Storage Study Report—Executive Summary

Cucharas Basin
Collaborative Storage Study

Executive Summary

Huerfano County, Colorado

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***Prepared for*:**

Huerfano County

Huerfano County Water
Conservancy District
P.O. Box 442
La Veta, CO 80155

***Prepared by*:**

Parsons Water

1619 Minear Road
Medford, OR 97501
Phone: 303-667-5067
Fax: 303-309-0068
www.parsonswater.com

Applegate Group, Inc.

Water Resource Advisors for the West

1490 W. 121st Ave., Suite 100
Denver, CO 80234
Phone: 303-452-6611
Fax: 303-452-2759
www.applegategroup.com

Executive Summary

The history of the Cucharas Basin is one of
perpetual drought punctuated by a few normal years.
-- Beaver Edmundson, HCWCD Board

The Cucharas River basin is water short, a condition exacerbated by serious lack of storage. In 2015, storage stakeholders formed the Cucharas Storage Collaborative which initiated this study to investigate joint projects meeting the basin's storage needs - opportunities for the collaborative repair, construction, and operation of selected storage structures within the basin.[1]

This reconnaissance-level study assesses the storage needs of the basin and develops options for collective storage development. The results of this study illustrate the prudence of the stakeholders moving forward with a joint project facilitating the storage and most efficient and effective use of water in an enlarged or new storage infrastructure.

This Executive Summary presents the findings, cost estimates and recommendations of the Cucharas Basin Collaborative Storage Study. The attached Study Report provides additional detail and is comprised of the attached task memoranda developed by ParsonsWater Consulting and Applegate Group.

Purpose and Approach

A needs assessment was conducted to determine current and future water demands in the basin. Estimates of the sufficiency of current water supply available to meet these demands were used to illustrate the amount of additional yield and storage necessary to meet shortages. Dam Safety reports and associated information were reviewed to characterize current storage conditions. Site visits to existing and prospective reservoir sites were carried out to identify maintenance needs and opportunities for new storage. Details regarding the storage needs assessment are included in the attached Task 1 report. Additional screening of the storage sites was used to narrow the list of alternatives to arrive at the most promising storage sites to meet Stakeholders' needs. A screening matrix was developed to compare the possible storage options based on volume, technical feasibility, storage yield, operational and administrative factors, and the potential for public benefit. A StateMod modeling platform was developed to assess the yield of various reservoir alternatives and the ability to deliver water to meet estimated water shortages. The effect of Arkansas River calls were not specifically evaluated but would decrease project yields. Scores assigned to the screening thresholds for each storage option, in conjunction with stakeholder feedback provided at eight public meetings, were used to identify a list of five preferred reservoir sites. Feasibility level cost estimates and preliminary design drawings were developed for the preferred sites. Permitting requirements and funding opportunities related to development of joint storage in the basin were identified. Recommendations were made to help direct the shareholders through the next stages of reservoir design and construction. Details regarding these aspects of the storage study are included in the attached Task 2 report.

[1] This study was first identified in a workshop conducted by the Huerfano County Water Conservancy District (HCWCD) with the Division Engineer and his staff in April 2013. A month later, it became part of the District's strategic plan. In 2015 it was included in the Arkansas Basin Implementation Plan's Master Needs List (Project 2015-007). Primary funding was a grant from the Colorado Water Conservation Board's Water Supply Reserve Account, along with matching funds from Huerfano County, the City of Walsenburg, the Town of La Veta, the Cucharas Sanitation and Water District, and the Huerfano County Water Conservancy District.

Storage Needs

Current water demands were tabulated based on water treatment plant deliveries provided by the three local municipal water providers (Cucharas Sanitation & Water District, Town of La Veta, and City of Walsenburg) and records of irrigation diversions maintained by the Colorado Department of Water Resources. Future water demands were estimated based on municipal planning efforts, projected population growth, and a maximum supply (i.e., not limited) to meet the demand associated with approximately 11,000 irrigable acres located within the Cucharas River basin.

