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Executive Summary

GREYBULL WATER SUPPLY PROJECT

LEVEL II - Phase II & III

Exploration Well and Conceptual Design

Wyoming Water Development Commission

NELSON ENGINEERING
P.O. Box 1599  Jackson, Wyoming

SEPTEMBER 1997
EXECUTIVE SUMMARY

INTRODUCTION

GENERAL

The Town of Greybull is located in Big Horn County in north-central Wyoming at the intersection of Highway 20 and Highway 14, as shown on Figure I.1. The Town lies on the banks of the Big Horn River which drains the Big Horn Basin. The Big Horn Basin is a north-to-south river basin bordered on the east by the Big Horn Mountains and on the west by the Owl Creek and Absaroka Mountains.

The climate is arid with an average precipitation of about 6.8 inches/year, 60 percent occurs during the April-to-August period in the form of rainfall. The normal period of $+40^\circ F$ mean daily temperature occurs from March 31 through October 28 providing 135 frost-free days per year.

The economy of the study area is agricultural, bentonite mining, railroading, and some tourism.

WATER SUPPLY

The Town of Greybull and Shell Valley rural users are all served by a common water supply system utilizing both surface water and groundwater. The surface water source is Shell Creek, and the groundwater source(s) are Shell Valley No. 1 and No. 2 Wells. The surface water Point of Diversion on Shell Creek is about 3-1/2 miles east of Shell and the Shell Valley Wells are about 3,000 feet southeast of the Community of Shell. The rural users are organized as the Shell Valley Watershed Improvement District. The District and Town of Greybull has reached written agreement whereby the District receives twenty-five percent of the water produced from the wells.

On December 9, 1993, the United States Environmental Protection Agency (EPA) issued a Notice of Violation (NOV) to the Town of Greybull. The NOV cited the water supply system for violation of the Surface Water Treatment Rule (SWTR), and provided eighteen months for compliance. The Town has continued using Shell Creek water in combination with their groundwater supply, but initiated Level II study effort to evaluate the various options available for a future water supply.
GREYBULL WATER SUPPLY STUDY
PROJECT LOCATION MAP
FIGURE I.1

I-2
PURPOSE AND BACKGROUND

The purpose of the Level II study was to determine an economical means acceptable to the Community of providing potable water for consumers. In order to meet that intent, two objectives were identified:

A. Determine a feasible methodology for the Town to comply with provisions of the EPA Notice of Violation.

B. Verify the capability of the existing transmission line to convey the water required to meet future needs.

The Level II Phase I Final Design Report was completed November 1995. Based on that report, the Town made a decision to explore groundwater alternatives through a Level II Phase II effort. An aquifer test well was drilled in September 1996 and a well stimulation procedure was completed in April 1997. Phase III Concept Design has been underway since well completion. This Level II Phase II report is intended to present supporting documentation for the Phase II effort, complete preliminary design for utilization of the well, display project costs, and present financial and economic consequences of implementing the well supply.

The Phase I Study also led to Level III funding for transmission line improvements currently in progress. Greybull also sponsored a Level II study of water storage needs.

AUTHORIZATION

EXISTING AND FUTURE CONDITIONS

WATER RIGHTS

The Town of Greybull holds a variety of water rights as illustrated below.

<table>
<thead>
<tr>
<th>Permit No.</th>
<th>Location</th>
<th>Priority Date</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>430</td>
<td>Shell Creek</td>
<td>March 7, 1893</td>
<td>1.326 cfs</td>
</tr>
<tr>
<td>7038 Enl.</td>
<td>Shell Creek</td>
<td>November 5, 1991</td>
<td>17.85 cfs</td>
</tr>
<tr>
<td>23241</td>
<td>Big Horn River</td>
<td>February 19, 1962</td>
<td>2.0 cfs</td>
</tr>
<tr>
<td>UW75583</td>
<td>Shell Creek Res.</td>
<td></td>
<td>375 ac-ft</td>
</tr>
<tr>
<td>UW75584</td>
<td>Shell Valley No. 2</td>
<td>September 29, 1985</td>
<td>1200 gpm</td>
</tr>
<tr>
<td>UW62476</td>
<td>Greybull No. 1</td>
<td>October 12, 1982</td>
<td>Canceled</td>
</tr>
<tr>
<td>UW75584</td>
<td>Shell Valley No. 1</td>
<td>September 29, 1985</td>
<td>300 gpm</td>
</tr>
</tbody>
</table>

The Shell Valley Wells No. 1 and No. 2, drilled in 1985, are flowing wells drilled into the Madison and Big Horn Formation to depths of 2440' and 3379', respectively.

