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Burns Well
Level II Study

Executive Summary

Prepared for:

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Prepared by:

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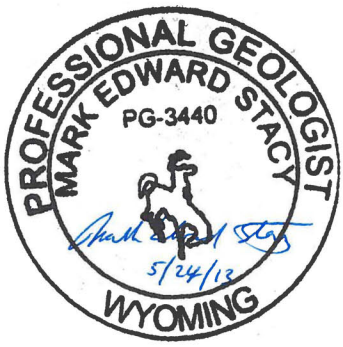

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Table of Contents

Tables

1.0 INTRODUCTION

In 2011 the Wyoming Water Development Commission (WWDC) retained Lidstone and Associates, Inc. (LA), to complete a Level II investigation for the Town of Burns (Town), the project sponsor. LA completed an evaluation of the Town's existing high capacity wells, supervised the construction of a new Arikaree Formation production well in the High Plains Aquifer and completed an evaluation of improvements to the delivery of suitable water quality to the Town's residents. LA was assisted by AVI, p.c., (AVI) throughout this investigation.

LA completed the earlier WWDC Level I Master Plan and concluded that the Town needs to obtain additional and supplementary water to (1) support future growth in the water system service area; (2) provide adequate source redundancy in case of well failure; (3) meet fire flows. The Master Plan study projected that the Town needs to supply approximately 325 gallons per minute (gpm) to meet the peak summertime demands in 2040. Based on the water use records, all the wells must operate continuously to meet the highest peak summer demand. If either one of the Town's highest capacity wells (Well A2 or A4) fail, the Town would not be able to meet peak demand. Given the ages (1956 and 1977, respectively) and history of Wells A2 and A4, the Town needed a new reliable high capacity well to provide water source redundancy.

1.1 History and Project Background

The Town's existing water system is supplied with potable water from four Arikaree Formation wells located within the Town limits. Wells A2 and A4 each yield 200 gpm to the water system, while Wells A5 and A6 each yield approximately 30 gpm. These four wells are directly connected to the water distribution system before delivery to storage. Preliminary investigation suggested that Wells A2 and A4 are nearing the end of their design life, but still have serviceable life remaining. Wells A2 and A4 historically yielded more than their 200 gpm operating capacity, but Well A4 produced considerable sand at higher pumping rates, particularly above 650 gpm. Well A3 is owned by the Town and is used to water athletic fields adjacent to the school located on the southeast side of Town. Well A3 is not connected to the distribution system. A 200,000-gallon water tank is located in the eastern portion of the Town near Well A6 and provides operating pressure, storage for peak demand periods, and fire flow demands for the water system. Water from the distribution system is used for residential and commercial purposes as well as fire suppression. The distribution system is looped throughout Town. The elementary and high schools are the largest commercial water user. The other commercial users in Burns are smaller businesses and it is thought their water use is comparable to residential use. A SCADA system (Supervisory Control and Data Acquisition) is used to control the operation of the wells and the water system.

The Level I Master Plan study highlighted two significant needs:

1. Increase the storage capacity of the water system to meet future growth and fire suppression requirements.
2. Develop additional water supply and provide redundancy via well improvements and/or a new water supply well.

To address storage capacity, a new 200,000-gallon elevated storage tank was completed in 2012 with Level III WWDC funding assistance. With the completion of the tank near Well A2, the Town has increased water storage capacity and can supply the required fire flows for the Laramie County School District as well as the Town of Burns.

The Level II Feasibility Study was undertaken to address the water supply end of the highlighted needs discussed above. Specifically the study:

- ✓ Evaluated the feasibility of increasing the pumping rates of A2, A3, and A4, and determine a sustainable yield.
- ✓ Identified potential drilling sites for an Arikaree Formation (High Plains Aquifer) test well in close proximity to the Town and completed a new high capacity test production well at the most favorable site.
- ✓ Developed designs for pumping system improvements, transmission and water treatment system alternatives.
- ✓ Prepared conceptual designs, cost estimates, financing and economic analysis of sufficient detail to allow the recommended improvements to be considered for WWDC Level III funding.
- ✓ Completed a water quality assessment to address concerns with regional nitrate and gross alpha concentration in the Town wells.

