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Laramie, WY 82071

**Physical Address:**
Wyoming Hall, Room 249
University of Wyoming
Laramie, WY 82071

**Phone:** (307) 766-6651
**Fax:** (307) 766-3785

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GREYBULL VALLEY DAM AND RESERVOIR
Level II - Phase V
Executive Summary - Conceptual Design Report

Prepared for:
Wyoming Water Development Commission
Cheyenne, Wyoming
Greybull Valley Irrigation District
Emblem, Wyoming

Prepared by:
GEI Consultants, Inc.

In association with:
States West Water Resources Corporation
Watts and Associates, Inc.

5660 Greenwood Plaza Blvd.
Englewood, CO 80111
(303) 779-5565

August 1994
Project 93151
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This Executive Summary of Level II, Phase V conceptual design evaluations for the Greybull Valley Dam and Reservoir Project includes an overview of engineering and economic analyses, cost estimates and permitting issues identified to date.

1.1 AUTHORIZATION AND PROJECT TEAM

Level II studies were authorized by the Wyoming State Legislature and administered by the Wyoming Water Development Commission (WWDC) on behalf of the project sponsor, the Greybull Valley Irrigation District (GVID). GEI Consultants, Inc. (GEI) was the prime engineering consultant responsible for the engineering evaluations. Associated members of GEI's multi-disciplined team included States West Water Resources Corporation (SWWRC) of Cheyenne, Wyoming, Watts and Associates, Inc. (Watts) of Laramie Wyoming, and several other Wyoming firms.

1.2 PROJECT OVERVIEW

The project will be located in Park County as shown on Figure 1. Studies to date indicate that the project’s "Purpose and Need" can be summarized as follows:

The Greybull Valley Dam and Reservoir will provide desperately needed supplemental lower basin water storage that will significantly reduce crop failures and increase crop yields in the GVID. An important additional benefit of a new reservoir located in the lower river basin is that it will provide the GVID with the capability to capture high runoff flows which cannot currently be put to beneficial use. This ability to "level" the Greybull River will dramatically reduce current water waste by providing more timely delivery of water closer to the majority of the irrigated lands. The new reservoir will also provide the GVID with the ability to capture winter return flows for beneficial use during the irrigation season. The project will provide approximately 30,000 acre-feet of additional storage that are needed to meet the sponsor’s current demands for supplemental water.

Level II studies have confirmed that there is unappropriated water available in the Greybull basin for the project and that the GVID has the right to divert and store this water. Evaluations to date have also confirmed that the project is technically feasible and that the membership of the GVID has both an ability and willingness to finance its portion of the project. In addition, preliminary evaluations have not identified any severe environmental or social obstacles to project development.
Figure 1 - Project Location, Vicinity and Features Map
2.0 WATER RESOURCES EVALUATIONS

2.1 HISTORY OF WATER RESOURCES DEVELOPMENT

The GVID membership irrigates approximately 65,000 acres of mostly sugar beets, dry beans, malt barley, and alfalfa in the Greybull River Valley. The majority of the water demands are from irrigators on the Farmers and Bench Canal systems located in the lower portion of the valley as shown on Figure 1. Development of these systems began in 1890 and both systems now have combined diversion water rights of approximately 470 cubic feet per second (cfs).

Severe droughts in the area in 1919, 1955 and 1960 prompted the formation of the GVID for the purpose of constructing Upper and Lower Sunshine Reservoirs in 1939 and 1972, respectively. These reservoirs, shown on Figure 1, have a combined storage capacity of approximately 112,000 acre-feet and are the source of irrigation water delivered to GVID members. Despite the construction of these reservoirs, irrigators in the valley continue to suffer from late season periodic irrigation shortages, resulting in damage to or complete failure of crops. Recent economic analyses have estimated that these shortages cost the GVID membership over $1.5 million on an average annual basis [Watts, 1994]. The present value of these losses over a 50-year period is in excess of $34 million. Independent water resources studies of the basin performed in the 1980s have concluded that the key to reducing periodic irrigation shortages in the valley is to provide additional supplemental reservoir storage [HDR, 1988]; [Bereman, 1989].

