



September 23, 2009

Certified Mail Return Receipt Requested # 7008 3230 0003 3234 7171

Mr. Bruce Barr
4412 Misty Drive
Colorado Springs, CO 80918-4206

RE: Complaint 200216061
Baseline Monitoring
River Ridge Ranch Lot 129
NWNW 31 29S, 66W Huerfano County, Colorado

Dear Bruce:

COGCC staff collected water samples from your domestic well in response to your request for baseline sampling and analysis. Water samples were collected for general organic and inorganic water quality testing as well as for analysis of dissolved methane and volatile organic compounds and BART test kits. A summary of the results of the chemical analyses is presented below. The analytical results are also compared to published water quality standards and to results of prior testing of water from your well.

FIELD TESTING

Peter Gintautas of the COGCC visited your property on September 1, 2009. I turned on an outdoor spigot at 08:52. The flow remained steady for more than 50 minutes at nearly 10 gallons per minute. The temperature of the water pumped from your well had been stable at 19°C for the last 20 minutes of pumping. Samples were collected at 09:45. The water is pumped directly from the well into a pressure tank in your home. No cistern is present inside or outside of your home. I periodically checked the wellhead for the presence of methane while the pump was operational. No methane was detected at the well head during or shortly after the sampling event. The samples for general chemical analyses were then shipped to Accutest Laboratories in Wheat Ridge, CO and received on September 2, 2009.

COMPARISON OF INORGANIC ANALYTICAL RESULTS TO CDPHE INORGANIC STANDARDS

The Water Quality Control Commission (WQCC) of the Colorado Department of Public Health and Environment (CDPHE) has established "Domestic Use-Quality" human health standards and drinking water standards. Analytical data for the samples from your water well was compared to these standards. This information is summarized in Table 1 which is located in Attachment 1 and discussed in narrative form below. Please keep in mind that these "Domestic Use-Quality Standards" were established for municipal public drinking water supplies and often people use and consume ground water from private wells that exceed these standards. The analytical reports from Accutest Laboratories are included as Attachment 2.

- **Antimony (Sb):** The CDPHE human health standard for antimony is 0.006mg/l. Antimony is a contaminate metal.

Antimony was not detected in the sample collected from your water well.

- **Arsenic (As):** The CDPHE human health standard for arsenic is 0.05 mg/l. Arsenic is a highly poisonous metal.

Arsenic was not detected in the sample collected from your water well.

- **Barium (Ba):** The CDPHE human health standard for barium is 2.0 mg/l. Barium is a contaminate metal.

Barium was detected in the sample collected from your water well at a concentration of 0.0464mg/l which is below the CDPHE human health standard.

- **Beryllium (Be):** The CDPHE human health standard for beryllium is 0.004mg/l. Beryllium is a contaminate metal.

Beryllium was not detected in the sample collected from your water well.

- **Cadmium (Cd):** The CDPHE human health standard for cadmium is 0.005 mg/l. Cadmium is a contaminate metal.

Cadmium was not detected in the sample collected from your water well.

- **Chromium (Cr):** The CDPHE human health standard for chromium is 0.1 mg/l. Chromium is a contaminate metal.

Chromium was not detected in the sample collected from your water well.

- **Lead (Pb):** The CDPHE human health standard for lead is 0.05 mg/l. Prolonged exposure to this metal can result in serious health effects.

Lead was not detected in the sample collected from your water well.

- **Nickel (Ni):** The CDPHE human health standard for nickel is 0.1mg/l. Nickel is a contaminate metal.

Nickel was not detected in the sample collected from your water well.

- **Selenium (Se):** The CDPHE human health standard for selenium is 0.05 mg/l. Selenium is a contaminate metal.

Selenium was not detected in the sample collected from your water well.

- **Silver (Ag):** The CDPHE human health standard for silver is 0.05 mg/l. Excess amounts of silver may cause a permanent gray discoloration of the skin.

