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INITIAL REVIEW OF WATER QUANTITY AND QUALITY DATA FROM FOUR GEC GAS EXPLORATION WELLS IN DELTA COUNTY

EXECUTIVE SUMMARY

As part of Gunnison Energy Corporation's (GEC) commitment to sharing non-proprietary information obtained from the exploratory drilling program, Wright Water Engineers, Inc. (WWE) was asked to prepare an initial assessment report (initial report) summarizing the information obtained to date. The information was compared to WWE's March 2003 report entitled, *Analysis of Potential Impacts of Four Exploratory Natural Gas Wells to Water Resources of the South Flank of the Grand Mesa, Delta County Colorado.*

Data obtained from the four-well exploration program indicate that the March 2003 WWE report reasonably portrayed the geologic, hydrogeologic and hydrologic conditions. A side-by-side comparison of exploration observations to statements made in the March 2003 report is provided in Section 5.0 (Conclusions) of this report. The findings contained in this initial report were submitted to an independent body for peer review. Major findings in the report are as follows:

- The local water supplies were protected from GEC's drilling and exploration activities at the Spalding Peak #1, Dever Creek #1, Lone Pine #1 and Stevens Gulch #1 wells by using solid steel casing and cement as physical barriers.

- GEC did not encounter potable surface water at depths greater than approximately 800 feet. GEC encased each well in steel and cement to a depth below the potable water-bearing intervals, removing the potential risk of connection to saline water.

- Hydraulic fracturing data show that the uppermost fractures are far beneath the ground surface. No connection between the hyrdrofractures and shallow groundwater was established in any of the four wells, based on hydraulic pressure plots obtained during stimulation and the depths where the fracturing occurred.

- Each exploration well was drilled to an average depth of 2,400 feet or the depth of the Rollins Sandstone (i.e., the lowermost sandstone of the Mesaverde Formation immediately below the coal-bearing portion of the formation.) Very little water was evident at such depths. Analysis performed on the water encountered at these levels revealed that it was non-potable with average total dissolved solids (TDS) values between 3,900 and 14,695 (U.S. Environmental Protection Agency's [USEPA] secondary drinking water standard is 500 mg/L).

- The first naturally occurring gas was observed at depths ranging from 310 to 720 feet, at concentrations potentially perceptible in water-supply wells. The presence of gas at these depths is natural and not the result of GEC's exploration program.

- Water samples taken from Lone Pine #1, naturally produced between 1,850 and 2,250 feet, demonstrated that the water is not suitable for potable purposes. This interval was cemented and sealed off from the exploration well. Inflows appear to be associated with existing fractures.

- Onsite geological logs show very little water was evident in the Stevens Gulch #1.

- Naturally occurring water inflows at Dever Creek #1 were encountered in the interval from 300 to roughly 450 feet below the ground surface. This interval was encased in cement, causing no adverse impact to the water supply. Subsequent drilling at deeper depths found very little water.

- In Spaulding Peak #1, as expected, water was encountered in the colluvium at shallow depths to approximately 200 feet. This upper zone was cased and cemented. Intermediate casing was set and cemented to 1,200 feet. Drilling logs show little to no water inflow (except that associated with hydraulic fracturing of the A- and B-seam coal) at depths below about 200 feet. Water samples taken from the stimulated A- and B-seam coals over a three-day period revealed high TDS, sodium, potassium, chloride and bicarbonate concentrations, making it non-potable.

Please refer to Section 5 for a more detailed discussion of findings and conclusions.

1.0 INTRODUCTION

Between July and November, 2003 GEC drilled, constructed and conducted initial testing of four gas exploration wells on private property in Delta County, Colorado. As part of GEC's commitment to sharing non-proprietary information obtained from the exploratory drilling program, WWE was asked to prepare this initial report to summarize the information obtained to date and to compare these observations to those described and discussed in WWE's March 2003 report entitled, *Analysis of Potential Impacts of Four Exploratory Natural Gas Wells to Water Resources of the South Flank of the Grand Mesa, Delta County, Colorado.* The March 2003 report described the anticipated effects that GEC's four-well gas exploration program would have on the surface water and groundwater resources of Delta County. A January 2003 report by WWE previously described the baseline water resources of a 756-square-mile study area that included parts of Gunnison and Delta Counties (the study area encompassed the four gas exploration wells).

A summary of the major conclusions reached by WWE in the March 2003 well impact report is as follows:

- No adverse effects to local water wells are expected due to protective measures during drilling operations, the limited extent of hydraulic fractures, and the vertical separation distance between the water wells and the top of hydraulic fracture zones.

- No impact to surface water from hydraulic stimulation will occur because there will be no hydraulic connection between the fracture zone and the surface water.

- No impact to surface waters from produced water will occur. Produced water will be collected and transported to a licensed disposal facility. Potential impacts from stormwater runoff will be controlled by an array of best management practices (BMPs), which will be regularly and carefully monitored and maintained.

This initial report will compare these major conclusions (along with more specific conclusions, provided in Section 5) from the March 2003 report against information obtained by GEC and their subcontractors during the past five months of drilling, construction and testing of the four gas exploration wells. Because of their proprietary nature, details regarding gas production quantities and gas-producing intervals are not discussed in this report.

This report focuses on downhole data, rather than surface data. Mr. Bruce Bertram and other representatives of Delta County regularly field inspected the four wells and monitored potential impacts to surface waters of the drilling operations, including the access roads.

In preparation of this report, WWE reviewed the following:

- Daily drilling reports prepared by GEC for each of the four wells.
- Mud logs, mud log reports and geologic sample logs prepared by Summit Consulting, Inc. (a contractor to GEC).
- Numerous geophysical logs generated by Halliburton Energy Services and Mesa Wireline, LLC.
- Water chemistry data from Halliburton Energy Services and Environmental Science Corporation for water samples obtained from three of the gas exploration wells.
- Pressure plots generated by Halliburton Energy Services during the downhole stimulation of the four gas exploration wells.

