

# SNYDERVILLE BASIN PILOT WATER BANK: SUMMARY ASSESSMENT

June 27, 2024

Prepared for:

**Utah Division of  
Water Resources**

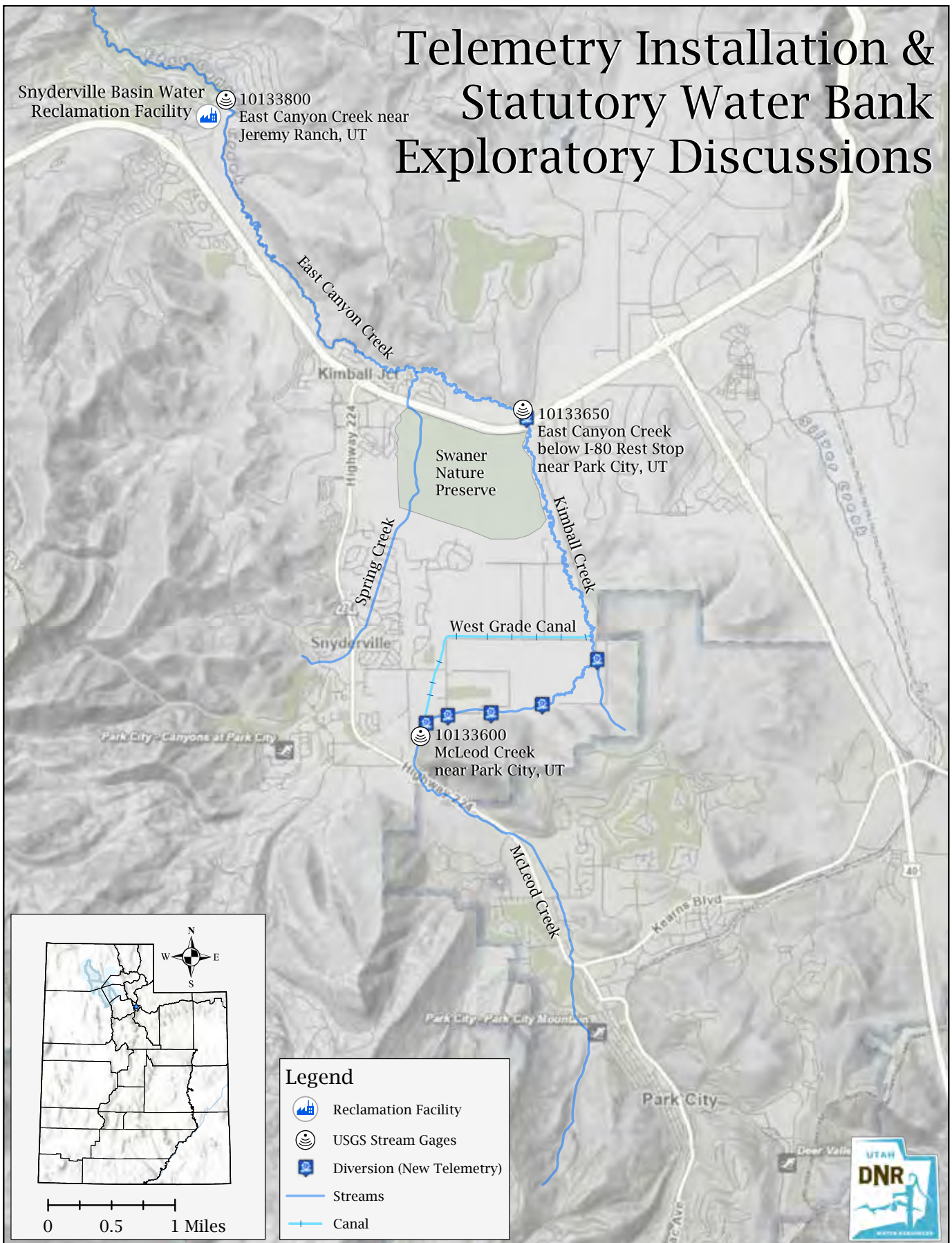


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# Telemetry Installation & Statutory Water Bank Exploratory Discussions



## Snyderville Basin Pilot Project Summary

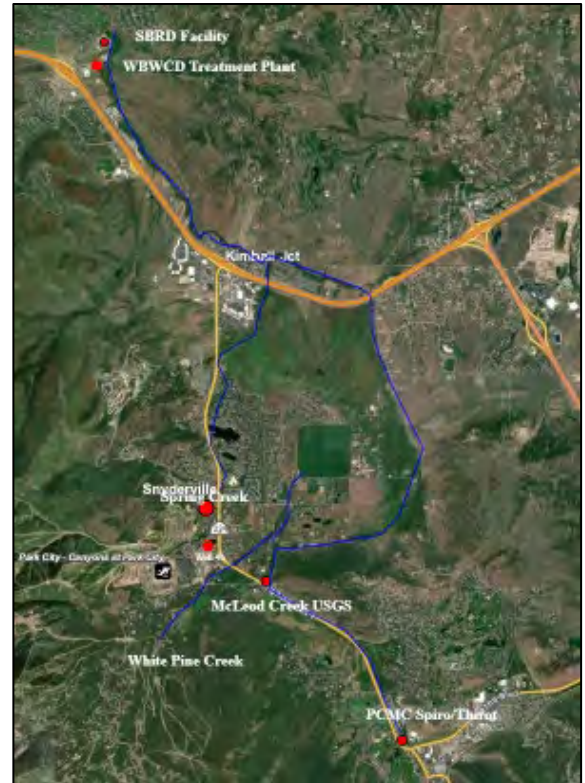
The Utah Water Banking Act promotes better management of the state's water resources through water leasing arrangements that are locally controlled, temporary, and voluntary. To demonstrate water banking, the Utah Division of Water Resources worked with local water users in the Snyderville Basin to evaluate the use of water banks to improve local streamflow conditions in East Canyon Creek. The local stakeholders evaluated the administrative and physical needs of establishing a water bank but ultimately decided not to pursue a statutory water bank application. Several water management and water banking tools were developed by the project team as part of the project.

### Participants

- Potential Lessor(s) and Lessee(s) were not specifically defined but generally included all Local Stakeholders
- Local Stakeholders: Snyderville Basin Reclamation District, Mountain Regional Special Service District, Park City, National Audubon Society, Trout Unlimited, Utah State University Swaner Eco-Preserve, Weber Basin Water Conservancy District
- Water Source: water rights diverting from the East Canyon Creek watershed.

### Concept

- East Canyon Creek suffers from low streamflow conditions in late summer and during drought years. Local parties have identified multiple benefits of conducting water leases to enhance streamflow.
- Water banking was investigated as a flexible tool to allow multiple beneficiaries to pool together resources to fund water leases from a variety of potential water right holders.



### Required Elements

- A statutory water bank requires significant monitoring and reporting activities each year. The local parties decided that they did not currently have the staffing capacity to undertake these activities which was a deterrent to pursuing a water bank application.
- Water measurement and accounting were identified as hurdles to protecting leased water supplies for instream flow. These hurdles were addressed through the installation of 10 new gaging stations and development of an accounting framework to allow water right distribution through the critical stream reaches.

### Key Lessons Learned:

- Water rights accounting is a critical piece of water leasing. Early in the process, it is important to understand if there are sufficient measurements and accounting procedures in place to ensure leased water supplies can be used as intended.
- Consider multiple marketing methods when formulating a water market and identify which methods best address the needs of the participants. The simplest approach may be best.
- Having an engaged and local champion is invaluable in setting up water markets.



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## PURPOSE AND ORGANIZATION

The Utah Water Banking Act (“Act”) passed in 2020 to promote better management of the state’s water resources through water leasing arrangements that are locally controlled, temporary, and voluntary. To kickstart water banking in the state, the Utah State Legislature approved a pilot program to create a Utah Water Banking Strategy led by the Utah Division of Water Resources (“UDWRe”). UDWRe has worked with local interested water users to identify, form, and demonstrate water banking projects across the state, with the objective of assessing whether water banks organized under the Act are useful tools to meet local water management needs. UDWRe created a team of stakeholders and consultants (“Project Team”) to assist strategy and pilot development.

The Project Team pursued pilot water banks in three markets: the Price River Basin, Snyderville Basin (also referred to as East Canyon Creek), and the Cache Valley. Each of these banks required varying levels of coordination, local engagement, and state and federal authorizations. The Snyderville Basin pilot water bank project (“Snyderville Pilot Project”) is the subject of this report. As will be explained later in this report, project participants and the Project Team ultimately determined that a statutory water bank was not a management tool that the local parties felt that they could properly administer due to required monitoring and reporting requirements. In the process of coming to this conclusion, several analyses, scoping tools, and accounting procedures were developed by the Project Team in cooperation with local stakeholders. The pilot was successful in establishing a robust process of water bank evaluation, even if that process ultimately resulted in a decision to not pursue a water bank application.

This report provides an overview of a statutory water bank investigated through the Snyderville Pilot Project, with focus on the evaluation process and the lessons learned during the project. It is intended to assist water users in evaluating the application of water banks and other water market mechanisms in other areas of the state. The report is organized as follows:

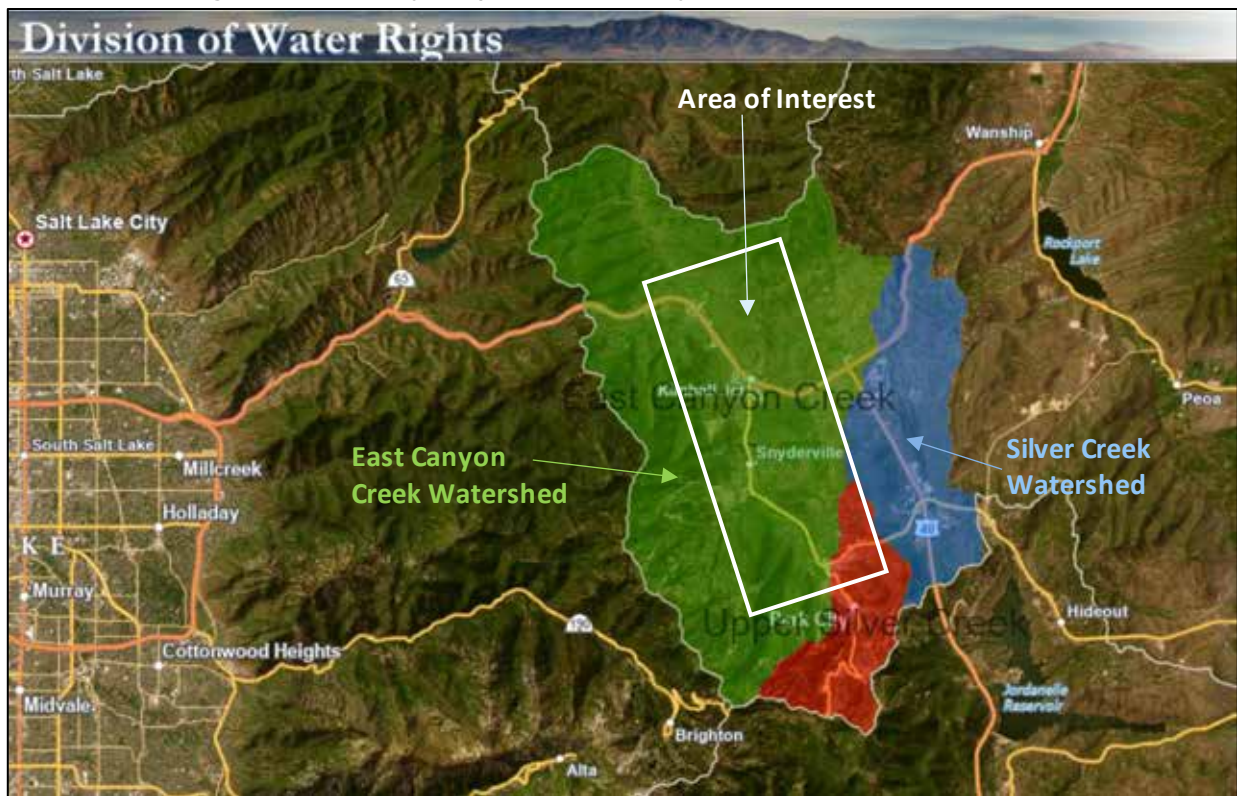
1. **Snyderville Basin Overview:** gives an overview of water supply and demand conditions in the Snyderville Basin.
2. **Project Concept:** addresses the impetus behind establishing a local water market and the goals for the project.
3. **Water Bank Evaluation:** summarizes the process that local stakeholders used to evaluate how a water bank would function in the Snyderville Basin and responsibilities for managing and administering the water bank.
4. **Water Distribution:** describes the technical work completed to understand and address the water distribution challenges in the Snyderville Basin to allow future water transfer activity.
5. **Next Steps and Observations:** describes next steps and provides commentary on key takeaways from the pilot project process.



