demonstrated, and the impacts of the Reservoir should be fully addressed, before there is any further consideration of the Reservoir as an IPP. Unless such additional analysis is undertaken, Morrison Creek Reservoir should be removed from the IPP list.			tkorver@petros-white.com
Kari Harden (on behalf of Lou Dequine, the Germaine family, and Kim Singleton)		7/21/2014	<p>As the landowners (for multiple generations) of close to 90 percent of the property proposed for conversion into Morrison Creek Reservoir, we are open to the idea of the project on the condition that it operates and functions in a manner that is reasonable, respectful, sustainable, and aesthetic. We have been in discussion with the Upper Yampa Water Conservancy District (UYWCD) for many years about the potential reservoir, and as families whose homes and livelihoods depend on this land, have carefully considered the personal tradeoffs.</p> <p>The proposed site of the reservoir includes valuable agricultural and recreational land, as well as favorite fishing grounds and the wedding locations of our daughters and granddaughters. We have been engaged throughout this process with the UYWCD regarding the specifics of the construction and operation of the reservoir. One primary concern discussed has been minimizing the draw down in order to minimize mudflats in the shallow areas.</p> <p>We have also agreed upon non-motorized recreational use, minimal traffic impacts, and private shoreline.</p> <p>Upon weighing the costs and benefits of the project as it relates to the land to which we are all deeply devoted, we have worked to also keep at the forefront what is best for the Yampa Valley community and state of Colorado.</p> <p>We support the Morrison Creek Reservoir project – but only with the inclusion of the aforementioned matters that relate directly to our continued quality of life on the land we have fought to preserve and the natural resources we have worked to conserve.</p>			kari.deq.harden@gmail.com lou@dequine.com

Yampa-White-Green BIP
Response to Public Comments Matrix

Commenter Name	Organization	Date received	Comment	Response to Comments	Change in Plan? Y/N	e-mail address
Richard Saterdal		7/21/2014	<p>We at the Morrison Divide Ranch subdivision, along with our neighbors, have been following the proposed Morrison Creek Reservoir with great interest since we first heard about this project in 2007. There is quite a bit of information available regarding this reservoir including information that is pertinent to the Yampa-White-Green Basin Implementation Plan (YWG BIP).</p> <p>The proposed Morrison Creek Reservoir is given prominence in the draft YWG BIP by being one of only five projects and processes called out by name in the executive summary. This reservoir is described in Chapter 4 where its purpose, capacity, storage right, cost and challenges are addressed in Table 4-4 of the draft YWG BIP. But much of this information has not been filled in yet in this table. For instance, Table 4-4 does not include a cost estimate for this project. However, Resource Engineering prepared a reservoir feasibility study report for the Upper Yampa Water Conservancy District (UYWCD) in 2009 that estimated the cost of this project to be \$20,300,000.</p> <p>Many of the challenges to making this reservoir a viable project and to getting the necessary permits and approvals are also known and should be included in Table 4-4. Construction of the proposed Morrison Creek Reservoir will destroy wetlands and encroach into the Sarvis Creek Wilderness area, requiring a challenging permitting and approval process. This reservoir will also destroy prime agricultural hay and meadowlands, as shown below, as well as inundate areas designated by the Colorado Division of Wildlife as severe winter elk habitat.</p>			cleanwater@pcisys.com
			<p>The proposed Morrison Creek Reservoir will also disrupt and deplete the natural flow of the outstanding trout stream below the Morrison Creek dam, especially since the UYWCD wants to transfer via pipeline the water stored in this reservoir out of the Morrison Creek basin and into Stagecoach Reservoir.</p> <p>The water rights that the UYWCD has for Morrison Creek water are very junior water rights, and for this reason there is a substantial risk that the UYWCD will be unable to store water in Morrison Creek Reservoir in dry years or periods of high demand. There is also community opposition, technical and cost challenges that the project must overcome. The benefits of this reservoir must outweigh the drawbacks in order for it to be a viable project. These issues should be listed in Table 4-4 to convey some of the challenges that the proposed reservoir project must overcome.</p>			
			<p>Chapter 2 of the draft YWG BIP discusses environmental needs, including instream flows. It is my understanding that the Colorado Water Conservation Board (CWCBC) has in recent years obtained decreed instream flow water rights for Morrison Creek downstream of the proposed Morrison Creek Reservoir for the protection of aquatic life, but that these rights are junior even to the UYWCD's water rights. This reservoir will therefore not be required to be operated in a way that maintains minimum flows in the creek. The CWCBC has discussed instream flows below the reservoir with the UYWCD and should be able to provide an accurate assessment of the potential impacts of the reservoir on instream flows for the YWG BIP.</p>			

Yampa-White-Green BIP
Response to Public Comments Matrix

Commenter Name	Organization	Date received	Comment	Response to Comments	Change in Plan? Y/N	e-mail address
			Table 2 14, Attributes of Major Stream and Lake Segments, does not include Morrison Creek. However the UYWCD has done a study that identified wetland plant communities at the proposed Morrison Creek Reservoir site that will require a U.S. Army Corps of Engineers 404 permit before the reservoir can be built. The section of Morrison Creek below the proposed reservoir site is also an excellent trout stream.			
			Table 2 15, Annual Instream Flow Target and Baseline Modeled Flows, does not list instream flow targets and baseline flows for Morrison Creek below the proposed reservoir, nor is this stream segment listed in Table 2 16, Monthly Instream Flow Targets and Percentage of Modeled Years that Reached the Target. Morrison Creek instream flow modeling results are also not included in Section 3.4.2, Environmental and Recreational Shortages. These things should all be provided for Morrison Creek in the YWG BIP in order to help evaluate the potential impacts of Morrison Creek Reservoir.			
			Figure 2-10 indicates that Morrison Creek below the proposed reservoir was not modeled. For this reason, when instream flows are discussed in Section 3.4.2, there are no impacts shown or discussed for Morrison Creek below the reservoir for any of the modeling scenarios. Since this reservoir will have enormous impacts on the instream flows below it, that section of Morrison Creek should be modeled and included in the YWG BIP. For the time being, in the absence of modeling results, the CWCBA assessment of reservoir impacts should be summarized in the YWG BIP so that readers of the report do not get the mistaken impression that the reservoir will not have any impacts on instream flows.			
			Chapter 3 discusses current and future water shortage analyses, including the Dry Future Identified Project and Process Scenario (IPP) which includes projects such as the proposed Morrison Creek Reservoir, and the Dry Future Scenario, which does not include projects such as the Morrison Creek Reservoir. The conclusion that many of the readers of the YWG BIP may come to is that each of the identified projects and processes modeled contribute to some of the benefits gained by implementing all of these identified projects and processes. But this is not necessarily true. Since the water rights that the UYWCD has for Morrison Creek water are very junior water rights, the UYWCD may be unable to store water in Morrison Creek Reservoir in dry years or periods of high demand. So this reservoir may not be able to provide any benefits in these scenarios.			
			<p>The YWG BIP results need to show what benefits each individual project and process provide in each scenario in order to determine whether or not an individual project or process is effective. The YWG BIP also needs to describe important operational assumptions for the projects, such as whether or not Morrison Creek Reservoir was modeled to protect instream flows. Operational assumptions could be briefly described in Table 4-4 or in Chapter 3 where the modeling scenarios are discussed. When the Colorado Water Plan is presented to the governor it needs to provide sufficient information to serve as a basis for determining which projects are effective and how they should be operated in order to achieve the desired mix of goals. Based on the information provided in the draft YWG BIP it is impossible to tell whether or not the proposed Morrison Creek Reservoir provides any benefits in the scenarios modeled.</p> <p>The addition of further relevant information for projects such as the proposed Morrison Creek Reservoir and discussion of what benefits each individual project and process provide in each scenario will add tremendous value to the YWG BIP.</p>			

