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Mailing Address:
Water Resources Data System
University of Wyoming, Dept 3943
1000 E University Avenue
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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WYOMING WATER DEVELOPMENT COMMISSION
LEVEL II - CONCEPTUAL DESIGN REPORT
TASK 10
DOWNSIZING OF THE
EDGERTON/MIDWEST WATER SUPPLY PROJECT
AUGUST, 1991
CONTRACT No. 9-00819

WORTHINGTON, LENHART AND CARPENTER, INC.
632 S. David St. Casper, Wyoming 82601 (307) 266-2524
AND
WESTERN WATER CONSULTANTS, INC.
611 Skyline Road
Laramie, Wyoming 82070
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INTRODUCTION

This report is presented as an addendum to the original Level II Conceptual Design Report and additional studies addressing wells as an alternative for providing water to the Towns of Edgerton and Midwest.

Background

The original study concluded a new pipeline from the North Platte River to the Towns, with appropriate water treatment, would cost approximately $10,000,000.00. The annual cost of operations for this system were anticipated to be $78,000.

The WWDC conducted further studies for alternative solutions which would develop wells located in the Fox Hills or Madison Aquifers and applying state of the art sophisticated treatment to known ground-water reserves. The selected alternate was to obtain water from the Madison Aquifer and provide treatment through a reverse osmosis (RO) system. This was selected because the wells were already drilled by AMOCO and could be utilized within the total system. AMOCO would also supply the pipeline from the wells to the new treatment plant location at the intersection of Highway 259 and Highway 387. The treatment facility, waste water storage and pipelines, and the water main to the existing treated water storage tank would become the responsibility of the Towns. This project was anticipated to cost $4,561,400 to construct. This cost was significantly lower than the $10,000,000 cost of the North
Platte River pipeline, but the annual O&M cost of the RO treatment plant and wells was estimated to be $121,288. This figure is significantly higher than the $78,000 O&M cost associated with the water supply from the North Platte River.

**Previous Studies**

The North Platte River pipeline and treatment project was designed for a 50 year life cycle as the proposed pipeline was anticipated to last well beyond the design life of the study. The Madison Aquifer well system was designed for and operational cost based on the 20 year life cycle typical for wells drilled and established in that aquifer. In order to accurately compare system cost over a comparable life cycle, the Madison Wells project included a sinking fund to provide for the replacement of the wells. When added to the O&M cost for the wells tyhe sinking fund increases the annual O&M amount to $161,767. The current O&M cost for the existing pipeline, pumps and treatment is $88,200.

The following table summarizes studies completed to date:

<table>
<thead>
<tr>
<th>Water Supply Source</th>
<th>Project Life</th>
<th>Water Demand</th>
<th>Construction Cost</th>
<th>O&amp;M Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Platte</td>
<td>50 yrs</td>
<td>652 gpm</td>
<td>$10,000,000</td>
<td>$78,000</td>
</tr>
<tr>
<td>Madison</td>
<td>20 yrs</td>
<td>440 gpm</td>
<td>$4,561,400</td>
<td>$121,288</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(With Sinking Fund $161,767 )</td>
<td></td>
</tr>
</tbody>
</table>
Project Task

The current task and the purpose of this study is to minimize the water supply system construction costs while complying with the water supply needs for the Towns of Midwest and Edgerton, Wyoming for existing and future demands as determined and agreed upon by the two entities. The original study for water supplies for the two Towns was based on the population projections determined by DAFC and the daily per capita use of 150 gpcpd in Edgerton and 200 gpcpd in Midwest. The latest projection of current needs was developed by the Salt Creek Joint Powers Board (SCJPB). The current number of dwellings, included in both towns, is 277 with a per capita of 2.5 per dwelling. The per capita usage for both Towns was determined not to exceed 175 gallons per capita per day (gpcpd). Some adjustment may be necessary in the use habits of the users if both Towns are to establish and maintain this maximum usage. The SCJPB has assumed the population will increase 15% in the next 20 years to 319 families. This projection was then used to determine the size of water line required for pumping water from the North Platte River wells located in Mills, Wyoming to the treatment plant in Midwest, a distance of approximately 42 miles.