Upper Sunshine Reservoir and Lower Sunshine Reservoir are filled via diversions from the upper reaches of the Greybull River and the Wood River, respectively. Snowmelt from the Absaroka Mountains is the major source of water stored in the Sunshine Reservoirs, but because these reservoirs are located over 20 miles from the respective headwaters and over 35 miles from the Farmers and Bench Canal Diversion, it is very difficult to make timely deliveries of water to most irrigators. Delivering the appropriate amount of water when needed is critical to the successful production of crops such as dry beans and sugar beets. This is further complicated by daily flow variations which can commonly exceed 500 cfs during the high runoff months of June and July. Therefore, in addition to providing supplemental water supplies, a new reservoir located in the lower Greybull watershed will have several very important secondary benefits to GVID operations. First, the Greybull Reservoir, located within five miles of the Farmers and Bench Canal diversions, can provide more timely and efficient water deliveries when needed by the irrigators. Second, the project could capture high river runoff flows during the daily periods in June and July when it is available. This water, which currently flows down river, could then be used when needed later in the growing season. Finally, the lower reservoir location provides an opportunity for the GVID to capture winter return flows from upstream irrigated lands. The average annual yield from these flows has been...
estimated to be approximately 21,000 acre-feet [Bereman, 1989]. The Sunshine Reservoirs cannot divert this water due to their location higher in the watershed.

### 2.2 RESULTS OF WATER RESOURCES EVALUATIONS

Water resources evaluations have included the development of a computerized Greybull River operations model, which can simulate systemwide operations of existing and new reservoirs. In addition, preliminary flood hydrology and water quality analyses have been conducted for the project. The results of the analyses are summarized below:

1) As illustrated in Table 1, the Greybull Dam and Reservoir will increase the average annual yield of the GVID raw water system by over 30,000 acre-feet and significantly reduce current irrigation shortages. Under current demands the GVID system provides an average annual yield of approximately 43,760 acre-feet and shortages of 1,550 and 14,065 acre-feet can be expected at two-year and five-year recurrence intervals, respectively. The second column shows that systemwide yields can be increased by approximately 19,000 acre-feet annually from 43,760 to 62,770 acre-feet by placing more demand on the system. In this case a demand for more water-dependent crops with a high demand for water in April for sugar beets was assumed. However, without additional storage, two-year and five-year shortages increase to over 10,000 and 48,000 acre-feet, respectively. The difference between the first and third columns shows the impact of the Greybull Valley Reservoir under this high demand scenario. As can be seen, total systemwide yield would be increased by over 30,000 acre-feet and shortages are reduced significantly under either demand scenario.

#### TABLE 1. COMPARISON OF YIELDS AND SHORTAGES

<table>
<thead>
<tr>
<th></th>
<th>Present System Demands (acre-feet per year)</th>
<th>Present System with Increased Demands (acre-feet per year)</th>
<th>Addition of Greybull Reservoir with Increased Demands (acre-feet per year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Sunshine Reservoir</td>
<td>15,910</td>
<td>32,890</td>
<td>18,250</td>
</tr>
<tr>
<td>Lower Sunshine Reservoir</td>
<td>27,850</td>
<td>29,880</td>
<td>29,200</td>
</tr>
<tr>
<td>Greybull Reservoir</td>
<td>--</td>
<td>--</td>
<td>26,510</td>
</tr>
<tr>
<td><strong>TOTAL YIELD</strong></td>
<td><strong>43,760</strong></td>
<td><strong>62,770</strong></td>
<td><strong>73,960</strong></td>
</tr>
<tr>
<td>Two-Year Shortage</td>
<td>1,550</td>
<td>10,840</td>
<td>910</td>
</tr>
<tr>
<td>Five-Year Shortage</td>
<td>14,065</td>
<td>48,160</td>
<td>8,030</td>
</tr>
</tbody>
</table>

GEI Consultants, Inc.
2) The project could allow the establishment of a permanent conservation pool of approximately 5,000 acre-feet in Upper Sunshine Reservoir and minimum streamflows of approximately 25 cfs on the Wood River with minor sacrifices in yield. This may result in future fisheries and recreational enhancements in the basin.

3) Overall systemwide yields could be further increased and shortages correspondingly further reduced if the Wyoming State Engineer would allow a two-fill rule for the project. This would allow total annual cumulative storage of twice the reservoir storage capacity.

