Colorado River District
Protecting Western Colorado Water Since 1937

Craig Godbout
Program Manager
Water Project Loan Program
Colorado Water Conservation Board
1313 Sherman St., Room 718
Denver, CO 80203

1/4/2019

via email

RE: PTGG1 #: 2019-2162 | Final Deliverable

Dear Craig:

This letter and attachments constitute the final deliverable under PTGG1 #: 2019-2162 for the Yampa White Green Implementation Plan Modeling.

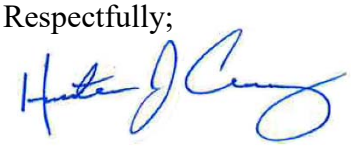
Summary of Final Deliverable

To complete task 1, WWG contracted with Community Agricultural Alliance (CAA) to conduct agricultural stakeholder meetings for the four river segments. CAA held six meetings, which engaged over 100 agricultural producers. WWG also conducted interviews with the division engineer and several members of her staff. The attached report summarizes CAA's findings (see IWMP Stakeholder Meetings Report) and a memo dated October 3, 2018 describes the findings from the DWR meetings and constitute the deliverables for task 2.

Task 3 consisted of compiling existing data and performing an assessment gap analysis. The attached Science Data Compilation and Gap Assessment describes the baseline data and assessment of gaps for each proposed river reach.

WWG worked closely with Nicole Seltzer at the River Network to develop recommendations and the Scope of Work for the Yampa IWMP. Also as part of the tasks 4 and 5, WWG presented their recommendations and Scope of Work to the IWMP Committee and BRT at subsequent meetings. Ultimately, the efforts culminated in the application to the CWCB to fund a Yampa IWMP.

Respectfully;



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Community Agriculture Alliance
IWMP Stakeholder Meetings Report

Methodology

Small group meetings were held in Phippsburg, Hayden, Clark, Steamboat, Craig and Maybell. Meeting attendance was limited to 15 participants (exception of Craig meeting, 27 participants) to allow for full participation and discussion. Meetings were held 6-8pm with dinner served. CAA staff provided meeting facilitation and discussion on IWMP related questions. Division of Water Resource staff, including Division Engineer Erin Light, joined meetings after an hour. DOWR and CAA led discussion on value of water rights, related maintenance and questions.

Meeting Goals

- Assess interest level to be involved with IWMP
- Gain feedback on IWMP priority issues
- Identify sub-basin coordinator prospects

Meeting Questions

- Please give us an overview of your irrigation system from a historical perspective, current practices and changes or improvements for the future.
- What issues do you have with your irrigation system?
- What is your understanding of how the watershed works? What do you see as your role within the watershed?
- What could be done to improve irrigation infrastructure in the watershed?
- What is your interest and/or input on upgrading infrastructure?
- What are your thoughts on current or new water storage projects?
- Do you have concerns about river access or recreation projects?
- Do you think endangered fish recovery is a critical issue?
- Do you have recommendations for projects or actions that could help improve water use and/or water quality?
- Do you think we can work together, as a bigger system, on watershed issues? Are you willing to be a part of that process? How?
- What is your willingness to work in connection to other groups on watershed projects? Ex environmental groups, government, industry, municipalities
- What would you want to see in the IWMP? What should not be included?
- Who would be recommended to help coordinate IWMP in this area/sub basin?

DOWR Questions

- In your minds, what do you believe to be the value of your Water right?
- What would happen to your ranch/farm if you had no water?
- What investments do you make annually to assure water is available for application and use? Labor, time or monetary
- Do you have an operable headgate? Do you have an operable measuring device? If yes to either a headgate or measuring device, what maintenance do you perform each year on these devices to assure they are operable?

- How is the ditch managed, part of company or individual owners? Does this pose any constraints on your ability to maintain the ditch?
- In closing, take a moment to consider what is the most valuable asset on you ranch/ what is the one thing you absolutely have to have in order for your ranch to operate? If the answer is "water" take some time to think about what you can do to assure this asset and its value is properly protected.

Meeting Summaries

Yampa Headwaters – Flat Tops to Stagecoach

Education and Outreach

- Common understanding that what they do has both local (neighbor) and broader impact on entire river system. Long time ranchers help educate new ag producers, ranch managers and 2nd home owners.
- Distrust of government, unwanted intervention and funding that could have different or a wide range of interests and possible influence. IWMP needs to address trust building and "one person at a time" approach to listening and engagement.
- Concerns and distrust of UYWCD, specific questions about Morrison Creek projects. UYWCD is negatively perceived and needs to work on building trust around common goals with agriculture.
- Acknowledge importance for some ag producers with fishing/recreation programs "If it weren't for fishing, we couldn't ranch". Possible education on benefits and successful structure of similar programs that have economic benefit for ag.
- Education for recreation, conservationists, 2nd home owners on importance and benefits of agriculture irrigation (specific example given of head gate being blocked with logs to try and stop water in ditch, lack of understanding importance of agriculture and water rights)
- Education for agriculture on different diversion structures (tour examples of fish structures on Snake River) and funding available for structure projects

IWMP Needs Assessment/Research

- Concern over low flow and river dry up (Bear River and tributaries) and impacts to fish, wildlife, ecology, water temp and overall riparian zone; could this be avoided with more flexible policy and cooperation. Education and cooperation on river/fish health projects. Improved communication with Division of Wildlife and other organizations, on how they can work together to keep river flowing and healthy fish population. Advocacy for common sense approach vs rigid statewide policy that does not fit all areas/situations
- Concerns about cost of water and ability of agriculture to afford reservoir water in the future and stay in production agriculture. Data and information on cost of water, and tools to help agriculture make economic decisions.
- Support additional storage depending on water right used and intended purpose (ag included). Ag involvement in assessment and research work to build cooperation and buy in.

Projects

- Feeling there have been many meetings with poor representation of South Routt agriculture and little or no action that is beneficial to ag. IWMP needs to address this and help create

opportunities for “low hanging fruit” type projects that can build good will, trust and interest in further cooperation/involvement.
- Every diversion could use some repair and/or upgrade both privately and critical repairs at Stillwater Reservoir.

Sub-Basin Coordination and Leadership

- South Routt community members feel they work well with one another and neighbors communicate. This is a strength to build upon for IWMP coordination. It is important to ask for their help in communicating with one another and that the sub-coordinator be someone from the area (not an outsider).
- They understand importance of accurate records and historical information. There is an opportunity for IWMP to gain historical information from long time ranchers in area.
- No identified Sub-Basin Coordinator (Andy Shaffner was suggested, but she was in attendance and declined)

Summary

- Scale of Interest for IWMP involvement - 1 (not interested at all) to 5 (eager to participate) = 3

Yampa Mainstem – Stagecoach to Elkhead Creek

Education and Outreach

- Concerns and misunderstanding of water conservation vs use it or lose it concept that is felt to encourage wasteful use. Education programs and support for one-on-one meetings to improve understanding of current system
- Need to keep water for livestock (augmentation possibilities). Education for ag on augmentation options and current programs.
- Frustration with littering from recreation users. Outreach, education and signage for rec users. Education and communication with recreation users on health of river, trash and impact
- IWMP must respect private property rights and focus on keeping water in Yampa Basin, not sending it downstream to CA or NV. Apprehension and distrust that outside groups offer money and want influence. Open communication and information sharing will help reduce this perception.
- Low water flows potential change in irrigation practices, “river has lost its ability to flood in my reach”, future plans to mitigate this would utilize pumps. Education and information on dealing with low flows, options and resources.
- Concerns that long ditches are not efficient due to water loss, gated pipe more efficient but costly; cost of pumps also an issue that it does not make economic sense with hay prices, how to stay in production agriculture and maintain irrigation? Information and resources on cost benefit analysis.
- Education for ag water users on head gate installation, maintenance and use.
- Interest in education on alternative dam methods (instead of push up or gravel dams)