2.0 EXISTING WELL EVALUATION AND TESTING

In collaboration with Sargent Drilling (Sargent) of Broken Bow, Nebraska, LA evaluated the physical condition and water yielding characteristics of Wells A2, A3, and A4. The evaluation of each well involved removing, inspecting, and cataloging the existing pumping equipment; video surveying of the well casing and screen; stepped and constant rate testing of the High Plains Aquifer using a test pump; collecting and analyzing water quality samples; and resetting the existing pumping equipment. Based on the condition of the pumping equipment in each well the Town opted at its own expense to pay for certain equipment improvements prior to pump reinstallation.

2.1 Well A2 Water Supply Improvement Alternatives

Several options were considered to increase the yield of Well A2.

1. **Do nothing** and continue to operate the well at 200 gpm. This option does not improve yield or improve the long term viability of the well.
2. **Increase the production rate of Well A2 to 400 gpm.** This change in production would be accomplished by exchanging the current pumping equipment with a variable frequency drive, pump, and motor. With this equipment, the Town could produce more water for either short or long periods of time. This option would compensate for lost production from another well or provide additional water during peak demand periods. Increasing the groundwater production of this well will result in additional sand production. Increasing both the water and sand production rates from this well will accelerate potential pump failure/replacement and could damage the aquifer.
3. **Drill a replacement well and abandon the current well.** Given the productivity of Well A2, LA anticipates that a 10-inch diameter replacement well could be drilled and completed at this location with an appropriate screen and gravel pack to maximize groundwater yield and minimize sand production for the Town.

2.2 Well A3 Water Supply Improvement Alternatives

The results of the Well A3 evaluation revealed that the Town has a serviceable well capable of supplying sufficient water to the athletic fields at the school. Due to problems with well construction and the requirements of a Public Water Supply system, it would be inappropriate to tie this well into the water system.

With this in mind, the Town has the following respective short term and long term options for this well:

1. **Do nothing and continue to utilize the current 80 gpm production rate for irrigation of the athletic fields.** This well provides value to the Town for irrigation purposes. Well A3 provides sufficient water to maintain healthy turf grasses, and effectively lowers the demand on the Town's water system.
2. **Drill a replacement well and abandon the current well**. When the present well is no longer serviceable due to casing failure, sand pumping, or collapse of the well annulus, a replacement well could be drilled and completed at this site. The well should be completed with 10-inch diameter casing, wire-wrapped well screen and gravel pack, and an appropriate sanitary seal such that it can be connected into the Town's water system.

2.3 Well A4 Water Supply Improvement Alternatives

Comparing the Level II evaluation work to historic documentation, the groundwater production capability of this well has declined from 1,500 to approximately 250 gpm, which represents an 83% loss in yield. The Town's records also indicated that the well did yield 450 gpm in 1994. This well has lost production in the last 30 years. Video data identified the presence of tubercles on the well screen and corrosion on both well casing and screen.

Several options were considered to increase the yield of Well A4.

1. **Do nothing and continue to utilize the 200 gpm production of essentially sand free water from the well.** Continued utilization of this well as is does not improve its remaining serviceable life, eliminate the ongoing losses in efficiency and/or yield, or increase the amount of water available for the Town.
2. **Rehabilitate the existing well.** Rehabilitation of the well utilizing mechanical techniques such as sonar jetting to remove the encrustations and tubercles. If this approach is successful, it is only a short term solution because it will not change the local groundwater chemistry or reverse the corrosion process. There is risk in proceeding with mechanical rehabilitation of the well, which could lead to damaging the well screen or casing and resulting in well failure.
3. **Drill a replacement well and abandon the current well**. Based on the well video, calculated hydrogeologic parameters, reported historic production, and local hydraulic communication with a previous test hole, it appears that additional groundwater could be produced from this location with a properly completed well. A higher capacity replacement well could be drilled and completed at this location with an appropriate screen and gravel pack to maximize groundwater production and minimize sand production.

