EXECUTIVE SUMMARY
LEVEL I RECONNAISSANCE STUDY

NOVEMBER 2010

Camp Creek Engineering, Inc.
in conjunction with
WYOMING GROUNDWATER, LLC
I, Edward P. Nowak, a Wyoming registered Professional Engineer, certify this Sweetwater Water Supply; Level I Study was prepared by me or under my direct supervision.

Edward P. Nowak

I, Christopher G. Moody, a Wyoming registered Professional Geologist, certify this Sweetwater Water Supply; Level I Study was prepared by me or under my direct supervision.

Christopher G. Moody
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SWEETWATER WATER SUPPLY, LEVEL I STUDY
EXECUTIVE SUMMARY

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EXECUTIVE SUMMARY

ES.1 Introduction

The Sweetwater Improvement and Service District (District) currently consists of 17 residences of the Cambria Estates Subdivision located 8 miles north of Newcastle in Weston County, Wyoming. The subdivision obtains water from a pipeline (Horton Pipeline) installed in the 1920s. The source of water to the pipeline is a reservoir and a spring situated along Sweetwater Creek about 3.8 miles north of the District.

The District was formed in an effort to resolve and manage water system issues associated with the pipeline and water quality from the reservoir/spring. In the fall of 2008, the District applied for and received funding from the Wyoming Water Development Commission (WWDC) to conduct a Level I study of the District water supply system.

The primary objective of the Sweetwater Water Supply, Level I Study is to identify water supply alternatives that comply with public drinking water standards and to provide cost estimates for the implementation of the alternatives. A secondary objective is to document the District’s current water system source, infrastructure, demands, water rights, and operation. The Level I study will help the District identify the most cost-effective alternative(s) for a new drinking water supply.

ES.2 District Water Supply and System

The location of the District relative to the water supply and near-by municipalities and water service districts is shown on Figure ES-1. The District service area encompasses the Cambria Estates Subdivision and six adjacent properties. There are currently 17 active water taps and commitments for 6 additional taps.

The Horton Pipeline receives water from the reservoir, the spring, and the collection well. The spring discharges from the top of the Hulett Sandstone Member of the Sundance Formation; specifically near the contact between Hulett Sandstone Member and the Lak Member. The Minnelusa and Madison aquifers are not the source of water to springs in the Sweetwater Creek drainage. Both aquifers do not have the hydraulic
energy required to discharge water through the overlying formations and to the ground surface along Sweetwater Creek.

The District’s current water supply is a surface water source. The reservoir/spring is not enclosed by a fence and livestock/wildlife have access. The District does not treat the water from the reservoir/spring; each homeowner is responsible for their individual point-of-entry/point-of-use water treatment or haul water.

The District is a public water system subject to the Safe Drinking Water Act and Wyoming Department of Environmental Quality (WDEQ) rules and regulations for a public water system. However, the District is not recognized by the EPA as a public water system and is not designed nor operated in compliance with WDEQ rules and regulations. The District recognizes that using untreated surface water from the reservoir has serious health risks and is unacceptable.

The Horton Pipeline is a 6-inch cast iron pipe of uncertain date (c.a. 1920) that was designed to serve the City of Newcastle and the historic mining town of Cambria. As shown on Figure ES-2, the pipeline provides approximately 15 psi at the high point in the District. This pressure does not satisfy the minimum pressure requirement of 35 psi. Some residences in this low pressure area use a booster pump to provide adequate pressure and flow. At the low point in the District along Highway 85, the pipeline provides approximately 140 psi and pressure regulating valves are used at services to reduce pressure to about 70 to 80 psi.

Some homes in the District are connected directly to the pipeline but the majority of residents are served from one connection located approximately ¼ mile south of the Cambria Estates water tank as shown on Figure ES-3. From the Horton Pipeline Reservoir to the District, the pipeline crosses 15 parcels of private property and 1 parcel of the State of Wyoming (Figure ES-4). There are four residential taps on the pipeline within 1.2 miles downstream from the reservoir that are not part of the District as shown on Figure ES-5.