4) The project will not impact the Yellowstone River Compact between the States of Wyoming and Montana.

5) The Inflow Design Flood (IDF) associated with the Probable Maximum Precipitation (PMP) can be safely passed by a very cost effective spillway which would be excavated in the left abutment of the dam.
The major components of the sponsor's preferred project configuration described in this section include the dam, the diversion dam and water supply canal. Key construction considerations are also discussed. This project, which could be revised or refined during the Environmental Impact Statement (EIS) process, provides the supplemental storage capacity required to meet the demands of the GVID in an ideal location where efficient water deliveries can be made to the majority of the irrigators. In addition, the project location in the lower basin will allow the GVID to divert and store winter return flows during the non-irrigation season for use when needed during the growing season.

3.1 DAM AND RESERVOIR

A plan view of the project’s 150-foot-high, zoned embankment dam is provided on Figure 2 and a typical section of the dam is shown on Figure 3. The majority of the dam would be located in the southwest quarter of Section 23, T.51N., R.98W. The dam crest would be approximately 25 feet wide and 1,720 feet long at an elevation of approximately 4950 feet. The reservoir would have a total storage capacity of approximately 33,500 acre-feet including an allowance for sediment accumulations so that the active capacity of the reservoir would not be less than 30,000 acre-feet over the design life of the project. A 150-foot-wide, trapezoidal-shaped spillway can be excavated in the left abutment to safely pass large floods. A 1,200-foot-long, concrete-encased, 54-inch-diameter steel outlet works pipe would also be constructed near the dam’s left abutment. The outlet would discharge into a 1,200-foot-long, excavated-earth canal which will convey water back to the Greybull River for deliveries to the Farmers and Bench Canal systems. Approximately 200 acres of private land and 715 acres of Bureau of Land Management (BLM) land will need to be acquired to construct the dam and reservoir.

3.2 DIVERSION DAM AND WATER SUPPLY CANAL

The diversion dam for the project would be located in the southeast quarter of Section 11, T.50N., R.99W. This dam would consist of a 200-foot-long, concrete structure with a 700-foot-long, earth training dike. The dam will be designed to pass the 100-year flood of approximately 14,000 cfs without overtopping the dike. The diversion dam will have radial gates which can simultaneously discharge up to 1,000 cfs to the canal while bypassing up to 800 cfs into the river at the usual water surface elevation of 5104 feet in the pool behind the dam.

The diversion dam would divert water into a six-mile-long, water supply canal that ultimately delivers water from the Greybull River to the new reservoir. This canal alignment is shown on Figure 1 and a plan view of the diversion dam and a typical canal section are shown on Figures 4 and 5, respectively. The canal would be designed to convey up to 1,000 cfs across four major drainages to the reservoir.
Figure 2 - Plan View of Lower Greybull Dam Site.

Figure 3 - Typical Cross Section of Dam.
Figure 4 - Diversion Dam Plan View

Figure 5 - Typical Water Supply Canal Section
Canal appurtenances would include four drop structures, five pre-cast bridges, and irrigation turnouts as required to supply water to irrigators adjacent to the canal. The canal will terminate at a natural rock shelf approximately one-half mile upstream of the reservoir. Water will then pass through a series of small check drop structures which will be designed to reduce velocities, remove silt, and create wetlands habitat upstream of the reservoir. Approximately 155 acres of private land and 33 acres of BLM land will be required to construct the canal and provide borrow sources for construction materials along its alignment.

3.3 CONSTRUCTION CONSIDERATIONS

The general geology of the project area is characterized by Quaternary and Tertiary alluvial and terrace deposits of sands, gravels, and cobbles overlying bedrock that consists of the Eocene age Willwood Formation (interbedded claystone, siltstone, and sandstone). Figure 1 shows alternative borrow areas which have been defined in the project area. Field studies have shown there are adequate quantities of materials available to construct the dam, canal, and diversion dam in the general project area. Additional testing is required during final design to identify suitable aggregate sources in the general area for structural concrete. Cost estimates to date have assumed that aggregates for concrete will have to be imported from the Cody or Worland areas in order to minimize concerns related to alkali aggregate reaction that may occur if local aggregate materials are used.

