ROCK SPRINGS PIPELINE
EXECUTIVE SUMMARY
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FIGURE 1.1
LOCATION MAP

PROJECT LOCATION

GREEN RIVER
CASPER
WYOMING
MONTANA
IDAH0
UTAH
COLORADO
SOUTH DAKOTA
NEBRASKA
CASPER
GREEN RIVER
ROCK SPRINGS/RELIANCE
RAWLINS
LARAMIE
CHEYENNE
1.0 INTRODUCTION

1.1 PROJECT HISTORY

The cities of Green River and Rock Springs have obtained their domestic raw water supply from the Green River for approximately 100 years. This raw water is pumped approximately ½ mile to the Green River Treatment Plant. The treated water is then pumped to distribution points at each city respectively. In the case of Rock Springs, the treated water is piped approximately 14 miles from the treatment plant to the Blairtown clear well pump station located on the west side of the City.

Available record drawings indicate the first major Rock Springs pipeline to have been 8-inch cast iron constructed in 1887. This pipeline was subsequently replaced with 12-inch cast iron in 1920 and 1948 under the ownership of Western Wyoming Utilities Company. In 1961 the entire Green River/Rock Springs water system was purchased by Pacific Power and Light Company (PP&L). PP&L replaced the 12-inch transmission line with 20-inch asbestos cement (AC) pipe under a segmented construction program from 1968 to 1971. Presently, the entire population of Rock Springs and Reliance is completely dependent on the single 20-inch AC pipeline to supply their domestic water needs.

The 20-inch pipeline was initially energized by pumps at the Green River treatment plant and the Middle Kanda pump station (located approximately midway in the pipeline). In 1979, Middle Kanda pump station was upgraded and two new pump stations (East and West Kanda) added to meet the increased demands on the system. In spite of the additional pumping capacity, the City of Rock Springs experienced water shortages and was forced into alternate-day use during the summers of 1986, 1987, and 1988.

In 1986, the legislature authorized funding for the purchase of the entire water supply, treatment, and distribution system from PP&L by the Green River-Rock Springs-Sweetwater County-Joint Powers Water Board. The Joint Powers Water Board sponsored a system evaluation and inventory prior to negotiations with PP&L. In this evaluation performed by CH2MHiIl, a 35% "lost capacity" in the Rock Springs pipeline was noted. The Joint Powers Water Board and the City of Rock Springs recognized the Rock Springs pipeline as the single most expensive element and a critical "weak link" in the system. Application was made to the Wyoming Water Development Commission to examine the problems associated with the existing pipeline and to consider the feasibility of constructing a second pipeline. This application was approved and funding authorized in the 1988 legislative session.

1.2 STUDY AREA

The study area focuses primarily on The City of Rock Springs and adjacent outlying subdivisions. The present service area of the Rock Springs pipeline includes the City of Rock Springs, Reliance, Sweets subdivision, Kanda subdivision, and the Chevron fertilizer
plant east of Rock Springs. Three significant subdivisions, Clearview Acres, White Mountain (Mountain-air), and Stassinos (including other minor development north of White Mountain) are not presently served. These subdivisions are presently served by shallow wells of questionable reliability and water quality. Additionally, the Sweetwater County Trap Club and Crossroads West Park are not connected to the system. This study is based on the premise that all these areas will eventually be connected to the water system.

Any increase in the capacity of the Rock Springs pipeline may necessitate a corresponding increase in the capacity of the Green River raw water intake facilities. Since this facility also supplies the City of Green River, population projections and consumptive water use for the Green River area were also examined as part of this study.

1.3 AUTHORIZATION

Authorization for the Rock Springs Pipeline Level II Study was granted by contract between Forsgren Associates (formerly Forsgren-Perkins Engineering) and the Wyoming Water Development Commission dated June 24, 1988. This contract was amended November 14, 1988 to include the evaluation of the Green River raw water intake facility and again on June 24, 1989 to include a more detailed evaluation of the Stassinos and White Mountain water supply needs.

1.4 STUDY OBJECTIVES AND SCOPE

Initially five major objectives for the Rock Springs pipeline Level II Study were established as follows:

1. Determine the feasibility of constructing a second pipeline from the Water Treatment plant located in Green River, to the City of Rock Springs and other outlying areas, with and without connections to new water users located along the route.

2. Determine a feasible location for the proposed pipeline. (A new pipeline corridor may be preferred over the existing utility constrictive corridor that parallels Interstate 80).

3. Develop preliminary cost estimates and designs for alternate pipeline routes, different construction methods, alternate materials, and various service area scenarios.

4. Develop conceptual cost estimates and designs for the preferred alternative.

5. Conduct an economic analysis for the proposed pipeline.

As the study progressed, it became increasingly clear that the other water issues pertinent to the Rock Springs area should be included in this study. Specifically, these additional issues were added to this study as follows:
6. Evaluate water supply and storage needs for the North Rock Springs Area to accommodate existing and future development including areas not presently served.

7. Evaluate transmission and storage needs of the Eastside Rock Springs area as this area is precariously supplied through the distribution network (as opposed to a direct transmission feed).

8. Evaluate the adequacy of the Green River Raw Water Intake facility. Consider alternative modification or replacement of that facility to meet the total Green River/Rock Springs area needs.

This study was conducted in two phases. Phase I (completed December 1988) included an investigation of the existing pipeline and a feasibility study for a second pipeline. After selection of the "best" pipeline alternative, Phase 2 is intended to include an economic analysis, conceptual design, conceptual cost estimates, and a public hearing to present the study findings and conclusions. A detailed description of the project requirements can be found in the text of the contract between Forsgren Associates and Wyoming Water Development Commission and has not been included herein for brevity.