IWMP Needs Assessment/Research

- Interest in improved head gates for more efficiency

- Interested in learning about more water storage options, ex Morrison Creek, or smaller storage in a variety of geographic areas to help capture high flows when available for agriculture and projects that benefit overall river health.
- Utilize technology to enter water records and communicate with DOWR, if developed would need training on this.
- Concern about wildfire impact, heavy rain or spring runoff can negatively affect water quality, silt and ash may impact municipal and irrigation systems. Learn from other communities and develop proactive plans for Routt National Forest. Study and implement check dams in the National Forest to minimize negative impacts on water quality.
- Questions about push up dams in the river and their effect on river health, interest in alternatives that are "fish friendly" and maintain river health.

Projects

- Signage for when the river is too low to float, improved communication with rec users at rental shops (fishing, tubing, rafting, paddleboard, etc). Possible training for guides and rental shop employees.
- Repair for Stillwater Reservoir

Sub-Basin Coordination and Leadership

- Limited communication among neighbors and even within ditches, facilitator would be helpful. Frustration with DOWR lack of communication ("no call, no text. Just an orange note on headgate saying we were shut off")
- No recommendations for Sub Basin Coordinator but feel it would be a great position to have filled; lots of ideas of what they could do.

Summary

- Scale of Interest for IWMP involvement - 1 (not interested at all) to 5 (eager to participate) = 2.5

Yampa Mainstem – Elkhead Creek to Deerlodge

Education and Outreach

- Beavers are negatively impacting irrigation ditches and flows. Education on how to mitigate and manage without negative impact.
- Concerns that agriculture may be at odds with environmentalists and the "wild and scenic" image of the Yampa . Outreach and relationship building with environmental groups.
- View a broader, whole system approach as important (several ranchers in Maybell area also have property on other part of the Yampa/tributaries and see need for bigger picture) Be aware of this when focusing on specific sub-basin issues, it is important to communicate with all ag producers equally.
- Be aware of salinity and selenium water quality in the Yampa Basin (concerns coming from issues in other parts of Colorado). While not a current issue, consider education and information sharing on current standards and management strategies.
- Questions on water quality monitoring in the area, education opportunity; and concerns that agriculture will be blamed for negative impacts when it may be industrial cause.

- Timing for irrigation is critical, some tributaries of the lower Yampa go dry quickly in spring (Milk Creek, Williams Fork); education on what happens to their water right if creek is dry.
- Education for recreation users on importance of agriculture and private property rights.
- Education for ag water users on tailwater use, legality and overall river health.

IWMP Needs Assessment/Research

- Additional storage is important to consider, concerns that water will go to Front Range and or CA, NV; ensure that storage is available and affordable for ag. Comments that "water will flow to the most voters and money, rather than to those with senior rights involved with production agriculture". Ag needs to be a part of storage projects and information shared so there is increased trust that water will be available for agriculture in our area.
- Recognition of importance of fish recovery program but strong concerns over management practices, seeking holistic approach that involves community (Question if it would be better for the native fish to have low flows since that is how they survived in the past and the non-native would not survive the low flows). Improved communication and education on fish program so ag producers can understand their role and goals of programs.
- Concerns about forest management and forest fires having a negative impact on water quality. Education and studies on impact, prevention and recovery plans.
- IWMP should include management and control of nonnative species (both plants and wildlife). Education for agriculture on what/why/how and management plans.
- Study and/or education on impact of irrigation systems (flood vs sprinkler). Ag producers acknowledge critical importance of up river flood irrigation for late stream flows but are concerned there is pressure to change for sake of efficiency and what negative impacts could happen to entire river system. "Need science to back this up."

Projects

- Opportunity for irrigation structure improvement, most are aging and inefficient. Include education on options, costs, assistance, installation and maintenance.
- Upgrading Maybell Ditch diversion to recreation/fish/ag friendly structure. Focus on multiple beneficial uses and partnerships.
- Research, study and educate about ag water storage projects at Milk Creek and Black Mountain
- Erosion control on Elk Head Reservoir, major concerns on impacts and inefficiency.

Sub-Basin Coordination and Leadership

- Distrust of outside organizations, specifically environmental groups, and fear that what starts out as cooperative projects will have increasing environmental stipulations and restrictions. Trust building, and cooperation is critical to project success.
- Sub basin coordinator recommendations – Mike Camblin and Frank Stetson

Summary

- Scale of Interest for IWMP involvement - 1 (not interested at all) to 5 (eager to participate) = 3.25

Elk River and Tributaries

Education and Outreach

- Limited interest on additional water storage, noted past studies and no action that impacts agriculture, "snow pack is our storage". Concerns about additional storage creating congestion of rec users and exorbitant costs. Consider outreach and including in education efforts on other basin storage projects.
- Irrigation is different, land has been subdivided creating narrow meadows that are not conducive to sprinklers and ditch maintenance is challenging. Education on irrigation options and technology use.
- Soil needs fall irrigation to help establish hay for next year. Education and information on soil health impact and irrigation practices.
- Visitors want to see the green valley, what is "value of the view" and impact on ag water use. This is a much broader issue that needs to be discussed further with ag producers in general.
- Private leasing for rec/fishing has positive economic impact and managed privately. Shared information from those who have successful programs with others who might want to consider.
- See themselves as part of water basin and their role is to use water efficiently and "conserve as much water as possible". Education on water use, legal implications and conservation.

IWMP Needs Assessment/Research

- How to balance river health/use and ranching stability is critical challenge while protecting overall river health/system. Science, data and information on impacts.

Projects

- Need strategies for agriculture going forward for the increased dry weather pattern, short and long term. This includes education, outreach and storage projects that will positively impact entire river system, not just Elk River area.
- Education for recreation users on their impacts and the importance of agriculture.

Sub-Basin Coordination and Leadership

- "We are busy and do not have the time to work on water issues" but recognize critical importance of someone to coordinate.
- No recommendations for Sub Basin Coordinator

Summary

- Scale of Interest for IWMP involvement - 1 (not interested at all) to 5 (eager to participate) = 2
- Note: limited participation at meeting, additional stakeholder input needed

CAA Summary and Key Recommendations

Overall there is a positive reception to the idea of involvement with the IWMP, with some areas more interested in specific projects than others. Ag water users understand that they need to be involved and be a part of the plan, not just heard or represented, but an active participant. This is a significant

challenge, as being involved or active means something different to each person. The best strategy to move forward on this is improved communication (website, email, phone calls, group and individual meetings) and an understanding that one method will not reach everyone. While ag producers recognize the importance of working on a broader plan and river related projects, there is significant mistrust of government and water organizations but an open attitude and willingness to work together on common goals. Building trust, one person at a time, will be the first step in any successful plan/project. Project coordinators and partnering organizations must be willing to develop relationships with ag water users. It is important to meet them in their communities, being cognizant of the time of day/year that works for ag producers. Listening, building trust, respect and an equal partnership is a critical first step. Improved coordination and communication would benefit all water users.

