NORTH END WATER USERS STUDY

LEVEL I STUDY

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EXECUTIVE SUMMARY

PREPARED FOR
WYOMING WATER DEVELOPMENT COMMISSION

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EXECUTIVE SUMMARY

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1.0 INTRODUCTION

The North End Water Users system is located in Park County north of the City of Powell in north central Wyoming. In response to poor system pressures and a moratorium on any new connections, the North End Water Users Board has requested the assistance of the Wyoming Water Development Commission to complete this Level I Study. Sunrise Engineering, Inc. was selected by the Wyoming Water Development Commission to identify structural measures or changes in operation that would correct deficiencies in the water system. This includes an assessment of, and recommended improvements to, system components including water supply, treatment, transmission, and distribution. A rehabilitation plan with associated cost estimates is also included.

This study covers the area presently served by the North End Water Users system, which is located in a basin to the north of Powell. The service area encompasses approximately 28 square miles and is generally agricultural. The North End system supplies only culinary water to residences. The service area is shown in Figure 2.1.

2.0 EXISTING WATER SYSTEM

The North End Water Users system was initially completed in 1965 using FmHA funding. The original system consisted of one well, two 50,000 gallon storage tanks, and a majority of the existing 50 miles of gravity-fed pipeline. Booster pumps were installed to provide adequate pressure at residences located at higher elevations. Residences located at lower elevations required pressure reducing valves (PRV's) to reduce pressure to acceptable levels. The PRV’s were located on individual services as well as pipes that served the east side of the service area.

Well No. 2 was added in 1976. The system was expanded in 1982-3 by adding additional piping, the 100,000 gallon Faxon storage tank, and Well No. 3. Since that time, the system has experienced supply and pressure limitations. The booster pumps included in the original system are no longer used due to high maintenance costs. Also, the PRV on the pipeline serving the east side of the system was rendered ineffective when bypass looping within the system was constructed without additional PRV’s. Currently the system uses telemetry to monitor the pumps and tanks. In addition to the telemetry starting the pumps, a timer starts the pumps each morning and evening to help alleviate pressure problems that are greatest during the morning and evening peaks. At times, this
method of operation has caused excess water to be introduced into the system and allowed water to be wasted through tank overflow.

The system serves a population of approximately 500 people and 205 taps. Water rates are $27.00 for the first 2,000 gallons and $0.75 for each additional 1,000 gallons. The water company reports an average bill of $33.00 per month, which equates to an average usage of 10,000 gallons per month. Water is metered, and meter readings and billings are completed three times per year.

Present demands on the North End Water User’s wells are nearing capacity for a single well, to the point that one of the wells is required to operate approximately 16 hours per day during the peak season. However, with three wells currently providing water to the system, two wells could be utilized concurrently to meet demands at peak times if needed.

Wyoming DEQ regulations state that the pressure in the system shall not be allowed to fall below 20 psi under any circumstances. The homes in the upper pressure zone are simply too high in elevation to maintain enough pressure to comply with this regulation. In some cases in the North End system, homes in this zone are at the same elevation as or are above the tank.

A Wellhead Protection Plan has been developed by Weston Engineering for the three North End wells as part of this study. The plan delineates areas that could influence the water quality of the wells and sets forth recommendations to protect the groundwater from future contamination.

The North End Water Users system has approximately 14 miles of transmission pipeline. This includes pipes running from the wells to each of the three storage tanks. The transmission pipelines consist mainly of 4-inch PVC pipe, with some 6 inch PVC pipe. There is a distinct lack of transmission piping running east of the Stutzman tank. Water conveyed to the east through small distribution piping has been the source of low pressure problems at the east end of the system even though the majority of that side of the system has more than adequate static pressures.

The North End system was originally constructed with over 15 miles of distribution piping. In the 1982 addition, over 9 more miles were added. While much of the distribution system performs reasonably well, some locations such as the east side of the service area suffer from low water pressure due to undersized transmission and distribution piping. Pipe diameters in the distribution system range from 1 inch to 3 inches. Small diameter pipes in some locations of the distribution system create bottlenecks that reduce pressure to an unacceptable level. Continued growth on the east side of the service area has driven the demand for water beyond what can be adequately delivered through the existing pipe system.
The North End system water storage facilities currently consist of three bolted, galvanized steel tanks with a combined storage capacity of 200,000 gallons. The 100,000 gallon Faxon tank is located on the west edge of the system near Road Twelve. The 50,000 gallon See tank lies in the northwest area of the system near Road Eleven. Another 50,000 gallon tank to the north adjacent to Road Nine is known as the Stutzman tank.

