Executive Summary
for the
Sheridan Hydropower Study
(Big Goose Treated Water Pipeline)
Level II

October 2002

Prepared for:
Wyoming Water Development Commission
Cheyenne, Wyoming

Prepared by:
HKM Engineering Inc.
Sheridan, Wyoming
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# Sheridan Hydropower Level II Study

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INTRODUCTION

Background and Location
The Sheridan Area Water System provides water to both the City of Sheridan and the rural areas south and west of Sheridan, which are under the jurisdiction of the Sheridan Area Water Supply Joint Powers Board (SAWSJPB). The primary system components that pertain to this study are shown in Figure 1. These components include the intake facilities located at the east edge of the Big Horn Mountains (about 12 miles west of Sheridan), which divert water from Big Goose Creek into raw water transmission mains (RWTMs) that lead to the two treatment plants. The Big Goose Water Treatment Plant (BGWTP) is the source of water for the Big Goose Valley (as well as other areas), including the 16-inch pipeline that is the subject of this study. The second plant is the Sheridan Water Treatment Plant (SWTP), which is supplied by the 30-inch RWTM.

The City of Sheridan and Sheridan County joined forces to form a Joint Powers Board to plan, construct, own and manage a regional water system for the Sheridan area. Approximately $60 million worth of water system improvements were constructed during the 1990 to 1998 period. This 16-inch treated water line is owned by the city, but leased to the SAWSJPB (71.3% lease). This pipeline primarily benefits the Big Goose and Little Goose services areas, which are SAWSJPB users. The BGWTP is 71.3% owned by the SAWSJPB and 28.7% by the city.

The pipeline discussed in this report and considered for rehabilitation or replacement is a 16-inch steel pipeline which runs from the BGWTP to the Airport Pump Station (a distance of about 12 miles). Two other runs of this pipeline will also be considered for rehabilitation. These are from the Intake Facilities to the BGWTP, and on the east end of the Big Goose valley, from the North Low tanks (SWTP source) to the airport.

Purpose of Study
This study has two primary purposes:
• To examine the feasibility of generating hydropower from the Sheridan Area Water System
• To evaluate the condition of the 16-inch treated water transmission main in the Big Goose valley, and recommend necessary improvements to or the replacement of this pipeline.

Authorization and Consultant Team
The Sheridan Hydropower Level II study was authorized by the Wyoming Water Development Commission (WWDC) in a contract with HKM Engineering Inc. of Sheridan, Wyoming dated June 20, 2002. Work was completed on October 31, 2002.

HKM Engineering was the primary consultant for this project. They handled project management, hydraulic modeling, pipeline analysis, evaluation of options, routing and easements, cost estimates, and assisted with hydropower and economic analysis. Eric Schulz with CH2M Hill in Boise, ID was the subconsultant for the hydropower evaluations and related economic analysis. Bill Spickelmire with RUSTNOT Corrosion Control provided insights on corrosion issues.

Schedule
The current project schedule calls for this study to be finalized by November 1, 2002. The city of Sheridan and SAWSJPB are requesting Level III funding from the WWDC for upgrading this pipeline. Design is expected to commence in the spring of 2003, with construction commencing in the summer of 2004, and being completed by the end of 2005. The project could be delayed due to easement acquisition, funding or other circumstances.
Population Estimates and Project Design Flows
A recent count of the number of user accounts in the Big and Little Goose service areas, showed 1462 accounts with an estimated 1365 of these in service. Looking back over the last 7 years, there has been a growth rate of about 3% in these rural areas. This is above the growth rate of the county as a whole, and therefore should be conservative. Using a 3% growth rate for 40 years and 2.5 people per house, a population estimate for 2042 is 11,150.

