Final Report
Executive Summary

Wamsutter Water Supply
Level II Study

A Wyoming Water Development Commission Project
Consultant Contract for Services 05SCO293588

May 2010

PMPC
Saratoga, Wyoming

in association with

Hinckley Consulting
Laramie, Wyoming
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INTRODUCTION

Since the early 1900s, the municipal water supply for the Town of Wamsutter has come from a series of deep wells along the railroad, in the center of town. The currently functional wells of this group (Nos. 5, 6, and 7) were constructed from 1902 to 1921. Well No. 8 was the first departure from this area, drilled on the benchland north of town in 1983. This well was only brought into use in 2008, in conjunction with construction of the adjacent storage tank. It has since become the backbone of the municipal system, relegating the older functional wells to backup-supply status. A second well was drilled on the north side of Wamsutter to supply the ESS Mancamp in 2006. This well has since been conveyed to the town and has been designated Well No. 10. The most recent Wamsutter well is No. 9, drilled in 2009 under this Level II project by the Wyoming Water Development Commission (WWDC). (See Figure 1.1 for location of wells and related facilities.) Aside from Well No. 9 this Level II study also addresses groundwater quality; wellfield management; inventory, evaluation and mapping of existing water system; population growth and water demand projections; identification and selection of future infrastructure improvement projects; conceptual design and cost estimates for selected improvement projects and water system financing and economic analysis.

CONCLUSIONS

This study has been a success in development of a water source for the Town of Wamsutter. Feedback from Town Officials has been very positive and all parties involved agree that this WWDC Level II study has provided worthwhile results and is a huge step in a positive direction for the Town. A short synopsis of the findings of this study are included below:

- Well No. 9 will provide a safe and viable additional water source for Wamsutter
- Combined use of Well Nos. 8, 9 and 10 will provide Wamsutter with ample quantities of water into the future based on projected population growth and water demands
- Current infrastructure is in good condition and weak areas have been included for replacement in selected improvement projects included in this study
- Population and water demand projections have been developed and analyzed for use in infrastructure design
- Selected infrastructure improvement projects will provide improvements to water source and transmission
- Economic analysis suggests that selected water system improvements are feasible and affordable and the water rate increases and necessary funding appropriations have been identified
HYDROGEOLOGY

Figure 2.1 shows the relative positions and depths of Wamsutter Wells No. 6 through 10, all of which are completed at depths greater than 1,000 ft. in the Wasatch Formation. The patterned areas along each wellbore indicate the location of well screens or perforations. That the targeted water-producing strata occur at different depths in different wells reflects the discontinuous nature of the individual very-fine to fine-grained sandstone layers interfingered with shale and thin coal beds.

Above approximately 1,000 ft. in depth, productive strata are relatively uncommon and groundwater quality is poorer than from the 1,000 – 2,000 ft. range. Below 2,000 ft., sandstone units, although still very-fine to fine-grained, become somewhat thicker, providing more productivity per unit of depth, although at the cost of a slight deterioration of groundwater quality.

Figure 2.1 – Wamsutter Wells Cross Section
WELL NO. 9 CONSTRUCTION AND TESTING

Along with providing an additional well into the known aquifer between 1,000 and 2,000 ft., Well No. 9 was extended into the previously unexplored underlying strata as a slim hole. Based on favorable indications of productivity and acceptable groundwater-quality, the final well was completed to a depth of 2820 ft. Figure 2.2 provides construction details.

Well No. 9 was constructed between June 20 and Sept. 25, 2009 (with a substantial delay between the initial, slim-hole drilling and the final well completion) and tested in October 3 and October 15. Airlift development of the well was conducted at discharge rates up to 525 gpm. A 5-day constant discharge test was conducted at 340 gpm, accompanied by transducer measurement of drawdown.

Analysis of test results determined an aquifer transmissivity of approximately 2500 gpd/ft; a confined-aquifer storativity on the order of 0.001 is assumed based on the depth of the well and the character of the overlying strata. (A storativity of at least 2 X 10^-4 is required by the absence of measurable interference drawdown in Well No. 8 over the course of the test. Primarily due to its greater penetration of water-bearing strata, Well No. 9 is by far the most productive of the Wamsutter wells. (Its depth is also such that the temperature of the produced water is 85°F.)