An overall schedule has been developed for permitting, final design and construction of the project. This schedule is provided on Figure 6. This schedule assumes that EIS studies will be initiated in the third quarter of 1994. Any delays to milestones shown in this schedule will result in subsequent schedule delays. The schedule illustrates a six year time frame to fully develop the project based on our experience with similar projects. It should be noted that significant time savings of up to two years or more can be realized by accelerating final design, land acquisition and construction of some features of the project. However, this would be done with the risk of spending project funds before permits are ultimately approved by the Federal agencies. The additional schedule could also be accelerated if all public stakeholders agree to manage the EIS such that it could be completed in one year.
<table>
<thead>
<tr>
<th>DESCRIPTION OF WORK</th>
<th>YEAR 1</th>
<th>YEAR 2</th>
<th>YEAR 3</th>
<th>YEAR 4</th>
<th>YEAR 5</th>
<th>YEAR 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>EIS ENVIRONMENTAL STUDIES</td>
<td></td>
<td>2 YEARS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FINAL DESIGN AND CONSTRUCTION</td>
<td></td>
<td></td>
<td></td>
<td>4 YEARS</td>
<td></td>
<td></td>
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<tr>
<td>FIELD EXPLORATION</td>
<td></td>
<td>6 MO.</td>
<td>1 YEAR</td>
<td></td>
<td></td>
<td>6 MO.</td>
</tr>
<tr>
<td>ENGINEERING DESIGN</td>
<td></td>
<td>3 MO.</td>
<td>(FINAL DESIGN)</td>
<td>(AS BUILT DRAWINGS AND O&amp;M MANUAL)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADVERTISING AND BIDDING</td>
<td></td>
<td>2 YEARS (+/-)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONSTRUCTION</td>
<td></td>
<td>6 MO.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONSTRUCTION PERMITTING</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6 MO.</td>
<td></td>
</tr>
<tr>
<td>LAND AQUISITION</td>
<td></td>
<td>1 YEAR + 3 MO.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POWER AND UTILITIES</td>
<td></td>
<td>1 YEAR + 3 MO.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**MILESTONES:**
- PROJECT FILING AND INITIAL PERMITS
- RECORD OF DECISION (ROD)
- NOTICE TO PROCEED
- PROJECT COMPLETION

Figure 6 - Estimated Project Schedule
A summary of the total estimated investment to construct the project, in 1992 dollars, is provided in Table 2. A detailed breakdown of the construction cost estimate is provided in Table 3. The project budget is a reasonably conservative estimate based on GEI's internal data base of recent bid information, the Means Estimating Guide, recent WWDC projects and the recent experiences of our staff. Cooperative agreements with the GVID, potential partnering agreements, and innovative designs and construction approaches have the potential to reduce the estimates shown. Conversely, project enhancements and mitigation requirements developed during the project EIS process could result in some increased costs. Table 4 illustrates the impact of a four-percent interest escalation on future project costs.

GEI’s estimated costs for construction of the dam and appurtenances, in 1992 dollars, are approximately $17.6 million. The 1992 estimated costs for the water supply canal, diversion dam and appurtenances are approximately $7.8 million. We have assumed that mobilization will be six percent of construction costs and have included an allowance for permitting, final design and construction engineering, change orders during construction, legal fees, and land acquisition. Operation and maintenance costs are estimated to be approximately $60,000 per year.

**TABLE 2 - ESTIMATED TOTAL PROJECT COSTS**(1)

<table>
<thead>
<tr>
<th>Final Design (6% of CCS No. 1)</th>
<th>$1,663,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitting and Mitigation</td>
<td>$1,200,000</td>
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<tr>
<td>Legal Fees</td>
<td>$150,000</td>
</tr>
<tr>
<td>Acquisition of Access and Right-of-Way</td>
<td>$305,000</td>
</tr>
<tr>
<td>Project Components</td>
<td></td>
</tr>
<tr>
<td>Lower Dam</td>
<td>$14,106,000</td>
</tr>
<tr>
<td>Spillway</td>
<td>$289,000</td>
</tr>
<tr>
<td>Outlet Works</td>
<td>$3,158,000</td>
</tr>
<tr>
<td>Diversion Dam</td>
<td>$1,718,000</td>
</tr>
<tr>
<td>Water Supply Canal</td>
<td>$6,057,000</td>
</tr>
<tr>
<td>Project Features</td>
<td>$818,000</td>
</tr>
<tr>
<td>Mobilization (6%)</td>
<td>$1,569,000</td>
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<tr>
<td>Construction Cost Subtotal No. 1</td>
<td>$27,716,000</td>
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<tr>
<td>Engineering Costs (10% of #1)</td>
<td>$2,772,000</td>
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<tr>
<td>Construction Cost Subtotal No. 2</td>
<td>$30,488,000</td>
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<tr>
<td>Contingency (15% of #2)</td>
<td>$4,573,000</td>
</tr>
<tr>
<td>Construction Cost Total</td>
<td>$35,061,000</td>
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<tr>
<td>TOTAL PROJECT COST</td>
<td>$38,379,000</td>
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</tbody>
</table>