Project Design Criteria:
- Average Day: 160 gpcpd
- Peak Day: 400 gpcpd
- Average Day to Peak Day: 2.65
- Average Day to Peak Hour: 4.50
- Design Flow (SAWS only):
  - Average Day: $11,150 \times 160 = 1.78 \text{ mgd}$
  - Peak Day: $11,150 \times 160 \times 2.65 = 4.7 \text{ mgd}$
- City (900 gpm for South Hill and 300 gpm for College area): 1.7 mgd
- Contingency: 0.5 mgd
- Pipeline Design Flows (allowing peak hour for Big Goose service area, and above flows for Little Goose and city): 7.8 mgd or 5400 gpm

EXISTING FACILITIES

16-inch Pipeline
The 16-inch Big Goose pipeline was constructed in 1936. Structurally, it appears to be in generally good condition, however, internal corrosion (tuberculation) has limited its capacity. This pipeline has an inside diameter (ID) of 15.25 inches (3/8-inch wall and 16-inch outside diameter (OD)). As part of the 30-inch RWTM project, the portion of the 16-inch line west of Beckton Hall Road was joint bonded and cathodic protected in an attempt to reduce future exterior corrosion from soils.

This transmission main is a key component to this regional water system. The treated water supplied by this main is needed to meet the usage requirements of the Big Goose and Little Goose areas, and to also supplement supply to the City of Sheridan. Because of its size and this internal corrosion problem, it has operated near its maximum capacity in summer months. This line does not have the capacity to carry future peak flows, and its limitations do not allow the BGWTP to operate at capacity. The internal corrosion has reduced the line's capacity to less than half of its original capacity. Its internal corrosion also deteriorates water quality by adding iron to the water.

While this 16-inch pipeline primarily serves the rural areas, it does supply the city system in three locations:
- Pressure sustaining valve at the Sheridan WTP (helps allow the BGWTP to operate at a more constant rate, but does not really benefit the city).
- PRV at West Brundage Lane, to supplement flow to the South Hill Area
- PRV at the Girl's School, to supplement flow to southeast Sheridan.

This 16-inch steel pipeline also connects the intake facilities to the BGWTP, a distance of approximately 6,200 feet. This pipeline only serves this plant, and is the normal source for this plant. At the BGWTP this pipeline converts to a treated water line. While the internal corrosion problem on this raw water line reduces its capacity, there is sufficient head between the intake and the BGWTP to currently supply all of the water requirements for this plant. The two tanks that are pertinent to the 16-inch pipeline are the 0.5-million gallon (mg) clearwell at the BGWTP, and the 1.0 mg Big Horn tank. The BGWTP can fill the Big Horn tank by gravity under some conditions. The overflow elevations of these two tanks are 4396 and 4158,
respectively. The primary PRV on this line, located at Beckton Hall Road, cuts the hydraulic grade line (HGL) to 4262. The pump stations pertinent to this study include the Airport Pump Station, which the 16-inch pipeline feeds, and the smaller booster stations in the Big Goose Valley that receive their water from this pipeline. The Airport Pump Station pumps to the Big Horn tank, when pumping is needed.

Several connection points on the 16-inch pipeline serve existing distribution systems in the Big Goose Valley, which in turn supply the users. This pipeline has also been tapped for individual service lines in many locations, where no distribution system or lateral lines existed. Currently there are about 375 user accounts in the Big Goose Valley.

**Easements**
The existing water mains follow different routes in the Big Goose Valley. These lines have their own easements, but none of these are sufficient to add the new pipeline to. These lines were constructed when there was less development in the valley, and therefore routing was more straightforward. The reported width of these existing easements are: 30-inch RWTM – 30 feet, 20-inch – 30 feet (private property, much of route is in highway R-O-W), 16-inch – 20 feet. Documentation is scarce on the easements for the older lines, therefore these need to be confirmed if they are to be used.

The proposed routing of the new pipeline requires new easements for virtually its entire length. The location, width of and congestion in easements along existing pipelines make them mostly unusable for the replacement pipeline. A thirty-foot wide permanent easement is proposed across private property, with the pipe located from the center to the one-third point in the easement. In addition, a 50-foot wide temporary construction easement is proposed. These are the widths used for the 30-inch RWTM, and they seemed to work acceptably. Where practical, the new easement will be located adjacent to other water line easements. In some locations, existing easements may be used for distribution piping. Also, road R-O-W may be utilized for distribution system piping and supplying water to existing connection points.