A related, but often conflicting statement, was "meeting and study fatigue". Ag producers feel there has been a lot of discussion on water related projects but little or no action. They expressed an interest in making decisions and taking action, especially on ag water storage projects. Identifying projects that are "low hanging fruit", smaller, easily accomplished while successful and impactful will aid in building trust and lay the groundwork for larger, more complicated projects. One ag producer explained their concerns by stating, "Storage is only beneficial to agriculture if the water is earmarked for irrigation use and that use must be protected long term. The Upper Yampa Conservancy District, the gov't entity that would build storage projects, does not want to build irrigation projects because they don't pay enough. They also want to replace the current irrigation storage water at the head of the river with the more lucrative uses of municipal, industrial or augmentation. This potentially harms agriculture and is a clear indication of what uses Upper Yampa would want any new storage to be earmarked for. In addition, there is a limited demand for irrigation water below Stagecoach."

Ag producers expressed a clear desire to protect and respect private property including river/water access. There is a strong perception that recreation (fishing, tubing, rafting) does not understand or value the importance of agriculture. There is an opportunity to build partnerships and education programs with recreation organizations.

There are also opportunities for additional education programs for ag water users. There are questions and ambiguity about water rights and responsibilities. Resources and assistance with measuring devices and headgate maintenance were also mentioned multiple times. There is confusion and frustration on "use it or lose it" concept. Many ag water users have misconceptions about losing their water rights if they don't use the full amount. In many situations they could use less water than their full water right, but the current system does not allow for this or provide an incentive to conserve water. Additionally, education programs on how to minimize water waste and irrigation practices that benefit overall river health would be of interest. Starting with education and information, helping build positive relationships with Division of Water Resource staff and working towards common sense solutions to aid the entire river system will take time but ag producers understand the critical role they play in the basin. One producer summarized this by explaining, "My role is to work as an active environmentalist rather than an environmental activist. To reasonably advocate for agricultural water use, to protect production agriculture and help preserve the river habitat for the diminishing wildlife populations along the river corridor."

In 2006 CSU Extension completed a study called "The Value of the View" that measured the economic impact and tourist value of Routt County's working landscape. The challenge remains how to create a

connection between visitors/2nd home owners/new residents who come to the Valley for its beauty and heritage, with local independent agriculture. Building understanding and awareness that agriculture is the foundation of water management and current ecological state of the river would be beneficial for all. Identifying programs and strategies that preserve open agriculture land while supporting a healthy river system is a critical consideration. If ag producers go out of business the entire community stands to lose economically, environmentally and the connection to our authentic agriculture heritage.

While the meetings did not identify sub basin coordinators, there is interest in having this position in the communities. Once specific projects are identified, CAA would be available to help recruit sub basin coordinators from the agriculture community and most likely have a greater success of filling the positions with a targeted project and direct ask.

Municipalities were not interviewed due to time constraints. An online survey was sent but there were no respondents at time of report. Additional outreach is needed for municipalities in Oak Creek, Yampa, Hayden and Craig.

Memo

DRAFT

To: Yampa IWMP Committee
From: Lisa Brown
Date: 10/3/2018
Re: Task Order No. 6, subtask 2: Division Engineer Interview

Introduction

As a result of the Basin Implementation Plan Modeling Phase 3 project, the Yampa/White/Green Basin Roundtable (BRT) is exploring the possibility of an Integrated Water Management Plan (IWMP). The BRT convened the IWMP Committee to clarify the purpose, need, and sideboards for the IWMP. The IWMP Committee has identified the following priority issues:

- Upgrading infrastructure, especially multi-purpose diversion rehab/upgrade projects
- Enhancing understanding of existing river corridor health (flow, stream structure, habitat, riparian condition) and identifying projects/strategies to protect or enhance
- Advancing an integrated system of current/new storage and releases to meet both consumptive and environmental needs
- Addressing flow management needs for endangered fish recovery
- Developing river access and recreation projects

The IWMP subcommittee has defined the geographic scope as four segments:

- Yampa headwaters (Bear River and its tributaries) from the Flattops to Stagecoach Reservoir and Oak Creek.
- Yampa mainstem from Stagecoach Reservoir to Elkhead Creek
- Yampa mainstem and Elkhead Creek from confluence to Deerlodge
- Elk River and major tributaries

Task Order No. 6 will assist the BRT in gathering and refining stakeholder input, performing an assessment gap analysis, determining what the IWMP scope of work should include, and deciding which segments of the Yampa Basin to move forward to a grant application. To support the BRT's decision making, Wilson Water Group (WWG) interviewed the Division Engineer and water commissioners for the areas under consideration. This memo summarizes the general themes from the interviews and highlights specific concerns by segment. WWG also discussed the quality and quantity of data that is collected by the water commissioner in order to inform how the Yampa River StateMod model can be enhanced. WWG makes recommendations by segment below. This memo serves as the deliverable for Task 6.2.

Division 6 Staff

WWG conducted one-on-one, in person interviews with Erin Light (Division Engineer) and the following Division 6 water commissioners:

- Scott Hummer - administers the Yampa River and tributaries upstream of Stagecoach Reservoir. Scott has extensive experience as a water commissioner in Summit County. This is his second season in the Yampa.
- Brian Romig - administers water district 57, Oak Creek, and the west side of the Yampa River from Stagecoach to the confluence with Elk River. As the lead water commissioner, Brain assists the other water commissioners when issues arise. Brian was the water commissioner on the Roaring Fork before moving to the Yampa in 2000.
- Glen Light - administer the Elk River basin and the east side of the Yampa River from Stagecoach to the confluence with Elk River. This is Glen's third season on the Elk River.
- Lauren Berrien - administers water district 44. This is Lauren's second season in the Yampa.
- Sarah Myers - administers water districts 54, 55, and 56. Sarah has water resources experience in Wyoming. This is her second season in the Yampa.

The map below shows the water district boundaries and the proposed IWMP segments.

