EXECUTIVE SUMMARY

BRIDGER VALLEY RESERVOIR
LEVEL II, PHASE II STUDY

Contract No. 05SC0292701

November 2006

SUBMITTED BY

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Gannett Fleming, Inc.
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Windsor, CO

IN ASSOCIATION WITH

STATES WEST WATER RESOURCES CORPORATION
1904 East 15th Street
Cheyenne, WY
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1. **Introduction and Project Background**

The Bridger Valley Joint Powers Board (BVJPB) supplies treated water to the towns of Lyman and Mountain View, the Blacks Fork Water and Sewer District, and individual homes and businesses in rural Uinta County within the Bridger Valley. The existing water treatment plant is located about two miles south of Mountain View, just west of state Highway 410 (Figure 1.1). Water supply for the four-million gallons per day (mgd) capacity plant is derived from direct stream flow rights in the Smiths Fork and Blacks Fork Rivers, and from a storage right of 1500 acre-feet in Stateline reservoir, which is operated by the U.S. Bureau of Reclamation (Reclamation). The contract with Reclamation requires specified releases of the 1500 acre-feet on a prescribed annual schedule – which allocates 800 acre-feet during the summer months between June and September, and 700 acre-feet from October through May. BVJPB members do not have carry-over storage rights in Stateline reservoir. During the winter release period, irrigation demands are low, and municipal water needs are more than met with ample in-stream flows. Recognizing this, the BVJPB saw a potential to “re-capture” the un-used portion of their water that is released from Stateline reservoir during the winter. Re-capturing and storing this available water would give the BVJPB added operating flexibility and assurance of adequate supplies, particularly during times of drought.

The BVJPB sponsored a Level II Phase I study in 2004 which looked at a variety of alternatives for conserving and managing their water supplies in a more favorable manner (ECI, 2004). The Phase I study concluded that a storage reservoir at the Jack Hollow site was the most favorable alternative. The Jack Hollow site is located near the existing water treatment plant in a drainage east of Highway 410 (Figure 1.1). The water stored in the Jack Hollow reservoir would be used as needed to supplement supplies to the plant when demands are high, and direct stream flows are inadequate or of poor quality. The Phase I study developed a conceptual design for an 80 feet high embankment dam and 1500 acre-feet capacity reservoir. The preliminary concept envisioned that the reservoir would be supplied by existing irrigation canals – either the Milich Ditch or Davis and Company Ditch. The Milich ditch diverts water from the Smiths Fork River about 13 miles upstream from the Jack Hollow site, and the Davis and Co. ditch diverts from the Smiths Fork about 6 miles above the site. Excessive seepage losses and reliability were identified as potential concerns for use of the irrigation ditches to supply the new reservoir. The Phase I engineer’s cost opinion for construction of the Jack Hollow dam and 1500 acre-feet reservoir, including permitting and engineering, ranged from $7.1 million to $8.1 million (2003 dollars). These preliminary cost estimates did not include potential costs for upgrading or maintaining the supply ditches.

The BVJPB (Sponsor) applied for funding of this Level II study because they considered the Phase I cost estimates for the Jack Hollow dam and reservoir to be excessively high. The Sponsor requested this Phase II study to consider optimizing and downsizing the Jack Hollow reservoir, refining the preliminary analysis and design of the Jack Hollow dam (including value engineering to identify potential cost savings for the Phase I design), and developing other concepts as necessary to reduce costs to the sponsors.

This Phase II study was carried out under the direction and funding of the Wyoming Water Development Commission (WWDC) by Gannett Fleming, Inc. (Gannett Fleming), in association
with States West Water Resources Corporation (States West). The scope of Phase II services, as documented in this report, included the following activities:

- population growth and water needs projections, and reservoir size optimization;
- supplemental geotechnical and hydrologic studies for the Jack Hollow dam and reservoir site;
- preliminary assessment of water quality in the Jack Hollow drainage;
- identification of multiple use (and cost sharing) opportunities;
- evaluation of water delivery options; and
- identification and evaluation of potential alternatives to store the winter releases at two basin reservoir (reclaimed gravel pit) sites.

2. **Key Study Findings**

**Population Projections, Future Water Needs, and Reservoir Size Optimization**

Population projections for the BVJPB service area were made for various growth rate assumptions out to year 2050. Water use projections were developed using design populations of 5000, 7000, 9000, and 12,000. Monthly water demands were developed for these populations, based on historic average water usage of about 220 gallons per capita per day (gpcd).