3.0 1-ANDERSON TEST WELL COMPLETION

Based on the results of the testing of the existing wells and discussions with WWDC personnel, the Town identified a need for a new production well, capable of producing approximately 350 gpm. Given the well siting criteria and the local hydrogeologic setting, LA evaluated the High Plains Aquifer data and identified eight favorable drilling locations for the test holes and test well to be drilled and completed in the Arikaree Formation. AVI negotiated with the landowners to acquire access. LA supervised the completion of three test holes by Sargent in January 2012.

With the concurrence of the WWDC and the Town in March 2012, LA completed the test well at the 1-Anderson test hole location to a depth of 225 feet in the Arikaree Formation. This site lies approximately 0.5 miles west of Town along 1st Street adjacent to three-phase overhead powerlines. Based on the results of aquifer tests completed on this well and water quality sampling, the following conclusions were reached:

- ✓ This well yields water efficiently at all pumping rates.
- ✓ The well can sustain a production rate of 150 gpm. The test did not reveal any significant hydrogeologic boundary conditions in the High Plains Aquifer.
- ✓ The well is located a sufficient distance from the other wells to reduce the potential for well interference.
- ✓ As noted during the stepped rate test, the hydrogeologic parameters associated with the High Plains Aquifer at this location are typical of sandstone.
- ✓ Pumping this well results in very little sand production as it was measured at 0.08 mg/L.
- ✓ Groundwater from the test well meets EPA primary and secondary drinking water standards.

4.0 ADDITIONAL WATER QUALITY TESTING

Additional sampling of both the Town's production wells, the test well, and several neighboring domestic wells was proposed because gross alpha concentrations at Well A6 had spiked in 2010 and 2011 and because nitrate concentrations in the area had been persistently elevated. LA also reviewed the laboratory certifications and found that there were discrepancies in the manner of gross alpha reporting. LA proposed to split samples between two laboratories to evaluate the potential for lab error and in particular the calculation and reporting of gross alpha.

Results of the 2013 sampling effort indicated that the concentration of nitrate exhibits a regional pattern. Nitrate concentrations generally increase to the east across this area, with the highest concentrations observed at Well A6 and the Frye well. Wells A2, A3, A4, A5 and A6 all had nitrate concentrations ranging from 5 to 7 mg/L. While these levels remain a concern, the concentrations are similar on a well-by-well basis to average nitrate concentrations reported for the 1999 to 2007 period under the Level I project. This indicates that nitrate concentrations have been relatively stable since at least 1999.

Gross alpha concentrations do not appear to exhibit any regional patterns, but concentrations are commonly more than half of the Maximum Contaminant Level (MCL). Following research and coordination with the regulatory agency (USEPA), LA found that the regulatory MCL for gross alpha is an "adjusted gross alpha" which effectively means that the initial gross alpha result needs to be adjusted to remove the source water's uranium concentration (adjusted to picocuries per

milliliter). Whereas uncorrected results from Wells A2, A3, and A6 were occasionally above the 15 pCi/L MCL, once corrected all sample results remained below the MCL. As noted above the MCL is based on corrected or adjusted gross alpha.

5.0 ENGINEERING EVALUATION OF SOURCE SUPPLY AND TRANSMISSION

The Level II study addressed the infrastructure required to bring the new well on-line. A well building, submersible pump and piping system are required to connect the new 1-Anderson Test Well to the Town's water system. The new well building was sized to accommodate the well, electrical and controls equipment, chlorine feed equipment, flow meter, valves, discharge to waste outlet, and piping. A new 3,200 linear foot 6-inch (C900 PVC) water line will be constructed to convey the potable water from the well to the Towns' existing distribution line near the Town's new (2012) 200,000-gallon elevated water storage tank.

Currently the Town's water system includes the four supply wells that are directly connected to the distribution system. The Town provides chlorination at each of the supply wells and there is minimal chlorine contact time before water is conveyed to the first tap. LA proposed and prepared conceptual designs for an isolated transmission line, which will connect the wells directly to the storage tanks, allowing adequate chlorine contact time prior to distribution. If at some time in the future additional water treatment is needed, the isolated transmission line will allow treatment at a single location. More importantly an isolated transmission line allows blending of all Town wells, thereby facilitating water quality compliance. For example and under current conditions should one of the supply wells exceed one specific water quality MCL (e.g. nitrate), that well would need to be shut down and the Town's water supply could be disrupted. With an isolated transmission line, all well water is blended, allowing dilution of the overall water quality and compliance with each MCL. Another benefit of constructing the isolated transmission line is that it will reduce water age within the system.