Silver was not detected in the sample collected from your water well.

- **Thallium (Tl):** The CDPHE human health standard for thallium is 0.002 mg/l. Thallium is a contaminate metal.

Thallium was not detected in the sample collected from your water well.

- **Uranium (U):** The CDPHE human health standard for thallium is 0.03 mg/l. Uranium can be present due to erosion of natural deposits of this element.

Uranium was not detected in the sample collected from your water well.

- **Fluoride (F)**: The CDPHE human health standard for fluoride is 4.0 mg/l. Where fluoride concentrations are in the range of 0.7 mg/l to 1.2 mg/l health benefits such as reduced dental decay have been observed. Consumption of fluoride at concentrations of greater than 2.0 mg/l can result in mottling of teeth. Consumption of fluoride at concentrations greater than 4.0 mg/l can increase the risk of skeletal fluorosis or other adverse health effects. Fluoride occurs naturally in the ground water in many areas in Colorado at concentrations that exceed the drinking water standard.

Fluoride was detected in the sample collected from your water well at a concentration of 0.82mg/l which is below the CDPHE human health standard.

- **Nitrate (NO₃)**: The CDPHE human health standard for nitrate is 10.0 mg/l. Nitrate can cause cyanosis in infants; a household water supply should not contain nitrate concentration in excess of 10 mg/l.

Nitrate was detected in the sample collected from your water well at a concentration of 0.0488mg/l which is below the CDPHE human health standard.

- **Nitrite (NO₂)**: The CDPHE human health standard for nitrite is 1.0 mg/l. Nitrite concentrations exceeding 1.0 mg/l should not be used for feeding infants.

Nitrite was not detected in the sample collected from your water well.

- **Copper (Cu)**: The CDPHE secondary drinking water standard for copper is 1 mg/l.

Copper was not detected in the sample collected from your water well.

- **Chloride (Cl)**: The CDPHE secondary drinking water standard for chloride is 250mg/l. Chloride concentrations in excess of 250 mg/l usually produce a noticeable taste in drinking water.

Chloride was detected in the sample collected from your water well at a concentration of 17.5mg/l which is below the CDPHE drinking water standard.

- **Iron (Fe)**: The CDPHE secondary drinking water standard for iron is 0.3mg/l. Small amounts of iron are common in ground water. Iron produces a brownish-red color in laundered clothing, can leave reddish stains on fixtures, and impart a metallic taste to beverages and food made with it. After a period of time iron deposits can build up in pressure tanks, water heaters, and pipelines, reducing the effective flow rate and efficiency of the water supply.

Iron was not detected in the sample collected from your water well.

- **Manganese (Mn)**: The CDPHE secondary drinking water standard for manganese is 0.05mg/l. Manganese produces a brownish color in laundered clothing, may stain fixtures and affect the taste of coffee or tea.

Manganese was detected in the sample collected from your water well at a concentration of 0.117mg/l which is above the CDPHE secondary standard.

- **Sulfate (SO₄)**: The CDPHE sulfate secondary standard for human drinking water is 250mg/l. Although CDPHE does not have an agricultural standard for sulfate, other agencies recommend a concentration below 1,500 mg/l for livestock watering. Waters containing high concentrations of sulfate, typically caused by the leaching of natural deposits of magnesium sulfate (Epsom salts) or sodium sulfate (Glauber's salt), may be undesirable because of their laxative effects.

Sulfate was detected in the sample collected from your water well at a concentration of 268mg/l which is above the CDPHE secondary standard.

- **pH:** pH is the measure of the hydrogen ion concentration in water. The pH of water in its natural state is generally from 5.5 to 9.0. The CDPHE standard for domestic and agricultural water is a range of 6.5 to 8.5. Seven (7) represents neutrality, while values less than 7 indicate increasing acidity and values greater than 7 indicate increasing alkalinity.

pH was measured in the water sample from your well with a value of 7.86 which is slightly within the CDPHE drinking water and agricultural standards.