The See tank was originally constructed in 1964. Due to excessive pitting and rusting of the floor due to the high electrolytic activity of the soils, the tank was replaced in 1998. Inspection of the Stutzman tank revealed severe pitting and rusting on the floor, although the coated metal panels of the tank walls are in moderately good shape in terms of coating integrity. If allowed to continue this rusting and pitting could result in failure and subsequent leakage. This problem will need correction in the near future by full replacement of the tank floor.

The North End system has several apparent needs:

1) The size of piping in the distribution system is generally small and limits the transfer of water to the eastern end of the system.
2) Construction projects subsequent to the original project have negated several of the pressure limiting mechanisms.
3) Maintenance problems and high costs caused the original booster pumps to be taken out of the system, leaving areas of unacceptably low pressures.
4) The system is lacking a strong east west transmission pipeline to efficiently convey water to the eastern end of the system during periods of high usage.

3.0 FUTURE WATER SYSTEM NEEDS

The land within the North End service area is generally used for agriculture and could accommodate a significant increase in population density. Present densities are very low, with only 205 taps in approximately 28 square miles, serving a population estimated at 500 residents. The geography and public ownership of lands surrounding the North End area will prohibit expansion to the west, north, and east. In recent years since the last expansion of the North End system, the number of taps available to water users has been held constant so that the pressure problems experienced in the system would not be intensified.

As the population grows in the service area, drinking water demands will increase. The source of this additional water has been debated in the past, particularly whether the North End users should buy water from another entity. One option to obtain additional water for the North End Water Users system is to configure the existing North End wells to provide more water than they are currently producing. Another option is to buy water from the Shoshone Joint Sunrise Engineering, Inc. North End Water Users Study
Powers Board via the Shoshone pipeline. Water could also be purchased from the nearby Northwest Rural Water District.

WDEQ Water Quality Rules & Regulations, Chapter XII states that a public water system must supply enough water for the design maximum daily demand. Also, a backup source is required, and the system must provide enough for the design average daily demand with the largest source of water out of service. WDEQ sets forth minimums of 125 and 340 gallons per day respectively for the average and maximum daily demand per capita on the system. Using these figures, the system must provide 124 gallons per minute total and 46 gallons per minute with the largest well out of service. These minimums are easily met at this time, as each well can produce 250 gallons per minute. According to the system operator, maximum demands in the summer cause the pump to run approximately 16 hours per day to keep up with demand and replace storage. This calculates to 167 gallons per minute for the maximum demand, which is still easily provided with one pump in operation.

One alternative to using the existing wells as the sole water source is to purchase water from the Shoshone Joint Powers Board. The Shoshone Pipeline has been operating for seven years. Surface water from the Buffalo Bill Reservoir, which is supplied by the North and South Forks of the Shoshone River, is treated and distributed for culinary use. The Shoshone pipeline supplies water to communities and water districts in Park and Big Horn Counties such as Cody, Powell, Byron, Lovell, Deaver, Frannie, and the Northwest Rural Water District.

The Shoshone water treatment plant has a current capacity of 16.5 million gallons per day, and can be upgraded to 22 million gallons per day. To date, the maximum demand has been approximately 4 million gallons per day. To obtain water from the Shoshone Pipeline, a service connection building is required at the tap site. This building will house pressure and backflow control devices and a master meter. There is no initial hook up fee to connect to the Shoshone system. Water rates consist of an equivalent tap fee, which is $8.00 for a ¾ inch tap or equivalent. This amounts to charges of $16.00 for a 1 inch tap, $32.00 for a 1 ½ inch tap, and up based on the amount of water that can pass through the tap as compared to the base ¾ inch tap. Also, a flat rate of $1.29 per 1,000 gallons is charged for all water obtained from the system.