There is a water storage tank located along Breakneck Road in the center of the District that is not operational. Lack of water storage leaves the District vulnerable to water outages during pipeline breaks or pipeline maintenance. The distribution system is
constructed primarily of 2-inch PVC pipe installed at various times since 1977. Distribution system maintenance history indicates minimal problems.

The District needs to redefine the water supply system in response to the following problems.

- Non-compliance with public water system standards
- Health risks associated with untreated surface water
- A 90 year old cast iron supply pipeline
- No designated ownership of the Horton Pipeline
- No easement agreements along the Horton Pipeline
- Uncertain surface water rights associated with the reservoir and no groundwater rights on the spring
- No access or use agreements with the reservoir/spring landowner
- Unrestricted access to the reservoir/spring
- Inadequate pressure in some parts of the District distribution system

**ES.3 Water Demand**

The District water supply is not metered and, therefore, there are no records of actual water use. Water use records from two nearby water districts/systems were used to estimate demands: 1) Cambria Improvement and Service District (CISD) and 2) West End Water District (WEWD).

The estimated current water demands of the District are shown below.

- Current Average Day Demand = 17 taps x 0.26 gpm/tap = 4.4 gpm
- Current Maximum Day Demand = 17 taps x 0.7 gpm/tap = 12 gpm

The population of the District in the year 2030 is assumed to be 75 people or 33 taps. Other potential future demands may occur if nearby non-District homeowners want to tap into the District water supply. With these potential increases, the estimated future water demands of the District are shown below.

- Future Average Day Demand = 33 taps x 0.26 gpm/tap = 8.6 gpm
Future Maximum Day Demand = 33 taps x 0.7 gpm/tap = 23 gpm
Future Peak Hour Demand = 2.5 x 23 gpm = 57.5 gpm

If residents to the north of the Cambria Estates Subdivision decide to join the District then 17 taps could be added for a total of 50 potential future taps.

Future Average Day Demand = 50 taps x 0.26 gpm/tap = 13 gpm
Future Maximum Day Demand = 50 taps x 0.7 gpm/tap = 35 gpm
Future Peak Hour Demand = 2.5 x 35 gpm = 87.5 gpm

Allowing mechanical equipment to rest for 20% of the time during a maximum demand day, the required system production capacity is approximately 42 gpm which will be considered adequate to meet the District’s projected future water demands to the year 2030. All wells, pumps, and water treatment will be sized for 42 gpm.

**ES.4 Groundwater Development in the Study Area**

Groundwater development in the study area consists of the following:

- There are no permitted water wells or springs within District boundaries.

- Within one mile of District boundaries, there are only 3 permitted wells: two wells are completed in the Madison Limestone and one well is completed in the Spearfish Formation.

- Domestic well development occurs along the east side of Sweetwater Creek where wells are completed in the Sundance Formation.

- East of Salt Creek and in the Sweetwater Creek drainage, there are numerous springs that discharge from landslide material.

- The Flying V Cambria Inn obtains its water supply for the restaurant and residence from Pisgah Spring (aka Mammoth Spring) which discharges from landslide material on the southwest side of Mount Pisgah.

On a regional scale, high yield wells (i.e., greater than 200 gpm) completed in the Madison Limestone are the primary water supply for public water systems in northeast Wyoming that include the municipalities of Newcastle, Sundance, Moorcroft, and Gillette; and local water districts that include Canyon Water District, Crown Subdivision/Wyoming Club, West End Water District, and the Salt Creek Water District.
There are two wells completed in the Madison Limestone that are located near the District: Crown No. 1 (U.W. 126550) and Cambria #1 (U.W. 35819). Crown No. 1 was installed in 2002 and is a water supply well for the Crown Subdivision/Wyoming Club. The well has the capacity to provide 500+ gpm. Cambria #1 was drilled in about 1900 and was used by the mining town of Cambria to provide water for a steam compressor and to supplement water from the Horton Pipeline. Cambria #1 is not in service and reportedly has a wellbore blockage.

