ARAPAHOE WATER SUPPLY LEVEL II STUDY

PREPARED FOR THE WYOMING WATER DEVELOPMENT COMMISSION & NORTHERN ARAPAHO UTILITIES

PREPARED BY

OCTOBER 2010
Correction to Chapter VI, Page 5-6, WATER TRANSMISSION, Paragraph 2.

Upgrading to a 12" Transmission Line Between the 1MG tank and 17-Mile Road

This line is the top priority in the needed line upgrades for the Arapahoe system. The 1 million gallon tank at the top of the hill on Left Hand Ditch Road above Arapahoe is the only functional tank the Arapahoe system now has. The present transmission line from that tank to the rest of the system is a 1960’s vintage asbestos cement (AC) line. It is critically undersized to deliver even summer use demand, much less required fire suppression flows. This top priority line upgrade will replace the 6" AC line between the tank and the 12" PVC transmission main on 17-Mile Road with a 12" PVC line (Figure VI-3). It, in combination with the 8" line leaving the tank to the north, will meet the system’s tank-to-system delivery needs. The cost of this project is estimated to be $649,100, of which $587,000 is WWDC eligible.

Correction to Chapter XI, Page 8, Table XI-2: Table of Financing, Priorities No. 3 and No. 4.

Table XI-2: Table of Financing

<table>
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<tr>
<th>Project Priority Ranking</th>
<th>Project Description</th>
<th>Total Project Cost</th>
<th>67% WWDC Grant</th>
<th>33% Matching</th>
<th>30% Grant</th>
<th>70% Loan</th>
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<th>Direct Funding 100%</th>
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<td>Water Metering with Individual Service Connections</td>
<td>$717,500</td>
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<td>2</td>
<td>Tie in Wind River Well No. 3</td>
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<td>3</td>
<td>Install 12&quot; Transmission Line Between the Two Casinos</td>
<td>$496,300</td>
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<td>Install 12&quot; Transmission Line from 1 MG tank to 17-Mile Road</td>
<td>$629,400</td>
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<td>5</td>
<td>Extend the 12&quot; Transmission Line From Goes-In-Lodge Road East to Highway 789</td>
<td>$1,239,600</td>
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<td>Distribution System Improvements in the Great Plains/Arapahoe Community Area</td>
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<td>Replace Chair Lane Lines</td>
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<td>Demolition of Abandoned Tanks</td>
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<td>System Extension to Wind River Bridge and Little Wind River Bottom Road</td>
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<td>$1,274,257</td>
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<td>Less WWDC 2010 Funding of Project #2 above</td>
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<td>$6,622,000</td>
<td>$2,183,643</td>
<td>$1,120,414</td>
<td>$703,674</td>
<td>$703,674</td>
<td>$475,179</td>
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WWDC Grant (67% of unfunded, eligible projects) | $3,415,847 |
Total RUS Grant | $1,274,257 |
Total RUS Loan | $2,973,266 |
Total Tribal | $16,000 |
Total IHS Funding | $4,346,900 |
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## Correspondence and Coordination

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### Permitting Requirements

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## Introduction

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## Introduction

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### System Economic Analysis

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## Rates Needed to Support the Arapahoe System with Present Assistance

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### Equivalent Dwelling Unit

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## Ability to Pay

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## Financing Planned Improvement Projects

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## Funding of Prioritized Projects

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## Loan Funding Impact on Water Rates

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## Water Rates Using Current Financial Assistance

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## Water Rates Required to Be Fully Self-Supporting

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CHAPTER I

CONCLUSIONS AND RECOMMENDATIONS

INTRODUCTION

The Arapahoe area of the Wind River Reservation is the fastest growing portion of the reservation. This is, in large part, due to the success of the Arapaho Tribe’s entry into the gaming business with the construction and operation of the Wind River Casino. There is additional development planned in the area of the casino, including additional housing and the construction of a hotel, and later, an accompanying commercial area.

The focus of this Arapahoe Water Supply Level II Study is to give Northern Arapaho Utilities (NAU) a Water Master Plan with which to guide meeting future potable water supply and delivery demands for the Arapahoe portion of their system. This study identifies improvements that are necessary for the Arapahoe area water system to meet demands for the next twenty years. The necessary improvements are prioritized based on the evaluation of what improvements will deliver the greatest benefits in proportion to system benefit each recommended improvement will deliver and its cost of installation. Currently, the Arapahoe area’s water system has numerous deficiencies when compared to generally accepted industry standards. The highest ranking improvements will make marked improvements in NAU’s capacity to manage the system and make it more reliable. Lower ranking improvements while critical to the system integrity, are of less urgency.

The discussion that follows will provide an understanding of the current and future demands being placed on the system, how those demands impact system operations, and the capacity of each system component to meet demands. From that understanding, a prioritized tabulation of needed improvements has been developed.

The current water source for the Arapahoe area is two wells in close proximity to each other. They are located in a the Arapahoe community which includes Great Plains Hall, the senior citizens center, a housing office, and other public service offices. This well water is brought from both wells to a central well house where it is treated with chlorine and pumped to the system.

Because of the well water capacity shortage in 2007, the Northern Arapaho Tribe requested that the Wyoming Water Development Commission explore groundwater resources that might meet the system’s needs. Two potential well sites were explored. Northern Arapaho Utilities elected to proceed with drilling a test well near the system’s one million gallon (1MG) tank and to drill a “slim hole” test well south of the Little Wind River near the Wind River Casino. The results of this exploration work is detailed in Chapter V. Both of these exploratory efforts met their intended objective.

The balance of this master planning effort is focused on assessing the condition and the capacity of the water supply, transmission, storage, and distribution components of the system. In summary, the evaluation identified numerous deficiencies in the system and its operation that
need to be corrected to enable the system to meet commonly accepted industry standards. Needed capital improvements include the following:

- Develop and put into service the WWDC funded well drilled in November of 2009.
- Loop existing transmission and distribution water lines within the system.
- Replace undersized lines throughout the water system.
- Add a storage tank on the east side of the system.
- Tie the Arapahoe Industrial Park system and the main system together.

The opinion of probable project costs for all recommended improvements totals $8,000,300. This cost includes engineering services, construction, permitting, fees, easement acquisition, and contingencies. Funding of the improvements is recommended to be sought from the Wyoming Water Development Commission (WWDC), USDA/Rural Development, and the Indian Heath Service. Other funding agencies may be approached if funds are available. Under the conceptual funding plan, WWDC would provide funding for the construction of the water source development, transmission lines, and storage facility. The balance of the improvements would be funded by the Indian Health Service (IHS), USDA Rural Development (RD), and the tribe themselves.

The project is considered to have minimal impacts on known cultural relics, the environment, or wildlife. The proposed transmission lines are adjacent to existing roadways or alongside existing pipelines. All lands have previously been disturbed through agricultural or other activities.

In the course of this master planning effort, the following conclusions and recommendations have been reached.

**CONCLUSIONS**

**Population and Potable Water Demand**

- The Arapahoe system’s service population is forecasted to grow from its present population of 1,311 to 1,806 people by the year 2030.
- Water demands in the year 2030 will grow to 535,000 gallons per day without conservation measures and only 367,000 gallons per day with conservation measures.
- The per capita water consumption is nearly 130% of that of surrounding systems.
- Once the new WWDC drilled well is tied in, the Arapahoe system will have an ample supply of water through the year 2030.

**Evaluation of Existing System**

- The system serves an area of 18 square miles with 22 miles of piping.
- The system is not metered, rendering water conservation, usage accounting ineffective.
- Service lines, in many cases, have more than one user connected to them, (daisy-chained) making usage enforcement impossible.
None of the known scientifically based information to date indicates any contamination of the NAU administered potable water supply from the abandoned uranium mill site and its associated groundwater plume containing trace radionuclides.

Upon tying in the test well drilled by WWDC in late 2009, the system will have more water supply that projected demands indicate will be needed.

The system’s storage capacity is 300,000 gallons less than needed to provide adequate service.

The east side of the system, which hosts the highest value properties and is the fastest growing section of the system, is without water storage and is entirely dependent on a single transmission line to deliver all water supply.

Almost none of the system has adequate fire flow capacity.

Many transmission and distribution lines are incapable of meeting delivery demand for their service area.

The oldest distribution lines are undersized and commonly constructed using AC pipe which is no longer manufactured.

A lack of fire hydrants across the system makes flushing difficult.

Northern Arapaho Utilities’ current Arapahoe area system needs significant upgrading to meet the long-term needs of the Arapahoe water users.

Northern Arapaho Utilities (NAU) has made excellent progress in the past two years to automate its system, thereby improving its reliability.

The BIA program of providing clusters of home site allotments in areas isolated from utilities is entirely counterproductive to the efficient management of providing tribal utility services. This practice needs to be stopped by the tribe.

**Operations and Management**

Because of lack of planning coordination and communication, Northern Arapaho Utilities is frequently “caught off guard” by demands for water service created by projects developed by other tribal entities.

The system is chronically understaffed.

Operators are provided little incentive and limited opportunity to obtain certification.

Operations staff performance and accountability is frequently lacking.

The system operators’ compensation package is not competitive with surrounding communities.

NAU has a difficult time hiring and retaining certified operators and turnover is frequent.

NAU chronically misses IHS project funding opportunities because of incomplete and untimely entry of needed projects into the IHS electronically based STARS system.

Under its present management structure, the Director is called upon to fill more roles than can be effectively overseen by one individual.

The system does not perform at optimum levels because of deferred maintenance and under-trained operators.

Under its present management structure, NAU does not have the autonomy to fill its mission.

NAU and the Northern Arapaho Business Council find that each is stymied by the other.
Changes in management approaches are uncommonly slow to be agreed upon and implemented.

Financial Findings

- NAU’s system is not financially self-supporting by a margin of almost $200,000 per year.
- NAU is challenged in becoming financially self-supporting because of the income status of a large percentage of its subscribers.
- There are opportunities for improvements in both revenues and reduction of expenses.
- The cost to produce, treat, store, and distribute water for Arapahoe is $2.16 per thousand gallons.

RECOMMENDATIONS

There are a large number of specific recommendations for needed improvement to the system contained in Chapter IV. The following is a summary of the major improvement recommendations.

System Infrastructure

- Install meters and backflow preventers each system service line.
- Install individual service taps for all services that are now daisy-chained.
- Tie in the WWDC drilled well and the accompanying SCADA controls.
- Loop the transmission line between the two casinos.
- Install 12" transmission line from 1 MG tank to 17-Mile Road.
- Extend the 12" transmission line from Goes-in-Lodge Road east to Highway 789.
- Construct a 300,000 gallon concrete storage tank and 10" transmission line.
- Replace all undersized and obsolete distribution system lines in the Great Plains/Arapahoe community area.
- Loop the Rendezvous Road line back to the 17 Mile Road transmission line.
- Replace the failed C’Hair Lane line.
- Extend the South Left Hand Ditch transmission line and install recommended Industrial Park improvements.
- Demolish the abandoned water storage tanks.

Operations and Management

- Serve only housing concentrated within the present service area boundary.
- Direct the BIA to stop its practice of granting home sites in isolated areas without water service because this creates isolated villages that later request central water systems worsening the already poor economies of scale of the NAU systems.
- Take special precautions within the UMTRA Institutional Control Boundary to prevent radionuclear contaminated groundwater from entering the distribution lines during any line repair operations within that area.
- Standardize all system valves and hydrants to a single manufacturer.
• Use only AWWA C-900, DR 18 PVC pipe for future replacement and expansions.
• Implement the management recommendations given at the end of Chapter VII.
• Implement a Leak Detection Program.

Financial

• Apply to the Wyoming Water Development Commission for Level III funding for the fund-eligible improvements delineated in Chapter IV and as show in the funding plan in Chapter XI.
• Enter into the IHS on-line SDS STARS system all improvement projects detailed in this Master Plan and aggressively seek that source of funding.
• Implement improvement projects in the sequence given in their priority ranking as shown in Chapter VIII.
• Apply to USDA Rural Development for funding as shown in the Chapter XI funding plan.
• Incrementally adjust rates and implement the tiered rate structure recommended in Chapter IV with the objective of having the system become financially self-supporting within the next five years.
CHAPTER II

SERVICE AREA AND WATER DEMANDS

INTRODUCTION

The Arapahoe community of the Wind River Indian Reservation is located in central Wyoming. The reservation is home to the Northern Arapaho and Eastern Shoshone tribes. The municipalities near the Arapahoe community are Riverton, which is approximately eight miles northeast, and Lander, approximately 22 miles southwest.

Arapahoe, Wyoming is located approximately 20 miles east of the flank of the Wind River Mountains. As the Wind and Little Wind Rivers drain off this mountain flank, their confluence forms an eastward pointing “V” near Riverton. Arapahoe is located approximately six miles west of that confluence in the middle of the “V”. The area consists of high plains desert. The area surrounding Arapahoe is irrigated agricultural land which is predominately pasture and some forage and grain cropping. The terrain between streams is rolling plains, sloping from the west to east.

Figure II-1: Vicinity Map
WATER SYSTEM OVERVIEW

The Northern Arapaho Tribe is one of two tribes living on the Wind River Indian Reservation. The Eastern Shoshone Tribe is headquartered at Ft. Washakie at the eastern base of the Wind River Mountain range. The Northern Arapaho Tribal headquarters are at Ethete, a community approximately five miles east of Ft. Washakie.

Northern Arapaho Utilities (NAU) operates and maintains the water and sewer utilities for the Northern Arapaho Tribe. NAU manages two independent water systems, each with its own production, storage, transmission, and distribution. The Arapahoe system serves the eastern portion of the tribe’s service area while the Ethete system, some 12 miles west of Arapahoe, serves the western portion of the Arapaho tribal service area. This report focuses on the Arapahoe service area, its accompanying demands, and the water system serving those needs.

The Arapahoe service area has two separate systems, both operated and maintained by NAU. The main system serves the community of Arapahoe (distinct from the Arapaho Tribe in its spelling), and extends some six miles east serving the rural area, St. Stephens Schools, Beaver Creek Housing, and the nearby commercial area along the State Hwy 789 corridor which includes the Wind River Casino. The casino and Beaver Creek Housing are on the eastern side of this system. The Industrial Park system serves the Arapahoe School and approximately 10 area homes.

Main System

Included in the main water system are two source wells, the pumphouse with chlorination treatment, transmission lines, two steel water storage tanks, and approximately 22 miles of waterlines. The water supply for the main system is two Wind River Formation deep wells located in the Arapahoe community. These two wells are only 400 feet apart. The water is pumped from the wells through the adjacent pumphouse where it receives chlorination, and then to the system and its one million gallon (MG) storage tank. The recommended chlorine contact time cannot be achieved with the present piping configuration.

There are three abandoned steel water storage tanks in the vicinity of the 1 MG tank which are no longer in service.

From Arapahoe, the distribution system serves an area approximately five miles long and two miles wide. It spans from the community of Arapahoe on Wyoming Highway 137 east to the Wind River Casino on Wyoming Highway 789. The water system serves the Arapahoe community consisting of the social services offices, a tribal housing office, senior citizens center, Great Plains Hall, and other public buildings. As mentioned above, the system also serves St. Stephens Schools, the Arapahoe Charter High School, the Wind River Casino, the 789 Truck Stop and Casino, and scattered rural housing.
**Arapahoe Industrial Park**

The Arapahoe Industrial Park system is a separate system serving the Arapahoe School, a few rural homes, and the Industrial Park. This park was constructed as an economic development project in the late 1960’s. It does not host any commercial or industrial users. The system is supplied by a primary well and a “back-up” well that pumps water through the pumphouse for chlorination treatment and then to the 250,000 gallon elevated welded steel storage tank located immediately north of the pumphouse. The one mile of distribution lines for the Industrial Park is composed of 8-inch cast iron pipe. Figure II-2 gives an overview of both the main system and the Industrial Park system.

Northern Arapaho Utilities invoices 324 water accounts on the Arapahoe system. There is a distinct difference in water rate billing between tribally-enrolled customers and non-enrolled customers (see Chapter XI). Of the 324 accounts, only 17 are being billed as non-enrolled customers. The commercial and public buildings are included in these water accounts. The Arapahoe Industrial Park users are also included in NAU’s invoicing.
Figure II-2: Arapahoe Water System Service Area and Pipe Size
DEMAND FORECAST

Future water service demand will be directly tied to the number of people who will be served and the commercial uses that need to be met. That demand is driven by two factors: first, the population growth or loss that is expected to occur in the area and the change in commercial user numbers; and second, the expansion of the geographic area that is served. In this section, population forecasting and residential demand will be discussed, followed by a forecast of commercial water demand.

Service Area Population Forecasts

For this report, a twenty-year planning horizon extending through the year 2030 was used to forecast water service demand in the Arapahoe area. Population forecasts were developed from the following sources:

- Fremont County U.S. Census population history,
- Wind River Indian Reservation population history,
- Northern Arapaho Tribal enrollment statistics,
- Current number of households in the Arapahoe area,
- Household population estimates from various sources, and
- Wyoming Department of Administration and Information population statistics.

The following table gives historical population numbers for Fremont County.

Table II-1: Historical Population Data for Fremont County, Wyoming

<table>
<thead>
<tr>
<th>Year</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960</td>
<td>26,168</td>
</tr>
<tr>
<td>1970</td>
<td>28,352</td>
</tr>
<tr>
<td>1980</td>
<td>38,992</td>
</tr>
<tr>
<td>1990</td>
<td>33,662</td>
</tr>
<tr>
<td>2000</td>
<td>35,804</td>
</tr>
</tbody>
</table>

*Data from the U.S. Census

The table below shows the historical population for the Wind River Indian Reservation. There was no reservation specific data published prior to 1990. The figures given here include enrolled and non-enrolled persons living within the boundaries of the reservation.

Table II-2: Historical Population Data for Wind River Indian Reservation, Wyoming

<table>
<thead>
<tr>
<th>Year</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>21,851</td>
</tr>
<tr>
<td>2000</td>
<td>23,250</td>
</tr>
</tbody>
</table>

*Data from the U.S. Census
The enrollment numbers from the Arapaho Tribal Enrollment Office were reviewed as a possible data source from which to estimate the service population for the Arapahoe Water System. It is determined that no correlation could be drawn from the enrollment figures and service population for the following reasons:

- Significant numbers of Arapaho Tribal members live off the reservation,
- There is no way to identify how many enrolled persons live in the Arapahoe service area versus any other geographic area of the reservation,
- A significant non-enrolled population is served by the Arapahoe water system.

Northern Arapaho Utilities keeps records of the number of tribal and non-tribal households served by the Arapahoe area system. That, though, has no correlation to total service population.

The total number of services, both residential and non-residential, is important in forecasting future demand. Not all occupied buildings in the Arapahoe area, residential and nonresidential, are serviced by the Arapahoe water system. However, it is likely that all occupied buildings are served with electrical power. By comparing the High Plains Power (the rural electrical power supplier) number of services to the number of NAU water services in the Arapahoe water system geographical area, the percentage of residences and non-residential buildings served by the NAU water system can be determined with good certainty.

Table II-3 shows the number of services for the respective utility or data source for the Arapahoe water service area.

<table>
<thead>
<tr>
<th>Data Source</th>
<th>Number of Households</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern Arapaho Utilities billing accounts</td>
<td>324</td>
</tr>
<tr>
<td>Housing by School District-2000, EAD Wyo. A &amp; I</td>
<td>422</td>
</tr>
<tr>
<td>High Plains Power-2008</td>
<td>489</td>
</tr>
<tr>
<td>House Count by James Gores &amp; Assoc.-2009</td>
<td>530</td>
</tr>
</tbody>
</table>

For the purpose of this report, the High Plains Power number of 489 services was judged to be the most reliable estimate of the number of possible water service connections if water service was provided to all structures that could be occupied for the following reasons:

- Northern Arapaho Utilities reports that there are an unknown number of water users who are not billed for service.
- Housing by School Districts only counts households which have school age children.
- The house count by James Gores and Associates likely included vacant homes and homes on private wells.
- High Plains Power can extrapolate power services by geographical area matching the water system service area.

High Plains Power reports that there are a small, but unknown, number of service connections that feed power to two or more residences or structures from a single service. Not all occupied buildings are receiving water from the central system but all occupied buildings do have power.
For purposes of this study, the number of potential water services within the current service area boundary was set at 490. Of that number, around 324 are now known to be on the system; the rest are not.

Also affecting demand forecasting is the number of people per household. There is reasonable agreement among published data sources on the number of people per residence as applied to the reservation. A summary of published household occupancy data is shown in Table II-4. There is no U.S. Census data on number of persons per household that can be specifically correlated to the NAU Arapahoe system water service area.

**Table II-4: People per Household**

<table>
<thead>
<tr>
<th>Data Source</th>
<th>People Per Household</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing by School District- Wyo. A &amp; I</td>
<td>4.88</td>
</tr>
<tr>
<td>U.S. Census – reservation as a whole</td>
<td>3.96</td>
</tr>
<tr>
<td>WIND 2 Study, 1998</td>
<td>3.99</td>
</tr>
<tr>
<td>U.S. Bureau of Reclamation, 1996</td>
<td>4.00</td>
</tr>
</tbody>
</table>

As mentioned in the preceding discussion, the Wyoming Department of Administration & Information (A & I) data applies only to homes with school age children. That is not a representative number of people per home that can be applied across the service area because it does not account for people who live alone or only as a couple. This report will use an average of **4.2 people per household**. This number cannot specifically be derived. It gives a 5% safety factor to the prevailing value of 4.0 persons per home.

The final factor that drives service population forecasting is the rate of population growth within the service area itself. There is a wide disparity of published population growth rates for the Wind River Indian Reservation. Some of those are shown in the table below.

**Table II-5: Area Growth Rates Reported**

<table>
<thead>
<tr>
<th>Data Source</th>
<th>Annual Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000 U.S. Census</td>
<td>0.87</td>
</tr>
<tr>
<td>U.S. Bureau of Reclamation, 1996</td>
<td>1.76</td>
</tr>
<tr>
<td>State of Wyoming A&amp;I</td>
<td>0.64</td>
</tr>
<tr>
<td>Indian Health Service 2003</td>
<td>3.28</td>
</tr>
</tbody>
</table>

Given such a wide variance in estimated growth rates, James Gores and Associates investigated historic school student population numbers because that age group is a source of future...
population increases. Fremont County School District No. 38 encapsulates the Arapahoe water system service area. The enrollment in District No. 38 over the past 20 years has been level to slightly declining. This indicates either a low population growth rate or an out-migration of students to other districts. Lander School District enrollment data shows that their Native American student count has varied by less than 1% over the past 20 years. During the 2008-2009 school year, 68 students from District No. 38 were attending Lander schools. Riverton School District reported a similarly static enrollment trend in Native American students. No verifiable data has been found to suggest that an unusual or increasing proportion of Arapahoe area children are attending out-of-district schools. It is concluded that the number of Arapahoe area students are going to neighboring schools has remained virtually unchanged for many years.

In conclusion, there is no verifiable data that suggests the Arapahoe area population is growing at a rate higher or lower than the rest of Fremont County. Both historical data and the best documented population forecasts indicate that the population growth rate is similar to that determined by the State of Wyoming for Fremont County. A growth rate of 0.64 percent was chosen as a reasonable rate to use for forecasting population growth for the Arapahoe service area.

**ARAPAHOE WATER SYSTEM SERVICE POPULATION FORECAST**

Both Northern Arapaho Utilities and High Plains Power track the number of service connections in the Arapahoe area. As explained earlier, there is a good geographical correlation between NAU’s records and High Plains Power’s records. High Plains Power shows that there are a total of 489 residential and commercial power service connections within the Arapahoe water service area.

Northern Arapaho Utilities invoices 324 customers monthly within that same area. From NAU’s data, the customer base includes the following:
- 311 homes,
- 5 Tribal Office Complexes,
- 1 Social Services Building,
- 2 public schools and one private school,
- 2 casinos,
- Great Plains Hall, and
- 1 church.

The number of services by High Plains Power includes all of these listed nonresidential users plus the three wells on the water system and two pump stations serving the sewage system. This is a total of 18 non-residential power services. These 18 non-residential services were subtracted from the 489 total power services to estimate that there are approximately **470 homes served by High Plains Power** in this area. Thus, 66% of the area homes (311/470) are served by the central water system.

Using 470 homes and 4.2 people per home gives a **2009 water and power service area population of 1,974 people**. It is estimated that of those, 66%, or **1,306 people were on the water system** in 2009.
To forecast future demand on the Arapahoe system, two assumptions were made. First, the future service area growth rate will be essentially the same as the rest of Fremont County. Second, having service from a central water system is a major convenience as compared to owning and maintaining a private well, and, because of that, as new homes are built the percentage of population served by the central system will increase between now and 2030.

For population forecasting purposes, the State of Wyoming estimated population growth rate of 0.64 percent for Fremont County was used. It was also assumed that the percentage of area population receiving water service will increase from the present 66% to 80% by the year 2030.

Based on that assumption and using an estimated base population of 1,974 people within the service area in 2009, a forecast of the population that may be served by the water system over time was made and is shown in Table II-6 below.

**Table II-6: Forecast Water Service Population for the Arapahoe Area (2009-2030)**

<table>
<thead>
<tr>
<th>Year from 2009</th>
<th>Year</th>
<th>Total Service Area Population at 0.64% Growth</th>
<th>Assumed Water Service Percentage</th>
<th>Estimated Water Service Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>2009</td>
<td>1974</td>
<td>66%</td>
<td>1303</td>
</tr>
<tr>
<td>2nd</td>
<td>2010</td>
<td>1987</td>
<td>66%</td>
<td>1311</td>
</tr>
<tr>
<td>3rd</td>
<td>2011</td>
<td>1999</td>
<td>67%</td>
<td>1340</td>
</tr>
<tr>
<td>4th</td>
<td>2012</td>
<td>2012</td>
<td>67%</td>
<td>1348</td>
</tr>
<tr>
<td>5th</td>
<td>2013</td>
<td>2025</td>
<td>67%</td>
<td>1357</td>
</tr>
<tr>
<td>6th</td>
<td>2014</td>
<td>2038</td>
<td>68%</td>
<td>1386</td>
</tr>
<tr>
<td>7th</td>
<td>2015</td>
<td>2051</td>
<td>69%</td>
<td>1415</td>
</tr>
<tr>
<td>8th</td>
<td>2016</td>
<td>2064</td>
<td>70%</td>
<td>1445</td>
</tr>
<tr>
<td>9th</td>
<td>2017</td>
<td>2077</td>
<td>71%</td>
<td>1475</td>
</tr>
<tr>
<td>10th</td>
<td>2018</td>
<td>2091</td>
<td>72%</td>
<td>1505</td>
</tr>
<tr>
<td>11th</td>
<td>2019</td>
<td>2104</td>
<td>73%</td>
<td>1536</td>
</tr>
<tr>
<td>12th</td>
<td>2020</td>
<td>2118</td>
<td>74%</td>
<td>1567</td>
</tr>
<tr>
<td>13th</td>
<td>2021</td>
<td>2131</td>
<td>75%</td>
<td>1598</td>
</tr>
<tr>
<td>14th</td>
<td>2022</td>
<td>2145</td>
<td>76%</td>
<td>1630</td>
</tr>
<tr>
<td>15th</td>
<td>2023</td>
<td>2158</td>
<td>77%</td>
<td>1662</td>
</tr>
<tr>
<td>16th</td>
<td>2024</td>
<td>2172</td>
<td>78%</td>
<td>1694</td>
</tr>
<tr>
<td>17th</td>
<td>2025</td>
<td>2186</td>
<td>79%</td>
<td>1727</td>
</tr>
<tr>
<td>18th</td>
<td>2026</td>
<td>2200</td>
<td>80%</td>
<td>1760</td>
</tr>
<tr>
<td>19th</td>
<td>2027</td>
<td>2214</td>
<td>81%</td>
<td>1794</td>
</tr>
<tr>
<td>20th</td>
<td>2028</td>
<td>2228</td>
<td>82%</td>
<td>1827</td>
</tr>
<tr>
<td>21st</td>
<td>2029</td>
<td>2243</td>
<td>79%</td>
<td>1772</td>
</tr>
<tr>
<td>22nd</td>
<td>2030</td>
<td>2257</td>
<td>80%</td>
<td>1806</td>
</tr>
</tbody>
</table>

Using the State of Wyoming, Department of Administration and Information, Economic Analysis Division forecasted growth rate of 0.64% annually, results in an estimated service...
population of approximately 2,257 people by the year 2030. Assuming 80% of that population will be on the water system results in a water service population of 1,806 people.

**WATER DEMAND FORECAST FOR STUDY AREA**

The Northern Arapaho Utilities water system does not, as yet, meter individual services. This is for a variety of reasons, some of which include lack of funding and the fact that the IHS, who designed the system, does not include metering in its system designs. The production meters at the Arapahoe pumphouse and at the Industrial Park well are the only meters on the system. A new pumphouse at Arapahoe was completed in November 2008. It included new meters for each of the two wells and a SCADA tank level control system. Records for water production have not been kept since then because the operators mistakenly assumed that production was automatically recorded by the SCADA system.

Handwritten records were kept for the Arapahoe main system for the years of 2006, 2007, and 2008. Separate records are kept for the well production at the Arapahoe Industrial Park. Adding both productions together results in the data summary shown in Table II-7.

**Table II-7: Historic Water Usage for the Arapahoe System and Industrial Park Combined**

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Annual Use Million Gal.</th>
<th>Estimated Service Population</th>
<th>Avg. Gallons Per Capita Day (gpcd)</th>
<th>3-Month Summer Million Gal.</th>
<th>Average Summer gpcd</th>
<th>Estimated Maximum Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>120.65</td>
<td>1,278</td>
<td>259</td>
<td>40.85</td>
<td>355</td>
<td>647</td>
</tr>
<tr>
<td>2007</td>
<td>131.54</td>
<td>1,286</td>
<td>280</td>
<td>37.52</td>
<td>324</td>
<td>701</td>
</tr>
<tr>
<td>2008</td>
<td>139.29</td>
<td>1,295</td>
<td>295</td>
<td>38.63</td>
<td>331</td>
<td>737</td>
</tr>
<tr>
<td>2009</td>
<td>N/A</td>
<td>1,306</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Table II-7a: Local System Comparison**

<table>
<thead>
<tr>
<th>Community</th>
<th>Year</th>
<th>Service Population Estimate</th>
<th>Total Annual Use</th>
<th>Average Annual gpcd</th>
<th>Estimated Maximum Day Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Riverton</td>
<td>2008</td>
<td>10,032</td>
<td>745</td>
<td>203</td>
<td>339</td>
</tr>
<tr>
<td>Lander</td>
<td>2008</td>
<td>7,264</td>
<td>623.7</td>
<td>235</td>
<td>826</td>
</tr>
<tr>
<td>Ft. Washakie</td>
<td>2009</td>
<td>2,870</td>
<td>224.2</td>
<td>214</td>
<td>535</td>
</tr>
</tbody>
</table>

The water usage for the Arapahoe main system alone (without the Industrial Park) is 268 gallons per capita per day (gpcd). It serves the community of Arapahoe and all of the local services buildings, St. Stephens Schools, 789 Truck Stop and Casino, Wind River Casino, Beaver Creek...
Housing, and the rural area between Arapahoe and the casino. The Arapahoe Industrial Park system is a stand-alone system serving approximately 10 residences and the Arapahoe School.

For the purpose of this report, the main system and industrial park system were combined, because NAU manages both systems and both are in the service area. Dividing the NAU’s recorded water production by the current estimated service population shows that the average daily demand on the two systems combined is 295 gallons per capita per day (gpcd). This water use rate is 34 percent higher than the average of other local area systems. This can be partially attributed to neither system being metered.

Using the above discussed population forecasts, coupled with the assumption that 80 percent of the area population will be served on the system by 2030, the Arapahoe service population will reach approximately 1,806 people. This is an increase of 503 people over the year 2009. Without water conservation, this increase in service population may result in an annual demand of 195 million gallons versus 2008’s use of 139 million gallons, a 40% increase in both demand and service population. Implementing conservation measures, such as metering and a progressive tiered rate structure could bring usage rates in line with surrounding systems. With conservation, consumption may bring usage closer to the average 220 gpcd in surrounding communities. Annual consumption might then only grow by 4% to 145 million gallons by 2030.

Table II-8 shows the demand for the service area. Usages shown in the table below without implementing conservation measures, are based on the average past consumption of 296 gpcd. With conservation, usage rates are estimated to be 220 gpcd.

<table>
<thead>
<tr>
<th>Table II-8: Arapahoe Water System Demand Forecast</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year</strong></td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td><strong>Without Conservation</strong></td>
</tr>
<tr>
<td>2010</td>
</tr>
<tr>
<td>2015</td>
</tr>
<tr>
<td>2020</td>
</tr>
<tr>
<td>2025</td>
</tr>
<tr>
<td>2030</td>
</tr>
<tr>
<td><strong>With Conservation</strong></td>
</tr>
<tr>
<td>2010</td>
</tr>
<tr>
<td>2020</td>
</tr>
<tr>
<td>2030</td>
</tr>
</tbody>
</table>
Table II-8 shows that the average day demand in the year 2030 will be approximately 446 gpm without conservation and 331 gpm with conservation. These numbers are derived by assuming the volumes shown in Table II-8 are produced in 20-hour pumping per day.

NEAR TERM DEMAND INCREASES

Wind River Casino is the largest employer in Fremont County with 541 employees. Of these, approximately 50 work in Ethete at the Little Wind Casino and Convenience Store. Thus, the work force at the Wind River Casino, served by the Arapahoe water system, is 490 employees.

Data provided by the meter at the Wind River Casino revealed 1,708,610 gallons of water used June 1, 2008 to June 1, 2009. This one-year total indicates the casino used 1.2% of the total water produced for the system.

The casino management closely tracks visitor numbers, and other activity indicators. The casino, in its first 18 months of operation, has experienced twice the visitor numbers predicted by the marketing consultant hired to evaluate the economic viability of a casino for the Northern Arapaho Gaming Commission. This success has lead to the tribe planning other expansions in the adjoining area. This expansion includes housing to more conveniently accommodate its workforce and commercial ventures to complement the casino industry.

A 90-room hotel adjacent to the Wind River Casino is scheduled for construction in the summer of 2010. This is to be followed by a buffet dining room and convention hall addition in 2011. The area has also been identified for a range of possible future facilities. Some of these include:

- 80 additional housing units in Beaver Creek Housing,
- 200 additional rooms that may be added to the hotel,
- Juvenile Detention Center,
- Health Clinic,
- Car wash,
- Museum, and
- Laundromat.

It is expected that the commercial elements of these plans will materialize in the next five to eight years. The health clinic and juvenile center are public facilities and their time of implementation is dependent on the award of public funding for them.

Currently the Northern Arapaho Housing Authority is constructing a new 12 unit housing area, Ben Gay Heights. It is located approximately ¼ mile south of the one million gallon tank and just south of the Social Services building. This is the first housing project on the system since the construction of the 20 housing units added to the Beaver Creek Housing project in 2008. No other building projects are known to be planned for construction in the Arapahoe service area prior to 2012.

WATER COSTS

Based on NAU cost accounting, water costs were $2.14 per thousand gallons for the Arapahoe system in 2008. It cost them $297,700 for the 139,291,000 gallons that were produced. Based on
the system’s present cost structure, water charges need to be at this level for the system to break even, making it financially self-supporting. Some system costs are fixed, others increase as production increases. Labor, for example will change very little or not at all because the system requires a certain number of operators regardless of the amount of water that is produced. Electrical power costs, on the other hand will fluctuate in direct proportion to the number of gallons pumped from the wells.

In 2008, the variable costs associated with producing the 139.29 million gallons of water used by the system’s customers were:

- Electric Power: $48,600
- Chlorine: $19,134
- Well Pump Wear: Unknown

Assuming a $0.02 per thousand gallons cost for pump wear and computing the other two volume dependent costs yields a cost of $0.51 per thousand gallons to pump and chlorinate water for the system.

Conservation measures could yield annual savings of 50 million gallons per year. Applying just the costs associated with pumping and treating this amount of water was $25,500 in 2008. Assuming an average annual inflation of three percent per year through the year 2030, the projected cost savings would be $48,900 in 2030. Assuming a service population of 1,806 people and 4.2 people per home (430 services), this equates to $113 per service per year or $9.42 per month per household.
CHAPTER III

INVENTORY & EVALUATION OF THE EXISTING ARAPAHOE AREA SYSTEM

INTRODUCTION

The water system serving the Arapahoe area is operated and maintained by Northern Arapaho Utilities (NAU). The Arapahoe system serves the eastern portion of the Northern Arapaho Tribe’s service area. The service area begins approximately one mile south of Riverton, Wyoming. From there it extends approximately three miles south and six miles west. As discussed in the introduction and overview of Chapter II, the system serves an area of approximately 20 square miles and 324 billed accounts.

Figure III-1: Arapahoe as Viewed from the System’s Water Tank Site

The area is served by two separate systems, one that serves a small area known as the Arapahoe Industrial Park, and the main system that serves the community of Arapahoe, including its tribal...
services offices, housing developments, and a charter high school. Five miles to the east, it also serves St. Stephens Schools, a growing casino complex, and the nearby Beaver Creek Housing. The water system consists of approximately 22 miles of distribution line, two supply wells, and a one million gallon storage tank.

The Industrial Park serves the Arapahoe School and approximately 10 homes. This system consists of a well, an elevated storage tank, and 1.5 miles of lines. The school is the primary user.

**WATER SUPPLY**

**Main System**

The current water source for the main Arapahoe system, as noted above, is two Wind River Formation wells (Nos. 1 and 2) located in what is considered the Arapahoe community and seen below in Figure III-2. These two wells are not on record with the Wyoming State Engineer’s Office (SEO). Permits for them must be filed with the SEO for the wells to legally serve as a source to the system. They are located on the far western edge of the water system. This community is home to a scattering of tribal offices, the senior citizen’s center, three housing projects, and Great Plains Hall.

These wells were drilled and put in service by the Indian Health Service (IHS) in the late 1960’s or early 1970’s. Well No. 2 was installed approximately 400 feet south of Well No. 1. In their present configuration, these wells can produce a combined rate of approximately 340 gpm. As presently configured, these wells have numerous shortcomings. Because of hydraulic interference caused by their close spacing, these wells act as a single well. The shallow setting of the upper screen in Well No. 2 severely limits pumping the two wells together. In fact, Well 1, alone, with a properly selected pump set at an optimum depth, could produce nearly 500 gpm. Both of the present pumps are operating nearly outside the manufacturer’s recommended range and in a very inefficient range of the pump curve. This is discussed in more detail in Chapter 5.

IHS records indicate that Well No. 1, shown on the left in Figure III-2, was drilled to a depth of 647 feet. A 60 slot well screen was installed from a depth of 547 feet to 647 feet. The installed pump is a Hydroflo 7HL 5 stage submersible, 4.775 inch impeller and a 60 horsepower motor.

Well No. 2 is located adjacent to the Arapahoe pumphouse. It was drilled to a depth of 650 feet. A 70 slot well screen was installed from a depth of 300 feet to 380 feet, from 430 feet to 480 feet, and from 630 feet to 650 feet. The same model pump and motor is installed in both wells.
Arapahoe Industrial Park

The Arapahoe Industrial Park is served by a well near the Arapahoe School with a backup well at the school. The Certificate of Appropriation of Ground Water, Permit U.W. 3989, calls this Northern Arapahoe No. 1 Well. It is located in the southwest ¼ corner of the northeast ¼ corner of Section 23, Township 1 South, Range 3 East. This well was drilled to a depth of 488 feet. The static water level is at five feet. The well had been out of service for over a year as of June 2010. Water was being supplied by the school’s irrigation well, serving as a system back-up supply.

A new submersible well pump was purchased but had not been installed as of June 2010. This pump is a Hydroflo 40 horsepower model 7LL 5-stage submersible pump with an impeller diameter of 5.12 inches. Planned installation depth is 420 feet. The pump curve indicates a 225 gpm design capacity at 400 foot of total dynamic head. Because of decline in the well’s capacity, the pump will only be able to produce 165 gallons per minute. The water is treated with chlorine at the pumphouse and stored in a 250,000 gallon elevated welded steel tank. NAU operates and maintains this system along with the main Arapahoe system.

Summary of Supply Capacity

The Arapahoe system now has three wells and will have a total of four wells feeding the system once the well drilled in 2009 is added to the system. The production capacity of the three present wells is:

<table>
<thead>
<tr>
<th>Well Name</th>
<th>Capacity in GPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arapahoe Wells No. 1 &amp; 2 combined</td>
<td>340</td>
</tr>
<tr>
<td>Industrial Park Well No. 1</td>
<td>165</td>
</tr>
<tr>
<td><strong>Total Production Capacity</strong></td>
<td><strong>505 gpm</strong></td>
</tr>
</tbody>
</table>

While Well No. 3 is not yet on the existing system, it will be capable of providing an additional 455 gpm for the system.
Radionuclide Contamination Concerns

Some of the eastern part of the Arapahoe system encircles a former uranium mill site. The presence of radio nuclear material in the groundwater in the vicinity of that site is of serious concern to some of the nearby residents served by the water system. These residents are concerned that radio nuclear material from the groundwater is entering the water lines, and is responsible for the perceived higher than normal rates of cancer among those residents. Acknowledging those concerns, this section of the report summarizes the known scientific findings on this topic.

In the 1950’s, a uranium processing mill occupied a site now on the eastern edge of the Arapahoe water system’s service area. The Susquehanna-Western Uranium Mill site, as it is locally known, is approximately three miles south of Riverton along the now abandoned Chicago Northern Railroad. It sits on the river delta formed by the confluence of the Big and Little Wind Rivers. This entire area is underlain with a layer of saturated river gravel approximately 20 feet thick. Ground water level is at approximately four feet below the ground surface.

The mill operated from 1957 until it shut down in February 1963. The mill processed 909,000 tons of ore in that time. The mill tailings were stored at the site for the duration of its operation. It was subsequently determined that the tailings presented a source of water and air contamination. Some shallow individual home wells in the area were found to have trace amounts of uranium in them above natural background levels.

Between May of 1988 and September 1990 the tailings were removed from the site following a rigorous protocol under the direction of the U.S. Department of Energy’s Uranium Mill Tailings Remedial Action (UMTRA) program. A brief history of the mill and its site remediation is available on the internet at http://www.eia.doe.gov/cneaf/nuclear/page/umtra/riverton_mill_title1.html.

Because of the trace amounts of uranium detected in the area’s shallow alluvial wells, the U.S. Department of Energy (DOE) agreed to install an alternate water supply for the residents in the proximity of the old mill and its tailings pile. A new storage tank, transmission line, and distribution lines were added to the Arapahoe water system to serve those residents who were on private wells. Suspicion remains today with some of the area’s residents that their water supply is still contaminated with radio nuclear material.

This issue was studied by the Department of Energy’s Office of Legacy Management. The findings were summarized in the January 2008 report titled, Alternate Water Supply System Flushing Report Riverton, Wyoming, Processing Site. The following information regarding radionuclide contamination was retrieved from this report as well as the Verification Monitoring Report for Riverton, Wyoming, Processing Site Update 2008 published in May 2009. Conversations were also held with Mr. Sam Campbell and Jalena Dayvault of the U.S. Department of Energy. DOE collected water samples from and flushed several hydrants around the main system over a two year period to test for radium-226, radium-228, uranium, gross alpha, and gross beta. That data was compiled in 2008 and compared to contaminate levels set by EPA Safe Drinking Water Standards.
The Safe Drinking Water Act, administered by EPA, has set acceptable levels for the aforementioned contaminants in potable water systems. The EPA has determined that acceptable levels of combined radium-226+228 and gross alpha are 5 picocuries per liter (pCi/L) and 15 pCi/L, respectively (Corporation, 2008). The acceptable level of uranium has been set at 30 pCi/L which converts to 0.044 milligrams per liter (mg/L) (Management, 2008). It has also been determined that pipe flow velocities of 2 to 3 feet per second will remove sediment and particles loosely attached to the pipe wall. Velocities of 5 feet per second and greater will scour and remove bio-film accumulation and material attached to the pipe wall (Corporation, 2008).