Consistent with the previous reports that WWE prepared for GEC, this report was peer-reviewed by Dr. Neil Grigg, P.E., of Colorado State University, Dr. Tissa Illangaskare, P.E., of the Colorado School of Mines and Mr. Paul Oldaker, Consulting Hydrogeologist. Mr. Oldaker assisted with geophysical log inspection due to his expertise in this area. Messrs. John Rold, C.P.G., and C. Richard Dunrud, P.E., assisted WWE with report preparation. WWE staff that prepared the report were Gary Witt, P.G., E. Robert Weiner, Ph.D., and Jonathan E. Jones, P.E.

2.0 BACKGROUND

In June and July 2002, GEC obtained four gas exploration-drilling permits from the Colorado Oil and Gas Commission. These permits allowed for the drilling, construction and testing of four natural gas exploration wells on private property in Delta County on the South Flank of Grand Mesa (see Figure 1). The name and location of each of these four wells is as follows:

- Lone Pine #1: SE¼ NW¼ Sec. 25, T12S, R91W
- Stevens Gulch #1: SE¼ NE¼ Sec. 1, T13S, R92W
- Dever Creek #1: SE¼ NW¼ Sec. 12, T13S, R93W
- Spaulding Peak #1: SW¼ NW¼ Sec. 24, T12S, R94W

GEC subsequently applied to Delta County for local approval of the gas exploration program. Delta County initially denied (July 22, 2002) all but one of the exploratory wells citing, among other things, concerns regarding the potential impact to the water resources of the County.

At that time, GEC hired WWE to conduct a baseline water resources assessment of a 756-square-mile study area in parts of Gunnison and Delta Counties. The purpose of the study was to establish surface water and groundwater baseline data against which potential effects of the exploratory drilling program were to be assessed. WWE subsequently prepared the previously described well impact assessment report for the four exploratory wells.

A Specific Development Permit was issued by Delta County to GEC for these four gas exploration wells on April 21, 2003.

2.1 Gas Exploration Well Drilling, Construction and Testing—A General Description

Some basic understanding of gas exploration well drilling, construction and testing is required to interpret the breadth of the data collected by GEC and discussed in this report. Accordingly, a general description of the exploration process is provided below:

- For each proposed exploratory drilling site, there is a corresponding depth of exploration or total depth (T.D.) which generally corresponds with the deepest formation that the exploration company proposes to evaluate.

- The size of the drill hole is a function of the diameter of the deepest well casing (production casing) that will be installed into the lowest reaches of the exploratory well and the amount of cement placed in the annular space (the area between the casing and the well bore) to obtain a satisfactory bond between the casing and the well bore. GEC used a 5.5-inch outside diameter (O.D.) production casing size on each of the four gas exploration wells. As a result, the minimum borehole diameter required to facilitate installation and cementing of the production casing was 7.875 inches.

- Production casing, however, is not the only casing set in a gas exploratory well. At a minimum, the Colorado Oil and Gas Commission requires that 40 feet of steel conductor casing (i.e., conductor pipe) be set to maintain a stable near-surface hole inside which the remainder of the well is to be constructed. The size of the conductor pipe and corresponding borehole is a function of the number of casings that will be set, which, in turn, is a function of the geologic conditions at the exploration site. A 16-inch diameter conductor pipe is generally large enough to allow for the installation of two sets of casing in addition to the production casing.

- Most gas exploration wells include the drilling and installation of steel surface casing. Surface casing (larger diameter than the production casing and smaller than the conductor pipe) is set from the ground surface to some relatively shallow depth which is sufficient to seal off shallow, potable groundwater. Surface casing prevents surface collapse of the well and supports those potentially unstable shallow geologic materials that are subject to movement when left unsupported in the well bore. Normally, this surface casing is set (i.e., cemented in place) to a depth several hundred feet into the consolidated bedrock surface.

- In some instances, there is need to stabilize more than one down-hole interval. Those casings that are set in-between the surface and production casing are aptly called intermediate casings.

- Gas exploration well casings are relatively standard in diameter. Typical production casing has an outside diameter of 5.5 inches. Outside casing diameters generally increase in 1-inch increments up to 12 inches (i.e., 6.625, 7.625, 8.625, 9.625, 10.75, 11.75 and 12.75) and in 2-inch increments up to 36 inches. The number of casings to be set in a particular well will establish the casing sizes. Each successive (deeper) casing interval must first be drilled with a bit small enough to fit through the previously set casing allowing room for placement of cement.

- Each of these steel casings is set in place with cement as a means to isolate the geologic formations from each other and the well casing. A high quality bond is required to guarantee an effective testing program. As a result, numerous methods may be employed to assess the cement bond between the casing and the formation. The most widely used method involves the use of sound waves emitted continuously from a device lowered into the well to assess the location and integrity of the cement and its bond with the casing and the formation. The information obtained from this sonic evaluation is called a cement bond log.

- While the well is being drilled, formation materials (cuttings) are circulated to the surface by the drilling fluids. A geologist then collects and describes the samples at 10-foot intervals. The returned cuttings are also analyzed for hydrocarbons using a "sniffing" device that can differentiate numerous gas types and their relative proportions. The accumulated collection of gas content and lithologic descriptions is referred to as the mud log. This mud log is a vital piece of the gas exploration program in that it is the initial evaluation tool used to identify those geologic formations or intervals with oil or gas potential. This mud log aids in decisions made regarding the intervals to perforate and hydraulically stimulate (hydrofrac or frac).

- The drilling fluid serves several functions. Its primary purpose is to move or circulate the cuttings from the cutting device (bit) to the surface where the cuttings are removed and the fluid is circulated back down the hole. The fluid also serves to keep the bit cool and provide sufficient pressure on the side of the borehole to prevent it from collapsing onto the drill bit. Numerous types of drilling fluids may be used provided they meet the aforementioned criteria and are not detrimental to the drilling environment. This includes water, air and/or a combination, either with or without other additives. Commonly, bentonite and polymers are added to water to create a drilling fluid or mud that has a viscosity greater than water to assist in the circulation of fluids from greater depths. Shallower wells sometimes use air and a water mist (sometimes with foam) to circulate the cuttings. The air/mist method allows for more direct observation of cuttings and identification of water production from the interval being drilled. Heavier drilling muds (i.e., those with bentonite and other clay-like additives) tend to mask the water production unless the pressure of the groundwater is greater than the hydrostatic pressure exerted by the drilling mud and the water is of sufficient quantity to noticeably dilute or cut the mud.