**HYDROPOWER**

**Potential Locations**
While many sites throughout the water system have potential for generation of hydropower, namely water flow between a zone of higher pressure and a zone of lower pressure, most of these have head differentials or flows too low to be economically viable. The result of this process is that a single site was determined to be a viable candidate for further feasibility analysis: that of the 30-inch RWTM pressure reducing valve (PRV) site at the existing Beckton Hall Road vault. This site has an average output of about 172 kW. An order-of-magnitude economic evaluation was performed on the next largest site: the 30-inch RWTM PRV installation at the SWTP, with an average output of 14 kW. This was not economically feasible. All but four of the sites have a generation potential of less than 1 kW. The economic feasibility analysis and cost estimates assume a Federal Energy Regulatory Commission (FERC) license exemption, Qualifying Facility (QF) certification, and a loan period of 20 years. The useful life of the generation equipment probably has a similar timeframe.

MDU will purchase power produced by a facility such as the proposed one under the terms of the their rates and guidelines. The operation, control, and protective functions of the proposed project must comply with a variety of technical interconnection requirements. These requirements, as well as detailed terms of the interconnection agreement will be established while applying for interconnection, a study and detailed review and coordination of project design features by MDU, and contract negotiations. It is assumed generation produced by the proposed project will be purchased by MDU at $0.01619 per kWhr and $9.06 per kW per month for capacity.
MDU owns and operates overhead, 3-phase, distribution line facilities along the Big Goose Road that are feasible for interconnection of the proposed plant. A single-phase tap of this circuit extends up Beckton Hall Road to the site, providing service to the existing PRV vault. An underground cable will need to be extended about 400 feet to the PRV vault and the existing Beckton Hall Road feeder tap will need to be converted from single-phase to 3-phase.

Although the initial evaluation of potential sites ruled out the possibility of any sites under 15kW, the new pipeline at the Beckton Hall Road site may have some cost advantage if the 30-inch RWTM site is developed for hydropower. To evaluate the feasibility of this, a cost estimate and economic analysis were prepared. The addition does take advantage of "riding on the coattail" of the main plant's licensing, final design, but the economics of this increment of added facilities are poor — therefore not justifying such an addition.

**Preliminary Equipment Selection and Sizing**

General equipment selection is driven by conditions of operation. The closed-conduit operation dictate that reaction turbine technology be employed (versus impulse or "Pelton Wheel" technology). The relative size of the proposed project and the need to minimize cost dictate that a fixed geometry-type turbine (pump equipment) be chosen. An adjustable-geometry turbine, with wicket gates and/or runner vanes that can be adjusted to improve performance over a range of hydraulic conditions is prohibitively costly in this size of project (3 to 5 times higher in cost). However, a fixed-geometry machine has a more limited operating range. It cannot cover the widely different levels of operation which vary from summer to winter.

As there is no need to provide the capability for stand-alone generation or control voltage on the interconnected power distribution system, the generator should be of the induction type (versus synchronous). This provides the added advantages of lower cost and simpler controls/operation.

**Permitting**

Several agencies were contacted regarding permitting. The development of this project requires the completion of permitting and agreements with FERC, and the local utility, (MDU). Two FERC-related permit processes are required in order to develop this project: hydropower licensing and certification as a Qualifying Facility (QF). For certain projects, an exemption from FERC licensing is available. Such is the case with the proposed development at the Beckton Hall Road PRV site. The exemption process presupposes that a project is straightforward and environmentally benign, and offers the advantage of a much–streamlined process. Exemptions are issued in perpetuity and are subject to mandatory conditions set by Federal and state fish and wildlife agencies.

The power market evaluation has established that the most viable approach for utilization of the generated power is that of operation as a QF under the Public Utility Regulatory Policies Act of 1978. Under the QF approach, the local utility is required to interconnect with the project and purchase the generated power. MDU has been contacted on a preliminary basis, regarding the feasibility and acceptability of interconnection, and the requirements pertaining thereto. The results of that evaluation were positive.