Since publishing the January 2008 report, DOE has not performed any more testing on the system. Any further testing is now the responsibility of the tribe. Copies of all of the data regarding the flushing of the system are in that DOE report.

The Department of Energy concluded that all radium, gross alpha, and gross beta contamination found to occur in the water system is naturally occurring nuclear material and is coming from the Northern Arapaho Utilities wells. This radio nuclear material is entirely different from, and in no way related to, the residual uranium found in the mill tailings that were stockpiled in the area (Corporation, 2008) or the uranium detected in the area’s shallow wells (Management, 2008). Neither is the material in the water samples any of the daughter products produced through the natural decay that uranium goes through. Significant amounts of uranium were found in a groundwater plume that is migrating away from the former tailings pile. No uranium was detected in any of the water samples taken from the system taps or system’s hydrant flushing operations. Radium is the only nuclear material that has been detected in the NAU administered water system. It is naturally occurring in the NAU wells, including the well drilled near the tank in late 2009. Radium is a chemically distinct material from uranium. The radium in the system cannot be coming from the former uranium tailings pile or the groundwater plume associated with the tailings.

Published testing of the uranium contaminated groundwater plume shows that it has been slowly migrating to the south and east toward the Little Wind River and away from its original mill site location. DOE has projected that the alluvial aquifer will naturally flush itself free of uranium contamination within the 100 year regulatory period or perhaps sooner. The uranium concentration contours for the years 2005 and 2008 are shown in Figures III-3 and III-4 (Management, 2008) below. These maps graphically show the concentration of uranium in the groundwater is lessening as it moves toward the Little Wind River.

As stated in the introduction to this section, the question of radiation entering the water lines from residual uranium in the groundwater surrounding NAU’s water lines was explored. As any radioactive material, like uranium, decays it emits subatomic alpha, beta, and gamma radiation. Uranium emits mostly alpha particles. It is well understood by nuclear science that any free alpha particles, because of their low energy, are easily stopped by solid objects. A sheet of paper will commonly stop them. Thus, it would be nearly impossible for an alpha particle to penetrate a pipe wall. Beta particles, on the other hand, are stopped by more dense material but are also stopped by materials commonly used in making water lines. Gamma radiation is pure energy, somewhat like sunlight and has no mass. It is not a particle. It is stopped only by very dense materials such as lead or thick concrete. This radiation energy would travel completely through...
both PVC pipe walls and the water in that pipe, in one side and out the other. It carries no particle that could lodge in water or any other material.

The water system in this area is under high pressure, 90 psi, making it physically impossible for the surrounding groundwater or soils to carry uranium or other dissolved radioactive constituents into the pipes. For these reasons it is impossible for the potable water to be contaminated by radioactive material outside the pipe under normal operating conditions.

The radionuclide material that has been found in the system has only been found in dead-end lines where there is little water movement. As a result of these facts, DOE determined that radionucler contamination that enters the water system comes solely from the two source wells and that the amount of radionuclide contamination that is present in the system is well below EPA acceptable levels. Regular flushing of those lines having low circulation will eliminate detectable amounts of accumulated radionuclide particles in stagnant areas of the system. The optimum frequency to perform unidirectional flushing is every six months (Corporation, 2008). Flushing of the system will create flow velocities sufficient to remove sediment and those particles that are loosely attached to the pipe wall. Because of the 90 psi pressures in the portion of the system that is of concern, the flushing velocities are great enough to scour the inside of the pipe and remove any bio-film accumulation as well.

The newly drilled Wind River formation well at the Arapahoe tank that will help supply the Arapahoe system was tested for radionuclides, among other possible contaminates. This testing shows that gross alpha, gross beta, radium 226, and radium 228 are all present, but were all below the acceptable EPA levels. The system’s other two wells also are in the same formation and show similar levels of radium. This supports the conclusion that all radionuclides found in the water system come from the system’s wells, are naturally occurring, and are not related to the uranium mill tailings.

No evidence could be found to indicate that any of the radio nuclear contamination found in the water system is coming from any source other than the system’s supply wells.
Figure III-3: Groundwater and Surface Water Sample Locations and June 2005 Uranium Concentrations at the Riverton, Wyoming, Processing Site
Figure III-4: November 2008 Uranium Distribution at the Riverton Site
Main System SCADA

The main system’s two wells are controlled through the SCADA system by the water level. All on/off set points may be adjusted at the pumphouse SCADA panel. The lead pump is set to turn on when the 1 MG tank level drops to 18 feet. The lag pump engages if the tank further drops to 16 feet. Both pumps will shut off when the tank is full at 22 feet. The SCADA system’s tank level control is equipped with an alarm that activates at a high tank level of 25 feet and a low tank level of 10 feet.

The SCADA system senses system pressure at the pumphouse, and, from that reading, determines that tank level with which to control the well pumps. The tank level is not determined at the tank itself. Three pieces of data need to be entered manually at the pumphouse for the SCADA system to accurately calculate the water level in the 1 MG tank. First is the static pressure at the pumphouse; second is the calculated friction loss in the line between the pumphouse and the tank when one pump is engaged, and third is the calculated friction loss between the pumphouse and the tank if both pumps are running. From this data, the SCADA then calculates the water level in the 1 MG tank using the pumphouse as the datum. Next, the water level in the tank relative to the tank floor is calculated. This approach has significant drawbacks. Because the discharge from the well pumps declines with pumping time, the friction loss declines, leading to a false tank level determination. Any imprecision in the calculated friction loss also leads to a false tank level. The SCADA system can be seen in Figure III-5 below.

Figure III-5: Arapahoe Pumphouse SCADA System

The two incoming lines from the two wells are each fitted with Badger meters that measure the flow rate from each well pump and totalizes gallons-produced. For much of 2009, the system operators neglected to read the meters because they were under the impression that the meter was connected to the SCADA system and would record water usage automatically. The present SCADA equipment does not do that.
Main System Chlorination Treatment

The water from the wells is treated with chlorine whenever one or both pumps are engaged. The chlorine feed rate is regulated by the SCADA system. Each well has its own corresponding chlorine injection pump interlocked with the well pump.

The Wyoming Department of Environmental Quality recommends one hour of contact time from the point of water treatment to the first consumer. The current configuration allows for a contact time of approximately ten minutes at a flow rate of 20 gpm before water reaches the first consumer. Given the system’s piping configuration, this condition would be very difficult and costly to correct. However, this should not be cause for alarm because a flow rate of 20 gpm is fairly generous. Flows in this area are typically much less, meaning that contact time is increased.

Arapahoe Industrial Park Wellhouse, Control, and Chlorination Treatment

In 2009, construction on a new wellhouse began for the Arapahoe Industrial Park. Also, the pump in this well was out of service and a new pump was shipped to NAU in late 2009. As stated above on page 3, as of June 2010 that replacement pump had not yet been installed.

The Industrial Park well head is located inside this pumphouse. Water pumped from the well is injected with chlorine and sent to the elevated tank. If there is a problem with this well, the irrigation well located a short distance (approximately 300 ft.) away at the Arapahoe School can be engaged. To operate this well, NAU must contact the school and have them turn it on and off manually. This water also passes through the wellhouse and is injected with chlorine before going to the tank. A Badger Meter on the outflow line from the wellhouse to the tank records production and shows flow rate. It does not indicate which well is being pumped nor is it totalized by the SCADA. All production and run-time records are kept by hand. The plumbing inside the wellhouse and the corresponding SCADA system are shown in Figure III-6 below.

Figure III-6: Industrial Park Wellhouse Plumbing and SCADA System
TRANSMISSION SYSTEM

Main System

The transmission line for the main Arapahoe system consists of:

1. 12-inch PVC transmission line extending east from the pumphouse for 2½ miles along 17-Mile Road to Goes In Lodge Road.
2. 4-inch and 6-inch AC transmission line from the pumphouse to the 1 MG tank,
3. 8-inch PVC transmission line extending north from the 1 MG tank and then easterly along Left Hand Ditch Road to Littleshield Road, and
4. 6-inch PVC transmission line extending east from the east end of the 12-inch main on 17-Mile Road at Goes In Lodge Road to Beaver Creek Housing and the Beaver Creek tank.

Arapahoe Industrial Park

The transmission line in the Arapahoe Industrial Park system is 8-inch cast iron pipe extending from the pumphouse to the elevated tank and then from the tank to the Arapahoe School and to the Industrial Park. The transmission lines in this small system total less than 1,000 feet of line.

WATER STORAGE

Main System Tanks

Currently, the main system has 1,060,000 gallons of storage capacity. The 1 MG glass-lined bolted steel tank seen in Figure III-6 below is in sound structural condition. This tank was constructed in 2002 at a foundation elevation of 5217 feet. The high water line for this tank is at an elevation of approximately 5246 feet.
Figure III-6: 1 MG Storage Tank

The additional 60,000 gallons of storage is contained in a welded steel tank located south of Beaver Creek Housing. Its foundation elevation is 5160 feet. The high water line of this tank is at elevation 5190. Because its high water line does not match that of the 1 MG tank, this tank is only marginally functional. It stores water that can only be used if the 1 MG tank is completely empty. Its high water line of 5190 feet is nearly 30 feet below the base elevation of the 1 MG tank. While this tank can supply a small amount of emergency water, it does little else for the system. The altitude valve that is supposed to control this tank is rendered unusable because it was placed west of the Wind River Casino on the incoming transmission line feeding the casino and Beaver Creek Housing. To be usable, the altitude valve needs to be on the transmission line at the base of the tank. The tank level is now controlled manually by shutting off the transmission line once the tank is filled. This valve has to again be opened to make use of the stored water. Because of the lack of circulation through this tank, its stored water will likely become stale, taking on an unpleasant taste.

The 1 MG tank and the Beaver Creek tank are both accessed by two-track dirt roads. There is security fencing around both tanks, and the access ladders to both tanks were securely locked at the time of the on-site inspection.

Arapahoe Industrial Park Tank

The Industrial Park tank is a 250,000 gallon elevated welded unit. It was constructed in 1971. Its foundation is set at an elevation of 5025 feet and has a high water line elevation of 5154 feet.

A conversation with Doyle Ward of Ward’s Well Service revealed that when this tank was first constructed the inflow/outflow column often froze, especially over Christmas break when the school was using very little water and there was little circulation through the tank. This freezing also adversely affected the level sensor float in the tank, further complicating the issue. To alleviate this problem, Ward’s Well Service advised NAU to manually turn the well pumps on
and off as indicated by the tank levels. To Mr. Ward’s knowledge, the tank has not frozen since manual operation of the pump was implemented.

Mr. Ward also stated that the tank interior and exterior was sandblasted and painted about 20 years ago. When this tank was originally installed, the contractor neglected to grind down the tips of the welds, which prevented paint from properly adhering to the weld metal. This created rust spots referred to as “wormholes”. Ward’s Well Service spent much time re-welding the tank to correct this imperfection. According to Neil Redman, an NAU operator, the interior of this tank has been cleaned within the last couple years.

This tank, like the 60,000 gallon Beaver Creek tank, has a different high water elevation than does the 1 MG tank, making this system operate as an entirely separate system. Its high water elevation is 92 feet (40 psi,) below that of the 1 MG tank.

**Figure III-6: Arapahoe Industrial Park Elevated Tank**

**Summary**

The three tanks of the Arapahoe system have volumes and operating elevations of:

<table>
<thead>
<tr>
<th>Tank</th>
<th>Storage Volume</th>
<th>Base Elevation</th>
<th>High Water Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 MG tank</td>
<td>1,000,000</td>
<td>5217</td>
<td>5246</td>
</tr>
<tr>
<td>Beaver Creek</td>
<td>60,000</td>
<td>5160</td>
<td>5190</td>
</tr>
<tr>
<td>Industrial Park</td>
<td>250,000</td>
<td>5025</td>
<td>5154</td>
</tr>
</tbody>
</table>

This combination of operating elevations creates challenges in being able to operate a unified system with its resulting pressure zones.

**DISTRIBUTION SYSTEM**

A significant portion of the distribution system is substandard. Construction of the Arapahoe water system began in the 1960’s. The waterlines consisted of 4-inch and 6-inch asbestos cement (AC) pipe. Over the years, the Arapahoe distribution system has been upgraded and expanded to include almost 114,000 linear feet of waterlines. Currently, the system is comprised of several different sizes and types of pipe material. Materials are primarily AC and different grades of polyvinyl chloride. A three mile section along 17-Mile Road was recently upgraded to
12-inch C-900 DR 18 PVC. The variety of pipe sizes and grades of PVC materials makes maintenance of the system difficult. The Arapahoe Industrial Park infrastructure was constructed in the 1970’s. The Industrial Park and nearby scattered housing is served by 8-inch cast iron pipe. The existing Arapahoe School is fed by 8-inch cast iron, but the new school will be supplied by 8-inch PVC.

Great Plains Hall Area

The area surrounding Great Plains Hall, shown in Figure III-8, is served by AC distribution waterlines. The lines in this area serve several various Arapaho Tribal public services. Currently, an 8-inch PVC line exits the pumphouse before reducing into a 4-inch AC line. The 4-inch AC distribution line feeds water to the Great Plains Hall area. This line follows Great Plains Road north, where it ties in with a 6-inch AC line extending to a newly installed 6-inch PVC line serving the newly developed Ben Gay Heights housing project. At Left Hand Ditch Road, just north of the Sub-Agency Ditch culvert, it ties into an 8-inch PVC line which ties to the 1 MG tank. At the Sub-Agency Ditch culvert, the 8-inch PVC transitions to a 6-inch AC line. This 6-inch AC line parallels the right-of-way on the west side of Left Hand Ditch Road south to the new 12-inch PVC transmission line running parallel with 17-Mile Road.

![Figure III-8: Great Plains Hall](image)

There are eight fire hydrants in the area around the Great Plains Hall, but NAU has advised that only two of them are in working order.

Left Hand Ditch Road South of 17-Mile Road, C’Hair Lane, and the Arapaho Charter High School

The existing lines in this loop consist of 4-inch AC pipe. This loop includes Left Hand Ditch Road south of 17-Mile Road and C’Hair Lane. This loop connects into the 12-inch line at the
intersection of 17-Mile Road and Left Hand Ditch and the intersection of 17-Mile Road and C’Hair Lane. This line also serves the Arapaho Charter High School, seen in Figure III-9, located at the intersection of Left Hand Ditch Road and C’Hair Lane. There are two fire hydrants on this loop, both located at the Arapaho Charter High School. The 4-inch line on C’Hair Lane, east of the charter school was valved-off several years ago because of repeated line breaks. This creates two dead end lines. There is also a 4-inch AC dead end line extending south off of C’Hair Lane for an unknown length.

Figure III-9: Arapaho Charter High School

Susquehanna Extension

As part of the uranium mill tailings removal and remediation project conducted in the late 1980’s, the Department of Energy (DOE) constructed a water transmission line, distribution lines, and the Arapahoe system’s 1 MG tank. An 8-inch PVC line extends north from the 1 MG gallon tank to the Left Hand Ditch Canal where it tees east and west. From this tee it extends westerly for about ½-mile serving several homes. From the tee it also extends easterly approximately 3 miles along the canal bank and on Littleshield Road, then ½-mile north on Bear Track Way, then east along Goes In Lodge Road for 2 miles to Rendezvous Road, the old Riverton-Hudson highway (State Highway 138). At the intersection of Goes In Lodge Road and Rendezvous Road, this line turns southwesterly to follow Rendezvous Road for approximately one mile, where it dead ends. A dead end 6-inch PVC line extends from the intersection of Rendezvous Road and Goes In Lodge Road to serve the 789 Truck Stop and Casino. A dead end line runs north on Crow Avenue for ¾-mile serving a small housing area. A 6-inch PVC line also extends southwesterly from the intersection of Goes In Lodge Road and Bear Track Way to the 12-inch line parallel with 17-Mile Road. This line continues as 4-inch PVC southwesterly for approximately 1/3-mile, where it dead ends.
There are 11 fire hydrants scattered along the Susquehanna Extension. There are minimal fire hydrants serving the housing areas and a few hydrants in open areas that can be used to fill fire tanker trucks.

**17-Mile Road**

As previously noted in the discussions of the transmission system, a new 12-inch PVC line was installed along 17-Mile Road in 2007. This line begins approximately 900 feet west of the intersection of Great Plains Road, at the Arapahoe pumphouse. From there, it extends east for roughly 2.7 miles, a short distance beyond Goes In Lodge Road. At this point, it reduces to 6-inch PVC that continues to St. Stephens Schools, then across the Little Wind River to Beaver Creek Housing. With the construction of the 12-inch PVC line, new services were installed for all residences, as were seven new hydrants.

**Beaver Creek Housing, St. Stephens Schools and Mission, and the Wind River Casino**

The Beaver Creek line begins on 17-Mile Road at the end of the new 12-inch PVC line. As discussed above, this line runs east to St. Stephens Schools then southeasterly across the Little Wind River, then east across Wyoming Highway 789 to Beaver Creek Housing. The total length of this line is approximately 2.2 miles. From Beaver Creek Housing, the 6-inch PVC line continues south for 1.1 miles to the 60,000 gallon Beaver Creek tank. A 6-inch PVC spur line runs northerly along Wyoming Highway 789 to the Wind River Casino. An 8-inch PVC loop of line was installed in 2009 to serve the St. Stephens Schools.

Three fire hydrants were installed to serve St. Stephens Schools and Mission. Fourteen hydrants are located within Beaver Creek Housing, and two hydrants serve the Wind River Casino. Several of the fire hydrants in the Beaver Creek Housing project are not working or have been damaged.

**Arapahoe Industrial Park and Arapahoe School**

The Arapahoe Industrial Park consists of approximately 8,000 feet of 8-inch cast iron line. It serves the Arapahoe School (pre-school through 8th grade), and approximately 10 residences on Lower Left Hand Ditch Road. This system is independent of the main Arapahoe system. Several hydrants are located around the existing Arapahoe School and their new school building completed in early 2010. Three hydrants were installed around the Industrial Park, and one flushing hydrant is located at the intersection of Left Hand Ditch Road and Wyoming Highway 138, also known as Rendezvous Road. None of the fire hydrants in the Industrial Park are functional.

**FIRE PROTECTION**

There are 54 fire hydrants on the Arapahoe system, most of which are flushed and inspected annually. NAU reports that 15 of the 54 fire hydrants need to be replaced. There are several different types of fire hydrants throughout the system which complicates the operation and maintenance of the system.
The Insurance Services Office (ISO) has developed guidelines for determining fire protection capacities on public water systems and for assessing fire risk. Fire risk is based on exposure factors including building materials, square footage, building height, distance between adjacent building structures, and whether a fire suppression sprinkler system is used in the building.

According to ISO fire flow calculations, the Wind River Casino requires the largest fire flow in the Arapahoe area. Flow must be provided at a rate of 3,500 gpm for a three hour duration, which results in a storage requirement of 630,000 gallons. The current storage volume for Arapahoe meets this requirement.

However, even though storage is sufficient for fire protection, the distribution system is incapable of delivering adequate fire flow rates to any of the system’s largest facilities and most densely populated areas. The areas, most affected by this lack of capability, are Beaver Creek Housing, the Wind River Casino, the 789 Truck Stop and Casino, the Great Plains Hall area, St. Stephens Schools, Arapaho Charter High School, and the Arapahoe School. If the Arapahoe Industrial Park were to be developed, fire flow to this locale would also need to be increased. An analysis of the needed fire flow for each region is given below.

Analysis

WaterGEMS V8i was used to model both the main Arapahoe system and Industrial Park system. Fire suppression capabilities were analyzed at specific locations. These locations were selected based on building size and/or population density. Recommendations to improve fire flows to these areas are listed in Chapter IV. Their required fire flows were calculated using ISO guidelines and are shown below.

**Beaver Creek Housing**

The Beaver Creek Housing area is currently supplied by 6-inch PVC waterlines. Fire flow throughout the Beaver Creek Housing subdivision ranges from 375 gpm to 410 gpm. Houses of this proximity should have a fire flow of 750 gpm.

**Wind River Casino**

A 6-inch PVC stub-out serves the Wind River Casino. Because of its size, the Wind River Casino requires a fire flow of 3,500 gpm, but the system is only capable of delivering approximately 430 gpm.

**789 Truck Stop and Casino**

The 789 Truck Stop and Casino is supplied by a 6-inch PVC stub-out. This building requires a fire suppression of 2,250 gpm but is currently only protected by 615 gpm.

**Great Plains Hall Area**
The 4-inch and 6-inch AC lines are installed throughout the Arapahoe community which includes Great Plains Hall, the clinic, and nearby housing project. Under its current configuration, the Arapahoe system can only supply 360 gpm to this area. The Health Services building alone requires a fire flow of 2,000 gpm.

**St. Stephens Schools**

In 2009 the St. Stephens Schools were tied into the Arapahoe system by an 8-inch PVC waterline connected to the 6-inch PVC transmission line between 17-Mile Road and Beaver Creek Housing. The current fire flow to the schools is roughly 790 gpm. A building of this size and type of construction requires a flow of 2,750 gpm.

**Arapaho Charter High School**

The Arapaho Charter High School receives water from the 4-inch AC line on Left Hand Ditch Road and C’Hair Lane. This structure necessitates a fire flow of 2,250 gpm, but the current system can only provide 345 gpm.

**Arapahoe School**

The Arapahoe School is served by the self-sufficient Arapahoe Industrial Park system. This system consists of 8-inch cast iron distribution lines. The fire flow to the school is approximately 1,660 gpm under existing conditions. A new Arapahoe School building is equipped with a sprinkler system thus eliminating fire demand for that new facility. The majority of the old school buildings are to be demolished. However, the Administration Building will be left in service which requires a fire flow of 2,000 gpm.

**Arapahoe Industrial Park**

Similar to the Arapahoe School, the Arapahoe Industrial Park is served by 8-inch cast iron pipe. Because only scattered housing currently exists in this area, the necessary fire flow is 500 gpm. The Industrial Park system can provide more than adequate fire protection of approximately 2,575 gpm.

Currently, each of these areas, except the Arapahoe Industrial Park, suffers substandard fire flow capacity due to undersized distribution lines. Strategic improvements were modeled for the system in an attempt to predict solutions to these deficiencies. These improvements are detailed in the Recommendations Section of Chapter IV. A summarized table of existing fire flow conditions at major locations in the Arapahoe system is shown below in Table III-1.
The only meters on the main system and Industrial Park system are the corresponding pumphouse meters on the discharge lines. The systems’ services are not metered. As a result, there is no usage control. Without metering, it is impossible to quantify water usage, where it is occurring, and what the system loss is.

There are no known backflow prevention devices anywhere on the system. This presents an out-of-standard health risk to the system’s users. When service meters are installed, backflow preventers should be a part of that installation.

A large number of services are “daisy-chained” together, meaning that two or more services are connected to a single service tap and curb stop. This practice renders NAU incapable of shutting off water for non-payment or any other reason without adversely affecting innocent users. These daisy chains need to be separated so that each service has its own tap, curb stop, meter, and backflow preventer.

### SYSTEM LEAKAGE LOSSES

The present water consumption rates in the main Arapahoe system and Industrial Park system cannot be readily explained. Combined, these systems yield a consumption rate of 296 gallons per capita per day (gpcd), which significantly exceeds usage rates in Riverton, Lander, and Fort Washakie. In general, residences on the system have small lawns or no lawns, and the system does not support any large public parks. Fire suppression and other uses are not significantly higher than on other systems. There is no indication that household uses should be above those in surrounding communities.

---

**Table III-1: Existing Fire Flows**

<table>
<thead>
<tr>
<th>Location</th>
<th>Existing Fire Flow (gpm)</th>
<th>Recommended Fire Flow (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beaver Creek Housing (FH 1)</td>
<td>375</td>
<td>750</td>
</tr>
<tr>
<td>Wind River Casino (FH 15)</td>
<td>430</td>
<td>3500</td>
</tr>
<tr>
<td>789 Casino (FH 52)</td>
<td>615</td>
<td>2250</td>
</tr>
<tr>
<td>Great Plains Hall Area (FH 36)</td>
<td>360</td>
<td>2000</td>
</tr>
<tr>
<td>Arapaho Charter High School (FH 25)</td>
<td>345</td>
<td>2250</td>
</tr>
<tr>
<td>St. Stephens Schools (FH 17)</td>
<td>790</td>
<td>2750</td>
</tr>
<tr>
<td>Arapahoe School (FH 29)</td>
<td>1,660</td>
<td>2000</td>
</tr>
<tr>
<td>Arapahoe Industrial Park (FH 32)</td>
<td>2,575</td>
<td>500</td>
</tr>
</tbody>
</table>

FH denotes fire hydrant designation
A large portion of the system lines are in rocky, river alluvium soils. This soil type prevents leaks from reaching the surface which makes them difficult to detect. Without consumption metering, there is no way to identify system losses or unauthorized uses. This, coupled with the generally poor state of repair of the system, strongly suggests that there could be significant undiscovered leaks.

The neighboring Shoshone Water Distribution System, also built by the Indian Health Service, had a similarly high per capita usage rate. By conducting a series of three annual leak detection programs, they have successfully found and corrected leaks amounting to 220,000 gallons per day (153 gpm). For example, several services were found where the curb stop was left running after a mobile home or other structure was removed from the site. It is believed that a leak detection effort on the Arapahoe system will result in similar lost water savings.

**WORKS CITED**


CHAPTER IV

SYSTEM DEFICIENCIES AND RECOMMENDED SOLUTIONS

INTRODUCTION

As identified in Chapter III, there are a number of deficiencies in the current Arapahoe potable water system. Several of these are identified in the Recommendations paragraph following the discussion of each topic. Those recommendations are reiterated in Chapter I. In this chapter, deficiencies will be discussed in detail along with alternative solutions followed by recommended solutions. This information is presented in the same sequence in which the system operates:

1. Water Supply Source,
2. Treatment,
3. Storage,
4. Finished Water Transmission,
5. Distribution, and
6. Consumption.

The present system deficiencies seriously hinder NAU from delivering the level of service that they, their customers, and the Northern Arapaho Business Council desire. These system deficiencies can be overcome. To improve the system and its performance will require a considerable and persistent effort. At expected funding levels, it will also require several years of dedication to the improvement goals detailed in this Master Plan. The Business Council and NAU will need to partner, and as a team make water utility maintenance and improvements a serious and consistent priority. It will also require a consistent performance of the NAU staff in seeking funding, implementing projects, and reporting in a timely manner as required by the various funding agencies’ programs. These issues have all contributed to the present state of the system.

WATER SUPPLY SOURCE

Main System

Currently, the main Arapahoe system is served by two wells located near the pump house at the Arapahoe community. Physical information regarding these wells is discussed in Chapter III. These two wells have not been granted a permit through the Wyoming State Engineer’s Office as required by Wyoming law and upheld by the Wind River Bighorn adjudication.

With the addition of the new well drilled by the Wyoming Water Development Commission, the system will have adequate supply for the planning period.
Recommendation:

1. File the required permits for Well No. 1 and Well No. 2 to legally protect NAU’s source supply provided by these two wells.

Arapahoe Industrial Park

As discussed in Chapter III, the Arapahoe Industrial Park area is served by a separate well near the Arapahoe School near the 250,000 gallon elevated tank. Also discussed in Chapter III, the school’s irrigation well has been plumbed into the Industrial Park system as an alternate supply. Very little is known about this irrigation well. However, because it is approximately 300 feet from the main well, it is almost certain that the two wells interfere when pumped simultaneously. The present well, once put back in service, is adequate to meet expected demands. Once this system is tied into the main system, forming a single system, the present well can continue to serve as a source of supply to the entire system.

Adequacy of Supply System-Wide

As stated in Chapter II, summer use demand for the combined system in 2030, assuming conservation measures are in place, is forecast to be approximately 331 gallons per minutes (gpm) (397,000 gallons with 20 hour pumping) while production capacity is approximately:

<table>
<thead>
<tr>
<th>Well</th>
<th>GPM Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arapahoe Wells No. 1 &amp; 2 combined</td>
<td>340</td>
</tr>
<tr>
<td>Industrial Park Well No. 1</td>
<td>165</td>
</tr>
<tr>
<td>NAU Wind River Well No. 3 drilled in 2009</td>
<td>450</td>
</tr>
<tr>
<td><strong>Total Production Capacity</strong></td>
<td><strong>955 gpm</strong></td>
</tr>
</tbody>
</table>

This production capacity is more than sufficient to meet forecast demand.

With properly sized and installed pumps, these wells could produce even more water. The Arapahoe Industrial Park well was pump tested at 350 gpm with only 79 feet of drawdown after 24 hours when it was drilled in 1970. For unknown reasons this well’s production has dropped. It is recommended that the cause of its decline in production be investigated and the well rehabilitated to restore its original capacity. Arapahoe Well No. 1, if produced alone with a proper pump setting depth and correctly sized pump, with Well No. 2 shut down, could produce nearly 440 gpm.

Main System Pump House and SCADA System

The SCADA system has the ability to automatically dial a sequence of designated phone numbers until an operator responds; however, the necessary phone line has not been installed. The SCADA system also has the ability to be accessed via the internet, but without the phone line this feature cannot be used. Once the phone service is in place the system could be monitored and adjusted by the operators from any internet terminal. This would significantly enhance the reliability of the system and allow the operators to be more efficient with their time.
Recommendations:

1. Connect the Arapahoe Industrial Park system to the main Arapahoe system.

2. Install a new pump in the Arapahoe Industrial Park well that can provide sufficient head to lift water to the 1 MG tank.

3. Integrate the main system with the Industrial Park system with an appropriate SCADA system to control the resulting two pressure zones.

4. Implement SCADA operation via the internet as was done with the Ethete system.

**TREATMENT**

**Main System**

As explained in Chapter III, chlorination is the only treatment provided and the only treatment necessary under EPA regulations for groundwater. It takes place in the well house. Each of the two wells is fitted with a chlorinator interlocked with its respective well pump. The water is then distributed to the system.

**Arapahoe Industrial Park**

The well water is injected with chlorine at the pump house before it enters the system. This treatment is adequate.

**STORAGE**

**Main System One Million Gallon Tank**

Currently, the main system has 1,060,000 gallons of storage. 1,000,000 gallons of this is contained in a glass-lined bolted steel tank located above the Great Plains Hall area. This tank was put into service in 2002. The tank is in sound condition needing no remedial work. The fill/discharge line connected to this tank is reported to be an 8" PVC line. As mentioned also in Chapter III, the present SCADA system measures pressure at the pump house which is 100 feet below and three quarters of a

![Figure IV-1: Tank Ice Due to Overflowing Caused by a Problem with the SCADA](image)
mile from the tank. Inconsistencies in pressure measurement leads to frequent malfunctioning of the pump controls either overflowing the tank or leaving it unfilled.

There are also two 100,000 gallon tanks and one 200,000 gallon tank located below and in the vicinity of the 1 MG tank. These three tanks have, for many years, been out of service and abandoned. They need to be demolished.

**Main System – Beaver Creek 60,000 Gallon Tank**

The 60,000 gallon tank above the Beaver Creek Housing project is a welded steel design constructed in 1984. The tank has a gravel and steel ring-wall foundation. In 2009, this tank was listing by approximately 16°. In April 2009, using foam injection technology, the tank’s foundation was stabilized and the tank was restored to its vertical position. At that time the tank had was filled but out of service. As near as could be determined, the entire volume was frozen. As noted in Chapter III, this tank’s high water line is 56 feet below that of the 1MG tank. This makes the tank of very limited use. This tank is opened manually during periods of high demand when pressures to the Beaver Creek portion of the system drop. Otherwise the water in this tank gets no circulation and grows stale. The altitude valve meant to control this tank was installed on the transmission line west of Highway 789 rather than on the 6" fill/discharge line to the tank, rendering the altitude valve ineffective.

For this tank to remain in service its altitude valve needs to be relocated to the base of the tank.

Security fencing is provided, and the access ladders are securely locked for the 1 MG and Beaver Creek tanks. Fencing at the Beaver Creek tank is in need of repair, but this tank is likely to be abandoned within a few years due to its limited utility, making the fence repair a low priority.

The access roads to the tanks are marginal, especially in winter months and in wet conditions. The road to the one million gallon tank is short and could be easily improved. The road to the Beaver Creek tank is nothing more than a “two track” road, is remote, is over ½ mile long, and is impassible in wet weather.

**Arapahoe Industrial Park System**

The Arapahoe Industrial Park has 250,000 gallons of storage held in an elevated welded steel tank. This tank stands approximately 129 feet high and is located adjacent to the Arapahoe School. The tank is in sound condition. It will require repainting some years in the future.

Security fencing is provided around the tank and is in good condition.

Access to the tank and well is from Left Hand Ditch Road and is adequate in all weather conditions.
Adequacy of System Storage

Using recognized storage sizing procedures, a recommended storage volume can be calculated. This procedure is based on:

1. fire demand, plus
2. emergency storage of one average day’s consumption, plus
3. equalization storage, the volume consumed over a 6-hour period of peak flow conditions or an additional 25 percent of the maximum day consumption.

Further, it is assumed:

1. maximum day demand is equal to 2.5 times average day consumption and that
2. peak hour demand is equal to 1.75 times average hourly demand, and
3. peak rate duration is for 6 hours.

Based on that criteria and disregarding the Beaver Creek tank, future storage requirements, assuming that NAU implements conservation measures, will increase to 1.3 million gallons. Thus, the system’s present storage capacity of 1.0 million gallons is 300,000 gallons shy of its 2030 requirement. These calculations take into account the population growth of Arapahoe, proposed development in the Beaver Creek area, and the addition of the Arapahoe Industrial Park to the main system.

Recommendations:

1. Install a 300,000 gallon tank south of Beaver Creek Housing having the same high water line elevation as the 1 MG tank. This will meet storage requirements and improve fire flows to the commercial area and eastern portion of the system.

2. Connect the Arapahoe Industrial Park system to the main system to increase fire flows and flow volume to the Arapahoe School. This will also allow the Industrial Park well to supply water to the main system.

3. Once a new 300,000 gallon concrete tank is in service, remove from service and demolish the Industrial Park elevated tank and the existing Beaver Creek tank. Also demolish the three abandoned tanks north of Arapahoe.

4. Upgrade the tank access road to the 1 MG tank to an all-weather graveled surface.

TREATED WATER TRANSMISSION

Treated water transmission on the Arapahoe area system will be carried by the following lines:

1. The line on Left Hand Ditch between the 1 million gallon (MG) tank and 17-Mile Road shown in Figure IV-3,
2. The line along 17-Mile Road and extending east to the Wind River Casino shown in Figure IV-2,
3. The 8” transmission line (Susquehanna Extension) extending north of the 1MG tank and east to Rendezvous Road (Highway 138) shown in Figure IV-2,
4. The planned transmission line between Rendezvous Road and the Wind River Casino Shown in Figure IV-7,
5. The transmission line between Beaver Creek Housing and its storage tank shown in Figure IV-6, and
6. The planned transmission line on Left Hand Ditch Road extending south of 17-Mile Road to the Arapahoe Industrial Park, linking these two systems together as shown in Figure IV-8.

Recommendations regarding each of these transmission lines are included in the narrative discussion accompanying each of the listed figures.

The needed transmission and distribution line improvements are grouped into logical geographical units that could be funded, designed, and constructed as individual logical construction projects. These are discussed below.

**DISTRIBUTION SYSTEM**

**Main System**

A significant portion of the distribution system is substandard. Many of the waterlines are 4-inch and 6-inch asbestos cement pipe. Currently, the system is comprised of several different sizes and types of pipe material, including asbestos cement, polyvinyl chloride, and polyethylene. The variety of pipe sizes and materials makes maintenance of the system difficult. In recent years, some of the Arapahoe transmission system has been expanded and upgraded to industry standard PVC lines. The lines that are included in this category are the Susquehanna extension, which was put in under the DOE UMTRA program, and the upgrading of 2½ miles of the 17-Mile Road transmission line.

The services on the main Arapahoe system are not metered, nor do they have backflow preventers to protect the system from contamination. It has been a common practice to have more than one user connected to a single service line.

**Arapahoe Industrial Park**

The Arapahoe Industrial Park is comprised of approximately 8,000 linear feet of 8-inch cement lined cast iron pipe. This system was constructed in 1970. The condition of this distribution pipe is unknown; however, there is no evidence of significant deterioration. The new Arapahoe School building, currently under construction, will be serviced by an 8-inch PVC line. Water system modeling of the Industrial Park shows that, with the recommendations listed below, an 8-inch line is sufficient to provide fire protection to the school.

As previously mentioned in Chapter III, the service in the Arapahoe Industrial Park system are not metered nor are they fitted with backflow preventers.
Metering is the only way to effectively regulate and fairly charge for usage. Without metering, NAU cannot fairly bill for service or determine whether there are unusual levels of water leakage in the system. Having meters on the system would improve revenues for NAU, help conserve water, and would give NAU valuable water management information to quantify possible leakage (non-revenue water) and to determine usage patterns.

On both the main system and the Industrial Park system, it is known that some services are “daisy-chained” together, meaning that more than one user or home is connected to the same service line. This condition makes administration of water use impossible as NAU cannot turn off service to a single user who is not paying their bill without also turning off service to a paying user. This condition needs correcting.

A potential health threat exists because none of the services have backflow protection devices on them. This is of particular concern on the Arapahoe system because some residents water livestock from their service. If a vacuum were to occur on the system due to a system break or a fire pump drawing on the system, a garden hose left in a horse trough, for example, could suck contaminated water back into the system, resulting in a public health threat. In most current day systems, this would constitute a code violation. This health threat needs to be addressed.

RECOMMENDATIONS

Supply

The WWDC drilled a test well just north of the 1 MG tank. That well pump tested at 300 gpm with a surplus of available drawdown, as is fully discussed in Chapter 5. It is recommended that this well be tied in to the system. It will provide nearly enough supply by itself to meet projected system needs.

Storage

It is recommended that a 300,000 gallon concrete storage tank be constructed southeast of Beaver Creek Housing as shown in figure VI-6. This additional storage will bring the system’s storage volume up to that recommended for domestic demand and fire protection. Just as importantly it will put storage on the east side of the system providing a much better balances feed to the system and an emergency supply to the east side of the system in the event that the areas’ transmission line is out of service.

Treatment

Only chlorination treatment is necessary for the system’s groundwater supply. That treatment is now provided both at the Arapahoe pumphouse and at the Industrial Park well. The planned tie in for the new well also calls for a chlorination system to be included in its pumphouse. With that added chlorination system, the system will be in remain in full treatment compliance.

Transmission and Distribution
Recommended transmission improvements are shown in Figures IV-3 through IV-8 with discussion following. These figures show logical projects broken out by geographical area across the system. Discussions of the recommended improvements precede each figure.

Based on the findings of this deficiencies investigation, recommendations applying to the entire system and then to specific segments of the system are made in the remainder of this chapter. Those are:

1. The current distribution system for the Arapahoe area is comprised of several sizes and types of pipe material. These are detailed in Chapter III. There are several distribution lines within the system that are smaller than the industry minimum standard size of 6-inches for municipal systems.

2. The different pipe materials known of in the main system include of Asbestos Cement (AC), C900 DR 18 Poly Vinyl Chloride (PVC), SDR 26 PVC (thin wall), and Polyethylene (PE). There may be additional materials that are used but not recorded. Neither the AC nor the thin wall PVC pipe are manufactured any longer.

3. Based on the inventory of the system, much of the system’s distribution lines are undersized. Several of the lines are mismatched to the demand and create system bottlenecks. In other locations, lines are not looped, again creating flow delivery constraints, especially under fire demand conditions.

4. Based on modeling of the system as discussed in Chapter III, several distribution line upgrades were identified. In the balance of this section, recommendations are based on those identified needs. Each is accompanied by a sketch showing the affected segment of the distribution system.

5. The legend shown below applies to all six of the system segment sketches in the balance of this chapter. Each segment sketch depicts the recommended line replacement or addition determined to be necessary based on system modeling. The recommended improvements are numbered 1 through 7. A key map of the figures used to show the system wide recommendations is given below in Figure IV-2 for reference. These diagrams are for the reader’s reference only, and are not drawn to scale.
Figure IV-2: Key Map
1. Arapahoe/Great Plains Hall Area (Figure IV-3)

   a. Replace the 6-inch and 4-inch AC lines in Great Plains Road with 6-inch PVC, and connect this line with the 12-inch PVC main on 17-Mile Road.

   b. Replace the 8-inch PVC and 6-inch AC transmission lines that run from the 1,000,000 gallon tank along Left Hand Ditch Road south to the 12-inch PVC on 17-Mile Road.

While it is not a deficiency in the existing system, which is the subject of this chapter, the new well drilled near the 1 MG tank by the WWDC in late 2009 needs to be tied into the system. That is mentioned here only because it is in the Arapahoe/Great Plains area. It is treated as a separate project in Chapter VI.

![Figure IV-3: Great Plains Hall Area](image-url)
2. **Left Hand Ditch Road South of 17-Mile Road, C’Hair Lane, and Arapaho Charter High School (Figure IV-4)**

   a. Replace the 4-inch AC line on Left Hand Ditch Road with 10-inch PVC.
   b. Replace the 4-inch AC line on C’Hair Lane with 6-inch PVC.
   c. Upgrade the 4-inch AC line serving the Arapaho Charter High School to 6-inch PVC.

![Figure IV-4: Left Hand Ditch Road South of 17-Mile Road, C’Hair Lane, and Arapaho Charter High School Recommendations](image-url)
3. Susquehanna Extension (Figure IV-5)

The Susquehanna Extension, or Alternate Water Supply System as it is also referred to, was constructed in the late 1990’s under funding from the Department of Energy’s part of the mill tailings removal under the UMTRA program. This portion of the system consists of adequately sized lines made of currently standard PVC material. It consists of the 8 inch PVC line that extends north from the 1 MG tank to the Left Hand Ditch canal and from there, east along Little Shield Road, continuing east along Goes In Lodge Road to Rendezvous Road (Highway 138). This line then extends southwest along Rendezvous Road approximately one mile toward Mission Road where it dead-ends. It is recommended that to follow sound system design norms that the line on Rendezvous Road be extended from its present dead-end south and east to the transmission line running between 17-Mile Road and Beaver Creek Housing.

4. 17-Mile Road and St. Stephens School (Figure IV-5)

a. Upgrade the 6-inch PVC line to 12-inch PVC between the east end of 17-Mile Road and Highway 789.

b. Install a 6-inch PVC line along Mission Road from the dead end 6-inch PVC line in Rendezvous Road to the recommended 12-inch PVC transmission line discussed above.

Figure IV-5: 17-Mile Road, St. Stephens School, and Rendezvous Road Recommendations
5. **Beaver Creek Housing (Figure IV-6)**

a. Install a 10-inch minimum PVC transmission line from the proposed 300,000 gallon Beaver Creek tank to Wyoming Highway 789.

