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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 BRT 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)



YAMPA/WHITE/GREEN BIP

Basin Goals and Measurable Outcomes



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_II_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 CWCBC'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.