**Recommendations**

Based on initial economic analysis of alternatives, it appears that the 30-inch RWTM site at Beckton Hall Road is not currently attractive because the payback period is greater than 10 years, based on a 20-year loan at 6%. However, several scenarios could make the economic analysis more favorable. They are:

- Higher power costs. As the cost of power and MDU's avoided cost rises, the dollars generated at this site will be greater.
- Higher minimum flows. As flows increase, particularly minimum flows (and they will over time), the generating potential of this site will also increase.
• Lower interest rate on the project loan.
• Alternative funding sources. If grants for small hydropower projects were utilized, the overall cost of the project to the city would decrease. One such source of funding could be the Wyoming Business Council.
• The ability to use the power, rather than needing to sell it to MDU. The two PRVs at the BGWTP and SWTP allow direct use of the power, but the cost per quantity of power generated did not appear currently attractive.

Therefore while it does not appear currently cost-effective to install hydropower generation on this system, conditions could change in the future. The current priority is the construction of the new transmission main. When this is completed, it is recommended the evaluation presented in this report be reviewed, and that the possible inclusion of hydropower generation on this water system be reconsidered, based on the circumstances at the time.

PROPOSED IMPROVEMENTS

Route Selection
Several factors were evaluated to determine the new pipeline route. These included locations of the existing users, existing distribution line connection points, existing pipelines, existing easements, other buried utilities, terrain, elevation, land ownership, geology, soil conditions, groundwater, access for future maintenance, locations of the crossing of Big Goose Creek and Big Goose Road, permitting considerations, and the length of the route. Aerial photographs, maps of the land parcels, and project maps from the 30-inch RWTM and Big Goose Valley distribution line projects, were used extensively in the routing process.

The recommended route is as follows:

BGWTP to Beckton Hall Road – The new pipeline should follow the existing 30-inch pipeline where possible. Placing the new pipe beside this existing pipeline should make easement acquisition easier, and take advantage of this shorter route.

Beckton Hall Road to Youth Camp – The new pipeline should follow a route between the 30-inch and 16-inch pipelines. This route was selected mainly because of the proximity to existing users and location of existing easements. By following Big Goose Road, the new pipeline will generally only require easements from the edge of existing lots, which should be easier to obtain than along the 16-inch pipeline. Ease of access to the new line plays a roll in this decision as well.

Youth Camp to Airport Booster – The new pipeline should follow the existing 16-inch pipeline where possible, to supply water to the existing users. In some locations, however, the new pipeline may deviate from the existing alignment to avoid obstacles. As the line nears the airport, the line will likely climb the hill more directly than the existing 16-inch route. Other locations such as through Normative Services, will require some deviation from the existing 16-inch route, but should not significantly affect design or cost.

Permanent easements will be needed along the most of the pipeline route. In a few areas along Big Goose Road, it appears some easements exist that can be used. In other areas along the pipeline route where the pipeline is next to existing pipeline easements, a smaller permanent easement may be possible. The 30-inch RWTM was primarily laid in the center of a 30-foot wide easement. In most places where the new pipeline parallels the 30-inch line, only an additional 15 to 20 feet of permanent easement may be needed. A construction easement will also be required. In some areas where multiple pipeline easements exist, using existing permanent easements for construction activities may reduce the required amount of construction easement.
Service to the city will remain in the same locations that currently exist. These are listed on page 2. Either distribution lines (4 to 8-inch) or direct taps (for single users next to the pipeline), will be used to connect existing users in the Big Goose valley.

**Pipeline Materials and Appurtenances**

Based on the design flow of 5400 gpm and extensive system modeling, a new 20-inch pipeline is proposed. Several pipeline materials were considered for this pipeline. Considerations when comparing pipeline materials include cost, pressure, constructability, corrosion resistance, durability, compatibility with the other materials in the water system, future tapping, and owner preference. Since cost is a primary consideration, in addition to the pipe material itself, associated costs to be considered include bedding and bedding placement, pipe installation, cathodic protection and need for appurtenances.

