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EXECUTIVE SUMMARY
OF
FINAL REPORT
BAIROIL WATER SUPPLY PROJECT
LEVEL II, PHASE V

Lidstone and Associates, Inc.
Engineering Geology, & Water Resource Consulting

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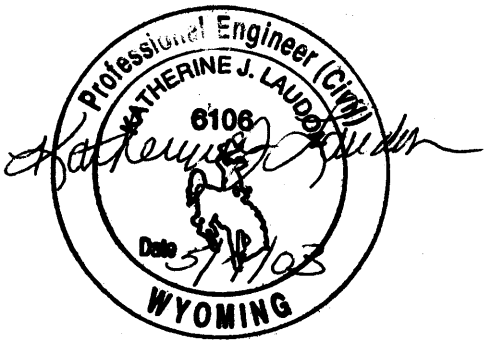
Prepared for:
State of Wyoming
Water Development Commission



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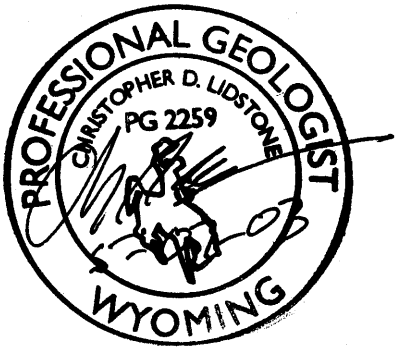

May 7, 2003

EXECUTIVE SUMMARY
BAIROIL WATER SUPPLY PROJECT
LEVEL II, PHASE V

1.0 INTRODUCTION

1.1 General

The Town of Bairoil (Town) is located 40 miles north of Rawlins on Highway 73 in Sweetwater County, Wyoming. The Town submitted an application to the Wyoming Water Development Commission (WWDC) to fund a Level II study for a conceptual design of a long-term, reliable water supply source. On June 1, 1999, Lidstone and Associates, Inc. (LA) entered into a contract with the WWDC to provide professional services on behalf of the Level II Bairoil Water Supply Project (Project). The purpose of this project was to conduct a system audit, explore ground water development options, and to make recommendations for the development of an additional long-term reliable water supply source.

1.2 History

The initial phases of the Project included a master plan evaluation of the water supply, transmission, storage, and distribution systems. After a complete evaluation of the water system (Phases I and II), LA recommended the Town complete a deep Battle Springs well to replace and/or supplement their existing supply. In advance of any production well completion, LA conducted a test drilling and geophysical logging program to address water quality and quantity concerns. The hydrogeologic investigation concluded that although the Battle Springs is a relatively prolific aquifer, water quality and specifically, radionuclides can be a problem.

During Phase III, LA successfully completed a deep Battle Springs Aquifer well, Bairoil No. 1, that has a sustainable yield of 60 to 70 gallons per minute (gpm). The water quality of this new well met U.S. Environmental Protection Agency (EPA) requirements. The Town requested Level III funding to bring this new well on-line and to prepare designs and upgrades for the Abel Springs system. In addition to the Level III funding request, the Town requested an extension of the Level II effort for the purpose of completing a second supplementary water supply well. LA's production goal for this well was to meet the long term municipal demand with a combination of the first and second wells. In the absence of any continuous meter records, LA utilized data from a nine month metering effort in 1997 to establish Maximum Daily Demand (MDD). This metering effort indicated the MDD during the summer of 1997 was 105 gpm. With this in mind, the design goal for the second well was 35 to 45 gpm.

The Phase IV effort consisted of the completion of a second Battle Springs Well. This second well met water quality standards but did not meet the quantity goal and the Town chose not to bring this well on-line.

1.3 Existing Water System

The Town of Bairoil's water system is classified as a community water supply (EPA, 1998) and provides water to a current resident population of 115 via 60 active service connections. The system is composed of nearly 60,000 linear feet of transmission line, a 350,000 gallon covered steel storage tank, and 18,000 linear feet of distribution line. Currently, the water into each service is unmetered.