The proposed conceptual alignment for the isolated transmission line will start at Well A4 and proceed to the south to the Well A2 and new storage tank location. The next segment is along 1st Street to Jefferson Street where it proceeds south and connects with Well A6. The final segment proceeds to the south and ties-in Well A-5 along 4th Street.

6.0 RECOMMENDATIONS

The Level II Study addressed the Town's existing high capacity wells, identified, completed and developed a new Arikaree water source (1-Anderson Test Well) and evaluated the existing water infrastructure. Based on the findings of this study, LA submits the following prioritized recommendations for the Town of Burns:

1. Incorporate the 1-Anderson Test Well into the Town water system. This will add an additional 150 gpm of supply capacity for a combined total of 610 gpm with the existing wells. With the 1-Andeson well online, if either Well A2 (200 gpm) or A4 (200 gpm) were to fail, the Town could still meet and exceed the estimated peak summertime demand. A project to tie the 1-Anderson Test Well into the Town water system was submitted and approved for Level III funding by the WWDC in early 2013. Costs associated with this recommendation are shown in **Table 1**.
2. Construct an isolated transmission line to tie all of the Town's wells (including the test well) to the storage tanks. Installing the isolated transmission line will improve water quality through mixing and minimize water age by supplying the storage tanks with a continuous

supply of fresh water. A project to construct the isolated transmission line was submitted and approved for Level III funding by the WWDC in early 2013. Costs associated with this option are shown in **Table 2**.

3. Construct a new well on Town owned land adjacent to Well A4 and abandon the existing well. Based on the well video, calculated hydrogeologic parameters, reported historic production, and local hydraulic communication with a previous test hole, it appears that there is additional groundwater that could be produced from this location, but is being prevented from entering the existing well due to deterioration of the well screen. A potentially higher capacity replacement well could be drilled and completed at this location. This option provides the Town a more reliable long term water supply with potentially additional yield. Cost associated with this recommendation is presented in **Table 3**.
4. Replace Well A2 with a new production well located on the same Town-owned land. Given the productivity of Well A2, LA anticipates an approximately 10-inch diameter replacement well could be drilled and completed at this location with an appropriate screen and gravel pack to maximize groundwater production and minimize sand production for the Town. Costs associated with this option are presented in **Table 4**.
5. Replace Well A3 with a new production well when the current well fails. The current well screen has a fracture in the lower screened interval and does not appear to have a sanitary seal. Replacing Well A3 would provide the Town another reliable well that could yield 150 gpm or more. Costs associated with this option are presented in **Table 5**.
6. Dedicate Well A5 to the school and allow them to utilize it for watering athletic fields. Allowing the school to irrigate from a dedicated well will continue to keep such water demand off the Town's water system and reduce water treatment costs. If Well A5 is used for irrigating the athletic fields, the well will need to be enlarged to produce 50 to 60 gpm in order to provide an adequate supply.
7. Continue to monitor and work with the analytical laboratories to ensure that all certified laboratory reports present gross alpha as both adjusted and non-adjusted values. It is important that gross alpha water quality data is reported to the EPA and the public as an adjusted gross alpha value, commensurate with the EPA MCL for that parameter.