Yampa-White-Green BIP
Response to Public Comments Matrix

Commenter Name	Organization	Date received	Comment	Response to Comments	Change in Plan? Y/N	e-mail address
Charlie Preston-Townsend	Friends of the Yampa	4/6/2015	Summary points: 1) The State of Colorado shall view the Yampa River as a significant and reliable source of water to meet Colorado River Compact obligations; 2) Colorado shall hold nonconsumptive needs as a priority and consider the significant conservation work that has been accomplished in the Yampa River Valley as an example for future water planning; 3) The Yampa Valley and Western Slope water users must be assured that, in the event of a compact call, negotiated equitable apportionment will be utilized to protect our many important junior water rights; 4) The Eastern Slope of Colorado must maximize water use efficiency through a variety of methods including, but not limited to conservation, reuse, fallowing, new and expanded Eastern Slope storage and wise land-use planning principles.			
Sue E. Masica	Regional Director, National Park Service	3/19/2015	Summary points: 1)NPS shares concerns regarding risk of shortage in the Colorado River basin; 2) supports western slope basins that minimum water conservation should be changed from low to medium to high; that water conservation and efficiency could positively affect the resources in the national park units; 3) encourages inventory for environmental and recreational purposes to protect values; 4) encourages more on the ground projects to improve water quality and the environment; 5) in addition to protecting minimum base flows through instream flows, consider the value of higher flows to protect environmental and recreational uses; 6) recognizes the risk of new supply projects to the Colorado River Basin, particularly new trans-mountain diversions; 7) wet-year filling strategy could have unintended consequences for aquatic and riverine systems that depend on high-flows; 8) need to be consistent in the application of metrics when comparing the economic value of consumptive and non-consumptive uses; 9) need to include "protection of instream natural resources including endangered fish and other natural resources" in the Colorado River Contingency Plan.			



watercomments <watercomments@gmail.com>

Future of CO Water

S.Foi <maxx05052003@yahoo.com>

Tue, Feb 18, 2014 at 3:36 PM

To: watercomments <watercomments@gmail.com>

OK, Jackie...you asked for it! Here comes some "way out" DOABLE suggestions I have been harboring for a very long time.....don't know if I'll live to see any of them implemented, but here goes:

- (1)Trickle IRRIGATION of parkland in & around Routt Cty, preferably near a river or existing reservoir. [create more parks in need of this kind of water usage]
- (2)Trickle or gravity fed SEWER systems to replace the ancient, decadent Vault System mandated in the county (& statewide)....needed in such infrastructure-poor places like SouthShore & Horseback Subs in Stagecoach.....both being near a reservoir or creek.
- (3)Creation of small RUNOFF RESERVOIRS in places not adjacent to reservoirs or streams in need of water & associated greywater sanitary systems for underdeveloped areas.
- (4)WETLAND creation.....mini-tributaries to rivers.....for migrating waterfowl and permanent wildlife residents.

Hope this is useful input.....appreciate your keeping me posted on your outcomes.

sf

[Quoted text hidden]



watercomments <watercomments@gmail.com>

Future of CO Water

S.Foi <maxx05052003@yahoo.com>

Fri, Feb 14, 2014 at 7:00 PM

To: "watercomments@gmail.com" <watercomments@gmail.com>

As the saying goes, "use it, or lose it."

We need to find captive uses for our finite aqua resources locally up here, or lose it to the thirsty masses down there. Simple as that...now or 50 years from now, and beyond.

S.Foi

Stagecoach



watercomments <watercomments@gmail.com>

How to save water

Allen Hischke <als362@hotmail.com>

Thu, Feb 20, 2014 at 8:41 AM

To: Allen Hischke <als362@hotmail.com>, watercomments@gmail.com

Hello:

I attended the Water Planning meeting that was held in Craig Colorado on February 19, 2014. I wanted to take the time to write the comments I made that night on these pages.

I believe that the best way to assure that we in Moffat County will have a good supply of water for the future is to conserve every drop that we can conserve. To do this I believe the correct thing to do would be to tell The Useless Fish And Wildlife Service (USFWS) to get out of the Yampa Valley forever, and take their unneeded, unnecessary, unwanted Squawfish with them. Then when they are gone build Juniper Cross Mountain Reservoir.

I say this because the USFWS wastes millions of gallons of our precious water allowing it to go down the Yampa River for these worthless sucker fish. If the people that live here in the Yampa Valley could save the water they waste our water woes would be greatly reduced. And If we had the Juniper Cross Mountain Reservoir, our woes would likely be eliminated.

Here is a letter I wrote to many of our elected officials. So far I have not received a response from any of them. That shows how much these politicians care about us. Please read my letter and feel free to share it with anyone you wish to. Thank You
Allen Hischke
als362@hotmail.com

Hello :

Today I am writing you about a subject that has needed attention for many years. The U.S. Fish and Wildlife Service (USFWS), has for years, been killing the game fish in the Yampa River. They are doing this in an effort to save the Colorado Pike Minnow (Squawfish), Humpback Chub, Bonytail and Razorback Sucker that are on the endangered species list. They shock the Yampa River to remove the non-native species, notably Smallmouth Bass, and Northern Pike, from the river.

For years they took these removed fish, and moved them to other impoundments. The Pike went in some small ponds near Hayden, CO., and they put the Smallmouth in Elkhead Reservoir. When these fish were moved they were tagged to identify them as fish removed from the river. This improved the fishing in these places.

Elkhead Reservoir, is the lake that recently had its level raised, and a taller dam with new spill structures and gates installed. When these gates were installed they were screened to

What I would like you to do is propose an amendment or to the Endangered Species Act. This amendment would require the people altering an area in an attempt to save another species to have a vote of the people in that area, every 5 years, to see if these people want this activity to continue. If the vote states that the altering activity must be stopped, then that will be the order to those doing these things. In this area, they would be required to stop killing the non-native fish in the Yampa River and Elkhead Reservoir. They could continue any other restorative efforts to help save these species.

For this area, the vote should be broken into several segments. The people in Steamboat Springs would vote on the area of the Yampa River upstream from Steamboat Spring then half way to Hayden Colorado. The people in Hayden and Craig, would vote on the area of the Yampa River halfway to Steamboat Springs then to Sunbeam CO. or the boundary of the Dinosaur National Monument.

Altering the Endangered Species Act in this manner would still allow the recovery efforts of the species in question, while also protecting the species that the local residents want to keep. It would save fuel, oil, promote tourism in many areas, add to the tax base of many communities, and give the children in these areas another form of summer recreation here, helping to keep them from getting into trouble. You know the old saying, "Get your kids hooked on fishing and they won't get hooked on drugs or alcohol". This is a very true statement.

I beg you to discuss this type of alteration to the Endangered Species Act. It will be a boon to many areas of the United States in many ways. I look forward to hearing about this new legislation on the news in the future.

If you are looking for a way to cut the federal budget, this is a very good place to start.

Thank you for taking the time to read this letter, this issue is important to the people that live here.

Allen J. Hischke P.O. Box 710 Craig, Colorado 81626 970-824-7921 als362@hotmail.com

cc: Obama, Bennett, Udall, Tipton, White, Baumgardner, Hickenlooper

February 24, 2014.