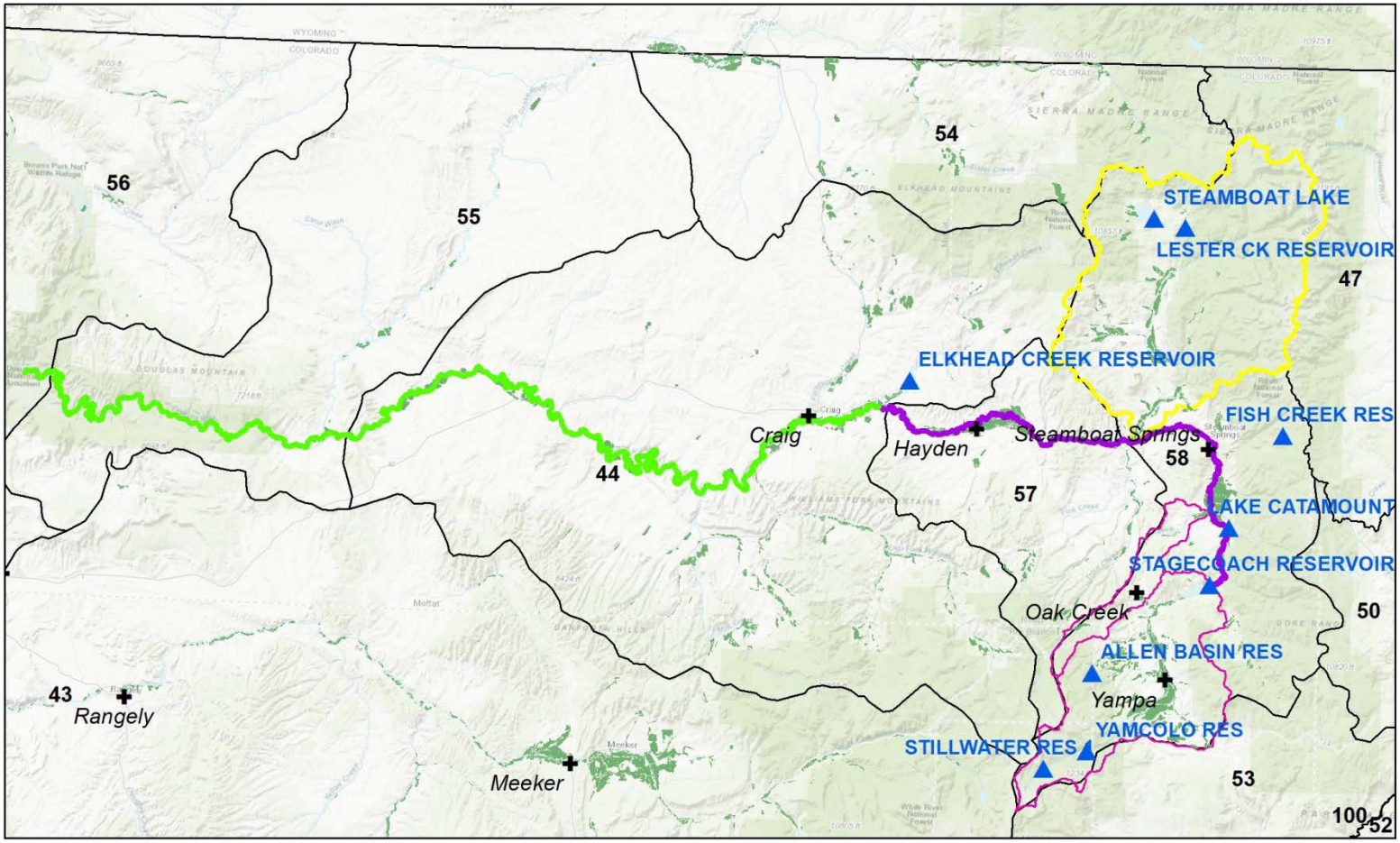

Figure 1: Yampa Basin Administration Boundaries, Proposed IWMP Segments, and Reservoirs Included in StateMod

Common Themes

The Division 6 Staff is supportive of an IWMP. Several themes emerged from the interviews of administrative priorities and needs in the basin that could be addressed with an IWMP:

- Lack of measuring devices on diversion structures
- Diversion structure improvements and maintenance
- Education of water users
- Research into return flows

The top three themes were highlighted by the first call on the mainstem of the Yampa River, placed by the Lily Park Ditch late this summer. Historically, there have been calls on major and minor tributaries to the Yampa River, but there had never been a call on the mainstem of the Yampa River. The Lily Park Ditch is just upstream of the Little Snake River confluence with the Yampa River, and the call impacted Water District 44, 57 and 58.

Lack of Measuring Devices

The Division began administering the call by turning off structures that do not have a measurement device. The following table summarizes the number of ditches, pipelines, and pumps with and without measuring devices by water district.

Water District	Number of Ditches, Pipelines, and Pumps **with** Measuring Device	Number of Ditches, Pipelines, and Pumps **without** Measuring Device	Percent **without** Measuring Device
44	140	300	68%
57	41	105	72%
58	275	448	62%

About 5 years ago, the Division Office ordered all of the structures in the Elk River basin to install measurement devices. The vast majority of the structures have complied, which means the remaining 448 structures without measuring devices are located in the headwaters of the Yampa.

The Division described the experience of a mainstem call as eye-opening for the water users throughout the basin. Water users expressed frustration because of the “sudden” requirement for a measurement device and the high cost of installation (quotes ranged from $1,000 to $5,000). Four water commissioners mentioned referring water users to the Upper Yampa Water Conservancy District (UYWCD) and Colorado River District grant programs to help off-set costs. The UYWCD grant program was specifically created to help water users install measurement devices and improve headgate infrastructure. While this grant program has been successful in many cases, one water commissioner mentioned that some water users refuse to apply to UYWCD’s grant program.

Diversion structure improvements

In general, Division Staff recommended the IWMP could help fund diversion structure improvements throughout the basin that would benefit both the water user and the river. The following structures were listed has high-priority by the water commissioners.

Yampa headwaters (Bear River and its tributaries) from the Flattops to Stagecoach Reservoir and Oak Creek

This region generally has low quality diversion infrastructure. Almost all of the structures could be improved. Many structures do not have operational headgates. The ditches are controlled by plywood boards placed across the opening of the ditch and reinforced by dirt plugs, or other inventive methods. When the river is low, some water users will build up diversion dams with whatever material is on hand.

In addition to diversion structure improvements, Division Staff highlighted the need for improvements at Stillwater Reservoir (Bear River) and Sheriff Reservoir (Trout Creek, surface water supply for the town of Oak Creek).

Yampa mainstem from Stagecoach Reservoir to Elkhead Creek

The Division Staff focused their recommendations on diversion structures that impact river connectivity and fish passage. The majority of the recommendations were in the Morgan Bottom area, near Hayden.

- Gibraltar Ditch (5700539) - Morgan Bottom area. The ditch has received grant money from TNC and was recently improved. This could serve as a model for the other structure in the area.
- Williams Irrigation Ditch (5700622) - Morgan Bottom area, needs improvement
- Walker Irrigation Ditch (5700611) - Morgan Bottom area, needs improvement
- Shelton Ditch (5700592) - Morgan Bottom area, needs improvement
- Marshall Roberts Ditch (5700563) - Morgan Bottom area, needs improvement
- Woolery Ditch (5800944) - near Steamboat Springs. The diversion dam prevents recreational users from floating a portion of the river.

Yampa mainstem and Elkhead Creek from confluence to Deerlodge

The major diversion point is the Maybell Ditch and they have started several infrastructure improvement projects. The water commissioner suggested that the IWMP could assist smaller ranches that don't have the resources to make changes, such as:

- Nichols Ditch No 2 (4400721) - has difficulty holding a headgate in the sandy soil and could benefit from converting to a river pump.
- Juniper Ditch (4400674) - has difficulty with ditch maintenance.

Elk River and major tributaries

A typical practice on the Elk River is for water users to build push-up dams during low flow times. The Elk River has an abundance of course sediment, so the push-up dams are primarily made of gravel from the riverbed. This can severely reduce or completely blocking white fish migration up the Elk River to their traditional spanning habitat. The following ditches generally impact the river conditions the most:

- Morin Ditch (5800783)
- Elk Valley Ditch Company Ditch (5900626)
- Keller Ditch (5800714)
- Campbell Ditch (5800577)
- Mountain Meadow Ditch (5800789)

Education of water users

The Division Staff recommended that water users need additional education opportunities to learn about the prior appropriate system, water rights administration, the value of a water right, and how to maintain their water right. Division Staff has conducted outreach and educational opportunities in the past, but has not reached the whole community. Division Staff expressed frustration that the water users are resistant to installing measurement devices because water users think that will reduce the value of their water right. However, the opposite is true under Colorado water rights administration. Division Staff expressed hope that the recent mainstem call would provide motivation for water users to take advantage of the resources that are currently available.