Before any pumping takes place, the depth to groundwater at Well No. 9 is approximately 37 ft., i.e. an elevation comparable to that which produced flow at the surface in the lower, “downtown” wells when they were first completed. The pumping water level in Well No. 9 will depend upon the rate of production; projection of test data indicate that 340 gpm could be sustained for months from a depth of approximately 420 ft. Production of 500 gpm could be sustained at the pumping water levels that occur in Well No. 8. Due to the intervening distance, the difference in depth, and the nature of the penetrated strata, significant interference drawdown between Well Nos. 8 and 9 is not anticipated to be a problem.
Figure 2.2 – Well No. 9 Diagram

Wamsutter Exploration Well #1; U.W. 186502
T20N, R94W, NE 1/4 SW 1/4, Section 22; Approximate Elev. = 6818 ft.

Depth

- 300 ft
- 600 ft
- 900 ft
- 1200 ft
- 1500 ft
- 1800 ft
- 2100 ft
- 2400 ft
- 2700 ft
- 3000 ft

$SWL = 36 \text{ ft}$

24" hole

16" 0.250-wall steel casing

8 5/8" 28 lb. steel casing

12 1/4" hole

7 7/8" hole

5 1/2" 14 lb/ft J-55 steel casing

5 1/2" stainless steel well screen

- 1040 ft (casing hanger/packer)
- 1090 ft

Lower hole test packer setting 1935 ft.
GROUNDWATER QUALITY

The quality of groundwater produced from Well No. 9 meets all US EPA Primary Drinking Water Standards. The Secondary Standard (based on aesthetics rather than health considerations) is slightly exceeded for Total Dissolved Solids (TDS) and approached for sulphates. Relative to the quality of groundwater from the previous Wamsutter wells, Well No. 9 is typical – poorer than some, better than others. Like all the wells, groundwater from Well No. 9 has a relatively high sodium adsorption ratio (SAR) which may compromise its suitability for salt-intolerant irrigation.

Wamsutter Well No. 8 was initially found to produce methane gas in sufficient quantities that air-stripping treatment has been provided. Well No. 9, in surprising contrast, was carefully tested for gas and found to produce only minor concentrations of methane, well below action levels. (Well No. 8 was retested as part of these investigations. It was found to continue to produce substantial quantities of methane despite having now been pumped aggressively for over one full year.)

Based on an observable growth of biological material in the air-stripping facilities for Well No. 8, Well No. 9 was tested for a variety of potentially problematic bacteria. Levels of iron-related bacteria comparable to those in the other Wamsutter wells were identified. These levels have not been found to cause problems in the other Wamsutter wells, and microscopic examination of the biofilm from the Well No. 8 air strippers found none of the filamentous structures that of primary concern with bacterial growth. Sulphate-reducing and slime-forming bacteria were found to be absent in both Well Nos. 8 and 9. Routine maintenance of the air strippers should alleviate problems associated with the biofilm.

WELLFIELD OPERATION AND MANAGEMENT

OPERATION SCENARIO 1 – ROTATION

Based on 2030 demand projections, maximum day demand is met by all three wells pumping: Nos. 8 and 9 at 190 gpm on average; No. 10 at 170 gpm on average. Average day demand is met by pumping in rotation among the three wells, with average production in the same proportions as for the peak-day: Nos. 8 and 9 at 75 gpm on average, and No. 10 at 68 gpm on average. The proposed pumping scenario creates maximum drawdown during the summer peak-use period, from which the wells only partially recover during the lower-use part of the year.

OPERATIONAL SCENARIO 2 - MINIMUM LIFT

The same water demands could also be met with an objective of minimizing total feet of lift. This would heavily weight production toward the most productive well - No.9. Well No. 9 would be equipped with a 400-gpm pump; Well No. 8 would be used as necessary to make up shortfalls during peak-demand periods and Well No. 10 would serve as a backup.
OPERATIONAL SCENARIO 3 - MAXIMUM QUALITY

Although all of the Wamsutter wells produce water within EPA Primary Drinking Water standards, the groundwater quality, in terms of dissolved mineral content (TDS and sulfates), is best from Well No. 8. Thus, the "best" water could be achieved by pumping Well No. 8 at near-capacity most of the time, using Well No. 9 to make up shortfalls during peak-demand periods, and using Well No. 10 as a backup. This assumes that the methane production of Well No. 8 could continue to be satisfactorily addressed through air-stripping and that the water-quality advantages of this scenario out-weighed the additional pumping and treating expense.

EXISTING WATER INFRASTRUCTURE INVENTORY

Major water distribution system improvements were constructed in 1977. These projects included PVC water distribution mains, new water services, fire hydrants and valves. In 2001 and 2002 a 12” PVC transmission line was constructed from an area just north of Interstate 80 to the Well No. 8 site and in 2006 water meters were installed on the distribution system. In 2008 an elevated steel 400,000 gallon water storage tank, water treatment facility and distribution system extension to the Latham Industrial Park were constructed. The operator has indicated that these portions of the water system require minimal maintenance at this time.