## SNYDERVILLE BASIN OVERVIEW

The Snyderville Basin is located in the Wasatch Mountains east of Salt Lake City (Figure 1). The Snyderville Basin is referred to in this report as the upper reach of East Canyon Creek, from the headwaters near Park City down to the Snyderville Reclamation Facility (Figure 2). East Canyon Creek forms from the confluence of several upstream tributaries including McCleod Creek which forms into Kimball Creek, and Spring Creek. The Snyderville Basin is characterized by a mix of large-lot residential development, high elevation meadows and wetlands, and some irrigated pastures.

Figure 1: Vicinity Map for East Canyon Creek Watershed



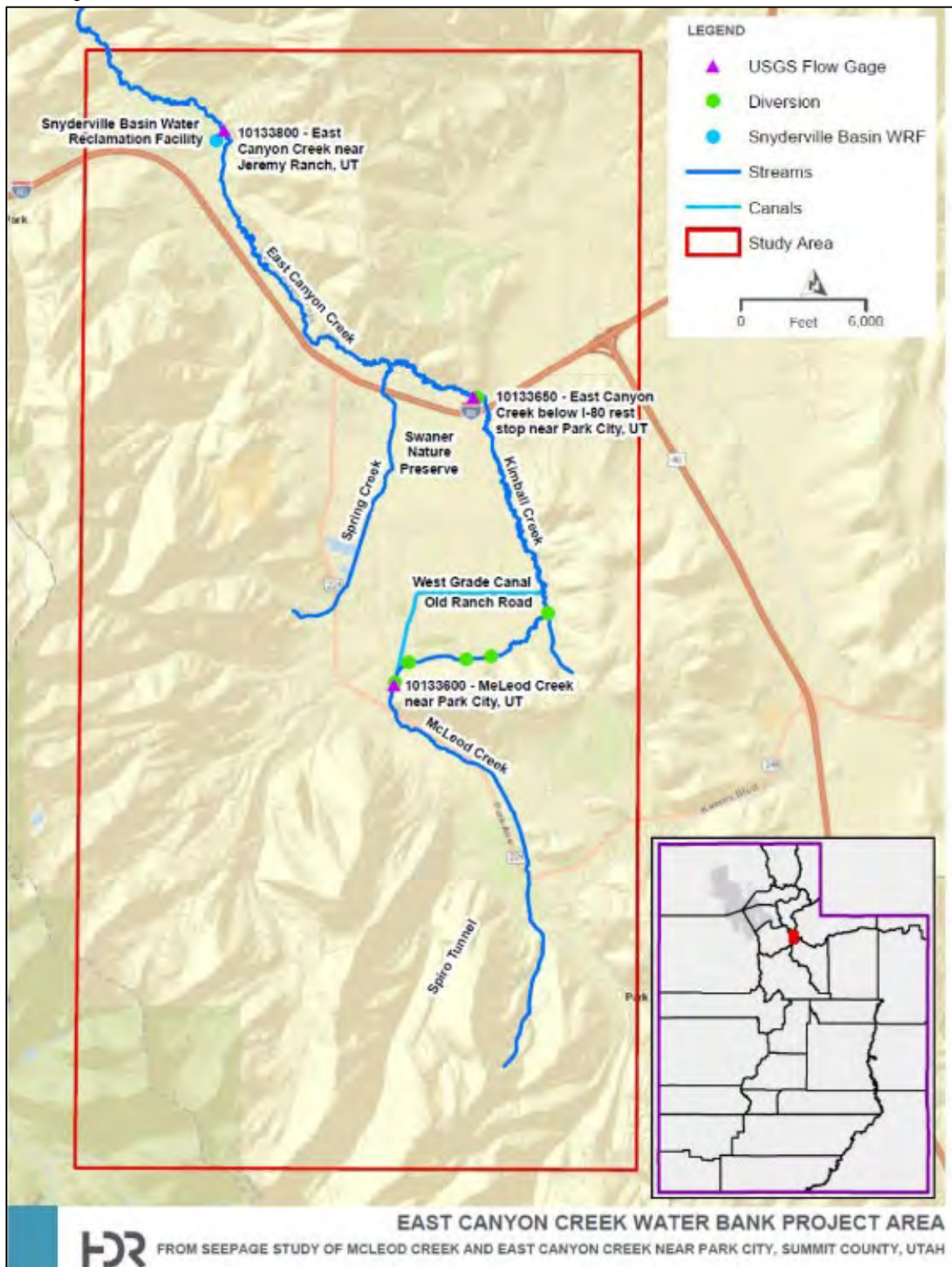
### Water Supplies

The water supplies of the Snyderville Basin are characterized by snowmelt hydrology and a relatively high degree of interconnection between groundwater and surface water flows. The Basin is a relatively small area. The entire East Canyon Creek watershed drains approximately 145 square miles and the Snyderville Basin portion consists of approximately 31 square miles (20,000 acres). Previous hydrologic evaluations of the Snyderville Basin (which includes McCleod Basin) estimate that, on average, approximately 36,000 acre-feet per year (AFY) flows through the basin as surface inflows and outflows<sup>1</sup>.

<sup>1</sup> <https://www.waterrights.utah.gov/cgi-bin/libview.exe?Modinfo=Viewpub&LIBNUM=50-1-165>



Figure 2: Snyderville Basin Map: East Canyon Creek from Park City to Reclamation Facility



## Regulatory Limits

As a result of extensive land development for residential and commercial uses, and the hydrologic impacts of well development, the Snyderville Basin has undergone a series of regulatory actions to maintain the long-term sustainability of water uses<sup>2</sup>. These regulatory actions include a basin closure to all new surface water right appropriations (1937), an extension of the closure to all new groundwater right appropriations (1973), a moratorium on the transfer of water rights into the basin (late 1970s and 1988), additional restrictions on the ability to exchange water rights from outside of the basin (2002), a reiteration of these water right restrictions in the form a management plan<sup>3</sup> (2019), and a recent gubernatorial order halting all new appropriations of water from tributaries to the Great Salt Lake (2022). At the present time, there is limited ability to further develop the water supplies of the Snyderville Basin and new uses must utilize existing water rights within the Snyderville Basin through transfer or exchange.

## Master Agreement

Water development activities, water supply stressors, and mixed management among a distributed set of municipal water providers resulted in several lawsuits in the Snyderville Basin and surrounding watersheds of the Weber River Basin<sup>4</sup>. To resolve these disputes, the parties entered into a Master Agreement<sup>5</sup> in 2013 that provided for consolidation of municipal water systems and sharing of surplus water supplies, coordination of water management under Weber Basin Water Conservancy District, and funding to support improved management. This Master Agreement contains several supporting agreements<sup>6</sup> and forms the recent backbone of water supply management in the Snyderville Basin.

## Water Demand

The water demands of the Snyderville Basin are divided into three primary categories: irrigation, municipal, and environmental. A preliminary water rights inventory for the Snyderville Basin which summarizes current water demand (in the form of water rights) is provided in Appendix B.

## Irrigation Water Use

Irrigation water use is relatively limited in the Snyderville Basin compared to other areas of Utah. Irrigated lands mapping indicates approximately 300 irrigated acres in the Snyderville Basin. The high elevation climate limits the growing season for most crops, and agricultural lands are largely limited to grass pastures and alfalfa hay. Several large irrigated ranches exist along McLeod Creek upstream of the Interstate 80 crossing, as shown in Appendix B. These ranches hold senior-priority water rights

<sup>2</sup> <https://www.waterrights.utah.gov/wrinfo/mmplan/ugw/snydvll.htm>

<sup>3</sup> [https://waterrights.utah.gov/groundwater/ManagementReports/Snyderville/Snyderville\\_GWMP.pdf](https://waterrights.utah.gov/groundwater/ManagementReports/Snyderville/Snyderville_GWMP.pdf)

<sup>4</sup> <https://www.eastcanyoncreek.org/documents/water-sustainability-in-the-snyderville-basin/item/84-the-right-decision-for-the-future-of-park-city>

<sup>5</sup> <https://www.parkcity.org/Home/ShowDocument?id=37053>

<sup>6</sup> <https://www.parkcity.org/Home/ShowDocument?id=37055>



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and represent potential opportunities for improved water management programs.

### **Municipal & Residential Water Use**

The largest sector of water use in the Snyderville Basin is municipal and residential water use. Municipal water use systems include the Summit Water Distribution Company, Mountain Regional Water District, Park City, and a few smaller entities. Several large residential development projects have also developed with their own diversions and water systems in the form of Home Owners Associations (HOAs). Demographic projections estimate that the Snyderville Basin area will continue to see population growth and an associated increase in municipal and residential water use. Related to the growth in water diversions and use, the increased wastewater flows associated with a growing population and increased stormwater runoff from land development activities have resulted in water quality impairments in East Canyon Creek.

### **Environmental Water Use**

The environmental water demands in the Snyderville Basin have historically focused on periods of low streamflow in the late-summer. These low-flow periods create a series of problems, including: warm temperatures and reduced habitat for cold water fish, reduced baseflow to absorb wastewater effluent, degraded water quality, and negative aesthetics for recreation. These concerns were the motivating factor behind exploring a water bank for the Snyderville Basin and involved a broad cross-section of local stakeholders affected by low streamflow conditions. Previously, local water districts have attempted to establish a minimum streamflow threshold of between 3 and 6 cfs for East Canyon Creek<sup>7</sup>. Preliminary research indicates that higher streamflow targets of up to 22 cfs need to be met to improve the cold water fishery but stakeholders are motivated to achieve the lower targets first and then reassess how to make further improvements.