Water Requirements

The total water required in 1991 based on 277 families with a per capita of 2.5 per family and 175 gpcpd is 84 gpm average flow with a peak day demand of 333,300 gallons or 231 gpm for both communities. The total water required in 2011 is based on 319 families with a per capita of 2.5 per family and 175 gpcpd is 107 gpm average flow and a peak day demand of 383,800 gallons or 266 gpm for both communities.
The current storage capacity of the treated water is approximately 1.0 million gallons and the current storage capacity for raw water is roughly 4.3 million gallons. The required storage for both communities was based on the new population projections and with operational storage being 25% of the peak day demand or (95,950 gal.), plus emergency storage equal to the peak day demand of (383,800 gal.), and fire storage capable of supplying 2500 gpm for a three hour period (2500 * 60 * 3 = 450,000 gal.) for a total storage of 929,250 gallons. With the existing 1 million gallon treated water storage and the 4.3 million gallon raw water storage, there is no need to increase either of the existing storage facilities, providing the pipeline can deliver the available water supply without interruption.

The SCJPB has elected to utilize Midwest's current water right of 283 gpm or 0.63 cfs and avoid for an additional water right from the North Platte River. To insure this quantity of water is available, the system design is for 300 gpm at the wells or 150 gpm per well and the pipeline is sized to carry the total 300 gpm to the raw water storage tanks.
Project Requirements

It is proposed that two new wells be drilled near the same location as the existing well in Mills. These wells will have pumps installed which will be compatible with those designed for the booster pump stations thus reducing the necessity for stocking different pumps and supplies. In an effort to reduce the cost of pumping and the installation of high pressure pipe, the pressures obtained in the system were held to a maximum of 200 pounds per square inch. The existing booster pump station, located between First Street and the North Platte River, in Casper will be abandoned and the new booster pump stations will be located along the pipeline route. The pipe material proposed for the project is a high density polyethylene and can be fused together prior to placement into the trench. This operation can reduce the necessity for worker involvement in the trench and thus reduce the excavation cost by approximately 2/3 of the standard trench excavation.

The Treatment plant will also be reduce in size to provide for the treatment of a 300 gpm peak day demand anticipated in the year 2011. The two raw water storage tanks located south of Midwest are to be refurbished and will provide for roughly 4.3 million gallons of raw water which can be sent to the treatment plant should the pipeline from the wells break, or in the event the wells would have to be shut down for repairs over an extended period of time. This storage of raw water will also provide for some growth in the two towns without creating a shortage in the water supply from the North Platte River. The raw water storage can allow for treatment plant capacity to be increased and provide for a greater quantity of potable water being sent to
the finished water storage tank without increasing the capacity of the pipelines or the wells. This is accomplished by utilizing the excess storage during the peak hours and replenishing of the storage during off peak usage.

To again summarize the data previously presented, in conjunction with the proposed studies a brief outline of the source of supply, the project design life, water demands, construction cost, and operation and maintenance (O&M) cost.

<table>
<thead>
<tr>
<th>Water Supply Source</th>
<th>Project Life</th>
<th>Water Demand</th>
<th>Construction Cost</th>
<th>O&amp;M Demand Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Platte</td>
<td>50 yrs</td>
<td>652 gpm</td>
<td>$10,000,000</td>
<td>$78,000</td>
</tr>
<tr>
<td>Madison</td>
<td>20 yrs</td>
<td>440 gpm</td>
<td>$4,561,400</td>
<td>$121,288</td>
</tr>
<tr>
<td>North Platte Down Size</td>
<td>50 yrs</td>
<td>300 gpm</td>
<td>$7,246,261</td>
<td>$75,000</td>
</tr>
</tbody>
</table>

(With Sinking Fund $161,767)

**Water Wells**

The construction of two new water wells will be undertaken at the north Platte River with each well capable of pumping 150 gallons per minute to the pipeline. The pumps proposed will be vertical turbine well pumps capable of supplying 150 gpm at pressures of 200 psi at the well head. The pump bowls and motors will be the same as those proposed for use in the booster pump stations along the pipeline route. The cost of these wells will remain much the same as in the original study except for the size of the pumps which have been increased to allow for the elimination of the booster station at the river.
Pipeline

The pipe proposed for the section from the wells, through the booster station, to the high point in the supply line located at Twenty Mile Hill will be a high density polyethylene, 10" nominal size, SDR 9, capable of handling working pressures of 200 psi. The piping to be utilized from Twenty Mile Hill to the raw water storage tanks south of Midwest will be high density polyethylene, 8" nominal size, SDR 9, capable of withstanding the same 200 psi working pressure. This reduction in size allows the designer to reduce the number of pressure regulating valves required to maintain the 200 psi. The piping from the raw water storage tanks to the treatment facility will be constructed of the 10" nominal polyethylene pipe. This will allow the higher pressure to be used to force the water through the sands filters at the treatment facility and possibility reduce the need for pumping.