TO: Committee Members Colorado Water Plan

FROM: Robert L. Tobin, Retired USGS Hydrologist 

PO Box 1065, Meeker, CO. 81641-1065

(970) 878-4205

RE: Water Quality in the Basin Implementation Plan

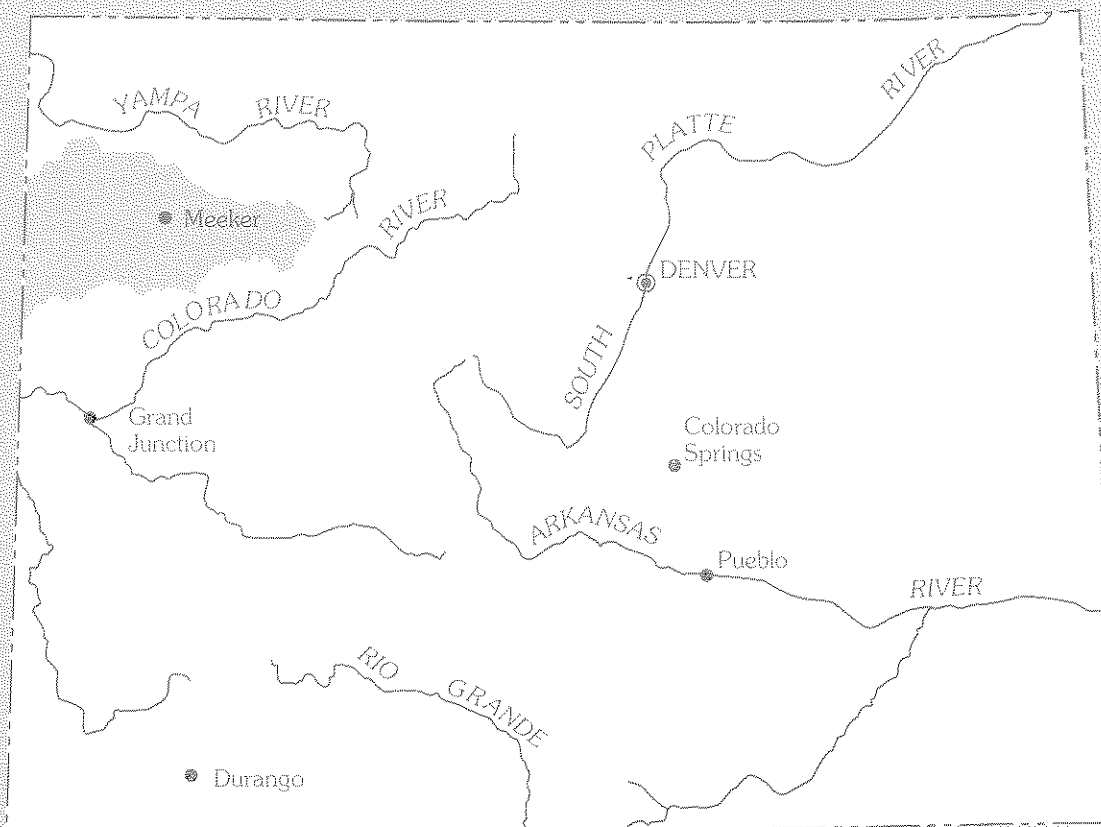
The scope of the Basin Implementation Plan for the Yampa and White River basins, as presented in the handouts at the recent Craig meeting, does not address water quality issues.

Plans for effective and optimal water management for the beneficial uses by residents within a river basin should include water quality and quantity information. The nature of dissolved and suspended constituents that define the water quality of surface and tributary ground water sources, and the variations that occur with changes in flow and seasonal activities, are very important factors for the proper management of both sources. The implementation and /or incorporation of water quality information was not included in the above mentioned handouts.

Enclosed for your information and potential use is a summary report of water quality characteristics and variations for a 15 year period for the White River. The period includes years of record high and low flows in the basin.

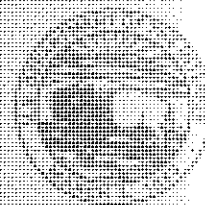
SEDIMENT TRANSPORT AND WATER-QUALITY CHARACTERISTICS AND LOADS, WHITE RIVER, NORTHWESTERN COLORADO, WATER YEARS 1975-88

U.S. GEOLOGICAL SURVEY



Water-Resources Investigations Report 92-4031

Prepared in cooperation with the
YELLOW JACKET WATER CONSERVANCY DISTRICT,
WATER USERS ASSOCIATION NO. 1,
RIO BLANCO COUNTY, and the
COLORADO RIVER WATER CONSERVATION DISTRICT



Cover Sheet for Input Document, Item #10

The document listed below was submitted as formal input for Colorado's Water Plan. A summary of the document, including a staff response and/or recommendation is included in the master spreadsheet included within this packet.

Date: March 12, 2014

Input provided by: Anthony D'Aquila

Method of submission: Online General Input Webform at www.coloradowaterplan.com

Summary of Input: Comments regarding the Yampa/White/Green Basin Implementation Plan.

Documents Submitted for Review: Comments in attached letter

Staff Response: CWCB Staff will forward the attached letter to the Yampa/White Green Basin Roundtable for review.

Comments to the Yampa/White/Green River Basins Roundtable

I wish to provide the following initial comments to the Basin Implementation Planning process. You have a tremendous responsibility, as in my perspective, this undertaking is perhaps the most crucial public planning effort Colorado will face in this century.

To bring the key points of my comments up front, I propose the following three goals.

GOAL #1: No new inter-basin transfers or withdrawals from the Yampa/White/Green River Basin unless all reasonable alternatives have been fully implemented, to include water conservation programs, demand management programs, tiered water pricing policies, and reclaim/re-use programs.

GOAL #2: The Colorado Legislature to establish and approve mandatory daily water consumption goals for every public and otherwise regulated water utility in the state to strive to achieve. Recommended goal is 120 gallons per person per day or less.

GOAL #3: That Colorado's state and federal legislators will represent these goals in their negotiations with our neighboring states, the federal government, and the various regional and national planning and water regulatory commissions and agencies. State and federal legislators should object to additional out-of-state water supply commitments from Colorado unless receiving entities have likewise adopted more stringent water conservation and demand reduction measures.

GOAL #4: Water policy and planning in our Yampa-White-Green Basin and preferably state-wide must be integrated and holistic, considering the full spectrum of impacts and benefits to ecosystems, communities, and businesses.

Background

For too long water policy focused on the supply-side of the argument. Demand-side programs need to be the primary mechanism in resolving our water shortages and developing long term solutions.

Colorado is the leader in the Mountain West in many areas of innovation and technology. We must be the leaders in terms of water policy and water conservation as well.

All aspects of water conservation should be investigated and applied vigorously where appropriate. All water users must be party to water conservation efforts. This includes the agricultural sector, ranchers and farmers. Antiquated methods of irrigation, such as open-ditch transport of water or broadcast spraying, must be phased out and replaced with best management practices (BMP's) such as drip irrigation and moisture content-controlled application, that conserve water, utilize reclaimed water, and minimize loss and waste.

Goal 1 is meant to convey a serious message concerning short-sighted water policy planning. Increasing supply before implementing alternative solutions to reduce demand is a short-sighted policy decision. Moving water from a remote basin to provide increased supply in another region is not only wasteful of resources, it is contrary to good policy or planning. Aiming to increase supply without addressing demand management is treating the symptom and not the cause. The streamflow that exist in a system

such as the Yampa River is not a “surplus” resource, it is an intrinsic component of that particular ecosystem and plays a role in all receiving downstream communities. Withdrawal and removal from those systems will be detrimental and cause economic and ecological harm. It would be detrimental to our community, to our ranchers and farmers, and to our businesses dependent upon a robust summer and winter outdoor recreation industry. Further, any use of such a mechanism as a future withdrawal and inter-basin transport should be as a last recourse, after all alternative mechanisms available to the proposed receiving basin have been fully implemented, and then only if a requirement still exists.

Key to achieving reduced potable water demand is to implement policies and programs to encourage demand reduction. That is the purpose behind Goal 2. As reported within the SWSI, the per capita daily consumption throughout the whole of Colorado exceeds 200 gallons per day. That is far out of line with the water consumption standard many, many other communities across the nation have already achieved. For a state hovering on the brink of water supply disaster, it is critical to reduce our per capita demand. We can do better, and need to implement programs to drive that demand for water down to the 120 gallon per capita per day average. Tiered water pricing strategies and programs to encourage water savings, such as rebates for low flow toilets and water saving appliances, must be considered. Likewise, planners need to recognize we live in an arid environment. Xeriscaping and severe limitations on lawn irrigation must be implemented. Our metropolitan areas and urbanized areas serviced by advanced wastewater treatment systems must implement reclaimed and recycled water programs and begin to distribute reclaimed water to industrial users and for residential lawn irrigation. Those initiatives need to be supported by the state legislature and provided funding as necessary.

If we as Coloradans are successful in implementing these water conservation and demand management programs, then our state and federal legislators will have more standing to defend Goal 3, holding the line on more withdrawals from our state to other regions.

