



September 24, 2008

Certified Mail Return Receipt Requested # 7007 1490 0001 8185 5039

Mr. