Executive Summary

Farview Water District Water Supply Level II Study

June 2010

Submitted to:
Wyoming Water Development Commission
Farview Water District

Prepared By: Stetson Engineering, Inc.
PO Box 1836
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In Association With: Western Groundwater Services, LLC
EXECUTIVE SUMMARY

For

FARVIEW WATER DISTRICT LEVEL 2 STUDY

Prepared for:

FARVIEW WATER DISTRICT
P.O. Box 1641
Riverton, WY  82642

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June 2010
PURPOSE

During 2007, the District prepared an in-house study equivalent to the WWDC Level I Study, and used this work as a basis for the Level II Study application. This document compiled information to support that the District’s public water system required a new source of supply to meet standards for source capacity. To this end, the primary focus of the Level II Study was the construction and testing of a new water supply well. The Level II Study also includes evaluations and recommended improvements with respect to storage, transmission, distribution, operations and maintenance, and financing of the public water system.

The District is located approximately 8-miles north of Riverton adjacent to Burma Road (Figure 1-1). There is potential for approximately 34 connections to the public water system. The water system is presently supplied from two water supply wells that withdraw groundwater from the Wind River Formation aquifer at depths of 400 to 600 feet below ground surface. The capacity of the wells is insufficient to meet peak demand and the water quality is aesthetically poor due to high salt concentrations.

CONCLUSIONS AND RECOMMENDATIONS

Water Supply

It was decided during the project that at this time the goal of the District is only to complete a new supply source and construct the infrastructure necessary to connect it to the District system. The only alternative considered with respect to water supply was a new well, as determined from the Level I Study. The goal of the well was to achieve higher capacity and improved water quality. Farview #3 Test was built during the Level II Study to meet these goals. Project planning for the test well also included the preparation of a Design Report and Testing and Development Plan (Western Groundwater Services 2008). Additional planning information is provided in this earlier report.

The well site was selected on Bureau of Reclamation (BOR) lands about 400 feet south of the District’s existing storage tank (Figure 1). The Farview Water District does not own any properties, and consequently, a well site within the District would have required negotiations and payment to a private land owner.

A successful test well was drilled to a total depth of 950 feet. The target aquifer for the project was sandstone within the Wind River Formation. An as-built of the well is shown on Figure 2. The final design for the test well utilized a 5-inch diameter schedule 80 PVC casing with stainless steel screens and a sand filter pack. The target yield for the well of 30 gpm can be achieved from a 4-inch pump and motor.

Farview No. 3 was permitted with the State Engineer’s Office (SEO) prior to drilling. The SEO assigned UW #187635 to the well. The permit designates a well for Miscellaneous use, a pumping rate up to 50 gpm, and an annual volume up to 34 af per year. The priority date is July 23, 2008. The place of use is designated to include up to 48 lots within the subdivision boundaries.
0 – 18 ft. Quaternary terrace and pediment deposits. Clay, silt, sand and gravel mixtures. Tertiary Wind River Formation

18 – 290 ft. Mostly claystone, with siltstone and fine sandstone interbeds.

290 – 370 ft. Predominantly sandstone, with coarse grain sizes. Last 30 feet is fine-grained. Includes claystone and siltstone beds.

370 – 670 ft. Interbedded claystone, siltstone and sandstone. Lower 100 ft of interval includes more sandstone than top part.

670 – 820 ft. Predominantly coarse sandstone, includes claystone and siltstone beds.

820 – 880 ft. Claystone, including soft reddish brown beds (probably red shale of local drillers)

880 – 900 ft. Sandstone, fine-grained, loose

900 – 910 ft. Claystone and siltstone beds

910 – 930 ft. Sandstone, fine-grained, loose

930 – 950 ft. Claystone and sandstone beds.

Water samples were collected on May 29 and June 11, 2009, during the construction of Farview Well #3. The samples were standard samples collected for the new well construction. The results of this testing indicate there is significant biofouling potential in the aquifer of Farview #3. Based on experience with these tests on other wells, the samples from Farview #3 indicate a relatively higher degree of biofouling potential than is often observed in groundwater. The BART™ analyses of the water produced from Farview #3 reacted quickly indicating multiple populations of very aggressive bacteria, providing a strong indication that well plugging could be an important problem for the District to address.

The most significant biofouling bacteria appear to be iron-related, which have a history of plugging wells by formation of biofilms on well screens and within media adjacent to the screen. However, the other bacteria types identified could also impact well performance. Sulfate reducers were observed to be abundant in the step rate sample, but were absent in the constant rate sample. Subsequently, it was decided to disinfect Farview #3 Well and conduct a resampling to verify plugging potential. For comparisons water samples were also collected from neighboring wells of similar depth during September 2009.