### **Water Quality Concerns**

There have been and continue to be water quality concerns in the East Canyon Creek watershed. A local committee<sup>8</sup> of stakeholders formed in the early 1990s to study water quality issues which ultimately resulted in the establishment of Total Maximum Daily Load (TMDL) limits for point-source loading of sediment and phosphorus to East Canyon Creek. The East Canyon Watershed Committee has also been active in implementing Best Management Practices (BMPs) and supporting projects<sup>9</sup> to increase streamflow in East Canyon Creek watershed to improve the cold-water fishery. These efforts have resulted in positive outcomes<sup>10</sup> for water quality but low streamflow conditions in late summer persist and are the focus of local stakeholder efforts<sup>11</sup>.

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<sup>7</sup> Weber Basin Water Conservancy District. April 2015. *East Canyon Creek Minimum Creek Flow Assessment*.

<sup>8</sup> <https://www.eastcanyoncreek.org/about-east-canyon-watershed/our-history>

<sup>9</sup> <https://www.eastcanyoncreek.org/our-work/recently-completed-work>

<sup>10</sup> [https://www.epa.gov/system/files/documents/2021-09/ut\\_east-canyon\\_2006\\_508.pdf](https://www.epa.gov/system/files/documents/2021-09/ut_east-canyon_2006_508.pdf)

<sup>11</sup> <https://www.kpcw.org/local-news/2021-07-28/ecosystems-suffering-with-east-canyon-creek-reduced-to-trickle>



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## PROJECT CONCEPT

The Snyderville Basin water bank concept was generated through joint interest by local stakeholders in developing a framework to allow water rights to be temporarily transferred for instream use in East Canyon Creek. As stated above, multiple stakeholders are working to increase the baseflows in East Canyon Creek, particularly in the late summer period. The reasons for stakeholder interest include:

- Meeting wastewater discharge regulatory limits
- Meeting TMDL requirements and Federal and State water quality standards
- Improving cold water fishery habitat and related ecological habitat
- Improving the aesthetic of the riparian area for recreational uses

The project stakeholders involved in the water bank concept development from an early stage included municipal water and wastewater districts, municipal representatives, environmental NGOs, and state water agency representatives. The initial water bank concept had several iterations but was based on the following basic concepts:

- **Water Bank to Allow Leasing for Instream Flows:** At the time that the water bank concepts were being developed, Utah had limited water right protections for water rights leased for instream flow purposes<sup>12</sup>. Local stakeholders were aware that several senior-priority water rights have historically diverted much of the summer streamflow of East Canyon Creek and water right distribution policies would be critical to protect leased water supplies to downstream critical reaches in East Canyon Creek. The Water Banking Act provided a new mechanism to protect leased water rights intended for instream flow purposes and this motivated the local parties to explore water banking concepts as a new tool to conduct water leasing that had not historically been available.
- **Buy Side:** The water bank concept was focused on pooling the financial resources and staff capacity of various stakeholders who are interested in seeing improved streamflow conditions. Ideas ranged from a very broad water bank concept where individual homeowners in the Basin could donate funds or be charged a small fee to generate revenue to lease water rights, down to a relatively small water bank involving a few key water rights and funding interests focused on the environmental NGO community.
- **Sell Side:** The water rights that could be deposited into the water bank were intentionally not defined but the concept was that the statutory water bank structure would allow for a variety of local water rights to be potentially leased through the water bank. Specific ideas that were generated early in the process included: (1) leases of Park City trans-basin supplies, (2) temporary non-diversion agreements by golf courses who could utilize regulating storage, and (3) leases from local HOAs and irrigated property owners. A preliminary inventory of potential water rights and lease concepts is provided in Appendix B.

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<sup>12</sup> <https://waterinthewest.stanford.edu/sites/default/files/WITW-WaterRightsLawReview-2015-FINAL.pdf>



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This basic water bank concept was further explored and evaluated by the local stakeholders and the project team through meetings, surveys, and shared information.



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# WATER BANK EVALUATION

The majority of time on the Snyderville Basin pilot project was spent communicating with local stakeholders about water bank concepts. These communications were critical to inform local parties about the requirements of the Water Banking Act and the opportunities that a water bank structure might provide for meeting local streamflow objectives in East Canyon Creek. This section summarizes the evaluation process that occurred among the local Snyderville Basin stakeholders and the Project Team.

## Stakeholder Meetings & Discussions

The Project Team organized close to 40 meetings among the Snyderville Basin stakeholders over the period July 2020 to December 2022. Appendix A provides a summary of these meetings and the Project Team has maintained notes of individual meetings. The meetings were critical to advancing the local understanding of water banks and exploring how a water bank might be established for the Snyderville Basin. The following notes summarize how the discussion progressed over the course of the pilot project:

- 1. Information Sharing.** Initial meetings were largely focused on information sharing between the Project Team and local stakeholders. These meetings included the Project Team summarizing the Water Banking Act and pilot project work plan, and local parties describing the need for improved streamflow conditions.
- 2. Water Right Administration.** At an early point in the project, the Project Team and stakeholders identified water right administration as a critical hurdle to conducting water leases for improved instream flows in East Canyon Creek. The measurement data and accounting policies were not established in East Canyon Creek to allow UDWRi to create a distribution order to protect water rights leased for instream flow purposes. Following identification of this problem, the Project Team started efforts at building the local water measurement and accounting tools to allow for water leasing. These efforts continued over the course of the pilot project.
- 3. Water Source Evaluation.** The Project Team understood the limited inventory of existing water rights in the Snyderville Basin to accomplish the goals of the water bank and facilitated an evaluation of specific ideas or sources of water supply that might be transferred through a water bank. While a statutory water bank would not define specific water rights at the outset, the Project Team wanted to better understand how a water bank might be structured to facilitate certain types of water transfers. At this time, specific water transfer ideas were explored with municipal water districts.
- 4. Water Bank Structure and Requirements.** The Project Team organized a series of meetings for local stakeholders to better understand the administrative tasks involved in establishing and operating a statutory water bank under the Water Banking Act. First, the Project Team presented on governance concepts and ways to organize the various parties under a statutory water bank. These meetings then produced a task list of annual activities and associated time requirements. The local stakeholders then took a survey of the estimated time required for these tasks and the capacity for each organization to assist with the tasks. These meetings resulted in a general consensus that there was a lack



of capacity among the local stakeholders to both establish and maintain a statutory water bank.

5. **Alternative Concepts.** At the conclusion of the pilot project, the Project Team convened local stakeholders to brainstorm around alternatives to a water bank to achieve the underlying objective of improved streamflow in East Canyon Creek. These alternative concepts will likely be further explored by the basin stakeholders moving forward.

## Statutory Water Bank Tasks

As identified in the meeting summary above, the Project Team worked with the Snyderville Basin stakeholders to develop a list of tasks that would be required of a water bank manager. These tasks were originally organized in a spreadsheet and represented a blend of legal requirements under the Water Banking Act and desired work tasks based on local stakeholder input. The group identified a list of over 50 tasks that a water bank manager would have to complete related to organizing the water bank, coordinating change of water right applications, assisting with water distribution, administering water leases, annual reporting, and other topics. Appendix C contains a list of the tasks identified.

## Stakeholder Survey

The local parties were concerned that establishing and operating a statutory water bank that complies with the Water Banking Act may not be feasible given local staff capacity among the stakeholder organizations. The Project Team facilitated a survey of the primary stakeholders to explore capacity constraints. The survey asked a series of questions about having both the expertise and capacity to complete each of the identified task categories, and also the organization's desired level of engagement in each task. The survey results are provided in Appendix D. The results indicated that the local stakeholders generally lacked the capacity to engage on most of the tasks and desired to provide a supporting role on the tasks instead of a leading role. The survey also asked the stakeholders about expected time commitments to complete each of the tasks and the responses indicate that hundreds of hours of commitment would be required on an annual basis to effectively manage a water bank. This process was helpful because it provided some context for local stakeholders on the level of effort required to implement a statutory water bank. Ultimately, the local parties involved in the discussion decided that a water bank represents a level of effort that they could not support at the present time.

## Alternative Concepts

Following the survey, the local stakeholders started to pivot their attention to other mechanisms by which the underlying objective of improved instream flows may be achieved. During the course of the pilot project, new state legislation was being developed that would allow increased flexibility in leasing water for instream flow purposes (outside of a water bank). In addition, the stakeholders started to consider infrastructure projects such as small reservoir storage and pump-back projects to improve streamflow conditions. The Project Team provided a preliminary summary of these alternative concepts (see Appendix G) for further analysis and development by local stakeholders.



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## WATER DISTRIBUTION

The Project Team and local stakeholders engaged the local river commissioner and UDWRi staff early in the pilot project to understand how water rights administration could handle water leasing in East Canyon Creek. From the outset, it was apparent that the in-place measurement data and accounting tools were insufficient to support water leasing for instream flow purposes. This prompted efforts by the Project Team and UDWRi to coordinate the installation of additional measurement stations on primary diversions and the development of an accounting tool to track water flows in East Canyon Creek. These efforts have established new capabilities in the Snyderville Basin to accomplish instream flow leasing.

### Technical Analysis

Members of the Project Team worked with UDWRi staff to expand upon the information and tools available to distribute water rights in East Canyon Creek. The following field studies and technical analyses were completed as part of this effort:

- **Water Diversion Inventory.** The Project Team worked with UDWRi staff to inventory diversion points and identify information gaps in water use and flow accounting. Appendix F contains summary notes and maps of diversion points along East Canyon Creek as part of this initial inventory.
- **Water Accounting Framework.** The Project Team conducted a field visit to major diversions and streamflow measurement stations along East Canyon Creek and drafted a water accounting schematic (see Appendix F) that forms the basis for an accounting tool to be developed by UDWRi to implement a distribution order on East Canyon Creek for any future water leasing activity.
- **Measurements.** The Project Team also developed initial recommendations on new measurement stations along East Canyon Creek that would provide data to support the accounting tool. The Project Team drafted a report summarizing these measurement station recommendations (see Appendix E).

### Measurement Installation

Following the technical work, a cooperative effort among UDWRi, UDWRi, and the Project Team proceeded to install 10 new water measurement stations along East Canyon Creek. These new measurement stations will allow for accurate accounting of water flows and uses through an accounting framework. The major benefit to the Snyderville Basin is that UDWRi now has the data information and accounting tools to develop distribution orders to protect water rights leased for instream flow purposes in the future.



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## NEXT STEPS AND OBSERVATIONS

The Snyderville Basin pilot project was a useful exercise in evaluating water marketing strategies to achieve local objectives. The pilot project did not result in the establishment of a statutory water bank but through the process, the local stakeholders better understood why a water bank was likely not a good solution and what other opportunities exist. In addition, critical water administration capabilities were developed to allow water marketing solutions to move forward in the future.

### Key Lessons Learned

The following observations are highlighted by the Project Team as lessons learned from the pilot project. These observations will hopefully guide future water bank and water marketing evaluation efforts in Utah.