Table 1 Costs for 1-Anderson Test Well Pumping Equipment and Transmission Line

Item	Unit	Estimated Quantity	Unit Price	Cost
Mobilization/Demobilization	LS	1	$32,000	$32,000
Well Pump, Motor, VFD, and Cable	LS	1	$25,000	$25,000
Column Pipe and Pitless Adapter	LS	1	$20,000	$20,000
Well Building	LS	1	$20,000	$20,000
Well Building Piping and Pump to Waste	LS	1	$24,000	$24,000
Electrical	LS	1	$36,000	$36,000
Telemetry and Programming	LS	1	$24,000	$24,000
Flow Meter	LS	1	$10,000	$10,000
Pipeline (Open Trench Construction)	LF	2900	$60	$174,000
Restoration	LS	1	$10,000	$10,000
Pipeline (Directional Drill Highway Crossing)	LF	500	$130	$65,000
Fence at Well Site	LS	1	$5,000	$5,000
Miscellaneous Cost and Testing	LS	1	$5,000	$5,000
Well Site Easement	LS	1	$25,000	$25,000
SUBTOTAL 1				$475,000
ENGINEERING @ 10% OF SUBTOTAL 1				$ 47,500
SUBTOTAL 2				$522,500
CONTINGENCY @12% OF SUBTOTAL 2				$ 65,850
TOTAL CONSTRUCTION COSTS				$588,350
SURVEYING AND GEOTECHNICAL				$ 12,000
PERMITTING/LEGAL				$ 6,000
FINAL PLANS AND SPECIFICATIONS				$36,000
			TOTAL COSTS	**$642,350**
Note: Costs in 2012 dollars. Costs provided at time of Level III application submittal.				

Table 2 Costs for Isolated Transmission Line

Item	Unit	Estimated Quantity	Unit Price	Cost
Mobilization/Demobilization	LS	1	$29,000	$29,000
6-inch DR-18 PVC Transmission Line and Appurtenances	LF	2250	$60	$135,000
8-inch DR-18 PVC Transmission Line and Appurtenances	LF	1990	$70	$139,300
Import Backfill	CY	2000	$4	$8,000
Production Well Connections	EA	4	$15,000	$60,000
Utility Potholing and Crossings	EA	15	$1,000	$15,000
Gravel Road Surface Restoration	TON	1830	$15	$27,450
Turf Restoration	ACRE	1	$1,700	$1,700
Concrete Removal and Replacement	SY	30	$75	$2,250
Fence Removal and Replacement	LF	100	$30	$3,000
SUBTOTAL 1				$420,700
ENGINEERING @ 10% OF SUBTOTAL 1				$ 42,070
SUBTOTAL 2				$462,770
CONTINGENCY @12% OF SUBTOTAL 2				$ 58,077
TOTAL CONSTRUCTION COSTS				$520,847
SURVEYING AND GEOTECHNICAL				$ 10,000
PERMITTING/LEGAL				$ 65000
FINAL PLANS AND SPECIFICATIONS				$35,000
			TOTAL COSTS	**$570,847**
Note: Costs in 2012 dollars. Costs provided at time of Level III application submittal.				