Because of the pressures involved in much of the route (up to 200 psi), a metal pipe is needed. While both steel and ductile iron were considered, because of corrosion issues with ductile iron, steel pipe will be assumed at this time. This issue can be investigated further during final design. For steel pipe, we will assume a 3/8-inch cement mortar lining and 80-mil triple tape wrap coating. The steel pipe will be per AWWA C200, with a 0.188-inch wall thickness assumed at this time. It is proposed that AWWA C905 OR18 PVC be considered in areas where static pressures do not exceed about 125 psi. This will primarily be a 3½-mile run east of the BGWTP.

All laterals to connect distribution systems (typically 4 to 8-inch pipe), are proposed to be AWWA C900 DR18. Valves and fittings will comply with the City of Sheridan standards specifications. All metallic valves and fittings must be epoxy coated and cathodically protected. A considerable number of appurtenances will be required on this pipeline. These include isolation valves, combination air/vacuum valves, blow offs (hydrants), bends, taps for smaller lines, and probably two pressure relief valves to help protect the system from a pressure surge.

**Pressure Control**

The existing 16-inch water main has one pressure control point, a PRV at Beckton Hall Road. This works well within the overall water system and it is proposed this be duplicated with the new pipeline, so modifications are not needed as to how the users downstream of Beckton Hall Road are served. The same downstream hydraulic grade line (4262) is proposed for the new pipeline, which will result in similar pressures reaching the smaller PRV's, booster stations and taps in the valley. A two-valve PRV station will be installed. If hydropower is added, it will be in a bypass to the PRVs so either one or the other can be used. Like other PRV stations on the system, these valves will be housed in underground vault with isolation valves. Static pressures in and out of this PRV are 165 and 107 psi. The influent pressure will reduce as flows increase up until the capacity of the pipeline is reached.

**Rehabilitation**

Rehabilitation (lining) the 16-inch steel line and 20-inch ductile iron pipe (DIP) was considered. Two types of lining are available. These are a tight liner, which simply provides a slick surface inside the pipe and separates the metal in the pipe from the water, preventing further internal corrosion; and a slip liner, which is heavy walled HDPE pipe inserted into the pipe being rehabilitated. For the tight liner to work, the existing pipe wall must be strong enough to continue to hold pressure. This is true with the 16-inch steel pipe but as discussed above, the 20-inch DIP is heavily graphitized and failing from corrosion, therefore a tight liner is not an acceptable option with it. Two types of tight liners were considered - HDPE and cement mortar. HDPE is more expensive, however it has some advantages, so it is assumed at this time.

Tight lining the 16-inch steel line is feasible, however the resulting pipe will have an ID too small for the design flows. Therefore lining the 16-inch line by itself is not an option. Lining the 20-inch DIP is not seen as a long-term solution because of its poor condition from soil corrosion. Lining of the 16-inch steel line may be appropriate for two segments. These are from the Intake to the...
BGWTP (a raw water pipeline), and from the SWTP source between the North Low tanks and the airport.

Slip lining the 16-inch steel line between the North Low tanks and the airport can increase the water supply from the SWTP to the South Hill area. Eventually, it will be best to supply the majority of the water to the South Hill area for the SWTP because as the Big and Little Goose valleys grow, the higher pressure water from the BGWTP should be preserved for them. Once the new pipeline from the BGWTP is installed, it will be possible to complete this lining project. An improvement that will provide even greater benefit to the South Hill area, is replacing the old and heavily tuberculated 10 and 12-inch lines from their origin near the South Low tanks, to about DeSmet Avenue. This will reduce the head losses that are occurring as water is delivered to the South Hill area under peak demand conditions. Further investigation into the distribution system for this area is needed to identify other improvements, particularly in north-south lines.

**Tank/Clearwell**

The clearwell at the BGWTP, with a capacity of less than 0.5 mg, has proven to be too small for optimum operation. A larger clearwell or storage tank would benefit not only the overall water supply facilities from this source (which include the pipeline recommended under this project), but would enhance plant operations. Currently as flows increase and decrease due to demand, little reserve capacity remains in the clearwell, requiring adjusting the flow rate through the plant. A larger clearwell would address both the plant operating issues and greatly improve the capacity of the water supply facilities in the Big Goose valley.