Implementing good water policy and programs need not require us to choose between agriculture and urban users, or to short change the environment. If we use integrated management and careful analysis of benefits and impacts, we can achieve balance. We do not need to choose between the lesser of two evils, if we plan better and seek mutually compatible and supportive results. For example, a surface water impoundment can exist as a system of ponds and wetlands beneficial to wildlife and outdoor recreation use.

Thank you for the opportunity to express these opinions.

Sincerely,

Anthony J. D’Aquila
2315 Ski Trail Lane, #21
Steamboat Springs, CO 80478
adaquila@tampabay.rr.com

mailing address:
P.O. Box 771239
Steamboat Springs, CO 80477-1239

Cover Sheet for Input Document, Item #12

The document listed below was submitted as formal input for Colorado's Water Plan. A summary of the document, including a staff response and/or recommendation is included in the master spreadsheet included within this packet.

Date: March 14, 2014

Input provided by: Ben Beall, Yampa River System Legacy Partnership/America's Great Outdoors

Method of submission: Email to cowaterplan@state.co.us

Summary of Input: Text from email: "I have attached a letter that the Yampa River System Legacy Partnership/ America's Great Outdoors as requested by Jay Gallagher which the Legacy Partnership sent to Jacob Bornstein, Program Manager, CWCB. Last Wednesday, March 12, 2014 the Legacy Partnership submitted a similar letter concerning the CWP to the Yampa/White/Green Roundtable. Thanks for your consideration of the Legacy Partnership Principles in regards to the Yampa River for the CWP."

Documents Submitted for Review: Comments in attached letter

Staff Response: CWCB Staff will forward the attached letter to the Yampa/White Green Basin Roundtable for review.

YAMPA RIVER SYSTEM LEGACY PARTNERSHIP AMERICA'S GREAT OUTDOORS
Continuing the Legacy of the Yampa River

March 6, 2014

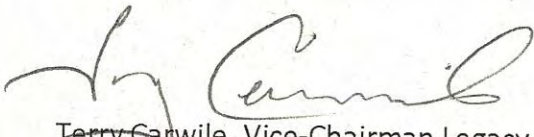
Jacob Bornstein, Program Manager
Colorado Water Conservation Board
1580 Logan St., Suite 200
Denver, CO 80203

Mr. Bornstein,

Please find attached comments from the Yampa River System Legacy Partnership to the Yampa/White/Green Basin Roundtable regarding the Basin Implementation Plan and the Colorado Water Plan.

Thank you.

For the Yampa River System Legacy Partnership – America's Great Outdoors



Terry Carwile, Vice-Chairman Legacy Partnership and Mayor, City of Craig on behalf of
Ben Beall, Chairman Legacy Partnership and Alternate for Routt County

cc: Yampa/White/Green Basin Roundtable
cc: Governor Hickenlooper

YAMPA RIVER SYSTEM LEGACY PARTNERSHIP AMERICA'S GREAT OUTDOORS

Continuing the Legacy of the Yampa River

Comments to the Yampa/White/Green Basin Roundtable Regarding Basin Implementation Plan and Colorado Water Plan

The Yampa River System Legacy Partnership – America's Great Outdoors (Legacy Partnership), formed in 1995, is one of the longest established, if not *the* longest, community-based, conservation-oriented organization composed of local, state and federal partners representing both the Upper and Lower Yampa River Basins. The Legacy Partnership operates under a Memorandum of Understanding, which was revised and expanded in 2011 to include goals of the America's Great Outdoors Initiative. The eighteen Partner representatives (along with alternates) from both Routt and Moffat Counties include; county and municipal elected officials; state and federal representatives; conservation, agricultural, business and recreation community members; youth and outdoor job and outdoor education proponents; and public lands and Yampa River advocates. These Partners bring to the Legacy Partnership diversity in experience from both Routt and Moffat Counties that serve the entire Yampa River Basin.

The revised 2011 Legacy Partnership Mission states: *"The Yampa River System Legacy Partnership is a voluntary collaborative, incentive-based project designed to protect and enhance the health of the Yampa River and its tributaries; adjacent agricultural lands and ecosystems; and the wildlife supported by these lands and waters. The YRSLP advances this mission through land conservation activities while providing recreational opportunities compatible with the natural environment of the Yampa Valley. This Legacy mission is closely aligned to and consistent with the recently announced America's Great Outdoors Initiative and is herein updated and revised to address AGO's expanded focus on connecting youth to the natural environment through jobs, environmental education and outdoor experiences along with AGO's focus on river restoration."*

The Yampa River and its surrounding lands are at the core of Legacy's mission and the rationale in submitting the following comments and principles to the Yampa/White/Green Roundtable, the Colorado Water Conservation Board (CWCB), and other interested stakeholders. The Basin Implementation Plan and the Colorado Water Plan (CWP) must take into consideration current and future water needs, both consumptive and non-consumptive, of the Yampa River Basin.

The Yampa River Legacy Partnership's two-decade long commitment has been focused on the importance of the Yampa River, its water and flows, in both the Upper and Lower Yampa River Basins. Legacy's successful program includes projects related to protection of the environment and important wildlife habitat; appropriate river recreation uses; and conservation of the valley's agricultural lands. Thousands of acres of agricultural lands have been conserved

through the Legacy program and over a hundred-thousand acres conserved in the region that complement Legacy's work.

A Non-Consumptive Needs Assessment was completed by the Yampa/White/Green Basin Roundtable. This Assessment identifies and maps key environmental and recreational attributes and activities that are directly tied to the Yampa River and its flows (CWCB 2011 and 2012). The report highlights the importance of protecting the flows of the Yampa River that are critical to sustaining the environmental health of the Yampa River along with those needed to support the river-related outdoor recreational economies of the region. The implications of the study lead to the understanding of the far-reaching significance that the Yampa River has to the region, more than are captured by the report. The Yampa River serves as the foundation for an ever-expanding economy developed around outdoor recreational activities, industries and travel related businesses – all defined as “non-consumptive uses” that depend on the lifeblood of water that the Yampa River provides.

The Legacy Partnership, a local, community-based collaboration, has demonstrated success in addressing projects along the entire reach of the Yampa River. The Partners strongly believe the following principles are important to planning for future water needs in the Yampa River Basin for the citizens of Colorado, those that live in the Yampa Basin and to future generations of Colorado residents. The principles outlined herein address two of the three requirements as mandated in Gov. Hickenlooper's Executive Order for the CWP (D2013-005). The Colorado Water Plan must incorporate: (1) “a viable productive economy including a productive agriculture . . . recreation and tourism industries”; and (2) “a strong environment that includes healthy watersheds, rivers, streams, and wildlife.” These requirements align with Legacy's mission and mission success for the Legacy Partnership is dependent on these requirements being met.

Principles for Future Water Needs Planning in the Yampa Basin

General Principles:

1. Protect the flows in the Yampa River and its tributaries, all of which support agriculture and the outdoor and water-based recreation economies of communities found throughout the Yampa River Basin. (Requirement One of Gov. Hickenlooper's Executive Order for the CWP.)
2. Protect the flows of the Yampa River and its tributaries in order to protect the natural resources and ecology of Northwest Colorado for future generations. (Requirement Three of Gov. Hickenlooper's Executive Order for the CWP.)
3. Protect current and future flows of the Yampa River in light of the potential effects of Compact Calls or climate change.

Specific Principles:

1. Protect agricultural water in order to preserve agricultural lands.
 - Encourage preservation of irrigated agricultural lands through voluntary, incentive-based programs such as conservation easements and alternative agricultural water transfer methods (interruptible supply agreements).
2. Protect the flows of the Yampa River to preserve the native riparian habitat that supports native (and non-invasive, non-native) fish and native birds and native wildlife.
 - This includes protection of the globally rare riparian habitat found along certain reaches of the Yampa.
3. Protect the flows of the Yampa River in order to ensure the survival of the four endangered fish.
 - Support the goals of the Endangered Fish Recovery Program and the agreement captured in the Yampa River Programmatic Biological Opinion (1999-2000).
4. Protect the flows of the Yampa River to ensure both existing and future recreational opportunities will be viable throughout the entire reach of the Yampa River, including opportunities for boaters, hunters, anglers and wildlife watchers.
 - The rapidly expanding outdoor recreation industry based around the Yampa River (recreation, retail, manufacturing and travel-related businesses) is a significant component of the Northwest Colorado economy.