- Prior to the cementing of the casing string, several downhole techniques are generally employed to assess the lithology and formation properties of the materials through which the drill has passed. Most of these techniques involve the continuous raising of a tool on a cable that can both transmit and receive electrical or radioactive impulses as they travel out into and respond back from the drilled geologic formations. The general name for the collection and evaluation of information by these instruments is borehole geophysics and the resulting information obtained is called a geophysical log. Most geophysical logging techniques are most effective when completed in an open hole (i.e., prior to placement and cementing of casing). Geophysical logging techniques are primarily used to identify lithology, the presence or absence of water/hydrocarbons, and rock properties such as porosity and density. An understanding of the most common borehole geophysical logs is important to interpret the information that is collected and analyzed as part of an exploration program. A general description of the geophysical logs obtained and used in the GEC gas exploration program is provided in Appendix A.

- Analysis of the mud log, drill cuttings or cores, and borehole geophysical logs enables the exploration team to assess which gas-bearing intervals appear to have sufficient porosity and potential gas yield. These become target zones for perforation and evaluation. Note that after the well is drilled and the casing strings are cemented in, there is no direct communication between the inside of the production casing and the geologic formations (or groundwater). This contact is made in the specific target intervals by perforating both the casing and cement. The production casing is perforated by means of a shaped charge (high pressure gas stream) that is projected through the casing and cement leaving small diameter holes. Several shaped charges are loaded into a hollow steel carrier known as a perforating gun. The shaped charges are connected by primer cord and are fired simultaneously. The charges are spaced and placed in the gun so as to perforate at specific intervals. Perforation of each target zone is generally conducted from the bottom of the zone to the top and from the deepest target zone to the shallowest target zone.

- Once the perforations have been created, inflatable devices known as packers are placed in the production casing above and below one or more selected perforated intervals so that they can be isolated from the rest of the production casing. This enables direct analysis of gas and/or water production from that interval. If the permeability of the target formation is low, hydrofracing may be conducted. This technique involves forcing a pressurized fluid into the pore spaces of the target formation to dilate those pores and fracture the rock. Generally, a propping agent (usually sand) is introduced with the fluid to help hold open the pore spaces after the pressure on the fracing fluid is dropped. The over-pressurized formation then drives the fracing fluid back toward the well casing where it is pumped to the surface. Typically, much of the stimulation fluid (although not all) is recovered from the formation. Direct analysis of gas and water production is again assessed. This isolation and analysis process is repeated for each of the targeted production zones until all zones have been evaluated. In some cases the perforated intervals are isolated and cemented off and in other cases they are left open for further evaluation and potential production.

- At the surface, several fluid tanks are located in close proximity to the well. These are used to hold the fracing fluid during the stimulation process and to collect the returning fluid upon recovery. Generally, during the exploration program, the produced gas is flared (burned off) or vented (there is usually no direct means to transport the gas) and the water is hauled off in trucks for disposal either in an injection well or by other means approved by the Colorado Oil and Gas Commission and Colorado Department of Public Health and Environment.

3.0 EXPLORATION PROGRAM DATA

As of December 2003, GEC has completed the drilling, construction and initial testing of four permitted gas exploration wells on private property in Delta County. Each exploration well was drilled to the depth of the Rollins Sandstone (i.e., the lowermost sandstone of the Mesaverde Formation immediately below the Coal Bearing Member of the formation). Both the Stevens Gulch #1 and Spaulding Peak #1 wells were drilled deep enough to assess the upper portion of the underlying Mancos Shale beneath the Rollins Sandstone.

Each of the exploration wells was hydraulically stimulated with non-hazardous fluids in the Coal Bearing Member of the Mesaverde Formation.

Specific information obtained from the initial gas exploration program is provided below. The information for each well is presented in the order that it was drilled.

3.1 Lone Pine #1

The Lone Pine #1 well is located in the Lone Pine drainage, a tributary of Hubbard Creek (see Figure 1). This well is on the extreme eastern edge of Delta County approximately 5 miles northwest of the town of Somerset and about 0.75 miles north of the active Elk Creek Mine permit boundary.

Drilling of the well occurred between July 24 and August 7, 2003. The well was drilled to a total depth of 2,880 feet below ground surface and continuous core was obtained between 2,218 and 2,409 feet. The well was constructed with 2,873 feet of 5.5-inch production casing and 510 feet of 9.625-inch surface casing. Specific information regarding the total depth drilled, cored intervals, casing sizes and depths, and the type of drilling fluid used is summarized in Table 1. A summary of the geologic formations encountered and their respective depths can be found in Table 2. A wellbore diagram illustrating Lone Pine #1 well details is provided as Figure 2.

The sample log for this well begins at a depth of 50 feet in materials described by the onsite geologist as shale of the Wasatch Formation. The unconsolidated alluvial/colluvial cover overlying bedrock at this well location is, therefore, no more than 50 feet in thickness. There are no known Colorado State Engineer's Office (SEO) permitted water wells within a one-mile radius of this gas exploration well to corroborate this observation. The first indication of naturally occurring gas within the exploration well occurred at 580 feet. Additional gas was noted at 630 feet in association with a minor amount of groundwater (too small to be quantified). The amount of gas is relatively small but could be potentially detectable if water wells were completed to these depths. The occurrence of gas at these depths is natural and not the result of activities associated with the GEC exploration program.

Surface casing (9.625-inch O.D.) was set through the Wasatch Formation into the Ohio Creek Formation on July 26, 2003 (approximately 510 feet below the ground surface). On July 27, 2003, the surface casing was pressurized to 1,600 pounds per square inch (psi) to ensure casing and joint integrity. There was no reported loss in pressure during this testing.