- **Total Dissolved Solids (TDS):** CDPHE's TDS standard for human drinking water is 500 milligrams per liter (mg/l). Although CDPHE does not have an agricultural standard for TDS, other agencies recommend concentrations below 1500 mg/l for irrigation, and below 5,000 mg/l for most livestock watering. TDS occurs naturally in the ground water in many areas of Colorado at concentrations that exceed the drinking water standard.

TDS was measured in the water sample collected from your well at a concentration of 712mg/l which is above the drinking water standard.

- **Zinc (Zn):** CDPHE's Zn standard for human drinking water is 5 milligrams per liter (mg/l) and the agricultural standard is 2mg/l.

Zinc was not detected in the sample collected from your water well.

The following parameters were also measured as part of the laboratory analysis although there are no CDPHE standards.

- **Sodium (Na):** People on salt restricted diets should be aware of the sodium concentration in the water they drink. A concentration of less than 20 mg/l is recommended by some for people on salt restricted diets or for people suffering from hypertension or heart disease. Sodium occurs naturally in the ground water in many areas of Colorado at concentrations that exceed this health advisory level.

Sodium was detected in the water sample from your well at a concentration of 187mg/l which is above the recommended level.

- **Boron (B):**

Boron was detected in the sample collected from your water well at a concentration of 0.0604mg/l.

- **Calcium (Ca):**

The calcium concentration in the sample collected from your well was 38.2mg/l.

- **Magnesium (Mg):**

The magnesium concentration in the sample collected from your water well was 6.11mg/l.

- **Potassium (K):**

The potassium concentration in the sample collected from your well was 1.65mg/l.

- **Molybdenum (Mo):**

Molybdenum was not detected in the sample collected from your well.

- **Bicarbonate (HCO₃):**

Bicarbonate alkalinity was measured in the sample collected from your well at a concentration of 249mg/l.

- **Bromide (Br):**

Bromide was detected in the sample collected from your water well at a concentration of 0.276mg/l.

METHANE GAS ANALYSIS

Methane was detected in the sample collected from your well at a concentration of 0.28mg/l. The concentration of methane in the water produced from the well is below the threshold level of 1.1mg/l that theoretically could allow methane to accumulate in small, confined, unventilated spaces and potentially be explosive.

VOLATILE ORGANIC COMPOUNDS ANALYTICAL RESULTS

No volatile organic compounds detected in the samples collected from your domestic well in September 2009.

BACTERIAL ANALYSIS

The COGCC collected samples to analyze for the presence of iron, slime and sulfur bacteria in your water well. Samples from your water well were tested for the presence of iron-related (IRB), sulfate reducing (SRB) and slime forming (SLYM) bacteria using Biological Activity Reaction Test (BART) kits. In addition to detecting the presence of bacteria the BART Kits allow for an estimation of the size of the population and/or the rate at which they can metabolize and/or grow through an observable change or reaction. This reaction rate is referred to as the “aggressivity” of the bacterial population. The aggressivity levels of the bacteria are described as **Not Detected, Background, Moderately Aggressive, Very Aggressive, or Extremely Aggressive Levels**. The results of the tests are provided below and documented in Photographs 1, 2 and 3. The progress of the bacterial growth two days after the cultures were started is seen in Photograph 1. Photograph 2 shows the progress of the bacterial tests three days after the cultures were started. Photograph 3 shows the progress of the tests on the eighth and final day of observation after the cultures were started.

- **Iron-Related Bacteria (IRB):** Although not harmful, iron-related bacteria can become a nuisance by plugging the well pump, causing red staining on plumbing fixtures and laundered clothing, building up red, slimy accumulations on any surface the water touches, and causing what appears to be a sheen on standing water. Signs that may indicate an iron bacteria problem include “yellowish, red or orange colored water, rusty deposits in toilet tanks and strange smells resembling fuel oil, cucumbers or sewage. Sometimes the odor will only be apparent in the morning or after other extended periods of non-use” (CDPHE, Laboratory Services Division).