Sampling results were similar to the results measured previously, although biofouling potential was slightly lower, which could be attributed to the effects of disinfection. These data support that the conditions measured in the samples are representative of the aquifer and that it is unlikely drilling work impacted the water quality. When comparing the water samples taken from the other wells in the area with respect to biofouling parameters, there is no comparison to Farview #3. The other four samples are substantially different, with little indication that biofouling would be problematic.

A cost comparison between a monitoring/rehabilitation maintenance program and one that uses only periodic well replacements (i.e., maintenance free) is discussed in detail in section 8 of the report. Based on the analysis, maintenance free operation of the well until replacement appears economically favorable to monitoring and rehabilitations. The exception is that if plugging occurs more quickly, and for instance, two replacement wells are needed in a 20 year period, the rehabilitation option has greater value. Based on these potential unknowns, monitoring carefully in the first several years of well operation is recommended, as the actual performance of the well can then be factored into a revised analysis.

The following tables provides a summarized comparison of the collected water quality data:
### WATER QUALITY DATA SUMMARY

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sample Location</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>District</td>
<td>Kennedy</td>
<td>Osborne</td>
<td>Standridge</td>
<td>Farview #3</td>
<td>Retest</td>
<td>Farview #3</td>
<td></td>
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<tr>
<td>U.W. No.</td>
<td>73136</td>
<td>82306</td>
<td>114265</td>
<td>73742</td>
<td>187635</td>
<td>187635</td>
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<tr>
<td>Land Elevation (ft msl)</td>
<td>5295</td>
<td>5270</td>
<td>5485</td>
<td>5405</td>
<td>5395</td>
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<td></td>
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<tr>
<td>Total Depth (ft)</td>
<td>600</td>
<td>790</td>
<td>980</td>
<td>800</td>
<td>930</td>
<td>930</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Screen Elevation^c (ft msl)</td>
<td>4720</td>
<td>4490</td>
<td>4550</td>
<td>4635</td>
<td>4490</td>
<td>4490</td>
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<tr>
<td>Temp (°C)</td>
<td>16</td>
<td>15.5</td>
<td>17.5</td>
<td>17.2</td>
<td>17.1</td>
<td>16.8</td>
<td></td>
<td></td>
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<tr>
<td>pH</td>
<td>7.97</td>
<td>8.4</td>
<td>8.64</td>
<td>8.61</td>
<td>8.37</td>
<td>8.73</td>
<td></td>
<td></td>
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<tr>
<td>TDS^D (mg/L)</td>
<td>1260</td>
<td>525</td>
<td>323</td>
<td>363</td>
<td>648</td>
<td>600</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium (mg/L)</td>
<td>391</td>
<td>186</td>
<td>126</td>
<td>140</td>
<td>230</td>
<td>205</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iron (mg/L)</td>
<td>ND</td>
<td>0.15</td>
<td>0.13</td>
<td>ND</td>
<td>0.18</td>
<td>0.965</td>
<td></td>
<td></td>
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<tr>
<td>HPC (MPN/mL)</td>
<td>310</td>
<td>21</td>
<td>140</td>
<td>17</td>
<td>2160</td>
<td>ND</td>
<td></td>
<td></td>
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<tr>
<td>HAB^B (cfu/mL)</td>
<td>&lt;7000</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>50,000</td>
<td>10,500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SLYM (cfu/mL)</td>
<td>ND</td>
<td>&lt;500</td>
<td>ND</td>
<td>ND</td>
<td>66,500</td>
<td>2,100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IRB^A (cfu/mL)</td>
<td>500</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>140,000</td>
<td>25,500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SRB (cfu/mL)</td>
<td>500</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

^A Sample collected from hose bib at Hutson residence. Well data are for Farview #1.

^B Values are estimated based on days to reaction for HAB, SLYM, IRB, and SRB. The method does not count microorganisms – see Appendix B.

^C Elevation is midpoint of entire screen interval in well.

^D Total dissolved solids (TDS).
Completion and Connection of the Water Supply

The request for the purchase of the well was completed during the Level II project and a loan for $36,555.98 was approved through the 2010 legislative Assembly at a rate of 4% for a term of 20 years.