It is important to note that the Shoshone Board has in the past decided against providing water to any system for the purpose of supplying peaking water only. They guarantee the communities that they will have enough water over a twenty-four hour period to meet their demands. In addition to the tapping facility, they require that the entities they serve have their own storage for peaking which the North End system currently has.

Another alternative water source is the Northwest Rural Water District. The District obtains water from the Shoshone Pipeline, and supplies water to various
rural areas in Park County. The area served by the North End system is included
in the O’Donnell service area of the NRWD, but is not served or assessed due to
low population densities and past opposition of North End Water Users. Fees to
customers in the Northwest Rural Water District are a $37.60 customer charge
plus $1.45 per 1,000 gallons with no minimum use flat rate. Water usage over
24,000 gallons incurs a higher rate of $2.90 per 1,000 gallons, and water usage
over 29,000 gallons has a cost of $4.35 per 1,000 gallons.

Although the NRWD gets its water from the Shoshone Pipeline, they would be
willing to provide peaking water to the North End system. According to Dossie
Overfield, manager of the NRWD, the NRWD is willing to charge the North End
Water Users one tap fee with an additional charge for the amount of water used
each month. In comparison, if a Shoshone tap is used, the Shoshone Board have
decided to count all of the North End taps in compliance with their existing rules.

The Stutzman storage tank has immediate rehabilitation needs. The rehabilitation
effort should include removal and replacement of the tank floor. Once this tank is
rehabilitated, no further improvements other than regular maintenance should be
needed for water storage facilities through the planning period. As part of the
rehabilitation project, adequate cathodic protection should be installed. The
degree of protection required differs with the soil type and water content in each
area. An analysis should be performed to determine the type of protection suited
to each site. A field check of the protection should be performed after
construction. The cost of the rehabilitation project is estimated to be $15,000.

4.0 DEVELOPMENT OF ALTERNATIVES

As discussed previously, the impetus behind this study was the lack of adequate
pressure in the eastern portion of the system during periods of high demand. The
second limitation of the existing system is the number of homes that have been
built too high in elevation to be sufficiently served by the storage tanks.

Relocating the See tank to a higher elevation would provide water to the upper
zone at a higher pressure. Water would be pumped from the Faxon tank into the
See tank. The Faxon tank would still be filled by the wells with level control
being provided by the Stutzman tank. The pump for the See tank would be
controlled by the water level in the See tank. Piping for the upper pressure zone
cannot be connected directly to the lower pressure zone. This requires additional
bypass piping to be constructed. A similar option would be to build a new tank at
an elevation higher than the existing tanks instead of relocating an existing tank.

The Northwest Rural Water District pipeline runs within the North End service
area at the western edge of the system. The NRWD system could be tapped at
this location to provide water at a higher pressure.
The original system was designed for boosting the pressure in the upper zone. The system has been subsequently looped and the booster pumps have been abandoned due mainly to maintenance issues. To return to that mode of operation, several pipelines must be severed and new booster pump stations must be constructed.

Pressure at the eastern end of the system could be augmented during periods of high demands through the construction and use of a Shoshone pipeline tap. This alternative would require the construction of a valve building in accordance with the Shoshone pipeline regulation. This building would house a minimum of two check valves for backflow prevention, a pressure regulating valve, and a master meter. In our contacts with Lowell Anderson, manager of the Shoshone Pipeline and treatment plant, he indicated that the board has turned down past requests of communities who wish to augment supply using Shoshone water. The North End Board must make a request to the Shoshone Board and be denied or approved before knowing if this is a viable alternative.

Purchasing water from the Northwest Rural Water District would augment the pressure at the eastern edge of the system much the same as the Shoshone tap. The NRWD tap would require much more pipe to be installed as the NRWD system is not located immediately adjacent to the North End System.

The hydraulic analysis included scenarios for upgrading the distribution system at several locations. The first upgrades to the system created some looping. To complete the looping, this option would require the construction of a new pipeline on Lane Five between Road Eight and Road Nine. Another weak spot in the distribution system would be corrected under this option. The two inch pipe on Lane Six between Road Six and Road Eight would be replaced.