The well was initially drilled with air/foam/mist to a depth of 2,409 feet (into the Coal Bearing Member of the Mesaverde Formation). Of this amount, the interval from 2,218 to 2,409 feet was core drilled to obtain *in situ* samples of the formation. The use of air/foam/mist as a drilling fluid enables more accurate and direct observations of groundwater inflows as they occur. For this reason, GEC attempted to use this type of drilling fluid as much as possible on the four subject gas exploration wells.

Small groundwater inflows were noted (too small to be quantified) at depths of 632 feet and again at 1,250 feet. During air/foam/mist drilling on July 29, 2003, the drillers noted a groundwater inflow at a depth of about 1,850 feet in a fractured sandstone lens within the Barren Member of the Mesaverde Formation or Upper Mesaverde Formation (see Table 4). This inflow was estimated at 30 barrels per hour (bph) or 21 gallons per minute (gpm). Drilling continued with air/foam/mist to a depth 2,218 feet with additional water inflow increasing to 35 bph (24.5 gpm) at a depth of 2,190 feet (all within the Upper Mesaverde Formation). At 2,218 feet, core drilling began and continued to a depth of 2,409 feet. On July 31, 2003, a notation in the daily drilling report indicates that the hole was producing about 30-40 bph (21-28 gpm) while coring between 2,251 and 2,347 feet. A sample of the water produced from between 1,850 and 2,250 feet was obtained for water quality analysis. The results of this analysis (LP-GW1) are presented and discussed in the next section of this report.

At a depth of 2,409 feet, degrading hole conditions (sticking of the bit) forced the drilling program to convert to a mud-based drilling fluid. Core samples in this interval revealed a high angle fracture lined with calcite. Severe lost circulation occurred during the mud drilling and a large amount of lost circulation material (cedar fiber and sawdust) was required to maintain circulation. Circulation was regained and drilling continued. An estimated 2,775 barrels of fresh water was lost in the interval between the E- and D-seam coals of the Coal Bearing

Member of the Mesaverde Formation. This loss of fluid indicates increased formation permeability (possibly as fractures) with a formation potentiometric pressure less than that of the drilling fluids.

Upon converting to a mud-based drilling fluid, core drilling was terminated and the hole was extended to a T.D. of 2,880 feet. Upon reaching the T.D., numerous geophysical logs were obtained. A list of the geophysical logs and the logging companies used to obtain them is summarized in Table 3.

Production casing (5.5-inch outside diameter [O.D.]) was placed from 2,873 feet to the surface (see Table 1) and cemented from T.D. to 850 feet below the ground surface. On August 15 and again on August 18, 2003, the production casing was pressurized to 2,000 and 5,000 psi, respectively, to ensure casing and joint integrity. There was no reported loss in pressure during this testing.

Based on information obtained during the drilling and geophysical logging portion of the exploration program, GEC decided to perforate and stimulate the B-seam coal, the D-seam coal and a sandstone unit approximately 40 feet above the D-seam coal.

No groundwater inflow was noted after perforation of the B-seam coal between 2,768 and 2,794 feet. The B-seam was stimulated by injecting into this interval approximately 617 barrels of fracing fluid along with 20/40 sand (as a propping agent). Approximately 89% of the frac fluid volume was recovered over five days. No groundwater was sampled for analysis from this interval.

The perforation and stimulation of the D-seam coal (2,424 to 2,434 feet) and the overlying sandstone (2,374 to 2,382 feet) was completed simultaneously. This produced approximately 30 bph (21 gpm) of groundwater inflow to the well. Approximately 580 barrels of fracing fluid along with 20/40 sand (as a propping agent) was injected into this interval. In two days the well had returned a volume of fluid greater than that used in the stimulation. Three days following stimulation, 172% of the injected fluid volume had been removed from the formation. Two samples of the recovered fluid (LP-GW2 from the sandstone and LP-GW3 from the D-seam coal) were obtained at that time and submitted to a water quality laboratory for analyses (see results and discussion in the next report section). This well is now shut-in for the winter and will be further evaluated in the spring of 2004.

Table 4 summarizes the stimulation and water inflow observations for this well.

3.2 Stevens Gulch #1

The Stevens Gulch #1 well is located near the hydrologic divide between the Stevens Gulch drainage and the drainage of the West Fork of Terror Creek (see Figure 1). The well is approximately 6.5 miles northwest of Paonia and about 0.25 miles north of the active Bowie #1 Mine permit boundary.

The well was drilled between August 9 and August 22, 2003 to a total depth of 2,400 feet below ground surface. Continuous core was obtained between 1,188 and 1,458 feet. The well was constructed with 2,152 feet of 5.5-inch production casing and 630 feet of 9.625-inch surface casing. Specific data regarding the total depth drilled, cored intervals, casing sizes and depths, and the type of drilling fluid used are summarized in Table 1. A summary of the geologic formations encountered and their respective depths can be found in Table 2. A wellbore diagram showing Stevens Gulch #1 well characteristics is provided as Figure 3.

The mud log for this well begins at a depth of 100 feet in materials described by the onsite geologist as shales and sandstones of the Ohio Creek Formation. The unconsolidated alluvial/colluvial cover overlying bedrock at this well location is, therefore, less than 100 feet in thickness. This is consistent with the 32-foot depth of the only known permitted water well (SEO Permit No. 11687) within a one-mile radius of the gas exploration well. The first indication of naturally occurring gas within the exploration well occurred at a depth of 720 feet and is associated with a minor amount of groundwater. The amount of gas is relatively small but could be potentially detectable if water wells were completed to these depths. The occurrence of gas at these depths is natural and not the result of activities associated with the GEC exploration program.

Surface casing (9.625-inch O.D.) was set through the Ohio Creek Formation into the Upper Mesaverde Formation (approximately 630 feet below the ground surface). On August 12, 2003, the surface casing was pressurized to 1,500 psi to ensure casing and joint integrity. There was no reported loss in pressure during this testing.

The well was initially drilled with air/foam/mist to a depth of 1,458 feet (into the Coal Bearing Member of the Mesaverde Formation). Of this amount, the interval from 1,188 to 1,458 was core drilled to obtain *in situ* samples of the formation.