It is recommended that if a tank is constructed, it be located immediately adjacent to the BGWTP. This location will not change the design of a new pipeline between BGWTP and the airport, so if the tank cannot be constructed at the same time as the pipeline (the pipeline has a higher priority), this can be phased, allowing the project to better fit into budgets. Since the existing BGWTP site is quite congested, additional land will be needed for this tank. For several reasons it is recommended the new tank be buried concrete except for the roof slab.

**Permits**

While several permits will be required for this project, there does not appear to be any “fatal flaws” which would eliminate some possible pipeline routes from consideration. The Corps of Engineers (COE) permitting is required for the crossing of Big Goose Creek and other wetlands. Their Nationwide Permits should apply to these crossings. These permits are similar to those used on other creek crossings by water mains under other SAWSJPB projects. As long as these conditions are complied with, it appears the crossing of the creeks and wetlands will be allowed.

The Wyoming Department of Environmental Quality (DEQ) requires a 401 permit, which is involved with a COE permit. The DEQ Water Quality Division Rules and Regulations state that owners or operators of any point source discharging to a state water obtain an appropriate discharge permit. Discharges associated with this project would be only associated with the construction phase. A pollution prevention plan must be prepared for controlling runoff (stormwater) from construction sites. A DEQ Permit to Construct is also required.

**Cathodic Protection**

Previous experience in the Sheridan area and sound engineering practice both dictate that a corrosion protection system be installed on the new steel pipeline, and any metal fittings or valves. The recommended corrosion control system proposed at this time consists of:

- Electrical continuity (joint bonds)
- Test stations (to verify electrical continuity and monitor the cathodic protection)
- Pipeline coatings and linings
- Electrical insulators (where the new pipeline connects to unprotected pipe)
- Cathodic protection (either anodes or an impressed current system)
- Select bedding
COST ESTIMATES AND RECOMMENDATIONS

Cost Estimates
Multiple projects could result from this study. These could include:
- The primary project of upgrading the 16-inch steel line to a new 20-inch line.
- The lining of the 16-inch steel line between the Intake and BGWTP and the lining of the steel pipeline between the North Low tanks and the airport.
- The installation of a storage tank at the BGWTP.
- The replacement of the 10 and 12-inch transmission mains into the South Hill area.
- The installation of hydropower on the existing 30-inch RWTM at Beckton Hall Road.

Estimated costs for these projects (except hydropower) are summarized in the following tables. The hydropower analysis is more complex. Please refer to the Final Report for hydropower cost estimates and financial feasibility.

Table 1
Estimated Cost of 20-inch Pipeline

<table>
<thead>
<tr>
<th>Cost Item</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation of Final Plans &amp; Specifications</td>
<td>$644,000</td>
</tr>
<tr>
<td>Permitting and Mitigation</td>
<td>$25,000</td>
</tr>
<tr>
<td>Legal Fees</td>
<td>$25,000</td>
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<tr>
<td>Acquisition of Access &amp; Right-Of-Way (Table 5 + $6500 from Table 4)</td>
<td>$270,800</td>
</tr>
<tr>
<td>Cost of Components</td>
<td></td>
</tr>
<tr>
<td>19,500 of PVC Pipeline @ $58/ft</td>
<td>$1,131,000</td>
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<tr>
<td>40,000 of Steel Pipeline @ $84/ft</td>
<td>$3,360,000</td>
</tr>
<tr>
<td>Bond/Insurance/Mobilization</td>
<td>$300,000</td>
</tr>
<tr>
<td>Pipeline Appurtenances (Table 30)</td>
<td>$1,365,000</td>
</tr>
<tr>
<td>Connection of Users (Table 4, eligible only)</td>
<td>$287,800</td>
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<tr>
<td>Construction Sub-Total</td>
<td>$6,443,800</td>
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<td>Engineering During Construction (10%)</td>
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<td>Sub-Total</td>
<td>$8,052,600</td>
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<tr>
<td>Contingency (Sub-Total x 15%)</td>
<td>$1,208,000</td>
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<tr>
<td>Project Total Cost</td>
<td>$9,260,000</td>
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Table 2
Estimated Cost of New Tank at BGWTP