Storage requirements were developed for the design population projections. The projections were done for both dry and average water year conditions. During average water years, 2.75 million gallons per day would be available during the summer. In dry years, the dependable flow available in the summer months is reduced to approximately 1.5 MGD. Shortages were determined for the dry and average conditions for population projections up to 12,000.

In addition to storage demands driven by population growth, it would be advantageous to withdraw water from a storage reservoir during spring run-off months, when the turbidity of the river water can be quite high. It was assumed that water would be supplied from storage for a two month period to simulate this operating condition to improve water quality. The use of storage water for two months in the spring to mitigate water turbidity problems would have a larger relative effect on storage requirements for smaller populations.

The analyses show that reservoir storage could be staged with time to accommodate anticipated population increases and/or drought. A reservoir sized at about 750 acre-feet would meet all foreseeable supplemental needs through about year 2020. Assuming average water years, a 750 acre-foot reservoir would meet the area needs through year 2040, even for the most rapid population growth projections. For this study, a reservoir sized at about 750 acre-feet was assumed to be the optimum size.

**Jack Hollow Dam and Reservoir**

The Phase II supplemental investigations described in this report confirmed:

- poor foundation conditions (thick, weak, compressible, and potentially dispersive clay sediments) in the valley bottom at the Jack Hollow dam site, and
- very poor water quality (high concentrations of arsenic, sulfates and total dissolved solids) in the natural stream that flows within the drainage.
Poor water quality is attributed to natural springs and seeps that emerge on the upper slopes of the valley at a geologic contact between the Bridger Formation bedrock and overlying sand and gravel terrace deposits. Preliminary mixing calculations indicate that dilution of the natural stream flows with good quality water diverted from the river to storage would not be adequate to dilute concentrations of contaminants to acceptable standards for drinking water. The existing water treatment plant is not equipped to treat for total dissolved solids, arsenic and other contaminants that would be introduced into the system.

The Jack Hollow storage design was revised to address water quality and dam foundation concerns that were identified in this Phase II study. Recommended design changes that have significant cost implications include complete stripping of the clay sediments from the dam foundation, lining of the reservoir area with geomembrane to isolate and protect diverted river water quality, and installation of a groundwater interception system that would capture and divert poor quality groundwater around the reservoir area. If the Jack Hollow site is retained for further evaluation, in spite of the problems that have been identified, the need for a reservoir liner will require further evaluation to understand whether or not the contaminated, soluble-mineral rich sediments in the reservoir area would present a potential problem for water quality.

The revised design did identify potential cost savings that would result from downsizing the dam and reservoir (from 1500 to 750 acre-feet), and eliminating the emergency spillway (flood storage would be accommodated with additional freeboard). Base construction cost estimates for a 57-feet high embankment dam and 750 acre-feet reservoir at the Jack Hollow site ranged from $6.7 million to $7.5 million, with and without a reservoir liner, respectively. This cost estimate does not include estimated costs for operation and maintenance, water delivery to the reservoir, or costs for a pipeline to deliver water from the reservoir to the water treatment plant.

**Basin Reservoir Storage Alternatives**

Because of the adverse water quality and foundation conditions identified at the Jack Hollow site, the Phase II study team evaluated preliminary alternative reservoir storage options. Two possible locations for an excavated and lined basin reservoir were identified in relatively close proximity to the water treatment plant. These sites are indicated as Basin Site A and Basin Site B on Figure 1.1. Both locations are at the sites of currently operating sand and gravel mines. Potential advantages of the basin storage options over the Jack Hollow dam site include:

- water quality would be protected,
- construction cost estimates are lower,
- the reservoir size could be easily staged to accommodate growing needs by starting with smaller cells and adding additional lined cells as needed,
- permitting for construction could be simpler for a lined basin rather than for a high hazard dam, and
- the basin sites are better situated topographically to provide opportunities for multiple use benefits such as recreation, wildlife habitat, and residential development enhancement.

Very preliminary design layouts and cost estimates were developed for Basin Sites A and B. Preliminary project construction cost estimates for either basin option are about $5 million. These cost estimates should be considered very preliminary. Site investigations, including
geotechnical studies and topographic surveys, are required to develop more reliable cost estimates for the basin reservoir options.