![Figure IV-6: Beaver Creek Housing Recommendations](image)

Figure IV-6: Beaver Creek Housing Recommendations
6. Wind River Casino and 789 Truck Stop and Casino (Figure IV-7)

   a. Upgrade the 6-inch PVC line between Highway 789 and the Wind River Casino to 12-inch PVC.
   b. Construct a 10-inch minimum PVC line between the Wind River Casino and the 789 Truck Stop and Casino to loop the east end of the system and increase fire flows.

Figure IV-7: Wind River Casino and 789 Truck Stop and Casino Recommendations
7. **Arapahoe Industrial Park (Figure IV-8)**

a. Install a 10-inch PVC line from the intersection of C’Hair Lane and Left Hand Ditch Road to the Industrial Park well house. This will allow tying the two systems together and allowing the industrial park well to supply water to the main system and the main system to deliver water to the Industrial Park system.

![Figure IV-8: Arapahoe Industrial Park Recommendations](image)
A summary of improved fire flows, taking into account all of the aforementioned upgrades, is shown in Table IV-1 and Figure IV-9.

Table IV-1: Tabular Representation of Improved Fire Flows

<table>
<thead>
<tr>
<th>Location</th>
<th>Recommended Fire Flow (gpm)</th>
<th>Flow After Improvements (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beaver Creek Housing (FH 1)</td>
<td>750</td>
<td>4605</td>
</tr>
<tr>
<td>Wind River Casino (FH 15)</td>
<td>3500</td>
<td>3595</td>
</tr>
<tr>
<td>789 Truck Stop and Casino (FH 52)</td>
<td>2250</td>
<td>3145</td>
</tr>
<tr>
<td>Great Plains Hall Area (FH 36)</td>
<td>2000</td>
<td>1960</td>
</tr>
<tr>
<td>Arapahoe Charter High School (FH 25)</td>
<td>2250</td>
<td>2510</td>
</tr>
<tr>
<td>St. Stephens Schools (FH 17)</td>
<td>2750</td>
<td>5315</td>
</tr>
<tr>
<td>Arapahoe School (FH 29)</td>
<td>2000</td>
<td>1940</td>
</tr>
<tr>
<td>Arapahoe Industrial Park (FH 32)</td>
<td>500</td>
<td>2380</td>
</tr>
</tbody>
</table>

Figure IV-9: Graphical Representation of Improved Fire Flows

Consumption Management Recommendations
As the system now functions, NAU has nearly no control over the system usage and no ability to enforce revenue collection. To address these two shortcomings the following two projects and implementation of a progressive rate structure are recommended.

1. **Install meters and backflow preventers on all services** on the system. It is recognized that this will be a major undertaking. The benefits will heavily outweigh both the costs and the user resistance that is expected.

2. **Separate all daisy-chained services** so that each service is connected to the main, has its own meter, and is controlled with its own curb stop valve.

3. **Implement progressive tiered water rate structure** very similar to the one shown in Table IV-2.

   **Table IV-2: Arapahoe Area Recommended Water Rates**

<table>
<thead>
<tr>
<th>Usage</th>
<th>2008 Expenses</th>
<th>2008 Gallons Produced</th>
<th>Cost per 1000, Gal</th>
<th>Assume 90% of consumption is residential</th>
<th>Assume 10% of consumption is commercial and public facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008 Expenses</td>
<td>$ 297,697</td>
<td>139,290,000</td>
<td>$ 2.14</td>
<td>125,361,000</td>
<td>13,929,000</td>
</tr>
<tr>
<td>2008 Gallons Produced</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost per 1000, Gal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assume 90% of consumption is residential</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assume 10% of consumption is commercial</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>and public facilities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008 Costs Attributable to residential use (90%)</td>
<td>$ 238,157.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008 Costs Attributable to Commercial/Pub (10%)</td>
<td>$ 29,769.70</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008 Number of homes served</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Revenue required per residence/yr.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Required revenue per residence/mo.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008 Residential revenue collected</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collected Residential revenues/household/mo.</td>
<td>$ 19.07</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008 Residential billing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average residential billing/household/mo</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average monthly household water consumption</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computation of Residential Rates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Usage</td>
<td>Rate/1000 gal.</td>
<td>Water Charge</td>
<td>Total Bill</td>
<td>Income/yr.</td>
<td></td>
</tr>
<tr>
<td>Base Rate (Minimum bill)</td>
<td>$ 20.00</td>
<td>$ 20.00</td>
<td>$ 74,640</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tier 1 0 to 5,000 gal</td>
<td>$ 2.00</td>
<td>$ 10.00</td>
<td>$ 115,692</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tier 2 5001 to 10,000 gal</td>
<td>$ 3.00</td>
<td>$ 15.00</td>
<td>$ 177,270</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tier 3 10,000 to 20,000</td>
<td>$ 4.00</td>
<td>$ 40.00</td>
<td>$ 341,478</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tier 4 Above 20,000</td>
<td>$ 5.00</td>
<td></td>
<td></td>
<td>$ 1,500</td>
<td></td>
</tr>
<tr>
<td>Residential Tap Fee</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**System Pressure Management Recommendations**
Currently, there are not any pressure-reducing valves (PRV) on either system. Due to the 5246 elevation of the high water line of the 1,000,000 gallon storage tank, the system pressures at elevations lower than 5060 exceed the maximum recommended operating pressure of 80 psi. Even so, there have not been complaints regarding over-pressurized households. It is recommended that customers in the high pressure area continue to utilize individual PRVs.

Main line PRVs should also be installed on selected lines at the 4960 foot contour. These are:
- on Crow Avenue at its intersection with Littleshield Road,
- on both ends of Goes-In-Lodge Road; at its Littleshield and 17-Mile Road intersections,
- on both ends of the Rendezvous Road line,
- The north end of the line joining the Rendezvous Read line and the Goes In Lodge Road line,
- on the Left Hand Ditch Road main where it is planned to tie into the Industrial Park system near Little Wind Bottom Road.

Other Recommendations

The Arapahoe system could operate with greater efficiency and serve future demands at a lower cost if significant policy changes were implemented. These include:
- Limiting the future expansion of the service to those having a density of customers that make the expansion economically self-supporting. A rule of thumb is that it requires about 30 services per mile to pay for construction of a main over a 30-year life.
- Work with the BIA to end the practice of issuing contiguous 2½ acre home sites in areas not already served by the central water system. This practice creates scattered areas of concentrated development that, through time, turn into villages demanding central systems which cannot be cost efficiently and only further burden all users with expense.
- Concentrate future development in areas where the system is already available and fire protection is adequate.
- Expand existing housing projects and commercial areas, such as Beaver Creek Housing and the Wind River Casino complex, instead of setting up new housing projects in unserved areas.
- Basing water charges on metered consumption regardless of age, tribal enrollment, or other criteria.

Standardization of the system materials will significantly enhance operation efficiency and allow faster and more effective repair of the system when failures occur. In that vein, the following recommendations are made:

1. Use only AWWA C-900 DR 18 PVC pipe, minimum 6-inch diameter, for all new and replacement lines.
2. Standardize all water system valves and hydrants to a single brand such as Mueller® or Waterous®.
CHAPTER V

GROUNDWATER ALTERNATIVES

INTRODUCTION

The existing Arapahoe water supply system is sourced from three Wind River Aquifer wells. These wells provide a good quality water and the aquifer has demonstrated that it is capable of providing the quantities needed to meet the projected demands of the Arapahoe system. Therefore, the initial phase of the Arapahoe Water Supply Project – Level II included a review of the potential sites for an additional Wind River Aquifer water supply well. The intent of this review was to identify potential sites that could yield a large volume of good quality water. Constraints imposed included: 1) siting the proposed well near existing water system infrastructure to minimize completion costs; 2) trying to concentrate on the anticipated large growth areas; and 3) trying to balance the supply system by providing water from the east side of the system as well as the current west side sources. Materials used in this review included previous water system reports of the area, the United States Geological Survey publications (several of which have a pretty exhaustive inventory of the groundwater sources on the Reservation), the Wyoming Water Resource Data System (WRDS), the Wyoming State Engineer’s Office (SEO) and the Wyoming Oil and Gas Commission records. The remainder of this chapter describes the well siting approach and ranks the identified sites.

WIND RIVER AQUIFER

The following description of the Tertiary Wind River Aquifer in the southern Wind River Reservation area was described by Hinckley Consulting and contained in the Northern Arapahoe Groundwater Supply Project Report prepared for the Wyoming Water Development Commission (James Gores and Associates, 2009). The Tertiary-age section in the study area is represented by the Wind River, Indian Meadows, and Ft. Union Formations. The Wind River Formation is present at the land surface over most of the central portion of the Wind River Basin. The Indian Meadows Formation is distinguished from the overlying Wind River Formation mainly along the northern margins of the Wind River Basin. Elsewhere, including in our study area, the difference between the two is indistinct and a combined “Wind River and Indian Meadows Formations” is mapped beneath the Wind River Formation (e.g. McGreevey, 1969). Beneath these deposits lies the Ft. Union Formation, like the other Tertiary deposits, thinnest along the flanks of the mountains and becoming vastly thicker towards the center of the basin.

From the south, the Wind River Formation begins approximately at Hudson and increases in thickness to the northeast to reach a maximum thickness of approximately 5,000 feet in the central part of the basin. In the Hudson area, the Ft. Union Formation outcrops as a narrow band along the edge of the Wind River Formation.

The Wind River Formation is a regional aquifer, although its water-production is quite variable. According to a schematic cross section from McGreevey et. al (1969) (Figure V-1), the most
consistently coarse-grained sequence of the formation - the sequence with “the most productive aquifers” – is that nearest the south flank of the Wind River Range. Detailed field work and exploratory drilling reported by Flores et. al (1993) document significant, localized aquifer potential in conglomeratic zones of the Ft. Union Formation north of Hudson. Between the Little Wind and Popo Agie Rivers, they identified a northeast flowing channel in which coarse, framework-supported conglomerates accumulated to a thickness of 250 feet. Several of their exploration boreholes produced small flows at the surface (up to 12 gpm), demonstrating at least locally confined-aquifer conditions. The viability of the Ft. Union was tested with an exploration well drilled for the Town of Hudson as a Level II Wyoming Water Development Commission (2009) project. Although the drill cuttings and geophysical logs appeared promising, the Ft. Union Formation was found to be tight with very little production and the water quality was very poor.

Figure V–1: Wind River Formation Schematic Cross-Section

Quantity

Daddow (1996) reports specific capacities for Wind River Formation wells across the Wind River Basin ranging from 0.04 - 23 gpm/ft, with a median value of 0.4 gpm/ft. Demonstrating the higher values from this basin-wide range, Wind River Formation wells supplying the City of Riverton have developed substantial supplies from this formation. These wells are from 500 to 1800 feet deep, with pumped yields from 150 to 550 gpm (Wyoming State Engineer’s Office permit files). The Riverton wells are completed in McGreevey et al.’s (1969) “coarse-grained sequence.” The 1998 Regional Water Master Plan for Riverton (James Gores and Associates, 1998) provides the following summary:

“Pumping test data as reported by Morris et al. (1959), McGreevy et al. (1969), Anderson & Kelly (1986) and Wester-Wetstein (1997) indicate transmissivity (T) values from 2,000 gallons per day per foot (gpd/ft) to 12,000 gpd/ft. Also, from the pumping tests performed in 1951 (Morris, et.al.), a coefficient of storage value for the Wind River aquifer was determined to be 2 x 10-4. The resulting specific capacity (ratio of yield to drawdown) from these same tests ranges from 1.5 gallons per minute per foot of drawdown (gpm/ft) to over 5 gpm/ft. Anderson & Kelly
(1976) recommend that values for T and S of 5,000 gpd/ft and 1 x 10-4, respectively, be used for planning purposes and anticipated specific capacities of approximately 2.5 to 3 gpm/ft.”

Pump testing on the Riverton Honor Farm well indicated transmissivities of 2,000 to 2,300 gpd/ft. At a transmissivity of 2,000 gpd/ft, a drawdown of 180 feet is sufficient to produce 200 gpm in an ideal aquifer (assumes storage coefficient = 0.1, 8-inch well, 100 days of continuous pumping).

The Arapahoe system currently utilizes the Wind River Formation for its water supply source. A summary of the existing Wind River Formation wells utilized in the Arapahoe water supply system is contained in Chapter 3 of this report. The production potential from the aquifer to augment the system is, therefore, not a major concern in the siting review. However, the variability of the quality of water produced from the Wind River is one of the primary components upon which the well locations were based.

Quality

Daddow (1996) found the groundwater quality in the Wind River Formation to be quite variable across the Wind River Basin, a function of local recharge, permeability, groundwater flow, and lithology conditions. TDS levels from 211 - 5,110 mg/l were measured. “Near Riverton and Arapahoe,” Daddow (1996) reports the Wind River Formation has TDS concentrations “usually less than 500 mg/l” with sodium as the dominant cation. The Wind River aquifer is anticipated to produce water meeting EPA Primary Drinking Water standards, but TDS and sulphate are of potential concern with respect to secondary standards. Additionally, the recent Wind River Aquifer exploration well drilled for the Ethete area produced water that exceeded EPA’s Primary Drinking Water Standards for the combined Radium 226 and 228 levels. Water quality records for these three constituents (TDS, sulphate and radionuclides) were the primary basis on which the well siting ranking was based.

Well Siting Investigation

As mentioned earlier, one of the controlling factors in deciding upon a future site of another Wind River Aquifer well for the Arapahoe system was the proximity of the proposed well to the current water supply system infrastructure. In Chapter II, Figure II-2 shows the existing configuration of the water system and the large aerial extent that it encompasses. With the large aerial expanse of this system, the number of locations to site a future well within a short distance to tie it into the water system is quite numerous. In order to reduce the number of potential wells sites, the potential sites were limited to those areas within a reasonable distance to a storage tank and to the southeast area of the Arapahoe system where the population growth is anticipated to be the highest due to the influence from the casino development.

The quality of water produced from the Wind River Aquifer in the Wind River Reservation area is quite variable. In an effort to identify areas or zones within the aquifer that will yield high water quality, water quality records from the State Engineer’s Office, the Wyoming Water Resources Data System Library, publications from the United States Geological Survey, which included records from the Indian Health Service and the Bureau of Indian Affairs, were
reviewed. The depositional history of the Wind River Formation was also investigated. The presence of the coarse-grained middle sequence of the Wind River Formation is well documented. However, in addition to tracking the depth of this facies in the study area, publications which investigated the ancient Eocene period flow paths and the positions of the ancient Eocene period river systems were also reviewed. The Eocene period flowpaths and river system data were of interest in an effort to identify areas where the water systems would have deposited the coarsest material. These areas would then yield potentially higher quality of water because the groundwater would travel through these zones quicker and there would be less dissolution of minerals into the water. It was the intent of this review to try to identify a pattern where the water quality of the Wind River Aquifer would coincide with these ancient river or flow systems.

Figure V-3 was modified from a USGS report by David Seeland (1986) which shows the Eocene period rivers and structural features. The southeast corner of the Arapahoe Water System area looked promising where the ancient Popo Agie River flowed up against the Riverton Anticline and had to change its course from northeast to due north. It was hypothesized that there would be a larger deposit of coarse-grained sediments where the river changed course due to a slowing of the river in this area and a loss of river energy. A review of the water quality from wells completed in the Wind River Formation in this area, however, did not correlate with this hypothesis, in that the majority of the wells in this area produced marginal quality water.

The most promising correlation appears to be with the correlation of high quality water produced from wells that have been completed in zones that outcrop beneath the Little Wind River. It is believed that the recharge from the Little Wind River travels through the more porous zones associated with the coarse-grained middle facies in the formation which produces the high quality of water. The association between the recharge from the Little Wind River and the high quality of water effectively lowered the priority of siting a well on the south side of the Little Wind River.

Final Well Site Selection

Due to the demands on the Arapahoe water system, it was the desire of the Northern Arapaho Tribe to incorporate the test well, if successful, as quickly as possible into their existing system. Because of the immediate needs of this additional water supply source, the selection of the test
well drilling location was concentrated on areas very near the existing storage tanks which are located just north of the Arapahoe community. The reasoning for this was as follows:

1. Locate near a storage tank to allow appropriate contact time after disinfection

2. Minimize conveyance cost to tie well into system

3. The pipeline diameter from the Industrial Park storage tank to the remainder of the Arapahoe water supply system is too small and would restrict the additional flow from this well – therefore, a well near this tank was rejected

4. Availability of Tribal Lands

As shown in Figure V–2, most of the existing infrastructure for the Arapahoe system is supplied from a single one million gallon storage tanks north of Arapahoe. In order to immediately utilize the additional supply from the new well, a well site very near these storage facilities was selected. An alternative site was also selected near the Wind River Casino. It was the desire of the Northern Arapaho Tribe to develop a water supply source near the casino area because of the anticipated growth in that area. However, because the existing data indicates that on the south side of the Little Wind River the Wind River Aquifer produces generally a poor quality of water, the probability of developing a high quality water source in the area of the casino was believed to be very small. Therefore, because of the immediate needs of this water source, it was decided to drill the production well near the existing infrastructure in an area with proven water quality and to drill a slim hole exploration well near the casino to verify the water quality of the Wind River Aquifer in this area. Figure V–4 shows the location of the production test well which is located in the NE¼ NE¼ of Section 11, Township 1 South, Range 3 East of the Wind River Meridian.

Once clearance was approved for access to the Production Well drill site, the project was let for bid on October 23, 2009. A total of three bids were received. These were from D.C. Drilling Company of Lusk, Wyoming in the amount of $259,088.00, Nucor, Inc. of Riverton, Wyoming
in the amount of $272,772.00, and Water System Drilling from Gillette, Wyoming in the amount $266,606.00. The project was awarded to D.C. Drilling Company. A Notice to Proceed was issued to D.C. Drilling Company on November 11, 2009.

PRODUCTION WELL

Production Well Drilling and Construction

The drilling contractor mobilized to the drill site on November 12, 2009 through November 16, 2009 and drilling of the Arapahoe Water Supply Wind River Production Well (Northern Arapaho Utilities Wind River Well No. 3, Permit No. U.W. 191375) was initiated on November 17, 2009 using a Midway 2250 rotary drilling rig. This rig was used to drill an 18½-inch borehole and to set and cement in place 55 feet of 13½-inch O.D., steel surface casing. A 12¼-inch diameter borehole was next advanced to a depth of 1,041 feet below ground level (bgl) using a light bentonite mud drilling fluid. It required approximately three days to drill the 1,041 feet of 12¼-inch borehole. Deviation surveys were conducted approximately every 200 feet with the last survey conducted at a depth of 1,041 feet. The deviation of the well ranged from 0° to ¾°. At 1,041 feet, the deviation survey indicated the well was nearly plumb with a deviation of less than 1°.

After reaching a depth of 1,041 feet bgl, the borehole was conditioned for the geophysical logging survey by circulating on bottom for approximately one hour. The Contractor tripped the drill string out of the borehole (standing doubles) and assisted the geophysical logging subcontractor, Century Geophysical from Casper, Wyoming, in rigging up. In their first attempt to log the well, Century Geophysical’s logging tool could only reach a depth of 515 feet bgl. The tool was retrieved from the borehole and the Contractor picked up a long tooth rock bit and tripped back in to the borehole to clear the obstruction. The drilling assembly reached the bottom of the borehole without encountering any significant obstruction. After circulating on bottom for over an hour, the Contractor tripped out of the borehole and the geophysical logging survey was successfully conducted. Two separate suites of logs were run. The first consisted of a gamma, resistivity, density and caliper log, and the second, a neutron and SP log. Both logs were able to reach the total depth (TD) without any problem. The logger’s TD was 1,037.6 feet bgl. While the geophysical logger was being rigged down, the depth and length of screened sections were being determined by reviewing the geophysical log field copies. This information was delivered to the Contractor and the Contractor began cutting the 8⅝-inch O.D., API, 32 lb/ft steel casing to the required lengths. The Contractor worked the remainder of the day, approximately eight hours, cutting the steel casing and welding sections of the casing to the 8-inch stainless steel screen. The Contractor welded together approximately 40-foot long sections of steel casing and stainless steel screen. After the geophysical logging subcontractor was rigged down, the borehole was further conditioned for the casing run by tripping back to the bottom of the borehole and circulating on bottom for approximately six hours. During this period, the drilling mud weight was increased by adding 20 sacks of bentonite gel. The drilling Contractor also advanced the 12¼-inch borehole to a depth of 1,051 feet bgl to provide a little more rathole to ensure that the casing and screen could be landed at the correct depth.
On the following day, November 21, 2009, the Contractor ran in approximately 1,030 feet of 8⅞-inch O.D., API, 32 lb/ft (some 28 lb/ft), H-40 steel casing (880 feet) and 8-inch pipe size, 15-slot stainless steel screen (150 feet). The casing (steel cap) was landed at a depth of 1,030 feet below ground level. Shale baskets were installed on top of most of the screened sections to prevent the migration of fines down the annular space and into the screened intervals. Where screened sections were separated by a short length of steel casing, only one shale basket was placed at the top of the shallower screen section. It required approximately eight hours to set the casing string.

After the casing was landed, the cementing subcontractor, Sanjel Corporation of Riverton, Wyoming arrived on site to cement the casing in place. Prior to installing the casing, the Contractor inserted a float collar in the casing string at a depth from 500 feet to 502 feet bgl. Above the float collar, at a depth of approximately 499.6 feet bgl, two 1-inch holes were drilled in the steel casing. Below the float collar, two cement baskets were attached to the outside of the casing string. The depths of these two cement baskets were 547 feet bgl and 505 feet bgl. Prior to rigging up the cement head, the Contractor pushed a rubber plug down to the top of the float collar and began circulating through the 1-inch ports cut in the casing. After rigging up the cement head, Sanjel placed 260 sacks of Type G cement (15.8 lbs/gallon slurry) which was displaced with a rubber plug followed by 30 barrels of fresh water. There were good returns of cement to the surface with an estimated 11 bbls of cement being displaced to the mud pits. This volume accounted for almost all of the excess cement that was called for in the driller’s contract. The construction of the Arapahoe Production Well is shown on Figure V-5

Production Well Development

After allowing the cement to cure for 18 hours, the Contractor tripped back into the casing with a 7⅞-inch bid and drilled out the rubber plugs and the float collar. After drilling out the float collar and plugs, the driller tripped out his drill string and laid down the bit and drill collars. They then commenced developing the well by tripping in 400 feet of drill pipe and began air lifting from this depth. Well development efforts continued during the next five days with the development program consisting of both air development and water jetting the screens. Each screen section was jetted for approximately 2 to 3 minutes per foot of screen. The well did not take a lot of water during the initial jetting operations. After the first four days of development efforts, the well was only producing approximately 60 gpm when air lifted from a depth of 600 feet. The flow was measured using a V-notch weir. Just prior to shutting down for the evening on the fourth day of development, the Contractor mixed up two sacks of sodium acid pyrophosphate (SAPP) in the mud tank and jetted this mixture into the two upper screens and the deepest screened section. The next day, after allowing the SAPP to remain in the well for over 12 hours, the production from the air development increased from approximately 60 gpm to over 120 gpm. Development efforts continued by surging and air lifting the well. At the conclusion of the well development efforts, the well produced over 350 gpm steadily with the air eductor piping set at a depth of 680 feet bgl. Well development efforts were concluded after approximately 28½ hours.
ARAPAHO WIND RIVER PRODUCTION TEST WELL

LITHOLOGY/GEOPHYSICAL LOG

CONSTRUCTION DETAILS

13 3/8 - INCH SURFACE CASING SET AND CEMENTED AT A DEPTH OF 55 FEET BGL
18½ - INCH DIAMETER BOREHOLE TO 55 FEET BGL

BOREHOLE CEMENTED WITH 260 SACKS OF TYPE G CEMENT

8 5/8-INCH O.D., 32 LB/FT (SOME 28 LB/FT) API H-40 STEEL CASING SET AT 1,030 FEET BGL

12¼-INCH DIAMETER BOREHOLE TO 1,051 FEET BGL

CENTRALIZER

TWO (2) 1" HOLES CUT IN CASING AT 499.6 FEET BGL

FLOAT COLLAR SET AT 500.3 FEET TO 501.6 FEET BGL

CEMENT BASKET SET AT 505.3 FEET BGL

CEMENT BASKET SET AT 547 FEET BGL

SHALE BASKET

8-INCH PIPE SIZE, V-SLOT, CONTINUOUSLY WIRE-WOUND, 0.015-INCH SLOT OPENING STAINLESS STEEL SCREEN SET AT THE FOLLOWING DEPTHS:
- 572' TO 587'
- 604' TO 614'
- 709' TO 724'
- 735.5' TO 755.5'
- 780' TO 800'
- 899' TO 909'
- 927' TO 937'
- 947' TO 952'
- 972' TO 977'
- 991' TO 1,021'

WELDED STEEL CAP AT 1,030 FEET BGL

WELL TD AT 1,051 FEET BGL

Figure V–5: Production Well “As-Built” Diagram
Production Well – Aquifer Testing

It was originally anticipated that the Wind River Production Test Well would be capable of producing over 250 gpm. This was based upon the available well data in the area and production history of the Wind River Aquifer in the Wind River Basin. The test pump provided by the Contractor was a J-Line, 8-Stage, submersible pump with 50 Hp motor, which was set at a depth of approximately 560 feet using 3½-inch O.D. steel drill pipe. This pump is rated to produce 300 gpm with a total dynamic head of 450 feet. To aid in determining the discharge rate for the long-term test and to determine the efficiency of the well, a step test was initially conducted on the well.

On December 3, 2009, the Contractor installed the test pump and checked the pump rotation. Two airlines were attached to the drill pipe. The ends of the airlines were set at a depth of 559.4 feet bgl. The test pump was started and rotation checked and, after allowing the well to recover for approximately one-half hour, the step test was initiated.

Step Test

The step test consisted of pumping the well at different rates for a period of approximately 45 minutes and measuring the total drawdown experienced in the well through each step (See Figure V-6). Initially the water comes from both the aquifer and water stored in the casing, however, after a short time casing storage is negligible and all water is developed from the aquifer. Therefore, each step must be sufficiently long enough to ensure that the pumping water level is not affected by water stored in the casing. The amount of time in which casing storage becomes negligible is variable and dependent on aquifer parameters, casing size, the drop pipe size and the pumping rate. During the first step, the time to overcome the casing effects was calculated and it was determined to be approximately 4½ minutes using the formula developed by Schafer (1978). A static water level of 172.78 feet bgl was recorded prior to starting the step test. The water level was monitored using both an airline and a 200 psi Weksler gauge with 2 psi increments and an electronic sounder. The pumping rate was measured using a 6-inch by 4-inch orifice weir.

Four steps were conducted, each 45 minutes in length, at the

![Figure V-6: Production Well Step Test](image-url)
following pumping rates: 150 gpm, 200 gpm, 250 gpm and 300 gpm. At the conclusion of the 300 gpm step, an attempt was made to run a last step at a rate of 400 gpm; however, due to the significant head loss in the drop pipe, the production would not increase past 300 gpm. The step test was terminated at this time and recovery data collected. Table V-1 is a summation of the step test.

Table V-1
Northern Arapaho Wind River Production Well
Step Test Results

<table>
<thead>
<tr>
<th>Pumping Rate (gpm)</th>
<th>Drawdown (Feet)</th>
<th>Specific Capacity (gpm/ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>150</td>
<td>24.83</td>
<td>6.04</td>
</tr>
<tr>
<td>200</td>
<td>35.26</td>
<td>5.67</td>
</tr>
<tr>
<td>250</td>
<td>44.97</td>
<td>5.56</td>
</tr>
<tr>
<td>300</td>
<td>53.85</td>
<td>5.57</td>
</tr>
</tbody>
</table>

In a 100-percent efficient well, the steps (drawdown verses discharge) should plot as a straight line with a slope of 1 on log-log paper (Figure V-7). Theoretically, it is impossible to have a 100-percent efficient well, as a certain amount of head loss due to turbulent flow and friction is inherent in all wells. The wells actually receive their water by lowering the head in the well that results in the flow of water toward the well bore in the aquifer material. As the water gets close to the well bore, the gradient increases and the flow becomes turbulent in and around the screened intervals in the well bore. This results in the hydraulic head in the well bore being lower than the hydraulic head in the aquifer and is attributed to well inefficiency. During each successive step, these turbulent head losses increase and the efficiency becomes less, which also lowers the specific capacity of the well. Specific capacity values for the well appear to fall on or slightly below the line with a slope of 1 (Figure V-7). This indicates that the well is operating at a fairly high efficiency.

The results of the step test were quite promising and appeared to be very consistent with the reported yield from the two nearby Arapahoe water supply wells, Arapahoe No. 1 and Arapahoe...
No. 2 Wells, located in the SW¼, SE¼ of Section 11, T 1 S, R 3 E, approximately 4,900 feet south – southwest of Wind River Well No. 3.

Following the step test, recovery data was only collected for approximately 20 minutes because the Contractor wished to recheck the pump rotation again due to the inability to increase the production of the pump above 300 gpm. The wiring was determined to be correct and the limitation in the production determined to be from the head loss in the drop pipe.

**Long-Term Constant Rate Drawdown Test**

Because the discharged water from the pump test crossed two access roads and was ponding near some vacant homes, it was decided (with the approval from the WWDC Project Manager) to limit the duration of the constant rate drawdown test to 24 hours instead of the contractual 7-day period. The constant rate test was initiated on December 4, 2009 at 8:15 A.M., after being allowed to recover for approximately 14¾ hours following the step test. The discharge rate during this test remained constant at a rate of 300 gpm. The drawdown data were plotted on semi-logarithmic paper as shown in Figure V-8 and analyzed using the modified non-equilibrium equation developed by Cooper and Jacob (1946).

As shown in Figure V-8, the drawdown at the conclusion of the constant rate test was 60.8 feet. The transmissivity calculated from the slope of the drawdown data at the conclusion of the test approximated 10,700 gpd/ft. As can be seen in Figure V-8, the slope of the drawdown data is fairly consistent throughout the length of the test, with the exception of the very early time data (less than 2 minutes). At the conclusion of the drawdown test, the aquifer had not reached a state of equilibrium and the pumping level was still declining at a constant rate.

**Constant Rate Recovery Test**

After being pumped at a constant rate of 300 gpm for a 24-hour period, the pump was then shut off and recovery was monitored for another 8-hour period (91% recovered). The equipment used to monitor the recovery was the same as used in the pumping test, consisting of an airline set just above the pump at a depth of 697 feet bgl and a 200 psi Weksler gauge with 2 psi increments. A semi-log plot of the recovery data is shown in Figure V-9. Theoretically, the calculated aquifer parameters from the recovery test should be very similar to that calculated from the time-
A drawdown plot in the constant rate pumping test; however, the constant rate pumping test data is subject to small changes in pumping rates and the head loss resulting from the turbulent flows into the well. The recovery data should show more accuracy because the residual drawdown measurements are not affected by slight changes in the pumping rate or the turbulent flow head loss. The residual drawdown is plotted against time since pumping started \((t)\) divided by time since pumping stopped \((t')\). With this type of plot, the early recovery data is shown on the right side of the plot while latter data is shown on the left side of the plot.

The recovery test data was plotted (Figure V-9) and analyzed using the same method used in the pumping test analysis. The analysis indicated a transmissivity value of 9,430 gpd/ft, which is slightly less than the transmissivity from the time vs. drawdown plot. There is no shift in the residual drawdown data to the right or left as \(t/t'\) approaches one (1). This indicates that there was no boundary (either positive or negative) encountered during the duration of the test and there was no change in the storage coefficient due to imperfect elasticity properties of the aquifer. In essence, the aquifer rebounds vertically during the recovery period at the same rate that it is compressed during the drawdown test (discharge of water).

Aquifer Test Summary

Because of the limitations of the capacity of the test pump, the pumping level of the well at increased discharge rates was calculated using the method developed by Bierschenk (1964). Bierschenk used a straight line graphical method to solve for the constant values in the equation describing the drawdown associated with laminar and turbulent flow developed by Jacob (1946) and described by Driscoll (1986). Jacob expressed the drawdown as a combination of laminar flow \((BQ)\) and turbulent flow \((CQ^2)\) in the following equation:

\[
s = BQ + CQ^2,
\]

Bierschenk’s method of determining the constants \(B\) and \(C\) values involves plotting the inverse of the specific capacity values from the step test versus the discharge. The constant values of \(B\) and \(C\) were then plugged into the following equation to determine the specific capacity of the well at different pumping rates

\[
Q/s = 1/(CQ+B).
\]
From the turbulent and laminar flow constants it was calculated that 85% of the head loss (drawdown) in the well is due to laminar flow. Comparing the theoretical specific capacity using a transmissivity of 10,000 gpd/ft (transmissivity value from constant rate drawdown and recovery tests) to the calculated specific capacity after pumping at 300 gpm for one day, the calculated well efficiency is over 90%. Based on the above equation, the well is capable of producing over 500 gpm on a sustained basis (drawdown at 500 gpm of approximately 100 feet - pumping level of approximately 273 feet); however, the largest 6-inch diameter submersible pump available is a 60 Hp pump and, therefore, the capacity of the well is limited to approximately 450 gpm.

Production Well – Water Quality

Due to the timing of the pump test (Friday), water samples were collected near the beginning of the long term constant drawdown tests so that the sample could be submitted to an EPA-certified laboratory for analysis prior to the weekend. The results of these analyses are compared to EPA Primary and Secondary Drinking Water Standards in Table V-2. In addition, the temperature, conductivity and pH of the water were monitored throughout each of the aquifer tests performed. These data are shown graphically in Figures V-10 and V-11. The temperature, conductivity, and the pH of the discharged water all remained fairly constant over the length of aquifer test. The water temperature remained approximately 16.2° C (61.16° F) throughout the test, with some minor fluctuations which were thought to be more of a function of the ambient temperature’s effect on the small water sample in the conductivity/pH meter used to measure the temperature. The pH ranged from 8.4 to 8.83 while the conductivity ranged from 548 to 560 micromhos per centimeter. The field recorded conductivity and pH values are in close agreement with the laboratory results (pH of 8.34 and conductivity of 589 micromhos/cm).
At the onset of this project, it was thought that the quality of water produced from the Wind River Aquifer in the vicinity of the Production Well (Northern Arapaho Utilities Wind River Well No. 3) would be good. However, in recent Wind River wells drilled in the Ethete area (James Gores & Associates, 2009), the groundwater produced has been found with levels of Radium 226 + 228 exceeding EPA’s Primary Drinking Water Standards MCL. The level of radionuclides measured in the Arapahoe water supply system piping also raised some concerns regarding the potential for the radionuclides to be out of compliance in the No. 3 well. As shown in Table V-2, the quality of the water produced by the Wind River Production Well (Northern Arapaho Utilities Wind River Well No. 3) is very good. This water satisfies all of EPA’s Primary and Secondary Drinking Water Standards.

### TABLE V-2
Water Samples Comparison with EPA Drinking Water Standards
Wind River Production Well

<table>
<thead>
<tr>
<th>Parameters (mg/l except as noted)</th>
<th>EPA Maximum Contaminant Level</th>
<th>Wind River Production Well Sample Date 12/4/09</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulated VOC's</td>
<td>Various</td>
<td>ND</td>
</tr>
<tr>
<td>Synthetic Organic Chemicals</td>
<td>Various</td>
<td>ND</td>
</tr>
<tr>
<td>Total Trihalomethanes (µg/l)</td>
<td>100</td>
<td>ND</td>
</tr>
<tr>
<td>Pesticides/Herbicides</td>
<td>Various</td>
<td>ND</td>
</tr>
<tr>
<td>Antimony</td>
<td>0.006</td>
<td>ND</td>
</tr>
<tr>
<td>Asbestos</td>
<td>*</td>
<td>NA</td>
</tr>
<tr>
<td>Arsenic</td>
<td>0.01</td>
<td>ND</td>
</tr>
<tr>
<td>Barium</td>
<td>2.00</td>
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</tr>
<tr>
<td>Beryllium</td>
<td>0.004</td>
<td>ND</td>
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<tr>
<td>Cadmium</td>
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<td>ND</td>
</tr>
<tr>
<td>Chromium</td>
<td>0.10</td>
<td>ND</td>
</tr>
<tr>
<td>Copper</td>
<td>1.30(^a)</td>
<td>ND</td>
</tr>
<tr>
<td>Cyanide</td>
<td>0.20</td>
<td>NA</td>
</tr>
<tr>
<td>Fluoride</td>
<td>4.00</td>
<td>0.6</td>
</tr>
<tr>
<td>Lead</td>
<td>0.015(^a)</td>
<td>0.003</td>
</tr>
<tr>
<td>Mercury</td>
<td>0.002</td>
<td>ND</td>
</tr>
<tr>
<td>Nickel</td>
<td>0.10</td>
<td>ND</td>
</tr>
<tr>
<td>Parameters (mg/l except or as noted)</td>
<td>EPA Maximum Contaminant Level</td>
<td>Wind River Production Well Sample Date 12/4/09</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>-------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Nitrite (as N)</td>
<td>10.00</td>
<td>ND</td>
</tr>
<tr>
<td>Nitrate + Nitrite (as N)</td>
<td>10.00</td>
<td>ND</td>
</tr>
<tr>
<td>Selenium</td>
<td>0.05</td>
<td>ND</td>
</tr>
<tr>
<td>Thallium</td>
<td>0.002</td>
<td>0.0005</td>
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</table>

**Radionuclides**

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<th>Wind River Production Well Sample Date 12/4/09</th>
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<tbody>
<tr>
<td>Uranium</td>
<td>0.03</td>
<td>ND</td>
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<tr>
<td>Radium 226, pCi/l</td>
<td>5.0&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.7</td>
</tr>
<tr>
<td>Radium 228, pCi/l</td>
<td>&lt;sup&gt;_&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.7</td>
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<tr>
<td>Gross alpha, pCi/l</td>
<td>15.00</td>
<td>5.5</td>
</tr>
<tr>
<td>Gross beta, pCi/l</td>
<td>&lt;sup&gt;_&lt;sup&gt;b&lt;/sup&gt;</td>
<td>7.6</td>
</tr>
<tr>
<td>Radon pCi/l</td>
<td>NS</td>
<td>NA</td>
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</table>

**Secondary EPA Parameters**

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<th>EPA Maximum Contaminant Level</th>
<th>Wind River Production Well Sample Date 12/4/09</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acidity (mg/l as CaCO&lt;sub&gt;3&lt;/sub&gt;)</td>
<td>NS</td>
<td>ND</td>
</tr>
<tr>
<td>Alkalinity (mg/l as CaCO&lt;sub&gt;3&lt;/sub&gt;)</td>
<td>NS</td>
<td>132</td>
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<tr>
<td>Bicarbonate</td>
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<td>162</td>
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<tr>
<td>Boron</td>
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<td>0.1</td>
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<td>Calcium</td>
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</tr>
<tr>
<td>Carbonate</td>
<td>NS</td>
<td>ND</td>
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<tr>
<td>Chloride</td>
<td>250.00</td>
<td>11</td>
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<tr>
<td>Color (color units)</td>
<td>15</td>
<td>5.0</td>
</tr>
<tr>
<td>Conductivity (μmhos/cm @ 25°C)</td>
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<td>589</td>
</tr>
<tr>
<td>Corrosivity (Langlier Index)</td>
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<td>Foaming Agents</td>
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<td>&lt; 1.0</td>
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<td>Iron</td>
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<td>Manganese</td>
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<td>1.7</td>
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<tr>
<td>Odor</td>
<td>3 TON</td>
<td>ND</td>
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<td>Parameters</td>
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</tr>
<tr>
<td>----------------------------------</td>
<td>------------------------------</td>
<td>---------------------------------------</td>
</tr>
<tr>
<td>pH (units)</td>
<td>6.5-8.5</td>
<td>8.34</td>
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<td>Potassium</td>
<td>NS</td>
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<td>Sodium</td>
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<td>Fluoride</td>
<td>2.00</td>
<td>0.6</td>
</tr>
<tr>
<td>Sulfate</td>
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<td>Temperature (°F)</td>
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<tr>
<td>Total Dissolved Solids</td>
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<td>384</td>
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<tr>
<td>Silica</td>
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<td>Silver</td>
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<td>Zinc</td>
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<tr>
<td>Turbidity</td>
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**Microbiological**

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<tr>
<td>Total Coliforms</td>
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<tr>
<td>E-Coli Coliforms</td>
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<td>Absent</td>
</tr>
<tr>
<td>Iron Bacteria</td>
<td>NS</td>
<td>8600</td>
</tr>
<tr>
<td>Bacteria – Sulfate Reducing</td>
<td>NS</td>
<td>NA</td>
</tr>
</tbody>
</table>

* 7 million fibers/liter longer than 10 μmeter

** Action Level MCL - Sample with contaminant in greater quantity than this as measured in the 90\textsuperscript{th} percentile of all samples at the customer's tap will trigger treatment technique requirements to be implemented

** The regulation states that the total radium (radium 226 + radium 228) cannot exceed 5.0 pCi/L, alpha particle activity can not exceed 15 pCi/L and the uranium MCL is 0.03 mg/L. The MCL for beta activity is stated such that the beta activity cannot produce an annual dose to the total human body or to any internal organ greater than 4 millirem/year

** no more than one sample per month can test positive if fewer than 40 samples are analyzed per month - populations serving less than 1000 people require only one sample per month

NA Not Analyzed

ND Not Detected

NS No Standard
SLIM HOLE TEST WELL EXPLORATION PROGRAM

The Arapahoe water system is currently sourced from three Wind River Formation wells, all of which are located on the west side of the distribution system. As part of this study, the feasibility of developing a water source (Wind River Formation well) on the east side of the system where the present development growth is currently taking place was investigated. Based on the lack of wells producing a good quality water south of the Little Wind River, the probability of developing a potable water supply source in this area of the Arapahoe system was deemed to be very low. As a result, the exploration program to test the feasibility of developing a water supply source on the east side was limited to a slim hole test where just the water quality was analyzed.

The slim hole test well was an “Add-Alternative” to the contract for the drilling, construction, development and testing of the production well which has been described in the earlier sections of this Chapter. To minimize the time required to gain access to a drill site location, it was decided to locate the slim hole test well on the Wind River Casino property just to the west of State Highway 789 in the NE¼ NW¼ Section 15, T1S, R4E (See Figure V-12).