POPULATION AND DEMAND

According to the Department of Administration and Information, the population in the Town of Greybull is presently at 1,910. The estimated population for the entire service area is presently 2,462. Future population is estimated for the year 2015 at 2,163 for the Town and 623 for the rural area.

WATER USAGE

In the Phase I report, water consumption was estimated 1) based on individual meter readings, and 2) based on production records. In order to provide redundancy to the system, results of that work established a required yield for a new well at 200-250 gpm. Consumption records for 1996 were recently reviewed for the Phase III Study, and the demands have been updated as follows:

- Town of Greybull: 297 gpcd
- Shell Valley Rural Customers: 493 gallons/day/hook-up

Nelson Engineering, and authors of the Level II Study for storage improvements, have coordinated their work to estimate future flow requirements for the system. The results are illustrated in the following table:
### Total System Demands

<table>
<thead>
<tr>
<th>YEAR</th>
<th>ADD</th>
<th>PEAKING FACTOR</th>
<th>MDD</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>GPM</td>
<td>3.0</td>
<td>1560</td>
</tr>
<tr>
<td></td>
<td>GPD</td>
<td>750,000</td>
<td>2,250,000</td>
</tr>
</tbody>
</table>

### SYSTEM INVENTORY

The water system has two tanks, 1.0 MG and 0.35 MG. An interior inspection of both tanks completed in 1995 reveals that both tanks are in good condition. The infiltration gallery, located approximately 3-1/2 miles east of Shell, will be phased out. A detailed description of the gallery and the transmission line is contained in the Phase I Report.

### REGULATORY REQUIREMENTS

As seen from the data, the supply in 2015 should produce 520 gpm and 1,560 gpm to meet ADD and MDD requirements. The specific supply strategy implemented by Greybull must satisfy the provisions of Chapter XII of the WDEQ regulations.

EPA does not currently require groundwater supplies of acceptable quality to be disinfected. However, the Groundwater Disinfection Rule will be refined and adopted in 1999, and disinfection may be required subsequent to that date.

### AQUIFER TEST WELL

The Shell No. 3 Well was drilled by Ruby Drilling Co. of Gillette, Wyoming, as an aquifer test well in September 1996. The well site is located approximately four miles east of Shell and 19 miles east of Greybull, Wyoming, located on private land owned by Chuck and Gail Lander. The location is approximately one mile west of the western flank of the Bighorn Mountains. The well was completed as shown in the following table.
The flowing well produced about 65 gpm and exhibited a shut-in pressure of about 78 psi. Since the yield was not sufficient to meet projected demands (200-250 GPM), a decision was made to acid-frac the well. On April 25, 1997, 10,000 gallons of 15% hydrochloric acid was injected into the well and held for about an hour. The spent acid water was subsequently released and blended with copious amounts of aquifer water for final disposal in a land application. Extensive aquifer testing was completed with the following results.

Aquifer Transmissivity 7109 gpd/ft (0.66 ft²/min)
Specific Capacity 1.8 gpm/ft²
Yield (Atmospheric Pressure) 275 gpm
Sustainable Yield (15psi Pressure) 210-220 gpm

Water quality testing indicated the water is a calcium-bicarbonate type water. The water contains no coliform, iron, bacteria, giardia or cryptosporidium, and otherwise meets all applicable Wyoming and EPA quality standards.

CONCEPTUAL DESIGN

GENERAL

This section of the report is devoted to 1) evaluating alternative methods for implementing the new well into the Greybull supply system; 2) completing conceptual drawings for the preferred alternate; and, 3) providing project estimates.
DESIGN CRITERIA

Primary criteria for this project include the following:

Year 2015  Greybull  Rural
1. Design Population 2,163  235 hook-ups
2. Demand Criteria:
   a) Average Day Demand (ADD)  642,411 gpd  115,855 gpd
   b) Maximum Day Demand (MDD)  1,605,600 gpd  289,440 gpd
   c) Total System Average Day Demand  750,000 gpd (Red) (520 gpm)
   d) Total System Maximum Day Demand  2,250,000 gpd (Rnd) (1,560 gpm)
3. Lander's Pump Station - Cistern System:
   Q = 15 gpm
   TDH = 140'
   Duplex Pumps - 3/4 BHP

Additional criteria are discussed in the report.