Division Staff also suggested that the IWMP could be an opportunity for agricultural water users to learn from each other about best practices. Many irrigators are using the same technique as their grandfathers. There are some innovators in the basin and this might be a nice forum for exchanging ideas.

Research into return flows

Division Staff commented on the fact that some irrigators are starting to convert to sprinkler irrigation. There are several motivating factors, but the primary driver for conversion in the upper Yampa is that sprinklers are physically easier to manage than flood irrigation. Therefore, as the ranching population gets older, some are converting to sprinklers in order to be able to continue ranching. This conversion to sprinklers may be at odds with the conventional wisdom that flood irrigation fills the soil moisture and alluvial aquifer, which then provides return flows to the river during the late irrigation season and early fall. However, some flood irrigation practices seem to result is large amounts of surface return flows that come back to the river almost immediately. Division Staff would like to see some field-level research considering different soil types and different flood irrigation practices that addresses the following questions:

- How much does flood irrigation contribute to late season return flows?
- How does flood irrigation practices and soil type impact the amount and timing of return flows?
- How can users implement best practices to minimize diversions and maximize late season return flows?

Challenges to an IWMP

WWG specifically asked the Division Staff what could motivate agricultural water users to participate in an IWMP. Staff suggested that there is no "one-size-fits-all" approach. Agricultural producers are busy and will need focused interaction during the time of year and time of day that are less busy. Some folks will not participate. Division Staff thinks that the recent call experience may motivate people, but it could be in either a positive direction (get involved, take advantage of opportunities for education and funding for improvements) or a negative direction (more distrust). Some staff suggested that the IWMP could offer a carrot to the water users in the form of funding to help install measurement devices, headgates, and general ditch maintenance.

Two water commissioners mentioned that some water users mistrust UYWCD. WWG suggests that this sentiment reflects a rift in the agricultural community, since there are agricultural producers serving on the UYWCD Board. This rift in the agricultural community presents a challenge to engaging the whole agricultural community and UYWCD in the IWMP processes.

Yampa River StateMod Status and Potential Enhancements

StateMod is the official State of Colorado water resources planning model. The Yampa River StateMod model was updated by WWG for the Phase 3 modeling project. Refinements were made to the model in order to capture the current operations of large users and reservoir operators, as well as accurately depict future projects (IPPs). The Yampa River StateMod model is appropriate for basin-wide planning studies. It is very well calibrated. The model represents 100% of the irrigated acreage and about 100% of the consumptive use.

However, the model may need further refinements to represent the watershed upstream of Stagecoach, Oak Creek, and the Elk River basin for an IWMP because of the finer spatial resolution required. Currently, diversion structures with water rights greater than 5 cfs are represented explicitly, meaning that the model accurately represents the physical location, structure capacity, water rights, and demands. Smaller agricultural users are aggregated by sub-watershed and small domestic water provider diversions are estimated based on population. The limiting factor for spatial refinement will be the availability of diversion records for small structures. The primary source of data used by StateMod is HydroBase, the official State of Colorado database. Diversion records, diversion coding, reservoir storage and accounting are stored in HydroBase and extracted for inclusion in StateMod. This information is collected by the Division Staff. WWG discussed the process of collecting diversion records with the water commissioners to better understand this limiting factor.

Record Keeping

WWG discussed diversion and reservoir records with the water commissioners. Because of the wide-spread lack of diversion measuring devices, the water commissioners have become very adept at performing "chip tests". This is a common, field-based flow measurement technique. When there is no call to administer, the water commissioners are spending a significant amount

of their time visiting diversion structures and recording diversion amounts. The major structures in each water commissioner's area are visited at least once a month. When a call is being administered within a water commissioner's area, the majority of their time goes into administering the call. Structures impacted by calls are generally visited every two or three days.

Water users are asked to submit diversion records, but the Division Staff only receives information from about 10 percent of the structures. The Division Staff is becoming more critical of user-supplied information and have taken the approach of "no information is better than wrong information". Therefore, water users reporting a constant diversion amount that is exactly equal to their water right for the entire irrigation season are not being accepted by the Division Staff. Sophisticated water users (such as the City of Steamboat and Mt. Werner Water District) records are trusted and incorporated into the official record.

The general lack of measurement devices throughout the Yampa Basin makes the Division Staff's job difficult in two ways:

1. Division Staff must estimate diversions in the field, which is time consuming.
2. Division Staff can rarely accept water user supplied records, because most water users are not proficient at chip tests and therefore cannot provide accurate estimates of their diversions.

WWG believes that the Division Staff is doing the best they can with the resources that they have.

StateMod Enhancement Recommendations

Good record keeping by Division Staff is critical to creating an accurate Yampa River StateMod model. The diversion structures that are explicitly represented in the model are generally considered major structures or important for administration. Therefore, they receive the majority of the water commissioner's attention, visits, and record keeping. Disaggregating the smaller structures in StateMod will most likely require some level of estimation of diversion records. Some of the structures may have received monthly visits from the water commissioners, but some may have only received one or two visits for the whole irrigation season.

WWG recommends taking a targeted approach to refining the spatial resolution of StateMod for the IWMP. Priority areas identified by stakeholders can be refined on an as-needed basis. If diversion records must be estimated, the modelers can work with the stakeholders to understand typical irrigation practices in order to inform the estimation techniques. This targeted approach is in contrast to disaggregating all of the structures. A general refinement approach would be a significant level of effort that may not result in more accurate model results, or better inform the IWMP decision-making process.

WWG also asked the water commissioners if additional reservoirs need to be considered due to their importance in administration or water delivery. Division Staff recommended including Simon Reservoir No. 1 because of the interaction with Allen Basin Reservoir, Sheriff Reservoir

because of the interaction with the town of Oak Creek, and Long Lake because of the interaction with Fish Creek Reservoir. These reservoirs have previously been excluded from the model because of the lack of historical storage data. WWG recommends that these reservoir be included in the model using estimated data.

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TO: Yampa IWMP Committee
FROM: The Nature Conservancy
DATE: October 15, 2018
RE: Science Data Compilation and Gap Assessment – Yampa IWMP

SUMMARY

The Nature Conservancy has compiled and assessed baseline science for the four segments identified for potential inclusion in the Yampa River Integrated Water Management Plan (IWMP). We reviewed 54 different data sources relevant to priority issues in the segments. These sources included peer reviewed literature, engineering and other projects, planning studies, PowerPoint presentations, and citizen science focused on physical, ecological, and spatial data. We evaluated the existing scientific information for addressing the five priority issues identified by the IWMP committee (*see Table 1*). Using these five priority issues as a filter, we assessed methods, scale, and scope of existing science and "scored" how well the existing science addressed the priorities for each segment.