Very Aggressive levels of IRB bacteria were detected in the water sample collected at this well. The orange cloudy layer, at the bottom of the IRB tube (red cap) and the foam at the top in Photograph 2

developed after three days. This rapid development of foam and orange color indicates Very Aggressive levels of IRB population present in the water from your well.



Photograph 1. BART Kits September 3, 2009

- **Sulfate Reducing Bacteria (SRB):** Sulfate reducing bacteria are serious nuisance organisms in water since they can cause severe taste and odor problems. These bacteria reduce sulfate that occurs naturally in the water and generate hydrogen sulfide (H_2S) gas as they grow. In turn, the hydrogen sulfide (H_2S) gas is a nuisance because it smells like rotten eggs, initiates corrosion on metal surfaces and reacts with dissolved metals such as iron to generate black sulfide deposits.

SRB were not detected in your well water as shown by the lack of black particulates at the bottom of the black capped vial in Photograph 3. The culture turns black if SRB are present and this culture remained clear for eight days after the culture was started.

- **Slime Forming Bacteria (SLYM):** Although not usually harmful, Slime Forming Bacteria (SFB) can become a nuisance by plugging well pumps and causing slimy accumulations on plumbing fixtures and standing water. Slimes are often gelatinous in nature and may range in color from white, to red, or black. As slime bacteria mats grow they create an environment in which complex associations of other strains of bacteria can develop.

SLYM bacteria were not detected in the water sample collected from this well as indicated by the clear yellow liquid seen in the green capped vial in Photograph 3 after eight days.

Iron related bacteria were present in your well. Since iron related bacteria were detected in the water distribution system or the well you should consider treating the well and distribution system with disinfecting solutions in the near future. Once bacterial colonies are established they are difficult to eliminate; therefore,

you may need to establish a schedule for periodic disinfection of your well system to help control the bacteria present in it. The chlorination process is more easily accomplished if you have a frost-proof hydrant near the well head that you can use to remove the chlorinated water from the well. One technique that water well professionals use is to re-circulate the chlorine solution down the sides of the well shortly after adding the chlorine. This helps to kill bacteria on the sides of the well and on the pipes in the well.



Photograph 2. BART Kits September 4, 2009

Pamphlets published by the CDPHE that provide more information concerning the treatment of iron and sulfur bacteria and shock chlorination treatment of bacteria are included as Attachment 3. You may also want to contact a licensed water well contractor for additional information or for help in disinfecting your well and distribution system. Additional information and assistance can be provided through the State of Colorado Health Department. Contact information for the agency is provided below.

Colorado Department of Public Health and Environment

Colorado Drinking Water Program
4300 Cherry Creek Drive South
Denver, CO 80246-1530
Phone: 303-692-3500
Fax: 303-782-0390