The production well (Northern Arapaho Utilities Well No. 3) was completed under-budget, and therefore, funding was available to issue the change order for the drilling and testing of the slim hole test well. After the completion of the pump testing operations at the production well, the Contractor demobilized from the production well site and mobilized to the slim hole location on December 14, 2009. This test well was permitted by the SEO under U.W. 191376. Drilling of the slim hole test well was begun on December 16, 2009 when a 12¼-inch borehole was advanced to a depth of 52 feet bgl and 52 feet of 8¾-inch 32 lb/ft, API, H-40 steel surface casing was set and cemented in place. After allowing the cement to set for approximately 18 hours, the Contractor rigged down the cementing head and tripped in a 7⅞-inch bottom hole assembly and began drilling a 7⅞-inch diameter borehole from 52 feet bgl to a final total depth (TD) of 801 feet bgl. The following day, Century Geophysical arrived on site and logged the slim hole test well. The logger encountered 10 feet of fill in the bottom of the borehole and was only able to log the borehole from a depth of 791 feet bgl to the surface. A diagram of the Slim Hole Test Well is shown in Figure V-13.
Figure V–13: Slim Hole Well Diagram

ARAPAHO SLIM HOLE TEST WELL

LITHOLOGY/GEOPHYSICAL LOG

CONSTRUCTION DETAILS

8 5/8 - INCH, 32 LB/FT, STEEL SURFACE CASING SET AND CEMENTED AT A DEPTH OF 52 FEET BGL

12¼ - INCH DIAMETER BOREHOLE TO 52 FEET BGL

7 7/8-INCH DIAMETER BOREHOLE TO 801 FEET BGL

WELL TD AT 801 FEET BGL

TERTIARY WIND RIVER FORMATION

DEPTH IN FEET

MUDSTONE GRAVEL SHALE SAND/SANDSTONE CLAY
After completing the logging runs, the Contractor rigged down the geophysical logging equipment and then laid down their drill collars and picked up, ran in and set a packer at depth of 506 feet bgl. A review of the geology in the area indicated that if there were a component of recharge from the Little Wind River where the river crossed the exposed formation then it would occur at a depth of approximately 500 to 800 feet in the Slim Hole Test Well location. Once the packer was set, the Contractor installed 300 feet of 1-inch SCH 80 PVC pipe inside the drill pipe to air lift the water from the borehole below the packer’s depth. The borehole was then airlifted from a depth of 292 feet (discharge head approximately 8 feet above ground level). The well initially discharged approximately 10 to 15 gpm, but then fell off to nearly no flow after a half hour of air-lifting. Air-lifting was then shut down, and the well was allowed to recover for a half hour before being air-lifted again. After 15 more minutes of air-lifting, the well stopped producing. At this point, the Contractor was directed to terminate the air-lifting and install an additional 100 feet of 1-inch PVC pipe. After installing the additional 1-inch pipe, air-lifting was began again from a depth of approximately 392 feet bgl. From this depth the borehole was producing from 30 to 50 gpm. The borehole was air-lifted for 5 hours during which time the conductivity and pH of the discharged water was monitored. The conductivity of the groundwater from the Wind River Aquifer, below a depth of 500 feet, at the slim hole location was found to be very high (>2,000 µmhos/cm). The slim hole well was air-lifted for a total of 7½ hours, at which time a water sample was taken and air-lifting was terminated. After grabbing the water sample and terminating the air-lifting, the Contractor tripped out the 1-inch PVC pipe. Prior to removing the packer, the depth to water was measured at 59.9 feet bgl.

The Contractor next released and retrieved the packer. They picked up six joints of drill pipe and bit and tripped back into the borehole to the bottom of the borehole and began circulating and mixing a “Gel Plug” to plug the well. The mud system was conditioned to a viscosity of 90 seconds at which time the borehole was filled with the heavy bentonite mud to a depth of approximately 100 feet bgl. The upper 100 feet of the borehole was plugged with sand-cement slurry placed from the surface using a Ready-Mix truck. The upper 6-feet of well casing was exposed and cut off and the excavation then backfilled. The contractor demobilized from the slim hole site after the plugging and abandoning operations were completed.

The water sample that was collected near the end of the air-lifting operations was submitted to a laboratory for analysis. The results of this analysis are tabulated in Table V-3 which also shows the results from the production well (Well No. 3) as a comparison in the variation in the water quality that occurs within the Wind River Aquifer. As shown in Table V-3, the quality of water from the Wind River Formation is generally very poor in the area of the Slim Hole Test Well. These results generally are in agreement with the quality of water that was produced from the Sand Draw No. 1 well which was drilled in 2003 by the Northern Arapaho Tribal Housing Authority for the Sand Draw Housing Project. The Sand Draw well had a total dissolved solids concentration of 1,150 mg/l and sulfate levels of 580 mg/l (Lidstone, 2003). The Sand Draw No. 1 well, similar to the Slim Hole Test Well, was located south of the Little Wind River approximately 8,400 feet northeast of the Slim Hole Test Well site in the NE¼ NW¼ of Section 11, T1S, R4E. Both of these wells produced from approximately the same interval within the Wind River Formation. Based on the water quality results, the Wind River was determined to be a non-viable water supply source in this region of the Arapahoe water system.
TABLE V-3
Water Samples Comparison with EPA Drinking Water Standards
Wind River Production Well and Slim Hole Test Well

<table>
<thead>
<tr>
<th>Parameters</th>
<th>EPA Maximum Contaminant Level</th>
<th>Wind River Production Well Sample Date 12/4/09</th>
<th>Wind River Slim Hole Test Well Sample Date 12/18/09</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radionuclides</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radium 228, pCi/l</td>
<td>2.7</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>Gross alpha, pCi/l</td>
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<td>5.5</td>
<td>31.4</td>
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<td>Secondary EPA Parameters</td>
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</tr>
<tr>
<td>Alkalinity (mg/l as CaCO₃)</td>
<td>NS</td>
<td>132</td>
<td>136</td>
</tr>
<tr>
<td>Calcium</td>
<td>NS</td>
<td>29</td>
<td>25</td>
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<tr>
<td>Chloride</td>
<td>250.00</td>
<td>11</td>
<td>68</td>
</tr>
<tr>
<td>Conductivity (μmhos/cm @ 25°C)</td>
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<tr>
<td>Iron</td>
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<td>0.28</td>
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<td>Magnesium</td>
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<td>1.7</td>
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<td>Nitrate + Nitrite (as N)</td>
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<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>pH (units)</td>
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<td>8.52</td>
</tr>
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<td>Potassium</td>
<td>NS</td>
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<td>Sulfate</td>
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<tr>
<td>Total Dissolved Solids</td>
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<td>384</td>
<td>1,700</td>
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</table>

ND  Not Detected
NS  No Standard

GROUNDWATER ALTERNATIVES INVESTIGATION CONCLUSIONS

The Production Well (Northern Arapaho Utilities Wind River Well No. 3) was drilled and completed to a depth of 1,030 feet and was proven to be an excellent water supply source for the Northern Arapaho Utilities from both a production and water quality stand point. Based on the results of the 24-hour pump test performed, the production potential from this well is greater than
500 gpm; however, due to the diameter of the well casing (7.921-Inch I.D.) production will be limited by the size of the submersible pump motor that can be installed. The largest 6-inch diameter submersible motor is a 60-horsepower motor which will limit the production from this well to approximately 450 gpm. As mentioned, the quality of the water produced is excellent. The high levels of radium found in other recently drilled Wind River Formation Wells were not present and the produced water meets all of EPA’s Primary and Secondary Drinking Water Standards.

It has been recommended that this well be tied into the existing Arapahoe water supply system and a preliminary design and a cost estimate for this completion work have been prepared and are contained in Chapter VI of this report.

One goal of the groundwater exploration phase of this project was to try to determine the groundwater potential on the eastern side of the Arapahoe Water Supply System service area; and, more specifically, in the immediate area of the Wind River Casino. In order to ascertain this potential, a Slim Hole Test Well option was bid as an “Add-Alternative” to the contract for the drilling, construction, development, and testing of the production well. The final cost of the production well allowed the Slim Hole Test program to be conducted; however, the results were disappointing. A 7⅞-inch borehole was advanced to a depth of 801 feet and a mechanical packer set at a depth of approximately 500 feet in order to sample the quality of water produced below this depth. The groundwater was produced by air-lifting techniques and a sample submitted to a laboratory for analysis. The production potential from the well was not reviewed since the quality of the water first had to be verified before this area could be considered for a potential water supply source. The quality of the water produced from the Slim Hole Test Well was found to be of unacceptable quality. The total dissolved solids concentration of this water was 1,700 mg/l which is well above EPA’s Secondary Standard Limit of 500 mg/l and also the water had high levels of radionuclides (Gross Alpha).

During the initial well-siting study, it was hypothesized that recharge from the Little Wind River plays a major role in the quality of groundwater produced from the Wind River Aquifer in the Arapahoe area. Therefore, it was surmised that the quality of water on the south side of the Little Wind River would be poor – as having not been refreshed by the recharge from the Little Wind River. The results of the Slim Hole Test Well in comparison to the quality of water produced from the Production Well and other wells located north of the Little Wind River appear to verify this assumption. Because of the poor quality of water produced from the Slim Hole Test Well, it was determined that the Wind River Aquifer in this region of the Arapahoe system is not a viable water supply source. The Slim Hole Test Well was plugged and abandoned at the conclusion of this study.
CHAPTER REFERENCES


James Gores and Associates; 1998; Riverton Regional Water Master Plan Level 1 Report, June 1998.


CHAPTER VI

COST ESTIMATES OF PROJECT FINANCING

INTRODUCTION

This chapter presents the Preliminary Opinions of Probable Project Costs for the conceptual recommendations presented in Chapter IV. The cost estimates are grouped here in the same order as the conceptual recommendations in Chapter IV. They are:

7. Water Supply Source,
8. Treatment,
9. Storage,
10. Finished Water Transmission,
11. Distribution, and
12. Consumption.

Where applicable, the recommended improvements are shown in a conceptual sketch following its cost estimate.

The recommended improvements include:

1. Tying in the new WWDC drilled well near the 1 MG tank,
2. Installing a SCADA system and tank level controls,
3. Upgrading lines in the transmission line from the 1 million gallon tank (1MG),
4. Extending the 17-Mile Road 12" transmission main east to the Wind River Casino,
5. Looping the transmission line between Rendezvous Road (Highway 138) and Wind River Casino,
6. Constructing a 300,000 gallon concrete storage tank and accompanying transmission line,
7. Extending the transmission line along Left Hand Ditch Road from 17-Mile Road to the Industrial Park,
8. Upgrading the Great Plains/Arapahoe Community area distribution system,
9. Looping the Rendezvous Road distribution line to St. Stephens,
10. Replacing the C’Hair Lane distribution line,
11. Improving the Industrial Park distribution,
12. Installing meters on all services and separating interconnected services, and
13. Demolishing and salvaging of the obsolete water storage tanks.

For the reader’s reference to the conceptual sketch figures given in this chapter, Figure VI-1 shows the layout of the entire Arapahoe system and the area which each cost estimate in this chapter covers.
Figure VI-1: Key Map

WATER SUPPLY SOURCE

In November 2009, the WWDC finished drilling a test well near the one million gallon tank (1MG). The well is designated as Arapahoe Wind River No. 3. That well proved to be quite successful, as detailed in Chapter 5. The well now needs to be put in service by installing a pump, controls, and chlorination. The State of Wyoming, through the WWDC, in March of 2010, appropriated 2/3 of the funding to accomplish that work. The Northern Arapaho Utilities now needs to obtain the matching 1/3 of the funding and proceed with the project. That funding is being sought through the USDA Rural Utilities Services (RUS).
The costs associated with tying in this well (Figure VI-2) are:

**FINAL COST ESTIMATES**

**PROJECT: WWDC ARAPAHOE WATER SUPPLY - LEVEL II**

**New Well Tie-in and SCADA**

Preparation of Final Designs and Specifications $35,880
Permitting and Mitigation $4,000
Legal and Administrative Fees $2,000
Acquisition of Access and Rights-of-Way $3,000
TERO Fees 2% $7,176

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Price</th>
<th>Estimated Cost</th>
</tr>
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<tbody>
<tr>
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<td>Mobilization, Bonds, and Insurance</td>
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<td>Contract Bond and Insurance</td>
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<td>5</td>
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<td>LF</td>
<td>$45</td>
<td>$15,750</td>
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<tr>
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<td>2</td>
<td>EA</td>
<td>$1,200</td>
<td>$2,400</td>
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<tr>
<td>7</td>
<td>6-inch by 2-inch Tee</td>
<td>1</td>
<td>EA</td>
<td>$750</td>
<td>$750</td>
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<tr>
<td>8</td>
<td>6-inch Bends</td>
<td>1</td>
<td>EA</td>
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<td>$450</td>
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<td>9</td>
<td>Tie Into Transmission Pipeline to Tank</td>
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<td>11</td>
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<td>12</td>
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<tr>
<td>15</td>
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<td>HR</td>
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<td>16</td>
<td>Access Road Gravel</td>
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<td>TON</td>
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<td>$1,350</td>
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<tr>
<td>17</td>
<td>Chain Link Fence</td>
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<td>$35</td>
<td>$10,500</td>
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<td>18</td>
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<td>19</td>
<td>Reclamation</td>
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<td>LS</td>
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<td>$3,500</td>
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</table>

Construction Cost Subtotal #1 $358,800
Engineering Costs = Subtotal #1 x 10% $35,880
Subtotal #2 $394,680
Contingency = Subtotal #2 x 15% $59,202

Construction Cost Subtotal $453,882

**Project Cost Total** $505,900
TREATMENT

Because the system receives all of its water from groundwater sources through its three wells, the only treatment required under EPA regulations is chlorination. The three existing wells are:

- Arapahoe No. 1,
- Arapahoe No. 2, and
- The Industrial Park well.

Each has their own chlorination treatment. Tying in the new well, discussed previously, includes its own chlorination system as part of the well house, Item No. 11. No other treatment modifications are recommended.
STORAGE AND TANK LEVEL CONTROLS

As noted in Chapter IV, the Arapahoe system requires 1.3 million gallons of storage to adequately meet needs. As discussed in Chapter IV, it is recommended that a 300,000 gallon concrete storage tank be constructed on the east side of the Arapahoe system, above Beaver Creek Housing, to meet these needs.

The estimated construction cost of this concrete storage tank is approximately $300,000. That tank and its accompanying transmission line are estimated to cost $1,398,400, as detailed below in the water transmission portion of this chapter and Figure VI-6.

In addition to the SCADA improvements recommended to accompany the 300,000 gallon tank, the Arapahoe system will require an integrated SCADA system that will automatically control:

1. The 1 million gallon tank and pumps for wells No. 1 and No. 2 at Arapahoe,
2. The WWDC drilled well at the 1 MG tank, and
3. The well pump at the Industrial Park.

The cost of each of these additional SCADA elements is detailed in the estimate for their respective projects. When finished, the system will have to function as an integrated system, controlling all four wells and the water level in two tanks. The component cost for this system is in the SCADA line item for the project budgets for each tank and well component. Still, it must function as an integrated system as each component is added.

WATER TRANSMISSION

The recommended water transmission improvements include five line segments listed here in their order of priority:

1. The 12" transmission line between the 1MG tank and 17-Mile Road,
2. The extension of the 17-Mile Road 12" transmission main east of Goes In Lodge Road across the Little Wind River to Highway 287 near the Wind River Casino,
3. The 8" and 12" looping of the transmission lines between Rendezvous Road, the 789 Truck Stop, and the Wind River Casino,
4. The 10" transmission line to the planned 300,000 gallon storage tank above Beaver Creek Housing, and
5. The 10" transmission line south on Left Hand Ditch Road from 17-Mile Road to the Industrial Park.

The cost of these transmission lines is summarized in the cost estimate following the description of each transmission line.

Upgrading to a 12" Transmission Line Between the 1MG tank and 17-Mile Road

This line is the top priority in the needed line upgrades for the Arapahoe system. The 1 million gallon tank at the top of the hill on Left Hand Ditch Road above Arapahoe is the only functional tank the Arapahoe system now has. The present transmission line from that tank to the rest of the system is a 1960’s vintage asbestos cement (AC) line. It is critically undersized to deliver even summer use demand, much less required fire suppression flows. This top priority line
An upgrade will replace the 6” AC line between the tank and the 12” PVC transmission main on 17-Mile Road with a 12” PVC line (Figure VI-3). It, in combination with the 8” line leaving the tank to the north, will meet the system’s tank-to-system delivery needs. The cost of this project is estimated to be $649,400, of which $587,000 is WWDC eligible.

### FINAL COST ESTIMATES

**PROJECT: WWDC ARAPAHOE WATER SUPPLY - LEVEL II**

**Transmission Lines - Phase I - N. Left Hand Ditch Road from Tank to 17-Mile Road**

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Price</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mobilization, Bonds, and Insurance</td>
<td>1</td>
<td>LS</td>
<td>35,000</td>
<td>35,000</td>
</tr>
<tr>
<td>2</td>
<td>12” C900 PVC Water Line</td>
<td>5,680</td>
<td>LF</td>
<td>60</td>
<td>340,800</td>
</tr>
<tr>
<td>3</td>
<td>12” Gate Valves</td>
<td>7</td>
<td>EA</td>
<td>2,900</td>
<td>20,300</td>
</tr>
<tr>
<td>4</td>
<td>Service Connection (Complete)</td>
<td>10</td>
<td>EA</td>
<td>1,200</td>
<td>12,000</td>
</tr>
<tr>
<td>5</td>
<td>Fire Hydrant</td>
<td>4</td>
<td>EA</td>
<td>5,500</td>
<td>22,000</td>
</tr>
<tr>
<td>6</td>
<td>Grade Access Road to Tank</td>
<td>8</td>
<td>HR</td>
<td>100</td>
<td>800</td>
</tr>
<tr>
<td>7</td>
<td>Gravel Access Road</td>
<td>380</td>
<td>TON</td>
<td>20</td>
<td>7,600</td>
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</tbody>
</table>

Construction Cost Subtotal - Transmission Phase I $438,500
Engineering Costs = Subtotal #1 x 10% $43,850
Subtotal #2 $482,350
Contingency = Subtotal #2 x 15% $72,353

Construction Cost Subtotal $554,703

**Project Cost Total** $629,400
Extending the 17-Mile Road 12" Transmission Main East to the Wind River Casino

The second highest transmission priority is constructing the 12" transmission main extending from where it ended in 2008 on 17-Mile Road at Goes in Lodge Road east to Highway 789 and Beaver Creek Housing and the Wind River Casino (Figure VI-4). Presently, the transmission line is a 6" PVC line. It is the only source of water supply for St. Stephens School, Beaver Creek Housing, and the Wind River Casino.

With a planned hotel, additional housing, and several other commercial and social services buildings planned, this is the most rapidly growing area of the reservation and this system’s service area. At present, the transmission capacity is inadequate for peak use and for fire protection of the housing and commercial development in the area. Cost of this transmission
extension is estimated to be $1,239,600, of which $1,210,100 is WWDC eligible. The remaining $29,500 is fire hydrants and service reconnections.

### FINAL COST ESTIMATES

**PROJECT: WWDC ARAPAHOE WATER SUPPLY - LEVEL II**

**Transmission Lines - Phase II - 17-Mile Road Extension**

**Date: June 23, 2010**

**Preparation of Final Designs and Specifications**

$86,601

**Permitting and Mitigation**

$10,400

**Legal and Administrative Fees**

$9,000

**Acquisition of Access and Rights-of-Way**

$20,800

**TERO Fees 2%**

$17,320

**Cost of Project Components**

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Price</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
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<td>$68,500</td>
<td>$68,500</td>
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<td>2</td>
<td>12&quot; C900 PVC Water Line</td>
<td>10,410</td>
<td>LF</td>
<td>$60</td>
<td>$624,600</td>
</tr>
<tr>
<td>3</td>
<td>River Crossing with Casing</td>
<td>250</td>
<td>L.F.</td>
<td>$300</td>
<td>$75,000</td>
</tr>
<tr>
<td>4</td>
<td>12&quot; Gate Valves</td>
<td>20</td>
<td>EA</td>
<td>$2,900</td>
<td>$58,000</td>
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<tr>
<td>5</td>
<td>Fire Hydrant Assembly</td>
<td>1</td>
<td>EA</td>
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<td>$5,500</td>
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<tr>
<td>6</td>
<td>Service Connection (Complete)</td>
<td>20</td>
<td>EA</td>
<td>$1,200</td>
<td>$24,000</td>
</tr>
<tr>
<td>7</td>
<td>Seeding and Restoration</td>
<td>10,410</td>
<td>LF</td>
<td>$1</td>
<td>$10,410</td>
</tr>
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</table>

**Construction Cost Subtotal - Transmission Phase II**

$866,010

**Engineering Costs = Subtotal #1 x 10%**

$86,601

**Subtotal #2**

$952,611

**Contingency = Subtotal #2 x 15%**

$142,892

**Construction Cost Subtotal**

$1,095,503

**Project Cost Total**

$1,239,600
The third highest transmission line priority is looping of the system’s two transmission lines (Figure VI-5). At present, the entire water supply for Beaver Creek Housing and the Wind River Casino commercial area is fed by the single transmission line extending from 17-Mile Road. If a line break occurs in those two miles of line, there is no way to get water to this area. This has happened on occasion, leaving the area dependent on only the 60,000 gallons of storage in the Beaver Creek Tank, which holds approximately ½ day of usage. This situation presents an unacceptable public safety and health risk. This will be even more critical once the planned hotel complex is constructed. The estimated cost of installing this transmission loop is $996,300, all of which is WWDC eligible cost.
## FINAL COST ESTIMATES

### PROJECT: WWDC ARAPAHOE WATER SUPPLY - LEVEL II

**Transmission Lines - Phase III - Hwy. 138/Rendezvous Rd. and Wind River Casino Loop**

Preparation of Final Designs and Specifications $ 69,460
Permitting and Mitigation $ 9,100
Legal and Administrative Fees $ 7,000
Acquisition of Access and Rights-of-Way $ 18,200
TERO Fees 2% $ 13,892

### Cost of Project Components

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Price</th>
<th>Estimated Cost</th>
</tr>
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<td>LF</td>
<td>$ 60</td>
<td>$ 262,800</td>
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<td>3</td>
<td>12&quot; Gate Valves</td>
<td>7</td>
<td>EA</td>
<td>$ 2,900</td>
<td>$ 20,300</td>
</tr>
<tr>
<td>4</td>
<td>10&quot; C900 PVC Water Line</td>
<td>4,680</td>
<td>LF</td>
<td>$ 50</td>
<td>$ 234,000</td>
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<td>5</td>
<td>10&quot; Gate Valves</td>
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<td>EA</td>
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<td>$ 15,000</td>
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<tr>
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<td>River Crossing with Casing</td>
<td>300</td>
<td>LF</td>
<td>$ 300</td>
<td>$ 90,000</td>
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<tr>
<td>7</td>
<td>10&quot; PRV with 72&quot; Manhole</td>
<td>1</td>
<td>EA</td>
<td>$ 17,500</td>
<td>$ 17,500</td>
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</table>

**Construction Cost Subtotal - Transmission Phase III** $ 694,600

**Engineering Costs = Subtotal #1 x 10%** $ 69,460

**Subtotal #2** $ 764,060

**Contingency = Subtotal #2 x 15%** $ 114,609

**Construction Cost Subtotal** $ 878,669

**Project Cost Total** $ 996,300
The fourth highest priority is providing storage on the east side of the system. The total storage needed for the Arapahoe system is 1.3 million gallons. The system’s storage capacity is 300,000 gallons short of recommended volume. With no functional water storage on the east side of the system, all water supply has to flow from the 1MG tank, which is over five miles west of Beaver Creek Housing and the Wind River Casino. This leaves this part of the system vulnerable in the event of a fire.

In the event that the 1MG tank is out of service for maintenance, or any other reason, the entire system is without storage. Additionally, all of the system’s storage is now on the extreme western side of the system. The highest value structures are on the extreme eastern side of the system. Additionally, it would help balance the system hydraulically to have usable storage on the eastern side of the system.

Because of these facts, it is recommended that a new 300,000 gallon concrete storage tank constructed of concrete be built southeast of Beaver Creek Housing (Figure VI-6). Because of
the local terrain, the tank will have to be sited 1½ miles from the highway. With that remote location, the tank can be subject to vandalism. Access to maintenance will be difficult, especially in wet weather. Considering these conditions, coupled with the comparative longevity of steel and concrete construction, it is recommended that this tank be constructed of concrete. Putting this tank in service will make the existing 60,000 gallon tank obsolete. It could then be demolished.

The estimated cost of the tank and its accompanying 10” transmission line is $1,398,400, of which $1,285,200 is WWDC eligible. The access road, replacement service connections, and fire hydrants costing $113,200 are the only WWDC ineligible costs.

### FINAL COST ESTIMATES

**PROJECT: WWDC ARAPAHOE WATER SUPPLY - LEVEL II**

**Transmission Lines - Phase IV - 300,000 Gallon Tank and Transmission Line**

<table>
<thead>
<tr>
<th>Item No.</th>
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<th>Unit</th>
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<td>8’ Security Fence with Barbed Wire</td>
<td>420</td>
<td>LF</td>
<td>$35</td>
<td>$14,700</td>
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<td>4</td>
<td>8’ Gate</td>
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<td>EA</td>
<td>$1,000</td>
<td>$2,000</td>
</tr>
<tr>
<td>5</td>
<td>20’ Dia. Crushed Base (4”) Around Tank</td>
<td>110</td>
<td>TON</td>
<td>$20</td>
<td>$2,200</td>
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<tr>
<td>6</td>
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<td>LS</td>
<td>$10,000</td>
<td>$10,000</td>
</tr>
<tr>
<td>7</td>
<td>10” C900 PVC Water Line</td>
<td>8050</td>
<td>LF</td>
<td>$50</td>
<td>$402,500</td>
</tr>
<tr>
<td>8</td>
<td>10” Gate Valves</td>
<td>12</td>
<td>EA</td>
<td>$2,500</td>
<td>$30,000</td>
</tr>
<tr>
<td>9</td>
<td>Service Tap, Complete</td>
<td>27</td>
<td>EA</td>
<td>$1,200</td>
<td>$32,400</td>
</tr>
<tr>
<td>10</td>
<td>6” PRV Station in 72” Manhole</td>
<td>2</td>
<td>EA</td>
<td>$16,000</td>
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<tr>
<td>11</td>
<td>Replace Fire Hydrant Assembly</td>
<td>3</td>
<td>EA</td>
<td>$6,000</td>
<td>$18,000</td>
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<td>12</td>
<td>Acces Road to Tank</td>
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<td>LF</td>
<td>$5</td>
<td>$30,000</td>
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<td>13</td>
<td>Gravel Acces Road</td>
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</table>

Construction Cost Subtotal Transmission Phase IV $985,100
Engineering Costs = Subtotal #1 x 10% $98,510
Subtotal #2 $1,083,610
Contingency = Subtotal #2 x 15% $162,542

Construction Cost Subtotal $1,246,152

**Project Cost Total** $1,398,400
Figure VI-6: 300,000 Gal Tank and Transmission Line

Transmission Line on Left Hand Ditch Road South to the Arapahoe Industrial Park

The fifth and final transmission line priority is tying the main system and the Industrial Park together, forming a single system having two pressure zones. This line would extend from 17-Mile Road south to the Industrial Park and Arapahoe School (Figure IV-7). Presently this portion of the system is operated as a separate stand-alone system serving the Arapahoe School and a small number of residences. Tying the two systems together will make it possible to feed this system from the main system and its 1 MG tank. With a different pump installed in the Industrial Park well, it could provide water to the pressure zone of the 1MG tank.

This project is estimated to cost $824,600 of which $800,600 is WWDC eligible. The $24,000 to reconnect services on this line is likely ineligible.
## FINAL COST ESTIMATES

**PROJECT:** WWDC ARAPAHOE WATER SUPPLY - LEVEL II  
**Date:** June 23, 2010

Transmission Lines - Phase V - Left Hand Ditch Rd., South Portion to Arapahoe Industrial Park

<table>
<thead>
<tr>
<th>Cost of Project Components</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation of Final Designs and Specifications</td>
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<tr>
<td>Permitting and Mitigation</td>
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<td>Legal and Administrative Fees</td>
<td>$ 6,000</td>
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<tr>
<td>Acquisition of Access and Rights-of-Way</td>
<td>$ 16,000</td>
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<tr>
<td>TERO Fees 2%</td>
<td>$ 11,475</td>
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### Cost of Project Components

<table>
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<tr>
<th>Item No.</th>
<th>Description</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Price</th>
<th>Estimated Cost</th>
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</thead>
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<td>LF</td>
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<td>EA</td>
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<td>4</td>
<td>Fire Hydrant Assembly</td>
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<td>6</td>
<td>SCADA System</td>
<td>1</td>
<td>LS</td>
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<td>$25,000</td>
</tr>
</tbody>
</table>

- **Construction Cost Subtotal #1**: $573,750
- **Engineering Costs = Subtotal #1 x 10%**: $57,375
- **Subtotal #2**: $631,125
- **Contingency = Subtotal #2 x 15%**: $94,669

**Construction Cost Subtotal**: $725,794

**Project Cost Total**: $824,600
Figure VI-7: Arapahoe Industrial Park Recommendations

WATER DISTRIBUTION

Distribution System Piping

There are several areas of the system that need improvements in the water distribution function. These have been grouped together along with nearby transmission line improvements into logical construction projects that are similar in nature and benefit to the overall function of the system. Those are mapped out and discussed in Chapter IV. The remainder of this chapter discusses these projects along with their companion transmission line project and their expected costs.

None of the recommended distribution line improvement projects are eligible for funding through the WWDC. For that reason, they are separated for the recommended transmission cost estimates. The projects are listed in their recommended priority.
Upgrading the Great Plains/Arapahoe Community Area Distribution Lines

This area formed the original Arapahoe water service area installed by the Indian Health Service (IHS) in the early 1960’s. In the years since, it has been added to in a piece-meal fashion of mismatched line extensions. It serves the Arapahoe Clinic, a couple of housing projects, and miscellaneous public buildings. The lines were constructed of 4" and 6" AC along with three water storage tanks, now abandoned. AC pipe is no longer manufactured. Four inch lines violate current industry standards. Some of the lines are dead end and should be looped. The project would simply upgrade the existing system to current materials and line sizes meeting regulatory standards. The replacement of these lines could be combined with the upgrading to a 12" transmission line between the IMG tank and 17-Mile Road designated as the first transmission line priority.

Figure VI-3 shows this project’s conceptual layout along with the recommended transmission line from the IMG tank. The cost of the recommended distribution line upgrades is estimated to be $578,300 as detailed below.

FINAL COST ESTIMATES

PROJECT: WWDC ARAPAHOE WATER SUPPLY - LEVEL II

Date: June 23, 2010

Distribution System - Great Plains Area

Preparation of Final Designs and Specifications $ 39,650
Permitting and Mitigation $ 7,600
Legal and Administrative Fees $ 5,500
Acquisition of Access and Rights-of-Way $ 16,000
TERO Fees 2% $ 7,930

Cost of Project Components

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Price</th>
<th>Estimated Cost</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Mobilization, Bonds, and Insurance</td>
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<td>LS</td>
<td>$ 40,000</td>
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</tr>
<tr>
<td>2</td>
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<td>LF</td>
<td>$ 40</td>
<td>$ 302,600</td>
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<tr>
<td>3</td>
<td>6&quot; Gate Valves</td>
<td>14</td>
<td>EA</td>
<td>$ 1,100</td>
<td>$ 15,400</td>
</tr>
<tr>
<td>4</td>
<td>Replace Fire Hydrant Assembly</td>
<td>7</td>
<td>EA</td>
<td>$ 5,500</td>
<td>$ 38,500</td>
</tr>
</tbody>
</table>

Construction Cost Subtotal #1 $ 396,500
Engineering Costs = Subtotal #1 x 10% $ 39,650
Subtotal #2 $ 436,150
Contingency = Subtotal #2 x 15% $ 65,423

Construction Cost Subtotal $ 501,573

Project Cost Total $ 578,300
Rendezvous Road Line Looping

As part of the alternative water supply project funded by the Department of Energy as part of the UMTRA site cleanup, a distribution line was extended southeast along Rendezvous Road (Highway 138) and dead ended just south of the mill site. In the radionuclide testing of the system’s potable water, dead end lines have consistently shown elevated readings. It is believed this is primarily due to these dead ends trapping material because of a lack of water circulation. In addition, to provide adequate fire flow, this line needs to be looped back to the transmission line at St. Stephens School. This would do away with the concentration of radionuclides, improve fire protection capacity, and improve system circulation.

This estimate includes the installation of one 8" and one 6" PRV which are to be installed in other parts of the system and are shown here simply to account for them.

The cost of this line looping is estimated to be $390,400. It is shown in Figure VI-4 along with the upgrading of the 17-Mile Road transmission line to Highway 789.

**FINAL COST ESTIMATES**

**PROJECT: WWDC ARAPAHOE WATER SUPPLY - LEVEL II**

**Date: June 23, 2010**

**Distribution System - Rendezvous Road**

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Price</th>
<th>Estimated Cost</th>
</tr>
</thead>
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<tr>
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<td>$25,000</td>
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<td>2</td>
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<td>$36</td>
<td>$185,040</td>
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<td>6&quot; Gate Valves</td>
<td>7</td>
<td>EA</td>
<td>$1,000</td>
<td>$7,000</td>
</tr>
<tr>
<td>4</td>
<td>6&quot; PRV with 72&quot; Manhole</td>
<td>2</td>
<td>EA</td>
<td>$16,000</td>
<td>$32,000</td>
</tr>
<tr>
<td>5</td>
<td>Service Tap with Corp Stop &amp; Saddle</td>
<td>20</td>
<td>EA</td>
<td>$900</td>
<td>$18,000</td>
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</table>

Construction Cost Subtotal #1 $267,040
Engineering Costs = Subtotal #1 x 10% $26,704
Subtotal #2 $293,744
Contingency = Subtotal #2 x 15% $44,062

Construction Cost Subtotal $337,806

Project Cost Total $390,400
C’Hair Lane Line Replacement

The C’Hair Road loop is constructed of iron pipe diameter (SDR 41) thin-wall PVC pipe. It was constructed under an IHS project over 30 years ago. The line has a history of chronic freeze breaks because of its shallow bury depth. Breaks were so frequent and numerous that, in desperation, NAU simply valved-off the middle section of this 1½ mile line loop some years ago. This created two dead end lines; this situation needs to be corrected.

The cost of this replacement line is estimated to be $679,300. Figure VI-8 shows this project.

**FINAL COST ESTIMATES**

**PROJECT: WWDC ARAPAHOE WATER SUPPLY - LEVEL II**

**Date: June 23, 2010**

**Distribution System - C’Hair Lane**

Preparation of Final Designs and Specifications $46,826
Permitting and Mitigation  $8,200
Legal and Administrative Fees  $6,600
Acquisition of Access and Rights-of-Way  $16,000
TERO Fees 2%  $9,365

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Price</th>
<th>Estimated Cost</th>
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<td>Mobilization, Bonds, and Insurance</td>
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<td>EA</td>
<td>$1,100</td>
<td>$12,100</td>
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<tr>
<td>4</td>
<td>Fire Hydrant Assembly</td>
<td>14</td>
<td>EA</td>
<td>$6,000</td>
<td>$84,000</td>
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<tr>
<td>5</td>
<td>Service Tap with Corp Stop and Saddle</td>
<td>23</td>
<td>EA</td>
<td>$1,200</td>
<td>$27,600</td>
</tr>
</tbody>
</table>

Construction Cost Subtotal #1  $468,260
Engineering Costs = Subtotal #1 x 10%  $46,826
Subtotal #2  $515,086
Contingency = Subtotal #2 x 15%  $77,263

Construction Cost Subtotal  $592,349

**Project Cost Total**  $679,300
Industrial Park Improvements

Tying the Arapahoe Industrial Park into the rest of the system will require installation of a pressure reducing valve and vault along with changing out the pump in the well to be able to pump water to the 1MG tank. These changes would allow water from the upper portion of the system to feed to the Industrial Park area. In turn, it would make it possible to lift water from the Industrial Park well to the 1MG tank.

The cost of this project is $40,600 and could easily be combined with the construction of the project described above as the “Transmission Line on Left Hand Ditch Road, South to the Arapahoe Industrial Park.”
FINAL COST ESTIMATES

PROJECT: WWDC ARAPAHO WATER SUPPLY - LEVEL II

Date: June 23, 2010

Distribution System - Industrial Park

Preparation of Final Designs and Specifications $ 2,500
Permitting and Mitigation $ 2,000
Legal and Administrative Fees $ 1,000
Acquisition of Access and Rights-of-Way $ 3,000
TERO Fees 2% $ 500

Cost of Project Components

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Price</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mobilization, Bonds, and Insurance</td>
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<td>LS</td>
<td>$ 2,000</td>
<td>$ 2,000</td>
</tr>
<tr>
<td>2</td>
<td>8&quot; PRV with 72&quot; Manhole &amp; Appurtances</td>
<td>1</td>
<td>EA</td>
<td>$ 18,000</td>
<td>$ 18,000</td>
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<tr>
<td>3</td>
<td>Upgrade Industrial Park Well Pump</td>
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Construction Cost Subtotal #1 $ 25,000
Engineering Costs = Subtotal #1 x 10% $ 2,500
Subtotal #2 $ 27,500
Contingency = Subtotal #2 x 15% $ 4,125

Construction Cost Subtotal $ 31,625

Project Cost Total $ 40,600

Distribution Metering and Backflow Protection

Installation of meters on individual services on the system would give NAU an improved ability to manage the system. The Arapahoe system is not metered. This leaves NAU with no means to enforce water conservation. Further, there are an undetermined number of “daisy-chained” services on the system. This makes it impossible for NAU to enforce payment of water bills on those services. Without these basic control measures, NAU is powerless to collect the revenue due it, or to set rational controls on water consumption. In essence, the users are “calling the shots” rather than NAU.

None of the service lines are equipped with backflow prevention units. This is a potential health threat, as explained in Chapter IV. To solve these deficiencies it is recommended to:

- Install meters on all services on the system,
- Connect each service to the main with its own separate service line curb stop (shut-off valve), and
- Require, along with meters, that each water service on the system have a backflow prevention device.
It is expected that this change would encounter resistance from some subscribers. Until these changes are made, however, the NAU cannot operate the system efficiently.

The cost estimate for this project includes two PRV stations simply because these units cannot be logically attached to other projects.

### FINAL COST ESTIMATES

**PROJECT: WWDC ARAPAHOE WATER SUPPLY - LEVEL II**

Date: June 23, 2010

**System Pressure Control and Metering Services**

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Price</th>
<th>Estimated Cost</th>
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</thead>
<tbody>
<tr>
<td>Preparation of Final Designs and Specifications</td>
<td></td>
<td></td>
<td>$20,000</td>
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</tr>
<tr>
<td>Permitting and Mitigation</td>
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<td>$16,000</td>
<td>$16,000</td>
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<tr>
<td>Legal and Administrative Fees</td>
<td></td>
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<td>$18,000</td>
<td>$18,000</td>
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<tr>
<td>Acquisition of Access and Rights-of-Way</td>
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<td>TERO Fees 2%</td>
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<td></td>
<td>$10,080</td>
<td>$10,080</td>
</tr>
</tbody>
</table>

Cost of Project Components

- **Construction Cost Subtotal #1**: $504,000
- **Engineering Costs = Subtotal #1 x 10%**: $50,400
- **Subtotal #2**: $554,400
- **Contingency = Subtotal #2 x 15%**: $83,160

Construction Cost Subtotal: $637,560

**Project Cost Total**: $717,500
Demolition of Abandoned Storage Tanks

The system currently has three abandoned water storage tanks at Arapahoe. None of these tanks are usable because they are at significantly lower elevations than is the 1 MG tank that currently serves as the system’s sole usable storage. They have been out of service for more than 10 years. Additionally, the 60,000 gallon tank at Beaver Creek will become completely obsolete once the recommended 300,000 concrete tank is built. Likewise the elevated Arapahoe Industrial Park 250,000 gallon tank will become obsolete once the transmission line to the industrial park is installed. That tank can then be removed.

It is recommended that these tanks be demolished. It is estimated that the cost for demolishing the three ground level tanks will be between $11,000 and $16,000. The elevated storage tank will be more costly to take down than will be largest of the ground level tanks.

Extending Distribution from Arapahoe to Little Wind River Bridge on 17-Mile Road and Looping Along Little Wind River Bottom Road to Arapahoe Industrial Park

Extending service to this area is a long-term goal of NAU management because some tribal member homes west of Arapahoe have poor water quality in their private wells. The cost of this extension is estimated at approximately $4,346,900. At present this extension would serve some 45 additional residences at a cost of $96.90 per service. Until the number of customers in this area increases many-fold this system extension is not economically justifiable.
CHAPTER VII

ARAPAHOE SYSTEM OPERATION AND MAINTENANCE

INTRODUCTION

This chapter evaluates the operation and maintenance of the Arapahoe water system and offers recommendations to improve the functionality of the water supply, transmission, storage, and distribution.

The Arapaho Tribe has operated and maintained the Arapahoe water system since its inception in the early to mid 1960’s. That operational effort has had, and continues to have, its challenges. This chapter evaluates the present operation and maintenance (O & M) of the Arapahoe area portion of the Northern Arapaho Utilities (NAU) systems. NAU also operates a water system in the Ethete area of the reservation, some 15 miles west of the system at Arapahoe.

The tribe has had mixed success in adequately operating and maintaining the system throughout its life. Difficulties continue to occur in providing a consistently safe and adequate water supply for the Northern Arapaho Tribe. This is, in part, due to the tribe’s own management style, and, in part, because of the substandard, inadequate, and piece-meal water system provided by Indian Health Service (IHS).

Until 2003, the U.S. Department of Health and Human Services, Indian Health Service, controlled all planning, design, construction bidding, and contracting responsibilities for the Northern Arapaho Tribe. The IHS is charged with providing drinking water only to tribal members. The IHS program does not provide funding for facilities that provide fire protection, irrigation or the other services normally associated with a municipal water system. In 2003, the tribe decided to take opportunities offered under the Indian Self-Determination and Education Assistance Act, P.L. 93-638 program allowing Northern Arapaho Utilities (NAU) to assume responsibility of these activities.

OPERATION AND MAINTENANCE GUIDANCE

The Environmental Protection Agency created a document titled “Capacity Assessment and Planning Worksheets for Public Water Systems” to help guide small communities in managing their water systems. This guide can be viewed at http://www.epa.gov/region8/water/CapacityAssessmentAndPlanningWorksheets.pdf. Using this guide can help the tribe assess three primary factors in successfully managing a small water distribution system. These three factors are:

1. technical capacity,
2. managerial capacity, and
3. financial capacity,

which are discussed in the following paragraphs.
Technical Capacity

The technical capacity of system operation and maintenance consists of getting the job completed. It can be broken down into the current status of the system, the adequacy of supply, treatment, storage and distribution, system maintenance and asset management, recordkeeping, and regulatory compliance and reporting.

The existing status of the water system is paramount in deciding what operation and maintenance is necessary to control the system at full functionality. A comprehensive master plan will help the utilities operators to be proactive while maintaining the water system. Five significant questions need to be asked to determine the adequacy of the system:

1. What is the current state of the capital assets (water system)?
2. What is the required level of service?
3. What is required to maintain desired level of system performance?
4. What are the best “Operation and Maintenance” and “Capital Improvement” investment strategies?
5. What is the best long-term funding strategy?

If a comprehensive master plan is developed and followed, a proper operation, maintenance and obsolescence replacement program ensures that the facilities are adequate to meet current and future needs. The system improvements recommended in this Master Plan are detailed in Chapters IV and Chapter VI. Prior to this Master Plan, Northern Arapaho Utilities has not had a formal improvement plan or asset management program for its Arapahoe system.

Adequacy of Supply, Treatment, Storage, and Distribution

Chapters III, IV, and V discuss the adequacy and condition of the water source, treatment, storage, and distribution systems for the Arapahoe area. As of 2010, the entire Arapahoe system contained three source wells, two well houses with chlorine injection treatment, approximately 22 miles of PVC, AC, and Ductile Iron Pipe transmission and distribution lines, and two storage tanks totaling 1,060,000 million gallons. The system has 324 services. These include 311 houses, 5 tribal office complexes, 1 social services building, 3 public schools, 2 casinos, 1 church, and Great Plains Hall. The system is not metered, which leaves NAU with no way to account for water leaks and other system losses. This also makes water conservation difficult to enforce. Health threats also exist due to the lack of backflow preventers on the individual taps.