**Water Delivery Alternatives**

Three different types of systems were considered to deliver water released from storage in Stateline Dam to either the Jack Hollow reservoir site, or to Basin A or Basin B reservoir sites. The following delivery alternatives were evaluated:

- Use of existing irrigation river diversion structures and supply canals
  - Milich Ditch
  - Davis & Company Ditch
- New, dedicated diversion and gravity pipeline to reservoir
- Use of existing water treatment plan diversion structure with a booster pump station

Costs for construction of a new diversion structure with a gravity-flow pipeline to the reservoir were considered to be prohibitively high (over $2.8 million) compared to the ditch supply or pumping options, so this option was not considered further.

The use of existing, privately owned and operated irrigation ditches to fill the reservoir is feasible, but may be subject to important operating constraints. The reservoir must be filled between October 1 and June 1. Although there is no specified “schedule” for releases from Stateline over this time frame each year, historically, the releases are made month by month based on requests from the BVJPB. The ditch owners have made it clear that they are concerned about use of their ditches over winter months due to high potential for freezing, blockages by snow drifts and flooding. Ditch company representatives indicated that they may be willing to allow filling of the reservoir via the ditches over a relatively short time period (2 weeks to 1 month) immediately following or prior to the irrigation season when risks of freezing or blockage problems would be minimized. However, this accelerated release scenario would be a significant change from the historic release schedule from Stateline reservoir that could have potential adverse impacts on in-stream flows through the approximately five-mile reach of river through U.S. Forest Service lands immediately downstream from the dam.

Another option that was evaluated for delivering water to either the Jack Hollow site or to either basin site was to install booster pumps on the existing pipeline that supplies water to the treatment plant, and pump excess water up to the reservoir over the winter months. For this option, water would be delivered to the reservoir using the same pipeline that delivers water from the reservoir to the plant. Key advantages of this water delivery option are that the existing diversion structure and supply pipeline could be used, and the historic release schedule from Stateline Dam could be maintained.

3. **Comparison of Alternatives for Water Storage and Water Delivery**

Tables 1 and 2 provide a summary of the potential advantages and disadvantages for the water storage alternatives and water delivery options, respectively.

4. **Cost Estimates and Project Financing**

Costs were estimated on the basis of end costs to users. End costs are estimated based on assumed project financing assistance from the WWDC. No other sources of funding for
additional storage in the project area are deemed realistic at this time. Current WWDC funding guidelines for new projects allow for up to a 67 percent grant and 33 percent loan to the project sponsor. The loan can be repaid at 4 percent interest over a 30-year time frame. Post-construction costs to the sponsors include both the annualized debt share for project costs plus annual operation and maintenance (O&M) costs.

The analyses considered various combinations of storage and water delivery scenarios. Table 3 summarizes the base construction costs and the total project costs (= base construction cost + costs for engineering, permitting, legal fees, and land acquisition) for each storage and water delivery option. Water delivery costs for both the ditch and pumping supply alternatives include cost estimates to construct a pipeline from the reservoir to the water treatment plant.

Table 4 summarizes the project financing possibilities for various storage and water delivery options. Project costs plus annual operation and maintenance (O&M) costs for appropriate storage and water delivery combinations are summarized on Table 4.

Rate increases, shown on Table 5, were computed based on distributing the costs to construct the 750 acre-feet storage project to an initial 1,500 existing water taps. As the population and number of taps increases over the 30-year loan payback period, the monthly cost per tap to pay for the project will decrease.

5. Conclusions from Phase II Study

All proposed reservoir sites and water delivery options identified in this study need further investigation to advance conceptual designs and to estimate more accurate construction costs. Generally, estimated construction and O&M costs are highest for the Jack Hollow site compared to Basin A and Basin B storage alternatives. Conclusions from this Level II, Phase II study are summarized as follows:

1) Engineer’s cost analyses were completed for the three storage options. Costs for construction of a 750 acre-feet reservoir at Jack Hollow, including installation of a perimeter drain to intercept and bypass poor quality groundwater, are estimated to be on the order of $6.7 to $7.5 million. The higher cost range is for a reservoir with a geomembrane liner to protect water quality. Additional study would be needed to determine if the liner is required. Construction costs for a 750 acre-feet basin reservoir are estimated at about $5 million.

2) Engineer’s cost analyses for the water delivery options were computed separately. Costs for construction of a dedicated new diversion and pipeline to Jack Hollow exceeded $2.8 million, and are therefore considered prohibitive. Costs for construction of water delivery via existing irrigation ditches and the delivery outlet pipeline from the reservoir to the water treatment plant, range from about $270,000 to $390,000. Costs for construction of a pump station from the existing diversion/supply pipeline and the water supply/delivery pipeline to the reservoir range from $300,000 to $510,000.