Notes: (1) Project cost in 1992 dollars.
### TABLE 3 - CONSTRUCTION COST ESTIMATE

<table>
<thead>
<tr>
<th>Item #</th>
<th>Description</th>
<th>Quantity</th>
<th>Units</th>
<th>Unit Price</th>
<th>Item Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>A) Lower Dam</td>
<td>1 stripping (1-foot)</td>
<td>57,197</td>
<td>cy</td>
<td>$2.00</td>
<td>$114,394</td>
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<tr>
<td></td>
<td>2 rock excav. (cutoff trench)</td>
<td>347,594</td>
<td>cy</td>
<td>$5.00</td>
<td>$1,737,970</td>
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<tr>
<td></td>
<td>3 zone 1 fill</td>
<td>744,668</td>
<td>cy</td>
<td>$1.50</td>
<td>$1,117,002</td>
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<tr>
<td></td>
<td>4 zone 2 fill</td>
<td>448,883</td>
<td>cy</td>
<td>$8.00</td>
<td>$3,591,064</td>
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<tr>
<td></td>
<td>5 zone 3 fill</td>
<td>3,218,111</td>
<td>cy</td>
<td>$1.25</td>
<td>$4,022,639</td>
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<tr>
<td></td>
<td>6 slope protection</td>
<td>78,942</td>
<td>cy</td>
<td>$25.00</td>
<td>$1,973,550</td>
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<tr>
<td></td>
<td>7 road base</td>
<td>1,600</td>
<td>cy</td>
<td>$8.00</td>
<td>$12,800</td>
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<tr>
<td></td>
<td>8 grout hole drilling</td>
<td>6,215</td>
<td>ft</td>
<td>$25.00</td>
<td>$155,375</td>
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<tr>
<td></td>
<td>9 grout volume</td>
<td>4,012</td>
<td>sk</td>
<td>$42.00</td>
<td>$168,504</td>
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<tr>
<td></td>
<td>10 foundation preparation</td>
<td>77,165</td>
<td>sf</td>
<td>$6.00</td>
<td>$462,990</td>
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<td></td>
<td>11 instrumentation</td>
<td>1</td>
<td>L.S.</td>
<td></td>
<td>$400,000</td>
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<tr>
<td></td>
<td>12 parapet wall</td>
<td>1</td>
<td>L.S.</td>
<td></td>
<td>$350,000</td>
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<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>$14,106,288</td>
</tr>
<tr>
<td>B) Spillway</td>
<td>1 excavation</td>
<td>580,900</td>
<td>cy</td>
<td>$0.50</td>
<td>$290,450</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>$290,450</td>
</tr>
<tr>
<td>C) Outlet Works</td>
<td>1 outlet excavation</td>
<td>126,000</td>
<td>cy</td>
<td>$5.00</td>
<td>$630,000</td>
</tr>
<tr>
<td></td>
<td>2 outlet backfill</td>
<td>51,000</td>
<td>cy</td>
<td>$2.00</td>
<td>$102,000</td>
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<tr>
<td></td>
<td>3 60° steel conduit</td>
<td>1,250</td>
<td>ft</td>
<td>$225.00</td>
<td>$281,250</td>
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<td></td>
<td>4 control structures</td>
<td>1</td>
<td>L.S.</td>
<td></td>
<td>$265,310</td>
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<tr>
<td></td>
<td>5 concrete for conduit</td>
<td>1</td>
<td>L.S.</td>
<td></td>
<td>$651,750</td>
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<td></td>
<td>6 valves furnished &amp; installed</td>
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<td>L.S.</td>
<td></td>
<td>$458,000</td>
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<td>7 4x4 sliding gate + liner</td>
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<td>L.S.</td>
<td></td>
<td>$270,000</td>
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<tr>
<td></td>
<td>8 trashrack</td>
<td>1</td>
<td>L.S.</td>
<td></td>
<td>$15,000</td>
</tr>
<tr>
<td></td>
<td>9 channel excavation</td>
<td>115,000</td>
<td>cy</td>
<td>$2.00</td>
<td>$230,000</td>
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<tr>
<td></td>
<td>10 channel earth lining</td>
<td>6,200</td>
<td>cy</td>
<td>$3.00</td>
<td>$18,600</td>
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<tr>
<td></td>
<td>11 basin RCC/soil cement liner</td>
<td>5,400</td>
<td>cy</td>
<td>$25.00</td>
<td>$135,000</td>
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<tr>
<td></td>
<td>12 baffled apron drop structure</td>
<td>1</td>
<td>L.S.</td>
<td></td>
<td>$101,100</td>
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<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>$3,158,010</td>
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<tr>
<td>D) Diversion Dam</td>
<td>1 dam overflow section</td>
<td>1</td>
<td>L.S.</td>
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<td>$751,302</td>
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<tr>
<td></td>
<td>2 left abutment embankment</td>
<td>1</td>
<td>L.S.</td>
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<td>$131,889</td>
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<td>3 sluice structure</td>
<td>1</td>
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<td>$173,482</td>
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<td>4 canal intake structure</td>
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<td></td>
<td>$341,123</td>
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<tr>
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<td>5 care, diversion, &amp; watering</td>
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<td>L.S.</td>
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<td>$320,000</td>
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<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>$1,717,796</td>
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<td>E) Canal</td>
<td>1 common excavation</td>
<td>697,861</td>
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<td>2 rock excavation</td>
<td>77,537</td>
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<td>$387,685</td>
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<td>3 embankment</td>
<td>730,460</td>
<td>cy</td>
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<td>4 earth lining</td>
<td>204,800</td>
<td>cy</td>
<td>$3.00</td>
<td>$614,400</td>
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<td>5 drop structures no. 1-4</td>
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<td>6 road crossing</td>
<td>1</td>
<td>L.S.</td>
<td></td>
<td>$500,500</td>
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<tr>
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<td>7 drainage structures</td>
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<td>L.S.</td>
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<td>F) Other Project Features</td>
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<td>2</td>
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<td>2 construct access roads</td>
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<td>mi</td>
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<td>3 caretakers facilities</td>
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<td>4 power</td>
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<td>5 borrow area restoration</td>
<td>325</td>
<td>acres</td>
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<td>6 automated operations</td>
<td>1</td>
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<td>Total</td>
<td></td>
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<td>$817,750</td>
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</table>