POPULATION GROWTH AND WATER DEMAND PROJECTIONS

Current population estimates for Wamsutter range from 261 persons to 650 persons. Estimates were attained from State Agencies, census data, EPA and from Town Officials. The high estimate of 650 persons was obtained from the U.S. EPA and represents the number of people served by the water system with a 25% increase for transient users, back calculating from 650 yields a permanent population of 520 persons. The Town estimates the current population to be 400 persons based on rental availability within the Town (Pers. Comm.: Lisa Colson, Nov 2009). The Town also estimates the transient population during the height of a boom cycle to be equal to the base permanent population of 400 persons. The current economic conditions reflect average conditions that do not include a significant transient population. The sporadic bursts of energy development near Wamsutter make population projections difficult to estimate with any degree of accuracy. The methodology used for projections for this report consists of a base population of 400 in 2010 and a projected increase in base population of 2% per year, resulting in a 20-year, 2030, projected base population of 594. It is proposed that a peak 2030 design population of 1200 persons, including a 600 person base population, and a 600 person transient population, be used for facility design purposes. The design population does take into account the likely future energy boom impacts as well as currently proposed residential, commercial, and industrial developments. Utilizing a design population that includes energy boom impacts added to conventional base population projections provides a reasonable design safety factor.
With an average daily demand of 89,000 gpd (based on Town records) and a current estimated population of 400 persons the average per capita day demand is \( \frac{89,000}{400} = 223 \) gpcd. The projected average daily water demand for 2030 is \( 1200 \times 223 = 267,600 \) gpd. Following completion of the Well 10 and Well 9 projects, the water source for the Town of Wamsutter will exceed projected demands. The 400,000 gallon storage tank is also adequate for projected demands. 200 gpm production rates for Well No. 9 were utilized for capacity analysis. If higher unanticipated demands occur in the future a larger pump could be installed to meet said demands.

**SELECTION OF PREFERRED INFRASTRUCTURE IMPROVEMENT PROJECTS**

Fourteen infrastructure projects were identified as part of this study. Following conceptual level design and cost estimates, the list was narrowed down to five. All of the identified preferred projects were selected by the sponsor and have been evaluated based on current need, constructability, complexity and feasibility of implementation. The preferred projects are listed below:

- 2010 Well No. 9 Connection
- 2010 Well No. 10 Connection
- 2010 Kelly Street Transmission Line
- 2011 350,000 Gallon Tank Demolition
- 2011 Abandonment of Well Nos. 6 and 7

**2010 No. 9 and No. 10 Wells**

Incorporation of Well Nos. 9 and 10 into the water supply system are current projects considered high in importance. The Well No. 10 project is currently in a Level III design phase with construction tentatively scheduled for 2010. The well number 9 connection project is currently listed as a WWDC Level III project. Funding for the Well No. 9 Connection project has been approved and construction is anticipated in 2010 or 2011. The new wells will provide a dependable long term water source for the Town. Water quality testing has been performed and analyzed for both of the wells. The 2010 estimated cost for these two projects is $1,613,000.

**2010 Kelly Street Transmission Line**

The transmission line extension project on Kelly Street is considered the next highest priority project based on providing a looped alignment for service to the distribution system south of Interstate 80, system hydraulics and fire flow improvement. The 2010 estimated cost for this project is $454,000.

**2011 350,000 Gallon Tank Demolition and Abandonment of Well Nos. 6 & 7**

Demolition of the original 350,000 gallon water tank and abandonment of Well Nos. 6 and 7 are also considered priority projects at this time in order to "clean up" the water system and reduce stagnant water located within the well and connecting piping. It is recommended that Well No. 5 remain intact for future use as a source for irrigation water. The 2011 estimated cost for this project is $192,000.
WATER SYSTEM FINANCING AND ECONOMIC ANALYSIS

Current economic conditions in the Wamsutter area have diminished considerably over the last year when compared with previous years. It is the Town’s intention to improve their water system by utilizing available grant and loan programs offered through State and Federal Agencies. Debt service on any loans shall be kept at manageable levels that can be paid for during non-elevated economic times.