ALTERNATIVE EVALUATION

Available groundwater supply to the system is dependent on two alternatives: 1) the wells operating as flowing wells, or, 2) a pump placed in one or more wells. The projected supply for the alternatives can be summarized as follows:

<table>
<thead>
<tr>
<th>Artesian Supply</th>
<th>Sustained Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shell Valley #1</td>
<td>224 gpm</td>
</tr>
<tr>
<td>Shell Valley #2</td>
<td>950 gpm</td>
</tr>
<tr>
<td>New Well</td>
<td>220 gpm</td>
</tr>
<tr>
<td>Total</td>
<td>1,394 gpm (2,007,000 gpd)</td>
</tr>
</tbody>
</table>

Pump Placed in New Well:

| Shell Valley #1  | 224 gpm          |
| Shell Valley #2  | 950 gpm          |
| New Well         | 350 gpm          |
| Total            | 1,524 gpm (2,195,000 gpd) |
Only the pumped scenario comes close to meeting all design criteria. With the largest well out of service, supply of 574 gpm exceeds the design ADD criteria of 520 gpm. However, design MDD of 1,560 still exceeds the estimated long-term well yield of 1,524 gpm.

A third alternative is available and that is to drill a fourth well, with the expectation that the entire system can be operated on a flowing basis. Raw construction cost estimates for the alternatives are as follows:

**PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST**

- Artesian Well Estimate (220 gpm) $440,660
- Pumped Well Estimate (350 gpm) $498,160
- Future Well $521,220
- Existing Well $498,160
- TIE TO EXISTING SYSTEM $1,019,380

**TIE TO EXISTING SYSTEM**

As noted previously, the new well and control tank will be tied to the existing transmission line with an 8-inch diameter pipeline. The connecting point is shown on Sheet 5 of the Conceptual Drawings.

**PERMITTING**

To implement the selected alternative will require procurement of the following permits.

- WDEQ Permit to Construct
- National Pollution Discharge Elimination System (NPDES)
- State Engineers Office
- WYDOT Approach Permit
- WYDOT Encroachment License
- Easements:
  - Charles and Gail Lander
  - Andrew (Irvie) Davis

**PROJECT COST ESTIMATES**

**GENERAL**

The project costs represent anticipated work to implement the well, but does not include the $232,000 cost for the previously completed drilling and development work.
PROJECT COST ESTIMATE

Preparation of Final Design (includes pump test) and Specifications: $27,700
Permitting and Mitigation: $6,840
Legal Fees: $2,000
Acquisition of Access and Rights-of-Way: $2,000

Cost of Project Components
- Mobilization: $4,500
- Wellhead Piping: $8,395
- Well House: $15,600
- Chlorination Package: $13,500
- Pump, Motor, Column Pipe: $13,000
- Trenching, Bedding, Backfill: $43,875
- Special Bedding: $1,500
- 8" AWWA C-900 PVC: $11,050
- 8" Gate Valves: $4,900
- 12" Gate Valves: $2,800
- Tie to Existing System: $2,000
- 3" HDPE: $7,500
- 3" Gate Valves: $1,400
- 100,000-Gal. Storage Tank: $38,000
- Electrical Service (3Φ): $30,000
- General Electrical & MCC: $6,500
- Instrumentation: $23,000
- Pump Test: $8,500
- Lander Pumpstation: $9,530
- Lander Meter Pit: $4,200
- Site Grading: $2,500
- Crushed Base: $1,610
- Asphalt: $1,200
- Fencing: $6,600
- Landscaping & Drip Irrigation: $4,500

Construction Cost Subtotal 1: $266,160
Engineering Costs (10% Subtotal 1): $26,616
Construction Cost Subtotal 2: $292,776
Contingency (15% total): $43,916
Construction Cost Total: $336,692
Project Cost Total: $375,23

ECONOMIC ANALYSIS/ABILITY TO PAY

PROJECT FINANCING

Two sources are readily available to provide project financing:
- Wyoming Water Development Commission
- Rural Utility Systems
**WWDC Funding** - Under present policy, WWDC will participate in the project on the basis of 60% grant - 40% loan. Annual Debt Retirement for the project is calculated at 7 1/4% per year for 30 years. Operations, Maintenance and Repair (OM&R) has been estimated at an annual cost of $18,587.