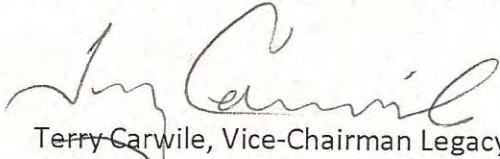
The Future of the Yampa River

The Legacy Partnership understands the importance of water for the Yampa Basin and its residents, economy and visitors. The future of our basin is in jeopardy if we, the citizens and members of the Yampa/White/Green Roundtable, do not accurately evaluate and plan for *all* our future water needs – both consumptive and non-consumptive. If this opportunity to plan appropriately into the future is missed, the Legacy Partnership's accomplishments will be at risk. We also risk the opportunity to secure significant financial resources from local, state and federal partners that have invested in the past and are poised to make additional investments to protect the future of the Yampa Basin, its lands and wildlife.

We are confident the Yampa/White/Green Roundtable will understand the importance of the Yampa River as the only relatively free-flowing river system in Colorado and understand why the Legacy Partnership shares its history, mission and accomplishments in support of the Yampa River. Please let our mission and accomplishments guide your deliberations to ensure that both consumptive and non-consumptive water uses on the Yampa River are protected within the Colorado Water Plan. The Legacy Partnership is proud of our accomplishments and we will continue to advance our mission, to which the Yampa River is critical. The Yampa River

is our legacy and is the foundation upon which the future of the entire Yampa River Valley is based.

For the Yampa River System Legacy Partnership – America's Great Outdoors



Terry Carwile, Vice-Chairman Legacy Partnership and Mayor, City of Craig on behalf of Ben Beall, Chairman Legacy Partnership and Alternate for Routt County

YAMPA RIVER SYSTEM LEGACY PARTNERSHIP – AMERICA GREAT OUTDOORS PARTNERS:

VOTING PARTNERS:

Routt County
Moffat County
City of Steamboat Springs
City of Craig
Town of Hayden
Bureau of Land Management
Colorado Parks and Wildlife (Wildlife Representative)
Colorado Parks and Wildlife (Parks Representative)
Yampa Valley Land Trust
The Nature Conservancy
Agricultural Representative Routt County
Agricultural Representative Moffat County
Recreation Representative
Business Representative
Youth and Outdoor/Environmental Education Representative
Youth and Outdoor Environmental Jobs Representative
Public Lands Representative
Yampa River Representative

NON-VOTING PARTNERS:

US Forest Service
Dinosaur National Monument
US Fish and Wildlife Service
US Geological Service
US Bureau of Reclamation
Colorado Department of Natural Resources
Northwest Colorado Watershed Partnership
Veterans Green Jobs
Routt County Conservation District

Cover Sheet for Input Document, Item #48

The document listed below was submitted as formal input for Colorado's Water Plan. A summary of the document, including a staff response and/or recommendation is included in the master spreadsheet included within this packet.

Date: April 10, 2014

Input provided by: Kevin McBride, Upper Yampa Water Conservancy District

Method of submission: Online General Input Webform at www.coloradowaterplan.com

Summary of Input: Letter to the Yampa/White/Green Basin Roundtable (YWGBRT) regarding their support for the YWGBRT's White Paper.

Documents Submitted for Review: Comments in attached letter

Staff Response: The CWCB will send the Upper Yampa Water Conservancy District's letter to the YWGBRT. These comments also helped inform the IBCC discussion during the April 29, 2014 IBCC meeting.



Upper Yampa Water
Conservancy District

April 15, 2014

Mr. Jon Hill,
Chairman, Yampa/White/Green Basin Roundtable
Via email

RE: Yampa/White/Green Basin Roundtable, White Paper

Dear Chairman Hill

The Upper Yampa Water Conservancy District (UYWCD) Board has reviewed and approves of the Yampa White Green Basin Roundtable's (YWGRT) White Paper. The UYWCD Board wants to stress that it agrees with the need for an equitable apportionment for use of local waters. With regards to any additional Trans-Mountain Diversion (TMD) of water from the Colorado River Basin, given concerns about the Colorado River Compact and operational difficulties at Lake Mead and Powell, we are opposed to such diversions.

Before additional TMD's should be considered, some amount of the water resources of local rivers must be available first to those who live here; and that must be agreed upon prior to any additional TMD from the Colorado Basin at any location. The operation of any proposed Trans Mountain Diversion and its impacts on our Basin must be thoroughly understood prior to any agreement. Finally, the construction of such a project must be funded by the beneficiaries of the project and not by State taxpayers.

As the State of Colorado seeks to create a Colorado Water Plan it should not lose sight of the geographic diversity within the State, the variability of water supplies through time, and of particular interest to the Upper Yampa Water Conservancy District, the unique situation in the Yampa River Basin. As the UYWCD seeks to fulfill its mission:

"To lead water resource management within the District's boundaries by responsibly conserving, protecting, developing, providing and enhancing the water resources of the Yampa River Basin. The District will initiate and participate in projects that embody and promote the protection of water rights, provide broad benefits to District constituents and develop projects that provide responsible conservation, responsible growth, beneficial water storage and usage, and public awareness within the Upper Yampa Water Conservancy District".

We appreciate that the State seeks a Basin Implementation Plan that is truly a "bottom up" process, so that local entities can truly lead the process.

Sincerely,



John V. Redmond
President, Upper Yampa Water Conservancy District

Cover Sheet for Input Document, #74

The document listed below was submitted as formal input for Colorado's Water Plan. A summary of the document, including a staff response and/or recommendation is included in the master spreadsheet included within this packet.

Date: May 2, 2014

Input provided by: Stephanie Scott, Colorado Trout Unlimited

Method of submission: Email to Kate McIntire, forwarded to cowaterplan@state.co.us

Summary of Input: Text from email: "Thank you for the opportunity to submit materials to the CWCB Board and also for the time to speak to them at the board meeting. Attached are the final packets that Trout Unlimited has prepared that are specific to each basin. These packets are our suggested content for the basin implementation plans. While we intended on developing comments for all 9 basin we realized that it was best to focus on just the ones attached. We have combined the South Platte and Metro comments into one packet. For the basins that do not have comments we are still pushing our TU Water Plan Principles to be incorporated into the BIP and our members will be involved at the meetings. Those principles are attached to this email in a separate document. After speaking with roundtable representatives it was suggested that we included both broad level and specific detailed comments. Per this request we have gathered and organized the packets into 3 sections to make it easier for the roundtables to incorporate the comments.

- The first section includes broad principles that Trout Unlimited would like to see incorporated into all of the BIPs throughout CO.
- The second includes bullet point comments that are specific to each of the basins.
- The third section lays out each of those bullet points in more detail.

I will be the one speaking at the CWCB Board meeting. I will be presenting these packets to the board and explain the outreach that Trout Unlimited has done on the water plan, emphasize the opportunity for the CWCB Board and Trout Unlimited to work together and give a brief overview of our high level principles. Please let me know if there is anything else that you need."

Documents Submitted for Review: Comments in attached letters

Staff Response: Staff appreciates the considerable work Trout Unlimited (TU) put into the comments provided and will pass each of the basin-specific documents to the respective BRTs. With regard to TU's Water Plan Principles, "meaningful efforts to protect and restore healthy rivers and streams" will be incorporated into Section 5.9 and the BIPs. The CWCB expects that the BIPs will help refine the municipal supply gap and Colorado's Water Plan will emphasize efficient use of Colorado's Water supplies in Section 5.6. The initial draft of Chapter 5.6, released in May for public review, explores conservation and reuse. Colorado's Water Plan suggests that at a minimum and in the near term, Colorado should seek to implement "medium" conservation practices while acknowledging that in the future "high" levels of conservation may be needed depending on which scenario presents itself in Colorado. Section 5.7 is also now available for public review on Alternative Transfer Methods and the BIPs will explore the integration of water supply systems. Overall, TU's Water Plan Principles are consistent with the values expressed in Colorado's Water Plan and the plan will encourage multi-purpose projects. With regard to new transmountain diversion projects, the IBCC is exploring innovative ways to address this issue in a balanced manner. Lastly, CWCB will consider the laws and policies suggested by TU to facilitate creative water management when drafting Section 5.11.