This study has identified five preferred projects, funding options that have been considered for these improvements include WWDC Grants, SLIB Mineral Royalty Grants, Rural Utility Service (RUS) loans and grants, DWSRF loans, County 1% Specific Purpose Tax, private funding provided by BP America and water user fees. The following tables provide a breakdown of costs based on various funding sources:

### TABLE 3.11 - WATER SYSTEM IMPROVEMENT COSTS AND FUNDING BREAKDOWN

<table>
<thead>
<tr>
<th>Economic Analysis</th>
<th>Estimated Costs</th>
<th>WWDC (67% Grant)</th>
<th>33% Town Match</th>
<th>Other Funding</th>
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<tr>
<td><strong>Current Projects (2010)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Well #9 Connection - Town Match includes $80K for Well Purchase</td>
<td>$804,000</td>
<td>$538,680</td>
<td>$345,320</td>
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<tr>
<td>Well No. 10 Connection</td>
<td>$809,000</td>
<td>$542,030</td>
<td>$266,970</td>
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<tr>
<td><strong>Subtotal - (1)</strong></td>
<td>$1,613,000</td>
<td>$1,080,710</td>
<td>$612,290</td>
<td></td>
</tr>
<tr>
<td><strong>Preferred Improvement Alternatives (2011)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kelly Street Transmission Line</td>
<td>$477,000</td>
<td>$319,590</td>
<td>$157,410</td>
<td></td>
</tr>
<tr>
<td>350,000 Gallon Tank Demolition</td>
<td>$78,000</td>
<td>$78,000</td>
<td></td>
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<tr>
<td>Abandonment of Wells No. 6 and 7</td>
<td>$114,000</td>
<td>$114,000</td>
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<tr>
<td><strong>Subtotal - (2)</strong></td>
<td>$669,000</td>
<td>$319,590</td>
<td>$157,410</td>
<td></td>
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<tr>
<td><strong>Total</strong></td>
<td>$2,282,000</td>
<td>$1,400,300</td>
<td>$769,700</td>
<td>$192,000</td>
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### TABLE 3.12 PREFERRED ALTERNATIVES - ANNUALIZED COSTS

<table>
<thead>
<tr>
<th>Economic Analysis</th>
<th>SRF Loan (2.5%, 20 yr)</th>
<th>RUS Loan / Grant (3.375%, 20 yr)</th>
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<tr>
<td><strong>Current Projects (2010)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Well #9 Connection (33% Match)</td>
<td>Principal Amount ($)</td>
<td>Annual Payment ($)</td>
</tr>
<tr>
<td>Well #9 Connection (33% Match)</td>
<td>$362,586</td>
<td>$23,000</td>
</tr>
<tr>
<td>ESS Well (#10) Connection (33% Match)</td>
<td>$280,319</td>
<td>$18,000</td>
</tr>
<tr>
<td><strong>Preferred Improvement Alternatives (2011)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kelly Street Transmission Line</td>
<td>$157,410</td>
<td>$10,000</td>
</tr>
<tr>
<td>350,000 Gallon Tank and Pump Station Demolition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abandonment of Wells No. 6 and 7</td>
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<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
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Additionally, operation and maintenance projects were identified and an enterprise fund or “sinking” fund list was developed as shown below.
Table 3.14 ECONOMIC SUMMARY - WATER SYSTEM IMPROVEMENTS

<table>
<thead>
<tr>
<th>Economic Analysis</th>
<th>SRF Loan (2.5%, 20 yr)</th>
<th>RUS Loan / Grant (3.375%, 20 yr)</th>
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<tr>
<td></td>
<td>Principal Amount ($)</td>
<td>Annual Payment ($)</td>
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<tr>
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<td>$18,000</td>
</tr>
<tr>
<td>Preferred Improvement Alternatives (2011)</td>
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<td>$10,000</td>
</tr>
<tr>
<td>350,000 Gallon Tank and Pump Station Demolition</td>
<td></td>
<td></td>
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<tr>
<td>Abandonment of Wells No. 6 and 7</td>
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<tr>
<td>Total</td>
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<td>$51,000</td>
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Future values for sinking fund projects were extended out 20 and 15 years depending on the existing utility life expectancy. An annual inflation factor of 5% was used to forecast future values. A 3% return on investment for sunken funds was used based on historic averages. An annual payment of $67,000 into a sinking or enterprise fund would be required given the chosen parameters. It is anticipated that meetings and discussions will be conducted with Town Officials on incorporating the enterprise fund into the 2011 budget.

The table below provides an economic summary and water rate increase amount based on current water revenues and expenditures; proposed annualized payments for anticipated infrastructure improvements and sinking fund projects. A monthly per tap water rate increase is also provided based on a 5,000 gallon per month usage volume.