MUNICIPAL	Current Demand	Future Demand
Cucharas S&WD	141 AFY	196 AFY
La Veta	325 AFY	408 AFY
Walsenburg	1,106 AFY	2,212 AFY
Unincorporated	228 AFY	286 AFY
Total	1,800 AFY	3,103 AFY
IRRIGATION	12,980 AFY	33,573 AFY

Municipal demands are typically satisfied in wet and average hydrologic years but face shortages in drought years. Shortages to irrigation demands occur in all but the wettest of years. The current level of infrastructure and water supply are not sufficient to meet anticipated future demands in average to below-average years and during multi-year drought periods. The extent of shortages to future demands was estimated with spreadsheet models over a three-year drought planning scenario.

Additional total storage/supply to cover a three-year drought period was estimated, as follows:

- Cucharas Sanitation & Water District — 30 acre-feet to 40 acre-feet
- Town of La Veta — 400 acre-feet
- City of Walsenburg — 3,200 acre-feet

Irrigation shortages are significant and average approximately 15,000 acre-feet per year under the future demand scenario. With the exception of irrigators, these estimates represent the needs of individual stakeholders. Operations to gain the greatest benefit for all stakeholders would rely on cooperative operations with whatever supplies may be available to meet future demands.

Existing Infrastructure

Only about 30 percent of the approximately 47,000 acre-feet of capacity historically impounded behind 70 dams in the basin is currently available for use and not under dam restriction. The status of existing infrastructure in the basin was determined based on review of decreed storage rights, historical storage contents records, review of Dam Safety reports, and discussions with Division of Water Resources personnel. This information was reviewed with Collaborative stakeholders at public meetings, at which a number of potential reservoir sites were also identified.

Site visits to 26 existing reservoir sites and 7 potential reservoir sites confirmed the lack of ongoing maintenance for the aged dams in the basin, and provided the information needed to estimate the cost of deferred maintenance that would be required to bring existing reservoirs into current day Dam Safety standards. The opportunities and limitations of the new reservoir sites and existing reservoirs that are most promising from an enlargement perspective were used as part of the screening analysis directed towards identification of effective storage options to meet anticipated water shortages.

Screening

A screening matrix was developed using criteria to assist in evaluating each storage alternative. Each alternative was comparatively scored under the selected screening criteria. A weighting factor was applied to each screening criteria to arrive at a weighted score for each storage alternative. Seven scoring thresholds were analyzed, including the following:

1. Storage Volume – Qualitative analysis of vessel size within which water could be stored.
2. Technical Feasibility – Qualitative analysis of complexities of site geology, availability of borrow material, and associated impact of construction.
3. Yield – Quantitative analysis of water that could be stored in priority without injury to existing Cucharas direct flow and storage water rights.
4. Project Cost – Quantitative analysis of the cost efficiency of the sites for comparison purposes, including dam construction, land acquisition, and O&M costs.
5. Operational Factors – Qualitative analysis of level of automation possible and level of coordination necessary among multiple owners.
6. Administrative – Qualitative analysis of permitting requirements, need for detailed water court efforts, and easements.
7. Public Benefit – Qualitative analysis of potential socioeconomic benefit based on recreational benefit provided by an alternative.

The following thirteen sites and three additional integrated operational scenarios were evaluated for the screening task:

Existing Reservoirs

- Britton Ponds Enlargement
- La Veta Lakes Enlargement
- HR Carson #1/#2 Combined Storage
- Daigre Reservoir Enlargement
- City Lake Rehabilitation and Enlargement
- Holita Reservoir Rehabilitation
- Maria Stevens Rehabilitation and Enlargement
- Horseshoe/Martin Joint Use Pool

New Storage Projects

- South Baker Creek Reservoir
- Chaparral Creek Reservoir
- Bruce Canyon Reservoir
- Coler Seepage Reservoir
- White Creek Reservoir