3) Annual O&M cost estimates range from $9,600 to $19,500. These include costs for both dam/reservoir O&M and water supply system O&M (which includes costs for electricity for pumping options).
4) Significant water quality concerns have been identified at the proposed Jack Hollow dam site, as follows:
   a. Groundwater springs discharge at the contact between the Bridger Valley bedrock formation and the overlying sand and gravel deposits that cap the reservoir rim area. These springs have elevated concentrations of arsenic, sulfates, total dissolved solids, and other constituents that greatly exceed drinking water standards.
   b. Preliminary mixing calculations are based on preliminary water quality analyses and stream gage flow measurements that were conducted as part of this study. From the gage data, the estimated volume of poor quality water that would enter the Jack Hollow reservoir is about 375 acre-feet, annually. The mixing calculations indicate that there will not be sufficient dilution of the poor quality natural spring flows by good quality overland surface runoff (primarily irrigation ditch waste water), and river water delivered to the site for storage, to reduce concentrations to below standard limits. Dilution on its own cannot be relied upon to ensure that water quality in the reservoir will meet drinking water standards. The existing water treatment plant is not equipped to treat for the constituents of concern (e.g., TDS and arsenic), which can only be removed using a specialized reverse osmosis process.

5) Supplemental geotechnical investigations conducted under this Phase II study indicate that the thick, fine-grained sediments within the valley bottom in the proposed Jack Hollow dam foundation are:
   a. potentially dispersive, meaning that the soils are highly vulnerable to internal erosion and piping under seepage forces;
   b. compressible and subject to large differential settlements that could lead to embankment cracking; and
   c. weak and subject to development of high pore pressures during and shortly following embankment construction, potentially resulting in slope instability.

6) Population and water use projections indicate that a reservoir sized at about 750 acre-feet would meet all foreseeable supplemental needs through about year 2020, including during times of drought. Assuming average water years, a 750 acre-feet reservoir would meet the area needs through year 2040, even for the most rapid population growth projections. For this study, a reservoir sized at about 750 acre-feet was assumed.

7) Based on the findings of the Phase II site study for the Jack Hollow dam, Gannett Fleming recommends that the BVJPB consider alternative storage sites, such as the Basin A and Basin B sites described in Section 4 of the report. If the Jack Hollow dam and reservoir are retained for further consideration, the following design changes are recommended to the preliminary design originally proposed by ECI (2004):
   a. Downsize the reservoir from 1500 acre-feet to 750 acre-feet. This reduces the embankment height from about 80 feet to about 57 feet.
   b. Install a groundwater interception system to collect and convey poor quality groundwater around the reservoir area.
   c. Eliminate the emergency spillway – the full PMF for the small (1.5 square mile) drainage can be stored within the freeboard between the normal operating pool and dam crest.
d. Completely excavate the valley bottom sediments to fresh bedrock in the dam foundation.

e. Incorporate a specially designed and processed internal sand filter that extends the full height of the dam core into bedrock to protect against internal erosion or piping of the potentially dispersive soils.

f. Realign the outlet works pipe to found it on rock in the lower abutment.

g. Use soil-cement plating for erosion protection on the upstream face of the dam instead of riprap which is scarce in the project area.

8) As an alternative to the Jack Hollow site, two additional, 750 acre-feet storage site options were identified in close proximity to the water treatment plant. Basin Site A and Basin Site B are described in report Section 4. The proposed basin reservoir(s) would be situated at the sites of existing gravel quarry operations in areas that have already been disturbed and partially excavated.

a. Site development to construct a reservoir at Basin Site A would be fairly straightforward, consisting primarily of site grading and construction of wide, low berms to form a 15 to 20 feet deep basin.

b. For the preliminary layout of Basin Site B, a large embankment is incorporated on the north end of the reservoir. The embankment was incorporated in order to develop a small, deeper area within the reservoir that could sustain a small fishery, which could enhance the multiple-use (recreational) potential for a reservoir at this site.

c. It is anticipated that a basin reservoir at either site A or B would be fully lined with a geomembrane to protect water quality.