Table 3 Well A4 Replacement Costs

Item	Unit	Estimated Quantity	Unit Price	Cost
Replacement of Well A4				
Test Hole Drilling				
Mobilization	LS	1	$10,000	$10,000
Test Hole Drilling	FT	275	$17	$4,675
Geophysical Logging	FT	275	$4	$1,100
Borehole Abandonment	FT	275	$10	$2,750
Site Restoration	LS	1	$2,000	$2,000
Replacement Well Drilling, Completion, and Testing				
Mobilization	LS	1	$20,000	$20,000
Bonds and Insurance	LS	1	$4,000	$4,000
Site Restoration	LS	1	$3,000	$3,000
Drill, Furnish, and Install 20-inch Surface Casing	FT	20	$250	$5,000
Drill 17.5-inch Diameter Borehole	FT	260	$100	$26,000
Furnish and Install 10.75-inch Stainless Steel Screen	FT	100	$200	$20,000
Furnish and Install 10.75-inch PVC Casing	FT	155	$60	$9,300
Furnish and Install 10.75-inch Steel Casing	FT	22	$60	$1,320
Furnish and Install Gravel Pack	CF	260	$30	$7,800
Furnish and Install Sand Cement Grout	CY	4	$500	$2,000
Rig Time	HR	8	$325	$2,600
Standby Time	HR	4	$300	$1,200
Plug and Abandon Well	FT	275	$40	$11,000
Geophysical Logging-Mob/Demob	LS	1	$2,500	$2,500
Geophysical Logging – 17.5-inch Hole	FT	260	$10	$2,600
Downhole Video	LS	1	$2,500	$2,500
Well Development	HR	24	$350	$8,400
Mobilize and Set Test Pump	LS	1	$10,000	$10,000
Conduct Aquifer Testing	HR	176	$200	$35,200
Disinfection	LS	1	$2,000	$2,000
Abandonment of Existing Well				
Well Abandonment	FT	220	$60	$13,200
Pumping Equipment and Supporting Infrastructure				
Mobilization/Demobilization	LS	1	$27,000	$27,000
Demolition	LS	1	$2,500	$2,500
Well Pump, Motor, VFD, and Cable	LS	1	$50,000	$50,000
Column Pipe and Pitless Adapter	LS	1	$25,000	$25,000
Well Building	LS	1	$30,000	$30,000
Well Building Piping and Pump to Waste	LS	1	$35,000	$35,000
Electrical	LS	1	$60,000	$60,000
Telemetry and Programming	LS	1	$35,000	$35,000
Fence	LF	150	$30	$4,500
Site Piping	LF	100	$200	$20,000
Site Restoration	LS	1	$3,000	$3,000
SUBTOTAL 1				$502,145
ENGINEERING @ 10% OF SUBTOTAL 1				$ 50,215
SUBTOTAL 2				$552,360
CONTINGENCY @ 15% OF SUBTOTAL 2				$ 82,854
TOTAL CONSTRUCTION COSTS				$635,213
HYDROGEOLOGY AND WELL DESIGN				$ 10,000
SURVEYING AND GEOTECHNICAL				$ 2,000
LEGAL FEES				$ 5,000
PERMITTING				$ 7,500
FINAL PLANS AND SPECIFICATIONS				$ 36,000
			TOTAL COSTS	**$705,700**
Note: Costs based on 2013 dollars.				

Table 4 Well A2 Replacement Costs

Item	Unit	Estimated Quantity	Unit Price	Cost
Replacement of Well A2				
Test Hole Drilling				
Mobilization	LS	1	$10,000	$10,000
Test Hole Drilling	FT	300	$17	$5,100
Geophysical Logging	FT	300	$4	$1,200
Borehole Abandonment	FT	300	$10	$3,000
Site Restoration	LS	1	$2,000	$2,000
Replacement Well Drilling, Completion, and Testing				
Mobilization	LS	1	$20,000	$20,000
Bonds and Insurance	LS	1	$4,000	$4,000
Site Restoration	LS	1	$3,000	$3,000
Drill, Furnish, and Install 20-inch Surface Casing	FT	20	$250	$5,000
Drill 17.5-inch Diameter Borehole	FT	290	$100	$29,000
Furnish and Install 10.75-inch Stainless Steel Screen	FT	100	$200	$20,000
Furnish and Install 10.75-inch PVC Casing	FT	180	$60	$10,800
Furnish and Install 10.75-inch Steel Casing	FT	22	$60	$1,320
Furnish and Install Gravel Pack	CF	297	$30	$8,910
Furnish and Install Sand Cement Grout	CY	4	$500	$2,000
Rig Time	HR	8	$325	$2,600
Standby Time	HR	4	$300	$1,200
Plug and Abandon Well	FT	300	$40	$12,000
Geophysical Logging-Mob/Demob	LS	1	$2,500	$2,500
Geophysical Logging – 17.5-inch Hole	FT	290	$10	$2,900
Downhole Video	LS	1	$2,500	$2,500
Well Development	HR	24	$350	$8,400
Mobilize and Set Test Pump	LS	1	$10,000	$10,000
Conduct Aquifer Testing	HR	176	$200	$35,200
Disinfection	LS	1	$2,000	$2,000
Abandonment of Existing Well				
Well Abandonment	FT	200	$60	$12,000
Pumping Equipment and Supporting Infrastructure				
Mobilization/Demobilization	LS	1	$21,000	$21,000
Well Pump, Motor, VFD, and Cable	LS	1	$40,000	$40,000
Pitless Adapter, Column Pipe and Check Valves	LS	1	$25,000	$25,000
Well Building Piping and Pump to Waste	LS	1	$35,000	$35,000
Electrical	LS	1	$55,000	$55,000
Controls	LS	1	$35,000	$35,000
Site Piping	LF	100	$200	$20,000
Site Restoration	LS	1	$3,000	$3,000
SUBTOTAL 1				$450,630
ENGINEERING @ 10% OF SUBTOTAL 1				$ 45,063
SUBTOTAL 2				$495,693
CONTINGENCY @ 15% OF SUBTOTAL 2				$ 74,354
TOTAL CONSTRUCTION COSTS				$570,047
HYDROGEOLOGY AND WELL DESIGN				$ 10,000
SURVEYING				$ 8,500
GEOTECHNICAL				$ 5,000
LEGAL FEES				$ 5,000
PERMITTING				$ 7,500
FINAL PLANS AND SPECIFICATIONS				$ 57,005
			TOTAL COSTS	**$663,100**
Note: Costs based on 2013 dollars.				