Booster Stations

Two booster pump stations are to be constructed along the pipeline in order to pump the water over the crest at Twenty Mile Hill and to prevent the pressures in the system from being in excess of the 200 psi. The costing as proposed provides for three pumps per booster station with each pump being capable of pumping 150 gpm. It may be possible during the design phase of the project to reduce the number of pumps required at each booster station and reduce the construction cost, as all pumps and motors will be designed for the same horse power and bowl size with the only variable being the number of bowls required. The necessity to provide electrical power to the booster stations has also been included in the costing of the system. This is another item which could be addressed in the final design stage for the project and, providing
the operational cost would warrant it, possibly the three phase power could be changed to single phase and reduce the initial construction cost.

**Treatment Plant**

The treatment plant design was reduced to provide for treatment of the 300 gpm water supply. These changes have resulted in fewer new filters being required. The general layout of the facility has not changed and only minor cost adjustments were made. The necessity to connect the new treatment facility to the Midwest sanitary sewer is still required and these cost are included as a portion of the total project cost. The necessity to provide for retention time after chlorination of the treated water required the connection of a water transmission line from the treatment plant to the existing 12" line supplying the treated water storage tank. The location of the treatment plant has not changed from the original location as proposed in the Level II study.
The unit cost affiliated with this revised study were developed using 1991 dollars. While these unit cost are not significantly different than those generated during the original Level II study, this study has selected differing types of material for the construction of the system. The following estimated cost summary indicates the total capital cost required for construction of the complete system.

**TREATMENT FACILITY**

1. Treatment Units - 1 skid mounted pressure filter, TWT Model ADF-600 (100 gpm instantaneous capacity) with automatic backwash, including surface wash, and filter to wash capability. $16,000
2. Existing Treatment Units - moved to new location. 11,250
3. Chemical Addition - Three each; 200 gallon mix tank 1 HP tank mixer, duplex chemical metering pumps, injectors. 28,600
4. Mixing - In-line mixer. 2,805
5. In-Line Trubidimeters - Two, plumbed to monitor any unit or total production. 8,000
6. Chlorinator - Existing, moved from previous location. 2,000
7. Piping - Supply, backwash, and drain. 19,670
8. Air, Instrumentation and Major Electrical. 31,255
9. Housing - Steel building, 2100 square feet. 35,438
10. Interior building finishing. 8,550
11. Concrete slabs and foundations. 18,225
12. Land - 3500 square feet. 500

**SANITARY SEWER**

1. 8" PVC SDR35 Pipe - 1600 ln. ft. @ $15.00 per foot. $24,900
2. 48" manholes - 6 each @ $1500 each. 9,000
3. Pavement removal and replacement. 19,200

*Note.* These items are not eligible for WWDC funding. $53,100

**Total** $182,293
WELLS

1. Drilling and mobilization. $10,400
2. Completion, including setting casing and installing gravel pack, bentonite seal and surface grouting. 750
3. Development - swabbing, surging, and air-lift pumping. 4,500
4. Materials
   10' of 16" Johnson low carbon well screen. 1,102
   20' of 16" API casing for upper blank section. 715
   Bottom plate 85
   3 weld rings 327
   Freight 250
5. Professional Services 11,245
6. Pumps and Piping
   4 Vertical turbine 5-stage pumps 37,400
   Control for pumps 8,500
   Control valuing 10,000
   External piping connections 4,000
   Concrete block buildings 12,000
   **Total:** $101,274

BOOSTER STATIONS (two required)

1. Vertical Turbine Pumps - 5-stage for 150 gpm 3-pumps per station @ $7,500 each. $45,000
2. Electrical controls @ $1,500 per pump. 9,000
3. Valuing and piping @ $6,000 per station. 12,000
4. Buildings @ $10,750 each. 21,500
   **Total:** $87,500

POWER SUPPLY

1. Construct 8 miles of 3-phase power line to booster stations @ $28,000 per mile. $224,000

VALUING AND TELEMETRY

1. Air-Vacuum valves @ 1,000 foot intervals plus pressure regulating valves (270 valves total). $560,250
2. Telemetry controls and cables. 327,237
   **Total:** $887,487
PIPELINE

1. Section One - From wells to top of Twenty Mile Hill- 108,100 ln.ft. of 10" poly pipe @ $14.35 per ln.ft. $1,551,235
2. Section Two - Twenty Mile Hill to Raw Water Tanks 78,550 ln.ft. of 8" poly pipe @ $10.25 per ln.ft. 805,137
3. Section Three - Raw water Tanks to Treatment Plant 33,100 ln.ft. of 10" poly pipe @ $14.35 per ln.ft. 474,985 $2,831,357