System Maintenance and Asset Management

Overall, the Arapahoe system has been satisfactorily maintained. It is annually flushed, but many fire hydrants are not in working condition and need to be repaired or replaced. Because of the naturally occurring radionuclides in the source wells, portions of the system need to be unidirectionally flushed on a bi-annual basis. According to water quality testing, this has not been accomplished. Dead end portions of the system exist that are smaller in diameter and lengthier than recommended by the Wyoming Department of Environmental Quality. These
inadequacies are created, in part, by NAU’s reliance on funding from Indian Health Service, which is further discussed under the Financial Capacity section of this chapter.

Recordkeeping

Historical Drawings

Northern Arapaho Utilities is in the process of compiling records of their system from various sources. Because of this, some operation and maintenance responsibilities are more difficult than necessary. NAU does plan to digitize all of their records, but accomplishing this goal has been slow due to staffing issues and lack of funding. Almost all historical construction drawings are contained in blueprint format. A few newer developments are stored as electronic copies.

It is recommended that NAU have scanned and recorded in electronic form, all of their paper plans. This is a comparatively low cost endeavor.

Operational Records

Much of NAU’s day-to-day recordkeeping is kept in hand written records. This can be effective if done diligently. That has not always been the case with NAU’s recordkeeping. This leaves the operators and administrator with incomplete and poor quality data from which to draw conclusions about operational changes that could benefit the system and its customers.

It is recommended that the recordkeeping be optimized by making use of an automated recording of well production diurnal tank fluctuations and power consumption. Further, it is recommended that a database of scheduled equipment maintenance and repair records be established and kept current. This can be done either electronically or by hand. This would cover pumps, motors, wellhouse meters, chlorinators, SCADA system and similar equipment. It would also cover valves, hydrants, PRV stations, air-vac stations and similar facilities on the distribution system.

Regulatory Compliance and Reporting

Northern Arapaho Utilities was, as recently as 2008, under an administrative order by EPA for failure to comply with drinking water testing reporting requirements. They came into compliance and the order was lifted. However, the EPA reported that NAU failed to sample and report water quality test results for the first quarter of 2010, again leaving them vulnerable to another Administrative Order being issued. The system has a long history of sporadically failing to meet testing and reporting requirements.

Managerial Capacity

Overview

Operation and maintenance of the Arapahoe system is handled by two operators. These two operators are also responsible for operation of the sewer system. On the water system, these operators are responsible for maintaining the wellhouse, transmission lines, storage tanks, and
distribution lines for the main system and the Industrial Park system. Any repair requiring excavation is performed by the NAU construction crew.

The water and sewer systems in Arapahoe and Ethete are overseen by the director, Gerald (Gerry) Redman. Gerry serves many roles with regard to the systems, their operation, maintenance, and in building upgrades and new facilities. He is responsible for managing the operators, office staff, construction crews, weatherization crew, and public works staff, as well as planning the systems needs and financing. Part of his job also requires him to meet federal audit requirements for several different funding programs.

Additionally, NAU is responsible for maintaining individual tribal member’s home-site wells and septic systems.

Management Structure and Accountability

System Classification

The type of staff needed to properly operate the system can be identified through Wyoming Department of Environmental Quality regulations. The State of Wyoming has created a scoring system to determine what class of operator is necessary to manage a particular public water system. Classification is established on an accumulation of points in various categories. This scoring system is shown in Appendix “B” and is summarized below:

1 point: Design flow average day, or peak month’s average day, whichever is larger, rounded up to the next 0.5 million gallons per day.
5 points: Hypochlorite disinfection.
4 points: Use of SCADA or similar instrumentation systems to provide data with extensive or total process operation – alarms and shutdowns, full remote operation of plant possible.

Because the summation of these points equates to less than 30, only a Class 1 operator would be required to manage this system under Wyoming regulations. The backup operator for this system must also hold a Class 1 certification. However, the Wyoming Department of Environmental Quality does not hold jurisdiction on the reservation. EPA, who does have jurisdiction over operator certification, can only regulate tribal systems “at the tap.” Thus, there is no enforceable requirement for operator certification on NAU’s systems. Operator certification requirements can be found in the Wyoming Department of Environmental Quality, Water Quality Rules and Regulations, Chapter 5, Section 10.

Staffing

In July of 2010, the NAU staff engaged in the operation of the water and sewer systems included the director; one accountant; three administrative staff; and four operators, two each assigned to the Arapahoe and Ethete portions NAU’s systems.
As noted earlier in this report, the Arapahoe area water system covers a large geographic area and is comprised of two separate systems.

The two operators assigned to the Arapahoe portion of the water system are also responsible for the operation and maintenance of the three wastewater lagoon systems within the Arapahoe water service area. These three wastewater systems have extensive collection systems and each has a pump station. In addition, NAU is responsible for repairing individual wells and septic systems for tribal members who are not on the central systems.

This is obviously a larger work load than should reasonably be expected of only two individuals. In practice, staff from other portions of NAU’s forces helps the operators when changing pumps, installing services, and doing other major maintenance. The construction crew provides all excavation for water breaks, installing services, and similar excavation needs.

Operation of the water system alone requires at least two full time staff when considering having someone on-call 24 hours per day, making allowances for normal sick leave, vacation time, and training time to maintain operators’ licensure. Too frequently, important system operation functions get neglected or simply left undone. These include exercising valves, flushing lines and hydrants, and keeping current on EPA required testing and reporting. NAU has been under an EPA Administrative Order for failure to report testing results. These are symptomatic of a staff that is over-tasked or not being held accountable for their assigned tasks or both.

It is recommended that NAU cross-train staff assigned to other programs so that an adequate number of skilled Class I operators are available to accomplish all tasks required to competently operate the system.

Compensation Management

Few benefits are paid to the NAU staff by the Business Council. Other than FICA, FUTA, and worker’s compensation, only sick leave and time off for funerals are compensated. Hourly pay, depending on experience and certification, ranges from $12 per hour to $20 per hour. This can be compared to Riverton’s and Lander’s reimbursements shown in the table below:
Table VII-1: Comparative Water System Operator Compensation

<table>
<thead>
<tr>
<th>Certification Level</th>
<th>Riverton Pay Rate</th>
<th>Lander Pay Rate</th>
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<tbody>
<tr>
<td>Class 1</td>
<td>$13.44 - $17.48</td>
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<tr>
<td>Class 2</td>
<td>$14.71 - $19.10</td>
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<td>Class 3</td>
<td>$15.67 - $20.37</td>
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<td>Class 4</td>
<td>$17.15 - $22.29</td>
<td>$18.29 - $26.11</td>
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</table>

**Benefits**

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Riverton</th>
<th>Lander</th>
</tr>
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<tbody>
<tr>
<td>Retirement</td>
<td>11.25 % Wyoming Retirement</td>
<td>11.25 % Wyoming Retirement</td>
</tr>
<tr>
<td>Health Insurance</td>
<td>City pays for employee, employee pays for dependents</td>
<td>City pays 85% of both employee and family</td>
</tr>
<tr>
<td>Dental Insurance</td>
<td>Paid by employee through supplemental policy</td>
<td>Included in health plan</td>
</tr>
<tr>
<td>Vision Insurance</td>
<td>Optional, paid by employee</td>
<td>Included in health plan</td>
</tr>
<tr>
<td>Life Insurance</td>
<td>$15,000 paid by city</td>
<td>$15,000 paid by city</td>
</tr>
<tr>
<td>Vacation</td>
<td>8 hours per month with increase for tenure</td>
<td>8 hours per month with increase for tenure</td>
</tr>
<tr>
<td>Sick Leave</td>
<td>1 day per month</td>
<td>1 day per month</td>
</tr>
</tbody>
</table>

Until the tribe can pay wages and benefits comparable to the surrounding communities, they will struggle to adequately staff their water system, which is the singular most important public health program they administer.

**Training**

NAU has a policy to hire certified operators who are enrolled tribal members. Finding individuals who are available for employment and who meet both criteria is very difficult. Additionally, the salaries and benefits offered by the tribe further increases the difficulty of hiring operators. Because the tribe cannot fully staff their operation needs with licensed operators, this results in most hires having to gain accreditation after being hired. These policies are counter-productive to NAU’s mission.

There is no regulatory authority requiring reservation water systems to be run by operators holding a license. Training becomes an unimportant matter. For those who wish to further their career, training has not been made a priority by the tribal government. At present, time off to attend training and continuing education classes, and the associated travel expenses, must all be approved by the Northern Arapaho Business Council. Such requests are reportedly not often honored. This demoralizes those operators who are interested in becoming licensed. For the tribe,
the combination of these situations result in NAU being far less able to meet the mandates placed on it by the tribe and EPA. If this is to change, so must the tribe’s policies. There is on-line training and testing available through Wyoming DEQ at http://deq.state.wy.us/wqd/www/opcert/TrngOpp.asp and through other similar sources. It is recommended that the NAU operation staff be made aware of these training opportunities as well as live classes offered in the state. It is recommended that NAU adopt a formal policy governing allowable time off and expenses for operator training. Finally, it is recommended that continued employment for each operator be made contingent upon them attaining and maintaining licensure at the level recommended in DEQ regulations. Only when defined levels of competency are required and operators are held accountable for maintaining those competency levels will the tribe be reasonably certain that they won’t be cited by EPA for violations.

FINANCIAL CAPACITY

Revenue Sufficiency

Under current conditions, the Arapahoe system is not self-supporting. In fiscal year 2008, NAU’s total O & M expenses for the Arapahoe system were $297,697. They only billed $124,109 and collected $98,865.80. If the 2008 O & M costs are divided only among the service population of 1288 people, the cost per capita is $19.26 per person per month. This does not account for O & M costs that may be allocated to commercial and public facilities.

Assuming that 90% of the water consumption and O & M expenses are attributable to residential service would assign 125.36 Million gallons of use and $238,160 in expenses to the 311 homes served by the system. This equates to $63.82 per residence per month to break even on normal operation and maintenance costs. To augment revenues, NAU relies on funding appropriation from the Northern Arapaho Business Council. Making the Arapahoe system self-supporting will be difficult because a large percentage of users are low income families.

Bringing the system closer to being self-supporting is most likely to be successful with a combination of improving income and reducing expenses. Improving system automation and upgrading deficient system components will reduce labor and maintenance costs. Improved efficiencies can also likely be gained from the present workforce.

Putting conservation measures in place, i.e. metering, can make a significant difference in costs to users. Given cost of $0.51 per thousand gallons as the cost of electricity, chlorination, and as determined in Chapter II, Arapahoe Utilities could have saved $25,000 in 2008 and 50,000,000 gallons of water if water consumption per person were similar to Lander and Riverton usage. That would have amounted to about $5.00 per month per household. If inflation is just 3% per year, by 2030 the savings to NAU and its customers could be $49,000 per year.

A tiered rate structure would significantly encourage water conservation and enable NAU to be reimbursed for expenses incurred in producing excess water. The minimum base rate for water usage should cover basic per capita winter usage at a reasonable cost. After this base rate has
been surpassed, then a tiered structure would take effect by charging the user incrementally more per thousand gallons as they choose to increase consumption.

For the Arapahoe system’s present water consumption and O & M costs, including the addition of a 3% sinking fund, a rate structure that would could generate revenues equal to 2008 expenses could be as follows:

<table>
<thead>
<tr>
<th>Rate Structure</th>
<th>Gallonage</th>
</tr>
</thead>
<tbody>
<tr>
<td>$20.00</td>
<td>Base Rate (no usage)</td>
</tr>
<tr>
<td>$ 2.50</td>
<td>Block 1 Rate (up to 5000 gallons)</td>
</tr>
<tr>
<td>$ 3.50</td>
<td>Block 2 Rate (5,000 to 10,000 gallons)</td>
</tr>
<tr>
<td>$ 5.50</td>
<td>Block 3 Rate (10,000 to 20,000 gallons)</td>
</tr>
<tr>
<td>$ 7.00</td>
<td>Block 4 Rates (above 20,000 gallons)</td>
</tr>
</tbody>
</table>

Utilizing this rate structure would result in an average monthly billing per household of $32.50 ($20.00 +$12.50 for first 5000 gallons) during winter months and between $50.00 and $100.00 during summer months, depending on the irrigation usage. A rate structure of this magnitude is necessary to make the system self-supporting, given its present cost structure.

**Fiscal Controls**

According to Northern Arapaho Utilities staff, the NAU is funded by seven separate federal programs as well as the Arapaho Business Council. Each funding source has to be accounted for separately. To remain eligible for each of these funding agencies, NAU has to meet the federal audit process for each source. To ensure that this process continues as smoothly as possible, it is important that NAU separately account for costs on the Ethete and Arapahoe systems. Each system needs to be self-sufficient and cannot rely on funds or revenues from the other system. Because of the multiple audit requirements, NAU has unusually high administrative and accounting costs as compared to other Wyoming municipalities. Auditing deficiencies have caused NAU to be ineligible for certain funds in past years.

**Access to Needed Funds**

Funding for Northern Arapaho Utilities tends to be quite variable from fiscal year to fiscal year. System expenses in excess of funding availability must be made up from other tribal revenues with the authorization of the Tribal Business Council. NAU and its users would be best served if they could bring the water system up to a self-supporting status.

**OPERATION AND MAINTENANCE RECOMMENDATIONS**

After extensive review of the Arapahoe system, it is recommended that Northern Arapaho Utilities make the recommended improvements to their operation and maintenance listed in the following paragraphs.
Technical Capacity

Adequacy of Supply, Treatment, Storage, and Distribution

1. Using this Master Plan as a guide, continue to develop an ongoing list of needed system repairs and upgrades for water production, transmission, storage, and distribution.
2. Put in place the improvements recommended in Chapter VIII.
3. Upgrade, to industry standards, all substandard water lines, valves, and hydrants.
4. Implement the SCADA system recommended in Chapter VIII which will improve reliability of water delivery and reduce required operator attendance.

System Maintenance and Asset Management

5. Carry out the recommended unidirectional flushing routine on the system every six months, especially in the alternate water system, to eliminate radionuclide build up.
6. Exercise each valve and hydrant on the system every six months.
7. Repair or replace all non-functional fire hydrants on the system with a single brand.

Recordkeeping

8. Develop a standardized system of recordkeeping for the following components:
   a. Well pump repair or replacement.
   b. Pump volume readings.
   c. Water quality testing data.
   d. Waterline repair and replacement.
   e. Storage tank inspection, cleaning, and painting.
9. Set up the SCADA system to automatically record and store well meter readings, tank levels, alarm conditions, pump run times, and chlorination. Monthly, print reports from the system and file them in NAU’s permanent records.
10. Create electronic copies of all existing paper drawings for the system.

Regulatory Compliance and Reporting

11. Assign a specific individual to be responsible for doing all water sampling and reporting required by the Environmental Protection Agency. Ensure that this individual’s training is current with EPA requirements and hold that person accountable for meeting all reporting requirements.
12. Record and report to the EPA all water quality testing and data.

Managerial Capacity

Management Structure and Accountability

13. With regard to the utilities system operation, it is recommended that Northern Arapaho Utilities be charged with full authority and responsibility for staffing, training, compensation management, and day to day decision making.
14. Work with the Bureau of Indian Affairs to properly locate home sites in areas where utilities are already present.
15. Create and implement a formal employee evaluation and compensation system.
16. Require that operator certification be a condition for continued employment of operators.

**Staffing**

17. Retain no less than two certified water system operators for the Arapahoe area system.
18. Cross train other NAU staff members to competently substitute for operators when they are in training, on vacation, or otherwise temporarily absent.

**Training**

19. Encourage the staff to pursue training opportunities through pay scale incentives.
20. Provide compensation for time off for training, such as pay and travel expenses.
21. Develop a set of Standard Operating Procedures and familiarize the staff with those procedures.

**Compensation Management**

22. Develop and implement an employee salary and benefit program that is competitive with other Fremont County municipal utility entities.
23. Provide salary and benefits incentives that recognize certification levels, leadership, teamwork, responsibilities, and other job skills.

**Financial Capacity**

**Revenue Sufficiency**

24. Aggressively pursue making the system financially self-supporting by implementing operational efficiencies and revenue improvements. Implement the rate structure shown in Table IV-2.

**Fiscal Controls**

25. Continue to practice and enforce NAU’s systems for:
   a. Purchase orders
   b. Receipting and depositing cash
   c. Keeping financial records “audit ready” as required for each funding source, whether that is done by the NAU staff or the Tribal Administrator’s office.
26. Separate revenues and funding for the Ethete and Arapahoe systems. Ensure that the auditing for each system remains independent.
Access to Needed Funds

27. Aggressively pursue all funding opportunities, especially through IHS, RUS, and the State of Wyoming, to continually upgrade the water system to current industry standards.

28. Proactively work with the Northern Arapaho Business Council to keep them fully informed of the funding that is required to operate and maintain the system.

Table VII-2: Priority Matrix for Operation and Maintenance

<table>
<thead>
<tr>
<th>Project Description/Name</th>
<th>Financial Capacity</th>
<th>Technical Capacity</th>
<th>Management Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial Capacity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Revenue Sufficiency</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>2 Fiscal Controls</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>3 Access to Needed Funds</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Technical Capacity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Adequate System</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>5 System Maintenance &amp; Management</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>6 Recordkeeping</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>7 Regulatory Compliance &amp; Reporting</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Management Capacity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 Management Structure and Accountability</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>9 Staffing</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>10 Training</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>11 Compensation Management</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Ranking: Lowest 0, Best 3
Priority: High 1, Low 11

CONCLUSION

Implementation of the recommendations listed above will ensure that the Arapahoe water system remains compliant with widely accepted industry standards. Proper operation and maintenance will help ensure that the system can fully achieve the level of service Northern Arapaho Utilities desires, and that its customers receive an uninterrupted, safe, potable water supply.
CHAPTER VIII

PRIORITIZED MASTER PLAN

INTRODUCTION

The prioritizing of the recommended improvements is the element of this master plan most subject to local adjustment. The prioritization given below is James Gores and Associates’ ranking of which the work projects should be initiated. This ranking was developed based on both the urgency of the system needs and the suggestions of Northern Arapaho Utilities. It is expected that this prioritization may be changed in the final report in response to local comment and preferences.

Implementing the recommended projects cannot be realistically tied to incremental increases in demand, because none are driven by forecast increases in demand. As a result, no time line is proposed. The projects should be implemented in their priority sequence as funding is cultivated and made available. The recommended projects are listed in their recommended sequence of implementation and a brief description of each is given in the remainder of this chapter. The information presented in this chapter is a summary of the recommendations contained in Chapters III, IV, V, and VI. They are presented here in project priority ranking order, considering the criteria shown below. These criteria are ranked in the order shown from the most important to least important.

1. Public health and safety – Drinking water and fire protection
2. Meeting consumer needs/delivery capacity
3. Standards compliance – EPA Safe Drinking Water Act
4. System and operational efficiency
5. Revenue improvement
6. Funding availability
7. Operational flexibility/ease
8. System sustainability

These criteria may also be subject to change as a result of comments that may be received in the presentation of the draft report. A ranking matrix for each recommended improvement is included in the report appendix.

Each of the projects was ranked on a scale of 0 to 3 for criteria listed above, with 0 being the lowest and 3 being the highest. The higher the numerical sum, the higher the priority of the project. The resulting priorities are presented in this chapter in their order of priority. Each project is described in detail with an accompanying map in Chapters IV and VI. The recommended improvement projects are listed and discussed in order of their priority from first place to last, 1 through 14.
SYSTEM CONTROL

1. Water Metering With Individual Service Connections

Water metering, along with installing individual service connections, will give Northern Arapaho Utilities more control over the system than any other recommended improvement. It will make possible:

- Equitable distribution of costs among the system users,
- Implementation of water conservation,
- Public health security by prevention of contamination through back-siphoning,
- Enforcement of payment for service, and
- Water accounting information that is presently unattainable.

By installing meters, backflow preventers, and separation of the presently daisy-chained services, it will be possible for NAU to much more effectively manage the system and limit its excessive water use. The Shoshone Utility Organization, serving Fort Washakie and attendant Wind River Indian Reservation rural areas, is presently implementing the installation of meters on its system.

WATER SUPPLY

2. Tie in Wind River No. 3 Well

Tying in the new well drilled in 2009 will give the system a more sustainable and reliable water supply. The two present wells are so closely spaced that they can produce no more water than just No. 1 Well, operated by itself. No. 2 Well has a history of running dry because of the comparatively shallow setting of its upper well screen.

Installing the planned pumphouse, chlorination system, pump, and SCADA system will alleviate all current difficulties of the well running dry, the pump(s) failing, and the system running out of water.

WATER TRANSMISSION

3. Loop the Transmission Line Between the Two Casinos

The 6" transmission line extending east from the end of 17-Mile Road, across the Little Wind River to the Wind River Casino and Beaver Creek Housing is presently the only source of water for the most rapidly growing area in the system. This leaves the entire area without water supply in the event that a break occurs in its only feed line, the transmission line from 17-Mile Road. This has happened on several occasions in the past, causing NAU to have to hurriedly repair the transmission line break. At present, fire protection is dangerously compromised by having only a single line feeding this area. Looping the transmission line on Rendezvous Road (Wyoming 137) with the main transmission line extending from 17-Mile Road will resolve this shortcoming.
4. **Install 12" Transmission Line from 1 MG Tank to 17-Mile Road**

The one million gallon (1 MG) tank is the only useful storage on the Arapahoe system. The present 6" AC line for this tank, and the 12" transmission line on 17-Mile Road, is a serious bottleneck to delivery of domestic and fire flow to the rest of the system. Until this line is replaced, the delivery capacity of the system is seriously constrained. It renders the balance of the system ineffective. Upgrading this line will resolve this bottleneck.

5. **Extend the 12" Transmission Line From Goes-in-Lodge Road East to Highway 789**

As discussed in priority No.3, the present 6" transmission line dangerously compromises the fire safety of the Wind River Casino and Beaver Creek Housing. Increasing this line to 12" PVC will allow providing recommended fire flow rates to the Beaver Creek Housing, the casino and any future commercial development in this area.

The Wind River Casino does have a 10,000 gallon underground storage tank to provide modest fire protection, assuming there is no disruption of electrical power to the pumps that feed the fire suppression system of the casino. This amount of water would provide only brief supply for a fire and only in the casino itself.

**WATER STORAGE**

6. **Construct a 300,000 Gallon Concrete Storage Tank and 10" Transmission Line**

As discussed in recommendation No. 4, all of the system’s present storage is held by the 1 MG tank. This tank is over five (5) miles west of the Wind River Casino and Beaver Creek Housing area, the fastest growing and highest fire demand area of the system. This configuration of storage leaves the system both short of storage and completely unbalanced in its location and availability of storage in the event of feed from the area’s only transmission line. As noted in recommendation No. 5, in the event of a break in the transmission line on 17-Mile Road, this area can be left without water. Installing this recommended concrete tank would solve this deficiency. It would best be constructed southeast of Beaver Creek Housing and with the same high water elevation as the 1 MG tank. The addition of this tank, its accompanying 10" transmission line and SCADA addition will provide essential system storage, essential fire protection, and will hydraulically balance the system.

As an additional note, the nearby area also includes St. Stephens School, the second highest value structures in the service area.

The five mile transmission distance from the existing 1 MG tank to the casino and housing area makes fire protection hydraulically challenging. The system is 300,000 gallons short of the recommended storage volume. Installing this recommended tank and its accompanying line will correct this shortage.
WATER DISTRIBUTION

The distribution system for the Arapahoe area was largely installed under Indian Health Services program. The lines are generally constructed using 4" AC or PVC material. Using current standards, these lines are considered undersized for their intended service level.

The portion of the system installed under the DOE Alternate Water Supply program in the late 1980’s does meet current standards. This portion of the system, except for needed looping of some lines and the addition of some valves, is satisfactory.

The sections below list in order of priority the recommended improvements that will bring the distribution system up to current industry standards.

7. Distribution System Improvements in the Great Plains/Arapahoe Community Area

It is recommended that the old and undersized distribution lines in the Arapahoe community be replaced and the system looping be improved. This is the oldest part of the Arapahoe system. The system was designed and constructed in the 1960’s by the Indian Health Service with the objective of providing essential drinking water to the two housing projects, health clinic, and other buildings in the area. The system is constructed largely of 4" asbestos cement (AC) pipe, which is no longer made, and is undersized according to present regulations. The modeling of the system also shows these lines to be significantly undersized for fire protection needs. Because this area serves a comparatively large population, and some of the area’s most valuable public structures, it ranks as the most needed distribution system improvement.

8. Looping of Rendezvous Road Line

Looping the Rendezvous Road line will accomplish two important objectives:

1. It will loop this line back through St. Stephens to the transmission line providing circulation, and
2. It will stop the accumulation of radionuclear material at what is now a dead end line on Rendezvous Road.

It is recommended that this 6" PVC line be extended from its present dead end at the fire hydrant on the south side of Rendezvous Road, south to Mission Road, and then along Mission Road to the planned transmission line discussed in priority No. 5. This will improve system redundancy by increasing both circulation and fire flow capacity in the area, including St. Stephens and the system east of there.

The dead end of this line is presently in the identified plume of radionuclear contaminated groundwater associated with the decommissioned Susquehanna uranium mill. This is a matter of great concern to some of the residents who live in the area and receive their water supply from this line. As discussed earlier in this report, there is no published scientific data showing that the presence of this groundwater in any way affects the safety of the drinking water carried by this or other lines in the system. The potable water fully meets EPA safe drinking water standards for radionuclear constituents.
9. **C’Hair Lane Line Replacement**

This, 1½ miles of 4" PVC line, creates an “L” shaped tie between south Left Hand Ditch Road and 17-Mile Road. It is constructed of “thin wall” 4" PVC. Because of repeated freeze breaks NAU has valved off the central section of this line. This creates two dead sections in this line. For obvious reasons this damaged and inadequate part of the system is recommended for replacement.

10. **South Left Hand Ditch Transmission Line and Industrial Park Improvements**

This set of recommended improvements involves constructing a 10" water transmission line between 17-Mile Road and the Arapahoe Industrial Park. It also involves installing an upsized pump at the Industrial Park well so that this well can pump water to the 1MG tank. Additionally, it includes the pressure control equipment and a PRV station necessary to serve the Industrial Park and Arapahoe School from the 1 MG tank and larger service area. Unlike the preceding recommendations, this set of improvements is not required for the system to meet recommended standards, thus its lower ranking.

This project will combine two projects that are shown separately in Chapter 6,

1. the South Left Hand Ditch Transmission Line, and
2. the Industrial Park Improvements.

A second nearby well, owned by the school, was tied into the Industrial Park System as a backup source when a past pump failed. It has been intermittently used as the system supply since the tie-in. An important part of this project is that the school well must be disconnected from the system for three reasons. First, it is not a recognized source of supply for the system and under EPA regulations requires testing and reporting the same as any other system well. Second, its pump does not have the capacity to pump water to the higher pressure zone of the 1 MG tank. The system has an abundance of supply and does not need this well as a supply. Finally, there is no record as to how this well was complete and its sanitary integrity.

After this set of improvements is installed, the 250,000 gallon elevated tank will be obsolete. It can then be taken out of service and demolished, if NAU so wishes.

11. **Demolition of Abandoned Water Storage Tanks**

It is recommended that NAU demolish its three presently abandoned water tanks. Further, it is recommended that once the 300,000 gallon tank is constructed near Beaver Creek Housing, the 60,000 gallon tank be abandoned and demolished. Likewise, when the Arapahoe Industrial Park tank is decommissioned, it is recommended that it be demolished. Demolishing these unused tanks will eliminate any responsibility or liability that NAU would otherwise have for the safety of these old tanks. Disposing of these tanks also does away with the visual impacts of these tanks very prominently on the skyline. The demolition of these tanks ranks as the next to last priority in the recommended system improvements.
12. Extending Distribution From Arapahoe to Little Wind River and Looping Along Little Wind River Bottom Road to Arapaho Industrial Park

The Northern Arapaho Utilities has asked that the cost be estimated for extending the Arapahoe system west to the Little Wind River and looping the line back along the Wind River Bottom Road to the Industrial Park. This system extension would require 12 miles of 6" PVC line. This system addition would serve approximately 45 additional residences. This averages out to less than four (4) residences per mile. The cost of this portion of the system would be $4,346,900 which is $96,900 per residence, rendering this addition economically unfeasible.

The terrain rises to the west of Arapahoe. At the higher residences, just east of the Little Wind River, it is estimated that the best system pressure will be 28 psi under static conditions. This is marginal pressure for these residences.

For reasons of cost and the level of service that can be provided, it is recommended that this system expansion not be considered further by the Northern Arapaho Tribe.
CHAPTER IX

ENVIRONMENTAL REPORT

INTRODUCTION

The Arapahoe area potable water system Master Plan has been grant funded by the Wyoming Water Development Commission (WWDC) for the Northern Arapaho Tribe’s utility organization Northern Arapaho Utilities (NAU). WWDC contracted the firm of James Gores and Associates to prepare this Level II Water Supply Master Plan. The report accomplishes three objectives:

1. It investigates additional water supply sources.
2. It evaluates the water transmission, storage, and distribution system serving the Arapahoe area.
3. And it prioritizes needed improvements to NAU’s Arapahoe area water system.

The project area is located in Fremont County, Wyoming as shown in Figure II-1, the Vicinity Map.

LOCATION

Arapahoe, Wyoming is located on the Wind River Indian Reservation in Fremont County, in central Wyoming. The project area is generally bounded by U.S. Highway 789 on the east, the Little Wind River on the south and west, and the Big Wind River on the north. The nearest communities are Riverton, Lander, and Fort Washakie.

Present day land use in the surrounding area is a combination of irrigated agriculture, livestock grazing, and rural residential. The terrain is a high desert, sagebrush, grassland plain extending eastward from the base of the Wind River Mountains. The mountain flank, sixteen miles to the west, rises abruptly from these plains into a sub-alpine terrain and progressing to an alpine environment along the continental divide. The Wind River Mountains hold the largest concentration of remnant glaciers in the lower 48 states. Numerous eastward flowing streams head at the Continental Divide. These streams provide a source of water for local agricultural and municipal uses.

EXISTING SYSTEM

The Arapahoe portion of the Northern Arapaho Utilities water system extends from the community of Arapahoe, east to U.S. Highway 789, north to the Wind River, and south to the Little Wind River. The service area encompasses approximately 20 square miles serving 311 homes, five tribal office complexes, one social services building, two public schools, one private school system, three businesses, and one church. A full description of the system is given in Chapter III.
PURPOSE AND NEED FOR THE PROJECT

The purpose of this WWDC funded Level II Study was to evaluate additional water supply sources, evaluate the current water system, and prioritize needed improvements to the Arapahoe system. The function of the water system is to provide an adequate and safe potable water supply to the residents in the Arapahoe area.

This environmental report focuses on those projects identified in the WWDC funded Level II Study that would affect the physical and sociological environment of the Arapahoe community. These projects are needed to correct the many deficiencies in the present system that compromise both public health and safety. Those deficiencies are identified in the preceding portions of this report. Public health and safety of the Arapahoe area residents will be significantly improved by implementing the recommended improvements to the following:

- Water supply sources,
- Water storage,
- Water transmission, and
- Water distribution.

Listed below are the recommended improvements for the Arapahoe potable water system.

**System Control**

1. Water Metering With Individual Service Connections

**Water Supply**

2. Tie in Wind River No. 3 Well

**Water Transmission**

3. Loop the Transmission Line between the 2 Casinos
4. Install a 12” Transmission Line from the 1 MG Tank to 17-Mile Road
5. Extend the 12” Transmission Line from Goes-in-Lodge Road, east to Highway 789

**Water Storage**

6. Construct a 300,000 Gallon Concrete Storage Tank and 10” Transmission Line

**Water Distribution**

7. Distribution System Improvements in the Great Plains/Arapahoe Community Area
8. Looping of Rendezvous Road Line
9. C’Hair Lane Line Replacement
10. South Left Hand Ditch Transmission Line and Industrial Park Improvements
11. Demolition of Abandoned Water Storage Tanks
12. Extending Distribution from Arapahoe to Little Wind River and Looping Along Little Wind River Bottom Road to Arapahoe Industrial Park

Each of these projects is described in detail in Chapters III, VI, and VIII. Those descriptions are not repeated here.

Alternatives

Two alternatives have been developed for the purpose of this environmental report. They include:

1. Do Nothing. The present water system fails to meet recognized industry standards for drinking water safety and delivery of fire protection. The “Do Nothing” alternative accepts the status quo which puts at serious risk the health and safety of the human population now served by the Arapahoe area potable water system.

2. Following the prioritized Master Plan, implement the system improvements as recommended. This alternative will result in upgrading the Arapahoe area public drinking water system to meet recognized standards for providing a safe drinking supply and fire protection, as well as bringing the system up to the physical integrity that can be properly operated and maintained.

AFFECTED ENVIRONMENT/ENVIRONMENTAL CONSEQUENCES

Land Use

Affected Environment

The principal land use in the Arapahoe area is irrigated agriculture. Pasture and hay cropping are the primary agricultural products within the Arapahoe water system service area. Rural housing, reservation housing projects and community buildings are somewhat concentrated in the area of the community of Arapahoe. The dry land above the reaches of the irrigation system is used for sagebrush livestock grazing.

Five miles east of Arapahoe on the sagebrush prairie bench above the Little Wind River, the tribe has constructed the Wind River Casino. This area also hosts the Beaver Creek Housing project. The Little Wind River borders the southwest perimeter of the service area. The Big Wind River creates the northern most border of the service area. Four schools, St. Stephens Elementary School and High School, Arapahoe Elementary School, and Arapahoe Charter High School, are in the service area as is the 789 Smoke Shop and Casino.

With the exception of the proposed 300,000 gallon concrete tank above Beaver Creek Housing, all of the proposed improvements will be constructed on previously disturbed lands. With the exception of three proposed lines, all water line construction will be the replacement of existing lines. All proposed water line routes are in or adjoin road right-of-ways.
Environmental Consequences

Under the preferred alternative, installation of the waterlines will cause temporary disturbance to vegetation, soil, and transportation. No permanent impacts to soil and vegetation are expected. Disturbed areas will be leveled to their previous condition and seeded as a part of construction. Soils in the project area are classified as clay loams with fine, silty loams and gravel deposits in floodplains. Native vegetation in the project area consists of sagebrush, willow, and cottonwood trees interspersed with an under story of grasses, sedges and brush adjacent to the river. Non-irrigated upland areas are dominated by sagebrush and various species of grasses and forbs. Irrigated crops are predominately hay and grass pasture. A small percentage of the acreage is in row crops.

There are no prime farmlands, prime forest, rangelands, or formally classified high-value agricultural lands within the project area. The project will not directly affect current land use. The US Natural Resource Conservation Service did not respond to the inquiry regarding this project; it is understood that this agency did not perceive any adverse affects regarding the Farmlands Protection Act, specifically, farmlands protected under the Farmlands Protection Act of 1981, and regulations at 7CFR Part 658, or other laws and regulations protecting farmlands.

Mitigation

Reclamation of disturbed areas with native plant species adapted to the site will begin as the final construction activity by seeding disturbed areas to reduce the possibility of erosion, invasion of noxious weeds, and to replace vegetation impacted by construction. Appropriate erosion controls will be used and maintained in effective operating condition during construction. The US Army Corps of Engineers indicated in their response dated July 9, 2010 that the work may fall under the existing Nationwide Permit 12 for utility line activities so long as the construction activities do not result in the loss of more than 0.5 acre of waters of the U.S. and the permittee complies with all of the terms and conditions of the permit. In the event that the acreage limitations are exceeded, an individual permit is required. The US Army Corps will require preconstruction notification so that they may obtain certification from EPA that the project is acceptable under Section 401 of the Safe Drinking Water Act.

Floodplains

Affected Environment

The proposed improvements call for two crossings of the Little Wind River. One is the replacement of the only transmission line now serving the Beaver Creek Housing area and the Wind River Casino. The second is the construction of a new 10" line that crosses the river at the U.S. Highway 789 Bridge. This line will create a loop between the system’s two transmission lines and will greatly improve fire protection capacity for Beaver Creek Housing and the Wind River Casino and its planned commercial area.
Environmental Consequences

Construction of these two river crossings will each cause a one or two day disruption of the natural flow of the Little Wind River in the immediate area of construction only. Vegetation over the area of trenching will be disturbed.

Mitigation

The construction will call for the installation of a casing pipe to be installed at a sufficient depth below the river bed, and extending beyond the river bank on each side of the river. Prior to trench excavation, top soil will be stripped and stockpiled for replacement over the completed trench once it is backfilled. Disturbed areas will be graded smooth and reseeded.

Wetlands

Affected Environment

Some wetlands adjoin the Little Wind River in the area of the two planned crossings. These are ephemeral wetlands, wet normally only during spring runoff season and at brief intermittent periods of high water due to summer thunderstorms.

Environmental Consequences

Wetlands may be temporarily disturbed during construction of the one replacement water line and the one new water line. If the Preferred Alternative is constructed, no permanent impacts to wetlands or riparian habitats will occur. The U.S. Army Corps of Engineers (ACOE) regulates the placement of dredged and fill material into wetlands and other waters of the United States. The activities most likely qualify for authorization under Nationwide Permit (NWP) 12 as defined in Part III of the Federal Register published on March 9, 2000 (Volume 65, No. 47). Authorization under NWP 12 assumes full compliance with the permit conditions. Exhibit 6.2 and 6.4.

Wetlands are afforded protection under Section 404 of the Safe Drinking Water Act and Executive Order 11988 (floodplain management). This is addressed in the letter from the US Army Corps dated December 4, 2008.

Mitigation

All activities undertaken to construct the project must comply with the General Conditions described in NWP 12 fact sheet. Specific actions will be outlined to avoid, minimize, and compensate all unavoidable wetland impacts. Best Management Practices should be implemented within the project area. All disturbed areas will be reseeded with riparian vegetation native to the area. The appendix contains correspondence from the Corps of Engineers and the US Fish and Wildlife Service addressing the wetland issues.
Cultural Resources

Affected Environment

The affected environment includes the proposed well site, replacement pipeline routes, rural residential and agricultural properties adjacent to pipeline routes, and all areas of surface disturbance and appropriate buffer areas around ground disturbance activities. With the exception of the 300,000 gallon concrete storage tank site, all of the project area has previously been disturbed with agriculture, road construction, and construction of the existing utilities.

Environmental Consequences

Historical/Prehistoric Resources

With the exception of the proposed 300,000 gallon concrete water storage tank and its transmission line, the proposed project improvements are all located in previously disturbed areas. Thus, the probability of locating surface archeological or historic manifestations is low. For the previously undisturbed area leading to and including the planned new tank site, prior to construction, a professional cultural resources firm qualified under the Secretary of the Interior’s Professional Qualification Standards (48 FR 22716, Sept. 1983), should be hired to conduct a cultural resources survey according to 36 CFR Part 800. The Area of Potential Effect will need to be defined and then evaluated for the need to conduct a more intensive survey and determine mitigation requirements. The Northern Arapaho and the Eastern Shoshone Tribal Historic Preservation Officers will be consulted with regard to this project. The Wyoming State Historic Preservation Office and both Tribal Historic Preservation Offices will review and comment on the cultural resource report.

Visual Aesthetics

There are no visually sensitive areas in the project area. Some minor short-term visual impacts will result from ground disturbance associated with construction; however, successful reclamation and repairing of disturbed areas will remove these visual impacts. Visual aesthetics will be improved, however, with the removal of three presently abandoned water storage tanks, if demolished as recommended.

Mitigation

A cultural resources survey will be conducted to determine historical and archaeological resources in the project area and Area of Potential Effect. If any undocumented archeological/cultural resources are uncovered during construction, work in the area will halt immediately and the Northern Arapaho and the Eastern Shoshone Tribal Historic Preservation Officers must be contacted. Work in the area may not resume until the materials have been evaluated and adequate measures for their protection or collection have been taken. All disturbed areas will be reclaimed using native vegetation as soon as practical following construction.
Biological Resources

Affected Environment

The affected environment includes vegetation and wildlife within or adjacent to the project area.

Environmental Consequences

Threatened and Endangered Species

Threatened, endangered, and proposed species that may occur in Fremont County include the bald eagle, whooping crane, black footed ferret, and mountain plover. Additionally, in their reply letter dated July 30, 2010, the United States Department of the Interior, Fish and Wildlife Service stated that they have determined that Ute ladies’-tresses (Spiranthes diluvialis) may be present in the proposed project area.

The project is not likely to adversely affect any of the terrestrial threatened or endangered animals and plants occurring in Fremont County. Protective measures for migratory birds will be addressed in accordance with the Migratory Bird Treaty Act (MBTA), 16 U.S.C. 703, the Bald and Golden Eagle Protection Act (BGEPA), 16 U.S.C. 668, and Executive Order 13186. The US Fish and Wildlife Service addresses this issue in their letter dated July 30, 2010.

While it is not listed as a threatened species, the sage grouse is an inhabitant of Fremont County. A large portion of Fremont County has been designated by the State of Wyoming as a Core Sage Grouse Breeding Area. Because the Arapahoe water service area is used heavily for agriculture and has been for nearly 100 years, there is no suitable sage grouse habitat in most of the project area, with the possible exception of the proposed water storage tank.

Fish and Wildlife Resources

On a scale of 1 to 5, with one being the best, the Wind River within the project area is classified as a Class 4 trout stream. This classification means that the Wind River is low biomass trout water with a fishery that may be locally important, but generally incapable of sustaining substantial fishing pressure (WGFD 1991).

Riparian habitats are used by many species of wildlife including migratory songbirds, deer, waterfowl, small mammals and game birds. Impacts to fish and wildlife are expected to be minimal. No significant impacts to wildlife are anticipated for any of the alternatives considered.
Protective measures for migratory birds will be in accordance with the Migratory Bird Treaty Act (MBTA), 16 U.S.C. 703, The Bald and Golden Eagle Protection Act (BGEPA) 16 U.S.C. 668, and Executive Order 13186.


Vegetation

The riparian vegetation adjacent to the Wind River and in the project area is dominated by plains cottonwood trees and Russian olive with an understory of several species of willow, grasses and forbs. Upland areas are grassland with a mixture of rabbitbrush, sagebrush, and forbs. Because of the sparse rainfall (less than 7” annually) and clay soils that dominate Fremont County, much of the uplands are sparsely vegetated. Impacts to vegetation will be minimal where the construction of new wells and pipelines are planned. The total surface disturbance associated with the construction of these components will total less than one acre. The impacts to vegetation will be associated with construction of the new water lines.

Mitigation

Best Management Practices should be implemented within the project area. Specific actions will be outlined to avoid, minimize, and compensate all wetland impacts. All disturbances to stream banks will be reclaimed. All areas of disturbance, especially within the riparian zone, will be limited to the minimum area required to meet project objectives. The riparian areas of disturbance will be reclaimed and re-seeded with native plant species immediately following construction.

Water Quality Issues

Affected Environment

The affected environment is that portion of the Wind River, its tributaries, and watershed within and downstream from the project area.

Environmental Consequences

There is minimal potential to impact water quality in the Wind River because the project components are located some distance from the mainstream channel. There is very minor potential for construction-related sediment-laden runoff or petroleum products to enter the drainage. Stream disturbances to the mainstream channel of the Little Wind River will not occur if any of the alternatives are selected. The US Army Corps will require preconstruction notification so that they may obtain certification from the EPA that the project is acceptable under Section 401 of the Clean Water Act. Best Management Practices should be implemented
to prevent sediment-laden water from entering the drainage; minimal water quality impacts are expected.