Trout Unlimited's Comments for Colorado's Water Plan

Trout Unlimited's Statewide Colorado Water Plan Principles

Colorado Trout Unlimited's board of directors, which includes representation for 24 local chapters statewide, supported the following core principles as measures that should be reflected in the Colorado Water Plan.

- 1. The Colorado Water Plan must include meaningful efforts to protect and restore healthy rivers and streams and environmental and recreation uses of water.** Just as it is important to address consumptive water supply "gaps", the State must also document and address its environmental and recreational supply gap. Healthy rivers are vital to communities, promote property values, support a strong recreation economy, and contribute to the quality of life that makes Colorado a great place to live. Beyond identifying focus reaches with key values for protection and restoration, the Colorado Water Plan should lay out specific actions to assess and quantify environmental and recreational needs in each basin, timelines for implementation of both the needs assessments and projects to provide for those needs, and resources to complete them. By way of illustration, projects could include restoration of river and wetland habitat, appropriation and acquisition of instream flows to protect, enhance and restore the environment, management of new and existing water supply projects to enhance flows, and collaborations with irrigators to increase efficiency and keep more water in-stream. Colorado's Water Plan should ensure that our State continues to enjoy the many ecological, social, and economic benefits of healthy rivers.
- 2. Basin implementation plans need to help refine the municipal supply "gap" at a local level.** Planning to meet future water demands depends on understanding what the needs are at a local level, so that strategies can be designed to provide water when and where it is actually needed.
- 3. Filling the municipal water supply gap requires a balanced strategy emphasizing efficient use of Colorado's limited water supplies.**
 - a. High water conservation targets should be reflected in basin implementation plans.** Water efficiency is the cheapest, fastest, and least environmentally-damaging way to meet growing municipal water needs in communities across Colorado. As technology improves, and with use of incentives to further promote xeric landscaping, water conservation can go a long way in helping fill Colorado's future water supply gap. State policies should promote such conservation efforts throughout Colorado. Our water



resources are limited, and maximizing the efficiency with which they are used must be a cornerstone of statewide water policy.

- b. Water re-use should be an increasing part of meeting future water needs.** Where water can legally be reused to extinction (transbasin water, already converted consumptive use water, non-tributary groundwater), it should be. This is part of maximizing the use of existing (or new) water supplies to meet demands. Necessary infrastructure for treatment and delivery of re-use water should be incentivized with state funding.
- c. Alternative transfer mechanisms and improved agricultural efficiency should be used to meet growing needs while maintaining agriculture and protecting Colorado's environment** Irrigated agriculture provides far-reaching benefits to the economy, environment and quality of life in Colorado. The state should support water sharing arrangements – from water banks to rotational fallowing – that can help meet municipal supply needs and maintain healthy rivers while avoiding the social, economic and environmental impacts associated with traditional “buy and dry” transfers. The focus should be on temporary transfers, not permanent fallowing of irrigated ground. State support could include funding support as well as legal and policy changes to reduce the burdens and risks associated with such nontraditional water sharing agreements. The state should also support infrastructure improvements to benefit agricultural operations, healthy flows, recreation, and local communities.
- d. Better integration of water supply systems can help increase efficient use of Colorado's water.** Collaborative efforts among water suppliers can help use strengths in one supply system to bolster weaknesses in another, and vice versa – which will help increase the overall efficiency and reliability with which water can be provided for present and future demands. Partnerships such as those envisioned with the WISE project between Denver Water and south-metro-area suppliers can help responsibly meet water needs more efficiently and effectively than a “go-it-alone” approach.
- e. Structural projects to bolster water supply should avoid harmful effects to rivers and local communities.** Where structural projects are needed to firm water supplies, provide storage for managing water yielded from other strategies like reuse, and otherwise assist in meeting future needs, they should be designed to avoid adverse impacts to environmental and community values. Given the importance of healthy rivers to Colorado's economy and quality of life, it is critical that future projects protect, and where possible enhance, non-consumptive water values. Projects that can provide multiple benefits should be encouraged. Partnerships – such as those under the Colorado River Cooperative Agreement and associated agreements – can be a key part of managing water supplies to provide those multiple benefits.
- f. A new large trans-basin diversion from the Colorado River is not the answer for meeting Front Range needs.** Local, focused projects (such as conservation, re-use, temporary agricultural transfers, and small-scale storage) can be tailored to address community-specific “gaps” in future supply in ways that large, costly transbasin



diversions cannot. Such diversions also create risks of over-development of Colorado's compact entitlements, cause significant environmental impacts, and threaten West Slope agriculture and communities. These projects generate great controversy and conflict, and can result in lengthy, costly permitting processes with uncertain outcomes. Colorado will be better served by the other water supply strategies described above.

4. Laws and policies to facilitate creative water management should be encouraged.

Current law and policy may be an obstacle to many of the water supply strategies discussed above. Transaction costs and risks to existing water rights can be major roadblocks to creative solutions to better meet Colorado's water needs. Colorado should adopt legislation and policy to help encourage rather than discourage creative arrangements for efficient water supply and water sharing. Current legislative efforts to encourage agricultural efficiency and protect instream values (SB 23) or to allow flexible marketing of water generated through changes within agricultural operations (HB 1026) are examples of changes that can help promote creative solutions for better meeting Colorado's future water supply needs.



Agriculture in northwest Colorado is of vital importance, both locally and state wide. Agriculture has provided the economic and cultural engine that has shaped Northwest Colorado for the past 150 years. Much of the region's current diversity is built on the foundation that Agriculture continues to provide economically, socially, recreationally, and environmentally. Therefore, maintaining and expanding the future viability of Agriculture in Northwest Colorado should be a top priority in the Colorado Water Plan.

To that end Community Agricultural Alliance of Northwest Colorado endorses the following principles and values to be incorporated in the Colorado Water Plan ("CWP"). These principles are of equal worth and are not listed in any order of importance.

- Agricultural water rights in Northwest Colorado should be protected and enhanced by the CWP. Existing agricultural water rights, both pre-Colorado River Compact and post Compact water rights, must be protected.
- Agriculture in Northwest Colorado must be viewed equally with agriculture and industry throughout the state of Colorado. The agricultural interests in one part of the state should never be elevated over the agricultural interests in another part of the state.
- Agriculture water rights in Northwest Colorado provide a cornerstone of all other economies in the region; recreation, environment, retail, social, municipal, residential and industrial. Agriculture water must be protected and enhanced for the other sectors to succeed.
- Future agricultural needs in Northwest Colorado must be considered and planned for in the CWP.
- The principal of equal apportionment of water resources throughout the state must be a corner stone of the CWP to protect the Yampa, White and Green basin in Northwest Colorado from disproportionate impacts of a Colorado River Compact call.
- Any consideration of "New Supply" in the form of trans-mountain diversions from the West Slope to the East Slope should not threaten western slope water rights, including increasing the chances of a Colorado River Compact call.
- The CWP should promote water conservation in each basin to fully utilize the available water supply within each basin before any "new supply" trans-basin diversions are considered. Under no circumstances should agriculture be penalized for more efficient water use methods.
- The importance of non-consumptive benefits provided by flood irrigation should not be underestimated in the CWP. The historic use of agriculture water rights provides a river flow regime that helps maintain wetlands, recharge alluvial aquifers, provide late season flows to downstream users and augment minimal stream flows which help mitigate environmental concerns, including threatened and endangered species.