The Town presently receives its water supply from a primary source, Abel Springs, and a secondary source, the Merit Energy Battle Springs Well Field. The Town Engineer has prepared a permit application to appropriate ground water from the new well, Bairoil No.1, which is located northwest of Abel Springs.

Abel Springs were developed in the 1950s. The springs are located approximately three miles northwest of the Town and provide an estimated flow of 35 to 75 gpm from an infiltration gallery. The springs are susceptible to drought and reportedly fail to provide a satisfactory water supply during drought conditions. Currently utilized as the supplemental water source for the Town, the Battle Springs Well Field is comprised of six deep wells. The combined yield for all wells is approximately 2,650 gpm. The wells provide source redundancy and additional fire fighting capacity for the Town.

Water from the Abel Springs infiltration gallery flows to the southeast through a six-inch PVC pipe and a four-inch PRV vault before flowing through another six-inch pipe and into the storage tank. Water from the Battle Springs transmission line flows into the Town's water system through a four-inch line. The Town's potable water is disinfected prior to entering the storage tank. No other treatment is applied to the water. The tank is structurally sound, well maintained, and in good condition. Treated water from the storage tank is conveyed to the distribution system via the 10-inch PVC pipeline. The entire transmission and distribution system is gravity-based.

1.4 Purpose and Scope of Project

Questions remained as to why the per capita design water demand for the Town was nearly twice the Wyoming average, and whether the current Abel Springs or an Abel Springs design alternative would actually serve as a supplementary water supply. There were very little usage data to document the Town's needs and the Abel Springs collection system was poorly understood and documented.

Concerns existed regarding the quality and quantity of water provided by Abel Springs. Abel Springs does not provide sufficient water to supply the Town during peak demand periods. During these peak periods, the Abel Springs supply is supplemented with water from several deep wells in the Merit Energy, Inc. Battle Springs Well Field. The Merit Energy wells and transmission line into the Town are expensive to operate because of the deep pump settings and long transmission distance. Operational issues associated with the transmission line further compound these problems. The Town does not currently pay for water from these wells, and is concerned that they may not be able to use water from this source indefinitely. In addition, water quality from these wells may exceed EPA standards for radionuclides. Therefore, the Town would like to be independent of the Battle Springs

Well Field, and anticipates that the new well and a second source would provide that independence.

The Abel Springs water supply currently meets primary drinking water standards. However, the EPA generally classifies an infiltration gallery as ground water under the direct influence of surface water, subject to the requirements of the Surface Water Treatment Rule (SWTR: 40 CFR Part 141, Subpart H). If the EPA reclassifies the Abel Springs source or if waterborne pathogens are detected, filtration will be required. The Abel Springs water has also shown elevated iron concentrations. In addition to the anticipated regulatory requirements, the Town is concerned about watershed protection, source contamination in the vicinity of the water source, and livestock grazing in the area.

In response to the concerns mentioned above, the WWDC and the Town sponsored the Level II, Phase V investigation to conduct a system audit and Abel Springs evaluation as well as submit a source water assessment application on behalf of the Town. Specifically, the Phase V Scope of Work included the following:

- Evaluate and document the existing Abel Springs collection and supply;
- Establish and prepare design alternatives to increase the ground water supply at the Abel Springs collection system;
- Collect data to address the Town's water usage;
- Complete a leak detection survey;
- Predict system upgrades, improvements, and expansions over the next 30 years; and
- Assist the Town in preparation of a Source Water Assessment Plan application.

2.0 WATER DEMAND

Few detailed records of water consumption exist for the Town. A flow meter was installed in the transmission line that exits the water storage tank in January, 1997. Unfortunately, this meter ceased to work after one year and records were only available for 1997. In July of 2002, the meter was returned to service and is now operational. Meter readings have been recorded since that time. Usage data recorded from July to October of 2002 were annualized using the 1997 data. Average and maximum daily demands for 2002 are estimated at 498 and 1140 gallons per capita per day (gpcpd), respectively. The following table shows the measured and annualized demands for the Town.