A request was also processed during the Level II project for WWDC Level III construction funds to connect the well to the system. Estimated costs to complete the well and make the connection to the existing system totaled approximately $95,500.00. The grant and loan were approved during the 2010 Legislative Assembly. The total appropriation for the Level III Project was $100,000.00. The split for the funding is 67% grant and 33% loan. The loan of $33,000.00 was approved at a rate of 4% for a term of 20 years. The total combined loan to the District is $69,555.98.

The work would include the following:

- The completion of the well with a pump capable of producing 30 gpm at a head of 700'. This would include the pitless unit, pump, control wire, pump panel, drop pipe, and 1" PVC sounding tube.

- Construction of a control, metering, and treatment building. Treatment would be for chlorination only, metering would be manual read, and a sampling tap must be provided in the building.

- Installation of a new 3 phase service drop from the power pole between the well and existing storage. This work would be completed to the meter by High Plains Power. The meter will be mounted on the existing power pole. Connection from the meter would be included in the construction of the control building.

- Installation of approximately 400 lf of 2" HDPE transmission main to go from the well to the Control building and then be tied into the existing 6" PVC transmission main near the existing storage tank. The connection can be made with a SS tapping saddle. This would include a blow-off hydrant for pumping to waste from the well.

The new well will be controlled in the same manner as the existing wells (simple pressure Murphy switches). If well No.2 is taken off line its’ controls could be used. Otherwise the existing manifold could be extended and a new switch added.
WATER SUPPLY DEMAND

Service Area and Population

The Farview Water District is located within the Knight Subdivision, within the Wind River Basin, approximately 8 miles north of Riverton in the Southeast ¼ of Section 21, Township 2 North, Range 4 East, of the Wind River Meridian, Fremont County, Wyoming.

The original plat, completed in 1977, shows the Knight Subdivision as consisting of two blocks that are geographically separated. The Farview Water District consists only of Block 1, and the service area considered for this report consists only of the Lots within the District. Block 1 originally contained a total of 26 lots all of which can be accessed from Alaska Road and Farview Circle.

Based on research of the Fremont County records for Warranty Deeds, the Fremont County Assessors GIS data base, and previous water improvement plans prepared for the Farview Water District provided by Cardinal Design Group in 1986, it was determined that Block 1 of the Subdivision (the Service Area) currently consists of 34 described lots.

The Level I Study estimated a current population of 65 residents within a total of 24 developed lots within the Knight Subdivision. This estimate was based on the personal knowledge of the level I author who is a resident and District Board member. This would provide an average of 2.7 persons per home. This matches closely with the U.S. Census Bureau year 2000 estimate of 2.58 people per household for Fremont County. To be conservative it was decided to round these values and assume an average of 3 persons per household for the calculations in this study.

There are currently 23 lots being served by the District. This would bring the current estimated population to 69 (23 lots x 3 per/home). To estimate the future population it was assumed the District will reach a full buildout of all 34 Lots. The buildout will consist of single family homes with an average of 3 persons per household. This provides a future population of 102 persons. The current number of services (23) and the projected full buildout number of services (34) was used in the economic analyses in the report.

Figure 3-1 shows a system map of the current Farview Water District.

Water Demand

The Farview Water District does not have sufficient historic water usage data to generate average daily demands and maximum daily demands for the system. Because of the insufficient historic records it was decided to estimate the usage based on data from the WWDC Water Usage Surveys for 2007 through 2009. The Survey information was tabulated and is shown in TABLE 4-1 of the report. The data incorporated was narrowed down to districts with populations between 72 and 155 people. Entities with incomplete or what looked to be erroneous data were also eliminated. The 2007 data was used because this was the last reporting many of these districts provided in the surveys.
From this data an average per capita use of about 159 gallons a day was estimated. For the calculations in the report this figure was rounded this to 160 gallons/capita/day (gpcpd). This value exceeds the minimum value allowed by the Wyoming Department of Environmental Quality (WDEQ) Chapter 12, Section (8)(a), of 125 gpcpd where system records are not available to establish water use.

As a further conservative measure, due to the small size of the water system and the potential for erratic peaks, a peaking factor of 3 was used to determine the max day demand from the average day demand. This is slightly higher than the 2.72 factor used in the WDEQ Chapter 12, Section (8)(a), but it is estimated that this is a more accurate estimation of the system. This higher peaking factor is supported by the present water system use which can experience water shortages from the two existing wells. This is discussed more within this section. The peak hour demand was estimated by multiplying the peak day by a factor of 1.5.

The following table provides a summary of the water demand for the present population of 69 residents in 2010 and the projected population at full buildout of the District. The full buildout population of 102 is based on development of 34 lots at three persons per dwelling.