This final report contains the Phase 2 findings along with pertinent and updated sections of the Phase 1 report. It should be noted that some of the Phase 1 recommendations were modified to reflect community comments, concept refinement, etc.
2.0 PROJECT SPECIFICS

2.1 IDENTIFICATION OF WATER USE

2.1.1 Population Data

Because of the cyclical "boom-bust" economy of the past two decades, reliable population data was difficult to obtain. Data taken from the Sweetwater County Population Projections (Jan 1987), Wyoming Population and Employment Forecast Report (Jan 1988), and the Wyoming Data Handbook (1987) were found to be conflicting and uncertain. As a verifying check on present populations in Green River and Rock Springs, Sweetwater Cable TV Co. was contacted to determine the actual number of homes served within each community. Using these four sources, it was concluded that the 1988 population of the Rock Springs area was between 20,260 and 23,300 people of which approximately 12 1/2% are not presently served by the municipal water system. The population of the Green River area is estimated to be between 13,230 and 14,960 people.

The probable growth rate in the Green River/Rock Springs area is highly dependent on economic conditions. This fact resulted in a "boom" growth of 5 to 10% annually during the 1970’s and a stagnant (or negative) growth rate during the 1980’s. Given the relatively stable soda ash, fertilizer, and power industries now driving the area’s economy, it was subjectively decided that an average 1% annual growth rate would be reasonable and prudent for designing and planning any water system improvements. This 1% annual growth rate was accepted by the consensus of the Joint Powers Water Board, WWDC Staff, and Forsgren Associates for the assumptions of this study.

2.1.2 Domestic Water Consumption

Rock Springs/Green River water system operators have diligently maintained daily records of each community’s water use for many years. These records are based on master meter readings at the Green River water treatment plant. There was, however, valid concerns about the accuracy and reliability of the these master meters. As a check on the Rock Springs meter, therefore, field measurements were taken on the Rock Springs transmission pipeline using a manometer and pito rod during high and low flow conditions. These measurements, repeated one year later using an ultra-sonic meter, revealed that the Rock Springs master meter was registering approximately 25% low. These low readings account for nearly all of the "lost capacity" noted in CH2M Hill’s report on the system. The Green River master meters were felt to be reasonably accurate and reliable. It should be noted that the Green River and Rock Springs master meters were replaced in November of 1988.

The 1988 water records (as adjusted) were used as a basis for the projections of this study. This year was selected as a base year because of the reliability of the data and the fact that it was a relatively dry year. Water consumption was assumed to increase at an average of 1% annually to match population increases. It was also assumed that those portions of the Rock Springs area not presently served will be connected to the system when an adequate water source...
supply is available. Each of these areas has already taken positive action towards that end. A summary of present and future water needs is shown in Tables 2.1 and 2.2 herein.

2.2 WATER RIGHTS

The Green River and Rock Springs areas presently rely on direct flow water rights from the Green river. Their original 1871 permit (4 CFS) and their 1st 1928 enlargement (6 CFS) will provide a legally secure supply to the communities. Subsequent enlargements of 10 CFS each in 1978 and 1980, however, are not senior to Fontenelle Reservoir. The further allocation of Fontenelle storage could result in water administration under which the annual refilling of Fontenelle Reservoir will impact the effectiveness of the two later enlargements. It is clear that the Joint Powers Water Board will need to secure their legal supply through the acquisition of more senior direct flow rights or the purchase of Fontenelle storage to meet present and future needs.

The Joint Powers Water Board has already taken steps to firm up their legal water supply. The Board has entered into a contract with Crank Engineering to explore water rights options and to implement the preferred alternative(s). In addition, filings will be made to update and define the actual area served by the system.

2.3 CONDITION AND CAPACITY OF EXISTING FACILITIES

2.3.1 Existing Rock Springs Pipeline

The existing Rock Springs Pipeline consists of approximately 73000 linear feet of 20-inch asbestos cement pipe. The present line was constructed in segments between Green River and Rock Springs from 1968 to 1971. The initial system was energized by two pump stations at Green River and Kanda (approx. midway along the line). As growth occurred in Rock Springs and demands increased, two additional pump stations were added. They became known as East and West Kanda respectively.

In September of 1988, a detailed hydraulic analysis was performed based upon actual field-measured conditions. The pipeline was accurately surveyed to determine grade elevations. Line taps were made near the Green River treatment plant and the East Kanda pump station to accurately measure flows. A two hour pump test was then performed with controlled "peak flow" and "low flow" scenarios. Pressure readings were also taken at two minute intervals at the suction and discharge side of each pump station. From this data, it was possible to determine meter accuracies, pump efficiencies, pipeline roughness, etc. The following significant conclusions were made regarding the existing pipeline:

- The pipeline material is in reasonably good condition. No significant leakage was noted indicating the transmission line is "tight". It is our opinion that the existing pipeline could remain in use for at least another 30 years without serious problems.