Table 1. Priority Issues Identified for Yampa IWMP (by the IWMP committee)	
A.	Upgrading infrastructure, especially multi-purpose diversion rehab/upgrade projects
B.	Enhancing understanding of existing river corridor health (flow, stream structure, habitat, riparian condition) and identifying projects/strategies to protect or enhance
C.	Advancing an integrated system of current/new storage and releases to meet both consumptive and environmental needs
D.	Addressing flow management needs for endangered fish recovery
E.	Developing river access and recreation projects

The following sections are organized by proposed river segment for the Yampa IWMP and provide a synthesis of scientific data and studies. This information is catalogued and detailed in an Excel spreadsheet titled **Yampa_IWMP_science_assessment.xls***.* While we found and assembled a significant amount of available science for the Yampa River (mostly publicly available data), it is important to note that these data are not necessarily comprehensive. Once final segment selection occurs, there may need to be additional literature review and science data assessment for the segments that are included in the Yampa River IWMP. However, we believe that the 54 sources reviewed for this assessment offers a solid foundation for informing the Scope of Work for the IWMP.

SEGMENT 1: YAMPA HEADWATERS (BEAR RIVER AND TRIBUTARIES) FROM THE FLATTOPS TO STAGECOACH RESERVOIR

Existing data and priority issues

We identified 29 studies or projects that focused on at least one of the five IWMP priority issues. In cataloging those 29 studies or projects, the breakdown of priority issues and methods was:

- Priority issue A (infrastructure) = 8 studies. Most of the assessment or analysis for this segment was either not targeted on infrastructure or done at a scale that individual infrastructure was not assessed. Rather, analysis of infrastructure was more broadly captured as a component of modeling and scenario planning (e.g., Yampa White Green BIP, Working with Agriculture to Conserve Declining Native Fishes: Opportunities for Water Transactions in the Yampa-White and Upper Colorado Basins (NFWF)). Example methods: scenario planning, hydrologic modeling, spatial analysis (GIS), and engineering studies.

- Priority issue B (river health) = 20 studies. Because priority issue 2 includes various aspects of river health, several studies addressed river health using a variety of methods and across scales. See the accompanying spreadsheet for more details. Example methods: scenario planning, hydrologic modeling, spatial analysis (GIS), field data collection (sediment, hydrologic, water quality), aquatic and riparian habitat assessments.

- Priority issue C (storage) = 12 studies. There was very little information on integrated storage, so our count includes any projects or studies that had a storage component. It seems that what the IWMP committee intends for "integrated storage" should be more clearly defined moving forward. The types of storage addressed mostly focused on Stagecoach Reservoir. Example methods: scenario planning, hydrologic modeling, spatial analysis (GIS), and engineering studies.

- Priority issue D (endangered fishes) = 13 studies. Similar to Priority Issue C, if the study area included this segment and mentioned or focused on endangered fishes, it was marked as included. There wouldn't be any warm water fishes in these headwaters areas, but could be important native cold water fish, like trout. Most of the studies that focused on endangered fishes were further downstream, or at the Yampa River Basin scale. Example methods: flow-ecology relationships, hydrologic analysis, scenario planning, hydrologic modeling, GIS.

- Priority issue E (recreation) = 12 studies. No studies explicitly focused on recreational boating or river access in this segment, but similar to Priority Issue A (infrastructure), recreation was included more broadly as a target in basin-wide modeling and scenario planning. Example methods: flow modeling, scenario planning, hydrologic modeling, GIS.

Data assessment and gaps

Much of the scientific data for this segment were generated as part of a larger basin-scale analysis. Not many studies explicitly focused on the Yampa Headwaters and tributaries as a study area. For example, the Yampa River Watershed Flow Evaluation Tool (WFET) (2012) used flow-ecology relationships and

hydrologic data to model potential risk of ecological change due to changes in flow and increased water use throughout the Yampa River Basin. However, because the Yampa WFET does not require site-specific ecological data to identify these potential risks, it does not offer a good basis for reach-specific flow prescriptions. The State of the Watershed report for the Upper Yampa (2014) provided a more general assessment and overview of the biophysical characteristics of the Upper Yampa. While this work focused on a specific part of the Yampa River Basin – the headwaters of the Yampa River to the confluence of, and including, Elkhead Creek – the analysis and output were much more generalized and less technical. Only a few studies specifically focused on capturing field data and establishing quantitative baselines. These studies were largely focused on physical parameters such as land use, hydrology, and sediment transport (e.g., Andrews, E.D. 1978; Johnson E.A. et al, 2000.)

Segment score/notes

- According to stakeholder analysis, scale of interest of 1 (not interested at all) to 5 (eager to participate) = 3. The stakeholders identified the need for more agricultural and storage studies.
- Using a similar scale 1 (no data linked to priority issues) to 5 (lots of directly measured data linked to priority issues), **data availability for this segment = 2.5 - 3**
    - Many of the data were at a broader scale (i.e., HUC 12 or greater), which translates to limited site- or reach-level data and analysis.
    - Most data were focused on physical habitat parameters (hydrology, sediment), limited biological information.
    - Largely modeling output and data.
- The river health priority issue was most directly assessed in this segment, with most work emphasizing basin-scale modeling outputs that cover this region. There were some site-specific storage studies for Stagecoach Reservoir but 'integrated storage' was not highlighted. Very limited agricultural analysis.

SEGMENT 2: YAMPA MAINSTEM FROM STAGECOACH RESERVOIR TO ELKHEAD CREEK

Existing data and priority issues

We identified 39 studies or projects that focused on at least one of the five IWMP priority issues. Of those 39 studies or projects, there was a wide range of scale and specificity for this segment of the Yampa. There were many more detailed, site-specific studies included in this segment as it contains the City of Steamboat Springs. The Morgan Bottom reach was influential in driving studies investigating opportunities and methods for restoring river health, protecting flows for endangered fishes, and improving connectivity for agricultural infrastructure. In cataloging the 39 studies or projects, the breakdown of priority issues and methods was as follows:

- Priority issue A (infrastructure) = 12 studies. Because the Morgan Bottom reach is a section of the Yampa where agricultural infrastructure and use, river health, and endangered fishes have been highlighted as key issues. Several projects (e.g., Characteristics and Behavior of River Form on the Yampa River at Morgan Bottom, Yampa River PBO) have focused on the Morgan Bottom reach and the lower Yampa. Many of the same broad-scale studies referred to in the first segment also apply to this segment, but there were several site-specific, targeted studies through the City of Steamboat

Springs that explicitly assessed existing infrastructure and potential infrastructure needs (e.g., Yampa River Structural Master Plan, Yampa River Master Plan). Example methods: site level mapping, GIS, river cross sections and surveys, modeling.

- Priority issue B (river health) = 36 studies. River health was assessed across a variety of scales and included a wide range of targets (e.g., State of the Watershed report, Healthy Rivers Assessment). Example methods: riparian habitat assessment and mapping, GIS, river cross sections and surveys, modeling, FACStream 1.0, R2Cross.

- Priority issue C (storage) = 12 studies. The site-specific studies tied to integrated storage in this reach were largely focused on planning and management with Stagecoach Reservoir. However, many of the studies don't necessarily address 'integrated storage.' There were also some basin-level assessments, such as the Yampa ATM and the internal TNC research focused on agricultural efficiency improvements that were obliquely linked to integrated storage. Example methods: scenario planning, hydrologic modeling, ag efficiency analysis, spatial analysis (GIS), field work, cross sections.

- Priority issue D (endangered fishes) = 14 studies. Some studies were explicitly designed to address flow targets for endangered fishes (e.g., Procedures for Releasing and Administering Water from Elkhead Reservoir to Augment Yampa River Flows for Endangered Fish) while others focused on river health targets with endangered fishes as a co-benefit. Endangered and native fishes were certainly a consideration in this segment, but not necessarily a focus because of location in the watershed. Example methods: R2Cross, scenario planning, hydrologic modeling, field sampling.