**Mitigation**

Mitigation will include implementation of standard erosion control measures where practical, including: 1) sediment detention ponds intercepting discharges where construction related sediment-laden runoff will occur, 2) timely reclamation of disturbed areas, and 3) compliance with all pertinent permits. The EPA may require the following three Water Quality Division permits:

- A Temporary Discharge Permit is required for any discharges to “waters of the state.” These discharges are permitted under the National Pollution Discharge Elimination System (NPDES).
- If the project will result in clearing, grading, or otherwise disturbing five or more acres, a Storm Water Associated with Construction Activities permit will be required.
- Whenever a public water or waste system is constructed, installed or modified, a “Permit to Construct” is required. Adherence to required permits will minimize any impacts on water quality.

**Coastal Resources**

There are no coastal resources in the project area which is some 1500 miles inland from the nearest ocean, the Pacific.

**Airport Clear Zones**

The Riverton Municipal Airport is 5 air miles north of the project area. No portion of the project area is not within the Riverton Regional Airport’s Runway protection or its runway approach pattern.

**Socio-Economic / Environmental Justice**

**Affected Environment**

The affected environment includes the entire pipeline system, Arapahoe and all residents served by the NAU Arapahoe water supply system.

**Environmental Consequences**

All residents of the Arapahoe system and landowners along the pipeline route are potential beneficiaries of the proposed project. Improvements to the water supply and the added fire protection will improve the quality of life for all residents served by the expanded NAU Arapahoe area water supply system.
No known business or industrial expansion is expected as a result of the project. The project is authorized under the Water Development Program for the purpose of improving a sponsor’s water supply.

*Environmental Justice Considerations*

On February 11, 1994, President Clinton issued Executive Order 12989 requiring federal agencies to incorporate environmental justice considerations into the NEPA process. The purpose of this order was to ensure that low-income households, minority households, and minority businesses do not experience a disproportionate share of adverse environmental effects resulting from any given federal action.

The proposed action will not negatively affect a disproportionate amount of minority households, minority businesses, or low-income households. The proposed project will in fact benefit all citizens of the Arapahoe system, predominately a Native American population and the rural area served by the expanded water supply project.

The expanded water project is being constructed expressly for the benefit of a reservation community. As a result of the project, minority households and minority businesses will experience a significant increase in the reliability and safety of their potable water supply as well as the secondary impact of significantly improved fire protection.

*Mitigation*

No mitigation is required for socio-economic or environmental justice issues in the proposed project area.

*Miscellaneous Issues*

*Affected Environment*

The affected environment includes the project construction area and areas near Arapahoe.

*Environmental Consequences*

*Air Quality*

Air quality will be lowered slightly in the project area during construction due to dust and exhaust from construction equipment. These impacts should be short term, localized, and are dependent on weather conditions during the construction period. After construction, air quality is expected to return to pre-construction levels. The US Environmental Protection Agency has approved the State Implementation Plan for Wyoming. The State Implementation Plan has established the Wyoming Air Quality Standards and Regulations. Three sections of the Wyoming Air Quality Standards and Regulations (WAQSR) apply to the listed projects. These sections are WAQSR Chapter 3, Section 2(f) regarding fugitive dust control, Chapter 6, regarding permitting, and Chapter 10, Section 2 regarding open burning. The project area is not in an EPA non-attainment area.
Transportation
The project area is traversed by State Highways WYO 137 and 138, west to east, and Wyoming 789 north to south on the easterly end of the system. Several BIA roads traverse the project area. During construction, traffic may be temporarily impacted on local roads by slightly increased volumes. The project will not have any permanent impacts on transportation.

Noise
Noise impacts in the project area will be temporary and will consist of increased noise levels associated with construction activities. Regular maintenance and upkeep of construction equipment will minimize noise impacts. After construction is complete, noise levels are expected to return to pre-construction levels.

Solid Waste Management
Solid waste resulting from the project is expected to consist of normal construction debris and must be disposed of in the approved landfill.

Farmland Protection
There are no lands in the project area protected under the Farmlands Protection Act of 1981.

Mitigation
Mitigation for temporary air quality impacts during construction will include: 1) spreading water on work areas and other areas of exposed soil to suppress fugitive dust emissions, 2) maintenance of construction equipment and heavy machinery to minimize exhaust emissions, and 3) revegetation of disturbed areas as soon as practical.

Public transportation will be protected through the usage of proper construction signage as per the Manual on Uniform Traffic Control Devices.

If construction work is conducted during normal working hours, noise impacts, especially to nearby residents, can be alleviated.

Solid waste accumulated as a result of the construction process must be contained in covered containers on site and removed to an approved landfill upon completion of the project.

SUMMARY OF MITIGATION

Land Use – Reclamation of disturbed areas with native plant species adapted to the site will begin as soon as possible during and/or following construction to reduce the possibility of erosion and invasion of noxious weeds and to replace vegetation impacted by construction. Appropriate erosion, silt and runoff controls will be used and maintained in effective operating conditions during construction.
**Floodplains** – The work within the Little Wind River flood plain will be conducted during low water times of the year and will be only temporary. No permanent alteration of any floodplain will occur.

**Wetlands** – All activities undertaken to construct the project must comply with the General Conditions described in the attached NWP 12 fact sheet. If wetlands are to be destroyed or degraded by the proposed project, the project area will be inventoried. Specific actions will be outlined to avoid, minimize, and compensate for all wetland impacts. To further minimize temporary impacts to wetlands, all disturbed areas will be re-seeded with native wetland seed, and/or plants adapted to the site.

**Cultural Resources** – If any archeological/cultural resources are uncovered during construction, work in the area will halt immediately and the Northern Arapaho and Eastern Shoshone Tribal Historic Preservation Officers will be contacted. Any cultural resource survey must be reviewed by the State of Wyoming Historical Preservation Office as well as the Tribal Historic Preservation Offices. Work in the area may not resume until the materials have been evaluated and adequate measures for their protection or collection have been taken. To reduce impacts to aesthetics, all disturbed areas will be reclaimed using native vegetation as soon as practical following construction.

**Biological Resources** – Protective measures for migratory birds will be in accordance with the US Fish and Wildlife rules and regulations. Best Management Practices will be used to prevent petroleum products and/or sediment-laden water from entering the Little Wind River. Fish passage will be maintained at all times during construction so as to not disturb spawning or other fish movements. Any disturbance to stream banks will be reclaimed. All areas of disturbance will be limited to the minimum area required to meet project objectives. The areas of disturbance will be reclaimed and re-seeded with native plant species immediately following construction.

**Water Quality Issues** – The US Army Corps will require preconstruction notification so that they may obtain certification from the EPA that the project is acceptable under Section 401 of the Clean Water Act. Mitigation will include implementation of standard erosion control measures where practical, including: 1) sediment detention ponds intercepting discharges where construction related sediment-laden runoff will occur, 2) timely reclamation of disturbed areas, and 3) compliance with all pertinent permits. According to the EPA Water Quality Division, three Water Quality Division permits may be required. A Temporary Discharge Permit is required for any discharges to “waters of the state.” These discharges are permitted under the National Pollution Discharge Elimination Systems (NPDES). If the project will result in clearing, grading, or otherwise disturbing five or more acres, a Storm Water Associated with Construction Activities permit will be required. Finally, any time a public water or waste water system is constructed, installed or modified, a “Permit to Construct” is required. While these would normally be required in the course of a construction project, these permits are not required because this project is located on a federally recognized reservation.
Air Quality Issues – Fugitive dust will be regulated by the Wyoming Air Quality Standards and Regulations. If asbestos cement pipe is found in the distribution system, the pipe will be left in the ground and larger pipe will be installed at a reasonable offset distance to avoid breaking the pipe during removal.

Socioeconomic/Environmental Justice Issues – No mitigation measures are required for socioeconomic or environmental justice issues in the proposed project area.

Miscellaneous Issues – Mitigation for temporary air quality impacts during construction will include: 1) spreading water on work areas’ access roads, haul roads, and areas of exposed soil to suppress fugitive dust emissions, 2) maintenance of construction equipment and heavy machinery to minimize exhaust emissions, and 3) revegetation of disturbed areas as soon as practical. Public transportation will be protected through the usage of proper construction signage as per the Manual on Uniform Traffic Control Devices. Impacts from noise can be alleviated if construction work is performed during normal working hours. Solid waste accumulated as a result of the construction process must be contained in covered containers on-site and removed to an approved landfill upon completion of the project.

CORRESPONDENCE AND COORDINATION

Initial consultation letters requesting comments relating to environmental concerns related to the proposed project were sent to the state, federal, and local government agencies listed on the last page of this chapter.

Of the Ten (10) agencies contacted, Three (3) responded with specific concerns that have been addressed in this document. Each of these agencies was contacted by phone to determine if they intended to respond, and no further response was received.
Agencies that were notified of the project on October 21, 2008 and were requested to provide their input are listed below. Agencies that responded are shown in **Bold**.

**Mr. George Gover, Superintendent**  
**Bureau of Indian Affairs**  
P. O. Box 158  
Ft. Washakie, WY 82514

Ms. Claudia Nissley  
Division of Cultural Resources  
Wyoming State Historic Preservation Office  
2301 Central Avenue  
Barrett Bldg, 3rd Floor  
Cheyenne, WY 82002

Mr. Steve Poistras  
USDA-NRCS  
PO Box 127  
Ft. Washakie, WY 82514

**Mr. Dan Olsen, Administrator**  
**Air Quality Division**  
**Wyoming Department of Environmental Quality**  
122 West 25th Street  
Cheyenne, WY 82002

Mr. David Skates  
U.S. Fish and Wildlife Service  
170 N. First Street  
Lander, WY 82520

Mr. Brian T. Kelly, State Supervisor  
U. S. Fish and Wildlife Service  
4000 Airport Parkway  
Cheyenne, WY 82001

Ms. Claudia Nissley  
Division of Cultural Resources  
Wyoming State Historic Preservation Office  
2301 Central Avenue  
Barrett Bldg, 3rd Floor  
Cheyenne, WY 82002

Mr. Steve Poistras  
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122 West 25th Street  
Cheyenne, WY 82002

Mr. David Skates  
U.S. Fish and Wildlife Service  
170 N. First Street  
Lander, WY 82520

Mr. Ken Schmidlin, Supervisor  
Wyoming Game and Fish Department  
260 Buena Vista Drive  
Lander, WY 82520

Mr. Ken Schmidlin, Supervisor  
Wyoming Game and Fish Department  
260 Buena Vista Drive  
Lander, WY 82520

Mr. Don Aragon, Director  
Wind River Environmental Quality  
P. O. Box 217  
Ft. Washakie, WY 82514

Mr. Don Aragon, Director  
Wind River Environmental Quality  
P. O. Box 217  
Ft. Washakie, WY 82514

Mr. William Urbigkit, Airport Manager  
City of Riverton  
P. O. Box 1700  
Riverton, WY 82501

Mr. William Urbigkit, Airport Manager  
City of Riverton  
P. O. Box 1700  
Riverton, WY 82501

Paige Wolken  
US Army Corps of Engineers  
Wyoming Regulatory Office  
2232 Dell Range Blvd., Suite 210  
Cheyenne, WY 82009

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US Army Corps of Engineers  
Wyoming Regulatory Office  
2232 Dell Range Blvd., Suite 210  
Cheyenne, WY 82009
CHAPTER X

PERMITTING REQUIREMENTS

INTRODUCTION

Identifying Permits for Construction

Permitting of water improvement projects being constructed on the Wind River Indian Reservation does not follow the permitting requirements and review procedures for similar projects located elsewhere in Wyoming. The reservation has unique jurisdictional controls. Wyoming Department of Environmental Quality (DEQ) rules and regulations do not apply on the reservation, though the Northern Arapaho Utilities (NAU) organization does follow these published standards.

The Wyoming State Engineer’s Office, U.S. Environmental Protection Agency (EPA), U.S Bureau of Indian Affairs (BIA), Wind River Environmental Council, the Tribal Water Resource Board, The Tribal Engineer’s Office, the Tribal Historical Preservation Offices, and NAU, each have authority over specific activities on the Wind River Indian Reservation.

The tribal governments for the Northern Arapaho and Eastern Shoshone tribes each have their own review and approval primacy over public utilities projects on their respective systems, rather than DEQ. Nonetheless, the tribes approve the construction of public utility projects based on those projects compliance with DEQ’s current standards.

The U.S. Environmental Protection Agency (EPA) requests that Northern Arapaho Utilities submit this Master Plan, along with any new waterline or well construction plans and specifications, so that the documents can be compliance-reviewed with the Safe Drinking Water Act. The EPA needs to be advised of any new drinking water sources. A standard form has been developed by EPA for this process.

Northern Arapaho Utilities will review, approve, and submit to the Tribal Water Resource Board, any construction plans involving the use of additional water resources or construction of waterlines for their approval.

Water Rights

The Wyoming State Engineer’s Office has primacy over beneficial use of groundwater on the reservation. Any new wells must be permitted through the Wyoming State Engineer’s Office. Additionally, the Tribal Water Resource Board also requires that well construction, well completion permits, and a driller’s license be obtained through their office.

The Wyoming State Engineer’s Office has discovered that the two wells serving the Arapahoe area system are not presently permitted through their office. This permitting deficiency needs to be corrected by filing an Application for a Permit to Appropriate Groundwater. Once that permit
is issued, a Statement of Completion and Beneficial Use must be filed for Northern Arapaho Utilities to receive and adjudicated water rights for these two wells. The Indian Health Service, who contracted to have these wells drilled and put in service, has all the records that NAU will need to complete those applications.

Cultural Resources

There are two different methods of approval for historical and cultural resources on the Wind River Indian Reservation.

- On projects of less than five (5) acres, the Northern Arapaho Utilities, through its consultant, can perform a historical and cultural resource survey and compile a report of findings. This report will be submitted to the Tribal Historical Preservation Offices for a 30-day review. As well, the Wyoming State Historical Preservation Office will review the results of the survey for historical and cultural resources.

- For projects greater than five acres, the BIA must perform the historical and cultural resource study through their Billings, Montana office. The report will then be reviewed by the Tribal Historical Preservation Offices and the Wyoming State Historical Preservation Office.

Utility Right-of-Way Procurement

Granting of right-of-way for any improvements on the reservation is a highly bureaucratic process that frequently requires a year or more to complete for major projects. Under formal processes, the Bureau of Indian Affairs (BIA) must review and approve project right-of-way (ROW) requests which they then take to the Joint Business Council (JBC) for approval action. The JBC has ultimate approval authority.

There are three categories of property on the reservation: tribal trust, allotted, and private deeded, each requiring its own easement permitting process. Easements on private lands require no BIA permitting. Allotted lands are those that are in private ownership by tribal members who are heirs to the original tribal person to whom the land parcel was allotted. In most cases these lands have a large number of persons who hold interest in the property. Tribal trust lands require BIA permitting. Tribal trust lands are held jointly by the two tribes and are administered by the BIA.

Under traditional methodologies that apply to Tribal Trust and allotted lands, acquiring right-of-way (ROW) must go through the following process steps:

- NAU will identify the line routes for which they want to obtain a ROW and give that information to the BIA.
- The BIA Realty Office then researches its records to determine ownership along the routes.
- NAU then applies for a “Permit to Survey”.
- NAU must seek concurrence from all landowners to grant permission to be surveying on their property. Where the sought right-of-way crosses allotted lands, 51% of the heirs to the properties must grant permission.
Once NAU acquires the landowners’ consent to survey, the BIA will request the granting of the permit to survey be added as an agenda item for the Joint Tribal Business Council (JBC).

JBC will then review the application for Permit to Survey and take action on it.

Once approved by the JBC, the applicant can conduct the needed field surveying and prepare legal descriptions of the ROW across each parcel.

NAU must then obtain landowner agreement to grant the ROW, pay BIA’s appraised compensation to the landowner, and make application for the needed right-of-way as prescribed in BIA regulations. Again, 51% of the heirs to the allotted properties must grant permission. A corridor map must be attached to the permits showing the proposed waterline ROW across each parcel.

Upon completion of receiving signed concurrence from all needed landowners, the BIA will again review documentation.

BIA will request the application be added as an agenda item for the Joint Tribal Business Council (JBC). JBC will then review the permit applications and take action based on BIA’s recommendation.

The JBC can then grant the requested right-of-way.

The tribes have adopted a license process by which they can grant a utility license without going through the formal BIA right-of-way process. In cases involving only tribal lands, as opposed to allotted lands, either tribal business council can directly grant a license request to install utilities. Individual tribal members or the majority interest holder on an allotted parcel may grant a permission to trespass with a utility line, again, without the process of formal BIA review and recommendation. There is no easement process on tribal trust or allotted lands.

Rights-of-way will be required for all planned construction of new facilities which include:
1. Tying the new well into the 1 MG tank transmission line,
2. The transmission line looping between the two casinos,
3. The new 300,000 gallon concrete storage tanks and its accompanying transmission line,
4. The new transmission line on Left Hand Ditch Road from C’Hair Lane to the industrial park.
5. The looping of the Rendezvous Road (Highway 135) line to the transmission line near St. Stephens Schools, and
6. Tying the new well into the 1 MG tank transmission line.

Portions of the proposed project include upgrading the existing water distribution system. Those improvements can best be constructed immediately adjacent to the existing lines in the existing right-of-way, assuming there is one of record. The BIA has these records. Though past experience, it has been found that BIA records are in poor condition due to incomplete and inconclusive records on the status of utility rights-of-way.

Right-of-way status of the existing lines on the system has not been fully investigated and verified. That work is beyond the scope of this study.
Corps of Engineers

NAU will have to apply for and obtain Corps of Engineers approval of permits to cross the Little Wind River to install the water transmission crossings for both the replacement of the 17-Mile Road transmission line running east of St. Stephen’s Mission and the line looping the transmission between the two casinos. It is expected that these will result in a routine granting of a permit for such construction.

Tribal Employment Rights Office (TERO)

A contractor of any kind doing work on the Wind River Indian Reservation is required to be licensed with the Tribal Employment Rights Office (TERO). The contractor must pay a fee equal to 2% of the contract work to the TERO office. There are also requirements for hiring preference being given to enrolled Native American workers. Details are available through the TERO office.
CHAPTER XI

SYSTEM ECONOMIC ANALYSIS AND PROJECT FINANCING

INTRODUCTION

This chapter covers the economic status of the Northern Arapaho Utilities Arapahoe system much of which was covered in Chapter VII, Operation and Maintenance. Also presented in this chapter is the economic status of the NAU system compared to other similar reservation systems. Reiterated here also are the water rates that the system would have to charge to be financially self-supporting.

A plan for financing the proposed improvements is developed in this chapter. That financing plan makes assumptions of available funding sources. Because the system is on a reservation and serves primarily a Native American population, some limited funding sources are available that are not available to similar off-reservation systems in Wyoming. There are also some otherwise available state sources for which the tribe does not qualify due to legal and jurisdictional issues.

SYSTEM ECONOMIC ANALYSIS

The Arapahoe portion of the Northern Arapaho Utilities water system provides potable water service to:

- 311 homes,
- 5 Tribal office complexes,
- 1 Social services building,
- 3 public schools,
- 2 casinos,
- Great Plains Hall, and
- 1 church.

The estimated service population as of 2009 was 1,303 people out of the 1,974 people estimated to be living within the area served by the water system. The remaining 671 people are using private wells. This served population is made up of tribal and non-tribal individuals.

As described in Chapter III, the water system is comprised of 26 miles of pipe spread over a 20 square mile service area. It uses well water treated at the pumphouse near the Great Plains Hall Complex. The Arapahoe Industrial Park area uses well water treated at the pumphouse near Arapahoe School. This is a widespread system as compared to its service population. Because of its size and complexity, this is a costly system to operate and maintain on a per-customer basis.

The system is in poor operational condition due to a combination of marginal construction quality and minimal maintenance investment. In order to improve the system, investment will have to be made by Northern Arapaho Utilities.
Northern Arapaho Utilities’ Present Water Rates

Northern Arapaho Utilities has the following water rates:

<table>
<thead>
<tr>
<th>Rate Classification</th>
<th>Monthly rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential Water</td>
<td>$17.00</td>
</tr>
<tr>
<td>Non-enrolled Water</td>
<td>$21.00</td>
</tr>
<tr>
<td>Senior Water</td>
<td>$11.00</td>
</tr>
<tr>
<td>Non-enrolled Water Senior</td>
<td>$13.00</td>
</tr>
</tbody>
</table>

Other subscribers, such as schools and businesses, are billed at a rate dependent on the type of use and size of establishment.

These rates are comparable to other reservations. They are lower than rates in surrounding off-reservation communities.

Currently, the Arapahoe water system is not self-supporting, nor has it ever been. In 2008, the system had expenses of $297,697. Its billing was $98,736 and collected revenues were $73,493. Fiscal year 2007 had very similar results. This is a typical ratio of billing, collections, and expenses. As a result, the system is not self-supporting and NAU has to rely on funds from the Northern Arapahoe Business Council to make up revenue shortfall. This is typical of other reservation water systems, as is shown in the section that follows.

RATES NEEDED TO SUPPORT THE ARAPAHOE SYSTEM WITH PRESENT ASSISTANCE

There are a total of 324 services on the Arapahoe system. These services are billed on a monthly basis and include the public and commercial services. Total billing in 2008 was $98,736, or an average of $25.40 per customer per month when adding in nonresidential billing.

Based on NAU cost accounting, total water costs amounted to $2.14 per thousand gallons in 2008 for the Arapahoe system which equates to $297,697 for the 139,291,000 gallons produced.

Using the present 324 services, the average water bill per service would be $921.66 per year, equating to $76.81 per month. This is higher than water rates in local municipalities. This rate covers only basic operation and maintenance. The rate will have to be much higher to cover the cost of retiring the debt that will likely be required for financing the improvements needed to bring the system up to accepted standards.

Table XI-1, on the next page, shows a recommended rate structure that would allow NAU to be self supporting.
Table XI-1: Arapahoe Area Recommended Water Rates

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008 Expenses</td>
<td>$297,697</td>
</tr>
<tr>
<td>2008 Gallons Produced</td>
<td>139,290,000</td>
</tr>
<tr>
<td>Cost per 1000, Gal</td>
<td>$2.14</td>
</tr>
<tr>
<td>Assume 90% of consumption is residential</td>
<td>125,361,000</td>
</tr>
<tr>
<td>Assume 10% of consumption is commercial and public facilities</td>
<td>13,929,000</td>
</tr>
<tr>
<td>2008 Costs Attributable to residential use (90%)</td>
<td>$238,157.6</td>
</tr>
<tr>
<td>2008 Costs Attributable to Commercial/Public (10%)</td>
<td>$29,769.70</td>
</tr>
<tr>
<td>2008 Number of homes served</td>
<td>311</td>
</tr>
<tr>
<td>Revenue required per residence/yr.</td>
<td>$765.78</td>
</tr>
<tr>
<td>Required revenue per residence/mo.</td>
<td>$63.82</td>
</tr>
<tr>
<td>2008 Residential revenue collected</td>
<td>$71,186.46</td>
</tr>
<tr>
<td>Collected Residential revenues/household/mo.</td>
<td>$19.07</td>
</tr>
<tr>
<td>2008 Residential billing</td>
<td>$96,429.00</td>
</tr>
<tr>
<td>Average residential billing/household/mo</td>
<td>$25.84</td>
</tr>
<tr>
<td>Average monthly household water consumption</td>
<td>403,090</td>
</tr>
</tbody>
</table>

### Computation of Residential Rates

<table>
<thead>
<tr>
<th>Usage</th>
<th>Rate/1000 gal</th>
<th>Water Charge</th>
<th>Total Bill</th>
<th>Income/yr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Rate (Minimum bill)</td>
<td>$20.00</td>
<td>$20.00</td>
<td>$74,640</td>
<td></td>
</tr>
<tr>
<td>Tier 1 0 to 5,000 gal</td>
<td>$2.00</td>
<td>$10.00</td>
<td>$30.00</td>
<td>$115,692</td>
</tr>
<tr>
<td>Tier 2 5001 to 10,000 gal</td>
<td>$3.00</td>
<td>$15.00</td>
<td>$45.00</td>
<td>$177,270</td>
</tr>
<tr>
<td>Tier 3 10,000 to 20,000 gal</td>
<td>$4.00</td>
<td>$40.00</td>
<td>$85.00</td>
<td>$341,478</td>
</tr>
<tr>
<td>Tier 4 Above 20,000 gal</td>
<td>$5.00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Residential Tap Fee**: $1,500

### EQUIVALENT DWELLING UNIT

The Arapahoe system consumed 126,245,031 gallons of water in 2008. There are 311 homes on the system. Since the system is not metered, the assumption was made that 80% of that use, 100,996,024 gallons, was residential use. That equates to 311,716 gallons of residential use per household.
Rates for nearby communities and other reservation systems are as given below.

**Shoshone Utilities, Ft. Washakie, WY**

<table>
<thead>
<tr>
<th>Rate Classification</th>
<th>Monthly rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enrolled Shoshone</td>
<td>$20.00</td>
</tr>
<tr>
<td>Other Tribe</td>
<td>$23.00</td>
</tr>
<tr>
<td>Non-enrolled</td>
<td>$23.00</td>
</tr>
</tbody>
</table>

This system is not metered and charges only a flat rate. The service population is reported to be 2,870. System billings are $230,000 with collections of $212,000. The system is not self-supporting.

**Northern Cheyenne Utilities Commission, Lame Deer, MT**

<table>
<thead>
<tr>
<th>Rate Classification</th>
<th>Monthly rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential water and sewer combined</td>
<td>$48/mo.</td>
</tr>
</tbody>
</table>

The system serves 520 residential and 90 commercial accounts. It has a service population of approximately 2,600. It reported 2007 revenues of $303,923 and expenses of $400,000. The system is not self-supporting.

**Gila River Indian Community, Sacaton, AZ**

<table>
<thead>
<tr>
<th>Rate Classification</th>
<th>Monthly Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>$0.50/1000</td>
</tr>
<tr>
<td>Commercial</td>
<td>$.075/1000</td>
</tr>
<tr>
<td>Seniors</td>
<td>$5.00/mo. flat rate</td>
</tr>
</tbody>
</table>

The system serves approximately 10,000 people and has 2,850 connections, 2,000 of which are metered. It reports annual billing of $650,000, collections of $510,000 with total operating expenses of $1,500,000. The system is not self-supporting.

**Nez Perce Tribe, Lapwai, ID**

<table>
<thead>
<tr>
<th>Rate Classification</th>
<th>Monthly rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>$27.00/mo. For first 1,000 gal and $1.50/1000 thereafter</td>
</tr>
</tbody>
</table>

The system serves 134 connections, has 134 services, and serves a population of 536 people. They report billing of $88,440 per year. The system is not self-supporting and relies on an $80,000 annual subsidy from the tribe to offset non-payment.

**Mid-Dakota Water Development District**

<table>
<thead>
<tr>
<th>Rate Classification</th>
<th>Minimum</th>
<th>1st Tier/1000 gal.</th>
<th>2nd Tier</th>
<th>3rd Tier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural Household</td>
<td>$34.90/mo.</td>
<td>$3.50/1st 10,000</td>
<td>$3.50 to 33K</td>
<td>$5.25 over 33K</td>
</tr>
<tr>
<td>Municipal</td>
<td>$18.50/mo.</td>
<td>$3.50/1st 20K</td>
<td>$3.50 to 188K</td>
<td>$5.25 over 188K</td>
</tr>
</tbody>
</table>
This system serves 30,000 people, many of whom are Native American, in 18 municipalities, and 2,350 rural taps. It has 2,340 miles of distribution and 89 miles of main line, 10 tanks and a 9 MGD water treatment plant. The system was set up and funded by a specific Act of Congress. The self-supporting status of this system was not determined.

ABILITY TO PAY

Many of NAU’s system subscribers are categorized at or below poverty level incomes for annual family income levels. The poverty level was established for 2009-2010 by the U.S. Health and Human Services for a family of at $22,050. As a result, there are practical limitations to what the tribe can do to improve system revenues. This is evident in the delinquency rates on billings, discussed earlier. Some of these difficulties are related to NAU’s collection policies and NAU’s inability to enforce collection through physically shutting off service for non-payment. Still, there is room for rate adjustments and revenue improvement including:

- General rate adjustment
- Billing all system connections including tribal facilities and tribal officials for whom water fees are presently waived
- Rigorously enforcing collections

These efforts will be more effective if accompanied with a rate payer education program.

NAU relies on both federal and tribal funding to carry out its mission. Federal funding has been sporadic at best. The level of funding allocated in any federal fiscal year varies widely. Supplemental funding from the Northern Arapaho Tribal Business Council is allocated on local criteria. This includes availability of funds, council priorities as perceived from constituent input, and other changing factors. The result is that NAU has an inconsistent revenue stream that thwarts efforts to implement a consistent program of maintenance and the staffing of operations essential to an efficiently operated system.

FINANCING PLANNED IMPROVEMENT PROJECTS

Northern Arapaho Utilities has relied almost entirely on federal funding for capital improvements since its inception. This is representative of reservation systems. The Indian Health Service (IHS) has been tasked by the U.S. Congress with that assignment. As discussed above, this funding source has a history of being sporadic, depending on federal policy during any given administration. It is assumed that the IHS will continue to be the primary source of funding for future capital improvements for NAU’s system.

In the past, it has been common that the funding cycle is protracted to the extent that once projects receive the requested funding, the amount received has been eroded by inflation cost escalations and budget cuts, or both. By the time funding is received, it is insufficient to achieve the planned project and meet objectives. This situation, coupled with substandard maintenance of the system, has contributed significantly to the piecemeal, inferior quality, and poorly performing system that NAU now operates.
The available sources of project funding for Northern Arapahoe Utilities’ capital projects have been identified to include:

- Indian Health Service – Sanitary Facilities Construction Program
- Wyoming Water Development Commission
- USDA – Rural Development
- Arapaho Tribal Funding

Other sources, such as EPA, are available on a special projects or special legislation basis (i.e. ARRA/Stimulus Funding) but are not known to be available on an on-going basis.

**FUNDING OF PRIORITIZED PROJECTS**

It is recommended that the following project Table of Financing, Table XI – 1, be used as a guideline for seeking the prioritized projects as listed. All of the recommended projects are eligible for funding through IHS and the Rural Development (R.D.) office of USDA.

The Billings area office of IHS receives only $2,000,000 dollars annually to distribute among nine (9) tribes on eight (8) reservations. In reality, IHS will provide only marginal financial help to the overall need for $8,000,000 of improvements to the Arapahoe system. To accomplish NAU’s Arapahoe area project alone, it would require that IHS fund only this Arapaho Tribe project for at least four (4) years at the exclusion of all the other tribes and reservations. That won’t happen. The principal advantage of this funding source is that there is no required funding match.

**USDA Funding**

All of the recommended projects can qualify for funding through the Rural Development (RD) branch of the USDA. This funding source has a sliding scale of grant to loan and applicable interest rates. USDA prefers that the projects be funded primarily by loans, assuming water rates can remain reasonable. That is a point of negotiation at the time of application and is not defined here.

For purposes of developing a funding plan for the needed Arapahoe system, it is assumed that the project will be offered funding consisting of **30% grant accompanied by 70% loan for 20 years** and a “poverty” **interest rate of 3.25%**. This is a realistic and slightly conservative funding forecast. A higher percentage of grant and/or a lower interest rate, or vice versa, might ultimately be offered by RUS. The Wind River Indian Reservation’s income level makes the tribe eligible to receive the “poverty” interest rate. Paying off the required loan amounts would be a serious financial burden to the Arapahoe area residents.

**Wyoming Water Development Funding**

For qualifying projects, which are limited to:

- water source development,
- water transmission, and
- storage,
The Wyoming Water Development commission offers 67% grant, to be coupled with 33% local matching funding. The Arapaho Tribe will have to arrange non-state funding for the matching funds required.

Table XI-2 shows the projects in their priority and the conceptual financing plan for each project. The grant and loan amounts that are estimated to be available through the funding agencies for each project are shown.
## Table XI-2: Table of Financing

**WWDC Arapahoe System Master Plan Recommended Improvements**  
**September 2010**  

### 20 Year Project Financing

<table>
<thead>
<tr>
<th>Project Priority Ranking</th>
<th>Project Description</th>
<th>Total Project Cost</th>
<th>WWDC</th>
<th>RDA</th>
<th>IHS</th>
<th>Tribal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Water Metering with Individual Service Connections</td>
<td>$717,500</td>
<td>67% WWDC Grant</td>
<td>$215,250</td>
<td>33% Matching</td>
<td>$502,250</td>
</tr>
<tr>
<td>2</td>
<td>Tie in Wind River Well No. 3</td>
<td>$505,900</td>
<td>$336,929</td>
<td>$168,971</td>
<td>$50,691</td>
<td>$118,279</td>
</tr>
<tr>
<td>3</td>
<td>Loop the Transmission Line Between the Two Casinos</td>
<td>$629,400</td>
<td>$419,180</td>
<td>$210,220</td>
<td>$63,066</td>
<td>$147,154</td>
</tr>
<tr>
<td>4</td>
<td>Install 12&quot; Transmission Line from 1 MG tank to 17-Mile Road</td>
<td>$996,300</td>
<td>$663,536</td>
<td>$332,764</td>
<td>$99,829</td>
<td>$232,935</td>
</tr>
<tr>
<td>5</td>
<td>Extend the 12&quot; Transmission Line From Goes-In-Lodge Road East to Highway 789</td>
<td>$1,239,600</td>
<td>$825,574</td>
<td>$414,026</td>
<td>$124,208</td>
<td>$289,818</td>
</tr>
<tr>
<td>6</td>
<td>300,000 Gal. Concrete Tank and 10&quot; Transmission Line</td>
<td>$1,398,400</td>
<td>$931,334</td>
<td>$467,066</td>
<td>$140,120</td>
<td>$326,946</td>
</tr>
<tr>
<td>7</td>
<td>Distribution System Improvements in the Great Plains/Arapahoe Community Area</td>
<td>$578,300</td>
<td>$173,490</td>
<td>$404,810</td>
<td>$27,842</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Looping of Rendezvous Road Line</td>
<td>$390,400</td>
<td>$117,120</td>
<td>$273,280</td>
<td>$18,796</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Replace C'Hair Lane Lines</td>
<td>$679,300</td>
<td>$203,790</td>
<td>$475,510</td>
<td>$32,705</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>South Left Hand Ditch Transmission Line and Industrial Park Improvements</td>
<td>$865,200</td>
<td>$576,223</td>
<td>$288,977</td>
<td>$86,693</td>
<td>$202,284</td>
</tr>
<tr>
<td>11</td>
<td>Demolition of Abandoned Tanks</td>
<td>$16,000</td>
<td>$16,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>System Extension to Wind River Bridge and Little Wind River Bottom Road</td>
<td>$4,346,900</td>
<td>$4,346,900</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Project</td>
<td>$12,363,200</td>
<td>$3,752,777</td>
<td>$1,882,023</td>
<td>$1,274,257</td>
<td>$2,973,266</td>
<td>$204,498</td>
</tr>
</tbody>
</table>

### WWDC Eligible
- $5,634,800

### Non WWDC Eligible
- $6,728,400

### Total Project
- $12,363,200

### Less WWDC 2010 Funding of Project # 2, above
- $(336,929)

**Total WWDC Grant (67% of unfunded, eligible projects)**
- $3,415,847

**Total RUS Grant**
- $1,274,257

**Total RUS Loan**
- $2,973,266

**Total Tribal**
- $16,000

**Total IHS Funding**
- $4,346,900
LOAN FUNDING IMPACT ON WATER RATES

At present, the NAU system has 324 services and a service population of 1,303 people. Assuming that same ratio prevails to the year 2030, the system would have 470 services for its forecast population of 1,882 people. The rate impacts discussed in the balance of this chapter are based on those assumed figures.

As discussed earlier in this chapter, NAU’s water rates would have to average approximately $76.81 per month per service to cover present operation and maintenance costs only. When the cost of financing the recommended improvements is added, the monthly rate increases appreciably. Table XI-3 below shows the incremental monthly rate increase needed to finance each of the top ten (10) recommended projects.

WATER RATES USING CURRENT FINANCIAL ASSISTANCE

To retire the debt load conceptually shown in the Table of Financing would require a monthly rate increase of $52.76. When added to the $76.81 required to cover current operation and maintenance, **water rates would have to be $130 per month if the system is to be self-supporting with currently available financial assistance.** This rate is nearly eight (8) times the current rates and is viewed as well above the users’ current ability to pay at their current income levels. No current figures are known to be available for median income on the Wind River Indian Reservation.

It is clear that NAU ratepayers will benefit from any assistance they can receive from IHS because no loan is required under that program.

WATER RATES REQUIRED TO BE FULLY SELF-SUPPORTING

It is difficult to accurately predict the revenue required for NAU’s Arapahoe system to be fully self-supporting with no outside income. In a self-supporting scenario, the system revenues will have to pay operation, maintenance, debt retirement, and obsolescence replacement. Assuming inflation will average 3% per year, a 60-year life for the water lines, storage tanks, and wells and assigning a 30 year life to the SCADA system, and 15 years to the well pumps yields an annual obsolescence cost of approximately $538,000 per year. Spreading that cost among the 324 present services adds another $138.74 per month to the $130 to pay O&M and debt retirement resulting in a **total billing of nearly $270 per month per household to achieve a totally self-sustaining system.** Once the debt for the recommended project is retired the rates can be dropped back to $215 per month.
Table XI-3: Required Rate Increases to Support Project Loans

WWDC - Arapahoe Water Supply Level II Study

Rate Increases Required to Support Project Loans

<table>
<thead>
<tr>
<th>Project Priority Ranking</th>
<th>Project Description</th>
<th>RDA</th>
<th>Required Loan Payment per Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Water Metering with Individual Service Connections</td>
<td>$34,544</td>
<td>$8.91</td>
</tr>
<tr>
<td>2</td>
<td>Tie in Wind River Well No. 3</td>
<td>$8,135</td>
<td>$2.10</td>
</tr>
<tr>
<td>3</td>
<td>Loop the Transmission Line Between the Two Casinos</td>
<td>$10,121</td>
<td>$2.61</td>
</tr>
<tr>
<td>4</td>
<td>Install 12” Transmission Line from 1 MG tank to 17-Mile Road</td>
<td>$16,021</td>
<td>$4.13</td>
</tr>
<tr>
<td>5</td>
<td>Extend the 12” Transmission Line From Goes-In-Lodge Road east to Highway 789</td>
<td>$19,933</td>
<td>$5.14</td>
</tr>
<tr>
<td>6</td>
<td>300,000 Gal. Concrete Tank and 10” Transmission Line</td>
<td>$22,487</td>
<td>$5.80</td>
</tr>
<tr>
<td>7</td>
<td>Distribution System Improvements in the Great Plains/Arapahoe Community Area</td>
<td>$27,842</td>
<td>$7.18</td>
</tr>
<tr>
<td>8</td>
<td>Looping of Rendezvous Road Line</td>
<td>$18,796</td>
<td>$4.85</td>
</tr>
<tr>
<td>9</td>
<td>Replace C’Hair Lane Lines</td>
<td>$32,705</td>
<td>$8.44</td>
</tr>
<tr>
<td>10</td>
<td>South Left Hand Ditch Transmission Line and Industrial Park Improvements</td>
<td>$13,913</td>
<td>$3.59</td>
</tr>
<tr>
<td>11</td>
<td>Demolition of Abandoned Tanks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>System Extension to Wind River Bridge and Little Wind River Bottom Road</td>
<td>(204,498)</td>
<td>$52.76</td>
</tr>
</tbody>
</table>

Total Project

(204,498) $52.76
You Are Invited to Attend the

Public Meeting

For the

Arapahoe Water Supply
Level II Study

Funded by the
Wyoming Water Development Commission

September 14, 2010
6:00 p.m.
Saint Stephen’s Elementary School Cafeteria
MINUTES
WWDC ARAPAHOE WATER SUPPLY LEVEL II STUDY
PUBLIC MEETING
SEPTEMBER 14, 2010
6:00 P.M.

A carry-in dinner began at approximately 6:15 p.m. The meeting was opened at 7:00 p.m. by civil engineer Jim Gores of James Gores and Associates, P.C. Jim explained that this study is funded by the Wyoming Water Development Commission (WWDC) and the purpose of the study is to plan a better water supply for the Arapahoe area. By use of a PowerPoint presentation (see attached), Jim highlighted the findings of the study. He then opened the floor for questions and comments.

Kevin Boyce of WWDC stated that the priority of this project was to get a well drilled. Through the assistance of sub-consultants Wester-Wetstein & Associates, Inc. and Nech Engineering, James Gores and Associates was able to get the test well drilled in only 6 months. Dates for WWDC meetings: in Casper, November 3-5 when new projects will be considered; and in Cheyenne, December 14-15 and Select Water December 16.

Jim Gores introduced everyone in attendance who was involved in the project and representatives for involved offices:
  - Kevin Boyce of WWDC
  - Gerry Redman of Northern Arapaho Utilities (NAU)
  - Larry Wester of Wester-Wetstein & Associates
  - Travis Brockie of Nech Engineering
  - Pam Buline of U.S. Senator John Barrasso’s local office
  - Carol Justice, System Planner/Grants for NA Tribal Business Council
  - Annette Baxter of James Gores and Associates, P.C.

There was discussion about the purposes of metering being an aid in leak detection, monitoring consumption, and equitable billing. Gerry Redman explained that under treaty provisions, NAU can only charge a fee for operation and maintenance, and not for consumption. Larry Wester explained that funding agencies say you have to meter users, but they don’t require owners to charge for water. Metering doesn’t necessarily mean charging.

There was discussion by Mr. SoldierWolf about the history of the waterlines in relation to landowners and water fees. It was noted that the tribal members were told they would never have to pay for water consumption, just a fee for operations and maintenance.

There was discussion about the presence of radionuclides in the shallow groundwater in the mill tailings area. It was requested by Ms. Rae Friday that the waterlines be moved out of the tailing area to assure no contamination of the water. Jim Gores assured them that all research shows that the water in the Arapahoe water system is safe to drink and radionuclides cannot penetrate the waterlines (pipes) that are in place. He further stated that the water on the east end of the system tests the same as the water on the west end of the system. He also explained how looping the lines will ensure circulation and keep radioactive particles from accumulating at the ends of lines.
There was discussion about private wells in the mill tailings area. Jim explained that all private wells need to be disconnected from the houses to ensure that there is no water from those wells flowing back into their safe water carried by the Arapahoe system. He explained that the old wells could be capped or used for livestock or agricultural uses. He suggested that the UMTRA and DOE cooperative agreement could possibly inventory all private wells at houses in the tailings area and make sure they are disconnected from the houses to assure no backflow into water system.

Ms. Ray Friday expressed concern about the sulfur plant located in the tailing area and their effect on the groundwater in that area. Travis Brockie explained that the sulfur plant is being monitored by EPA and explained their cooling pond system. It was explained that the sulfur plant is on its own well water system.

There was discussion about houses tapping on to the system without permission and how that affects the system as a whole and NAU’s ability to safely operate the system and bill for service.

There was some discussion about “boil” orders being issued. Gerry Redman explained why boil orders are issued and how NAU disseminates the information.

There was discussion about possible water rates. A suggestion by Ms. Mary R. Goggles-Chavez was a flat rate of $15 for elderly and handicapped; $30 for other households; and the commercial, agricultural and school consumers would pay a rate for consumption.

There was discussion about the next step needed to implement this plan. Jim Gores explained that the Tribal Business Council will need to apply for funding to move forward. Kevin Boyce said there is an October 1, 2010 deadline for applications for funding with WWDC. He explained that WWDC will offer a 67% grant and the tribe must find funding for the remaining portion of the project. It was noted that other possible funding needs to be identified when the application is made, but that there does not have to be an obligation from other funding sources at the time of WWDC application. One suggestion was to seek RUS funding. Travis Brockie suggested they check into the possibility of the UMTRA program and DOE through its cooperative agreement being asked to financially assist with getting the well tied in.