Water Demand Estimates for the Town of Bairoil

1997 (Population 160)		
Demand (Measured)	**Gallons**	**Gallons per Minute**
Average Daily	56,250	39
Maximum Daily	150,000	105
Peak Hourly	12,500	210
2002 (Population 115)		
Demand (Annualized)	**Gallons**	**Gallons per Minute**
Average Daily	57,250	40
Maximum Daily	131,143	91
Peak Hourly	10,928	182

The 2002 water usage data include significant leakage with the Town's distribution system. Testing performed by American Leak Detection (ALD) of Denver, Colorado estimated leakage within the system at 10-15 gpm. If the existing leaks were repaired, the maximum daily demand on the system would be approximately 76 to 81 gpm. This reflects a significant reduction in required production capacity.

3.0 EVALUATION AND TESTING OF ABEL SPRINGS

In July and August 2002, LA conducted a site investigation at Abel Springs and recorded flows into the collection boxes. The purpose of this investigation was to quantify each production component of the Abel Springs collection system. The results of the Abel Springs investigation are summarized below.

1. The largest of the flows, approximately 40 percent, comes from the upper Abel Springs collection system;
2. The upper box is the most prolific, providing approximately 30 percent of the total flows;
3. The middle box provides an additional flow volume of approximately 23 percent; and
4. The west box provides approximately seven percent of the overall flow.

The upper 1270 feet of the top collection lines contributes approximately 14.4 gpm to the infiltration gallery production. Therefore, the collection lines contribute approximately 0.0113 gpm/foot. Based on these measurements, approximately 900 feet of new collection lines would need to be added to obtain an additional 10 gpm from the gallery, assuming similar conditions exist.

4.0 ABEL SPRING REDEVELOPMENT AND EXPANSION

Data from a series of soil pits excavated in the Abel Springs area during the 1999 field investigation were used to characterize that material gradation of the alluvium. Examination of the walls of the open test pits indicated that the shallow material in the Abel Springs area is very fine-grained sand/silty sand and stiff green clay with low hydraulic conductivity. Thin seams of coarser, more permeable sediment are also present.

Based on field investigation results and the measured flows, adding an additional 1,000 feet of four-inch collection lines in the main filtration gallery could increase the flows by approximately 10 to 15 percent. The existing trunk lines above the collection boxes would still be used to convey the water to the main transmission line.

LA observed that even during drought conditions, there were areas of seepage to the north of the Kids Pond, approximately 3,300 feet south of the main collection box. An additional 450 feet of four-inch collection line and a new collection box could be added at that location and tied into the line going to the storage tank, thus capturing the runoff and enhancing the overall springs flow.

Adding approximately 1,450 feet of additional four inch PVC collector arms could expand the infiltration gallery and increase the flows by approximately 15 to 20 percent. Prior to final design, all proposed areas of system expansion should be "potholed" and material sampled.

In order to meet EPA standards and to ensure continued health and safety for the Town, LA strongly recommends filtration of the current or expanded Abel Springs source. This filtration system will need to be sized to include the upcoming flows from the new Bairoil No.1 well, for a minimum of 105 gpm.

5.0 LEAK DETECTION

The Phase V Scope of Work included a leak detection survey of all existing meters and valves within the Town's distribution and transmission systems. Prior to the survey, LA inventoried all meters and critical valves within the system. Two non-operational meters were identified and either repaired or replaced.

American Leak Detection (ALD) performed a system leak survey in September of 2002. The survey was performed by electronically testing all accessible valves, hydrants, and curb stops for vibration indicative of leakage. Many curb stops were electronically located and excavated for testing. The routes of water main lines were tested with a ground vibration survey at six foot intervals for over three miles.
The estimated total system leakage rate was 12-17 gpm (518,400-734,400 gallons per month). On an annual basis, this amounts to approximately 7.6 million gallons of water lost to leakage. Assuming the measured average daily demand, this corresponds to approximately 36 percent of the Town's production. More than 80 percent of the leakage was associated with residences on the customer side of the curb stop and are not "Town responsibility". A two to three gpm leak at the saddle that feeds

water to the chlorine injection system in the chlorine building was detected. This leak will need to be repaired by the Town.