- The pipeline is presently operating at or near it's full capacity 24-hours per day throughout the summer months. It is not feasible (or cost effective) to continue to add pump stations in order to meet new demands imposed by the system (See figure 2.1).
# TABLE 2.1

## ROCK SPRINGS AREA WATER USAGE PROJECTIONS

(ROCK SPRINGS PIPELINE)

### PRESENT CONSUMPTION

(YEAR 1988)

<table>
<thead>
<tr>
<th></th>
<th>Existing Service Area</th>
<th>*w/Future Service Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MGD</td>
<td>Gal/Capita/Day</td>
</tr>
<tr>
<td><strong>Peak Day</strong></td>
<td>9.78</td>
<td>469 - 537</td>
</tr>
<tr>
<td><strong>Average Summer Day</strong></td>
<td>8.52</td>
<td>408 - 468</td>
</tr>
<tr>
<td><strong>Average Annual Day</strong></td>
<td>5.35</td>
<td>278 - 284</td>
</tr>
</tbody>
</table>

*Includes White Mountain, Clearview Acres, and Stassinos

### FUTURE CONSUMPTION

(YEAR 2020 INCLUDING AREAS NOT PRESENTLY SERVED)

1% Growth Rate

<table>
<thead>
<tr>
<th></th>
<th>MGD</th>
<th>Gal/Capita/Day</th>
<th>GPM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Peak Day</strong></td>
<td>15.14</td>
<td>469 - 537</td>
<td>10510</td>
</tr>
<tr>
<td><strong>Average Summer Day</strong></td>
<td>13.19</td>
<td>408 - 468</td>
<td>9160</td>
</tr>
<tr>
<td><strong>Average Annual Day</strong></td>
<td>8.26</td>
<td>248 - 284</td>
<td>5740</td>
</tr>
</tbody>
</table>
### TABLE 2.2

**TOTAL GREEN RIVER AND ROCK SPRINGS WATER USAGE PROJECTIONS**

(GREEN RIVER INTAKE FACILITIES)

**PRESENT CONSUMPTION**

(YEAR 1988)

<table>
<thead>
<tr>
<th></th>
<th>GREEN RIVER AREA ONLY</th>
<th>*GREEN RIVER AND ROCK SPRINGS AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MGD</td>
<td>Gal/Capita/Day</td>
</tr>
<tr>
<td>Peak Day</td>
<td>6.04</td>
<td>404 - 456</td>
</tr>
<tr>
<td>Average Summer Day</td>
<td>4.82</td>
<td>321 - 363</td>
</tr>
<tr>
<td>Average Annual Day</td>
<td>2.44</td>
<td>163 - 184</td>
</tr>
</tbody>
</table>

**FUTURE CONSUMPTION**

(YEAR 2020 - 1% GROWTH RATE)

<table>
<thead>
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<th></th>
<th>GREEN RIVER AREA ONLY</th>
<th>*GREEN RIVER AND ROCK SPRINGS AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MGD</td>
<td>Gal/Capita/Day</td>
</tr>
<tr>
<td>Peak Day</td>
<td>8.30</td>
<td>404 - 456</td>
</tr>
<tr>
<td>Average Summer Day</td>
<td>6.63</td>
<td>321 - 363</td>
</tr>
<tr>
<td>Average Annual Day</td>
<td>3.35</td>
<td>163 - 184</td>
</tr>
</tbody>
</table>

*Includes Reliance, White Mountain, Clearview Acres, and Stassinos.
PUMPING VS CAPACITY
EXISTING 20° AC PIPELINE

2020 PEAK DAY - 15.14 MGD
(VEL - 10.7 fps)

2020 AVE. SUMMER DAY - 13.14 MGD
(VEL - 9.3 fps)

1988 PEAK DAY INCLUDING AREAS NOT SERVED - 11.01 MGD
(VEL - 7.8 fps)

1988 PRESENT PEAK DAY - 9.78 MGD
(VEL - 6.9 fps)

DESIRABLE OPERATING RANGE
(VEL - 2.8 TO 5.0 fps)

1988 AVE. SUMMER DAY - 8.52 MGD (VEL - 6.8 fps)

PIPEDLINE FLOW (MGD)

PUMPING_REQ'D (BRAKE HORSE POWER)

FIGURE 2.1
Although the pipeline capacity is somewhat less than would be expected, this difference is substantially less than the 35% "lost capacity" previously noted in the CH2MHILL report. It was determined, rather, that the Rock Springs meter was simply reading low. The inefficiencies evident in the pipeline appear to be evenly distributed throughout the pipeline. Trying to identify and correct these inefficiencies would not, in our opinion, be cost effective or practical. Nor would such improvements provide the additional capacity need to meet even the expected short term demands on the system.

The pump stations were found to be operating at nearly 70% efficiency during peak flow conditions. Although these pumps have been consistently maintained, they are inherently inefficient due to poor pump matching, throttling valves to decrease flows during low demand periods, and the lack of adequate peaking storage to allow optimal pump operation.

It should be noted that the existing Rock Springs Transmission facilities represent a very high risk for service interruption to Rock Springs. Presently there is no reserve power supply at any of the pump stations. The severity of this problem was illustrated September, 1988 when a blown transformer resulted in service interruption for two days! It was fortunate that these days were unseasonably cold and rainy causing system demands to be low. As a second consideration, the reliance on a single pipeline (without adequate back-up storage in Rock Springs) requires that the community's water supply be interrupted for line breaks and occasionally, routine line maintenance.

It is our opinion that the Rock Springs Pipeline is already operating at capacity and that a second pipeline is essential to meet the future needs of the area. This second pipeline is also essential to meet the drinking water needs of those areas not presently served (i.e. White Mountain, Clearview, and Stassinos).

2.3.2 Rock Springs Distribution Facilities

It is understood that distribution facilities improvements, per se, are outside the accepted criteria for WWDC funding eligibility and outside the intended scope of this study. However, a basic understanding of the Rock Springs distribution system is essential when considering the relative benefits and impact of proposed transmission and storage improvements.

The entire Rock Springs water supply is presently delivered to a small clear well in the Blairtown area. From this small tank, the water is pumped into the distribution network where it is in turn pumped to 14 individual service zones! The creation of these zones was generally necessitated by the lack of adequate transmission piping and storage facilities. Typically each successive zone is supplied through a booster pump that draws water from an adjacent lower zone or tank. This has resulted in a precarious balance between available pressures, reservoir levels, pump delivery capacities, and zone demands. Poor system reliability and efficiency represent serious concerns from the standpoint of operational cost and public safety.
2.3.3 Raw Water Intake Facilities

The raw water supply for the Green River/Rock Springs water system is taken from the Green River approximately 2000 feet upstream of the treatment plant. The intake structure consists of a three-cell wet well with 24-inch culverts extending into the river. Trash racks and moving screens are used to remove debris from the raw water. The raw water is in turn pumped from the wet well by 8 vertical turbine pumps through dual 16-inch cast iron pipelines to the treatment plant.