**Notes:**
1. Construction cost in 1992 dollars

<p>|         | SUBTOTAL | $26,147,502 |
|         | Mobilization (6%) | $1,568,850 |
|         | CONSTRUCTION COST SUBTOTAL NO. 1 | $27,716,352 |</p>
<table>
<thead>
<tr>
<th>Year</th>
<th>Volume of Storage Sold (acre-feet)</th>
<th>Total Project Investment①</th>
<th>Total WWDC Investment (75%)</th>
<th>Total GVFD Investment (25%)</th>
<th>Annual Cost Per Acre-foot of Storage WWDC Financing② (4% - 50 yrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992 Dollars</td>
<td>$38,379,000</td>
<td>$28,784,000</td>
<td>$9,595,000</td>
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<tr>
<td>1993 Dollars</td>
<td>$39,914,000</td>
<td>$29,936,000</td>
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<td>1994 Dollars</td>
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<td>$31,133,000</td>
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<td>1995 Dollars</td>
<td>$43,171,000</td>
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<tr>
<td>1997 Dollars</td>
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<td>$11,674,000</td>
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<td>1998 Dollars</td>
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<td>$22.61</td>
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<td>1999 Dollars</td>
<td>$50,504,000</td>
<td>$37,878,000</td>
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<td>$29.59</td>
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<td>$19.59</td>
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</tr>
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<td></td>
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<td>$20.37</td>
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</tr>
</tbody>
</table>