BOARD OF DIRECTORS

Greg Brown, Co-chair
 Erika Murphy, Co-chair
 Diane Holly, Secretary
 Medora Fralick, Treasurer
 Carol Atha
 Barry Castagnasso
 Kelly Heaney
 Ren Martyn
 Brett Mason
 Wayne Shoemaker
 Brian Smith
 Rich Tremaine

ADVISORS

Adonna Allen
 Bill Badaracca
 Dan Bell
 Carl Herold
 Steve Ivancie
 Jenna Keller
 Karen Massey
 Kyle Monger
 Chayla Rowley

STAFF

Marsha Daughenbaugh
 Michele Meyer
 Lindsey Hall
 Nancy B Kramer

Community Agriculture Alliance
 PO Box 774134
 Steamboat Springs, CO 80477
 970-879-4370
www.communityagalliance.org

- Water quality and quantity are inextricably linked. Therefore, water quality as well as quantity must be considered a fundamental goal of the CWP. The health of all stakeholders can only be served if the quality of the water continues to support healthy Agriculture and Ecosystems through which it flows.
- Future municipal and industrial water supply projects that incorporate agricultural and non-consumptive water supplies must be prioritized over single- or limited-use water supply projects.
- The stewardship that agriculture continues to provide to wildlife and riparian habitat through the use of Best Management Practices (BMP's) by maintaining open space through authentic working landscapes and conservation easements must be protected and enhanced in the CWP.

Thank you for the opportunity to provide input on the Basin Implementation Plan. The Board of Directors and Advisors for Community Agriculture Alliance are greatly appreciative of the time, effort and resources expended by each of the Yampa-White-Green Round Table members to assure the protection of water resources in Northwest Colorado.

Sincerely,

Marsha Daughenbaugh
Executive Director



To Whom It May Concern:

The Friends of the Yampa is a volunteer-run nonprofit based in Steamboat Springs, Colorado, dedicated to the protection and enhancement of the recreational and environmental integrity of the Yampa River and it's tributaries through stewardship, advocacy, education and partnerships.

In response to the Colorado Water Plan, we have four primary expectations for future water planning: 1) The state of Colorado shall view the Yampa River as a significant and reliable supplier of water to meet Colorado River Compact obligations; 2) Colorado shall hold non-consumptive needs as a priority and consider the significant conservation work that has been accomplished in the Yampa River Valley as an example for future water planning; 3) The Yampa Valley and western slope water users must be assured that, in the event of a compact call, negotiated equitable apportionment principles will be utilized to protect our many important junior water rights; 4) Maximum efficiencies through reduction and reuse programs shall be fully implemented before any further trans-basin projects are undertaken in the Yampa River basin and across Colorado. In fulfilling these expectations, Colorado will benefit from a gem of American river antiquity in the Yampa River, featuring a living, flooding, changing and thriving natural system.

The state of Colorado shall view the Yampa River as a significant and reliable source of water to meet Colorado River Compact obligations.

Twelve of the last fifteen years have been drought years in the state of Colorado and the greater Colorado River basin. Weather projection models predict this trend to continue and worsen. Lake Powell, as Colorado's bank account to fulfill compact obligations, has struggled to maintain a sufficient water level to ensure downstream delivery obligations and electric power generation. The Yampa River, as an unimpeded and under developed river, stands as a steady contributor to fulfilling Colorado's Compact obligations.

Colorado shall hold nonconsumptive needs as a priority and consider the significant conservation work that has been accomplished in the Yampa River Valley as an example for future water planning

The state of Colorado stands to benefit from the unencumbered hydrograph of the Yampa River as it sustains our traditional economy, agricultural heritage, and recreational

activities for tourism and residents. Nonconsumptive uses such as rafting and kayaking, fishing and hunting along with tourism are activities that will continue to prove beneficial to the State of Colorado.

Protecting the Yampa River's flows will also benefit the four endangered fish species that count on the spring flooding, and the warm, sediment rich water present in the naturally flowing Yampa River.

The Yampa River Legacy Project, through land and river conservation efforts, has successfully conserved lands worth over \$70 million along the Yampa River Corridor. This collaboration was an effort to protect the integrity of the Yampa River's agricultural heritage and unique riparian and recreation values. These conservation measures were accomplished through a collaborative, inclusive effort by a diverse group of stakeholders throughout Northwest Colorado.

The Yampa Valley and Western Slope water users must be assured that, in the event of a compact call, negotiated equitable apportionment will be utilized to protect our many important junior water rights.

In the event of a Western Slope curtailment to meet compact obligations, strict adherence to prior appropriation would be harmful to many important junior water rights. By utilizing a negotiated equitable apportionment method in cases where it is beneficial to critical junior rights, the state of Colorado will be better prepared to deal with water shortages.

Finally, the Eastern Slope of Colorado must maximize water use efficiency through a variety of methods including, but not limited to conservation, reuse, fallowing, new and expanded Eastern Slope storage and wise land-use planning principles.

The Front Range of Colorado is generating the majority of new water demand and should use their existing water resources as though there is no additional water. Conservation efforts have made progress, significantly in some areas. Reuse projects are being designed and built. Cooperative efforts between water suppliers and agricultural water right holders should be emphasized, striving to share water between efficient agriculture and responsible water providers. Expanded and new Eastern Slope water storage projects need to be seriously revisited. Eastern Slope water providers must partner with their local governments and establish policies for land use approvals that ensure there is a sustainable water supply prior to approval of new growth. Projected long-term water shortages in the Colorado River basin, along with the anticipated growth of eastern Colorado make a strong argument for continued emphasis on these measures.

Any new trans-basin diversion on the Yampa River threatens the role of the Yampa River as a significant and reliable source of water to meet Colorado River Compact obligations, and threatens the recreational and environmental integrity of the Yampa River, and thus must be opposed.

The Friends of the Yampa are grateful for the opportunity to provide input and respectfully urge the Governor, the Colorado Water Conservation Board and the Yampa/White/Green Roundtable to take these points into consideration when preparing the Colorado Water Plan.

Kind regards,

Charlie Preston-Townsend
Vice President, Friends of the Yampa
Steamboat Springs, Colorado



United States Department of the Interior

NATIONAL PARK SERVICE
INTERMOUNTAIN REGION
12795 West Alameda Parkway
P.O. Box 25287
Denver, Colorado 80225-0287



IN REPLY REFER TO:
NR-RSS

MAR 19 2015

Colorado Water Conservation Board
1313 Sherman Street, Room 721
Denver, Colorado 80203

Dear Board Members:

The National Park Service (NPS) respectfully submits the following comments and questions regarding the Basin Implementation Plans (BIPs) and the Colorado State Water Plan (Water Plan or CWP). Our comments are consistent with the NPS mission -- to preserve unimpaired the natural and cultural resources and values of the national park system for the enjoyment, education and inspiration of this and future generations. The NPS' Colorado River Basin Parks Program includes eleven units within the Colorado River Basin that encompass 1,130 river miles and more than 5 million acres of surrounding land. Management decisions regarding the river system have the potential to affect the unique natural, cultural, and recreational resources of these park units including those downstream in other states.

I. Goals for the Environment and Recreation

Concerns and challenges with Colorado River supply and demand

We support and share your concern regarding risk of shortage in the Colorado River basin, that "*the gap between our water supply and water demand is real and looming*" (CWP-pg 1) and that "*climate change and associated impacts make it more difficult to meet Colorado's future water needs because of diminishing suppl[y]*" (CWP - pg 3).

Environmental and recreational values to be protected

We also agree that it is necessary and appropriate to highlight the exceptional environmental and recreational values within the State of Colorado. We share your goal to "*honor Colorado's water values and ensur[e] that the state's most valuable resource is protected and available for generations to come*" (CWP - pg 4) and agree that Colorado's multipurpose water projects should include language about "*protecting the health of rivers, streams and watersheds*" (CWP - pg 5).