**ES.5  Groundwater Resources Beneath the District**

Groundwater represents a viable water resource available for development by the District. Four aquifers were identified as potential water supplies for the District: Landslide material, Hulett Sandstone Member of the Sundance Formation, Minnelusa Formation, and the Madison Limestone.

*Landslide Material:* The District is situated on a narrow band of landslide material that extends 1.5 miles to the north and 3 miles to the south of the District. Groundwater in landslide material is an unconventional resource to consider; however, potential viability is indicated by the numerous local springs that discharge from landslide material to supply water to Sweetwater Creek, stock tanks, and the water system for the Flying V Cambria Inn. Based on the general absence of groundwater in numerous shallow test holes drilled as part of the evaluation of the Flying V Landslide by the Wyoming Department of Transportation (WYDOT), the movement of the landslide does not appear to be related to the persistent occurrence of groundwater at the base of the landslide. WYDOT observations and the small area of landslide material west of Salt Creek suggest that the landslide material beneath the District is unlikely to be an adequate or reliable source of groundwater for the District.

*Hulett Sandstone Member:* The Hulett Sandstone Member of the Sundance Formation is a viable groundwater resource in the Sweetwater Creek drainage. However, the hydrogeology of the Hulett Sandstone beneath the District may be significantly different than at Sweetwater Creek. It is speculated that the water quality beneath the District may
not be as good as the water quality the District historically has obtained from the spring on Sweetwater Creek. The Hulett Sandstone occurs beneath the District along Breakneck Road at a depth of approximately 300 to 400 feet. There are no water wells in the District to verify these depths of water occurrence or quantity/quality of the Hulett Sandstone. If the District wants to be completely informed of available groundwater resources, the groundwater characteristics of the Hulett Sandstone should be determined by an exploration drilling and testing program.

**Minnelusa Formation:** The sandstone and carbonate rock of the Minnelusa Formation are likely to provide an adequate quantity of water for District purposes. Although the Minnelusa is a demonstrated groundwater resource in the Black Hills of South Dakota, the Minnelusa is probably not a preferred aquifer target for the District because the water quality may be marginal to unacceptable for drinking purposes due to the dissolution of gypsum. However, poor water quality in the upper Minnelusa beneath the District is not a demonstrated fact. The anticipated static depth to water of 850 feet is fairly deep but does not prevent the use of water from the Minnelusa.

**Madison Limestone:** The Madison Aquifer is as close to a “sure thing” as one can expect for the purpose of providing adequate water quantity and quality for the District. The Crown No. 1 well provides the best information on what the District can expect for water quantity and quality in the Madison Aquifer. The specific capacity of the Crown No. 1 well is 2.3 gpm per foot of drawdown and the water quality is acceptable for drinking water purposes. Given the proximity of the Crown No. 1 well to the District and the low future demand requirement of the District (42 gpm), it is likely that the District will encounter adequate production with partial penetration of the Madison Aquifer. The elevation of the top of the Madison Limestone beneath the District is anticipated to be at 3300 to 3400 feet amsl or at a depth of approximately 1,800 to 1,900 feet below ground surface along Breakneck Road. The head elevation in the Madison Aquifer beneath the District is anticipated to be about 4870 feet amsl (+/- 50 feet) and that a well completed in the Madison Aquifer along Breakneck Road will have a static depth to water of about 330 feet (+/- 50 feet).
ES.6 Water Source Alternatives

Five (5) water source alternatives were identified for the District to consider.

1) Continue use of the District’s current water supply on Sweetwater Creek which would require the development of the groundwater source, replacement of the Horton Pipeline, and procurement of easements and water rights.

2) Obtain water from the City of Newcastle via the Cambria Improvement and Service District (CISD), establish service agreements, and install associated infrastructure.

3) Obtain water from the Crown Subdivision/Wyoming Club, establish service agreements, and install associated infrastructure.

4) Install a well completed in the Madison Aquifer on District property.

5) Install wells completed in the Hulett Sandstone on District property.

Figure ES-6 illustrates the hydraulic profiles of each alternative. Without consideration of cost, the following are general comments regarding water source alternatives.