- Priority issue E (recreation) = 18 studies. Recreation was a priority target in this segment. The reach of the Yampa through Steamboat Springs offers significant economic development opportunities. Recreation and river access were in site-specific designs (e.g., Bear Park Master Plan) and in basin-level work. There were other studies (Healthy River Assessment) that were much more multi-benefit in approach, with recreational outcomes as an important target in this segment. Example methods: hydrologic modeling, spatial analysis (GIS), field work, planning.

Data assessment and gaps

Much more robust scientific data were available for this segment across multiple scales, compared to Segments 1 and 4. Many of the larger basin-scale analyses from Segment 1 continued downstream into this segment. There were also reach-specific, focused studies for specific priority issues, such as river access and recreation. For example, the Yampa River Management Plan (2001) analyzed and modeled hydrologic data for the section of the Yampa River through the City of Steamboat Springs to look at river health, recreation, and water quality. The City of Steamboat Springs completed a Stream Management Plan (Healthy Rivers Assessment) in 2018 that focused on a 12.5-mile section of the upper Yampa. The Healthy Rivers Assessment modeled and assessed the core drivers of Yampa River health represented by 11 variables in an organizational framework adapted from FACStream 1.0. The Morgan Bottom reach also drove a number of studies that examined river health, geomorphology, endangered fishes, and

agricultural needs and infrastructure. These values all intersect in this dynamic reach of the Yampa. The SMP offers a good model for the types of planning approaches for the IWMP. It offers a multi-benefit assessment of the river system at a narrow scale and provides the foundation for designing and implementing projects. The recreational importance of the Yampa was a significant driver of this analysis, along with multiple facets of river health.

Segment score/notes

- According to stakeholder analysis, scale of interest of 1 (not interested at all) to 5 (eager to participate) = 2.5. The stakeholders identified the need for more agricultural and storage studies.
- Using a similar scale 1 (no data linked to priority issues) to 5 (lots of directly measured data linked to priority issues), **data availability for this segment = 4.5 - 5**
    - Data availability was much higher in this segment, with emphasis on river access and recreation, river health and some infrastructure information.
    - This segment had more targeted, discrete and implementable data. The 2017 Yampa River Stream Management Plan used FACStream 1.0.
    - The targets tended to be river access and recreational uses within the Steamboat area, with water quality and river health server as important drivers of the work implemented.

SEGMENT 3: YAMPA MAINSTEM AND ELKHEAD CREEK FROM CONFLUENCE TO DEERLODGE

Existing data and priority issues

For this segment of the Yampa, we identified 35 studies or projects that addressed at least one of the priority issues. There was a wide range of scale and specificity for this segment, which included the middle and lower Yampa River to Dinosaur National Monument. The Yampa PBO is a significant influence in this segment which emphasizes river health and endangered species. In cataloging those 35 studies or projects, the breakdown of priority issues and methods was as follows:

- Priority issue A (infrastructure) = 7 studies. The Yampa ATM project modeled and identified different candidate reaches, several of which were in this segment. The Nature Conservancy has also conducted research to identify opportunities to improve agricultural infrastructure and efficiency (Womble, 2015/2016; NFWF 2015). Many of these assessments have been at a slightly coarser scale. Example methods: hydrologic data assessment, water rights/infrastructure assessment, StateMod, R2Cross, irrigation efficiency analysis.

- Priority issue B (river health) = 25 studies. This segment has had several studies and projects focusing on river health, with specific emphasis on riparian forest health, channel migration, nonnative fish management, and geomorphic assessments. The data that exist range from site-level to larger scale planning and analysis. Example methods: hydrologic modeling and analysis (StateMod), geomorphic analysis, riparian and aquatic habitat surveys, tree ring analysis, biotic modeling.

- Priority issue C (storage) = 7 studies. While integrated storage is not explicitly captured for this segment, there have been basin-scale assessments (Yampa-White-Green BIP, Management Plan for Endangered Fishes in the Yampa River Basin) that examine storage needs and scenario planning for storage. Example methods: hydrologic modeling, infrastructure assessments, P&M Study model.

- Priority issue D (endangered fishes) = 20 studies. Management of flows for endangered fishes has also been a big driver of scientific analysis in this segment of the Yampa. The Yampa PBO is another driver for action and management in this segment. The Management Plan for Endangered Fishes in the Yampa River Basin is one of the more targeted assessments, identifying specific needs for endangered fishes ranging from natural flow pattern management and enhancement of base flows to water temperature regimes and nonnative fish management. Example methods: WFET, R2Cross, conceptual life history models, hydrologic modeling, flow duration curves.

- Priority issue E (recreation) = 11 studies. Most of the studies associated with this reach assessed recreation within a larger scale assessment (Yampa WFET, Yampa-White-Green BIP). Example methods: hydrologic modeling, StateMod, flow ecology metrics and modeling).

Data assessment and gaps

This segment, which has substantial agricultural land use along with endangered species management, has a good amount of scientific data and assessment at multiple scales. The top priority issues assessed in this reach included river health, endangered species, infrastructure. Some modeling and analysis also included data on integrated storage and recreation. Because the Morgan Bottom reach in the upstream segment (with some potential overlap with this segment) has received significant attention due to increased bank erosion and downcutting, channel migration that impacts agricultural infrastructure and land use, changes in riparian habitat, and increased sediment loads that influence native and nonnative fish management, there are several site scale analyses and assessments that have been completed that either also include some portions of this segment or have direct influence on this downstream segment. For example, Reconnaissance Level Geomorphic Assessment: Morgan Bottom Reach Yampa River, Yampa PBO along with basin scale assessments such as Yampa River Basin Aquatic Wildlife Management Plan, Basin Implementation Plan Modeling for Yampa and White River Basins) designed to understand the biophysical conditions and dynamics in the lower reaches of the Yampa.

It is also important to note that there was as gap in our assessment from the National Park Service. While we were able to gather some academic scientific studies for Dinosaur National Monument, we have not yet received studies or data directly from the science staff at Dinosaur National Monument.

Segment score/notes

- According to stakeholder analysis, scale of interest of 1 (not interested at all) to 5 (eager to participate) = 3.25. The stakeholders identified the need for more agricultural and storage studies.
- Using a similar scale 1 (no data linked to priority issues) to 5 (lots of directly measured data linked to priority issues), **data availability for this segment = 4 – 4.5**

    - Data availability and coverage was high in this segment, with more emphasis on agricultural infrastructure, river health, and endangered fishes.
    - The studies in this segment were more discrete and hard targeted, local scale data.
    - Water quality and recreation drive a lot of attention in this segment
- This segment exhibits significant tension between channel migration and functioning ag infrastructure.

SEGMENT 4: ELK RIVER AND MAJOR TRIBUTARIES

Existing data and priority issues

For this segment of the Yampa, we identified 22 studies or projects that addressed at least one of the priority issues. This segment has the least amount of data of all the proposed river segments. Of the 22 studies or projects, most were part of larger basin assessments and modeling, that highlighted river health, endangered fishes, and some recreation in this region. In cataloging those 22 studies or projects, the breakdown of priority issues and methods was:

- Priority issue A (infrastructure) = 5 studies. Very few studies examined the issue of upgrading infrastructure. Most data are associated with broader assessment and modeling. In this segment this is more emphasis on managing for river health and endangered species. Example methods: hydrologic assessment, sediment transport, riparian and aquatic habitat surveys and assessments.