All of the intake components, including the raw water transmission lines, were constructed in 1947 and have remained virtually unchanged since that time. Only the pumps appear to have been consistently maintained. The raw water transmission piping is badly corroded and unreliable. The eight intake pumps, cumulatively rated at 16000 GPM, are barely able to keep up with present day peak demands estimated to be 11000 GPM due to the excessive roughness of the pipeline. Coincidentally, the original design drawings indicate a facility design capacity of about 11000 GPM during low flow in the river.

Under present conditions, the Green River channel must be periodically diked to insure adequate water elevation to feed the wet-well. Icing and debris in the trash racks are a continual problem during certain times of the year. Another problem includes under-floor piping making pump maintenance difficult and unsafe. In general, the existing facilities are aging, deteriorated, and under-capacity. It is clear that these facilities must be upgraded and/or replaced to adequately and reliably meet the demands placed on the system.

2.4 AREAS NOT PRESENTLY SERVED

It is estimated that approximately 12 1/2% of the Rock Springs area population is not presently served by a municipal water system. These areas are all located north of the city and include the Clearview, White Mountain, and Stassinos subdivisions. The residents of these areas rely upon shallow wells to meet their domestic water needs. In recent years, these wells have become increasingly less reliable as the areas groundwater table has been pumped down. In addition to the questionable reliability of the area's groundwater supply, there is also a great deal of concern about the quality of the well water. This fact is illustrated by the fact that many of the area's residents drink only bottled water.

Each of these subdivisions have already formed political districts to deal with the legal issues involved with the funding and operation of a water system. Each District has formally expressed their desire to be included in this study and, if feasible, to be supplied by the Joint Powers Water Board via the Rock Springs pipeline. It is our opinion that connection to the Joint Powers Board system is clearly the most cost effective and reliable source of supply to these areas. In this report, therefore, it was presumed all these Districts will be connected to the system when an adequate water supply is available. Two of these areas, Stassinos (10-Mile Water and Sewer District) and White Mountain will be required to construct a distribution system independent of the funding associated with this project.
3.0 CONCLUSIONS AND RECOMMENDATIONS

3.1 SUMMARY OF SYSTEM CONCERNS

In our investigation of the Rock Springs water supply system, several significant problems and concerns became evident. These concerns are summarized as follows:

3.1.1 Inadequate Supply Capacity

As indicated in Chapter 2.0, the Rock Springs transmission pipeline is already operating at its peak capacity 24 hours per day throughout most of the summer months. In addition, the Green River raw water intake facility is also operating at or near its capacity during much of that same period. This has resulted in periodic water rationing during past summers. Perhaps more important, however, is the fact that the intake facility and transmission system cannot accommodate any growth or additional service areas without impacting present users. This is particularly significant to those areas of Rock Springs which are presently not served by the system. The severity of the problem is best illustrated by the Clearview District which has been forced to truck in drinking water to supplement their inadequate well water supply during the past three summers.

It is also important to recognize that the present water supply system represents a limiting factor to economic growth in the area. This inability to accommodate economic expansion can, in our opinion, have significant negative impact to the overall economic well-being of the area.

3.1.2 Excessive Pumping Costs

It is clear that the existing Rock Springs Transmission line is inefficiently sized to meet even present demands. In the past, it was standard practice to simply add pumps to help push larger volumes of water through the line to meet higher demands. This practice has resulted in substantially higher power costs than would be required in a larger, more appropriately sized pipeline.

The Rock Springs transmission and distribution system presently depends on 18 individual pump stations, most of which are in constant operation. Obviously, these pump stations represent a substantial maintenance cost. Perhaps even more costly is the increased power consumption due to poor pump efficiencies, circulation pumping between zones, etc. It should also be noted that PP&L’s rate structure is such that, the use of multiple pump stations (as opposed to just a few pumping locations) results in significantly higher power costs even though the actual energy consumption may be the same. This is an excellent incentive for the Joint Powers Water Board to eliminate pump stations from the system wherever it is reasonable to do so.
It appears that the addition of adequate dedicated transmission lines and peaking storage in Rock Springs can result in the cumulative elimination of 11 of the 18 existing pump stations.

### 3.1.3 Poor System Reliability / Potential Service Interruption

There is a great deal of concern about the high potential for extended service interruption to both Rock Springs and Green River in the event of power interruption, transmission line breakage, or other catastrophic event. Of course, this possibility represents a significant risk to public health and safety in the two communities. Typically, the numerous pump stations within the system are without a reserve power supply. Three zones in Rock Springs are "hard-pumped" continuously just to maintain safe water pressures. This condition raises serious questions about the ability to provide adequate fire protection to schools (and a hospital) within these zones. Much of the existing storage is undersized and/or elevated low to provide adequate reserves for an extended interruption of supply during the summer months. The potential for service interruption is increased by the aging and deteriorating components within the system. This is particularly true of the intake facility and raw water transmission piping. The severity of the problem was illustrated September 1988 when a blown transformer at the Green River treatment plant resulted in a two-day service interruption to both communities.

It is felt that the question of system reliability can be addressed in three ways:

1. Eliminate pump stations where reasonable through the construction of appropriate transmission piping and peaking storage.