Integrated Operations

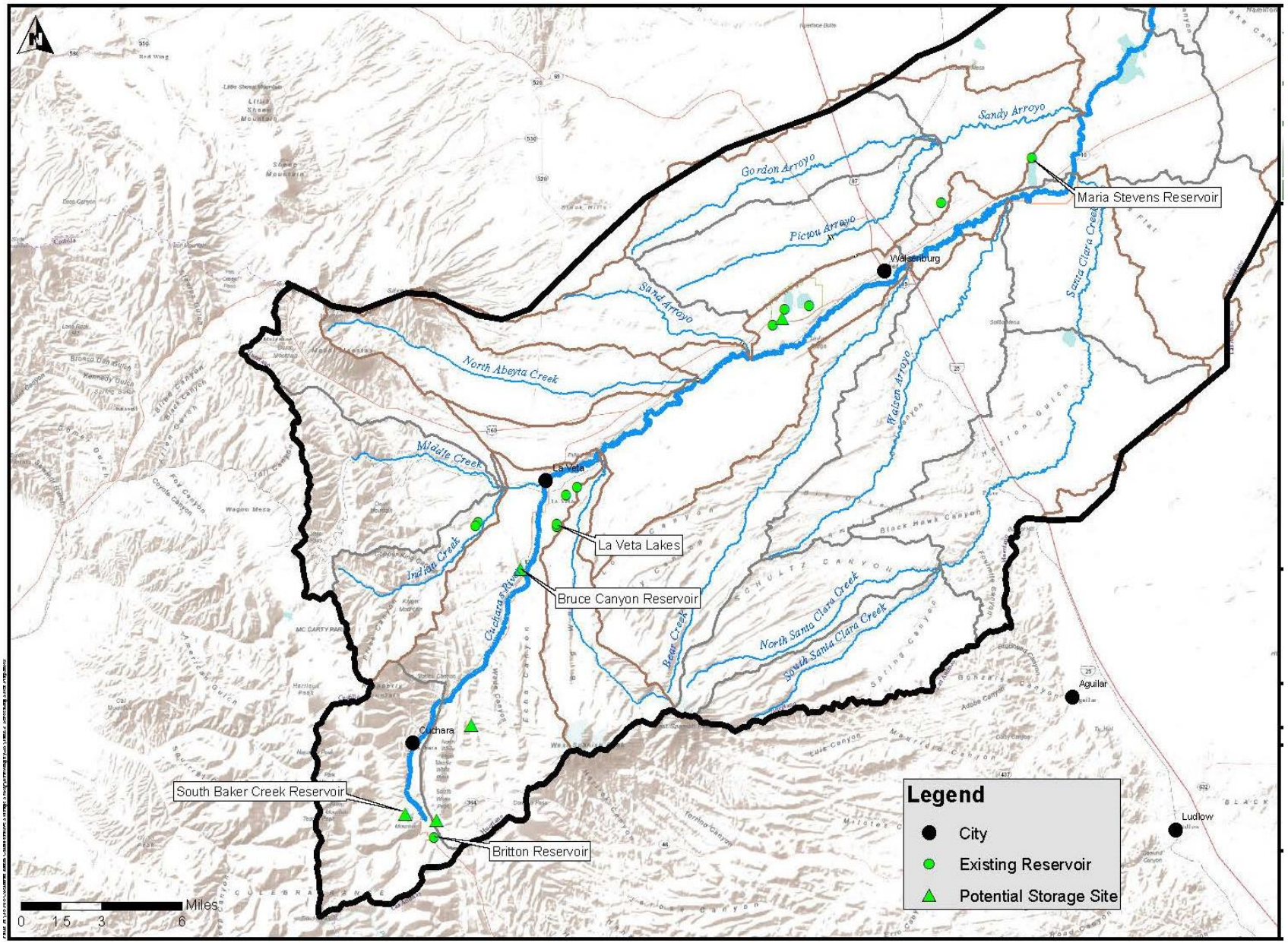
- Maria Lake - Bruce Canyon Exchange
- Change of Use of Unused Senior Rights
- Change Diversion to Coler Inlet Ditch

Based on the screening analysis and user input, the following five sites were selected as preferred sites for development of preliminary design drawings and development of cost estimates. The top five scoring sites are also noted in the figure below.