Looking at the cost per connection per month, the least cost alternative for the upper zone situation is relocating the See tank. For the low pressures on the east side of the system, the Distribution System Upgrade and the Shoshone Pipeline tap are similar in cost.

Both of the east alternatives have their advantages. To aid in the selection of the best east alternative, the following table was developed. The advantages of each option are listed and allow a comparison based on merit.

**Distribution System Upgrade**

**Advantages**

- Increases east/west flow – System integrity would be significantly improved by the construction of a strong east/west transmission line.
- Replaces old lines – The new pipe would be gasket joint PVC to replace the older style glued joint PVC. This allows for much more expansion and contraction without as much stress on the joints.
Shoshone Pipeline Tap

Advantages

Expandable for growth – The amount of water drawn from the tap may be adjusted to accommodate growth at the eastern end of the system.

Secondary source of water – Should the need arise, the tap is capable of providing a significant amount of water to the system.

Flexibility – In the event that a significant development be proposed for the east side of the system, the tap could be used as a primary source of water for the development.

Cost – The cost per connection per month will be slightly less if the Shoshone Board approves the suggested tap fee scenario.

Equipment Savings – Purchasing a portion of the needed water from the Shoshone Pipeline will allow the demand on the existing wells to remain moderate. Thus, the current mode of operation wherein only one well operates at a time should remain viable well into the future.

The advantages of the Shoshone tap outweigh the advantages of the distribution system upgrade. The distribution system is still undersized and will not provide much east/west transfer of water without the upgrade, but the Shoshone tap limits the need for west to east transfer of water. This reduces the friction loss which results in lower than acceptable pressures on the east side.

The Shoshone tap allows much more flexibility in serving the future needs of the system. If a significant development is built on the east side, the water for that development can come directly from that source. Should development occur on the west side, water will be intercepted and used before it can move to the east. In this case, the pipeline tap would begin to serve more on the east side to make up for the shortage. Therefore, the recommended alternative for the eastern end of the system with its dynamic pressure situation is the Shoshone Pipeline tap.

The Stutzman tank is in need of immediate assistance. This was not analyzed as part of any alternative as it is needed in any case.

5.0 COST ANALYSIS OF RECOMMENDATIONS

As discussed in the previous section, the selected alternative involves two sub-projects. The first involves the relocation of the See tank to a location near the Faxon Tank. The second entails constructing a tap into the Shoshone pipeline to boost pressures at the east end of the system during periods of high demand.

The relocation of the See tank to a higher elevation will allow it to serve the upper zone via gravity. Water for this zone will be pumped from the Faxon tank to the See tank using pumps and pipes that will also be constructed as part of this project. A level sensor in the See tank will be connected via telemetry to the pump. The pump and controls will be located at the Faxon tank. As the pumps
draw water from the Faxon tank, causing the water level in the tank to drop, the level in the Stutzman tank will also drop. The Stutzman tank will signal the wells to turn on and the wells will fill both the Faxon and Stutzman tanks.

This upper zone separation will entail physically severing the pipeline from Zone B at several locations. It will also require additional piping to tie the upper zone’s piping together. Piping must also be installed to connect the Faxon tank to the lower pressure zone. The cost of this project is estimated to be $535,000.

The Wyoming Water Development Commission has required the cost to be broken into three components:
1. 60% WWDC grant eligible for new construction
2. 50% WWDC grant eligible for rehabilitation
3. Loan (20 years, 7.25% interest) for remainder after grant

For the tank relocation option, the funding is as follows:

<table>
<thead>
<tr>
<th>Cost of Improvements</th>
<th>$535,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grant (60%)</td>
<td>$237,000</td>
</tr>
<tr>
<td>Grant (50%)</td>
<td>$70,000</td>
</tr>
<tr>
<td>Loan</td>
<td>$228,000</td>
</tr>
</tbody>
</table>

Figure 5.1 shows the preliminary design of the severing of the upper zone and the relocation of the See tank.

The following table shows the end user fees for the loan as well as for the operation and maintenance of the system for the tank relocation option.