2. Provide centrally located back-up storage in Rock Springs to meet the needs of the community in the event of supply interruption. An average peak day's use is felt to be appropriate to allow adequate response time for maintenance crews to restore service under most circumstances.

3. Consider duplication of the more critical system components. This could include dual transmission lines, back-up power, etc. The implementation of item No. 2 above would, however, minimize the need for system component duplication.

### 3.2 RECOMMENDED IMPROVEMENTS

The following improvements are recommended for the Rock Springs water supply and transmission system. An overview of the recommended project is shown in Figures 3.1 and 3.2 herein.
ROCK SPRINGS PIPELINE LEVEL II STUDY

THE STATE OF WYOMING

RECOMMENDED PROJECT OVERVIEW

PROPOSED FACILITY LEGEND

- PROPOSED PIPELINE
- TANK
- PUMP STATION

ROCK SPRINGS - FIGURE 3.1
CITY OF ROCK SPRINGS
PROPOSED SERVICE ZONES AND SYSTEM COMPONENTS

FIGURE 3.2
3.2.1 **Rock Springs Transmission Line**

3.2.1.1 **New Pipeline**

The following recommendations are made regarding the construction of a second Rock Springs Pipeline:

a. Obviously, larger diameter pipelines are more expensive to construct than smaller pipelines. It is less expensive, however, to pump water through a larger pipeline due to reduced frictional energy losses. Based on the lowest over-all 30-year present worth construction and operational cost it is recommended that a new 30-inch diameter, wrapped, mortar-lined steel pipeline be constructed (see figure 3.3).

b. A new 4 MG peaking storage facility should be constructed in the Blaitown area and filled directly from the new pipeline. This storage facility would replace existing deteriorated tankage in need of repair and greatly enhance operational efficiency and simplicity of the system. Optimal elevation of this storage is estimated to be 6440 to best meet the pressure needs of the base zone.

c. The recommended 30" transmission pipeline routing runs North out of Green River crossing I-80 at Cemetery Road. The proposed pipeline runs North of I-80 and then crosses back to the South near the Sweets area (See Figure 3.1). This general routing was evaluated in the Phase 1 study and was selected in a public meeting by consensus of representatives of the City of Green River, the City of Rock Springs, the Joint Powers Water Board, and WWDC.

d. Provide a cathodic protection system to extend the life of the proposed 30-inch pipeline. Careful coordination must occur with the many other oil & gas companies presently using the same corridor to insure that these cathodic systems can coexist without detrimental influence to each other.

e. The new pipeline should be energized by a single pump station at Green River thereby eliminating the three Kanda pump stations. This pump station would include two 3500 gpm and two 2000 gpm vertical turbine pumps to meet peak flows and provide flexibility in operating the system. The proposed improvements will also allow the future elimination of the Sweets, Industrial, and Blaitown stations.

3.2.1.2 **Existing Pipeline**

It is recommended that the existing pipeline remain in service along with the new pipeline as long as economically feasible. The continued use of this line will decrease energy costs, provide a back-up supply line, and act as a "tapping" line to maintain the integrity of the new pipeline. The three Kanda booster pump stations should be abandoned. Small sections of the existing 20-inch line may require replacement if
under-classed for the proposed system modifications.

3.2.2 North Rock Springs Supply

The area north of Interstate-80 represents the highest growth potential in the Rock Springs area. The northside residents presently rely upon a series of 5 service zones, 4 booster pump stations, and a complicated network of distribution piping to meet their domestic water needs. The system is a precarious balance between booster pumping, available storage, and demands within the distribution network. Available pressure within the system generally dictates the operation of the booster pumps.

Of more importance, is the fact that much of the Northside area is not presently served by a domestic water system. This problem is compounded by poor quality and dwindling ground water availability. These unserved areas include White Mountain Water and Sewer District, Clearview Improvement District, the proposed 10-mile Water and Sewer District (Stassinos), and the Sweetwater County Trap Club & County Park Facility.

The recommended Northside transmission supply lines and storage reservoirs are intended to provide service to all Northside residents, allow for future growth and development, increase system reliability (and public health and safety), and reduce operational problems and expenses.

3.2.2.1 Creation of new "Wind River" Service Zone

It is recommended that all of the area North of I-80 between elevations 6300± to 6400± be consolidated into a single service zone. This area is presently divided into three service zones due to the lack of direct transmission supply lines to the North. The consolidation of these zones will simplify system operation and maintenance while increasing the over-all reliability of the system. Specifically, the following improvements are recommended:

a) Construct a new 18-inch, C-900 PVC transmission pipeline from the present Industrial pump station location to the Wind River Tank.

b) Construct a new 16" C-900 PVC transmission pipeline from the Wind River tank to the South East corner of the White Mountain Water and Sewer District (SE corner of section 19).

c) Provide tie to existing 12-inch line feeding the Northpark Elementary School. This line will provide a backfeed to the east side of the proposed Wind River zone (presently the Outlaw service zone).

d) Consider elimination of Elk Street and Outlaw pump stations based on new direct northside feed. Verify from system computer model and/or experimentation that distribution is adequately sized to meet peak needs under this scenario prior to dismantling these pumps. College Hill tank must be tied to Gateway tank.
FUTURE 30-YEAR REPLACEMENT OF 20' AC LINE

TOTAL 30-YEAR P.W. COST

OPTIMAL PIPE SIZE = 30'

PIPING/PUMP STATION CONSTRUCTION COST

PIPE DIAMETER

30-YEAR P.W. ENERGY COST

30-YEAR COMPARITIVE D & M

4 MG BLAIRSDOWN TANK CONSTRUCTION

ROCK SPRINGS PIPELINE

OPTIMAL PIPE SIZE

FIGURE 3.3
(with a level-controlled valve) prior to the elimination of the Elk Street pump station.
e) Consider elimination of Lionkel Reservoir if or when it’s useful life is reached.
f) Eliminate Industrial wet well. Provide three matching in-line pumps at this location to feed Wind River zone. These pumps should be appropriately sized to efficiently meet peak-day demands using two pumps with the third pump in reserve.