- South Baker Creek Reservoir
- Britton Reservoir enlargement
- Bruce Canyon Reservoir
- La Veta Lakes combination/enlargement
- Maria Stevens Reservoir enlargement

As noted previously, the Collaborative was established with a focus on cooperative operations throughout the basin in order to gain the greatest benefit for all stakeholders. Water users throughout the basin have different advantages and deficits with physical water supply, location of demands and returns, and the extent to which sites are suitable for development of storage reservoirs. The most efficient way to get physical supply to where the demands are located is by moving water through different reaches of river during high streamflows. This is facilitated by the exchange of water where water is released to the river above the calling right to allow diversion at a location upstream from the point of release. For instance, water could be released from Maria Stevens Reservoir to satisfy the Arkansas River call in exchange for a like amount of water stored under a junior water right upstream at the Butte Ditch for storage in Bruce Canyon Reservoir. Alternately, upstream storage of unused and underused senior storage rights could be affected through an exchange of those rights to a decreed new location of storage.

At a later time, for instance, when a call has been placed on the lower Cucharas River and streamflows are high above Middle Creek, water could be released from Bruce Canyon Reservoir to meet the call and a like amount of water is exchanged upstream to storage in South Baker Creek Reservoir. These operations and similar operations (e.g., upstream storage of changed senior water rights) will require the adjudication of multiple exchange rights to facilitate the movement of water throughout the river for storage and for use – sometimes referred to as ladder exchanges or stair step exchanges. The different rights would identify the various locations of the exchange-from points that have the replacement supply; e.g., Maria Stevens Reservoir, Martin Lake, Butte Ditch, changed water rights at the Mexican Ditch, Ballejos Ditch, Gomez Ditch, and the exchange-to points; e.g., Bruce Canyon Reservoir, South Baker Creek Reservoir, La Veta Lakes. The various locations of demand, supply, and storage infrastructure point to the benefit of the stakeholders moving forward with a joint project where each entity is able to provide certain facets of the supply and infrastructure for the greatest overall benefit to all stakeholders.


Sandy Arroyo
Gordon Arroyo
Pictou Arroyo
Sand Arroyo
North Abeyta Creek
Middle Creek
Indian Creek
Chicharas River
Bear Creek
North Santa Clara Creek
South Santa Clara Creek
Plaisen Arroyo
Santa Clara Creek
Maria Stevens Reservoir
Walsenburg
La Veta
La Veta Lakes
Bruce Canyon Reservoir
Cuchara
South Baker Creek Reservoir
Britton Reservoir
Aguilar
Ludlow
Legend
City
Existing Reservoir
Potential Storage Site
Miles
0 1.5 3 6

Cost Estimates

Feasibility engineering was completed for the preferred alternatives, including the primary project components and sizes needed. Unlike the Project Cost criterion used in the screening analysis, the feasibility level cost estimates are more detailed and include high level estimates for design, construction, permitting, operations and maintenance, land acquisition, construction oversight, and energy costs. Unit costs were calculated as the ratio of the total cost of the project to the total storage capacity for the project. The unit cost for storage is the primary metric used in cost-benefit analyses, with a range of $10,000 to $20,000 per acre-foot as a threshold for feasible projects. However, these typical unit costs are generally applied to larger (e.g., greater than 1,000 acre-foot of storage volume) reservoirs. Unit costs for smaller reservoirs, similar to four of the preferred reservoir sites, may be higher. Bruce Canyon dam and the enlargement of Maria Stevens Reservoir are the only two projects that have a unit cost for storage volume below $20,000.

Reservoir Alternative / Storage Capacity	Project Cost[1,2]	Unit Cost ($/ac-ft Capacity)
Britton Ponds Enlargement (42 AF)	$6,577,340	$156,602
South Baker Creek Reservoir (122 AF)	$13,101,600	$107,390
La Veta Lakes Enlargement (102 AF)	$6,621,300	$64,915
Bruce Canyon Reservoir (1406 AF)	$19,184,100	$13,644
Maria Stevens Rehab/Enlargement (642 AF)	$8,406,300	$13,094

[1] Project Cost is based on the Construction Cost estimate, and does not include additional engineering design, permitting, land acquisition, or O&M costs.

[2] Deferred maintenance costs for existing reservoir sites are excluded from Project Cost, as it is assumed these costs will be separate from the Collaborative Storage improvements.

Another metric for cost-benefit analyses is the unit cost for project yield, defined as the ratio of the total cost of the project to the average annual yield. These unit costs represent the approximate cost of delivering an acre-foot of water over a 50-year project life. Annual unit costs over a 50-year project life range from approximately $620 to $5,980 per acre-foot.