Very little water inflow was noted by the onsite geologist while core drilling with air. At 1,458 feet, the hole was mudded up (flooded with a mud-based drilling fluid). The remainder of the well (T.D. of 2,400 feet) was drilled with a mud-based drilling fluid. Driller's information makes no mention of any additional water inflows. Therefore, no groundwater was sampled for analysis from this well.

Upon reaching 2,400 feet, hole instability forced casing to be set in the well before open-hole geophysical logs could be run. Several logs were run on this well from inside the production casing. These logs obtained similar information as those run in an open hole but collected in a different manner. A list of the geophysical logs and the logging companies used to obtain them is summarized in Table 3.

Production casing (5.5-inch O.D.) was placed from 2,152 feet to the surface (see Table 1) and cemented from T.D. to 960 feet below the ground surface in two stages. On September 12 and September 15, 2003, the production casing (with installed wellhead) was pressurized to 3,000 psi to ensure casing and joint integrity. There was no reported loss in pressure during either test.

Based on information obtained during the drilling and geophysical logging portion of the exploration program, GEC decided to perforate and stimulate the B- and C-seam coal.

No groundwater inflow was noted after perforation of the B-seam coal between 1,783 and 1,800 feet. Approximately 1,857 barrels of fracing fluid along with 20/40 sand (as a propping agent) was injected into this interval. Approximately 20% of the frac fluid volume was recovered over three days. No recovery fluid was sampled from this well.

Similarly, no groundwater inflow was noted after perforation of the C-seam coal between 1,692 and 1,700 feet. Approximately 1,085 barrels of fracing fluid along with 20/40 sand (as a propping agent) was injected into this interval. Approximately 19% of the frac fluid volume was recovered over two days, before the bridge plug was drilled and the B- and C-seams were co-mingled. Approximately 26% of the fluid in both fractures was recovered as of the date of this report. This well is now shut-in and subject to potential re-evaluation in the spring of 2004. No recovery fluid was sampled from this well.

Table 4 summarizes the stimulation and water inflow observations for this well.

3.3 Dever Creek #1

The Dever Creek #1 well is located in the headwaters of the Dever Creek drainage. The well is approximately 10 miles north of Hotchkiss (see Figure 1).

Drilling of the well occurred between September 18 and October 11, 2003. The well was drilled to a total depth of 2,575 feet below the ground surface and continuous core was obtained between 2,100 and 2,369 feet. The well was constructed with 2,560 feet of 5.5-inch production casing, 1,464 feet of 8.625-inch intermediate casing, and 300 feet of 11.75-inch surface casing. Specific information regarding the total depth drilled, cored intervals, casing sizes and depths, and the type of drilling fluid used is summarized in Table 1. A summary of the geologic formations encountered and their respective depths can be found in Table 2. A wellbore diagram showing Dever Creek #1 well characteristics is provided in Figure 4.

The mud log for this well begins at a depth of 80 feet in materials described by the onsite geologist as sandstones of the Wasatch Formation. The unconsolidated alluvial/colluvial cover overlying bedrock at this well location is, therefore, less than 80 feet in thickness. This is consistent with the 45-foot depth of the only known permitted water well (SEO Permit No. 29517) within a one-mile radius of the gas exploration well. The driller's report for this water supply well indicates that the water-bearing materials are unconsolidated colluvium. The first indication of naturally occurring gas within the exploration well occurred at a depth of 310 feet and is associated with an inflow of groundwater. The amount of gas is relatively small but could be potentially detectable if water wells were completed to these depths. The occurrence of gas at this depth is natural and not the result of activities associated with the GEC exploration program.

The well was initially drilled with air/foam/mist to a depth of 300 feet. Surface casing (11.75-inch O.D.) was set through the Wasatch Formation into the Ohio Creek Formation (approximately 300 feet below the ground surface). On September 21, 2003, the surface casing was pressurized to 1,500 psi to ensure casing and joint integrity. There was no reported loss in pressure during this testing.

After setting surface casing at 300 feet, drilling commenced again with air/foam/mist and a groundwater inflow was encountered just below the bottom of the surface casing. The onsite geologist noted an estimated groundwater inflow of 50-75 bph (35-53 gpm) continuously while drilling from 300 to 771 feet where the drilling fluid was converted to mud. Approximately 280 feet of this drilled section (308 to 588 feet) was through an igneous body (probably a dike). Although the dike was encountered for 280 feet in the drill hole, the dike is most likely nearly vertical and only 10 to 20 feet in true thickness. Water samples were obtained from a depth of 407 and 437 feet within the igneous body and submitted to a laboratory for analysis (see results and discussion in the next report section.

Upon converting to a mud-based drilling fluid, the hole was extended to a depth of 1,500 feet where an intermediate casing string was to be set. Upon reaching this depth, several geophysical logs (see Table 3) were obtained and an 8.625-inch O.D. intermediate casing string was set to 1,464 feet. This intermediate casing was cemented from 1,464 to 332 feet below the ground surface in two stages.

Drilling below the intermediate casing was initiated using air/foam/mist and continued to a depth of 2,572 feet. The interval from 2,100 to 2,369 feet was core drilled to obtain *in situ* samples of the formation. Air/foam/mist drilling continued to a depth of 2,572 feet where degrading hole conditions (sticking at the bit) caused the drillers to convert to a mud-based drilling fluid. Due to severe lost circulation and mechanical difficulties with the rig, only 3 feet of additional hole was drilled. Upon reaching the T.D. of 2,575 feet, numerous geophysical logs were obtained (see Table 3).

Production casing (5.5-inch O.D.) was placed from 2,560 feet to the surface (see Table 1) and cemented from T.D. to the ground surface in three stages. On October 30, 2003 the production casing was pressurized to 3,000 psi to ensure casing and joint integrity. There was no reported loss in pressure during this testing.

Based on information obtained during the drilling and geophysical logging portion of the exploration program, GEC decided to perforate and stimulate the A-, B- and C-seam coals as well as a sandy interval above the coal seams from 1,780 to 2,093 feet.

The B-seam coal was perforated and evaluated with an injection test to determine permeability and other reservoir characteristics separately from the A- and C-seam coals. The A- and C-seam coal were then perforated and stimulated simultaneously. No groundwater inflow was noted after perforation of these intervals.