There was a question about the casino possibly purchasing its own storage. Jim Gores pointed out the new proposed tank near Beaver Creek Housing. He also explained how other tribal programs make it difficult for NAU to keep up with demand on the system. Often the housing office chooses project sites and then contacts NAU for their need for water rather than using water availability as a criterion for choosing housing project sites. Better communication needs to happen before building more housing developments.

Jim Gores also discussed BIA’s practice of issuing clusters of home sites on scattered, remote parcels of tribal land. He said these grow into isolated little villages that, in time, request central water service. This fragmentation of service areas is counterproductive to establishing an economical, reliable system for all tribal users. It is recommended that the BIA be strongly encouraged to stop this practice.

Meeting closed at 8:30 p.m.
October 07, 2007

James Gores
James Gores and Associates
111 N. 3rd Street E.
Riverton, Wyoming 82501

Re: Comments on the Draft Master Plan of the Arapahoe Water System
Prepared by Gores and Associates

Dear Jim,

I have several comments to the Draft Master Plan Report your office prepared regarding the Arapahoe Water System.

The Draft Master Plan Should Refer to DOE as a Funding Source

As reflected in the Draft Master Plan Report (e.g., at III-4), uranium tailings from a processing mill site has led to uranium contamination of the ground water. As a result, the United States Department of Energy ("DOE") installed an alternative water supply system ("AWSS"), which included transmission and distribution lines and a large storage tank, among other additions to the Arapahoe Water System. The AWSS, which is approximately one-third of the overall system covered by the master plan, is part of the institutional controls DOE is providing the Tribes while the natural attenuation or flushing plan progresses. Therefore, DOE is the party primarily if not exclusively responsible for future funding one-third of the system. However, the Master Plan omits DOE from the list of funding sources available to the Tribes. (See I-2, I-5, VII-11, IX-4, XI-5, table XI-1.) The Master Plan should be corrected to reflect the fact that DOE is a primary funder of the system and should be approached for funding.

Natural Attenuation/Flushing of Uranium Contamination

The discussion about natural flushing is not totally accurate. The report states (at III-5) that the alluvial aquifer will be free of uranium contamination via natural flushing in 100 years or less. This appears to be based on a 2008 report prepared for DOE. However, more current DOE information puts the range at up to 160 years. In its Verification Monitoring Report Update for 2009, dated April 2010 (at 5-2), natural flushing is estimated to be complete in between 19 and 160 years. In light of this information, the United States Nuclear Regulatory Commission recently questioned...
DOE's basis for and the efficacy of, natural attenuation/flushing in a letter dated August 24, 2010. DOE has yet to reply.

The report also cites (at III-5) maps from 2006 and 2008 and states that the levels of uranium concentration in the alluvial aquifer is lessening. While overall that may be accurate, the report fails to note that in more recent tests (2008-2010), the mean uranium concentration levels have increased. (E.g., at 14, DOE PowerPoint presented August 10, 2010 at Joint Business Council Chambers.)

Perhaps because these important facts are relatively recent, they are not included in the Report. However, they call into question the statement made in the Draft Report that natural flushing will be successful within 100 years and the uranium concentrations have decreased. These statements should be corrected or qualified accordingly.

Radionuclide Contamination Concerns & Looping as a Priority

The Master Plan Report discusses the merits of the concerns of local residents of radio nuclear material entering the water line. (III-4 – III-6.)

The Report tacitly acknowledges (at III-4, VIII-4) that it simply summarizes known scientific findings, but should also clarify that Gores and Associates engaged in no sampling, testing, or other assessment of any kind.

The Report should also note that Gores and Associates did not assess or comment on the potential for the water system to be contaminated by radionuclide in the future. For example, the Report did not discuss whether the water line that exists within the plume of contaminated water could fail and whether, under those circumstances, contaminated water could enter the system. Indeed, it does not appear that all of the specifications for the AWSS were available to Gores and Associates.

Finally, because the transmission line at Rendezvous Road is in the middle of the contaminated plume, the Northern Arapaho Tribe also believes that the looping of that line should be given a higher priority than eighth. (See VIII-4.)

Very truly yours,

NORTHERN ARAPAHOE UTILITIES

Gerald Redman Sr, Director
DATE: October 24, 2010

TO: Gerry Redman, Northern Arapahoe Utilities and File

FROM: Mr. James C. Gores, P.E.

SUBJECT: 10-7-10 Comment letter regarding Arapahoe Water Supply Level II Study

James Gores and Associates offers the following reply to the comments contained in the referenced comment letter:

The Draft Master Plan Should Refer to DOE as A Funding Source
While it was recognized that DOE may be requested to contribute funds toward the resolution of Arapahoe area water system deficiencies noted in the study, DOE is not an agency who has programs for the purpose of aiding municipal utilities. Those agencies identified in the report as funding sources do regularly fund water systems and have programs specifically for that purpose. It is recommended that those agencies be the first applied to for needed funds.

If, in the current negotiations between the Arapahoe Tribe and the DOE, it is decided that additional UMTRA funds may be allocated to address the Arapahoe water system’s needs, that would be a favorable event to augment funding to implement the recommended improvements. To date, there has been no written assurance that such funding might be made available. The funding sources identified in the report, on the contrary, do have funding available.

Natural Attenuation/Flushing of Uranium Contaminates
The October 7, 2010 letter references more recent information than was known to be available at the time of writing of the report. The report hereby includes that information.

The trending of level of contamination has no significant effect on the recommendations in the report. The best available scientific information indicates that the presence and minimal level of this radionuclear contamination has no measurable effect on the public safety and health of those persons using the Arapahoe area public water system.

Radionuclide Contamination Concerns and Looping as a Priority
The report’s prioritization of the improvement projects is simply a recommendation based on the ranking criteria used at its writing. The sponsor, NAU, is encouraged to accomplish the recommended improvements in the priority that it believes best serves its subscribers.

The WWDC did not perform any supplementary testing of alluvial groundwater for radionuclear contamination nor was the consultant scoped to review issues specific to the AWSS.
WATER QUALITY
RULES AND REGULATIONS

Chapter 5
CERTIFICATION PAGE FOR RULES

Adoption date: October 13, 1997
To guarantee review by the Secretary of State within the 60 day deadline, this package must be submitted to the Secretary of State by: December 12, 1997.

GENERAL INFORMATION:

1. Agency: Department of Environmental Quality, Water Quality Division
   Address: 122 West 25th Street, Herschler Building, Cheyenne, WY 82002
   Agency Contact Person for these Rules: Larry Robinson
   Work Telephone: 777-7781

2. Are these new rules? ("new" - means the first set of regular rules to be promulgated by this agency after the Legislature adopted a new statutory provision or significantly amended an existing statute. Yes ____ No X

3. Chapter # of rules being created, amended or repealed: 5

4. Does this rule replace an existing rule? Yes _X_ No ____ If yes, which chapter(s)?
   Chapter 5

NOTICE OF INTENDED RULEMAKING TO AG, LSO AND SECRETARY OF STATE

5. Notice of intended rulemaking containing all of the information required by W.S. 16-3-103(a) was filed with the Secretary of State on October 21, 1997.

6. Notice of intended rulemaking and adopted rules in strike and redline format were provided to the Legislative Service Office and courtesy copies of the notice and adopted rules were provided to the Attorney General and the Governor on October 21, 1997.

PUBLIC NOTICE OF INTENDED RULEMAKING:

7. Yes X No ____ (If applicable) Notice was mailed 45 days in advance to all persons who made a timely request for advance notice.

8. Yes X No ____ A public hearing was held on the proposed rules on August 8, 1997.

FINAL FILING OF RULES:

9. Yes X No ____ An electronic copy was sent via electronic mail to the Secretary of State on October 20, 1997.
10. Final rules with original signatures were sent to the Attorney General’s office for the Governor’s signature and filing with the Secretary of State on October 21, 1997.

11. Final rules were sent to the Legislative Service Office the same date listed in number 10 above.

CERTIFICATION BY AGENCY:

The undersigned certifies that the foregoing information is correct.

Date 10-21-97

Title Director

GOVERNOR’S CERTIFICATION

I have reviewed these rules and determined that they:

(1) are within the scope of the statutory authority delegated to the adopting agency; and

(2) appear to be within the scope of the legislative purpose of the statutory authority.

Therefore, I approve the same.

11-19-97

Date Approved

Governor

STATE OF WYOMING

Filed the 21st day of Nov. 1997 at 2:21 P.M.

Grand Ohman
Secretary of State

/73170.ltr
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CERTIFICATION OF OPERATORS OF PUBLIC WATER AND PUBLIC WASTEWATER TREATMENT PLANTS, PUBLIC COLLECTION AND PUBLIC DISTRIBUTION SYSTEMS

CHAPTER 5

Section 1. **Authority.** These regulations are promulgated pursuant to W.S. 35-11-101 through 1207, specifically 302 (a) (iv), which states that no person shall operate a public water or public wastewater treatment plant, public collection, or public distribution system in violation of the requirements contained herein. In accordance with W.S. 35-11-302 (a) (iv), these regulations establish the standards for technical competency for owners and designated individuals who operate public water supplies and wastewater treatment systems.

Section 2. **Definitions.** The following definitions supplement those definitions contained in Section 35-11-103 of the Wyoming Environmental Quality Act.

(a) "Act" means the Wyoming Environmental Quality Act as amended (W.S. 35-11-101 et. seq.).

(b) "Activated sludge" means a biological wastewater treatment process in which a mixture of wastewater and activated sludge is agitated and aerated and includes extended aeration and oxidation ditch treatment processes.

(c) "Administrator" means the administrator of the Water Quality Division, Wyoming Department of Environmental Quality or his authorized agents.

(d) “Backup operator” is an individual who is designated by the owner to function in the role of the chief operator when the chief operator is absent.

(e) “Chief operator” is the individual who is designated by the owner to have the primary hands-on responsibility for the operation of each plant or system.

(f) "Contact hour" means one hour of administrator approved operator training and education including but not limited to technical seminars, college courses, lectures, workshops, correspondence courses, hands-on-training, and in-house training programs that are related to water and wastewater treatment, collection and distribution.

(g) "Experience" means employment as an operator or employment in other administrator-recognized professions closely related to the water/wastewater operator profession.
(h) "Facility configuration form" means a form sent to facilities for completion that will guide the Water Quality Division in determining the level of classification for the water and wastewater plants and distribution and collection systems.

(i) "Fixed growth" means a biological wastewater treatment process in which the wastewater is treated by contact with biological growth affixed to a media and includes trickling filter, rotating biological contactor, and biological tower treatment processes.

(j) "Hands-on responsibility" means the on-site responsibility for the operational decisions necessary for the proper functioning of plants and systems.

(k) "Municipality" means any city, town, county, district, association, or other public body including state and federal government.

(l) "Non-municipal public water supply" means any public water treatment plant and/or public water distribution system not operated by a municipality.

(m) "Nutrient removal" means a wastewater plant using biological, chemical, or physical/chemical nutrient removal in its process.

(n) "Operator" means, for systems, any individual who is directly involved in the on-site operation, maintenance, and repair of a system, or, for plants, any person who is directly involved in the on-site operation of the plant, but not those whose duties are related only to laboratory, maintenance, or other non-operational functions.

(o) "Owner" means in the case of a town or city, the mayor or his agent; in the case of a county, the chairman of the county commissioners or his agent; in the case of a water and sewer district, board of public utilities, association, or other public body, the president or chairman of the board or his agent; in the case of a non-municipal public water supply, the legal owner.

(p) "Physical/chemical" means a wastewater treatment plant which operates through the addition and removal of chemicals and alteration of physical properties and does not include any biological treatment processes.

(q) "Plant" means water treatment works or wastewater treatment works.

(r) "Public wastewater collection system" means any system of lines, pipes, manholes, lift stations or other facilities operated by a municipality for the purpose of collecting and transporting wastewater.
(s) "Public wastewater treatment plant" means any structure, pond, lagoon or combination thereof, but not including individual septic tanks, operated by a municipality for the purpose of treating wastewater.

(t) "Public water distribution system" means any system of pipes, pumps, wells, storage tanks, or other facilities for the purpose of conveying potable water to a system requiring standards for operators as defined in W.S. 35-11-302 (a) (iv). Such a system shall not include any treatment methods included under Section 6 (a) except disinfection and fluoridation.

(u) "Public water treatment plant" means any structure, equipment, or facility for the purpose of treating or conditioning raw water but not including systems consisting only of well(s), disinfection, and/or fluoridation. The plant must provide finished water to a system requiring standards for operators as defined in W.S. 35-11-302 (a) (iv).

(v) "Service connection" means the individual water service, metered or not, to a building, mobile home, campsite or consumer serviced from a public water distribution system.

(w) "Small consecutive water distribution system" means a system that purchases water from a public water supply to provide water to 100 or fewer service connections and the system does not include any storage, disinfection, or booster pumps.

(x) "System" means wastewater collection facilities or water distribution facilities.

Section 3. Operator Criteria.

(a) The chief operator must hold, at a minimum, certification at the same level as the classification of the plant or system for which he is responsible. Certification must be in the same area as the plant or system for which the operator is responsible.

(b) The backup operator must hold, at a minimum, certification at one level below the classification of the plant or system for which he may be held responsible. In the case of a Class I plant or system, this operator must hold a level I certification. Certification must be in the same area as the plant or system for which the operator is responsible.

(c) Other individuals may operate the plant or system provided they are under the direct supervision of a chief or backup operator.

(d) Operator-in-training is an individual who has passed the level I exam and is working towards meeting the experience and educational requirements for level I. This individual is not a certified operator until the educational/experience requirements of Section 10 have been met.
(e) Owners may designate contract operators to meet the requirements of this section, provided the operator has the appropriate level of certification for the plant or system and they can respond to systems operations and maintenance problems within a reasonable period of time. The owner shall retain verification that the contract operator has made the necessary inspections of repairs, provided maintenance and performed sampling.

(f) Owners or operators of small consecutive water distribution systems may obtain a small systems certification in accordance with Section 10 of these regulations. This certification cannot be used for a chief or backup operator of any other plant or system.

Section 4. Designation of Operators.

(a) Within 60 days of adoption of these regulations all owners shall provide the administrator with a written list of the chief and backup operators.

(b) Within 60 days of any change of the list referred to in item (a) above, the owners shall inform the administrator of that change in writing.

(c) All system owners shall inform the administrator in writing of any change in the employment of a chief or backup operator, or any alteration of responsibilities within 60 days of such change.

Section 5. Regulation Compliance.

(a) All municipal and non-municipal public water supplies in Wyoming shall be in compliance with the requirements of these regulations within one year of the date of adoption.

(b) If a municipal or non-municipal public water supply is unable to comply with these regulations, the administrator will negotiate a schedule of compliance which shall state action(s) to be taken towards compliance and date(s) by which compliance will be attained.

(c) It shall be the responsibility of the owner to ensure compliance with the requirements of these regulations.

Section 6. Criteria for Classification of Plants and Systems. Plants and systems will be classified by the administrator according to the criteria below; however, the administrator may, after negotiation with the owner, alter the classification of an individual plant or system because of special conditions including the ease or difficulty of operation or extraordinary environmental or public health factors.

(a) All public water treatment plants shall be classified according to the following criteria:
For purposes of plant classification, treatment facilities must be under the supervision of plant personnel.

**CLASSIFICATION**

<table>
<thead>
<tr>
<th>Class</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class IV</td>
<td>8 points or more</td>
</tr>
<tr>
<td>Class III</td>
<td>6 or 7 points</td>
</tr>
<tr>
<td>Class II</td>
<td>5 points or fewer</td>
</tr>
</tbody>
</table>

(b) All municipal wastewater treatment plants shall be classified according to the following criteria:

**Size**

- Population served 7,500 or less, or
- Population served 7,501 or more

**Points**

- 1
- 2

**Treatment**

- Non-aerated stabilization ponds, or

**Points**

- 1
Aerated stabilization ponds, or 2
Physical/chemical treatment, or 4
Fixed growth and solids handling, or 5
Activated sludge and solids handling 6
Calcium/sodium hypochlorite and dechlorination 1
Chlorine gas, ozonation, chlorine dioxide, ultraviolet systems or onsite generation of hypochlorite 2
Nutrient removal 2

Receiving Water

Class IV surface water, or 1
Class I, II, or III surface water, or 2
Subsurface disposal and/or land application 2

CLASSIFICATION

Class IV 9 points or more
Class III 7 or 8 points
Class II 5 or 6 points
Class I 4 points or less

(c) All public water distribution systems shall be classified in accordance with the following criteria:

Size  Points
Population served 7,500 or less, or 1
Population served 7,501 or more 2

Treatment

Calcium/sodium hypochlorite and/or fluoridation 1
Chlorine gas, ozonation, chlorine dioxide, ultraviolet systems, or onsite generation of hypochlorite 2

5-6
Flow

Gravity, or 1
Pressure provided by well pumps, or 1
Booster stations 2

For purposes of system classification, flow and treatment systems must be under the supervision of distribution personnel.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class II</td>
<td>4 points or more</td>
</tr>
<tr>
<td>Class I</td>
<td>fewer than 4 points</td>
</tr>
</tbody>
</table>

(d) All public wastewater collection systems shall be classified according to the following criteria:

<table>
<thead>
<tr>
<th>Size</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population served 7,500 or less, or</td>
<td>1</td>
</tr>
<tr>
<td>Population served 7,501 or more</td>
<td>2</td>
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</table>

Lift Stations

<table>
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<tr>
<th>Lift stations</th>
<th>Points</th>
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<tbody>
<tr>
<td>Lift stations</td>
<td>2</td>
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CLASSIFICATION

<table>
<thead>
<tr>
<th>Classification</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class II</td>
<td>4 points or more</td>
</tr>
<tr>
<td>Class I</td>
<td>fewer than 4 points</td>
</tr>
</tbody>
</table>

Section 7. Classification of Plants and Systems.

(a) Within 60 days of receipt of a facility configuration form, the owner shall complete said form and return it to the administrator.

(b) Within 60 days of receipt of a properly completed facility configuration form, the administrator shall classify the plants and/or systems and submit such classifications to the owner.
Section 8. Examinations.

(a) An operator must receive a score of 70% or greater on the examination which is prepared by the administrator to attain certification.

(b) Scheduled examinations will be given during the first full week of May and the second full week of September each year, and at other times as approved by the administrator.

(c) All applicants will take regularly scheduled written examinations except in cases which the administrator decides represent proper exceptions.

(d) Examination scores will be provided to the applicant in writing within 60 days of the date of the examination. The examination score will be held confidential and shall not be subject to disclosure to any other persons.

(e) The employer of each applicant who passes the examination will be informed 15 days after release of the scores to the applicant.

(f) Graded examinations may be reviewed by the examinee under supervised conditions and at a site approved by the administrator. Additional persons may not aid with the review without the permission of the administrator. Reviews will not be allowed 30 days prior to, or until 30 days after an examination.

(g) Separate examinations will be prepared to cover the basic differences in duties and responsibilities associated with the varying complexities and sizes of water and wastewater treatment plants and collection and distribution systems. A separate examination will be prepared for each plant or system classification described in Section 6, except a single water system examination will be prepared for class I public water distribution systems, and a single wastewater system examination will be prepared to include both class I public wastewater treatment plants and class I public wastewater collection systems. The administrator may appoint an examination certification committee to provide the certification staff with guidance and advice on the content of the examinations.

(h) A certificate will be issued to each certified operator. Upon initial certification and the renewal thereof, the administrator will issue wallet-size cards to each certified operator as proof of current certification.

Section 9. Application for Examination.

(a) No later than March 1 and July 15 of each year, the administrator shall establish the exact dates, times and locations for the next examination and shall make available, application forms for persons who wish to take the examinations.
(b) Any person wishing to take an examination must have submitted to the administrator a properly completed application form postmarked no later than August 15 for the September examinations and April 1 for the May examinations.

(c) The administrator shall send notice seven (7) days before the exam date advising applicants of their eligibility to take the requested examinations.

Section 10. **Eligibility to Take Examinations.** To be authorized to take any level examination, an applicant shall have a high school diploma or GED and meet the requirements given in the following table:

<table>
<thead>
<tr>
<th>Experience</th>
<th>Contact Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small consecutive systems</td>
<td>6 months</td>
</tr>
<tr>
<td>Level I</td>
<td>6 months</td>
</tr>
<tr>
<td>Level II</td>
<td>1 year</td>
</tr>
<tr>
<td>Level III</td>
<td>2 years total, 1 at Class II or higher facility(s) and 300</td>
</tr>
<tr>
<td>Level IV</td>
<td>3 years total, 2 at Class III or higher facility(s) and 400</td>
</tr>
</tbody>
</table>

Experience must be earned at the type of plant or system for which certification is desired. Contact hours must be specific to the area for which certification is desired.

Section 11. **Issuance of Certification.**

(a) Within 60 days of attaining a score of 70% or greater on a certification examination, the administrator shall issue the applicant a certificate designating the level and type of plant/system for which certification has been earned. Such certification shall expire on December 31 of the third full year following the date of certification issuance unless revoked according to the provisions of Section 16 of these regulations.

(b) Whenever a higher level of certification is earned in the same area, the lower level certification is inactivated; except:

(i) A level I certification shall not be inactivated (except in instances of failure to renew) until a higher level of certification is earned in all applicable plant and/or system types; or
(ii) When a higher level of restricted certification is held, a lower level of certification in the same area is not inactivated.

Section 12. Certification Renewal.

(a) An operator's certification shall be renewed provided the operator obtains seven (7) contact hours for small consecutive systems (in distribution only) and 21 contact hours for levels I through IV during the three (3) year renewal period.

(b) Contact hours earned during the three (3) years previous to the certification expiration date must be specific to the area for which certification is desired.

(c) Within 12 to 18 months prior to the expiration date of an operator's certification, the administrator shall send to the operator a reminder of the renewal requirements.

(d) If an operator fails to meet the requirements of the certification renewal, the operator's employer shall be notified 60 days prior to the certification expiration.

(e) An operator who fails to renew his certification may become recertified only by meeting the provisions of Sections 8, 9, and 10 of these regulations.

(f) Operators who hold multiple certifications may request the administrator to adjust their renewal date for each certification to coincide with one (1) renewal date.

Section 13. Training.

(a) Contact hours shall be earned through successful completion of administrator approved operator training programs including but not limited to technical seminars, college courses, lectures, workshops, correspondence courses, hands-on training and in-house training programs.

(b) Operator attendance is mandatory for the duration of any training session for contact hours to be awarded.

(c) Attendance at the same course in two (2) consecutive renewal periods unless the course content has been significantly changed, or completion of the same correspondence course more than once, will be counted only once for the purpose of earning contact hours.

(d) Any person who desires to obtain contact hours for a training program shall submit to the administrator the documentation necessary to evaluate the program. The administrator shall provide a determination of the number and type(s) of contact hours which will be earned for successfully completing the program as submitted.
Section 14. **Restricted Certification.**

(a) Upon receiving a written request from an owner, the administrator may, after making a determination of technical competency, and after considering other relevant factors, issue an operator of a specific plant or system a restricted certification. Such certification shall be limited to that specific plant or system and shall not be transferable to any other plant or system.

(b) When issuing restricted certifications the administrator must find substantial reason as to why it is not reasonable for the owner or the designated operator to meet the requirements of Section 10 and that the designated operator is technically competent to operate the plant or system.

(c) A restricted certification shall expire if the plant or system is significantly modified, but may be reinstated upon evaluation by the administrator.

(d) An operator holding a restricted certification shall be required to meet the renewal requirements described in Section 12.

Section 15. **Operator Position Vacancy.** In the event that a municipal or non-municipal public water supply loses or terminates an operator with the result that the entity cannot comply with Section 3, that entity shall have 60 days to either achieve compliance or submit a compliance schedule to the administrator for approval. The compliance schedule shall state action(s) to be taken and date(s) by which compliance will be attained.

Section 16. **Certification Revocation.** When, in the judgment of the administrator, it is deemed to be necessary, the administrator may revoke an operator's certification for a minimum of one (1) year. Appeal of the administrator's decision may be made as specified in the Environmental Quality Act. A copy of the act and appeal procedures will be provided to the operator and the owner.

Section 17. **Reinstatement of Certification.** If an operator's certification is revoked according to Section 16, that person may, at the discretion of the administrator, be allowed to become recertified by meeting the requirements of Sections 8, 9, and 10.

Section 18. **Renewal of Certification Earned Prior to Adoption of These Regulations.**

(a) Operators whose certifications were earned prior to the effective date of these regulations but whose certifications expire after the effective date of these regulations, must renew their certifications according to Section 12 of these regulations, except that for their first renewal under these regulations, such operators need prove only that a
minimum of 14 contact hours of operator training were earned for a level I and II operator
during the previous three (3) years.

(b) Operators who were certified on the effective date of these regulations need
not meet the minimum requirements of Section 10 to renew their certification.

Section 19. Reciprocity. The administrator shall have the authority to grant
reciprocity outside of Wyoming on a case-by-case basis. An application must be completed
for the area and the level that reciprocity is being sought. The administrator may request a
copy of the base exam taken to review for equivalency. Reciprocity is granted on meeting
the same requirements for experience and training of these regulations and equivalency of
the base exam.
June 24, 2010

Mr. Don Aragon, Director
Wind River Environmental Quality
P.O. Box 217
Ft. Washakie, Wyoming 82514

RE: Environmental Coordination for Arapahoe Water System Master Plan Recommendations

Dear Mr. Aragon:

Northern Arapaho Utilities received funding from the Wyoming Water Development Commission for planning the water supply, storage, and distribution in the Arapahoe, Wyoming vicinity. As the culmination of this project, we have developed a list of improvement recommendations for the system.

As shown on the attached map, the recommended improvements are in the following locations:

- T1S, R3E, Sections 1, 2, 11, 12, 13 14, 23, 24
- T1S, R4E, Sections 3, 4, 5, 6, 7, 8, 9, 10, 15, 16, 17, 18

The construction involves installation of a 300,000 gallon tank on the east side of the system, upgrading the current tank access roads to all weather surfaces, replacing transmission and distribution system pipelines, and installation of meters and backflow preventers on water services as well as appurtenances necessary for the operation of a public water system. A test well drilled during the course of this study was successful and will be tied into the system.

There are no known environmental impacts for this proposed action and it appears that it will not adversely affect any quality of the human or natural environment, specifically the following:

- Flood plain management or protection under the Flood Disaster Protection Act of 1973 (42 U.S.C. 4001 et.seq.) and implementing regulations, the National Flood Insurance Program (44 CFR 59-75), the Executive Order 11988 and HUD Procedure for Flood Plain Management (42 CFR 26951).
- Water quality protected under the Federal Water Pollution Control Act, as amended (42 U.S.C. 300f-300j10), EPA regulations at 40 CFR Parts 100-149 or other laws or regulations.

Please review the area for the proposed construction activity and provide your written response as soon as possible. If response is not received within thirty (30) days, it will be understood that your agency does not perceive any adverse environmental affects.

Thank you for your assistance and consideration of the Northern Arapaho Tribe’s request.

Sincerely,

Jim Gores, P.E.

JG:gb
Enclosures
June 24, 2010

John Emmerich
Deputy Director of External Affairs
Wyoming Game and Fish Department
5400 Bishop Boulevard
Cheyenne, Wyoming 82009

RE: Environmental Coordination for Arapahoe Water System Master Plan Recommendations

Dear Mr. Emmerich:

Northern Arapaho Utilities received funding from the Wyoming Water Development Commission for planning the water supply, storage, and distribution in the Arapahoe, Wyoming vicinity. As the culmination of this project, we have developed a list of improvement recommendations for the system.

As shown on the attached map, the recommended improvements are in the following locations:

- T1S, R3E, Sections 1, 2, 11, 12, 13, 14, 23, 24
- T1S, R4E, Sections 3, 4, 5, 6, 7, 8, 9, 10, 15, 16, 17, 18

The construction involves installation of a 300,000 gallon tank on the east side of the system, upgrading the current tank access roads to all weather surfaces, replacing transmission and distribution system pipelines, and installation of meters and backflow preventers on water services as well as appurtenances necessary for the operation of a public water system. A test well drilled during the course of this study was successful and will be tied into the system.

There are no known environmental impacts for this proposed action and it appears that it will not adversely affect any quality of the human or natural environment, specifically the following:

- Endangered species or critical habitat protected under the Endangered Species Act of 1983, as amended, (16 U.S.C. 1541-1543) or other laws or regulations.

Please review the area for the proposed construction activity and provide your written response as soon as possible. If response is not received within thirty (30) days, it will be understood that your agency does not perceive any adverse environmental affects.

Thank you for your assistance and consideration of the Northern Arapaho Tribe’s request.

Sincerely,

Jim Gores, P.E.

JG:gb
Enclosures
June 24, 2010

Mr. William Urbigkit, Airport Manager  
City of Riverton  
816 North Federal Boulevard  
Riverton, Wyoming

RE: Environmental Coordination for Arapahoe Water System Master Plan Recommendations

Dear Mr. Urbigkit:

Northern Arapaho Utilities received funding from the Wyoming Water Development Commission for planning the water supply, storage, and distribution in the Arapahoe, Wyoming vicinity. As the culmination of this project, we have developed a list of improvement recommendations for the system.

As shown on the attached map, the recommended improvements are in the following locations:

- T1S, R3E, Sections 1, 2, 11, 12, 13, 14, 23, 24
- T1S, R4E, Sections 3, 4, 5, 6, 7, 8, 9, 10, 15, 16, 17, 18

The construction involves installation of a 300,000 gallon tank on the east side of the system, upgrading the current tank access roads to all weather surfaces, replacing transmission and distribution system pipelines, and installation of meters and backflow preventers on water services as well as appurtenances necessary for the operation of a public water system. A test well drilled during the course of this study was successful and will be tied into the system.

There are no known environmental impacts for this proposed action and it appears that it will not adversely affect any quality of the human or natural environment, specifically the following:


Please review the area for the proposed construction activity and provide your written response as soon as possible. If response is not received within thirty (30) days, it will be understood that your agency does not perceive any adverse environmental affects.

Thank you for your assistance and consideration of the Northern Arapaho Tribe’s request.

Sincerely,

Jim Gores, P.E.

JG:gb

Enclosures
June 24, 2010

Mr. Ed LoneFight, Superintendent
Bureau of Indian Affairs
P.O. Box 158
Ft. Washakie, Wyoming 82514

RE: Environmental Coordination for Arapahoe Water System Master Plan Recommendations

Dear Mr. Lonafight:

Northern Arapaho Utilities received funding from the Wyoming Water Development Commission for planning the water supply, storage, and distribution in the Arapahoe, Wyoming vicinity. As the culmination of this project, we have developed a list of improvement recommendations for the system.

As shown on the attached map, the recommended improvements are in the following locations:

- T1S, R3E, Sections 1, 2, 11, 12, 13 14, 23, 24
- T1S, R4E, Sections 3, 4, 5, 6, 7, 8, 9, 10, 15, 16, 17, 18

The construction involves installation of a 300,000 gallon tank on the east side of the system, upgrading the current tank access roads to all weather surfaces, replacing transmission and distribution system pipelines, and installation of meters and backflow preventers on water services as well as appurtenances necessary for the operation of a public water system. A test well drilled during the course of this study was successful and will be tied into the system.

There are no known environmental impacts for this proposed action and it appears that it will not adversely affect any quality of the human or natural environment, specifically the following:

- soil suitability, erosion concerns, and consideration in relation to the project’s proposed construction sites

Please review the area for the proposed construction activity and provide your written response as soon as possible. If response is not received within thirty (30) days, it will be understood that your agency does not perceive any adverse environmental affects.

Thank you for your assistance and consideration of the Northern Arapaho Tribe’s request.

Sincerely,

Jim Gores, P.E.

JG:gb
Enclosures
June 24, 2010

Mr. Matthew A. Bilodeau, Program Manager
Department of the Army
Corps of Engineers, Omaha District
Wyoming Regulatory Office
2232 Dell Range Boulevard, Suite 210
Cheyenne, WY 82009-4942

RE: Environmental Coordination for Arapahoe Water System Master Plan Recommendations

Dear Mr. Bilodeau:

Northern Arapaho Utilities received funding from the Wyoming Water Development Commission for planning the water supply, storage, and distribution in the Arapahoe, Wyoming vicinity. As the culmination of this project, we have developed a list of improvement recommendations for the system.

As shown on the attached map, the recommended improvements are in the following locations:

- T1S, R3E, Sections 1, 2, 11, 12, 13, 14, 23, 24
- T1S, R4E, Sections 3, 4, 5, 6, 7, 8, 9, 10, 15, 16, 17, 18

The construction involves installation of a 300,000 gallon tank on the east side of the system, upgrading the current tank access roads to all weather surfaces, replacing transmission and distribution system pipelines, and installation of meters and backflow preventers on water services as well as appurtenances necessary for the operation of a public water system. A test well drilled during the course of this study was successful and will be tied into the system.

There are no known environmental impacts for this proposed action and it appears that it will not adversely affect any quality of the human or natural environment, specifically the following:

Wetlands protected under Executive Order 11990, Protection of Wetlands. We recognize that this project will cross the Little Wind River and 401 Permits will be requested.

Please review the area for the proposed construction activity and provide your written response as soon as possible. If response is not received within thirty (30) days, it will be understood that your agency does not perceive any adverse environmental affects.

Thank you for your assistance and consideration of the Northern Arapaho Tribe’s request.

Sincerely,

Jim Gores, P.E.

JG:gb
Enclosures
June 24, 2010

Mr. David A. Finley, Administrator
Wyoming Department of Environmental Quality Air Quality Division
122 West 25th Street
Cheyenne, Wyoming 82002

RE: Environmental Coordination for Arapahoe Water System Master Plan Recommendations

Dear Mr. Finley:

Northern Arapaho Utilities received funding from the Wyoming Water Development Commission for planning the water supply, storage, and distribution in the Arapahoe, Wyoming vicinity. As the culmination of this project, we have developed a list of improvement recommendations for the system.

As shown on the attached map, the recommended improvements are in the following locations:

TIS, R3E, Sections 1, 2, 11, 12, 13, 14, 23, 24
TIS, R4E, Sections 3, 4, 5, 6, 7, 8, 9, 10, 15, 16, 17, 18

The construction involves installation of a 300,000 gallon tank on the east side of the system, upgrading the current tank access roads to all weather surfaces, replacing transmission and distribution system pipelines, and installation of meters and backflow preventers on water services as well as appurtenances necessary for the operation of a public water system. A test well drilled during the course of this study was successful and will be tied into the system.

There are no known environmental impacts for this proposed action and it appears that it will not adversely affect any quality of the human or natural environment, specifically the following:

Environmental Quality protected under the Clean Air Act of 1970, as amended, (42 U.S.C. 7401-7642), EPA regulations at 40 CFR Part (S) 50, 51, 52, and 61, or other Laws or regulations protecting air quality.

Please review the area for the proposed construction activity and provide your written response as soon as possible. If response is not received within thirty (30) days, it will be understood that your agency does not perceive any adverse environmental affects.

Thank you for your assistance and consideration of the Northern Arapaho Tribe’s request.

Sincerely,

Jim Gores, P.E.

Enclosures
June 24, 2010

Mr. Arlen Shoyo  
Eastern Shoshone  
Tribal Historic Preservation Officer  
P.O. Box 538  
Fort Washakie, Wyoming 82514

RE: Environmental Coordination for Arapahoe Water System Master Plan Recommendations

Dear Mr. Shoyo:

Northern Arapaho Utilities received funding from the Wyoming Water Development Commission for planning the water supply, storage, and distribution in the Arapahoe, Wyoming vicinity. As the culmination of this project, we have developed a list of improvement recommendations for the system.

As shown on the attached map, the recommended improvements are in the following locations:
- T1S, R3E, Sections 1, 2, 11, 12, 13, 14, 23, 24
- T1S, R4E, Sections 3, 4, 5, 6, 7, 8, 9, 10, 15, 16, 17, 18

The construction involves installation of a 300,000 gallon tank on the east side of the system, upgrading the current tank access roads to all weather surfaces, replacing transmission and distribution system pipelines, and installation of meters and backflow preventers on water services as well as appurtenances necessary for the operation of a public water system. A test well drilled during the course of this study was successful and will be tied into the system.

There are no known environmental impacts for this proposed action and it appears that it will not adversely affect any quality of the human or natural environment, specifically the following:

- Historic sites listed on the National Register of Historic Places or sites protected by the Protection and Enhancement of the Natural Environment Act and Reservoir Salvage Act.
- Historic or Archaeological sites or data protected under the Preservation of Historical Data Act 1974.
- Executive Order 11593, Protection and Enhancement of the Cultural Environment, or Other laws or regulation.

Please review the area for the proposed construction activity and provide your written response as soon as possible. If response is not received within thirty (30) days, it will be understood that your agency does not perceive any adverse environmental affects.

Thank you for your assistance and consideration of the Northern Arapaho Tribe’s request.

Sincerely,

[Signature]

Jim Gores, P.E.

JG:gb
Enclosures
June 24, 2010

Mr. Brian T. Kelly, State Supervisor
U.S. Fish and Wildlife Service
5353 Yellowstone Road, Suite 308A
Cheyenne, Wyoming 82009

RE: Environmental Coordination for Arapahoe Water System Master Plan Recommendations

Dear Mr. Kelly:

Northern Arapaho Utilities received funding from the Wyoming Water Development Commission for planning the water supply, storage, and distribution in the Arapahoe, Wyoming vicinity. As the culmination of this project, we have developed a list of improvement recommendations for the system.

As shown on the attached map, the recommended improvements are in the following locations:

T1S, R3E, Sections 1, 2, 11, 12, 13, 14, 23, 24
T1S, R4E, Sections 3, 4, 5, 6, 7, 8, 9, 10, 15, 16, 17, 18

The construction involves installation of a 300,000 gallon tank on the east side of the system, upgrading the current tank access roads to all weather surfaces, replacing transmission and distribution system pipelines, and installation of meters and backflow preventers on water services as well as appurtenances necessary for the operation of a public water system. A test well drilled during the course of this study was successful and will be tied into the system.

There are no known environmental impacts for this proposed action and it appears that it will not adversely affect any quality of the human or natural environment, specifically the following:

Coastal zones protected under the Coastal Barrier Resources Act of 1982 (U.S.C. 3501 et.seq.) or other laws or regulations.

Endangered species or critical habitat protected under the Endangered Species Act of 1983, as amended, (16 U.S.C. 1541-1543) or other laws or regulations.

Rivers protected under the Wild and Scenic Rivers Act of 1968, as amended, (U.S.C. 1271 et.seq.) or other laws or regulations.

Please review the area for the proposed construction activity and provide your written response as soon as possible. If response is not received within thirty (30) days, it will be understood that your agency does not perceive any adverse environmental affects.

Thank you for your assistance and consideration of the Northern Arapaho Tribe’s request.

Sincerely,

Jim Gores, P.E.

JG:gb
Enclosures
June 24, 2010

Pat Hnilicka, Fish & Wildlife Biologist
U.S. Fish and Wildlife Service
170 North First Street
Lander, Wyoming 82520

RE: Environmental Coordination for Arapahoe Water System Master Plan Recommendations

Dear Pat:

Northern Arapaho Utilities received funding from the Wyoming Water Development Commission for planning the water supply, storage, and distribution in the Arapahoe, Wyoming vicinity. As the culmination of this project, we have developed a list of improvement recommendations for the system.

As shown on the attached map, the recommended improvements are in the following locations:

- T1S, R3E, Sections 1, 2, 11, 12, 13, 14, 23, 24
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There are no known environmental impacts for this proposed action and it appears that it will not adversely affect any quality of the human or natural environment, specifically the following:

- Wetlands protected under Executive Order 11990, Protection of Wetlands.

Please review the area for the proposed construction activity and provide your written response as soon as possible. If response is not received within thirty (30) days, it will be understood that your agency does not perceive any adverse environmental affects.

Thank you for your assistance and consideration of the Northern Arapaho Tribe’s request.

Sincerely,

Jim Gores, P.E.

JG:gb
Enclosures
June 24, 2010

Ms. Darlene Conrad
Northern Arapaho
Tribal Historic Preservation Officer
P.O. Box 1182
Fort Washakie, Wyoming 82514

RE: Environmental Coordination for Arapahoe Water System Master Plan Recommendations

Dear Ms. Conrad:

Northern Arapaho Utilities received funding from the Wyoming Water Development Commission for planning the water supply, storage, and distribution in the Arapahoe, Wyoming vicinity. As the culmination of this project, we have developed a list of improvement recommendations for the system.

As shown on the attached map, the recommended improvements are in the following locations:
- T1S, R3E, Sections 1, 2, 11, 12, 13, 14, 23, 24
- T1S, R4E, Sections 3, 4, 5, 6, 7, 8, 9, 10, 15, 16, 17, 18

The construction involves installation of a 300,000 gallon tank on the east side of the system, upgrading the current tank access roads to all weather surfaces, replacing transmission and distribution system pipelines, and installation of meters and backflow preventers on water services as well as appurtenances necessary for the operation of a public water system. A test well drilled during the course of this study was successful and will be tied into the system.

There are no known environmental impacts for this proposed action and it appears that it will not adversely affect any quality of the human or natural environment, specifically the following:

- Historic sites listed on the National Register of Historic Places or sites protected by the Protection and Enhancement of the Natural Environment Act and Reservoir Salvage Act.
- Historic or Archaeological sites or data protected under the Preservation of Historical Data Act 1974.
- Executive Order 11593, Protection and Enhancement of the Cultural Environment, or Other laws or regulation.

Please review the area for the proposed construction activity and provide your written response as soon as possible. If response is not received within thirty (30) days, it will be understood that your agency does not perceive any adverse environmental affects.

Thank you for your assistance and consideration of the Northern Arapaho Tribe’s request.

Sincerely,

Jim Gores, P.E.

JG:gb
Enclosures
June 24, 2010

Mr. Steve Poitras  
USDA-NRCS 
P.O. Box 127  
Ft. Washakie, Wyoming 82514

RE: Environmental Coordination for Arapahoe Water System Master Plan Recommendations

Dear Mr. Poitras:

Northern Arapaho Utilities received funding from the Wyoming Water Development Commission for planning the water supply, storage, and distribution in the Arapahoe, Wyoming vicinity. As the culmination of this project, we have developed a list of improvement recommendations for the system.

As shown on the attached map, the recommended improvements are in the following locations:
- T1S, R3E, Sections 1, 2, 11, 12, 13, 14, 23, 24
- T1S, R4E, Sections 3, 4, 5, 6, 7, 8, 9, 10, 15, 16, 17, 18

The construction involves installation of a 300,000 gallon tank on the east side of the system, upgrading the current tank access roads to all weather surfaces, replacing transmission and distribution system pipelines, and installation of meters and backflow preventers on water services as well as appurtenances necessary for the operation of a public water system. A test well drilled during the course of this study was successful and will be tied into the system.

There are no known environmental impacts for this proposed action and it appears that it will not adversely affect any quality of the human or natural environment, specifically the following:

Farmlands protected under the Farmlands Protection Act of 1981, and regulations at 7 CFR Part 658 or other laws and regulations protecting farmlands.

Please review the area for the proposed construction activity and provide your written response as soon as possible. If response is not received within thirty (30) days, it will be understood that your agency does not perceive any adverse environmental affects.