Notes: ① Total project costs escalated at 4 percent per year.
② WWDC financing is based on 50-year, 4 percent loan.
③ Costs do not include project O&M costs of $60,000 annually.
Economic evaluations performed for the project have included a survey of 76 irrigators in the Farmers and Bench Canal systems. This survey indicates a demand for at least 22,000 to 23,000 acre-feet of reasonably priced supplemental irrigation supplies on an average annual basis. Most irrigators surveyed indicate that they do suffer from crop failures and that most irrigators would use the additional water to prevent future crop damage or failure. When asked about the demand for water relative to price it was apparent that up to 20,000 acre-feet of additional project storage shares could be sold at a price of $20 per acre-foot. However, this demand is reduced dramatically as prices approach $30 per acre-foot. This is confirmed by the ability-to-pay analysis summarized in Table 5. This illustrates that the net composite return associated with an acre-foot of water is approximately $37. Table 4 indicates that the average annual cost of project water is well below $20 per acre-foot, which is a price that many irrigators would be willing to pay for the water. Economic evaluations have also shown that the project benefits to cost ratio is 1.06.

TABLE 5 - SUMMARY OF ESTIMATED AVERAGE RETURNS TO IRRIGATION WATER

<table>
<thead>
<tr>
<th>Crop</th>
<th>Percent</th>
<th>Net Farm Income From Irrigation (Per Acre)</th>
<th>Consumptive Irrigation Requirement (Inches/Acre)</th>
<th>Storage Requirement (Acre-feet/acre)</th>
<th>Farm Income/Acre-foot of Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugar Beets</td>
<td>25</td>
<td>$242.02</td>
<td>24.7</td>
<td>5.15</td>
<td>$46.99</td>
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<tr>
<td>Beans</td>
<td>25</td>
<td>$181.80</td>
<td>16.7</td>
<td>3.49</td>
<td>$52.09</td>
</tr>
<tr>
<td>Malt barley</td>
<td>33</td>
<td>$99.04</td>
<td>15.7</td>
<td>3.26</td>
<td>$30.38</td>
</tr>
<tr>
<td>Alfalfa</td>
<td>17</td>
<td>$101.94</td>
<td>32.0</td>
<td>6.68</td>
<td>$15.26</td>
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<tr>
<td>Composite</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
<td>$37.39</td>
</tr>
</tbody>
</table>

Notes:  
(1) From survey of GVID members [GEI, 1994].  
(2) After deducting $6.70 per acre as an annual opportunity cost of dryland grazing.  
(3) From the Wyoming Water Resources Center [GEI, 1994].  
(4) Assumes 40 percent of each acre-foot of water released from storage would be consumptively used by crops.
The WWDC, GVID, the U.S. Army Corps of Engineers (COE), and BLM are currently finalizing a Memorandum of Understanding to prepare an EIS for the project. The EIS is required by the National Environmental Policy Act (NEPA) because the approval of BLM right-of-way applications and a COE 404 dredge and fill permit for the project are considered major Federal Actions by these agencies. All parties have agreed that the COE will be the lead Federal agency responsible for preparing the EIS.

Preliminary environmental evaluations for the project have been performed with the objective of identifying insurmountable obstacles to project development. Additional information will be prepared during EIS activities, but to date, no insurmountable obstacles have been identified. A cultural resource inventory has been performed for approximately 1,050 acres of project lands. Twenty cultural sites were identified, but only one site appears to be significant and may require mitigation. Several wildlife, wetlands, recreational and U.S. Fish and Wildlife Service permitting issues that may require mitigation were also identified in a preliminary environmental assessment for the project prepared by the Wyoming Game and Fish Department (WG&FD). In addition, the WG&FD has prepared an instream flow report for the project which has resulted in preliminary minimum streamflow recommendations. However, minimum pool recommendations have not been addressed to date.

Preconstruction permitting activities will be conducted in accordance with the EIS studies required by NEPA in order to obtain BLM right-of-way approval and COE 404 permits. Upon approval of these permits, construction permitting will then be required from the Wyoming State Engineer’s Office and the Wyoming Department of Environmental Quality.
7.0 REFERENCES