<table>
<thead>
<tr>
<th>Cost Item</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation of Final Plans &amp; Specifications</td>
<td>$130,000</td>
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<tr>
<td>Permitting and Mitigation</td>
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<tr>
<td>Legal Fees</td>
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<tr>
<td>Acquisition of Access &amp; Right-Of-Way</td>
<td>$30,000</td>
</tr>
<tr>
<td>Cost of Components</td>
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</tr>
<tr>
<td>1.5 MG Buried Concrete Tank</td>
<td>$950,000</td>
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<tr>
<td>Piping and Fittings</td>
<td>$150,000</td>
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<tr>
<td>Bond/Insurance/Mobilization</td>
<td>$100,000</td>
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<tr>
<td>Miscellaneous</td>
<td>$100,000</td>
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<tr>
<td>Construction Sub-Total</td>
<td>$1,300,000</td>
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<tr>
<td>Engineering During Construction (10%)</td>
<td>$130,000</td>
</tr>
<tr>
<td>Sub-Total</td>
<td>$1,630,000</td>
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<tr>
<td>Contingency (Sub-Total x 15%)</td>
<td>$240,000</td>
</tr>
<tr>
<td>Project Total Cost</td>
<td>$1,840,000</td>
</tr>
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</table>
Ownership/Cost Sharing/Funding

Both of the city and SAWSJPB have strong interests in this particular pipeline, and the BGWTP which both serves this pipeline and is tied to the new storage tank that may be constructed next to this plant. The ownership share in the BGWTP and the interest in the existing 16-inch steel pipeline is 71.3% SAWSJPB and 28.7% City. While the primary purpose for this new pipeline is to serve the users in the Big Goose and Little Goose valleys because they are located at higher elevations than are users in the city, the project also benefits the city. It benefits the SAWSJPB service areas to a much greater degree. Based on the above, it proposed that we use the same 71.3 and 28.7 percent ownership shares between these two entities at this time to calculate funding.

The funding plan for this project consists of a grant from the Wyoming Water Development Commission (WWDC) and a loan. A 50% WWDC grant is anticipated. The remaining funds ($4,630,000 for the 20-inch pipeline), will be a loan. (The SAWSJPB may use reserves so the amount of their loan is reduces, while it appears the city will borrow 100% of their share). Interest rates will be either 6% (State Land Investment Board or the WWDC), or 2½% from the State Revolving Fund (SRF), administered by the Wyoming DEQ.

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**Table 3**

Estimated Cost of Lining Two Pipe Segments

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost (in $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation of Final Plans &amp; Specifications</td>
<td>61,000</td>
</tr>
<tr>
<td>Permitting and Mitigation</td>
<td>25,000</td>
</tr>
<tr>
<td>Legal Fees</td>
<td>5,000</td>
</tr>
<tr>
<td>Acquisition of Access &amp; Right-Of-Way</td>
<td>10,000</td>
</tr>
<tr>
<td><strong>Cost of Components</strong></td>
<td></td>
</tr>
<tr>
<td>Intake to BGWTP 6,200' @ $38/ft</td>
<td>235,600</td>
</tr>
<tr>
<td>North Low Tanks to Airport 8,600' @ $38/ft</td>
<td>326,800</td>
</tr>
<tr>
<td>Connections</td>
<td>50,000</td>
</tr>
<tr>
<td><strong>Construction Sub-Total</strong></td>
<td>612,400</td>
</tr>
<tr>
<td>Engineering During Construction (10%)</td>
<td></td>
</tr>
<tr>
<td>Sub-Total</td>
<td>774,400</td>
</tr>
<tr>
<td>Contingency (Sub-Total x 15%)</td>
<td>116,100</td>
</tr>
<tr>
<td><strong>Project Total Cost</strong></td>
<td>890,500</td>
</tr>
</tbody>
</table>

---

**Table 4**

Estimated Cost of Replacing 10 and 12-inch Mains into the South Hill Area

(From connection to 16-inch CIP to DeSmet Avenue)