Photograph 3. BART Kits September 9, 2009

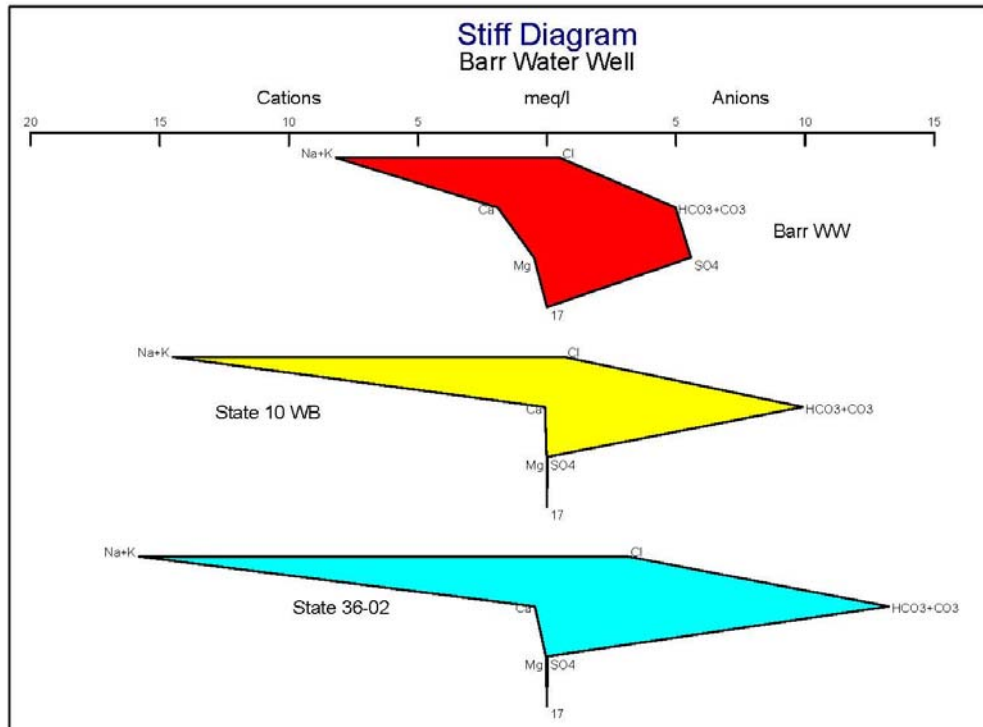
CONCLUSIONS

Table 1 in Attachment 1 compares the results of the most recent sampling and analysis event to the groundwater standards promulgated by the Water Quality Control Commission of the Colorado Department of Public Health and the Environment. All parameters tested are below the groundwater and equivalent public drinking water supply standards with the exception of manganese (Mn), sulfate (SO_4) and total dissolved solids (TDS). The standards for manganese and TDS are mainly for appearance and taste qualities of water. As we discussed on the phone, sulfate may have a laxative effect on its consumers at concentrations similar to those present in water from your well. No other analyte tested exceeds the health based standards established for Colorado groundwater. Simple treatments such as water softeners (ion exchange) or reverse osmosis may help lower the TDS and sulfate concentrations in your well water. The white crusts you have observed as developing when your water is allowed to evaporate are present because of the dissolved solids present in your water.

The Stiff diagram graphs below illustrate the major ion composition of the water in your well in comparison to the major ion composition of two nearby CBM wells. Stiff diagrams are a means of visualizing the major ion chemistry of water. The plots below show that the water from your well is dominantly of sodium-sulfate-bicarbonate character. Produced water from coal bed methane (CBM) wells typically have similar to higher concentrations of total dissolved solids than your well water contains. CBM produced water in the Raton Basin is characteristically of a sodium-bicarbonate nature (with lesser chloride) as seen in the diagram above. Sulfate is typically not present or present at relatively low concentrations in most CBM produced water from the Raton Basin.

The reported depth of your well is 680 feet below ground surface and is probably completed in the Raton Formation. The nearby CBM wells (approximately 1800 to 2200 feet west of your domestic well) are perforated into the Vermejo Fm. at depths of approximately 1050 to 1230 feet below ground surface. The records for the CBM wells indicate that they have not produced gas or water from the Raton Fm in which your well is completed. As seen above the differences in chemistry of water in your well and the nearby CBM wells indicates different sources of water are being accessed by your domestic well and the CBM wells. The Raton Fm. in your area does have several small coal seams present (as recorded in the mud log of the State 36-02). Dissolved methane is typically present in water wells that draw water from coal bearing aquifers. The relatively low concentration of dissolved methane present in your water well may be coming from coals in the Raton Fm. or maybe the product or bacterial activity in the groundwater near your well.

At present there is no data that would indicate the water quality in your domestic well has been impacted by nearby CBM drilling and operations.