3.2.2.2 White Mountain Water and Sewer District

It is recommended that the White Mountain Water and Sewer District be directly supplied from the proposed Northside transmission pipeline discussed above. This White Mountain supply will include the following:

a) Construct new 2 MG tank on the Mountain side near the West end of Mesa Drive in White Mountain. The recommended tank elevation is 6860 based on direction from the District’s engineer.

b) Construct a new 14" C-900 PVC pipeline from the Southeast corner of the White Mountain District running north to Mesa Drive to the proposed tank.

c) Construct a new pump station near the Southeast corner of the District to meet the new tank. This pump station would consist of three matching in-line pumps (two for peak needs plus one for back up). A PRV controlled by pass line is also recommended at this location such that the proposed White Mountain storage would be available to the Wind River Zone during fires or other unusually high demand periods.

d) The White Mountain District will need to construct a distribution system funded independently from this project. The District presently has an engineer under contract to design this system.

3.2.2.3 Clearview Improvement District

The Clearview District is presently facing a severe summertime water shortage that requires supplemental water to be trucked into their tanks. It is recommended, therefore, that Clearview be serviced from the Wind River zone directly off the proposed Northside transmission line. Until recently, the District’s distribution system was not well documented. An evaluation of this system was performed by JFC Engineering. The system, with some minor improvements, the system was deemed to be safe by the Wyoming DEQ. Clearview presently has two 10,000 gallon standpipe tanks that are constructed too low to adequately pressurize the system without booster pumping. These tanks (both of which are in poor structural condition), and the associated booster pumps can all be abandoned when this new connection is made.
3.2.2.4 Stassinos (10-mile Water and Sewer District)

The newly-formed 10-mile Water and Sewer District generally includes all development adjacent to Yellowstone Road between the White Mountain District and the Stassinos subdivision (Stassinos included). The following recommendations are made concerning the 10-mile District:

a) Construct a new 0.15 MG tank on the mountain side immediately west of the Stassinos subdivision. The recommended elevation of this tank is 6820.

b) Construct an 8-inch, C-900 PVC transmission line from the corner of Mesa Drive and Yellowstone road in White Mountain to the proposed Stassinos tank. The proposed line will follow Yellowstone Road. The Stassinos tank will be gravity fed from the proposed White Mountain tank.

c) The 10-mile Water and Sewer District will be responsible for the construction of a distribution system funded independent of this project.

3.2.2.5 Reliance

The Reliance storage tank is constructed at elevation 6740. With an appropriate connector line in place this area could be supplied directly from the proposed White Mountain storage tank or indirectly from the proposed Northside transmission line. This would allow the elimination of the Reliance pump station. Another benefit of improved system pressures would result from the decreased demands on the distribution system in the Elk Street/Outlaw area.

Although the future construction of this connector line is recommended, this line may be viewed as more of a distribution line and, as such, would be outside the WWDC funding criteria. This line, therefore, is not included as part of the proposed WWDC funded project.

3.2.3 East Rock Springs Supply

The East (and Southeast) area of Rock Springs is presently divided into six service zones. The lack of direct transmission supply to this area has resulted in a precarious "balance" between the levels of 4 tanks and the interrelated delivery capacity of 6 booster pumps. Two of the Eastside service zones must be continuously "hard-pumped" simply to maintain safe working pressures in the system. It is felt that the operation of this system is difficult at best and unreliable at worst. A direct transmission supply and storage facility for East Rock Springs is recommended to reduce the health and safety risk as well as operational problems in this part of the community. The following items are specifically recommended:

a) Construct a new 3 MG storage facility on the hills east of the lower existing Sunset reservoir (across highway 376) as shown on Figure 3.2. The recommended tank elevation is 6625.
b) Construct a new 18-inch, C-900 PVC transmission line from the proposed Blairtown reservoir to the new proposed Eastside reservoir. This line would generally parallel the south belt loop (Highway 376).

c) Construct a new booster pump station to feed proposed Eastside storage reservoir from Blairtown reservoir(s). It is anticipated that this station will require three matching pumps appropriately sized to meet peak days needs with one of three pumps in reserve. These pumps will be controlled by the Eastside tank level.

d) Consider the abandonment of the Edgar Street Reservoir due to it's age and lack of effectiveness. This reservoir simply provides a pool from which water is pumped to higher zones.

e) Abandon the Sunset and Palisade reservoirs due to their limited capacity and inadequate elevations.

f) Abandon the D-Street, Thompson Street, Edgar Street, Bighorn, and Sunset pump stations. Verify that PRV control valves and adequate distribution piping is in place to insure adequate supply from upper to lower zones.

3.2.4 Green River Raw Water Intake Facility Recommendations

3.2.4.1 Existing Facilities

It is recommended that the existing intake facilities be completely abandoned due to their age, poor condition, marginal reliability, poor location, etc. It is felt that renovation of these facilities would not fully address the needs of the system or provide long-term cost effectiveness.