6.0 DISTRIBUTION SYSTEM MODIFICATIONS

Wyoming Department of Environmental Quality / Water Quality Division (WDEQ/WQD) Rules and Regulations require a minimum operating pressure of 20 pounds per square inch (psi) under all operating conditions (including fire flow) and 35 psi under normal operating conditions. The distribution system was modeled using Haested Methods WaterCAD software. Model results indicated that the existing system configuration does not meet requirements under minimal fire flow conditions (1000 gpm). This situation is a direct result of the line sizes and demand at the dead-end mains. To bring the Town's system into compliance, the following modifications are recommended.

- Connect the dead-end main on Badger Circle to the eight-inch system main on Antelope Drive.
- Connect the dead-end main at the end of Deer Court to the dead-end main at the end of Elk Court, and then extend this main to the six-inch main on Iris Avenue.
- Connect the six-inch dead-end main at the intersection of Beebe Avenue and Iris Avenue to the eight-inch service main on Antelope Drive.
- Connect the six-inch main from Rodeo Road to the six-inch main at the intersection of Rodeo Road and Antelope Drive.
- Install approximately 1,650 feet of 6-inch PVC from the junction of Hwy 73 and Primrose Avenue and connect it to the 8-inch main on Antelope Drive.
- Connect the new line at the corner of Beebe Avenue and Rodeo Road to the proposed extension at the intersection of Rodeo Road and Antelope Drive.

7.0 SOURCE WATER ASSESSMENT

The Source Water Assessment and Protection Program (SWAPP) was initiated to help public water systems protect their water supply from contamination. WDEQ/WQD will complete assessments for public water systems that apply. Based on this assessment, public water systems will be encouraged to develop a protection program to safeguard the water supply. LA submitted a draft SWAPP application to the Town of Bairoil for approval and submission to the State. The completed application has been submitted to WDEQ/WQD, who will assist the Town with system evaluation and protection.

8.0 COST ESTIMATES

Conceptual designs and cost estimates were prepared for additional recommended work related to the Abel Springs collection system and the distribution system. These designs and cost estimates are discussed in the following sections.

8.1 Abel Springs Redevelopment and Expansion

The Abel Springs Redevelopment and Expansion cost estimate includes costs associated with the

infiltration gallery expansion, protection of the watershed collection area, and filtration of the water supply. All costs were calculated in 2002 dollars. The cost estimate for this work is $241,910. These costs include the

design and construction of a new collection box with radial arms and collection system, additional pipeline, granular filter, clay barrier, and woven wire fencing.

8.2 Distribution System Improvements and Miscellaneous Work

Distribution system modifications would result in a more efficient and easily maintained system with more balanced water pressures throughout. The cost estimate for this work is $503,421. This cost estimate includes the installation of a filtration system and approximately 65 meters on taps throughout the Town. Also included are costs associated with abandoning three wells along Abel Creek and the removal of the old storage tank.

9.0 PERMITTING AND ENVIRONMENTAL ISSUES

For this project to proceed with construction, the Town will be required to obtain certain permits, rights-of-way, and easements. State, county, and federal agencies must be contacted as part of the Level III process. In some instances, the initial contacts have already been made. The following issues must be addressed during the final design.

Abel Springs Redevelopment and Expansion

- Easements: Bureau of Land Management (BLM) and Sun Ranch
  The BLM permit will require clearance for the proposed activities from the State Historic Preservation Office and the US Fish and Wildlife Service
- U.S. Army Corps of Engineers §404 Permit
- WDEQ/WQD Permit to Construct
- Wyoming State Engineer's Office Water Rights Permit

Distribution System Improvements

- WDEQ/WQD Permit to Construct.