If you have any questions or would like to discuss these matters further, please contact me at 719-846-3091 or by email at peter.gintautas@state.co.us . We appreciate your continued cooperation with the staff of the COGCC in granting continued access to sample and investigate the occurrence of methane in the Poison Canyon aquifer.

Sincerely,
Colorado Oil and Gas Conservation Commission

Peter Gintautas
Environmental Protection Specialist

Attachments: Attachment 1 - Table 1 - Analytical Summary
 Attachment 2 - Accutest Laboratories Reports
 Attachment 3 - CDPHE pamphlets

cc: David Neslin, COGCC Director w/o attachments
 Debbie Baldwin, COGCC Environmental Protection Manager w/o attachments
 Tom Melland, Petroglyph w/o attachments

TABLE 1
ANALYTICAL SUMMARY
Complaint 200216061
Barr Water Well

Parameter	Water Sample		CDPHE Standards		
	Sample Date				
	01-Sep-09				
	Result	Unit	Domestic	Agriculture	Units
Antimony	ND	mg/l	0.006	NS	mg/l
Arsenic	ND	mg/l	0.01	0.1	mg/l
Barium	0.0464	mg/l	2.0	NS	mg/l
Beryllium	ND	mg/l	0.004	0.1	mg/l
Boron	0.0604	mg/l	NS	0.75	mg/l
Cadmium	ND	mg/l	0.005	0.01	mg/l
Calcium	38.2	mg/l	NS	NS	
Chromium	ND	mg/l	0.1	0.1	mg/l
Cobalt	ND	mg/l	NS	0.05	mg/l
Copper	ND	mg/l	1	0.2	mg/l
Iron	ND	mg/l	0.3	5	mg/l
Lead	ND	mg/l	0.05	0.1	mg/l
Lithium	0.00385	mg/l	NS	NS	
Magnesium	6.11	mg/l	NS	NS	
Manganese	0.117	mg/l	0.05	0.2	mg/l
Molybdenum	ND	mg/l	0.035	NS	mg/l
Nickel	ND	mg/l	0.1	0.2	mg/l
Potassium	1.65	mg/l	NS	NS	
Selenium	ND	mg/l	0.05	0.02	mg/l
Silver	ND	mg/l	0.05	NS	mg/l
Sodium	187	mg/l	NS	NS	
Strontium	1.27	mg/l	NS	NS	
Thallium	ND	mg/l	0.002	NS	mg/l
Uranium	ND	mg/l	0.03	NS	mg/l
Zinc	ND	mg/l	5	2	mg/l
Chloride	17.5	mg/l	250	NS	mg/l
Nitrite	ND	mg/l	1.0	10	mg/l
Nitrate	0.0488	mg/l	10.0	100	mg/l
Total Nitrite/Nitrate	0.0488	mg/l	10.0	100	mg/l
Fluoride	0.82	mg/l	4.0	NS	mg/l
Total Dissolved Solids	712	mg/l	400	*1500	mg/l
pH	7.86	No units	6.5 - 8.5	6.5 - 8.5	No units
Sulfate	268	mg/l	250	NS	mg/l
Bromide	0.276	mg/l	NS	NS	
Total Alkalinity	249	mg/l	NS	NS	
Bicarbonate	249	mg/l	NS	NS	
Carbonate	ND	mg/l	NS	NS	
Conductivity	937	umhos/cm	NS	NS	
methane	0.28	mg/l	NS	NS	

Notes

CDPHE	Colorado Department of Public Health and the Environment.
Domestic	Water Quality Control Commission 5 CCR 1002-41, Regulation No. 41 - The Basic Standards For Groundwater.
Agriculture	* Standards for agriculture complied from CDPHE and other of sources.
mg/l	milligrams per liter (ppm or parts per million).
umhos/cm	micromhos per centimeter
NA	Not analyzed.
ND	Not detected.
NS	No Standard.
**	Health Advisory.
	Human health standard.
	Secondardy standard.