Thank you for your assistance and consideration of the Northern Arapaho Tribe’s request.

Sincerely,

Jim Gores, P.E.

JG:gb
Enclosures
June 24, 2010

Ms. Mary Hopkins
State Historic Preservation Officer
Wyoming State Historic Preservation Office
Division of Cultural Resources
Barrett Building, 3rd Floor
2301 Central Avenue
Cheyenne, Wyoming 82002

RE: Environmental Coordination for Arapahoe Water System Master Plan Recommendations

Dear Ms. Hopkins:

Northern Arapaho Utilities received funding from the Wyoming Water Development Commission for planning the water supply, storage, and distribution in the Arapahoe, Wyoming vicinity. As the culmination of this project, we have developed a list of improvement recommendations for the system.

As shown on the attached map, the recommended improvements are in the following locations:

T1S, R3E, Sections 1, 2, 11, 12, 13, 14, 23, 24
T1S, R4E, Sections 3, 4, 5, 6, 7, 8, 9, 10, 15, 16, 17, 18

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There are no known environmental impacts for this proposed action and it appears that it will not adversely affect any quality of the human or natural environment, specifically the following:

- Historic sites listed on the National Register of Historic Places or sites protected by the Protection and Enhancement of the Natural Environment Act and Reservoir Salvage Act.
- Historic or Archaeological sites or data protected under the Preservation of Historical Data Act 1974.
- Executive Order 11593, Protection and Enhancement of the Cultural Environment, or Other laws or regulation.

Please review the area for the proposed construction activity and provide your written response as soon as possible. If response is not received within thirty (30) days, it will be understood that your agency does not perceive any adverse environmental affects.

Thank you for your assistance and consideration of the Northern Arapaho Tribe’s request.

Sincerely,

[Signature]

Jim Gores, P.E.

JG:gb
Enclosures
Dear Mr. Gores:

This letter is in response to a request for comments we received from your office on July 2, 2010, on behalf of Northern Arapaho Utilities, concerning an environmental review for the Arapahoe Water System Master Plan near Arapahoe, Wyoming. The project is located in Sections 1, 2, 11, 12, 13, 14, 23, and 24, Township 1 South, Range 3 East, and Sections 3, 4, 5, 6, 7, 8, 9, 10, 15, 16, 17, and 18, Township 1 South, Range 4 East, Wind River Meridian, Fremont County, Wyoming.

The U.S. Army Corps of Engineers (Corps) regulates the placement of dredged and fill material into wetlands and other waters of the United States as authorized primarily by Section 404 of the Clean Water Act (33 U.S.C. 1344). The term "waters of the United States" has been broadly defined by statute, regulation, and judicial interpretation to include all waters that were, are, or could be used in interstate commerce such as streams, reservoirs, lakes and adjacent wetlands. The Corps regulations are published in the Code of Federal Regulations as 33 CFR Parts 320 through 332. Information on Section 404 program requirements in Wyoming can be obtained from our web site at https://www.nwo.usace.army.mil/html/od-rwy/Wyoming.htm.

Based on the preliminary information provided, the proposed project involves installation of a 300,000 gallon tank, upgrading the current tank access roads to all weather surfaces, replacing transmission and distribution system pipelines and installation of various appurtenances which will cross the Little Wind River, adjacent wetlands and tributaries. Activities in waters of the United States such as those described above may be authorized by Nationwide Permit (NP) 12 for Utility Line Activities, as defined in Part II of the Federal Register published on March 12, 2007 (Vol. 72, No. 47), provided that construction activities do not result in the loss of more than 0.5 acre of waters of the U.S. and the permittee complies with all of the terms and conditions of the permit. Nationwide Permit 12, General Conditions and Regional Conditions can be found on our website. If permanent impacts exceed the acreage threshold for a nationwide permit, a standard (individual) permit would be required. In this case, we request that you contact our office as soon as possible to arrange a pre-application meeting.
In a letter dated May 11, 2007, the United States Environmental Protection Agency (USEPA) denied Section 401 certification of NP 12 activities in perennial drainages and wetlands, thereby deferring its final decision on specific activities until receipt of a pre-construction notification (PCN). Authorization by NP 12 is not valid unless and until the WDEQ provides certification. A project specific request for certification will be need to be submitted to the USEPA by us on your behalf; therefore, a pre-construction notification (PCN) is required for this project.

General Condition (GC) 27 defines the pre-construction notification (PCN) procedure. In order to verify authorization under NP 12, the Corps must document area of impact for each water of the U.S. As part of the PCN, please quantify temporary and permanent impacts for each wetland or other water of the U.S. affected by the project.

The lead federal agency for this project should follow its own procedures for complying with the requirements of the Endangered Species Act and Section 106 of the National Historic Preservation Act as defined under GC 17(b) and GC 18(b). The permittee shall not begin work until the lead federal agency has documented that the proposed activities will have “no effect” on listed species or critical habitat, or until Section 7 consultation has been completed. Appropriate documentation or determination of effect by the lead federal agency must be provided as part of a complete PCN. If the lead federal agency is the Corps, appropriate data must be submitted as part of the PCN in order for us to make an effect determination.

Please note, because the project occurs within the Upper Colorado River Basin, any increase in surface water depletions as a result of the proposed water system amendments needs to be documented and evaluated by the Wyoming State Engineers Office to determine if such uses have been accounted for within the Recovery Implementation Program Recovery Action Plan for endangered fish species in the Upper Colorado River Basin.

Thank you for your interest in cooperating with requirements of the U.S. Army Corps of Engineers' regulatory program. Please contact Ms. Paige Wolken at (307) 772-2300 if you have any questions and reference file NWO-2010-01501.

Sincerely,

Paige Wolken
Project Manager
Wyoming Regulatory Office
United States Department of the Interior
BUREAU OF INDIAN AFFAIRS
Wind River Agency
P.O. Box 158
Fort Washakie, WY. 82514

IN REPLY REFER TO: Natural Resources

James Gores & Associates
111 North 3rd East
Riverton, Wyoming 82514

RE: Environmental Coordination for Arapaho Water System Master Plan Recommendations

Dear Mr. Gores,

Thank you for consulting with the Bureau of Indian Affairs regarding the above referenced project. Since the area has been previously disturbed there is low probability the sites contains prehistoric or historic materials, however we recommend the following be incorporated in the construction stipulations.

- If any cultural materials are discovered during construction, work in the area should halt immediately and the Bureau of Indian Affairs and Tribal Historic Preservation Office staff be contacted.
- Disturbed area be reclaimed and seeded with native vegetation.

If you have any questions, or need more information contact the Agency Natural Resource Specialist, Antonio Pingree at 307/332-4637

Sincerely,

[Signature]
Edward Lone Fight, Superintendent
Jim Gores, P.E.
James Gores & Associates
111 N. 3rd E.
Riverton, Wyoming 82501

Dear Mr. Gores:

Thank you for your letter of June 24, 2010, received in our office on July 1, regarding plans for a water supply, storage, and distribution project for Northern Arapaho Utilities on the Wind River Reservation in Wyoming. The construction involves installation of a 300,000 gallon tank on the east side of the system, upgrading the current tank access roads to all weather surfaces, replacing transmission and distribution system pipelines, and installation of meters and backflow preventers on water services as well as appurtenances necessary for the operation of a public water system. A test well drilled during the course of the study was successful and will be tied into the system.

You have requested information regarding U.S. Fish and Wildlife Service (Service) concerns over the proposed project. The Service is providing you with comments regarding the species listed under the Endangered Species Act (ESA or Act) of 1973, as amended (16 U.S.C. 1531 et seq.). We are also providing recommendations concerning migratory birds in accordance with the Migratory Bird Treaty Act (MBTA), 16 U.S.C. 703 and the Bald and Golden Eagle Protection Act (BGEPA), 16 U.S.C. 668. Wetlands are afforded protection under Executive Orders 11990 (wetland protection) and 11988 (floodplain management), as well as section 404 of the Clean Water Act. Other fish and wildlife resources are considered under the Fish and Wildlife Coordination Act and the Fish and Wildlife Act of 1956, as amended, 70 Stat. 1119, 16 U.S.C. 742a-742j.

In accordance with Section 7(c) of the Act, we have determined that the following species or their designated critical habitat may be present in the proposed project area. We would appreciate receiving information as to the current status of each of these species within the proposed project area.
Listed Species that may be affected
by projects in the proposed Project Area

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>STATUS</th>
<th>Expected Occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ute ladies'-tresses (Spiranthes diluvialis)</td>
<td>Threatened</td>
<td>Seasonally moist soils and wet meadows of drainages below 7,000 feet</td>
</tr>
</tbody>
</table>

**Ute ladies'-tresses:** Ute ladies'-tresses (Spiranthes diluvialis) is a perennial, terrestrial orchid, 8 to 20 inches tall, with white or ivory flowers clustered into a spike arrangement at the top of the stem. *S. diluvialis* typically blooms from late July through August; however, depending on location and climatic conditions, it may bloom in early July or still be in flower as late as early October. *S. diluvialis* is endemic to moist soils near wetland meadows, springs, lakes, and perennial streams where it colonizes early successional point bars or sandy edges. The elevation range of known occurrences is 4,200 to 7,000 feet (although no known populations in Wyoming occur above 5,500 feet) in alluvial substrates along riparian edges, gravel bars, old oxbows, and moist to wet meadows. Soils where *S. diluvialis* have been found typically range from fine silt/sand, to gravels and cobbles, as well as to highly organic and peaty soil types. *S. diluvialis* is not found in heavy or tight clay soils or in extremely saline or alkaline soils. *S. diluvialis* seems intolerant of shade and small scattered groups are found primarily in areas where vegetation is relatively open. Surveys should be conducted by knowledgeable botanists trained in conducting rare plant surveys. *S. diluvialis* is difficult to survey for primarily due to its unpredictability of emergence of flowering parts and subsequent rapid desiccation of specimens. The Service does not maintain a list of "qualified" surveyors but can refer those wishing to become familiar with the orchid to experts who can provide training or services.

**Migratory Birds:** The MBTA, enacted in 1918, prohibits the taking of any migratory birds, their parts, nests, or eggs except as permitted by regulations, and does not require intent to be proven. Section 703 of the MBTA states, “Unless and except as permitted by regulations ... it shall be unlawful at any time, by any means or in any manner, to ... take, capture, kill, attempt to take, capture, or kill, or possess ... any migratory bird, any part, nest, or eggs of any such bird...” The BGEP A, prohibits knowingly taking, or taking with wanton disregard for the consequences of an activity, any bald or golden eagles or their body parts, nests, or eggs, which includes collection, molestation, disturbance, or killing.

Work that could lead to the take of a migratory bird or eagle, their young, eggs, or nests (for example, if you are going to erect new roads, or power lines in the vicinity of a nest), should be coordinated with our office before any actions are taken. Removal or destruction of such nests, or causing abandonment of a nest could constitute violation of one or both of the above statutes. Removal of any active migratory bird nest or nest tree is prohibited. For golden eagles, inactive nest permits are limited to activities involving resource extraction or human health and safety. Mitigation, as determined by the local Service field office, may be required for loss of these nests. No permits will be issued for an active nest of any migratory bird species, unless removal of an active nest is necessary for reasons of human health and safety. Therefore, if nesting migratory birds are present on, or near the project area, timing is a significant consideration and needs to be addressed in project planning.
If nest manipulation is proposed for this project, the project proponent should contact the Service’s Migratory Bird Office in Denver at 303-236-8171 to see if a permit can be issued for this project. No nest manipulation is allowed without a permit. If a permit cannot be issued, the project may need to be modified to ensure take of a migratory bird or eagle, their young, eggs or nest will not occur.

**Wetlands/Riparian Areas:** Wetlands may be impacted by the proposed project. Wetlands perform significant ecological functions which include: (1) providing habitat for numerous aquatic and terrestrial wildlife species, (2) aiding in the dispersal of floods, (3) improving water quality through retention and assimilation of pollutants from storm water runoff, and (4) recharging the aquifer. Wetlands also possess aesthetic and recreational values. If wetlands may be destroyed or degraded by the proposed action, those wetlands in the project area should be inventoried and fully described in terms of their functions and values. Acreage of wetlands, by type, should be disclosed and specific actions should be outlined to avoid, minimize, and compensate for all unavoidable wetland impacts.

Riparian or streamside areas are a valuable natural resource and impacts to these areas should be avoided whenever possible. Riparian areas are the single most productive wildlife habitat type in North America. They support a greater variety of wildlife than any other habitat. Riparian vegetation plays an important role in protecting streams, reducing erosion and sedimentation as well as improving water quality, maintaining the water table, controlling flooding, and providing shade and cover. In view of their importance and relative scarcity, impacts to riparian areas should be avoided. Any potential, unavoidable encroachment into these areas should be further avoided and minimized. Unavoidable impacts to streams should be assessed in terms of their functions and values, linear feet and vegetation type lost, potential effects on wildlife, and potential effects on bank stability and water quality. Measures to compensate for unavoidable losses of riparian areas should be developed and implemented as part of the project.

Plans for mitigating unavoidable impacts to wetland and riparian areas should include mitigation goals and objectives, methodologies, time frames for implementation, success criteria, and monitoring to determine if the mitigation is successful. The mitigation plan should also include a contingency plan to be implemented should the mitigation not be successful. In addition, wetland restoration, creation, enhancement, and/or preservation does not compensate for loss of stream habitat; streams and wetlands have different functions and provide different habitat values for fish and wildlife resources.

Best Management Practices (BMPs) should be implemented within the project area wherever possible. BMPs include, but are not limited to, the following: installation of sediment and erosion control devices (e.g., silt fences, hay bales, temporary sediment control basins, erosion control matting); adequate and continued maintenance of sediment and erosion control devices to insure their effectiveness; minimization of the construction disturbance area to further avoid streams, wetlands, and riparian areas; location of equipment staging, fueling, and maintenance areas outside of wetlands, streams, riparian areas, and floodplains; and re-seeding and re-planting of riparian vegetation native to Wyoming in order to stabilize shorelines and streambanks.
For our internal tracking purposes, the Service would appreciate notification of any decision made on this project (such as issuance of a permit or signing of a Record of Decision or Decision Memo). Notification can be sent in writing to the letterhead address or by electronic mail to FW6_Federal_Activities_Cheyenne@fws.gov.

We appreciate your efforts to ensure the conservation of Wyoming's fish and wildlife resources. If you have questions regarding this letter or your responsibilities under the Act and/or other authorities or resources described above, please contact Alex Schubert of my office at the letterhead address or phone (307) 772-2374, extension 238.

Sincerely,

Brian T. Kelly
Field Supervisor
Wyoming Field Office

cc: WGFD, Non-game Coordinator, Lander, WY (B. Oakleaf)
    WGFD, Statewide Habitat Protection Coordinator, Cheyenne, WY (M. Flanderka)
July 15, 2010

James Gores, P.E.
James Gores and Associates
111 N. 3rd E.
Riverton, WY 82501

RE: Fremont County General Permitting Requirements

Dear Mr. Gores:

Regarding your 6/24/10 letter requesting a compliance determination for the Arapahoe Water System project, the Air Quality Division has no concerns at this time and will not require any permitting. In order to maintain compliance with our general opacity and public nuisance standards, however, the contractor should be advised to minimize fugitive dust emissions during construction. This normally includes watering access roads and staging areas, particularly during dry, windy conditions. The burning of waste materials is prohibited without specific authorization from the Air Quality Division. This project is not located in the vicinity of an area where known violations of ambient air quality standards have occurred.

Please note this applies only to the portion of the project located southeast of the Little Wind River. The remainder of the project is not within the jurisdiction of the Air Quality Division.

Demolition of buildings may require an asbestos inspection prior to demolition. Contact Linda DeWitt at (307) 777-7394 for questions regarding asbestos abatement.

Please call me at 307-332-6755 or email at gmeeker@wyo.gov if you have questions concerning this matter.

Sincerely,

Greg Meeker
District 4 Engineer
Air Quality Division
September 29, 2010

Northern Arapaho Utilities
P.O. Box 1304
Fort Washakie, WY 82514
Attn: Gerry Redman

Re: Northern Arapaho Utilities Wind River Well No. 3 (TFN# 42-3-159)

Gerry:

An application for the above water well has been received in this office. Upon review, it was found that the following information is required:

- Under the remarks section of the application, three additional wells were stated to commingle with the proposed well. The Arapahoe #1 Well and The Arapahoe #2 Well are not permitted in our records. Please file existing well applications for both wells.

- The third well listed is the Northern Arapahoe No. 1 Well (U.W. 3989). This well has been originally permitted to supply water to a restaurant/motel complex, and Arapahoe School located in the SWNE, SENW, and NESE of Section 23, T1S, R3E. In order to completely commingle with the above system, an enlargement is required to cover both the additional use and points of use requirements of the system.

Please contact me if assistance is required for the above conditions. I will continue to hold the application for the Northern Arapaho Utilities Wind River Well No.3 until the above requirements have been submitted to our office. Please address all correspondence and permits to my attention.

If you have any questions, you may contact me at (307) 777-5959.

Sincerely,

Nicholas Leventis,
Ground Water Division

Cc: Harvey Spoonhunter, Northern Arapaho Business Council
    Kevin Boyce, Wyoming Water Development Commission
    Jim Gores, Gores & Associates
### ARAPAHOE WATER SUPPLY PROJECT NO. 25.008/JAMES GORES
**WIND RIVER LITHOLOGY LOG**

<table>
<thead>
<tr>
<th>Date</th>
<th>Depth</th>
<th>Major Lithology</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-19-2009</td>
<td>50-60</td>
<td>Sand</td>
<td>Brownish gray, coarse, sub-round to round, slightly glauconitic, predominantly quartz sands.</td>
</tr>
<tr>
<td></td>
<td>60-70</td>
<td>Shale</td>
<td>Maroon &amp; green, mod. soft, w/ minor amount of sands AA.</td>
</tr>
<tr>
<td></td>
<td>70-80</td>
<td>Claystone</td>
<td>Greenish gray to green, v. soft, plastic w/ trace of sands AA. w/ &lt; 3% v. fine to fine, salt &amp; pepper textured sand, sub-round to round.</td>
</tr>
<tr>
<td></td>
<td>80-90</td>
<td>Sand</td>
<td>Greenish gray, v. fine to v. coarse w/ trace of granite (&lt; 4 mm) gravels, sub-ang. to sub-round, predominantly coarse size w/ greenish gray to green shale &amp; claystone AA.</td>
</tr>
<tr>
<td></td>
<td>90-100</td>
<td>Sand</td>
<td>A.A. w/ trace of yellowish brown to greenish brown, soft, claystone, non-plastic.</td>
</tr>
<tr>
<td></td>
<td>100-120</td>
<td>Sand</td>
<td>A.A. predominantly coarse to v. coarse w/ trace of gravel (granule-size), sub-ang. to sub-round, slightly glauconitic w/ maroon and green shales A.A. w/ claystone A.A.</td>
</tr>
<tr>
<td></td>
<td>120-130</td>
<td>Shale</td>
<td>Drk green shale, soft w/ 15 to 25% sands A.A.</td>
</tr>
<tr>
<td></td>
<td>130-140</td>
<td>Claystone</td>
<td>Greenish gray, soft, plastic claystone w/ drk green shale and sands A.A.</td>
</tr>
<tr>
<td></td>
<td>140-150</td>
<td>Sandy Shale</td>
<td>Drk green shale A.A. w/ loose coarse to v. coarse sands A.A.</td>
</tr>
<tr>
<td></td>
<td>150-160</td>
<td>Sand</td>
<td>Lt. gray to gray, v. fine to v. coarse, predominantly coarse to v. coarse sub-ang. to round, quartz sands v. slightly glauconitic w/ minor amount of green &amp; maroon shales A.A.</td>
</tr>
<tr>
<td></td>
<td>160-170</td>
<td>Shale</td>
<td>Lt. gray to gray, slightly fissile soft shale w/ sands A.A.</td>
</tr>
<tr>
<td></td>
<td>170-180</td>
<td>Sand</td>
<td>Lt. gray to salt &amp; pepper texture, fine, sub-round to round, mod. indurated to loose sand w/ gray shale A.A.</td>
</tr>
<tr>
<td></td>
<td>180-200</td>
<td>Sand</td>
<td>Lt. gray to salt &amp; pepper texture, mod. well-sorted fine to v. coarse but predominantly coarse, sub-round to round quartz sands, trace of maroon to brown shales that diminish w/ depth.</td>
</tr>
<tr>
<td></td>
<td>200-210</td>
<td>Sand</td>
<td>Lt. gray, v. fine to fine, slightly salt &amp; pepper texture, mod. to slightly indurated w/ 3% yellowish brown, soft to mod. hard shale, blocky, non-fissile.</td>
</tr>
<tr>
<td></td>
<td>210-220</td>
<td>Sand</td>
<td>Lt. gray to salt &amp; pepper texture, mod. sorted.</td>
</tr>
<tr>
<td>Date</td>
<td>Depth</td>
<td>Major Lithology</td>
<td>Description</td>
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<tr>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>coarse, sub-round to round, quartz sands A.A. w/ 180 – 200</td>
</tr>
<tr>
<td>220 – 230</td>
<td>Sand</td>
<td></td>
<td>Lt. gray A.A. w/ &lt; 3% yellowish brown &amp; gray shales w/ trace of maroon shale</td>
</tr>
<tr>
<td>230 – 240</td>
<td>Sand</td>
<td></td>
<td>A.A. w/ shales decreasing w/ depth to just a trace</td>
</tr>
<tr>
<td>240 – 250</td>
<td>Sand</td>
<td></td>
<td>A.A. w/ trace of Hematite staining &amp; silty more shales like 220 – 230 sample</td>
</tr>
<tr>
<td>250 – 260</td>
<td>Sand</td>
<td></td>
<td>Lt. gray to salt &amp; pepper texture, well sorted, coarse, sub-round to round quartz sand</td>
</tr>
<tr>
<td>260 – 270</td>
<td>Sand</td>
<td></td>
<td>A.A. becoming finely grained, fine-coarse sands w/ 3 to 5% lt. gray to gray, soft shale</td>
</tr>
<tr>
<td>270 – 290</td>
<td>Sand</td>
<td></td>
<td>Lt. gray, fine to v. coarse, mostly coarse, sub-round to round sands A.A. w/ lt. gray to silty maroonish green soft shales</td>
</tr>
<tr>
<td>290 – 300</td>
<td>Sandy Shale</td>
<td></td>
<td>A.A. w/ &gt; 50% gray to green to maroon shales</td>
</tr>
<tr>
<td>300 – 320</td>
<td>Sandy Shale</td>
<td></td>
<td>Grey, greenish gray and maroon, soft shale w/ v. fine, gray to white, mod. indurated to loose quartz sands less shales at 310 to 320 but minor amount of soft, plastic, greenish gray clay</td>
</tr>
<tr>
<td>320 – 340</td>
<td>Sand</td>
<td></td>
<td>Green to white, v. fine, arcillaceous, sub-ang. to sub-round quartz sands w/ green to greenish gray soft shale w/ 3 to 5% v. light maroon shale A.A.</td>
</tr>
<tr>
<td>340 – 350</td>
<td>Sand</td>
<td></td>
<td>A.A. becoming coarser (fine to coarse) sub-round to round w/ Hematite staining and silty more maroon shales (15%)</td>
</tr>
<tr>
<td>11/20/2009</td>
<td>Shale</td>
<td></td>
<td>Gray, greenish gray to green, soft, blocky w/ sands A.A.</td>
</tr>
<tr>
<td>350 – 360</td>
<td>Sandy Shale</td>
<td></td>
<td>Sand and shale A.A.</td>
</tr>
<tr>
<td>360 – 370</td>
<td>Claystone</td>
<td></td>
<td>Lt. gray, soft, plastic claystone w/ gray shale A.A.</td>
</tr>
<tr>
<td>370 – 380</td>
<td>Claystone</td>
<td></td>
<td>A.A. w/ trace of lt. tan, non-plastic claystone w/ gray shale and sands A.A.</td>
</tr>
<tr>
<td>380 – 390</td>
<td>Sandy Shale</td>
<td></td>
<td>Gray, greenish gray &amp; maroon shales w/ arcillaceous fine sands, mod. indurated w/ &lt; 5% coarse, round loose sand, w/ plastic claystone A.A.</td>
</tr>
<tr>
<td>390 – 400</td>
<td>Sand</td>
<td></td>
<td>Lt. greenish gray, fine to coarse, mod. well-sorted coarse, sub-round to round quartz sand, loose w/ grey, maroon &amp; green shales A.A. w/</td>
</tr>
<tr>
<td>Date</td>
<td>Depth</td>
<td>Major Lithology</td>
<td>Description</td>
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</tr>
<tr>
<td>420 – 430</td>
<td>Sand</td>
<td>trace of brownish gray shales</td>
<td></td>
</tr>
<tr>
<td>430 – 440</td>
<td>Sand</td>
<td>Lt. gray, well-sorted, loose, coarse, sub-ang. to round quartz sand</td>
<td></td>
</tr>
<tr>
<td>440 – 450</td>
<td>Sand</td>
<td>Lt. gray, siltly glauconitic, loose, well-sorted, v. coarse sub-ang. to sub-round quartz sands w/ &lt; 3% drk gray shale</td>
<td></td>
</tr>
<tr>
<td>450 – 460</td>
<td>Sandy Shale</td>
<td>Sands A.A. coarse to v. coarse w/ reddish brown and green soft, plastic clay and drk green shale</td>
<td></td>
</tr>
<tr>
<td>460 – 480</td>
<td>Sand</td>
<td>Lt. gray, loose, well-sorted coarse, sub-ang. to round, quartz sands, siltly glauconitic w/ &lt; 3% reddish brown clay A.A. &amp; trace of black carbonaceous shale at 470 – 480'</td>
<td></td>
</tr>
<tr>
<td>480 – 500</td>
<td>Sand</td>
<td>Lt. gray, coarse to v. coarse sands A.A. becoming smaller (coarse-grained) at 490 to 500 w/ minor amount of yellowish brown, soft, siltly plastic clay</td>
<td></td>
</tr>
<tr>
<td>500 – 530</td>
<td>Claystone</td>
<td>Maroon and bluish-green, variegated soft, plastic claystone</td>
<td></td>
</tr>
<tr>
<td>530 – 550</td>
<td>Claystone</td>
<td>Brown and bluish-green, soft, plastic claystone w/ trace of maroon clay A.A. at 540 – 550 and becoming sandier w/ depth sands A.A.</td>
<td></td>
</tr>
<tr>
<td>550 – 580</td>
<td>Sand</td>
<td>Lt. gray, mod. well-sorted coarse to v. coarse, sub-ang. to sub-round, quartz sands w/ clay A.A. and clay becoming more prevalent (5%) at 570 to 580 feet</td>
<td></td>
</tr>
<tr>
<td>560 – 590</td>
<td>Sand</td>
<td>Lt. gray, well-sorted, coarse sands A.A.</td>
<td></td>
</tr>
<tr>
<td>590 – 600</td>
<td>Sand</td>
<td>Lt. gray, mod. well-sorted, coarse to v. coarse sub-ang. to sub-round quartz sands</td>
<td></td>
</tr>
<tr>
<td>600 – 610</td>
<td>Sandy Claystone</td>
<td>Lt. gray coarse sands A.A. w/ maroon &amp; bluish gray soft, plastic claystone A.A.</td>
<td></td>
</tr>
<tr>
<td>610 – 620</td>
<td>Sand</td>
<td>Lt. gray, well-sorted coarse sands A.A. w/ claystone A.A. w/ trace of soft, plastic, yellowish brown claystone</td>
<td></td>
</tr>
<tr>
<td>620 – 640</td>
<td>Claystone</td>
<td>Maroon and bluish-green, variegated, soft plastic claystone w/ sands A.A.</td>
<td></td>
</tr>
<tr>
<td>640 – 660</td>
<td>Claystone</td>
<td>Bluish-green and brown, variegated, soft, plastic claystone w/ sands A.A., mostly bluish green @ depth</td>
<td></td>
</tr>
<tr>
<td>660 – 690</td>
<td>Sand</td>
<td>Lt. gray, siltly glauconitic, mod. well-sorted, v. coarse to coarse w/ grains becoming</td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>Depth</td>
<td>Major Lithology</td>
<td>Description</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Claystone</td>
<td>Bluish green and brown, variegated A.A.</td>
</tr>
<tr>
<td>690 – 700</td>
<td></td>
<td>Claystone</td>
<td>A.A. w/ less brown &amp; becoming sandier at depth</td>
</tr>
<tr>
<td>700 – 720</td>
<td></td>
<td>Sand</td>
<td>Lt. gray, siltly glauconitic, well-sorted, coarse, loose sub-ang. to sub-round, quartz sands, becoming more clayey at depth; bluish-green clay A.A.</td>
</tr>
<tr>
<td>720 – 740</td>
<td></td>
<td>Sand</td>
<td>Lt. gray, well-sorted, coarse, sub-ang. to sub-round quartz sands</td>
</tr>
<tr>
<td>740 – 750</td>
<td></td>
<td>Sand/Clay</td>
<td>Sand A.A. w/ gray, sticky, plastic, soft clay</td>
</tr>
<tr>
<td>750 – 760</td>
<td></td>
<td>Sand</td>
<td>Lt. gray sand, coarse to v. coarse predominantly coarse (but mostly v. coarse at 770 – 760), loose, sub-ang. to sub-round, quartz sands w/ shales, maroon &amp; bluish green increasing at depth</td>
</tr>
<tr>
<td>760 – 790</td>
<td></td>
<td>Sand</td>
<td>Lt. gray, well-sorted, coarse, sub-ang. to sub-round loose quartz sands becoming more clayey at depth, bluish-green soft clay A.A.</td>
</tr>
<tr>
<td>790 – 810</td>
<td></td>
<td>Claystone</td>
<td>Bluish-green, soft, plastic claystone</td>
</tr>
<tr>
<td>810 – 820</td>
<td></td>
<td>Claystone</td>
<td>Bluish-green &amp; brown w/ minor amount of yellowish-brown, soft, plastic claystone</td>
</tr>
<tr>
<td>820 – 830</td>
<td></td>
<td>Clayey Sand</td>
<td>Reddish brown, to lt. gray, coarse sands A.A. w/ lt. reddish brown, soft claystone</td>
</tr>
<tr>
<td>830 – 850</td>
<td></td>
<td>Claystone</td>
<td>Maroon and bluish green, soft, plastic claystone</td>
</tr>
<tr>
<td>850 – 860</td>
<td></td>
<td>Sand</td>
<td>Lt. gray, loose, mod. well-sorted, v. coarse to coarse mostly coarse, sub-ang. to sub-round quartz sands</td>
</tr>
<tr>
<td>860 – 870</td>
<td></td>
<td>Sand</td>
<td>Lt. gray, loose, mod. well-sorted v. c. to coarse sands A.A. w/ 5% drk green to gray shale</td>
</tr>
<tr>
<td>870 – 880</td>
<td></td>
<td>Sand</td>
<td>Lt. gray, loose mod. well-sorted, med. to v. coarse sub-ang. to sub-round w/ sands becoming more coarse w/ depth, 900 – 910 is more shaly w/ 5% drk green shale A.A.</td>
</tr>
<tr>
<td>880 – 910</td>
<td></td>
<td>Claystone</td>
<td>Greenish gray, brown and maroon, variegated, sticky v. plastic claystone</td>
</tr>
<tr>
<td>11/20/2009</td>
<td>910 – 940</td>
<td>Claystone</td>
<td>A.A. becoming sandy w/ coarse, well-sorted sub-round to round, silt glauconitic sands</td>
</tr>
<tr>
<td>940 – 960</td>
<td></td>
<td>Sand</td>
<td>Greenish gray, to lt. gray, well-sorted, coarse w/ &lt; 3% v. coarse, sub-ang. to round, siltly glauconitic sands</td>
</tr>
<tr>
<td>960 – 980</td>
<td></td>
<td>Sand</td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>Depth</td>
<td>Major Lithology</td>
<td>Description</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Claystone</td>
<td>Lt. bluish green, v. soft &amp; plastic</td>
</tr>
<tr>
<td>980 – 990</td>
<td></td>
<td>Sand</td>
<td>Lt. gray to lt. greenish gray, well-sorted coarse, sub-ang. to sub-round w/ &lt; 3% v. coarse sand, siltly glauconitic</td>
</tr>
<tr>
<td>990 – 1010</td>
<td></td>
<td>Sand</td>
<td>Lt. gray to lt. greenish gray, well-sorted coarse, sub-ang. to sub-round, siltly glauconitic quartz sand</td>
</tr>
<tr>
<td>1010 – 1020</td>
<td></td>
<td>Sand</td>
<td>Lt. gray to lt. greenish gray, well-sorted coarse sand as 990 – 1010 above</td>
</tr>
<tr>
<td>1020 – 1040</td>
<td></td>
<td>Sand</td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>Depth</td>
<td>Major Lithology</td>
<td>Description</td>
</tr>
<tr>
<td>------------</td>
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<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>12-17-2009</td>
<td>50 - 60</td>
<td>Sand</td>
<td>Lt. gray, sub-round to round, mod. to well-sorted coarse quartz sands w/ brown, fine to med. sub-round to round clayey sand</td>
</tr>
<tr>
<td></td>
<td>60 - 70</td>
<td>Gravel</td>
<td>Brownish gray, ang. to sub-angular, predominantly pebble-size (&gt; 4mm &lt; 10mm) size granitic &amp; mafic gravels</td>
</tr>
<tr>
<td></td>
<td>70 - 80</td>
<td>Gravel</td>
<td>A.A. w/ 40% gray, mod. indurated, sub-ang. to sub-round medium, quartz sands</td>
</tr>
<tr>
<td></td>
<td>80 - 90</td>
<td>Mudstone</td>
<td>Greenish gray, silty, mod. ind. w/ gravels &amp; sands A.A.</td>
</tr>
<tr>
<td></td>
<td>90 - 100</td>
<td>Mudstone</td>
<td>A.A. w/ ≈ 3% orange hematite stained, sub-round to round pebbles to granules</td>
</tr>
<tr>
<td></td>
<td>100 - 130</td>
<td>Sand</td>
<td>Lt. gray to greenish gray, mod. indurated to loose, v. fine to coarse, sub-ang. to sub-round w/ minor amount of soft gray clay w/ a silty mudstone A.A. which is decreasing w/ depth, w/ trace of gravels A.A.</td>
</tr>
<tr>
<td></td>
<td>130 - 140</td>
<td>Sand</td>
<td>Lt. gray, well-sorted, sub-round to round, med. quartz sand loose to mod. indurated</td>
</tr>
<tr>
<td></td>
<td>140 - 170</td>
<td>Sandy shale</td>
<td>Greenish gray, mod. hard, block shale w/ small mafic veinlets w/ v. fine to fine, sub-ang. to sub-round sands, soft to mod. indurated w/ trace of pebble-size, sub-round to sub-ang. gravels (&lt;10mm)</td>
</tr>
<tr>
<td></td>
<td>170 - 200</td>
<td>Sand</td>
<td>Lt. gray, mod. well sorted, v. fine to fine mostly fine, sub-ang. to sub-round quartz sands, silty salt &amp; pepper texture w/ &lt; 3% reddish grains w/ med. to coarse sands (&lt;3%) mod. ind. to loose</td>
</tr>
<tr>
<td></td>
<td>200 - 210</td>
<td>Shale</td>
<td>Greenish gray, soft to mod. hard shale w/ sands A.A.</td>
</tr>
<tr>
<td></td>
<td>210 - 220</td>
<td>Sand – Shale</td>
<td>Shale A.A. w/ gray, v. fine to fine, mod. indurated, sub-ang. to sub-round sands</td>
</tr>
<tr>
<td></td>
<td>220 - 230</td>
<td>Shale</td>
<td>Green to lt. greenish gray, mod. soft shale w/ sands A.A.</td>
</tr>
<tr>
<td></td>
<td>230 - 240</td>
<td>Sand</td>
<td>Green to greenish gray, v. fine to fine, indurated, sub-ang. to sub-round</td>
</tr>
<tr>
<td></td>
<td>240 - 260</td>
<td>Shale</td>
<td>Greenish gray to gray, soft to mod. hard w/ sands A.A.</td>
</tr>
<tr>
<td>Date</td>
<td>Depth</td>
<td>Major Lithology</td>
<td>Description</td>
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</tr>
<tr>
<td>260 – 290</td>
<td>Clayey shale</td>
<td>Lt. green and reddish brown variegated, mod. stiff to soft clay and mod. hard shale, clay is slily plastic, becoming less variegated w/ depth and more greenish gray shale A.A. w/ less brown clay – mostly Lt. green clay</td>
<td></td>
</tr>
<tr>
<td>290 – 340</td>
<td>Sandy shale</td>
<td>Greenish gray w/ minor amount of reddish brown, mod. soft shale, slily fissile w/ v.fine to coarse, sub-ang. to sub-round sands w/ brown to Lt. green clays A.A.</td>
<td></td>
</tr>
<tr>
<td>340 – 370</td>
<td>Clay</td>
<td>reddish brown and lt. green variegated, soft plastic clay w/ greenish gray, mod-indurated, arcilaceous v. fine sand, sub-ang. to sub-round becoming sandier at 360-370'</td>
<td></td>
</tr>
<tr>
<td>370 – 380</td>
<td>Sand</td>
<td>Greenish gray, coarse to v. coarse, ang. to sub-round slily glauconitic sands w/ green &amp; reddish brown clays A.A.</td>
<td></td>
</tr>
<tr>
<td>380 – 390</td>
<td>Sandy clay</td>
<td>Sands A.A. w/ predominantly reddish brown clays A.A.</td>
<td></td>
</tr>
<tr>
<td>390 – 410</td>
<td>Clay</td>
<td>Lt. green &amp; reddish brown, mostly reddish brown, soft sticky clays</td>
<td></td>
</tr>
<tr>
<td>410 – 420</td>
<td>Sandy clay</td>
<td>Clay A.A. w/ coarse to v. coarse sands A.A.</td>
<td></td>
</tr>
<tr>
<td>420 – 440</td>
<td>Clay</td>
<td>reddish brown w/ 15% lt. green, slily variegated soft, plastic clay</td>
<td></td>
</tr>
<tr>
<td>440 – 450</td>
<td>Clay</td>
<td>A.A. becoming slily more sandy w/ 3 – 5 % coarse to v. coarse sands A.A.</td>
<td></td>
</tr>
<tr>
<td>450 – 460</td>
<td>Sand</td>
<td>Greenish gray to white, coarse to v. coarse, predominantly v. coarse, ang. to sub-round quartz sands w/ clays A.A.</td>
<td></td>
</tr>
<tr>
<td>460 – 480</td>
<td>Clay</td>
<td>reddish brown soft, plastic clay A.A. w/ drk greenish gray, soft, friable shale w/ sands A.A.</td>
<td></td>
</tr>
<tr>
<td>480 – 490</td>
<td>Sand</td>
<td>Greenish gray sand, coarse to v. coarse A.A. w/ 40% reddish brown clay &amp; greenish gray shale A.A.</td>
<td></td>
</tr>
<tr>
<td>490 – 510</td>
<td>Sand</td>
<td>Greenish gray, mod. well-sorted, med. to v. coarse, predominantly v. coarse, sub-ang. to sub-round, slily glauconitic quartz sands w/ minor amount of reddish brown clays A.A.</td>
<td></td>
</tr>
<tr>
<td>510 – 520</td>
<td>Sandy clay</td>
<td>Sands A.A. w/ reddish brown &amp; minor amount (&lt;15%) green to greenish gray soft clays</td>
<td></td>
</tr>
<tr>
<td>520 – 530</td>
<td>Clay</td>
<td>reddish brown and lt. green, slily variegated, soft, plastic clays</td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>Depth</td>
<td>Major Lithology</td>
<td>Description</td>
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</tr>
<tr>
<td>530 – 540</td>
<td>Sandy clay</td>
<td>A.A. w/ coarse to v. coarse sub-ang. to sub-round sands &lt; 40%, trace of bright brick-red clay</td>
<td></td>
</tr>
<tr>
<td>540 – 550</td>
<td>Sandy clay</td>
<td>A.A. w/ more lt. purplish maroon clays than reddish brown clay &amp; variegated w/ lt. green clay, soft plastic clay A.A.</td>
<td></td>
</tr>
<tr>
<td>550 – 580</td>
<td>Sandy clay</td>
<td>A.A. w/ 3 – 5% drk greenish gray, soft to mod. hard, siltly fissile shale</td>
<td></td>
</tr>
<tr>
<td>580 – 600</td>
<td>Clay</td>
<td>Purplish maroon &amp; lt. green, variegated, soft, plastic clay A.A. w/ minor amount of sands A.A.</td>
<td></td>
</tr>
<tr>
<td>600 – 630</td>
<td>Clay</td>
<td>A.A.</td>
<td></td>
</tr>
<tr>
<td>630 – 640</td>
<td>Sandy clay</td>
<td>Clay A.A. w/ &gt;15% fine to v. coarse, mostly fine-medium, sub-angular to sub-round quartz sands</td>
<td></td>
</tr>
<tr>
<td>640 – 660</td>
<td>Clay</td>
<td>Soft plastic clay A.A. w/ very little sand</td>
<td></td>
</tr>
<tr>
<td>660 – 680</td>
<td>Sand</td>
<td>Lt. gray, siltly glauconitic, mod. well-sorted coarse to v. coarse, predominantly v. coarse, sub-ang. to sub-round, loose quartz sands w/ clay A.A., clay decreasing w/ depth</td>
<td></td>
</tr>
<tr>
<td>680 – 690</td>
<td>Sandy clay</td>
<td>Sand A.A. w/ maroon to brown &amp; lt. green, soft plastic clay sand &lt;40%</td>
<td></td>
</tr>
<tr>
<td>690 – 700</td>
<td>Clay</td>
<td>Variegated maroon to brown &amp; lt. green, soft, plastic clay A.A.</td>
<td></td>
</tr>
<tr>
<td>700 – 710</td>
<td>Clayey sand</td>
<td>Lt. gray, well-sorted, v. coarse w/ some coarse, sub-ang. to sub-round, loose sands w/ brown &amp; lt. green soft clay A.A.</td>
<td></td>
</tr>
<tr>
<td>710 – 720</td>
<td>Clay</td>
<td>Lt. brown &amp; lt. green, variegated, soft, plastic clay</td>
<td></td>
</tr>
<tr>
<td>720 – 740</td>
<td>Clay</td>
<td>A.A.</td>
<td></td>
</tr>
<tr>
<td>740 – 750</td>
<td>Clay</td>
<td>A.A. w/ minor amount (&lt;15%) coarse to v. coarse sub-angular to sub-round sands A.A.</td>
<td></td>
</tr>
<tr>
<td>750 – 760</td>
<td>Clay</td>
<td>Lt. brown &amp; lt. green, soft, plastic clay w/ trace sand</td>
<td></td>
</tr>
<tr>
<td>760 – 780</td>
<td>Sand</td>
<td>Lt. gray to greenish gray, siltly glauconitic, loose mod. well-sorted, coarse to v. coarse, predominantly v. coarse, sub-round, quartz sands w/ clays A.A.</td>
<td></td>
</tr>
<tr>
<td>780 – 790</td>
<td>Clay to Sandy clay</td>
<td>Clay &amp; sand A.A.</td>
<td></td>
</tr>
<tr>
<td>790 – 800</td>
<td>Sand</td>
<td>Lt. gray to greenish gray, mod. well-sorted, v. coarse sub-ang. to sub-round, siltly glauconitic loose sand w/ clay A.A.</td>
<td></td>
</tr>
</tbody>
</table>