RAW WATER TANKS

1. Tank covers with fiber glass aluminum joist @ $130,00 per tank. $ 260,000
2. Sand blasting and painting tanks inside and outside @ $90,000 each. 180,000 $440,000

RESTORATION AND RECLAMATION

1. Reclamation of 218,518 ln.ft. of pipeline route with a 50' width @$0.04 per ln.ft. $453,036

HIGHWAY / ROAD CROSSINGS

1. Burlington Northern $ 5,000
   Highway First St. 3,000
   Highway I-25 110,000
   Highway 259 6,000
   Events Drive 5,000
   Highway 387 5,000 $134,000
LAND ACQUISITIONS

The pipeline will cross approximately 360 acres of privately owned land throughout its length. Assuming a construction width of 100 feet @ a maximum value of $500 per acre.

\[
\begin{align*}
180,000 \\
\hline
\text{TOTAL} = \$5,574,047
\end{align*}
\]

WWDC FUNDABLE PROJECT ITEMS

In dropping the Treatment Plant and the sanitary sewer system from the project those items remaining are the items which would be funded through the WWDC. The remaining items would total as follows:

\[
\begin{align*}
15\% \text{ Construction Contingency} & \quad \$ 836,107 \\
10\% \text{ Construction Engineering} & \quad 557,405 \\
5\% \text{ Design Engineering} & \quad 278,702 \\
\hline
\text{TOTAL} = \$7,246,261
\end{align*}
\]

SCJPB ITEMS FOR OTHER FUNDING

The treatment plant and sanitary sewer from the plant to the Midwest sewer system would total as follows:

\[
\begin{align*}
15\% \text{ Construction Contingency} & \quad 35,308 \\
10\% \text{ Construction Engineering} & \quad 23,539 \\
5\% \text{ Design Engineering} & \quad 11,670 \\
\hline
\text{TOTAL} = \$306,011
\end{align*}
\]
ECONOMIC ANALYSIS

An analysis was conducted to determine water costs to the towns of Edgerton and Midwest with variable financing options. The capital cost of the proposed pipeline and treatment facility is estimated to be $7,246,26. The pipeline is estimated to be $6,940,251 and the treatment facility is estimated to be $306,010. The treatment facility is considered separately from the pipeline because it is not eligible for WWDC Grants or Loans.

The annual cost of the pipeline considered amortizing the WWDC Loan amount over 50 years at 4% for two options, 1.) 67% WWDC Grant and a 33% WWDC Loan at 4% for 50 years and, 2.) 75% WWDC Grant and a 25% WWDC Loan at 4% for 50 years. The annual cost of the treatment considered two possibilities. 1.) A 100% legislative loan at 4% for 50% and, 2.) a 100% loan at 7.9% for 50 years. The interest rate represents the opportunity cost of WWDC funds invested by the Wyoming State Engineer as of September, 1991. The financing options follow:

○ Case 1

Pipeline - 67% WWDC Grant, 33% WWDC Loan at 4% for 50 years.
Treatment- 100 Legislative Loan at 4% for 50 years.

○ Case 1A

Pipeline- Same as Case 1.
Treatment- 100% loan at 7.9% for 50 years.

○ Case 2

Pipeline- 75% WWDC Grant, 33% WWDC Loan at 4% for 50 years.
Treatment- Same as Case 1.

○ Case 2A

Pipeline- Same as Case 2.
Treatment- Same as Case 1A.

Tables 1 and 2 show the economic effects for each of the four cases. Table 1 shows the total project costs and cost per 1000 gallons of water. Annual costs range between $170,012 and $206,340 for Cases 2 and 1A respectively. The cost of water range from $3.33/1000 gallons in Case 2 to $4.05/1000 gallons in Case 1A. Table 2 shows the cost of the new system per individual water user per month. The costs range from $51.15 per month for Case 2 to $62.07 per month for Case 2A. Estimated costs for water with the current system is $26.53.
### TABLE 1
Total Annual Costs