- **Water Administration is Critical to Water Marketing.** Water rights accounting is a critical piece of water leasing. Early in the process, it is important to understand if there are sufficient measurements and accounting procedures in place to ensure leased water supplies can be used and protected as intended. The lack of local data or procedures to facilitate a water right transfer can be a significant hurdle that must be addressed in order for any water marketing initiatives to move forward. For the Snyderville Basin pilot project, this hurdle was identified early and the Project Team supported efforts to establish the data and tools to reduce this administrative hurdle for future water marketing efforts.
- **Consider Multiple Water Marketing Options.** Water users should consider multiple marketing methods when formulating a water marketing plan and identify which methods best address the needs of the participants. The simplest approach may be best. For the Snyderville Basin pilot project, the Project Team identified early on that the pool of potential water supplies to support instream flows would be small and explored specific water transfers as examples. In addition, the Project Team helped local stakeholders evaluate whether a water bank could be accommodated with available capacity and resources, with the conclusion that alternative options would need to be pursued.
- **Important for Local Lead.** Having an engaged and local champion is invaluable in setting up complicated water marketing tools such as a water bank. It takes significant effort to coordinate efforts among multiple parties. In the Snyderville Basin, there was a broad stakeholder group that was interested in supporting the effort but a lack of capacity to lead water bank development and annual management.



## APPENDIX A: SUMMARY OF PROJECT MEETINGS

Date	Attendance	Pilot Project(s)	Topic(s)
7/16/2020	Project Team	Multiple	Project tracking and administration
7/21/2020	Project Manager	Snyderville	Description of low flow problem; background information
	Reclamation District		
7/28/2020	Project Team	Multiple	Project tracking and administration; pilot project scoping
7/25/2020	Project Manager	Snyderville	Current water right administration; Challenges for water bank concept
	WBWCD		
8/3/2020	Project Manager	Snyderville	Discussion of low flow problem and potential solutions
	Basin Stakeholders		
8/19/2020	Bureau of Reclamation	Multiple	Pilot projects scoping and grant administration
	UDWRe		
	Project Team		
8/26/2020	Project Manager	Snyderville	Pilot project work plan; Discussion of goals and outreach efforts.
	Basin Stakeholders		
9/15/2020	Project Manager	Snyderville	Use of Park City surplus water supplies; Distribution concepts
	UDWRi		
	Park City		
9/25/2020	Project Manager	Snyderville	Potential water right distribution concepts
	WBWCD		
9/30/2020	UDWR	Multiple	Project tracking and administration; pilot projects updates and outreach
	Project Team		
10/15/2020	Project Manager	Snyderville	Primary diversions in critical reach; potential change in distribution practices
	UDWRi		
10/19/2020	Project Team	Snyderville	Low flow description; water right administration; exploration of ideas to solve problem. Developed water bank working concept document.
	UDWRi		
	Basin Stakeholders		
11/3/2020	Project Manager	Snyderville	Local water right administration and measurement
	Reclamation District		
11/5/2020	Project Manager	Snyderville	Path forward among stakeholders; discuss water right enforcement
	Trout Unlimited		
1/12/2021	Project Team	Multiple	Project tracking and administration
1/22/2021	Project Team	Snyderville	Local water right administration, monitoring, and accounting
	UDWRi		
2/5/2021	UDWRi	Multiple	Water right administration, monitoring, and accounting

Appendix A is not a full recounting of all meetings held during the Snyderville Pilot Project; it does not include certain weekly coordination meetings or the many individual calls with stakeholders.



	Project Manager		
2/9/2021	Project Team	Snyderville	Project status update; Local demand evaluation; Water bank development
	Basin Stakeholders		
2/22/2021	Project Team	Snyderville	Update on measurement stations; MRSSD Willow Creek potential
	Basin Stakeholders		
2/23/2021	UDWRe	Multiple	Pilot project update; project tracking and administration
	Project Team		
3/3/2021	Local Stakeholders	Multiple	Pilot project operations; shepherding
	UDWRe		
	Smith Hartvigsen PLLC		
	Project Team		
3/10/2021	Project Manager	Snyderville	Distribution technical meeting. Local water operations
	WBWCD		
4/13/2021	Project Team	Snyderville	Distribution technical meeting; Diversion inventory and telemetry needs
	UDWRe		
4/16/2021	Project Team	Snyderville	Organization structure and mission discussions
	Basin Stakeholders		
7/27/2021	Project Team	Snyderville	Flow measurements for distribution; shepherding questions
	Basin Stakeholders		
9/3/2021	Project Manager	Snyderville	Organization structure and governance options
	Basin Stakeholders		
9/17/2021	Project Manager	Snyderville	Potential water bank structure
	Audubon		
3/3/2022	Project Team	Snyderville	Bank formation activities to date; Leasing for instream flow; Distribution considerations
	Basin Stakeholders		
4/12/2022	Project Team	Snyderville	Leasing for instream flow, outside of water bank
	Basin Stakeholders		
6/29/2022	UDWRe	Multiple	Pilot project update and planning; project tracking and administration
	Project Team		
6/29/2022	Project Team	Snyderville	Distribution plan & testing, Lease discussion, Exit plan
	UDWRe		
7/11/2022	UDWRe	Multiple	Water bank application process and forms; pilot project update
	Project Team		
7/19/2022	Project Team	Multiple	Project tracking and administration
8/16/2022	UDWRe	Multiple	Outreach and education on water banking; pilot project status
	Project Team		
9/13/2022	UDWRe	Multiple	Water bank application process and forms; pilot project update
	Project Team		
9/27/2022	UDWRe	Multiple	Project update, outreach, and application process improvements
	Project Team		
10/18/2022	Project Team	Multiple	Project status and documentation
12/20/2022	UDWRe	Multiple	Project status and documentation
	Project Team		



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# **APPENDIX B: DRAFT EAST CANYON CREEK WATER BANK MONITORING SYSTEM FUNDING RECOMMENDATIONS**



# 1 Summary

This Memorandum describes the recommended monitoring infrastructure system and financial contributions from the Utah Division of Water Resources needed to track flows and help achieve the goals of the proposed East Canyon Creek Pilot Water Bank. The East Canyon Creek Water Bank Project is one of the pilot projects being sponsored by the Utah Division of Water Resources as part of the Utah Water Marketing Strategies Report and Water Banking Pilot Project. Recommended Division of Water Resources contributions to improved monitoring total \$XX,000.

# 2 Introduction

The Utah Water Marketing Strategies Report and Water Banking Pilot Project was passed in 2020. The purpose of the Project is to develop and test the State's Water Banking Act, and to produce a statewide water marketing strategy. Water banks have the potential to facilitate the voluntary temporary transfer of the use of water rights from one user to another. Water Banking has the potential to facilitate:

- The protection or enhancement of instream flows for the natural system, wildlife and recreation uses;
- Balancing the competing uses of Utah's water supply;
- Flexibility to Utah water law; and
- The protection of agricultural uses.

The East Canyon Creek Pilot Water Bank is a new proposed water rights system intended to maintain increased late summer instream flows in the reach downstream of where the creek crosses under I-80, east of Kimball Junction and near USGS Gage #10133650, and upstream of the Snyderville Basin Reclamation Facility, near Jeremy Ranch and USGS Gage #10133800. Currently, this reach experiences insufficient streamflow during the late summer months to meet water quality targets and aquatic habitat goals. Water temperatures in the reach often exceed numeric criteria (20°C) for cold water fish (beneficial use 3A). Continued population growth and water demand pressure are expected to exacerbate these issues. A flow augmentation feasibility study, performed in 2005 by Kleinfelder, quantified the minimum streamflow augmentation volume needed to meet water quality and habitat goals as approximately 300 acre-feet over a critical 3-month period in late summer. This shortfall is expected to increase to 1,100 acre-feet (or more) with ongoing and expected future increases in Snyderville Basin water demands.

Under the proposed East Canyon Creek Pilot Water Bank, water for augmenting instream flows will be provided by releases from participating water suppliers within the basin. One potential supply could be from Park City Municipal Corporation, using mine tunnel drainage occurring above the McLeod Creek Mount Aire Splitter. Whatever the source, the additional water needs to be shepherded (i.e., kept safe from diversion by users who do not have a right to divert it) downstream as it passes approximately eight to ten irrigation diversions. The proposed monitoring system will provide data for the Weber River Commissioner to facilitate this shepherding. Improvements in

existing water temperature monitoring procedures would provide important data to demonstrate that the additional flow was also helping keep East Canyon Creek water cooler.

### 3 East Canyon Creek System

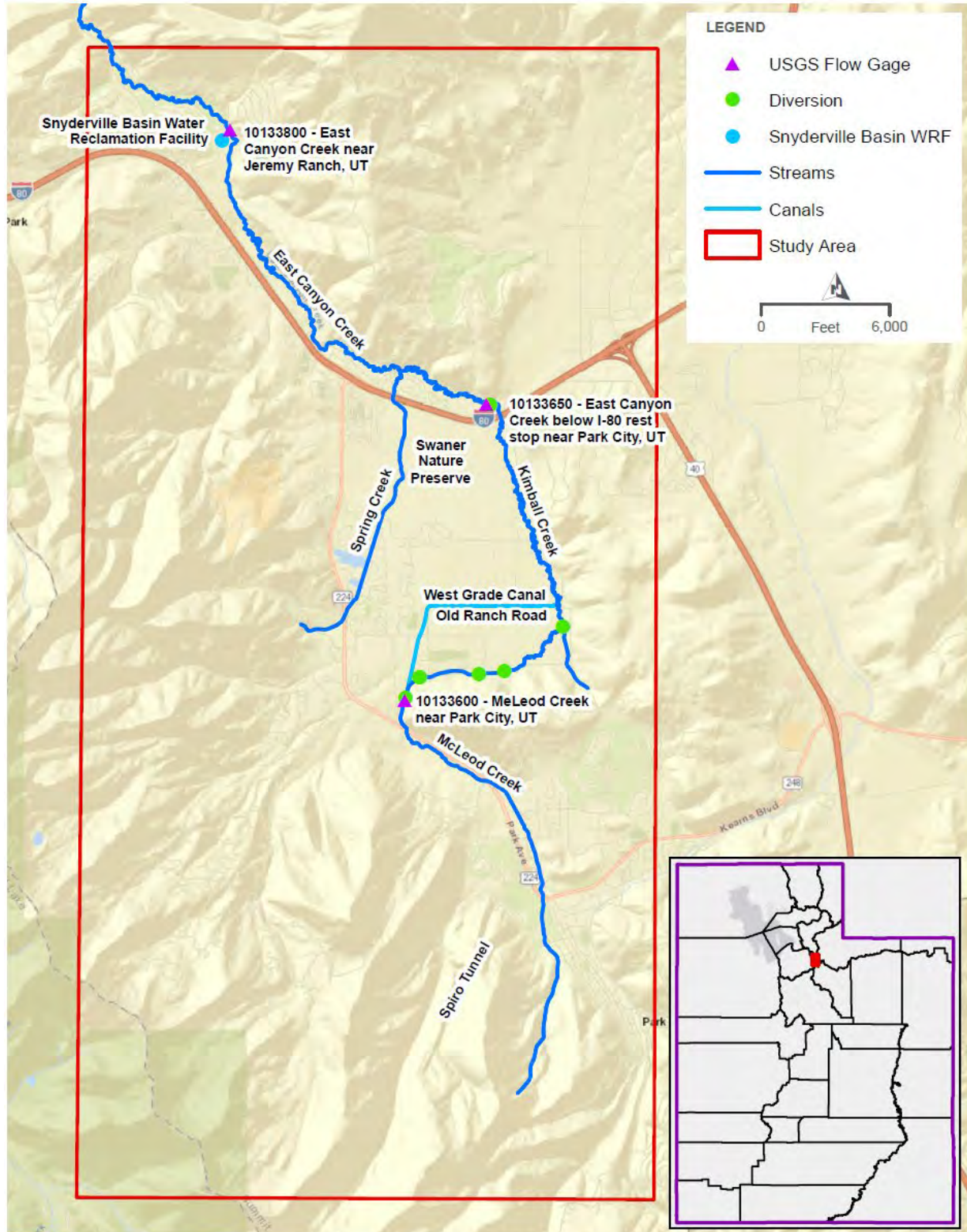
The area of the East Canyon Creek Water Bank Project is shown on Figure 1. McLeod Creek flows from a set of golf course ponds in the Park City area near the intersection of Highway 224 and 248, flows in a northeasterly direction alongside Highway 224 to confluence with Kimball Creek which flows north to East Canyon Creek, near USGS Gage 10133650.