- Modifications to the District’s current water supply on Sweetwater Creek which involve the development of a groundwater source and the continued use of the Horton Pipeline or a replacement pipeline will be extremely complicated and uncertain with respect to obtaining easements, permits, and regulatory compliance.

- Obtaining water from the City of Newcastle conveyed through CISD infrastructure is attractive because it would ensure a reliable and safe water supply, reduce infrastructure, and eliminate most of the operational and administrative duties of the District.

- The City of Newcastle is willing and able to supply water to the District via the CISD system.

- The District and CISD should consider the idea of the District becoming part of the CISD.

- Purchasing water from the Crown Subdivision/Wyoming Club may be attractive depending on the ability/willingness of the water system owner to provide water to the District under reasonable terms and contractual agreement.
• The Madison Aquifer is a proven public water supply and is an attractive alternative because it gives the District control over the design, operation, and development of their water system.

• The Madison Well alternative requires a tank capacity of 66,500 gallons and the Hulett Sandstone Wells alternative requires 33,300 gallons.

• The sizing of a water tank is determined by the number of taps served. If no more taps from north of the District are added, then the capacity of the existing District tank (12,000 gallons) satisfies WDEQ sizing requirements for alternatives without a well.

ES.7 Economics and Financing

Table ES-1 summarizes the construction and annual operation/maintenance costs associated with the following water supply alternatives:

• Alt No. 1: Improvements to the Current Water System
• Alt No. 2: Develop Current Source – Spring Collection System
• Alt No. 3: Develop Current Source – Well Collection System
• Alt No. 4: Regional Supply - City of Newcastle
• Alt No. 5: Local Supply – Crown Subdivision/Wyoming Club
• Alt No. 6: District Supply – Madison Well
• Alt No. 7: District Supply – Hulett Sandstone/Landslide Wells

Based on capital costs and financing assumptions that include use of the WWDC grant/loan program and use of the State Revolving Fund loan program, a monthly service charge for each service tap was calculated that allows the District to compare the cost of each water supply alternative (Table ES-2). With respect to Alternative No. 4, the CISD proposes to assess the District a $150,000 connection fee and a conveyance fee of $4.50 per 1,000 gallons. The following summarizes the economic and financing analysis.

• The least expensive water supply alternative (Nos. 7A and 7B) is development of the Hulett Sandstone, but the viability of the water resource has not been proven.

• Alternative 6B, development of the Madison Aquifer, is a cost competitive and reliable water supply alternative if the District can obtain Level II funding from the WWDC.
• The consensus of the District, WWDO, and Camp Creek Engineering is that the connection and conveyance fees proposed by the CISD in Alternative 4A are too high.

• Alternative 4B, integration of the District into the CISD, is a cost competitive and reliable water supply alternative.

• Alternative Nos. 1, 2, 3, 4A, 5, and 6A are significantly more expensive to implement than the other alternatives.

• Alternative 6A, development of the Madison Aquifer using District funds, allows for the most rapid completion of a new water supply but is relatively expensive.

• Alternatives with a higher percentage of cost in the front end are preferred which will lower operating cost after the project is constructed.

• If Alternative 4 is pursued, the connection fee paid to CISD should be a lump sum connection fee (i.e., $150,000) instead of each resident of the District paying $6,000 (i.e., CISD tap fee for new customers).

• Bringing District customers (23 taps) into the CISD water system will not significantly increase the cost of operating the CISD water system, but instead will increase the income base, distribute the costs over more customers, and reduce the monthly cost to each customer. There are practical advantages to both districts for the CISD to expand to include the Sweetwater District customers.

ES.8 Water Supply Project Development

In the fall of 2010, using information obtained during this Level I study, the District submitted an application to the WWDC for funding of a Level II feasibility study to install and test a Madison well. Concurrently, the CISD submitted an application to the WWDC for funding of a Level II study to evaluate storage tank and delivery operation improvements. The WWDO recommended that the scope of the CISD Level II study be expanded to include further evaluation of a connection for the Sweetwater District. The WWDO wants to more fully explore options associated with the regionalization of water supplies before considering a Madison well for the District.
ES.9 Recommendations

The following are recommendations for the Sweetwater Improvement and Service District to consider regarding the development of a new water supply.