9) Several water delivery alternatives were evaluated to deliver water to either Jack Hollow or the basin reservoir sites. These include:

a. Use of existing irrigation canals.
   i. Milich Ditch to Jack Hollow or Basin B
   ii. Davis and Company Ditch to Jack Hollow or Basin A

b. Construction of a new diversion and pipeline to Jack Hollow.

c. Installation of a pump station and inlet/outlet pipeline from the water treatment plant to any one of the reservoir alternatives.

10) Use of the existing irrigation ditches (Milich and Davis & Company Ditch) to fill the reservoir over the winter months will not be feasible according to the ditch operators who expressed significant concerns about freezing, snow drifts, and flooding.

a. The ditches have sufficient capacity to fill the reservoir quickly over about a two week to one month period. According to discussions at a project meeting in October 2005, if this operational constraint were imposed, use of the ditches for reservoir filling may be acceptable to the ditch companies. Preferably the filling would occur in October, immediately following the irrigation season, when losses would be minimized and freezing problems would be less likely.

b. There is some uncertainty about whether or not water can be called from Stateline Dam over a one month period to fill the reservoir. Even if a short-term release of the full 700 acre-feet is allowable per the operating agreement with U.S. Bureau of Reclamation, it is not known whether this change in historic operation would have an
adverse impact on in-stream flows in the five-mile reach downstream from Stateline Dam which is through a national forest fishery.

11) At a 67% : 33% grant/loan ratio, the most cost effective project would be construction of a reservoir at Basin Site A, with water delivery from either a pump station or via an extended Davis & Company ditch. Construction of Basin Site B with water delivery from either a pump station or Milich Ditch would have similar costs, estimated to be slightly higher due to the large embankment element included with that option. Construction of Jack Hollow dam and reservoir is the most expensive alternative, with costs ranging about 40% higher than the basin site options.

a. Annualized debt share to the sponsor ranged from $100,500 to $182,800.
b. Costs per tap (estimated for current population at 1500 taps) range from an increase of $6.12 to $11.94 per month. Excluding the most expensive (pipeline) delivery scenario, costs for storage and delivery from Jack Hollow would result in rate increases of $8.51 to $9.69 per month, or about 25% to 40% more than the rate increase for storage and delivery from either Basin A or Basin B ($6.12 to $7.05/month).
<table>
<thead>
<tr>
<th>Alternative</th>
<th>Description</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
</table>
| Jack Hollow                     | 57’ high, zoned embankment dam and 750 AF reservoir                         | • Land purchase costs may be lower than basin sites  
• Some potential for development of a fishery and recreation, although access is more difficult than for basin sites | • Very poor water quality in drainage; large estimated volume of poor-quality water relative to storage volume (est. 375 AF annually) requires groundwater interception and bypass around reservoir  
• Poor foundation conditions in valley bottom – dispersive clays, compressible & weak  
• Poor embankment construction materials due to high amounts of soluble minerals in soil and dispersive clays  
• Long-term, high-hazard dam safety risks (although risk will be low with modern dam design and construction quality assurance, still have risk & liability associated with a dam)  
• Potentially lengthy and difficult construction permitting process  
• Access to reservoir rim for recreation would be more difficult than for basin sites |
| Lined Basin (Site A or Site B)  | 750 AF, geomembrane-lined, excavated basin reservoir on Tipperary Bench above Water Treatment Plant | • Water quality in reservoir is protected  
• Construction costs are lower than Jack Hollow; Site B costs may be offset by sale of excavated aggregate  
• Reduced dam safety risk at Site A; easier to permit than a dam; lower annual O&M costs than dam  
• More recreational use potential | • Site B takes approximately 40 acres of agricultural land out of production  
• Site B has long-term, high-hazard dam safety risks as currently laid out |
### Table 2 Bridger Valley Water Delivery Alternatives