One potential source of augmentation water could be released into the upper end of McLeod Creek by Park City Municipal Corporation using drainage from mining tunnels located above the City. The supplemental water would bypass the flow splitters first at Mount Aire and then (after paralleling Highway 224 for two miles) at the West Grade Canal. McLeod Creek is first measured at the USGS gage (#10133600) above the West Grade Splitter. Downstream of the West Grade Canal, McLeod Creek bends to the north and then to the east and flows along the base of Quarry Mountain. After paralleling Quarry Mountain for a mile and a half, McLeod Creek joins with and becomes Kimball Creek, and turns to the north. Turnouts at the JH Bailey Jr Ditch, and five individual landscape irrigation pumps are situated in McLeod and Kimball Creeks in the reaches below the West Grade Splitter and along Quarry Mountain. Kimball Creek meanders for approximately two miles before crossing under I-80, turning to the west, and becoming East Canyon Creek. East Canyon Creek meanders along the north side of I-80 for approximately five miles and is joined by Spring Creek and several other drainages coming out of the Swaner Nature Preserve or downstream.

### 4 Proposed Diversion Monitoring System

The proposed diversion monitoring system is designed to provide accurate, near real-time flow diversion measurements for use by the Weber River Commissioner to facilitate protection of the supplemental water that will be provided to the upstream reach of McLeod Creek, as the water passes by the irrigation diversions in route to East Canyon Creek. The River Commissioner will calculate the available naturally occurring water in the system using data from the existing USGS gage #10133600 and will allocate that water, in priority order, to the entitled water right holders. The newly available real-time data on diverted water will allow the Commissioner to know if users are taking more water than their entitlement. This will ensure that the supplemental water is not being diverted as it flows through the system down to the lower reach where it is needed.

Table 1 shows the recommended new diversion monitoring equipment and sites. The Utah Division of Water Rights has prepared a cost estimate of \$28,945 to purchase the recommended monitoring equipment shown in Table 1. The equipment would be installed by Water Rights staff.



**EAST CANYON CREEK WATER BANK PROJECT AREA**

FROM SEEPAGE STUDY OF MCLEOD CREEK AND EAST CANYON CREEK NEAR PARK CITY, SUMMIT COUNTY, UTAH

FIGURE 1

PATH: H:\PLANS\BERG\EAST CANYON CREEK WATER BANK PROJECT\WATER\_BANK\_PROJECT\_FIGURE\_1\_MXD - USER: JFLAN8BERG - DATE: 9/2/2021

**Table 1 – Recommended Diversion Monitoring Equipment**

<b>Location</b>	<b>Meter Type</b>	<b>Site Equipment</b>	<b>Communications</b>	<b>Power</b>
West Grade Canal Flume	Water level sensor	Stilling well, weatherproof box, protective box, lightning arrestor, posts	Datalogger, cellular modem, radio, Yagi antenna	30W solar panel, controller, battery
Quarry Mountain #1	Water level sensor	Stilling well, weatherproof box, protective box, lightning arrestor, posts	Datalogger, cellular modem, radio, Yagi antenna	30W solar panel, controller, battery
Quarry Mountain #2	Water level sensor	Stilling well, weatherproof box, protective box, lightning arrestor, posts	Datalogger, radio, Yagi antenna	30W solar panel, controller, battery
JH Baily Jr. Ditch	Water level sensor	New flume, stilling well, weatherproof box, protective box, lightning arrestor, posts	Datalogger, radio, Yagi antenna	30W solar panel, controller, battery
Osguthorpe	Flow sensor	Weatherproof box, protective box, lightning arrestor, posts	Datalogger, radio, Yagi antenna	30W solar panel, controller, battery
Ranch Creek #1	On/off sensor	Weatherproof box, protective box, lightning arrestor, posts	Datalogger, cellular modem, radio, Omni antenna, Yagi antenna	30W solar panel, controller, battery
Ranch Creek #2	On/off sensor	Weatherproof box, protective box, lightning arrestor, posts	Datalogger, radio, Yagi antenna	30W solar panel, controller, battery
Ranch Creek #3	On/off sensor	Weatherproof box, protective box, lightning arrestor, posts	Datalogger, radio, Yagi antenna	30W solar panel, controller, battery
Ranch Creek #4	On/off sensor	Weatherproof box, protective box, lightning arrestor, posts	Datalogger, radio, Yagi antenna	30W solar panel, controller, battery
Glenwild	Flow meter (existing)	Weatherproof box, protective box, lightning arrestor, posts	Datalogger, cellular modem	30W solar panel, controller, battery

## 5 Proposed Contribution to Ongoing Flow and Water Quality Monitoring System

The primary goal of the East Canyon Creek Water Bank Project is to provide needed in-stream flow water for preservation of Bonneville Cutthroat in the reach of creek alongside I-80. Watershed stakeholders, coordinated by the Snyderville Basin Water Reclamation District have been monitoring streamflow, temperature, pH, conductivity, and dissolved oxygen for approximately 10 years at the four USGS gauges along East Canyon Creek, including USGS station 10133650 below I-80 Rest Stop and the USGS station 10133800 East Canyon Creek near Jeremy Ranch.

An extremely valuable dataset is being developed for the purposes of developing flow recommendations for the creek. Real-time temperature data are currently collected at the upstream and downstream limits of the critical reach, at USGS station 10133650 and USGS station 10133800. Temperature monitoring piezometers have been installed and monitored along the critical study reach. Also, Utah State University has been collecting fish population data throughout the watershed, and the Utah Division of Wildlife collects population data on a 5-year rotating basis. All of this data provides a great baseline dataset for the watershed stakeholders.

Ongoing monitoring is an expensive endeavor, costing nearly \$100k annually, with much of the data available in real-time. Funding for this ongoing monitoring has been provided through several channels, including Snyderville Basin Water Reclamation District, area water providers, Weber Basin Water Conservancy District, and Trout Unlimited. Ensuring that this effort remains fully funded for the long term, is a high priority.

As part of the East Canyon Creek Pilot Water Bank Project, it is recommended that the Division of Water Resources provide a one-time contribution of \$55,000. According to fisheries expert, Paul Burnett at Trout Unlimited, this will secure funding towards the ongoing streamflow and water quality monitoring of the East Canyon Creek for the next ten years.

## 6 Potential Future Use of WBWCD Automated Metering Infrastructure

Weber Basin Water Conservancy District is considering the future implementation of Automated Metering Infrastructure (AMI) in the Snyderville Basin area. Many water users in the East Canyon Creek study area utilize water right exchanges based on one or more Weber Basin water rights. In the future, as Weber Basin expands its monitoring system in the area, it may be useful to include the Pilot Project diversion monitoring sites as part of the Weber Basin system. Although not currently recommended, information on adding East Canyon Creek monitoring to the Weber Basin system is provided below for completeness.

The Weber Basin's Sensus AMI network, could be utilized to access the recommended East Canyon Creek diversion monitoring sensors described in Section 3, as follows:

- a. A new communications tower would be required in the area. The base price for a new tower would be about \$50k (2017 prices). For the currently recommended meter locations, a single tower is sufficient, but a Basin-wide metering system would likely require an additional tower.
- b. This option can collect either 4-20mA or digital input / output signals through a smart gateway device. This device is battery operated, can potentially use looped power on the 4-20mA signal, and costs around \$300-400. The duration of the battery would hinge on how often it is collecting data as well how often it is transmitting up to the network. Battery life is expected to be from one year to 5 years.
- c. This option also can connect a Sensus 520M radio (at a cost of \$150) and a compatible meter to transmit the measurements. There are a variety of meters that are compatible with the radio/network. They range from approximately \$190 for a 1" up to \$7-8k for a 24". There might be open channel flow meters that could also work. Plumbing the diversion into a 1" to 2" water-level meter would be the most cost-effective option. The battery for the radio is rated for 20 years, as are most 1" meters. Larger meters can have batteries that will last anywhere from 3 years to 10 years.
- d. The advantage to this approach is that all remote infrastructure is battery powered, and requires little to no maintenance and can potentially last 20 years without intervention. This is the same technology that Weber Basin is using to read over 13k residential retail meters in other service areas. The towers and radio's operate on a licensed radio network and have high resiliency.

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## **APPENDIX C: DIVERSION MAP & NOTES**



# REACH 1

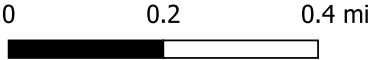
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- Diversion Stations
- ⊙ USGS Stations
- Stream



# REACH 2



- Diversion Stations
- USGS Stations
- Stream



# REACH 3

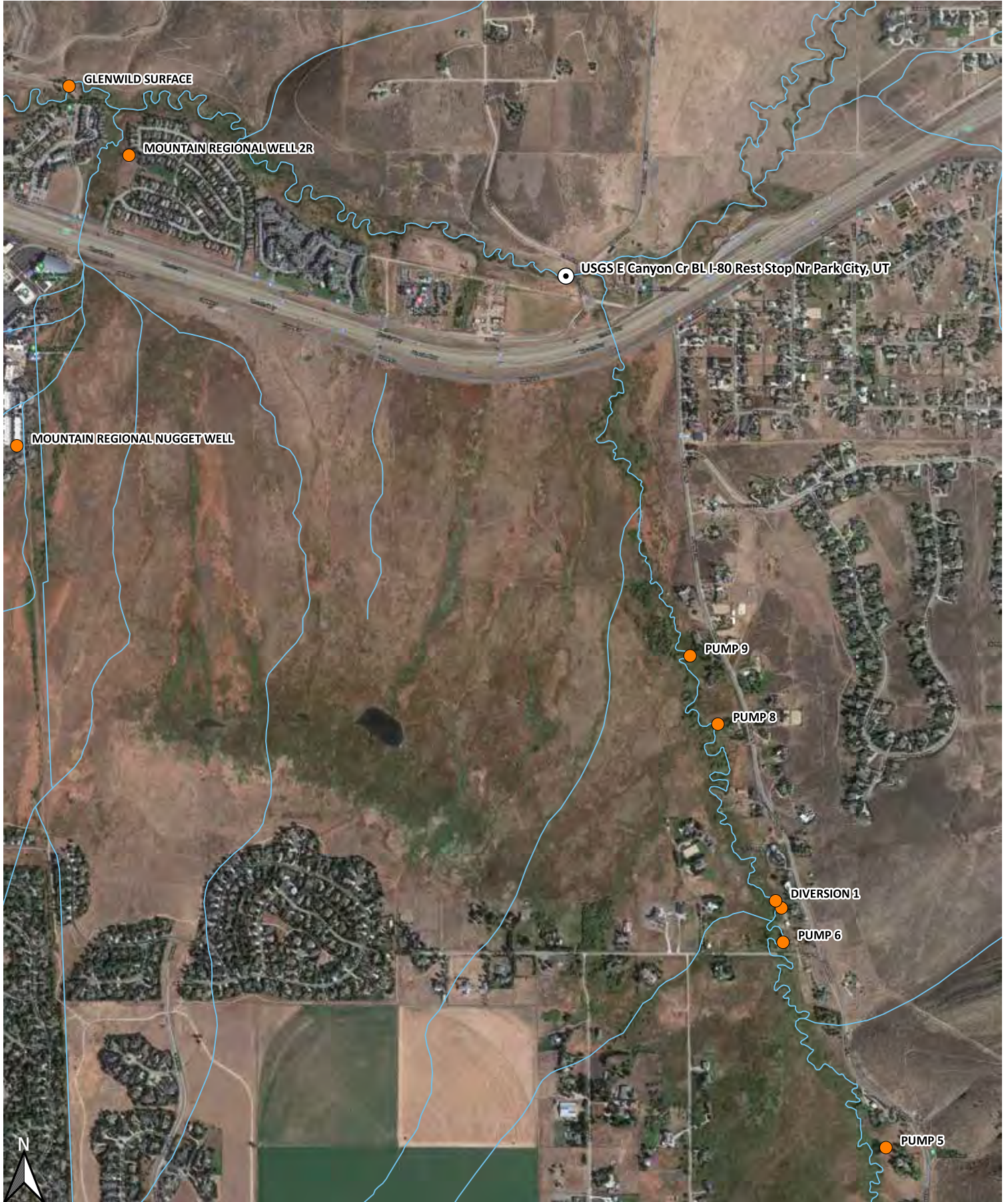
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● Diversion Stations