**Rural Utility System (RUS) Funding** - RUS presently offers grant and loan programs for water supply projects and participates jointly with the State agencies in projects. The loans must be guaranteed by issuance of General Obligation Bonds. Eligible costs for financing include bond council, engineering, attorney expenses, and construction. Two criteria govern eligibility of a project for grant funding: 1) Annual indebtedness on water projects must exceed 1% of the median income per equivalent water hookup; and, 2) Grant funding cannot result in suppressing monthly user fees to less than the average for the area.

From analysis completed in this study, it appears Greybull will not qualify for an RUS grant, however, loan money is available at a present rate of 5% for a 30-year period. Costs associated with issuance of General Obligation Bonds are estimated to add an additional $8000 to the loan principal, increasing it to $250,893.

**SUMMARY**

Comparison of the two financing alternatives is illustrated below.

<table>
<thead>
<tr>
<th></th>
<th>WWDC</th>
<th>WWDC</th>
<th>RUS Loan</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>60% grant</td>
<td>40% Loan - 7 1/4% Annually</td>
<td>60% Grant</td>
</tr>
<tr>
<td>Component Cost</td>
<td>364,339</td>
<td>242,893</td>
<td>364,339</td>
</tr>
<tr>
<td>Annual Debt Service</td>
<td>20,068</td>
<td>16,320</td>
<td></td>
</tr>
<tr>
<td>OM&amp;R Costs</td>
<td>17,029</td>
<td>17,029</td>
<td></td>
</tr>
<tr>
<td>Estimated Annual Cost</td>
<td>$37,097</td>
<td>$33,350</td>
<td></td>
</tr>
</tbody>
</table>

Monthly increase incurred by the estimated 1,219 active hookups would be about $2.54/mo and $2.28/mo, respectively.
CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

1. Slight growth (½% - 1%) is expected in the service area over the next 20 years.

2. The most economical source for future potable supply is groundwater.

3. In effort to mitigate terms of the EPA NOV, Greybull can convert to groundwater as a source of supply.

4. Sufficient groundwater is present to meet the needs of Greybull and the Shell Valley.

5. Shell Tank needs to be more fully utilized as equalization storage.

6. Greybull is progressing in the appropriate manner with implementation of the Transmission Line Rehabilitation Project.

7. Implementation of policy, regarding service hookups to the transmission line, is required for efficient and equitable service to all customers.

8. Recordkeeping on water produced and water consumed is continuing to improve.

RECOMMENDATIONS

The following recommendations are offered as a result of this study and as guiding objectives to improve the water supply system.

1. Accept the findings of this report and continue to move forward in improving the water supply for Greybull and the Shell Valley.

2. Convert from surface water to groundwater as the source of supply.

3. Rely on Shell Valley No. 1 and No. 2 wells as the primary groundwater source.

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4. Integrate the new well drilled during this study into the system as an additional supply source.
   A. Run a pump test on the well to confirm optimum pump depth setting and long-term yield.
   B. Place an appropriately-sized pump in the new well to enhance production.

5. Individual services south of Shell, dependent on a full tank, should be replumbed to allow full utilization of Shell Tank.

6. Apply to WWDC for Level III funding to complete the project as noted in Item 4 and referred to as Alternate No. 2 in this report.

7. Apply to Rural Utility Systems (RUS) to finance the loan portion of the project.
   Contact: John E. Cochran in Casper, Wyoming
   Phone (307) 261-5144

8. Maintain communication with EPA to keep them informed as to progress being made.

9. Contact appropriate landowners and agencies as soon as possible to refine and obtain easements and permits. (See Chapter X).

10. Enter into project design in the first half of 1998, and complete construction in the last half of 1998.

11. Continue to monitor consumption and production records, completing annual, quarterly, and monthly summaries.

12. On frequent occasions when maximum day demands approach 2,250,000 gpd, implement a fourth well and/or review prospects of placing a pump in Shell Valley No. 2.

13. Continue to investigate ways of utilizing Shell Creek water in the future so as to maintain legal right of use.