The total coal interval from 2,372 to 2,440 feet was fractured with approximately 2,085 barrels of fracing fluid along with 20/40 sand (as a propping agent. In eight days, the well had returned a fluid volume approximately 39% of that injected during stimulation. No recovery fluid was sampled from this well.

No groundwater inflow was noted following perforation of the sandy interval from 1,780 to 2,090 feet. Stimulation of this interval has yet to occur because the well has been shut-in for the winter.

Table 4 summarizes the stimulation and water inflow observations for this well.

3.4 Spaulding Peak #1

The Spaulding Peak #1 well is located on a hydrologic divide between the Surface Creek drainage and the drainage of Milk Creek (see Figure 1). The well is approximately 8 miles northeast of Cedaredge (see Figure 1).

Drilling of the well occurred between September 28 and October 23, 2003. The well was drilled to a total depth of 3,525 feet below the ground surface and continuous core was obtained between 2,864 and 3,247 feet. The well was constructed with 3,522 feet of 5.5-inch production casing, 1,201 feet of 8.625-inch intermediate casing, and 210 feet of 11.75-inch surface casing. Specific information regarding the total depth drilled, cored intervals, casing sizes and depths, and the type of drilling fluid used is summarized in Table 1. A summary of the geologic formations encountered and their respective depths can be found in Table 2. A wellbore diagram showing Spaulding Peak #1 characteristics is provided as Figure 5.

The mud log for this well begins at a depth of 80 feet in materials described by the onsite geologist as andesite boulders, presumably from the basalt flows capping Grand Mesa. The unconsolidated alluvial/colluvial cover associated with these basalt boulders continues to a depth of approximately 125 feet below the ground surface. This is about half of the 247-foot depth of the only known permitted water well (SEO Permit No. 226725) within a one-mile radius of the gas exploration well. The driller's report for this water supply well indicates that all water is from the unconfined, unconsolidated zone.

The well was initially drilled with air/foam/mist to a depth of approximately 82 feet where poor borehole conditions (i.e., water and boulders falling into the hole) caused the drillers to convert to a mud-based drilling fluid. The drilling depth was extended to a depth of 320 feet where surface casing was to be set within the unconsolidated materials to seal off water inflow and prevent boulders from collapsing into the hole and locking up the drill pipe.

Surface casing (11.75-inch O.D.) was set to a depth of only 210 feet due to a protruding rock in the borehole at that depth. The surface casing was cemented from 210 feet to the surface. On

October 5, 2003, the surface casing was pressurized to 1,500 psi to ensure casing and joint integrity. There was no reported loss in pressure during this testing.

Drilling below the surface casing was initiated using air only and continued to a depth of 1,201 feet. Nearly all of the drilled section between 300 and 745 feet was described as andesite by the onsite geologist. This andesite description is anomalous given the observation of sandstone bedrock materials at a depth of approximately 200 feet. Nonetheless, only 70 feet of this interval is described as sandstone or siltstone of the Wasatch Formation. An intermediate casing string was set through this interval and into the Ohio Creek Formation (approximately 1,201 feet below the ground surface). This intermediate casing was cemented from 1,201 feet to the ground surface in two stages. No water was encountered in this section.

After setting the 8.625-inch O.D. intermediate casing, drilling continued with air/foam/mist to a depth of 2,715 feet. The drillers converted to a mud drilling fluid at 2,715 feet. Even though the well was drilled with air and air/mist from 320 to 2,715 feet, no groundwater was observed in this interval. The remainder of the well was drilled with a mud-based drilling fluid.

The interval from 2,864 to 3,247 feet was core drilled with mud to obtain *in situ* samples of the formation. The remainder of the hole was drilled with mud to a T.D. of 3,525 feet. Upon reaching T.D., numerous geophysical logs were obtained (see Table 3).

Production casing (5.5-inch O.D.) was placed from 3,522 feet to the surface (see Table 1) and cemented from T.D. to the ground surface in two stages. On November 5, 2003 the production casing was pressurized to 3,000 psi to ensure casing and joint integrity. There was no reported loss in pressure during this testing.

Based on information obtained during the drilling and geophysical logging portion of the exploration program, GEC decided to perforate and stimulate the A- and B-seam coals.

No groundwater inflow was noted after perforation of the A-seam coal between 3,161 and 3,187 feet or the B-seam coal from 3,104 and 3,135 feet. The A- and B-seam coals were perforated and tested individually and they were stimulated at the same time. Approximately 1,587 barrels of fracing fluid along with 20/40 sand (as a propping agent) was injected into this interval. Approximately 89% of the frac fluid volume was recovered over a period of 12 days. Several recovery fluid samples from the stimulated interval were obtained from this well for laboratory analysis. The averaged results and discussion in the next report section. Recovery analysis is continuing as of the writing of this report.

Table 4 summarizes the stimulation and water inflow observations for this well.

4.0 ANALYSIS

The drilling and construction of the four gas exploration wells on private property in Delta County occurred over a three-month period between July and October 2003. In general, the geologic formations encountered were similar to those projected prior to drilling and represented in the March 2003 WWE report. The noted exception was the andesitic volcanic dike (igneous intrusion) in the Dever Creek #1 well (308 to 588 feet) and the unexplained andesitic materials beneath the first described bedrock in the Spaulding Peak #1 well. (Note: Andesite is a petrographic name given to a finely crystalline igneous rock that has more than 65% plagioclase feldspar and less than 20% quartz. This rock name is also associated with the basalt flows that cap Grand Mesa.)

The observed depths for each of the formations encountered were within 100 feet of those anticipated for those formations located above the Coal Bearing Member. Due to varying coal seam thickness, the encountered depths for the coal seams and formations underlying them were slightly greater (up to 200 feet).

As presented in the March 2003 report, GEC proposed to explore five potential zones for gas production. These included: (1) the Upper Mesaverde Formation, (2) the Coal Bearing Member of the Mesaverde Formation, (3) the Rollins Sandstone, (4) the Cozzette Sandstone, and, where applicable, (5) the Corcoran Sandstone. Each of the four gas exploration wells were completed through the first three exploration zones, if they existed (the Rollins Sandstone was apparently missing in the Dever Creek #1 well).