Reservoir Alternative / Storage Capacity	Delivery (ac-ft/yr)	50-Yr Cost[1,2] ($/ac-ft/yr)
Britton Ponds Enlargement (42 AF)	22	$5,979
South Baker Creek Reservoir (122 AF)	54	$4,852
La Veta Lakes Enlargement (102 AF)	102	$1,298
Bruce Canyon Reservoir (1406 AF)	622	$617
Maria Stevens Rehab/Enlargement (642 AF)	271	$620

[1] 50-Yr Costs are based on construction costs, and do not include additional engineering design, permitting, land acquisition, or O&M costs.

[2] Deferred maintenance costs for existing reservoir sites are excluded from Project Cost, as it is assumed these costs will be separate from the Collaborative Storage improvements

Permitting

Permitting requirements will vary somewhat between the five preferred alternatives, but each alternative project generally will require some level of permits. Based on an initial assessment of permitting requirements, the most difficult projects to permit would be the new on-stream dams: South Baker Creek, Bruce Canyon, and Britton Ponds enlargement. On-stream dams will require a Clean Water Act Section 404 Individual Permit, which are time consuming and costly. Federally funded projects would also be particularly difficult to permit, and may require National Environmental Policy Act (NEPA) permitting, which can vary significantly in cost and timing. Construction within the regulatory floodplain (i.e., South Baker Creek, Bruce Canyon, and Britton Pond) would generally require a floodplain development permit from Huerfano County, and could be an arduous process if the project would result in an impact to the regulatory floodplain. Based on an initial review of threatened and endangered species at the project locations, there are a few threatened species but no endangered species. As a result, Endangered Species Act (ESA) permitting may be relatively simple.

The variability of permitting requirements typically has a significant impact on project schedule. An organized approach to filing permit applications may require on the order of two years and $100,000 - $300,000 to acquire final permits necessary for a project.

Funding Opportunities

The Storage Study and cost-benefit analysis of the preferred reservoir sites provide the Collaborative some direction in its decision making process regarding choosing which way to move forward with development of storage in the basin. There are a number of steps needed to help the progress of that effort, including land acquisition; securing necessary rights-of-way and completing agreements between partners and affected parties; addressing various water rights issues; and finalizing permits and analyses used to support permit applications.

Various funding options were reviewed to support those efforts. The most promising funding options were identified as:

- EPA WIFIA (Water Infrastructure Finance and Innovation Act): loans for regionally significant projects, minimum $5 million project size with maximum 49% of project costs, 35-year maximum term of loan.
- CWCB Water Project Loan program: loans for new construction or rehabilitation of existing raw water storage and delivery facilities, minimum $100,000 loan, 2.55% to 3.30% interest rate, 30-year term of loan.
- CWCB Non-Reimbursable Project Investment Grants: studies and projects to address regional water issues, grant amounts and terms provided by CWCB.
- Water Supply Reserve Funding: competitive grants and loans to address water supply issues, 25% applicant match required.

Some of the loan and grant opportunities are focused on storage opportunities and some are not. Many of the funding opportunities are directed toward basin-wide efforts with multiple beneficiaries that typify the storage alternatives analyzed for the study.

Recommendations

Preliminary design drawings were completed for the five preferred dams, which can be used to support further efforts for dam design and associated investigations. The costs for the various storage projects range widely, in part due to lack of knowledge of underlying site geology, which factors significantly into project cost. Therefore, the primary recommendation from this study is to gather site-specific geotechnical data that can be used to refine the feasibility level designs and cost estimates, resulting in a better understanding of total construction costs. A secondary recommendation is to further investigate the ability of filling and operating new storage capacity without injury to water rights located outside of the Cucharas River basin. One option would be the use of the StateMod model of the entire Arkansas River basin that will be completed as part of the CWCB-sponsored ArkDSS planning effort. That effort is underway and is scheduled for completion in approximately two years. Replacement sources capable of meeting downstream calls do exist in the basin (e.g., Maria Stevens Reservoir, unused senior storage rights, and changed direct flow rights owned by the three municipalities). Further analysis to illustrate their use with operation of one or more exchanges to secure additional storage yield to meet stakeholders' needs is also warranted.