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Description</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
</table>
| Milich Ditch | Use existing canal diversion and 13-mile long, open-channel canal, extended approx. 1000 feet to fill Jack Hollow or approx. 6500 feet to fill Basin B | • Ditch has sufficient capacity to convey 700 acre-feet (diverted) to reservoir within a 10 to 15 day period following irrigation season  
• Costs are relatively low for extending the existing ditch  
• Estimated annual operation and maintenance (O&M) costs are slightly lower than pumping delivery O&M (O&M costs are defined in Section 7) | • Canal losses are estimated to be high. For losses of 1-2% per mile of canal (estimated), available water delivered to storage is reduced from 700 AF (diverted) to 500 to 600 AF in storage  
• Uncertainty about whether 700 AF in Stateline reservoir can be released over short period (10 to 15 days at end of irrigation season)  
• Canal cannot be used over extended winter months (to maintain current operating schedule of releases from Stateline) due to concerns about ditch O&M in winter |
| Davis & Co. Ditch | Use existing canal diversion and 5.3-mile long, open-channel canal, extended approx. 7000 feet to fill Jack Hollow or approx. 8000 feet to fill Basin A | • Ditch has sufficient capacity to convey 700 acre-feet (diverted) to reservoir within about a 30 day period following irrigation season  
• Much shorter canal length (including required extension to reservoir) compared to Milich Ditch  
• Costs are relatively low for extending existing ditch  
• Estimated annual O&M costs will be lower compared to pumping delivery or Milich Ditch | • Canal losses are estimated to be very high. For losses of 1-2% per mile of canal, water available for storage would be reduced from 700 AF (diverted) to 600 to 650 AF in storage  
• Uncertainty about whether 700 AF in Stateline reservoir can be released over short period; Canal cannot be used over extended winter months due to concerns about ditch O&M  
• Higher initial construction costs than Milich Ditch due to longer canal extension |
| Gravity Pipeline w/ New Dedicated Diversion | Construct a new diversion structure on river and a pipeline from the diversion to the reservoir | • Existing release schedule from Stateline can be maintained  
• Losses are negligible and water quality is protected | • Prohibitively higher construction costs compared to canal or pumping alternatives |
| Utilize Existing Diversion and New Pumping Station at WTP | Divert excess water at existing diversion during winter months, and pump excess up to reservoir from plant | • Existing release schedule from Stateline can be maintained  
• Losses are negligible; water quality protected  
• Low initial capital costs - would require only addition of booster pumps at water treatment plant; same pipeline would be used for delivery to and from reservoir | • Slightly higher annual operating costs for electricity and pump O&M, compared to annual canal O&M costs |
Table 3. Water Storage and Water Delivery Alternatives – Summary of Construction Costs

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<tr>
<th>Storage Options</th>
<th>Project Total Construction Cost</th>
<th>Base Construction Cost</th>
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<td>1 Jack Hollow Dam</td>
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<td>(a) No Reservoir Liner</td>
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<td>(b) with Reservoir Liner</td>
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<td>2 Basin A</td>
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<td>3 Basin B</td>
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<th>Delivery Options</th>
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<td>A Pump to Basin A</td>
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<td>B Gravity Pipe to JHD</td>
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<td>D Milich Ditch to JHD</td>
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<td>D Milich Ditch to Basin B</td>
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1 Includes engineering, permitting, legal fees, land acquisition/easements, and contingencies

2 Gravity pipe and ditch costs also include cost for outlet pipe from reservoir to WTP
### Table 4. Bridger Valley Storage and Delivery Options – Project Financing Summary

Table 8.2 Bridger Valley Storage and Delivery Options – Project Financing Summary

<table>
<thead>
<tr>
<th>Options</th>
<th>Total Storage Construction Costs</th>
<th>Total Delivery Construction Costs</th>
<th>Project Total Construction Costs</th>
<th>Sponsor Costs (33% cost share scenario)</th>
<th>Annualized Debt Share of Construction Costs (33% cost share)</th>
<th>Annual Storage O&amp;M Costs</th>
<th>Annual Delivery O&amp;M Costs</th>
<th>Total Annual O&amp;M Cost</th>
<th>Total Annual Cost (33% cost share)</th>
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1. All costs have been rounded to the nearest $100. The analysis is based on the assumption of a 30-year project life. The dam and pump/pipeline/ditch were assumed to have no salvage value after 30 years.
2. Estimate is based on a 30-year loan payback period at 4% interest.
3. Estimate for embankment dam O&M costs for Jack Hollow and Basin B are based on data from similar-sized water retention embankment dams. Basin A O&M costs were assumed to be 50% of dam O&M costs.
4. Irrigation ditches were assumed to have an O&M cost of $300 per mile per yr. Source for estimate is U.S. Bureau of Reclamation data for western irrigation systems. Gravity pipe O&M costs were assumed to be 10% of irrigation ditch O&M costs. Pump O&M.
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<th>Total Annual O&amp;M Cost</th>
<th>Total Annual Cost (33% cost share)</th>
<th>Rate Increase per Tap per Month (1500 taps)</th>
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