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost (in $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation of Final Plans &amp; Specifications</td>
<td>68,000</td>
</tr>
<tr>
<td>Permitting and Mitigation</td>
<td></td>
</tr>
<tr>
<td>Legal Fees</td>
<td>2,000</td>
</tr>
<tr>
<td>Acquisition of Access &amp; Right-Of-Way</td>
<td></td>
</tr>
<tr>
<td><strong>Cost of Components</strong></td>
<td></td>
</tr>
<tr>
<td>8500' of new 12&quot; C900 Water Main</td>
<td>323,000</td>
</tr>
<tr>
<td>Valves, Fittings and Appurtenances</td>
<td>113,000</td>
</tr>
<tr>
<td>Bond/Insurance/Mobilization</td>
<td>40,000</td>
</tr>
<tr>
<td>Surface Restoration</td>
<td>210,000</td>
</tr>
<tr>
<td><strong>Construction Sub-Total</strong></td>
<td>686,000</td>
</tr>
<tr>
<td>Engineering During Construction (10%)</td>
<td>68,000</td>
</tr>
<tr>
<td>Sub-Total</td>
<td>826,000</td>
</tr>
<tr>
<td>Contingency (Sub-Total x 15%)</td>
<td>124,000</td>
</tr>
<tr>
<td><strong>Project Total Cost</strong></td>
<td>950,000</td>
</tr>
</tbody>
</table>
The City of Sheridan has been evaluating their water rates and it appears a rate increase is imminent. This rate increase will need to take into account the payback of the loan associated with this project(s). The breakout of the estimated total costs and annual repayment for the above loan scenario, are shown in the Final Report.

**Operation and Maintenance**
The City of Sheridan provides operation maintenance (O&M) for their water system with their own crew. The same crew also provides O&M on the SAWSJPB system. Therefore O&M on the regional system is seamless. Since this is a replacement pipeline, O&M costs and time requirements should not increase. Decreases should actually be realized because currently adjustments on automatic valves such as the Beckton Hall Road PRV are made seasonally. The setting on this PRV, is increased in the summer during higher demands with the friction losses in the eastern half of this pipeline are counted on to avoid higher pressures. With reduced losses in the new pipeline, these settings should be more stable throughout the seasons. Also, currently the existing pipeline is “maxed-out” at times during peak demand, resulting in careful monitoring of reservoir levels and pressures. This too should be reduced with the new pipeline. The existing crews (both the water system crew and the plant operators) should be able to accomplish all tasks associated with these new projects within their current schedules and budgets.

**Summary of Recommendations**
This section briefly summarizes the recommendations discussed in this Level II study. For more information, refer to appropriate sections of this report. These recommendations include:

1. Replace the entire 16-inch steel line between the BGWTP and the connection to the existing 24-inch pipe at the airport with a new 20-inch pipeline.
2. The design flow for the new pipeline should be 5400 gpm.
3. Because of the flow limitations and water quality concerns imposed by the existing 16-inch steel line, proceed with the replacement of this line as soon as possible. This includes requesting Level III funding from the 2003 WWDC program.
4. Construction of a new storage tank (expanded clearwell) at the BGWTP. This could be a separate project from the pipeline. It should follow close behind however, as there are many benefits in both plant operation and supplying treated water that will be realized with this tank.
5. Rehabilitate the 16-inch steel line between the North Low tanks and the airport, and make appropriate connections so this line can help supplement flow to the South Hill area. Also replace the 10 and 12-inch cast iron lines that extend from a point near the South Low (Airport) tanks to DeSmet Avenue in the South Hill area.
6. Line the 16-inch steel line between the Intake and the BGWTP in the future when either the BGWTP is expanded, or additional capacity is required. Should the pipeline discussed in the previous item be lined, lining this pipeline should also be considered to see if economies of scale allow this pipeline to also be lined at the same time.
7. Recommendation relating to hydropower generation are discussed on page 4. While it does not appear cost-effective to install generating equipment at this time, there are circumstances that can make this more attractive. This situation should be monitored, with generation equipment possibly installed on the 30-inch and 20-inch pipelines at Beckton Hall Road, or in the RWTM vault at the SWTP, in the near future.