- Priority issue B (river health) = 21 studies. River health, as a broad, topic, was again largely represented in broader scale assessments for the Yampa. Most of the data found captured information around endangered fishes, riparian ecosystem health, fluvial and geomorphic processes. Example methods: hydrologic and flow assessments, R2Cross, GIS analysis.

- Priority issue C (storage) = 7 studies. The storage analyses linked to this segment were largely tied to basin-wide scenario planning and modeling. The need for integrated storage was not a main priority issue for this segment. Example methods: hydrologic and flow assessments, GIS analysis.

- Priority issue D (endangered fishes) = 13 studies. The Elk River is an important system for the lower Yampa. Most of the data associated with endangered species management are driven by the PBO.

- Priority issue E (recreation) = 10 studies. Similar to other priority issues, recreation was often addressed for this segment as a component of basin scale studies and modeling. Example methods: hydrologic modeling, GIS analysis.

Data assessment and gaps

This segment had the least amount of data and direct assessment compared to the other segments. Although there is baseline science and modeling linked to river health, endangered species management and some limited infrastructure work, the data are likely not fine-scale or targeted enough to implement local-scale projects. Example methods: hydrologic modeling, spatial data.

Segment score/notes

- According to stakeholder analysis, scale of interest of 1 (not interested at all) to 5 (eager to participate) = 2. The stakeholders identified the need for irrigation/agricultural studies.
- Using a similar scale 1 (no data linked to priority issues) to 5 (lots of directly measured data linked to priority issues), **data availability for this segment = 1.5 - 2**
    - Data availability linked to larger scale assessments, emphasis river health, endangered fishes some recreation, and limited agricultural work.
    - Data are broad and limited enough that it is likely that more scientific baseline work would be needed to design and implement projects.

KEY TAKE-AWAYS/RECOMMENDATIONS

Segment 1. There are some gaps in this segment, but it is unclear what, exactly, the science needs might be for the IWMP. Most of the scientific assessments and data available for this segment emphasize river health and storage. However, the focus on storage is not on "integrated" storage or how to manage storage for the whole system. The data that exist are typically linked to larger assessments which means to design and implement more targeted work in this reach there may need to be more local-scale, site-level assessments. Because of this, data gaps exist for all priority issues, but the biggest potential needs are for integrated storage and agricultural infrastructure in this segment.

The interviews and social science for this segment supported the data needs/gaps patterns identified in the assessment of biophysical data. Residents recognize the importance of their land use and other activities within the broader watershed. However, there has not be targeted agricultural assessments to understand what can be done in this reach. There is also a need to examine existing storage and management, along with potential future storage, and the implications in this part of the watershed, particularly as it related to "integrated storage" being proposed by the IWMP.

Segment 2. This segment had robust science with many studies and data across multiple scales (basin and local scales). The priority issues most emphasized in this segment were: recreation/access, river health, and some endangered species due to the presence of Steamboat Springs and the Morgan Bottom reach. The Healthy Rivers Assessment (SMP) recently completed represents some of the most current scientific data but is fairly narrow in its focus. The approach used for the SMP could serve as a good model for other segments, particularly if the scale were increased and the priority issues were used as the targets. The Morgan Bottom Reach – especially the most recent geomorphological assessment by Lotic Hydrological – offers some updated, robust baseline science on river health and agricultural infrastructure. There is still some science needed for this segment related to new reservoir being planned by the Upper Yampa District and what that means for all priority issues, but integrated storage and environmental flows in particular in this segment and beyond.

Residents in this part of the watershed were more conscious of water conservation needs, but also need education on prior appropriation and what types of opportunities exist to improve water use. River health concerns emphasized water quality issues, alternative dam methods, and recreational uses.

There is another opportunity in the segment to educate about "integrated storage" and water use/demand changes.

Segment 3. This segment also has a great deal of robust, basin- and site-level data. There is a focus on endangered species, agriculture, river health for the lower Yampa. The USFWS PBO, downstream presence of Dinosaur National Monument, and compact requirements shape much of the science assessments and data availability in this segment. Based on current levels of science, there are little to no significant data gaps, but there may need to be more targeted engineering and economic analysis on what types of agricultural water use and infrastructure improvements are possible and how those would influence the river health and endangered species. As with other segments, there is an opportunity for the IWMP to introduce a "systems thinking" or "whole system" approach for the Yampa Basin and what interventions in all segments would mean from headwaters through the state line.

Residents in this part of the watershed were very conscious of agricultural impacts, needs, and water conservation, but also need education the types of opportunities exist to improve water use and flexible water management. The water users in this segment are directly influenced by federal designations and protections and are concerned about overall river health and nonnative fish management. The level of interest for IWMP was the highest in this segment which also corresponds to the patterns of scientific data availability and quality.

Segment 4. This segment had the weakest levels of existing science and there are significant gaps in the baseline science, particularly at more local scales. Most of the baseline data that exists for this segment is captured as part of broader-scale modeling and assessments. The key issues in this segment are river health, endangered species, and agricultural needs and infrastructure.

Residents for this segment are not interested in storage but are aware of water scarcity. They have expressed desire for scientific baselines and strategies to inform water use and availability patterns, particularly for agriculture.

<u>Considerations for IWMP Scope of Work</u>

- The Yampa River Basin is well-established in its scientific assessments, particularly for basin-level hydrological modeling and scenario planning. Depending on project needs, there may be more local-scale, targeted scientific work needed to supplement and inform project design and implementation in specific segments.

- Recent scientific assessments and projects, such as the geomorphic work in the Morgan Bottom Reach and the Healthy Rivers Assessment by the City of Steamboat, are setting a standard for the level and quality of science needed to manage the Yampa as a whole system and sufficiently address the needs highlighted by the priority issues for the IWMP.

- While there is a significant amount of basin-level hydrologic modeling and scenario planning through the Basin Roundtable and statewide planning process, these analyses have not yet

connected to an informed approach for managing the Yampa as a connected, whole system. The IWMP offers an opportunity to use the priority issues as a framework to manage the Yampa across multiple scales and inform project design and planning while considering the impacts this work may have for the whole basin. To this end, the IWMP needs to be designed to clearly make those connections and help inform project prioritization for statewide planning purposes.

- The concept of integrated storage has not been explored or analyzed in depth in the existing data. This IWMP will need to include analyses and models to flesh out the concept and identify projects that exemplify layered, multi-benefit storage projects that maximize environmental and recreational benefits.

- Anecdotal conversations with the Division Engineer indicate that there are sediment transport issues in the Elk River. There is some baseline science that supports this information, but it is a little dated. This issue warrants more exploration in the IWMP to inform interventions and project designs for any work on the Elk and downstream on the Yampa.

- The IWMP Scope of Work should note that this science assessment did not constitute a completely comprehensive data capture but provides a solid summary of existing information available as a starting point. More specifically, there may be many more public data resources, than what this revealed. The IWMP would benefit from additional efforts to explore federal and state resources and datasets and a deep dive into other NGO research that may not be widely available to the public.

- Segment 3 exhibits tension between channel migration and agricultural infrastructure and water use needs. The IWMP will need to analyze the extensive existing studies and recommendations for this area through the lens of addressing this problem.

- Segment 4 may need more local-scale scientific assessments to inform baseline information if more site-specific, or targeted, project work is identified.