⊙ USGS Stations

— Stream



### Reach 1

<b>Diversion</b>	<b>Notes</b>
<b>Park City Municipal</b>	<i>Real time monitoring in place for multiple diversions or stream/ditch flow.</i>
<b>Mt. Aire Splitter</b>	<i>Part of Park City Monitoring. Mt. Aire East delivers water to Holiday Ranchettes and Saddle View Pond. Mt. Aire North is flow to McLeod Creek.</i>
<b>North Ditch Weir</b>	<i>Part of Park City Monitoring. Measures possible additional flow to McLeod Creek.</i>

### Reach 2

<b>Diversion</b>	<b>Notes</b>
<b>USGS McLeod Creek</b>	<i>Measures flow prior to creek being split to West Grade Canal or McLeod Creek through Quarry Mountain</i>
<b>Cumming Diversion</b>	<i>Small pump diversion in West Grade Canal. No measuring device and historically has not been monitored</i>
<b>Two Creeks</b>	<i>No flow present during critical times of the year.</i>
<b>Quarry Mountain Diversion 2</b>	<i>Feeds Quarry Mountain's gate pond. Flume, transducer, and data logger in place.</i>
<b>SBSRD Diversion</b>	<i>Snyderville Basin Special Recreation District diversion from West Grade Canal. Totalizing meter in place.</i>
<b>Osguthorpe Diversion</b>	<i>Diversion from West Grade Canal. Existing flume in place on West Grade Canal prior to diversion. Flume has no stilling well and most likely needs to be reset. No meter in place at Osguthorpe diversion.</i>
<b>Quarry Mountain Diversion 1</b>	<i>Feeds Quarry Mountain's other ponds. Flume, transducer, and data logger in place.</i>
<b>J.H. Bailey Jr. Ditch</b>	<i>No headgate or measuring device in place. Notified owner that diversions may not take place until items are in place. Is a client of Steve Clyde. Water Rights are 35-5721 and 35-12774.</i>
<b>Pump 1</b>	<i>Small Diversion. Unsure if metered.</i>
<b>Pump 2-4</b>	<i>Small Diversions. Unsure if metered. Segregated from water right 35-8420, a12951. Diversions on Kimball Creek above confluence with McLeod Creek not monitored.</i>
<b>Pump 5</b>	<i>Small pump in McLeod Creek. Not metered. Water Right 35-11061</i>

### Reach 3

<b>Diversion</b>	<b>Notes</b>
<b>Pumps 6 - 9 &amp; Diversion 1</b>	<i>Small pump diversions. Not monitored or metered. Water rights exist of exchanges and segregations of 35-8408, 35-8409, 35-8415, and 35-8420.</i>
<b>Glenwild Diversion</b>	<i>Diversion for Glenwild golf course. Totalizing meter in place.</i>

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## **APPENDIX D: ALTERNATIVE CONCEPTS MEMO**





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Fort Collins, CO  
80521

**Northwest**  
20522 NE 116th Cir.  
Brush Prairie, WA  
98606

# Memorandum

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To: Utah Water Banking Project Team  
 From: WestWater Research  
 Date: July 23, 2022  
 Re: Concepts for Providing Additional Instream Flow in East Canyon Creek

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## Background & Purpose

The Utah Division of Water Resources (UDWRe) has contracted with a water banking project management team to develop and test water banking concepts in Utah under the recently passed legislation allowing water banks. The project involves the development of pilot water banks in three specific areas that were defined at the outset of the project based on local stakeholder interest. One of the specific pilot water bank areas is the Snyderville Basin, also known as East Canyon Creek, in Summit County. The overall objective of the local stakeholders is to test water bank concepts for improving instream flows in East Canyon Creek during critical low-flow periods. The benefits of improved instream flows are expected to include: improved fish habitat, improved recreational aesthetics, and improved water quality for regulatory compliance with municipal outfalls.

The local stakeholders and the project team have had discussions about how a water bank might operate to improve flows of East Canyon Creek. Several ideas and hurdles have been discussed including concepts that do not involve water banking as defined by the legislation. This memorandum provides a preliminary analysis of stakeholder concepts for improving instream flows to better inform local stakeholders in defining their future efforts.

## Critical Reach & Flow Targets

The subject reach of East Canyon Creek extends roughly 10 miles from Park City down to the Snyderville Water Reclamation Facility. The most critical reach of East Canyon Creek is the 4-mile section that extends from Interstate 80 north (downstream) to the Snyderville Plant. Several tributaries flow into this critical reach of East Canyon Creek including McCloud Creek, Kimball Creek, and several unnamed tributary creeks. Figures 1 and 2 show satellite imagery and topography of the subject reach. A more detailed map set developed by the project team is attached to this memo.

Recent streamflow hydrographs for USGS stream gages in the subject reach are shown in Figure 3. The gages are located on McLeod Creek near the upstream end of the subject reach and on East Canyon Creek immediately downstream of the Interstate 80 crossing. The hydrographs indicate that the subject reach is generally a gaining stream during the spring snowmelt period but following snowmelt, the stream sees reduced flows moving downstream likely due to diversions. Trout Unlimited has done streamflow and temperature analyses which indicate that approximately 22 cfs is required to maintain adequate stream temperatures for trout. As shown in the hydrographs, a flow rate of 22 cfs is only maintained in the subject reach during the spring snowmelt season. For the late summer and winter periods, lower flow targets of 2 cfs and 6 cfs have been offered as preliminary targets. Table 1 summarizes the flow targets defined for this analysis based on the relatively low flow year of 2021.

Table 1: Definition of Additional Flow Targets based on 2021 Measured Flows

Criteria	No. Days Below Criteria	Flow Volume below Criteria (AF)
Daily flow <2 cfs	12	10
Daily flow <6 cfs	135	508



Figure 1: Satellite Imagery Map of Subject Reach of East Canyon Creek & Tributaries



Figure 2: USGS Topographic Map of Subject Reach of East Canyon Creek & Tributaries