3.2.4.2 New River Diversion and Pump House

It is our opinion that construction money would be best spent on a new, more adequate facility at a different location, rather than renovation of the present facility. This is particularly true given the fact that renovation of the present facility will not address problems related to the location, debris control, and sedimentation. It is recommended, therefore, that a complete new intake facility be constructed immediately adjacent to the treatment plant. This facility should include a sedimentation basin and adequate features for sediment and debris removal, hydraulic control of the river, a pumphouse, etc.
4.0 RECOMMENDED PROJECT FINANCIAL DATA

4.1 RECOMMENDED PROJECT BUDGET

The total cost of the recommended construction is conservatively estimated to be $23,000,000 as shown in Table 4.1

4.2 BENEFIT-COST ANALYSIS OF RECOMMENDED PROJECT

This section summarizes the costs and benefits to the State of Wyoming (and the local economy) resulting from construction of the recommended project. Future quantifiable benefits and costs are estimated in terms of their present worth for comparison. For simplicity in calculation, inflation is taken to be 0% with interest rates being 3.5% higher than inflation. Although the proposed capital improvements have an expected life of at least 40 years, a 30-year economic life has been conservatively assumed for the Cost-Benefit comparisons.

4.2.1 Project Benefits

The benefits resulting from this project can be separated into indirect non-quantifiable benefits and direct quantifiable benefits. Both of these groups are discussed hereafter.

4.2.1.1 Non-Quantifiable Benefits

As discussed in other portions of this report, the high dependence on pumps and lack of system component back-up represents a high potential for prolonged service interruption to area water users. The proposed project will alleviate these concerns through the provision of centralized back-up storage, elimination of several booster pump stations, construction of a second transmission line to augment the supply from an undersized pipeline to Rock Springs, etc.

Field flow measurements show that the existing transmission line is already operating at or near its maximum capacity throughout most of the summer months. The present system has no additional capacity to accommodate future economic growth and development. Equally disturbing is the fact that the existing system is not adequate to supply the already developed outlying areas not presently connected to the system. These areas are facing deteriorating ground water quality and reliability and generally have no other reasonable water supply options. The proposed project will also alleviate these problems through the increased delivery capacity of the new pipeline(s).

It is clear that this project is essential to the future economic growth of the Rock Springs area as well as the long-term health and safety of area residents. Although these benefits cannot be accurately quantified they are, in our opinion, of such
magnitude that they would justify the cost of the project even in the absence of other supporting economic data. Other non-quantifiable benefits that will result from this project are as follows:

- Economic Spin-off from Construction
- Property Value Increase
- Improved Fire Protection
- Public Health & Safety Enhancements
- Conservation of non-renewable resources (Power)

4.2.1.2 Direct Benefits

Three direct, quantifiable benefits resulting from this project have been identified as follows:

4.2.1.2.1 Energy Savings

An estimate of the 30-year energy cost for the proposed transmission system has been compared against those of a "do-nothing" approach. This comparison was performed on a present worth basis assuming a 1% annual increase in system demands. These savings result from the construction of a larger transmission line, the relocation of the intake facility closer to the treatment plant, and the elimination of several booster pump stations (and inefficient pumping scenarios) from the Rock Springs system. The total 30-year, present worth value of this energy savings (assuming a 1% annual growth in population) is estimated to be $6,133,000.00

4.2.1.2.2 Value of Additional Treated Water Delivered

The Rock Springs transmission line is typically operating at or near its maximum capacity through the summer months. Water rationing has been required during hot, dry periods. Naturally, the City of Rock Springs has been reluctant to expand it's service area and/or to allow new districts to tie into the system. In considering the benefits of this project, therefore, it is reasonable to consider the value of additional treated water delivered to Rock Springs by virtue of the increased delivery capacity of the new pipeline. The additional water includes the projected consumption of areas not presently served as well as the 1% annual growth for which the recommended system is sized to accommodate.

The value of each cubic foot of water delivered is best determined by what a consumer would be willing to pay for it. The most conservative estimate of what consumers are willing to pay is what they are presently paying. Based on Rock Spring’s present residential rate structure, the average residential cost for water is calculated to be 1.389¢/cubic foot.
<table>
<thead>
<tr>
<th>Construction Costs:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>- 30&quot; Rock Springs Pipeline/Blairtown Storage</td>
<td>$ 9,248,000</td>
</tr>
<tr>
<td>- Northside Supply System</td>
<td>$ 2,830,000</td>
</tr>
<tr>
<td>- Stassinos (10-Mile) Supply System</td>
<td>$ 596,000</td>
</tr>
<tr>
<td>- Eastside Supply System</td>
<td>$ 2,113,000</td>
</tr>
<tr>
<td>- Raw Water Intake Facility</td>
<td>$ 2,417,000</td>
</tr>
<tr>
<td></td>
<td><strong>$17,204,000</strong></td>
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</table>

<table>
<thead>
<tr>
<th>Engineering Services:</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>- Design Engineering</td>
<td>$ 980,000</td>
</tr>
<tr>
<td>- Geotechnical/Geomorphology</td>
<td>$ 45,000</td>
</tr>
<tr>
<td>- Survey/Mapping/Permitting</td>
<td>$ 75,000</td>
</tr>
<tr>
<td>- Resident Engineering/Testing/Insp. (10%)</td>
<td>$ 1,720,000</td>
</tr>
<tr>
<td></td>
<td><strong>$2,820,000</strong></td>
</tr>
</tbody>
</table>

| Subtotal                                         | $20,024,000 |
| Contingency (approx. 15%)                        | $ 2,976,000  |
| Total Recommended Project Budget                 | **$23,000,000** |
Using this above criteria, the estimated 30-year present worth value of additional water delivered is $18,960,000.