Table 5 Well A3 Replacement Costs

Item	Unit	Estimated Quantity	Unit Price	Cost
Replacement of Well A3				
Test Hole Drilling				
Mobilization	LS	1	$10,000	$10,000
Test Hole Drilling	FT	325	$17	$5,525
Geophysical Logging	FT	325	$4	$1,300
Borehole Abandonment	FT	325	$10	$3,250
Site Restoration	LS	1	$2,000	$2,000
Replacement Well Drilling, Completion, and Testing				
Mobilization	LS	1	$20,000	$20,000
Bonds and Insurance	LS	1	$4,000	$4,000
Site Restoration	LS	1	$3,000	$3,000
Drill, Furnish, and Install 20-inch Surface Casing	FT	20	$250	$5,000
Drill 17.5-inch Diameter Borehole	FT	310	$100	$31,000
Furnish and Install 10.75-inch Stainless Steel Screen	FT	100	$200	$20,000
Furnish and Install 10.75-inch PVC Casing	FT	203	$60	$12,180
Furnish and Install 10.75-inch Steel Casing	FT	22	$60	$1,320
Furnish and Install Gravel Pack	CF	312	$30	$9,360
Furnish and Install Sand Cement Grout	CY	4	$500	$2,000
Rig Time	HR	8	$325	$2,600
Standby Time	HR	4	$300	$1,200
Plug and Abandon Well	FT	325	$40	$13,000
Geophysical Logging-Mob/Demob	LS	1	$2,500	$2,500
Geophysical Logging – 17.5-inch Hole	FT	310	$10	$3,100
Downhole Video	LS	1	$2,500	$2,500
Well Development	HR	24	$350	$8,400
Mobilize and Set Test Pump	LS	1	$10,000	$10,000
Conduct Aquifer Testing	HR	176	$200	$35,200
Disinfection	LS	1	$2,000	$2,000
Abandonment of Existing Well				
Well Abandonment	FT	240	$60	$14,400
Pumping Equipment and Supporting Infrastructure				
Mobilization/Demobilization	LS	1	$22,000	$22,000
Well Pump, Motor, VFD, and Cable	LS	1	$25,000	$25,000
Pitless Adapter, Column Pipe and Check Valves	LS	1	$25,000	$25,000
Well Building	LS	1	$30,000	$30,000
Well Building Piping and Pump to Waste	LS	1	$30,000	$30,000
Site Piping	LF	100	$200	$20,000
Electrical	LS	1	$50,000	$50,000
Controls	LS	1	$35,000	$35,000
Fence	LF	150	$30	$4,500
Site Restoration	LS	1	$3,000	$3,000
SUBTOTAL 1				$469,335
ENGINEERING @ 10% OF SUBTOTAL 1				$ 46,934
SUBTOTAL 2				$516,269
CONTINGENCY @ 15% OF SUBTOTAL 2				$ 77,440
TOTAL CONSTRUCTION COSTS				$593,709
HYDROGEOLOGY AND WELL DESIGN				$ 10,000
SURVEYING				$ 8,500
GEOTECHNICAL				$ 5,000
LEGAL FEES				$ 7,500
PERMITTING				$ 7,500
EASEMENTS				$ 15,000
FINAL PLANS AND SPECIFICATIONS				$ 59,371
			TOTAL COSTS	**$706,600**
Note: Costs based on 2013 dollars.				