Downhole perforations completed to date were confined to the Barren Member and the Coal Bearing Member. Formation stimulations to date were confined to the Coal Bearing Member. Available hydraulic pressure plots associated with the stimulations were reviewed. These data appear to show that the hydraulic pressures exerted on the formation never exceeded the initial fracture pressure. This leads to the conclusion that the hydraulic fracturing stayed within the anticipated stimulation zone.

Each of the wells was initially drilled with an air/mist or air/foam/mist drilling fluid to maximize the observation of groundwater inflows, particularly near the unconsolidated surficial materials where the majority of domestic water supply wells are located. Circulation and borehole stability problems eventually caused the drillers to convert to a mud-based drilling fluid in order to prevent the loss of the well. While drilling with a mud-based drilling fluid makes it more difficult to identify each groundwater inflow, if a significant inflow was encountered, it would be noted due to the rise of fluid levels in the surface mud pits or by the dilution of the drilling mud.

Surface casing was set sufficiently deep to case or cement off the groundwater inflows encountered in the unconsolidated deposits overlying the bedrock formations. This construction process effectively prevents the interaction of the shallow water-bearing materials with the gas exploration activities within the production casing. In both the Dever Creek #1 and Spaulding Peak #1 wells, an intermediate casing was set and cemented to further protect the potential water resources to an even greater depth than those associated with the unconsolidated deposits. As stated in WWE’s March 2003 report, only the Spaulding Peak #1 well had originally been planned to have an intermediate casing.

Groundwater inflows were recorded in driller’s and/or onsite geologist’s notes for each of the four gas exploration wells. However, the inflow in the Stevens Gulch #1 well was so small that no sample was brought to the surface and submitted to a laboratory for analysis. Of the other three exploration wells, significant bedrock inflows below 1,000 feet were noted only in the Lone Pine #1 well.

The occurrence of groundwater in each of the gas exploration wells and their significance relative to impacts on the water resources of the area are discussed below.

4.1 Lone Pine #1—Inflows and Water Quality

Small groundwater inflows (630 and 1,250 feet) were noted below the surface casing depth but were too small to be sampled and quantified. These depths correspond with inflows from the Ohio Creek and Upper Mesaverde Formation, respectively. A more significant inflow (approximately 30-35 bph, 21 to 24.5 gpm) was noted between 1,850 and 2,250 feet (all within the Upper Mesaverde Formation). This interval was cemented and cased off behind the production casing.

A water quality sample was obtained from this interval and submitted to a laboratory for analysis. Table 5 includes a summary of the water quality analysis for this sample. The TDS concentration (3,900 milligrams per liter [mg/L]) is too high to be fresh or potable (i.e., less than 1,000 mg/L dissolved solids). Sodium is the major cation although its concentration (510 mg/L) is much less than is typical of coal seam groundwater (normally higher than 1,000 mg/L). Significant concentrations of calcium, magnesium and sodium suggest that this water is likely a mixture of drilling fluid from a surface pond and formation water with a combined TDS value well above the USEPA secondary safe drinking water standard of 500 mg/L for dissolved solids.

Groundwater inflows were not expected in this exploration well due to its proximity to the numerous dry coal resource evaluation holes drilled in association with the nearby Oxbow Mine. Electro-Magnetic Imaging (EMI) logs reveal several fractures in the sandstone units within this interval (1,850 to 2,250 feet) which are the likely source of the groundwater. Groundwater inflows from fractures in the coal mines of the area tend to be limited in extent, producing large initial inflows that steadily decline as the volume is drained. In general, this is the only type of groundwater encountered in these coal mines, which commonly have to import water (into the mines) for operational uses. The observed groundwater inflow from 1,850 to 2,250 feet was of a similar nature and would likely have decreased over time if it had not been cemented off behind the production casing.

Hole degradation problems at a depth of 2,409 feet caused the drillers to convert from air/mist to a mud-based drilling fluid. The loss of drilling fluid in this interval, while drilling with mud, was an indication of increased formation permeability. No other groundwater was reported during drilling or, if encountered, was not in sufficient quantity to noticeably dilute or cut the drilling mud.

Stimulation of the B-seam coal (2,768-2,794 feet) appeared to induce no groundwater flows. The recovered stimulation fluid volume recovered was less (89%) than the volume injected.

Stimulation of both the D-seam coal and a sandstone unit 40 feet above the D-seam resulted in an estimated groundwater flow of 30 bph (21 gpm). Flow rate and hydrostatic pressure were the same in each of these perforated intervals even when sealed off from each other within the casing. This observation indicates hydraulic connection between the two geologic units, that was likely created during well stimulation. Approximately 172% of the stimulation fluid volume was recovered from the well after three days when the hole was shut-in for the winter. GEC plans to return to this well next spring to assess whether the inflows from this interval will remain constant or diminish over time suggesting a finite volume of fluid stored within bedrock fractures.

A sample (LP-GW3) of the recovered stimulation fluid from the D-seam (2,424-2,434 feet) was submitted to a water quality laboratory for analysis. Table 5 includes a summary of the water quality analysis for this sample which shows that the water is a sodium-bicarbonate type with high TDS and very low calcium and magnesium concentrations. This is typical of groundwater in the coal-bearing units of the Mesaverde Formation with no significant contribution from surface/near surface water sources. The elevated chloride and potassium concentrations (which contribute to the elevated TDS value) are the result of the potassium chloride (KCl) used in the frac fluid.

A water quality sample (LP-GW2) was obtained from the sandstone interval (2,374 to 2,382 feet) for analysis. The results are presented in Table 5 and show concentrations similar to those for the D-seam sample. This indicates that the water is from the Coal Bearing Member of the Mesaverde Formation with no significant contributions from surface sources. The increase in TDS with depth (between LP-GW2 and LP-GW3) indicate there is little naturally occurring vertical water flow.