<table>
<thead>
<tr>
<th>Cost of Pipeline</th>
<th>$6,940,251</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of Treatment Plant</td>
<td>306,010</td>
</tr>
<tr>
<td><strong>Total Cost of Pipeline and Treatment Facility</strong></td>
<td><strong>$7,246,261</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Loan Amount</th>
<th>Case 1</th>
<th>Case 1A</th>
<th>Case 2</th>
<th>Case 2A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipeline</td>
<td>$2,290,283</td>
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<td>$1,735,063</td>
<td>$1,735,063</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Annual Loan Payment</th>
<th>Case 1</th>
<th>Case 1A</th>
<th>Case 2</th>
<th>Case 2A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipeline</td>
<td>$106,613</td>
<td>$106,613</td>
<td>$80,768</td>
<td>$80,768</td>
</tr>
<tr>
<td>Treatment</td>
<td>14,245</td>
<td>24,727</td>
<td>14,245</td>
<td>24,245</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Annual O &amp; M Costs</th>
<th>Case 1</th>
<th>Case 1A</th>
<th>Case 2</th>
<th>Case 2A</th>
</tr>
</thead>
<tbody>
<tr>
<td>$75,000</td>
<td>$75,000</td>
<td>$75,000</td>
<td>$75,000</td>
<td>$75,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total Annual Costs</th>
<th>Case 1</th>
<th>Case 1A</th>
<th>Case 2</th>
<th>Case 2A</th>
</tr>
</thead>
<tbody>
<tr>
<td>$195,858</td>
<td>$206,340</td>
<td>$170,012</td>
<td>$180,495</td>
<td></td>
</tr>
</tbody>
</table>

| Annual Water Useage (1000 Gallons) | 51,000 | 51,000 | 51,000 | 51,000 |
| Cost Per 1000 Gallons | $3.84 | $4.05 | $3.33 | $3.54 |

### TABLE 2
Individual Monthly Costs

<table>
<thead>
<tr>
<th>Monthly Loan Payment</th>
<th>Case 1</th>
<th>Case 1A</th>
<th>Case 2</th>
<th>Case 2A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipeline</td>
<td>$32.07</td>
<td>$32.07</td>
<td>$24.30</td>
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<tr>
<td>Treatment</td>
<td>4.29</td>
<td>7.44</td>
<td>4.29</td>
<td>7.44</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Monthly O &amp; M Costs</th>
<th>Case 1</th>
<th>Case 1A</th>
<th>Case 2</th>
<th>Case 2A</th>
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<tbody>
<tr>
<td>$22.56</td>
<td>$22.56</td>
<td>$22.56</td>
<td>$22.56</td>
<td>$22.56</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total Monthly Costs (New facility)</th>
<th>Case 1</th>
<th>Case 1A</th>
<th>Case 2</th>
<th>Case 2A</th>
</tr>
</thead>
<tbody>
<tr>
<td>$58.92</td>
<td>$62.07</td>
<td>$51.15</td>
<td>$54.30</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Current Montly Costs</th>
<th>Case 1</th>
<th>Case 1A</th>
<th>Case 2</th>
<th>Case 2A</th>
</tr>
</thead>
</table>
CONCLUSIONS/RECOMMENDATIONS

The Conclusions/recommendations section of this report utilizes information presented in previous reports and is included as a quick reference. Should the reader wish to obtain the concise information it will be necessary to reference the WYOMING WATER DEVELOPMENT COMMISSION EDGERTON/MIDWEST WATER SUPPLY PROJECT LEVEL II-CONCEPTUAL DESIGN REPORT, December 1988; WYOMING WATER DEVELOPMENT COMMISSION EDGERTON/MIDWEST WATER SUPPLY PROJECT LEVEL II-CONCEPTUAL DESIGN REPORT, TASK 15, ALTERNATIVE WATER SOURCE EVALUATION, August 1989.

- Conclusions -

1. As stated in the previous studies and investigations, of the existing pipelines, pumps and treatment facilities for both Towns has not improved and the Midwest Pipeline has exceeded its service life.

2. The deterioration of the systems will continue and the financial demands for both Towns will increase with no improvements to their quality or quantity of water.

3. All components of the original Level II study be down sized to reflect the anticipated growth and water usage of the two Towns. The actual number of users and the anticipated growth must be established and agreed upon by the Salt Creek Joint Powers Board.
4. The existing storage capacity of the raw water and treated or finished water remains as is with improvements to extend the life of the facilities.

5. The economics of the project dictate the need for the Salt Creek Joint Powers Board to receive substantial subsidies from the WWDC, Wyoming State Legislative, and other funding agencies.

- Recommendations -

1. The existing pipeline be replaced along its entire length with a new pipeline.

2. Two new wells be drilled near the present location of the existing well to assure the existing right of Midwest is capable of being diverted to the SCJPB water supply system.

3. Two new booster stations be constructed along the pipeline route at locations which will maintain the pipeline pressures at or below 200 psi.

4. The existing raw water storage tanks south of Midwest be rehabilitated and maintained for emergency or possible future growth.

5. A new treatment facility be constructed at the new location near the intersection of Wyoming Highways 259 and 387 in Midwest.

6. No consideration should be given to expanding the system to service intervening users between Casper and the Towns of Midwest and Edgerton.