<table>
<thead>
<tr>
<th>Year</th>
<th>Population</th>
<th>Unit Water Use (gpcd)</th>
<th>Average Day Demand (gpd)</th>
<th>Maximum Day Demand (gpm)</th>
<th>Maximum Hour Demand (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>69</td>
<td>160</td>
<td>11,040</td>
<td>23</td>
<td>34.5</td>
</tr>
<tr>
<td>Buildout</td>
<td>102</td>
<td>160</td>
<td>16,320</td>
<td>34</td>
<td>51</td>
</tr>
</tbody>
</table>

Water use data apply to water production from wells.

The District presently derives a water supply from two wells, designated as Farview No. 1 and Homeowner’s No. 2 (Figure 1-1). The permit numbers and status for the wells are as follows:

- **Farview No.1 Well – Permit # U.W. 73136.** The well is permitted for an appropriation of 20 gpm and all filings are complete. The well is un-adjudicated and is in compliance with the permit conditions of “Miscellaneous Purposes” not exceeding the stated appropriation and limited to the amount necessary for the beneficial use established by the appropriation.

- **Home Owner No.2 – Permit # U.W. 73135.** The well is permitted for an appropriation of 20 gpm and all filings are complete. The well is adjudicated in accordance with an order of the Fifth Judicial District Court, entered April 19, 1999 in Civil No. 86-0012-641UW (the General adjudication of all rights to use water in the Big Horn River System and all other Sources) and is in compliance with the permit conditions of “Miscellaneous Purposes” not exceeding the stated appropriation and limited to the amount necessary for the beneficial use established by the appropriation.

The combined total capacity of these wells is estimated at 25 gpm. As this rate would exceed maximum day demand for the present user base, either the wells do not sustain this rate, or the peaking factor is greater than 3.0. For planning purposes, it is assumed here that the wells can sustain only 17 gpm, or 75% of the peak instantaneous rate of 25 gpm. It is further assumed...
that 12 gpm of this flow is derived from Farview No. 1, and the remaining 5 gpm is from Homeowner’s No. 2, as it is generally known that Farview No. 1 is a more reliable producing well, and is the primary well used in the system. The rate of 12 gpm would satisfy water demand on most days of the year, consistent with the actual use, which relies on Farview No. 1 except for during the peak day flow.

In comparison to water demand, the present wells appear deficient to meet maximum day demand for present or full buildout populations. Source of supply capacity is deficient by 6 gpm to meet present maximum day, and by 17 gpm to meet projected maximum day demand at full buildout.

PREFERRED ALTERNATIVE COST ESTIMATE

This work and cost to complete the well and connect it to the system is summarized in the table below:

### Preferred Alternative Preliminary Construction Cost Estimate

<table>
<thead>
<tr>
<th>NON CONSTRUCTION COSTS</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation of Final Designs and Specification</td>
<td>$8,400</td>
</tr>
<tr>
<td>Permitting (Bureau of Reclamation SUP)</td>
<td>$850</td>
</tr>
<tr>
<td>Electrical Service (Install by High plains Power)</td>
<td>$6,000</td>
</tr>
<tr>
<td><strong>Total Pre-Construction Costs</strong></td>
<td><strong>$15,250</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CONSTRUCTION COSTS</th>
<th>UNIT</th>
<th>QTY</th>
<th>PRICE</th>
<th>TOTAL PRICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump, and motor (submersible, 7.5 -10 hp, 3-Phase, 4-inch motor)</td>
<td>EA 1</td>
<td>$6,500.00</td>
<td>$6,500</td>
<td></td>
</tr>
<tr>
<td>Pitless Unit</td>
<td>EA 1</td>
<td>$3,100.00</td>
<td>$3,100</td>
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</tr>
<tr>
<td>2” Galvanized Steel Column Pipe</td>
<td>LF 860</td>
<td>$9.00</td>
<td>$7,740</td>
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</tr>
<tr>
<td>Motor Wire</td>
<td>LF 860</td>
<td>$4.00</td>
<td>$3,440</td>
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</tr>
<tr>
<td>Installation of pitless, pump, and column pipe</td>
<td>LS 1</td>
<td>$7,500.00</td>
<td>$7,500</td>
<td></td>
</tr>
<tr>
<td>Other Mechanical</td>
<td>EA 1</td>
<td>$2,500.00</td>
<td>$2,500</td>
<td></td>
</tr>
<tr>
<td>Electrical</td>
<td>EA 1</td>
<td>$4,000.00</td>
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<tr>
<td>Building</td>
<td>EA 1</td>
<td>$5,000.00</td>
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<tr>
<td>2” HDPE Transmission line</td>
<td>LF 400</td>
<td>$26.00</td>
<td>$10,400</td>
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<tr>
<td>Bonds and Mobilization</td>
<td>EA 1</td>
<td>$12,000.00</td>
<td>$12,000</td>
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</table>