- Actively participate in the future WWDC Level II study sponsored by the CISD that will evaluate the connection of the District into the CISD water system.

- In view of the WWDO’s preference for a regional water supply alternative and the relative cost of non-regional alternatives, consider dissolving the District and becoming part of the CISD.

- If the District can afford to drill a Madison Well, desires to maintain District autonomy, and wants to develop a new water supply as quickly as possible, then installing a Madison well may be the best option.

- Continue to communicate with Mr. Chuck Weinreis regarding the status and availability of water from the Crown Subdivision/Wyoming Club.

- Consider further the cost and advantages to the District of adding the 12 residences nearest the north end of District.

- Independently pursue the collection of basic water quantity/quality data in the Hulett Sandstone beneath the District.
TABLES AND FIGURES
**Table ES-1: Summary of Construction and Annual O & M Cost Estimates for Water Supply Alternatives**

*Sweetwater Water Supply, Level I Study*

Update: 10/25/10

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<th>Alternative No.</th>
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<td>$733,050</td>
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<td>Groundwater resource viability not known</td>
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Note: GWUDISW = Groundwater under the direct influence of surface water
### Table ES-2: Project Financing Summary for Sweetwater Water Supply Alternatives, Sweetwater Water Supply, Level I Study

**With 87% Grant**

Crown Tap Fee Not Known at This Time

Cost of water from Crown not confirmed

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<td>$ 841,900</td>
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**WATER RATES**

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**ANNUAL LOAN PAYMENTS**

| 1 SRF Loan | $ 46,653 | $ 47,945 | $ 39,338 | $ 19,388 | $ 19,642 | $ 30,608 | $ 17,061.85 | $ 28,128.20 | $ 13,299.24 | $ 16,390 |

**B D&M COSTS - ANNUAL COST OVER 20 YEAR PERIOD (2010 Dollars)**

| Water Treatment Plant | $ 6,400 | $ 6,400 | $ 6,400 | $ 6,400 | $ 6,400 | $ 6,400 | $ 6,400 | $ 6,400 | $ 6,400 | $ 6,400 |
| Booster Station | $ 10,110 | $ 10,110 | $ 10,110 | $ 10,110 | $ 10,110 | $ 10,110 | $ 10,110 | $ 10,110 | $ 10,110 | $ 10,110 |
| Well System | $ 1,500 | $ 1,500 | $ 1,500 | $ 1,500 | $ 1,500 | $ 1,500 | $ 1,500 | $ 1,500 | $ 1,500 | $ 1,500 |
| Water Supply from Newcastle | $ 192,200 | $ 192,200 | $ 192,200 | $ 192,200 | $ 192,200 | $ 192,200 | $ 192,200 | $ 192,200 | $ 192,200 | $ 192,200 |

**E TOTAL COSTS (A+B+C)**

| 72,523 | $ 69,165 | $ 50,083 | $ 44,925 | $ 31,768 | $ 65,755 | $ 28,042 | $ 39,108 | $ 24,279 | $ 27,370 |

**ANNUAL COST OF PURCHASED WATER FROM NEWCASTLE, CISD OR WB**

| $ 262,77 | $ 250,60 | $ 181,45 | $ 162,77 | $ 115,10 | $ 238,24 | $ 101,60 | $ 141,70 | $ 87,97 | $ 99,17 |
ALTERNATIVE NO. 1, UPGRADE EXISTING SYSTEM, BUILD WATER TREATMENT PLANT AND PUMP STATION AND ALTERNATIVE NO. 3, CONSTRUCT WELL FIELD NEAR EXISTING SPRING

ALTERNATIVE NO. 2, REHAB EXISTING SPRING COLLECTION SYSTEM

ALTERNATIVE NO. 4, PURCHASE WATER FROM NEWCASTLE

ALTERNATIVE NO. 5, PURCHASE WATER FROM CROWN

ALTERNATIVE NO. 6, DRILL MADISON WELL AND
ALTERNATIVE NO. 7, DRILL HULETT WELL

PUMPING LEVEL