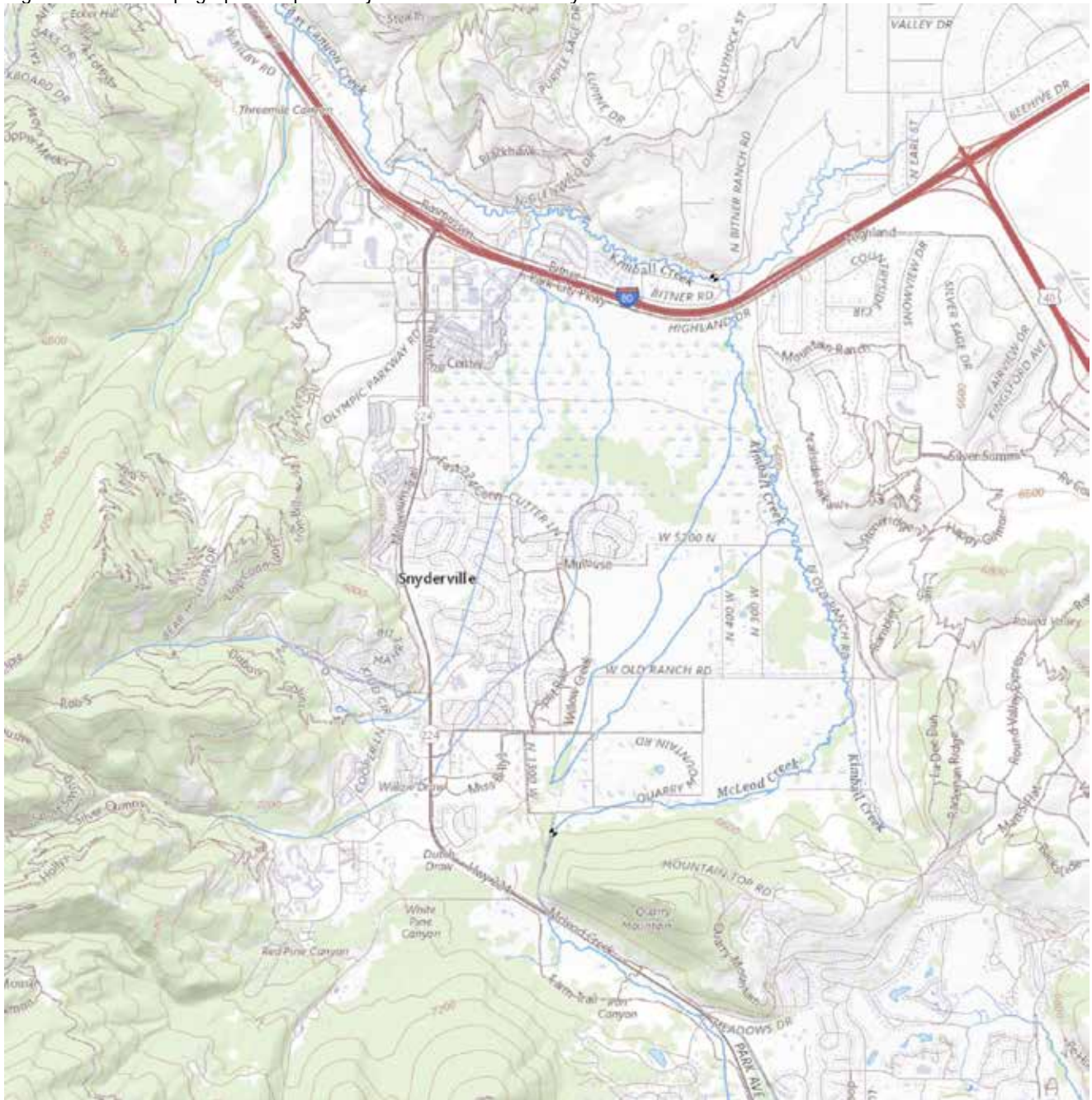
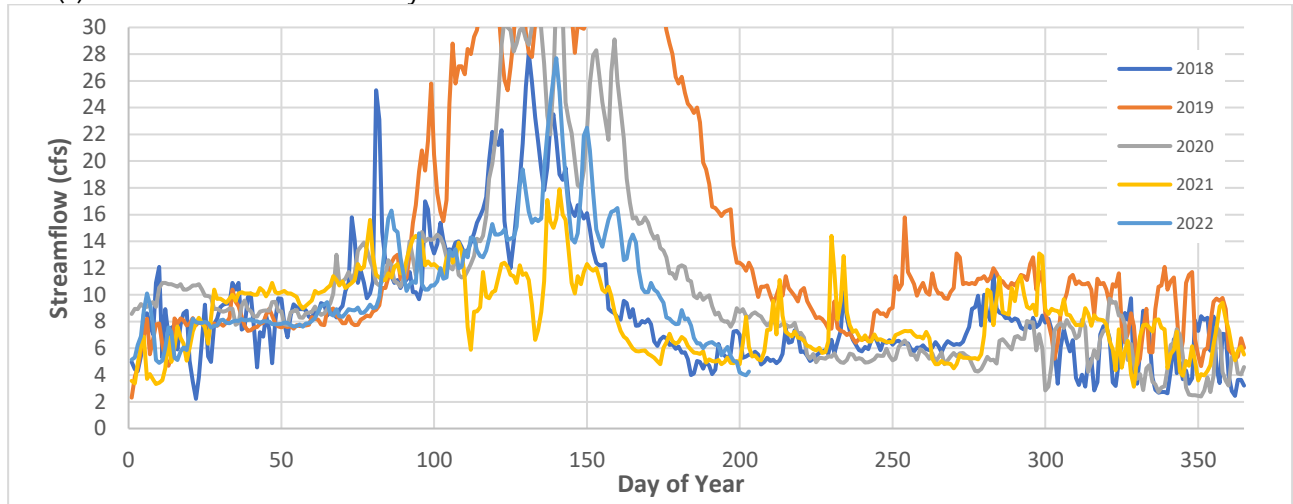
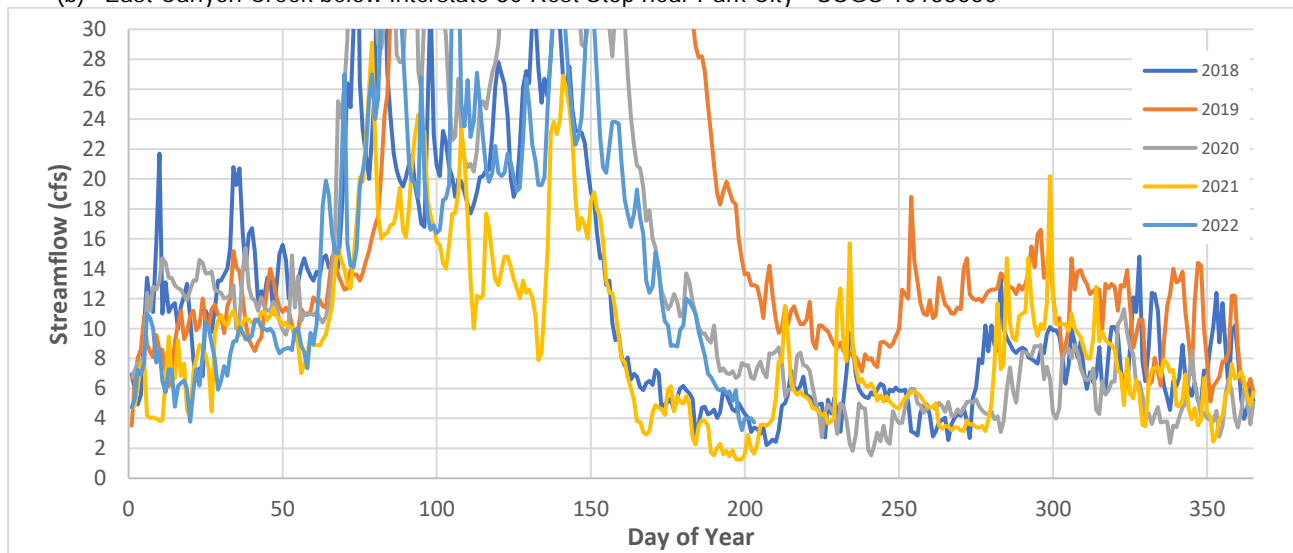


Figure 3: USGS Hydrographs of East Canyon Creek & Tributaries

(a) McLeod Creek near Park City - USGS 10133600



(b) East Canyon Creek below Interstate 80 Rest Stop near Park City - USGS 10133650



(c) Average (2018-2022) Streamflow Gain from McLeod Ck at Quarry Mtn. to E. Canyon Creek at I-80.



## Profile of Local Water Uses

WestWater previously compiled data on water rights in the area of interest that divert from East Canyon Creek and tributaries and summarized the data in a separate memo dated 2/3/2021. For water rights providing greater than 0.5 cfs of diversion, the inventory found 35 water rights totaling 35 cfs of diversion. These large water uses were divided into five categories: (1) municipal, (2) individual, (3) private entities, (4) Homeowners Associations (HOAs), and (5) golf clubs. Figure 4 shows the Utah Division of Water Rights "water related land uses" from 2020 for the area of interest. The following points summarize some important notes regarding water uses in the subject reach:

- There is limited irrigated agriculture diverting from the subject reach. In total, the UDWRi map shows roughly 300 irrigated acres. Roughly half of this acreage is held by Osguthorpe to serve a large center pivot. Multiple other small diversions are found along the creeks as shown in the attached maps. For perspective, 300 irrigated acres are estimated to have a peak diversion rate of about 6 cfs during the peak of the irrigation season.
- There are multiple HOAs that hold water rights from pre-development and the rights are often used for outdoor landscaping (if at all). These water rights could be acquired for instream flow protection but would not likely add to streamflow by reducing existing uses.
- Golf courses within the subject area of interest include (from upstream to downstream): Park City Golf Course, Park Meadows County Club, Canyons Golf, and Glenwild Golf Club. The Jeremy Ranch golf club is located immediately downstream of the Snyderville Water Reclamation Facility.

## Conceptual Options

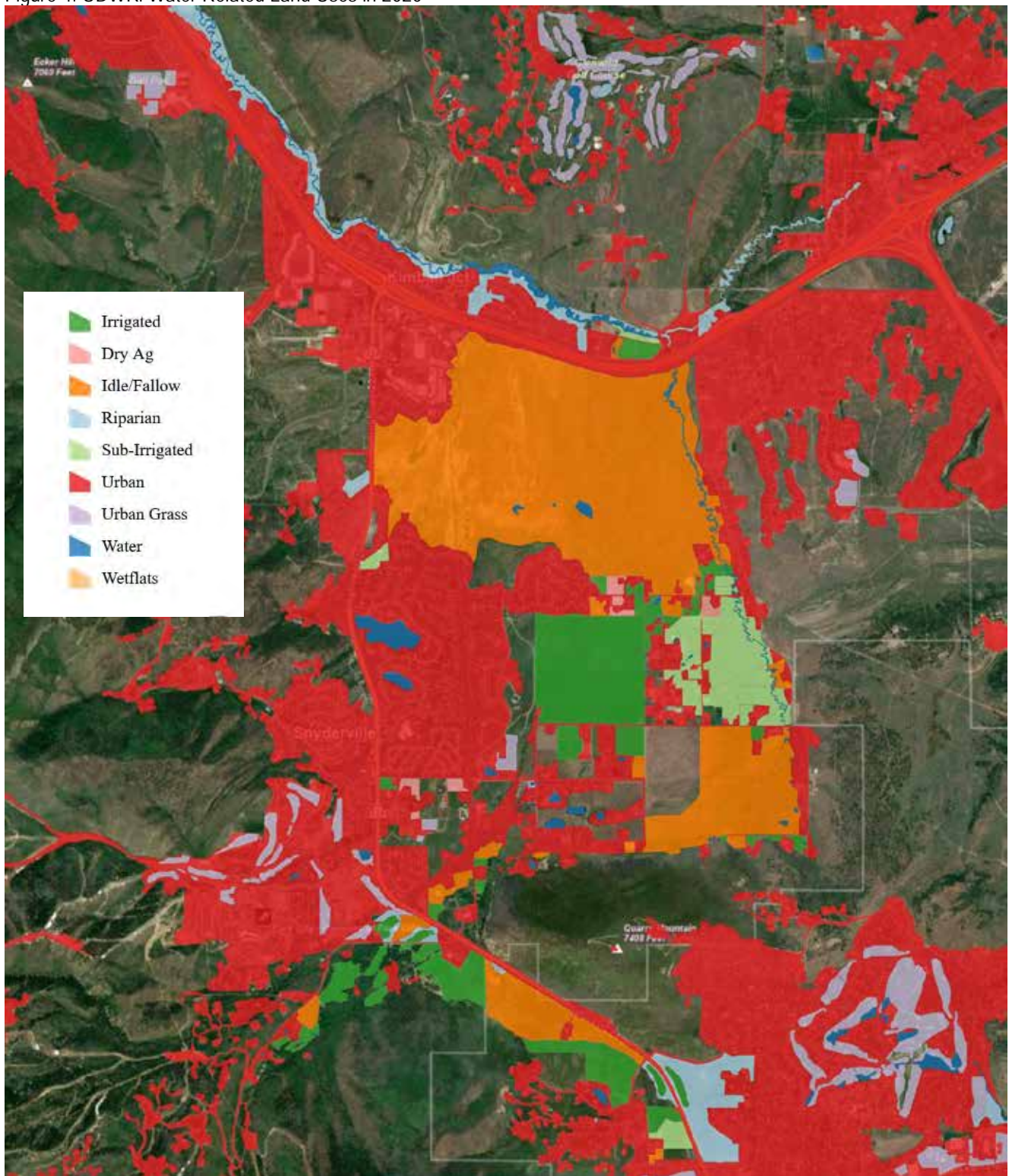
The project team and local stakeholders developed several ideas as options for improving instream flows in East Canyon Creek based on the criteria in Table 1. Four options are included and evaluated in this memo. Additional options may develop as further cooperation and dialogue occur among the stakeholders.

### 1. Water Right Acquisition

The concept that prompted involvement of the Water Banking Project Team and inclusion of the Snyderville Basin as a pilot project area for water banking efforts was water right acquisition. Local stakeholders were interested in being able to acquire water rights on a purchase or lease basis to add to the streamflow of East Canyon Creek instead of exercising the water right for diversion. There are various structures to acquire water rights, including: (1) permanent purchase and change of use, (2) annual or multi-year lease, and (3) water banks approved by the Utah Board of Water Resources. Based on discussions to date, some form of a water lease agreement is likely the best option for water right acquisition to support instream flows. Its important to note that winter time flow additions to East Canyon Creek may not be feasible through water right acquisition alone, as most water rights have a period of use during the growing season from April to October. This concern is more pertinent to achieve the goal of at least 6 cfs streamflow in East Canyon Creek. The previous WestWater memo describes some of the potential ideas for acquiring water rights from municipal water districts, private landowners, and HOAs.