4.2.1.2.3 O & M Reductions

The recommended project allows for the cumulative elimination of 11 booster pump stations for the Rock Springs system. Assuming ½ man-hour per day is required to monitor and maintain these stations, the annual O & M reduction can be estimated as:

\[
\frac{1}{2} \text{MH/day} \times 11 \text{ stations} \times 365 \text{ days} \times \$15/\text{MH} = \$30,112.00 / \text{year}
\]

30-year PW savings = $554,000.00

4.2.2 Benefit-Cost Ratio

The most commonly used criterion in judging the social profitability of a project is the benefit/cost ratio. This ratio compares the present value of the benefit stream to the present value of the cost stream. Generally, a project with a benefit-cost ration greater than 1.0 is considered to be worthwhile. The benefit-cost ratio for this project (not including non-quantifiable benefits) is estimated to be 1.12 as shown below.

| Total Project Cost: | $23,000,000 |
| Direct Benefits: | |
| Energy Savings | $6,133,000 |
| Additional Water Delivery | $18,960,000 |
| O & M Reduction | $554,000 |

\[
25,647,000 \quad = \quad 1.12
\]

\[
23,000,000
\]

4.3 ABILITY TO PAY

The two basic economic questions addressed in this study are:

1) Does the project make good economic sense?
2) Can the water users afford to pay for it?

From the cost-benefit analysis it is clear that the project makes good sense and, from a long-term standpoint, will more than pay for itself. The second question will be addressed hereafter in the "Ability to Pay" analysis. This analysis is helpful in the determination of relative rate impacts as well as the evaluation of appropriate funding mechanisms.
It was assumed, for this analysis that the Wyoming Water Development Commission would fund the entire proposed project through a 67%/33% grant-loan package as has been their practice on other similar projects. A 40-year loan period was selected based on the probable minimum life of proposed improvements. A 4% low-interest loan was also assumed based on past WWDC funding practices. It can be seen from Table 4.2 that the projected annual payback cost to the Joint Powers Board is $383,473.00.

It is our understanding that the Joint Powers Board is committed to the concept of uniform water rates for the entire Rock Springs area and the entire Green River area respectively. Based on this understanding, it is reasonable to "assign" the costs of the project to the area water users accordingly. It is estimated that the Green River water users account for approximately 35% of the entire system water consumption. Since the only facet of this project directly benefiting the Green river user is the proposed intake facility, 35% of the annual payback costs for this facility ($18,856/year) has been assigned to the Green River rate payers as part of this analysis. The remainder of the cost ($364,617/year) has been assigned to the Rock Springs area for the purposes of this study.

4.3.1 Rate-Payer Impact

The energy cost savings, when compared to a "do-nothing" approach, will largely offset the local share of the project regardless of other direct benefits. On a short-term basis, however, this project will result in an increased cost to water users. This cost burden will become less (or negative) over time as more users are added to the system. It is felt that the worst-case impact to area rate-payers will be at the beginning of the project. This first year scenario, therefore, has been adopted for presentation herein. In considering the rate of impact of this project, it should be noted that many other factors go into a rate structure determination. It is not the intention of this study to make recommendations regarding rate modifications. Actual water user rates may go up, down, or remain the same according to the specific financial requirements of the system as determined by the appropriate elected officials.

4.3.1.1 Rock Springs Residential Rates

Based on information obtained from the Rock Springs Water Department, the average Rock Springs residential connection uses approximately 1647 CF at a monthly cost of $22.95. Based on 1989/90 projected system revenues, the "equivalent" number of residential connections was calculated to be 11,195. Additional residential connections from areas not presently served are estimated at 540.

The average Rock Springs residential rate-payer impact of this project is calculated as follows:
### Table 4.2

**FUNDED PROJECT COSTS**

<table>
<thead>
<tr>
<th>Project Segment</th>
<th>Est. Capital Cost</th>
<th>67% WWDC Grant</th>
<th>33% WWDC Loan</th>
<th>Annual Loan Payment</th>
<th>Rock Springs Area Annual Loan Payment</th>
<th>Green River Area Annual Loan Payment</th>
</tr>
</thead>
<tbody>
<tr>
<td>30' Rock Springs Pipeline/Blairtown Storage</td>
<td>$12,363,600</td>
<td>$8,283,612</td>
<td>$4,079,988</td>
<td>$206,135</td>
<td>$206,135</td>
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<tr>
<td>Northside Supply System</td>
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<td>2,534,878</td>
<td>1,248,522</td>
<td>63,080</td>
<td>63,080</td>
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<tr>
<td>Stassinos (10-Mile) Supply System</td>
<td>796,800</td>
<td>533,856</td>
<td>262,944</td>
<td>13,285</td>
<td>13,285</td>
<td>-0-</td>
</tr>
<tr>
<td>Eastside Supply System</td>
<td>2,824,900</td>
<td>1,892,683</td>
<td>932,217</td>
<td>47,098</td>
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<tr>
<td>Raw Water Intake Facility</td>
<td>3,231,300</td>
<td>2,164,971</td>
<td>1,066,329</td>
<td>53,875</td>
<td>35,019</td>
<td>18,856</td>
</tr>
<tr>
<td></td>
<td><strong>$23,000,000</strong></td>
<td><strong>$15,410,000</strong></td>
<td><strong>$7,590,000</strong></td>
<td><strong>$383,473</strong></td>
<td><strong>$364,617</strong></td>
<td><strong>$18,856</strong></td>
</tr>
</tbody>
</table>

Notes:

1) Est. capital costs include pro-rated engineering and contingency costs as shown in Table 8.3.

2) Annual payment based on 40-year, 4% loan through Wyoming Water Development Commission.

3) Green River annual loan payment based on 35% of Raw Water intake cost.
Present Ave Monthly billing: $22.95
Project Loan Payment: $364,617/12 mo = $2.59/month
(11,195 + 540 conn)

Potential Energy Savings: $180,000/12 mo = <$1.34/month>
11,195 conn

Total Projected User Rate $24.20/MONTH

It should be noted that potential energy savings could vary depending on changes in PP&L's rate structures. The energy savings shown are estimated based on 1988 power billings.