4.2 Stevens Gulch #1—Inflows and Water Quality

A small amount of groundwater inflow was noted in this well below the surface casing at a depth of 720 feet in the Upper Mesaverde Formation. This interval was cemented and cased off behind the production casing so as to no longer have communication with the rest of the gas exploration program.

No additional groundwater inflows were noted during the drilling of the remainder of this well.

Stimulation of the B- and C-seam coals was unable to induce groundwater flows to the production casing. In both cases, the recovered stimulation fluid volume was less than 20% of the volume injected. As a result, no groundwater samples were obtained for analysis.

4.3 Dever Creek #1—Inflows and Water Quality

A significant groundwater inflow (50-75 bph, 35-52.5 gpm) was observed in this well between a depth of 300 and 771 feet. Surface casing was set and cemented to a depth of 300 feet. The largest portion of that inflow appeared to be associated with fractures in an unexpected volcanic dike that was encountered between 308 and 588 feet below the ground surface.

Water samples were obtained at 407 feet, 437 feet (in the volcanic dike interval) and at 771 feet (in the Ohio Creek Formation) for water chemistry analysis. Table 5 includes a summary of the water quality analysis for these samples (DC-GW1, DC-GW2 and DC-GW3, respectively). The samples obtained from the volcanic dike interval appear to be potable and have low TDS (200 and 350 mg/L, respectively) and chloride values (1.5 mg/L and 2.6 mg/L, respectively), characteristic of surface/near surface water sources. The water sample obtained from 771 feet (in the Ohio Creek Formation) is also potable with a somewhat higher TDS concentration (450 mg/L) but is otherwise similar to the other two samples. The analysis for this sample shows that the sodium concentration is higher than the calcium value even though both are low (60 mg/L and 13 mg/L, respectively). Although a sodium/calcium ratio this large would be anomalous for surface water, it has been observed in a few springs on the Grand Mesa and presumably results from the volcanic dike. The increase in TDS with depth indicates little downward water flow.

At a depth of 771 feet, the drillers converted from air/mist to a mud-based drilling fluid and the hole was advanced to a depth of 1,500 feet where an intermediate casing string was set and cemented. No other groundwater was reported during drilling or, if encountered, was not in sufficient quantity to noticeably dilute or cut the drilling mud. Air/mist drilling was again employed to maximize groundwater inflow observations while extending the well depth from 1,500 feet to 2,572 feet. No water was encountered in this portion of the hole. Hole degradation again forced conversion to a mud-based drilling fluid. However, only three additional feet were drilled due to mechanical difficulties and the drilling was terminated.

Perforation and simultaneous stimulation of the A-, B- and C-seam coal was unable to induce groundwater flows to the production casing. The recovered stimulation fluid volume from these three intervals was less than half of the volume injected. As a result, no groundwater samples were obtained from these deeper intervals for analysis.

4.4 Spaulding Peak #1—Inflows and Water Quality

Groundwater inflows in the unconfined, unconsolidated materials were described in both the daily drilling reports and on the geologic sample logs. Implicit in the discussion of boulders falling into the well bore is the fact that the materials surrounding the boulders are saturated and unable to support their weight when adjacent to an open borehole. Based on these descriptions, it appears that saturated, or partially saturated, unconsolidated materials exist at this location to a depth of approximately 125 feet. This is consistent with WWE's characterization of the geology and hydrogeology of the extensive unconsolidated deposits that are found in this area.

Surface casing was set and cemented to a depth of 210 feet, effectively sealing off the unconfined groundwater source behind the casing. Most of the remainder of the well was drilled with air/mist and encountered no additional groundwater inflows. An intermediate casing string was set and cemented at a depth of 1,201 feet. Air/mist drilling continued to a depth of 2,715 feet where gas inflows forced conversion from an air/mist drilling fluid to an aerated mud. A small amount of groundwater inflow was noted at a depth of 2,433 feet while drilling on air/mist (the inflow amount was too small to obtain a sample. No other noticeable quantity of groundwater was reported during drilling with mud.

Perforation and stimulation of both the A-and B-seam coals appeared to produce a flow of approximately 5 bph (3.5 gpm). Recovered fluid volumes exceeded 90% of the injected fluid 17 days after stimulation. Recovery rates appear to be consistent and the recovered volume is expected to exceed 100% of the injected volume.

Five water samples were obtained from the recovered fluids over a three-day period (November 24, 25 and 26, 2003). The results of these analyses were averaged (SP-GW1) and are presented in Table 5. This water is non-potable and characterized by high TDS, sodium, potassium, chloride and bicarbonate concentrations. Potassium and chloride concentrations are especially high. The elevated potassium and chloride concentrations are indicative of the stimulation fluid used (2% KCl) and indicate that a significant amount of fracing fluid was recovered. After accounting for the presence of fracing fluids, the high sodium and bicarbonate levels are typical of water from the Coal Bearing Member of the Mesaverde Formation.

5.0 CONCLUSIONS

In the course of drilling and testing the four gas exploration wells in Delta County described above, considerable data related to geology and water resources were gathered. These data were used to evaluate the reasonableness of the analysis and findings presented in WWE's March 2003 report entitled *Analysis of Potential Impacts of Four Exploratory Natural Gas Wells to Water Resources of the South Flank of the Grand Mesa, Delta County, Colorado*. As Table 6 explains, data from the four exploration wells indicate that the March 2003 WWE report accurately portrayed the geologic, hydrogeologic and hydrologic conditions.

Data collected from these four exploration wells does not permit an assessment of some statements in the WWE March 2003 well impact report, including, as examples:

- Maximum horizontal extent of hydraulic fractures, which was projected to be 500 feet in two directions, or 1,000 feet total.

- Risk of hydraulic stimulation initiating fault movement. This was projected to be insignificant, for many reasons. It is clear from the field data, however, that if any faults were encountered during hydraulic stimulation, there was no significant movement because this would have been detected.

Despite these few limitations, the field data from the four exploration wells collected thus far demonstrate that the March 2003 well impact report was reasonable and that there have not been adverse impacts to water wells or surface waters from drilling and hydraulically stimulating the four wells. Monitoring of these wells will continue in 2004.

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