Instream flow leasing is prevalent throughout the Western US. The exact deal terms are likely to only be known once further analyses are completed for individual water right holdings. For this analysis, it is assumed that a deal structure can be achieved that is flexible enough to only lease water when it is needed to meet critical instream flow periods. The market price for instream flow leases is usually reflective of foregone agricultural use and many instream flow leases have low prices because surplus water holdings are being dedicated to the instream flow lease. Prices ranging from \$50 to \$100 per acre-foot are common. In the subject area, irrigated agriculture is limited and there are not known to be surplus water holdings (with the potential exception of HOAs). Preliminary conversations have indicated that water lease rates may be much higher than seen in other river basins. There is not known to be any existing water leases in the subject area to inform price perspective of a water lease. For the purpose of this memo, a high lease price of \$500 per acre-foot is applied based on our experience in other Western water markets with high-value uses.

Figure 4: UDWRi Water Related Land Uses in 2020



Transaction costs associated with completing an instream flow lease can be significant, especially for a “first of its kind” water lease in a given area which may raise objections from local water users. In particular, if an acquired water right is to be shepherded past active diversions (providing them with less water than they are accustomed to), then a protracted regulatory approval process should be expected. Transaction costs related to regulatory approvals are estimated to be \$200,000 including engineering and legal analyses to resolve objections. If a broker is used to help secure the water lease agreement, then an additional 3% to 5% should be added to the transaction costs. These regulatory costs are upfront and one-time costs and would not persist each year under a multi-year lease agreement. For cost comparisons, a 30-year lease agreement is assumed and the transaction costs are annualized over this 30-year period.

No infrastructure costs are included for the water right acquisition option. This may or may not be the case depending on the characteristics of the water rights, its location, and how the buyer desires to utilize the water right. Piping or small reservoir infrastructure may be needed to effectively utilize an acquired water right for instream flow purposes.

## 2. Storage & Infrastructure

Instead of acquiring a water right, local stakeholders could work with local water users to provide them with an alternative source of water supply during the critical low-flow periods in East Canyon Creek. The objective would be to construct small storage reservoirs or shallow alluvial groundwater wells to be able to utilize storage water in July, August, and September when streamflow is lowest. Storage may also be able to be used in the winter months outside of the growing season. Two concepts are defined:

1. Local stakeholders construct an insulated small reservoir storage facility that diverts available surplus flows (with 2022 priority date) in the spring runoff season for later release during the late summer, with no involvement of existing water rights.
2. Local stakeholders construct a project (shallow wells or reservoir storage) to provide a supplemental water supply to an existing water right, and then the existing (senior-priority) water right is not exercised during the late summer and is used for instream flow purposes on a temporary basis.

Further analysis of water rights upstream and downstream of the subject reach is required to understand if there is a legal ability to develop storage rights to divert water during the spring runoff. There may be costs to motivate participation by an existing water right holder, but for the purposes of this analysis it is assumed that there are no deal costs.

Infrastructure costs for storage reservoirs are estimated in Table 2. For the 6 cfs target, the total storage volume capacity is estimated to be 500 acre-feet which will likely require several smaller storage sites as opposed to one large site. Land values in the subject area have a significant impact on the cost of storage ponds. For the large storage project size, the only diversion that could likely utilize an offset of this magnitude is the Osguthorpe diversion. The estimated construction costs were annualized based on a 30-year loan with an interest rate of 5%.

Project costs are estimated to include extensive design, permitting, and regulatory approvals. Similar to statements made above for water right transaction costs, there are estimated to be objectors and local concerns that will have to be mitigated requiring significant engineering and legal costs. Project costs are estimated to be higher for the larger volume storage objective. For this analysis, project costs are estimated as \$300,000 for the small storage and \$1,000,000 for the large storage project. These costs were included in the calculation of annual costs.

Table 2: Estimated Costs to Construct Small Reservoir Storage

## (a) 10 AF of Reservoir Storage Capacity for 2 cfs Target

Item	Quantity	Units	Unit Cost	Cost
Land Purchase	2	acres	\$100,000.00	\$200,000
Clear Site	2	acres	\$750.00	\$1,500
Excavate	16,134	cu.yd.	\$2.50	\$40,335
Fill	8,067	cu.yd.	\$2.50	\$20,168
Grading	1	lump sum	\$5,000.00	\$5,000
Impermeable Liner	90,000	sq.ft.	\$1.50	\$135,000
Pipeline	1,000	ft.	\$150.00	\$150,000
<b>Sub-Total</b>				<b>\$552,003</b>
Cost Factor				30%
<b>Total Cost</b>				<b>\$717,603</b>

## (b) 500 AF of Reservoir Storage Capacity (possible several sites) for 6 cfs Target

Item	Quantity	Units	Unit Cost	Cost
Land Purchase	50	acres	\$100,000.00	\$5,000,000
Clear Site	50	acres	\$750.00	\$37,500
Excavate	806,700	cu.yd.	\$2.50	\$2,016,750
Haul Material	403,350	cu.yd.	\$15.00	\$6,050,250
Fill	403,350	cu.yd.	\$2.50	\$1,008,375
Grading	1	lump sum	\$50,000.00	\$50,000
Impermeable Liner	2,200,000	sq.ft.	\$1.50	\$3,300,000
Pipeline	1,000	ft.	\$225.00	\$225,000
<b>Sub-Total</b>				<b>\$17,687,875</b>
Cost Factor				30%
<b>Total Cost</b>				<b>\$22,994,238</b>

## 3. Water Conservation Projects

The local stakeholders could invest in water conservation projects to reduce peak irrigation diversion demands during the growing season. This concept would likely not reduce consumptive use by the grass, pasture, or crops but would instead improve efficiencies such that the diversion demand on the water source is reduced during the late summer. The effect of improving irrigation efficiency through conservation projects is to reduce the instantaneous diversion of water but also to reduce the late season return flows caused by flood irrigation practices. As stated, the largest irrigation land use covering about half of the overall irrigated acreage is the center pivot operated by the Osguthorpe diversion. Some technology improvements such as sprinkler drops, improved nozzles, and irrigation scheduling could be applied but overall center pivot sprinklers are relatively efficient. Flood irrigation practices for the remaining lands in the subject area could be improved upon but it often does not make sense to invest in sprinkler technology for small and odd-shaped parcels that are common in the subject area. For perspective, if 100 irrigated pasture acres were to switch from a 50% efficient flood irrigation practices with a water duty of 3 AF/acre to 75% efficient sprinkler irrigation with a revised water duty of 2 AF/are, then the overall diversion reduction is approximately 1 AF/acre or 100 AF total. This represents the maximum potential of this concept for the subject area and therefore it is more applicable to the 2 cfs target. If irrigation investments are made to improve efficiency, then monitoring procedures and an agreement would need to be securing to ensure that water diversions reduced as a result of the investment.

4. Effluent Pump Back

A final concept that has been discussed among the local stakeholders is to build a water reuse system which would pump the effluent from the Snyderville Water Reclamation Facility upstream to rewater the critical reach. The distance of upstream pumping is directly related to the miles of additional instream flow benefit. Two project schemes are evaluated in this memo:

1. Upstream pumping along the interstate frontage road to discharge near the USGS gage station downstream of Interstate 80. The pipeline distance is approximately 4.2 miles with an elevation gain of approximately 140 feet.
2. Upstream pumping along the frontage road and then south along Hwy 224 towards Park City to discharge near the Park City Golf Course. The pipeline distance is approximately 8.1 miles with an elevation gain of approximately 570 feet.

Figure 5 illustrates these two pipeline alignments. Table 3 provides estimated costs for each alignment. The average annual discharge from the Reclamation Facility is about 4.8 cfs and this is assumed to be fairly steady throughout the year corresponding to municipal indoor uses. Two flow rate iterations of 2 cfs and 6 cfs are defined consistent with the other project concepts in this memo. The estimated construction costs were annualized based on a 30-year loan with an interest rate of 5%. Annual electric power costs to operate the pump stations are estimated in Table 4.

No costs were included for use of the reclamation facility effluent. Project costs including design, permitting, and regulatory approvals were estimated to be similar to the project costs for the storage facilities.

Table 3: Estimated Capital Costs of Pump Back Facilities

(a) Discharge at Interstate 80

Item	Units	2 cfs Target			6 cfs Target		
		Quantity	Unit Cost	Cost	Quantity	Unit Cost	Cost
Easement	acres	50	\$0.00	\$0	50	\$0.00	\$0
Pipeline	ft.	22,176	\$70.00	\$1,552,320	22,176	\$100.00	\$2,217,600
Pump Stations	hp	50	\$20,000.00	\$1,000,000	150	\$10,000.00	\$1,500,000
<b>Sub-Total</b>				<b>\$2,552,320</b>			<b>\$3,717,600</b>
Cost Factor				30%			30%
<b>Total Cost</b>				<b>\$3,318,016</b>			<b>\$4,832,880</b>

(b) Discharge at Pak City Golf Course

Item	Units	2 cfs Target			6 cfs Target		
		Quantity	Unit Cost	Cost	Quantity	Unit Cost	Cost
Easement	acres	100	\$0.00	\$0	100	\$0.00	\$0
Pipeline	ft.	42,768	\$70.00	\$2,993,760	42,768	\$100.00	\$4,276,800
Pump Stations	hp	180	\$10,000.00	\$1,800,000	560	\$6,000.00	\$3,360,000
<b>Sub-Total</b>				<b>\$4,793,760</b>			<b>\$7,636,800</b>
Cost Factor				30%			30%
<b>Total Cost</b>				<b>\$6,231,888</b>			<b>\$9,927,840</b>

Table 4: Estimated Annual Electricity Costs for Pump Back System

Discharge Location	Target	Power Required	Operating Time (hrs/yr)	Electricity Use (kW-hrs)	Annual Cost
I-80	2 cfs	35	288	10,080	\$4,811
	6 cfs	100	3,240	324,000	\$49,056
Park City	2 cfs	140	288	40,320	\$9,523
	6 cfs	415	3,240	1,344,600	\$183,715

## Summary of Findings

This memo provides a preliminary analysis of project concepts to provide additional instream flows into East Canyon Creek from Park City to the Snyderville Water Reclamation Facility. Four project concepts were evaluated and costs for each concept are summarized in Table 5. One concept involving agricultural water conservation through efficiency improvements was not evaluated for costs due to the low probability that it could achieve the desired flow targets.

The analysis indicates that a long-term water lease is the most cost effective concept at a water lease rate of \$500 per AF. Although cost effective, a previous analysis by WestWater indicates that there are limited water rights located in the subject area of interest and identifying a willing seller (lessor) may be challenging. The other options have higher capital and annual costs but may be easier to implement because a sale partner does not need to be identified.

Table 5: Summary of Concept Costs

Concept	2 cfs Target		6 cfs Target	
	Capital Cost	Annual Cost	Capital Cost	Annual Cost
1. Water Right Acquisition through 30-Year Lease	\$350,000	\$11,667	\$7,700,000	\$256,667
2. Constructing Reservoir Storage	\$1,017,603	\$66,197	\$23,994,238	\$1,560,860
3. Water Conservation Projects	-	-	-	-
4a. Effluent Pump Back to I-80	\$3,618,016	\$240,168	\$5,132,880	\$382,957
4b. Effluent Pump Back to Park City	\$7,231,888	\$479,968	\$10,927,840	\$894,587