10.0 ECONOMIC ANALYSIS AND ABILITY TO PAY

LA's recommendations to the Town can be considered in two parts (1) Abel Springs redevelopment and expansion, and (2) upgrades and modifications to the distribution system. There are several potential sources for funding this project. These include the following:

- Private financing through the Town
- Wyoming Water Development Commission
- Rural Utilities Service (RUS) Loan
- Wyoming State Revolving Fund (SRF)
- Wyoming Mineral Royalty Grant

- Wyoming State Lands and Investments (SLIB) Grant / Loan Program

The following tables present the financing options for the Abel Springs redevelopment and expansion, and the distribution system improvements. The Town had previously made the determination that they will not apply for RUS funding. For the purposes of this presentation, we have incorporated a WWDC grant/loan and a SRF loan portion of the grant/loan package.

Financing for Abel Springs Redevelopment and Expansion (WWDC/SRF Funding)

Item	Financing Amount		
Construction cost WWDC eligible	$241,910.25		
WWDC 50-percent Grant	$120,955.13	SRF Loan	
Loan Amount	$120,955.13	Loan Amount	$120,955.13
WWDC Loan @ 6.0% - 30 yr. Monthly Payment	$725.19	SRF Loan @ 2.5% - 20 yr. Monthly Payment	$640.94
Totals			
Monthly Loan Payment	$725.19		$640.94
Monthly Tap Cost Increase @ 60 taps	$12.09		$10.68

The work defined in the following table is not eligible for WWDC funding. LA has presented financing options for funding for a grant/loan from the State Loan and Investment Board and an option for a SRF loan in this table.

Financing of the Existing System Upgrades (SLIB/SRF Funding)

Item	Financing Amount		
Construction cost SLIB eligible	$503,421.75		
SLIB 50-percent Grant	$251,710.88	SRF Loan	
Loan Amoun	$251,710.88	Loan Amount	$251,710.88
SLIB Loan @ 6% - 30 yr. Monthly Payment	$1,509.13	SRF Loan @ 2.5% - 20 yr. Monthly Payment	$1,333.82
Totals			

Monthly Loan Payment	$1,509.13		$1,333.82
Monthly O& M: Filtration Costs	$43.63		$43.63
Monthly Tap Cost Increase @ 60 taps	$25.88		$22.96

11.0 RECOMMENDATIONS

Based on the Level II, Phase V investigation, LA recommends the following work.

1. *Rehabilitate and expand the Abel Springs infiltration gallery.* This alternative is considered a viable means of increasing the quantity of Abel Springs water, provides partial system redundancy, and augments the new ground water supply.

2. *Make improvements to the distribution system.* Improvements will increase water pressures throughout the system and maintain system pressures during fire flow. In addition, the improvements will eliminate the requirement for constant flushing under the current configuration.

3. *Remove old water system components.* The old storage tank and associated water system components should be removed because they are a source of contamination. Isolating and removing these abandoned components will improve overall water quality.

4. *Perform miscellaneous work.* Costs have not been prepared for all of this work.
   - Add water meters at the points of service.
   - Repair leaks found during the leak detection survey.
   - Install a backflow preventer at the junction between all ¾ -inch service lines to the corrals and the distribution line, if one is not already in place.

5. *Obtain all easements.* The Town's engineer has already initiated this process.

6. *Keep Merit Energy's Battle Springs well field on line.* The well field should continue to be utilized for supplemental water to meet high demand flows, as long as there is no cost to the Town for doing so.

7. *Operation.* The following recommendations are made for the Town's water system operation.
   - If meters are installed the rate structure could be modified to charge based on usage.
   - Establish a fire hydrant flushing program that involves each hydrant being flushed at least once a year.
   - Exercise all gate valves within the distribution system at least once a year.

- Establish a good record keeping protocol to include all testing results, meter records, dates of hydrant flushing, valve exercising, etc.
- A representative from the Town should attend the American Water Works Association Annual Meeting at least once every three to four years. This will keep staff abreast of the changes in technologies and useful products as well as Federal Rules and Regulations regarding the Safe Drinking Water Act.
- Consider instituting a water conservation program to reduce water demands.

If the above recommendations are implemented, a filtration system installed, and with the chlorination system already in place, the Town should be able to meet anticipated future EPA ground water treatment rules without any change in personnel requirements to operate the system.