Desire to use water the most efficiently

We agree with Governor John Hickenlooper's statement that "*Every conversation about water should start with conservation*" (CWP -pg 145). Given that "*future supply of Colorado River water is highly variable and uncertain*" (CWP - pg 282), the NPS believes, along with the western slope basin roundtables, that minimum water conservation for future scenarios should be changed from "*low to medium*" to "*high*" (CWP - pg 99) to more adequately address the gap between water supply and demand. We agree with the InterBasin Compact Committee (IBCC) work to further define what is meant by, and to set, "*high conservation standards*" (CWP - pg 76 and pg 274), particularly for municipal and agricultural efficiencies. Water conservation and efficiency could positively affect the resources in the national park units if that water was kept in the streams.

II. Environmental and recreational water quality and quantity

Encourage inventory for environmental and recreation purposes

Many projects listed in the BIPs seek to protect environmental and recreational resources via inventories of agricultural uses and existing infrastructure. While we agree it is important and necessary to inventory agriculture-related needs and conditions, we feel it is equally important to explicitly inventory and evaluate streams to identify key reaches with high (or low) environmental and recreational value, and those that are most in need of protection from threats to water quality and flow-dependent resources and values. We particularly encourage these inventories in the Gunnison Basin above Curecanti National Recreation Area and Black Canyon of the Gunnison National Park, and in the Yampa Basin above Dinosaur National Monument, as well as the Colorado Basin which is upstream of Canyonlands and Arches National Parks.

Identify more on-the ground projects for water quality or environmental improvements

We also encourage more action projects in all the BIPs to restore and address water quality and environmental concerns. We fully support those projects identified in the Colorado BIP that take steps towards on-the-ground environmental and recreation protection, and those in the Gunnison BIP that identify and address water quality concerns. More of these types of projects would help further meet BIP goals to ensure that key reaches are protected to the appropriate degree and to provide environmental and recreation benefits to the park units, the basins and the State.

Current in-stream flow protections of base flows may not protect all environmental and recreation purposes

Throughout the CWP and the BIPs, many references to existing in-stream flows imply that protection of minimum flows (i.e., base or subsistence flows) adequately protects all environmental and recreational uses. While in-stream flow protections for base flows are a good first step, it may be incorrect to assume that protection of just the minimum base flow will be sufficient to protect all environmental resources and/or recreational uses. Fish, sediment, and vegetation resources are influenced by peak and base flows, as well as other aspects of flow transitions, and in many cases have specific needs for both, as well as other specific flows, to maintain their quality and dynamic condition. It may be appropriate to evaluate whether existing in-stream flow protection is sufficient for environmental and recreational uses.

III. Concerns regarding risk associated with basin diversions

Risks and uncertainties related to water availability

We share the concerns raised by West Slope basins regarding increased risk in the Colorado River Basin from new supply projects, especially trans-basin diversions (CWP- pg 282-284). There has been a great deal of discussion in the roundtables about information which supports the idea that the Colorado River is currently over allocated. Uncertainty in climate change futures, changes in average inflow to Lake Powell, and incomplete information surrounding basin water commitments (e.g., existing water rights) result in uncertainty over the amount of water that is currently available for diversions out of the Upper Basin. During the West Slope Basin Meeting in December 2014, there was a call for more information on existing water commitments in each basin. The last Upper Basin hydrologic determination was completed in 2007, thus we are a long way from complete quantification of water rights and commitments in each basin. We support further data and information collection in order to better determine the water availability in these basins as it would help assess the potential impacts to our downstream national park units. Until there is more complete information available regarding commitments in each of the basins and less uncertainty in future water availability under climate change scenarios, concerns will remain related to any large future transmountain diversions.

Concerns related to diversions in wet years

We agree that *"Drought and dry periods have significant and lasting impacts on water supplies and availability for years, while wet years offer relief with as much as six times the amount of annual water*

supplies compared to dry years" (CWP -pg 56). Wet years refill reservoirs, like Lakes Powell and Mead, which are critical to the water infrastructure of the West. If wet-year water is instead diverted and used to supplement dry-year consumptive uses (CWP, IBCC Conceptual Agreement – pg 3), not only are reservoirs not refilled, but many of the aquatic and riverine ecosystems and associated wetland systems that depend on these high-flow wet years will be further imperiled. NPS recognizes the rights of states to develop their water and appreciates the State of Colorado's efforts on the CWP. Yet we remain concerned about the increasing risk of shortages and their effects not only on the environment and recreation, but also on agriculture, municipalities and industry. We agree with several of the roundtables that if new diversions are planned there is a need for thorough data collection and the need to quantify and evaluate impacts prior to setting aside water rights (CWP - pg 283). This would allow us to assess the impacts to our downstream resources in the park units.

IV. Economics metrics and trends for all sectors

Need for consistency in economic metrics

The CWP and BIPs use specific metrics (e.g., amount of water diverted and consumed, jobs generated, and dollars generated, etc.) to describe the contribution of agriculture to the regional and state economy (e.g., CWP –pg 78 and 118). These same reports also state that "[o]utdoor recreation (including hunting, fishing, biking, hiking, skiing, golfing, wildlife watching and many other types of outdoor activities) significantly contributes to Colorado's economy, with non-consumptive water-based recreation an important part of that economy" and that "Healthy watersheds, rivers and streams, and wildlife are vital to maintaining Colorado's quality of life and a robust economy" (CWP – pg 212). It would therefore seem appropriate to use the same metrics to compare and contrast the different uses of water (agriculture, hydropower, environmental and recreational) in terms of (1) amount of water diverted and consumed, (2) number of local and regional jobs supported, (3) dollars generated and infused into the local and regional economies, and (4) expected trends over time. This would provide clarity and allow for comparison of the economic value of consumptive and non- consumptive uses.

V. Drought contingency

Need inclusion of resource protection in priorities for drought contingency

Please include "*protection of in-stream natural resources, including endangered fish and other natural resources,*" as one of the principles for the contingency planning. On page 18 of the CWP, in legal and institutional setting, it currently mentions only power generation. Protection of downstream resources has been mentioned as a priority in discussions at the roundtables as well as in discussions with CWCB staff, so we agree with those sentiments and suggest that wording to that effect be included in this plan. Flows out of Flaming Gorge Dam and Aspinall Dam directly affect resources within National Park units as well as the endangered fish within these reaches.

Thank you for this opportunity to comment on the Colorado Water Plan and the Basin Implementation Plans. And thank you for incorporating in your December 2014 draft, many of the comments from our November 2014 letter. We look forward to working with the State of Colorado further on the Water Plan and issues affecting NPS system units which arise from it. Please contact Rob Billerbeck, NPS Colorado River Coordinator for additional information on these comments or for more in-depth discussion about them. Rob can be reached by telephone (303-987-6789) or by electronic mail at rob_p_billerbeck@nps.gov.

Sincerely,



Sue E. Masica
Regional Director

cc: NPS Colorado River Steering Committee Members:

- Christine Lehnertz, Regional Director, Pacific West Region
- Ray Sauvajot, Acting Associate Director, Natural Resource Stewardship and Science
- Mark Foust, Committee Chair and Superintendent, Dinosaur National Monument
- Dave Uberuaga, Superintendent, Grand Canyon National Park
- Todd Brindle, Superintendent, Glen Canyon National Recreation Area and Rainbow Bridge National Monument
- Bruce Noble, Superintendent, Black Canyon of the Gunnison National Park and Curecanti National Recreation Area
- Kate Cannon, Superintendent, Arches National Park and Canyonlands National Park
- Patrick Gubbins, Acting Superintendent, Lake Mead National Recreation Area

NPS Staff:

- Tammy Whittington, Associate Regional Director, Resource Stewardship and Science, Intermountain Region
- Karen Breslin, Senior Policy Advisor, Intermountain Region
- Rob Billerbeck, Colorado River Coordinator, Intermountain Region
- Ed Harvey, Chief Water Resources Division, Natural Resource Stewardship and Science
- Bill Hansen, Water Resources Division, Natural Resource Stewardship and Science
- Mark Wondzell, Water Resources Division, Natural Resource Stewardship and Science

Basin Implementation Plan Representatives:

- Michelle Pierce, Gunnison Basin Roundtable Chair
- Jon Hill, Yampa Basin Roundtable Chair
- Jim Pokrandt, Colorado River Roundtable Chair