**Construction Subtotal =** $62,180

**Construction Engineering (Level III only 10%) =** $6,218

**Construction Subtotal =** $68,398

**TERRO Fee (2%) =** $1,368

**Construction Subtotal =** $69,766

**Contingencies (15%) =** $10,465

**Total Construction Costs =** $80,231

**TOTAL ESTIMATED PROJECT COST =** $95,481
ECONOMIC ANALYSIS AND PROJECT FUNDING

Operations, Maintenance, and Reserve Costs

The estimated operational costs were discussed with the District at several meetings to try and determine a proper budget to pay all O&M needs and continue to maintain the reserve. The District has a good current reserve for their system size and do not want to add significantly to it. The District rates would be adjusted as needed if the reserve is depleted for repairs. The budget costs used for the funding and fee impacts are as follows:

- Water Quality Testing $215.00 / month
- Well Monitoring (section 8.3.3) $100.00 / month (part of this work would be included in the water quality testing)
- Electrical Power $250.00 / month

Total O&M $565.00/ month or $6,780.00 year

Approximately 10% was added to the O&M for variances. The total used for planning is $7,500/year.

Funding Scenarios and Fee Impacts

The preferred alternative and the one currently in Level III funding is the purchase and Connection of Farview Well No.3. It was determined during the Level II project that the most beneficial funding for the project could be provided by the WWDC.

The request for the purchase of the well was completed during the Level II project and a loan for $36,555.98 was approved through the 2010 legislative Assembly at a rate of 4% for a term of 20 years. A request was also processed during the Level II project for WWDC Level III construction funds to connect the well to the system. Estimated costs to complete the well and make the connection to the existing system totaled approximately $95,500.00. The grant and loan were approved during the 2010 Legislative Assembly. The total appropriation for the Level III Project was $100,000.00. The split for the funding is 67% grant and 33% loan. The loan of $33,000.00 was approved at a rate of 4% for a term of 20 years. The total combined loan to the District is $69,555.98.

The fee impact to users based on this alternative would be about $45.32 / month based on the current user base of 23 taps (EDUs), (See Tables 1 and 2). It can be seen from table 9-2 that an increase in the user base would quickly reduce the estimated monthly rates.
### Table 1
Costs to Sponsor

<table>
<thead>
<tr>
<th>WELL COSTS (33 % of Construction)</th>
<th>ESTIMATED LEVEL III COSTS</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>$36,555.98</td>
<td>$31,515.00</td>
<td>$68,070.98</td>
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</table>

### Table 2
ESTIMATED MONTHLY COST PER MEMBER (WELL, COMPLETED LEVEL III, O&M, and RESERVE):
(WWDC Funding - 67% Grant, 33% Loan)

<table>
<thead>
<tr>
<th>Interest Rate</th>
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<tbody>
<tr>
<td>Length of Loan (years)</td>
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<tr>
<td>Payments per year</td>
<td>1</td>
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</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Loan Amount</th>
<th>Annual Loan Payment</th>
<th>Annual O&amp;M and Reserve</th>
<th>Monthly Payment/Member</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete Farview Well</td>
<td>$68,070.98</td>
<td>$(5,008.78)</td>
<td>$(7,500.00)</td>
<td>$45.32</td>
</tr>
</tbody>
</table>

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**PREVIOUS STUDY/WWDC INVOLVEMENT**

During 2007, the District prepared an in-house study equivalent to the WWDC Level I Study. The Study LEVEL I STUDY FOR FARVIEW WATER DISTRICT, prepared by Harold J. Hutson, and submitted to the Wyoming Water Development Commission, August 13, 2007.

**ADDITIONAL PERMITTING**

A Special Use Permit (SUP) will be required by the Bureau of Reclamation (BOR) for the Well Site Control Building and new Transmission line. The District currently has a SUP with the BOR for the existing tank and transmission line on the BOR lands. The permit number is “Special Use Permit 6LM-66-00010”. The permit expires on February 24, 2011. The BOR has determined that instead of creating a new SUP just for the well and new infrastructure they are going to require the District to combine all existing and new infrastructure into one new SUP. An application for the new SUP was sent to the BOR in June of 2010 at the end of this study.