<table>
<thead>
<tr>
<th>Monthly Loan Payment (7.25%, 20 years)</th>
<th>$1,828.46</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly User Cost</td>
<td>Divide by 205 users $8.92</td>
</tr>
<tr>
<td>Monthly Operation and Maintenance</td>
<td>Divide by 205 users $200.00</td>
</tr>
</tbody>
</table>

**Total for Tank Relocation Option** $9.89 per connection per month

Pressure at the eastern end of the system could be augmented during periods of high demands through the construction and use of a Shoshone pipeline tap. This tap would be set to monitor pressures in the North End system. When the pressure drop reaches a preset low, the valve would open. This would increase the system pressures and maintain them at the preset amount.

The Shoshone tap allows much more flexibility in serving the future needs of the system. It will serve the system with water as required for new developments at either end of the system. The amount of water purchased from the Shoshone
Pipeline is adjustable through the setting of the PRV valve. This valve will sense the pressure in the North End system. As the pressure drops below the PRV setting, the valve will begin to open. As the North End pressure continues to drop, the valve will continue to open, allowing more water to enter the system.

For the Shoshone Pipeline tap option, the funding is as follows:

<table>
<thead>
<tr>
<th>Cost of Improvements</th>
<th>$160,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grant (60%)</td>
<td>$96,000</td>
</tr>
<tr>
<td>Grant (50%)</td>
<td>$0</td>
</tr>
<tr>
<td>Loan</td>
<td>$64,000</td>
</tr>
</tbody>
</table>

Figure 5.1 shows the preliminary design of the Shoshone Pipeline tap.

The following table shows the end user fees for the loan as well as for the operation and maintenance and water purchasing estimates of the system for the Shoshone Pipeline tap option.

<table>
<thead>
<tr>
<th>Monthly Loan Payment (7.25%, 20 years)</th>
<th>$513.25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly User Cost</td>
<td>$2.50</td>
</tr>
<tr>
<td>Monthly Operation and Maintenance</td>
<td>$515.00</td>
</tr>
<tr>
<td>Total for Shoshone Pipeline Tap Option</td>
<td>$5.01 per connection per month</td>
</tr>
</tbody>
</table>

As part of this report, the Stutzman tank was inspected. The floor of the tank is severely rusted with the rust having eaten away the upper layer of metal in several places. The See tank experienced similar rust and was replaced in 1998.

For the Stutzman Tank Rehabilitation, the funding is as follows:

<table>
<thead>
<tr>
<th>Cost of Improvements</th>
<th>$15,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grant (60%)</td>
<td>$0</td>
</tr>
<tr>
<td>Grant (50%)</td>
<td>$7,500</td>
</tr>
<tr>
<td>Loan</td>
<td>$7,500</td>
</tr>
</tbody>
</table>
The following table shows the end user fees for the loan to complete the Stutzman Tank Rehabilitation.

<table>
<thead>
<tr>
<th>Monthly Loan Payment (7.25%, 20 years)</th>
<th>$60.15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly User Cost</td>
<td>Divide by 205 users</td>
</tr>
<tr>
<td>Monthly Operation and Maintenance</td>
<td>Divide by 205 users</td>
</tr>
<tr>
<td><strong>Total for Stutzman Tank Rehabilitation</strong></td>
<td><strong>$0.29 per connection per month</strong></td>
</tr>
</tbody>
</table>

6.0 CONCLUSIONS AND RECOMMENDATIONS

With pressures lower than acceptable in significant parts of the system, the North End Water Users should take steps to overcome the two causes of the low pressures. The upper zone has lower than acceptable pressures due to the elevation of the distribution system and users in relation to the tanks. The eastern end of the system experiences low pressures during periods of high demands. The water flowing to the eastern end of the system must flow through several miles of small diameter pipes, which causes a substantial pressure drop to occur.

It is the recommendation of this study that the upper zone be isolated and supplied with water from the relocated See tank. It is also recommended that a tap to the Shoshone Pipeline should be installed to supplement pressures at the east end of the system.

The Stutzman tank is in need of immediate attention. The floor of the tank is rusted through in several locations. This was not analyzed as a separate option since it must be completed regardless of the other alternatives.

For the North End Water Users to qualify for assistance from either the WWDC or from the Wyoming State Land and Investment Board, they must form a district. Since the process of forming a district can be very time consuming, it is advisable for the North End Board to start the process as soon as possible.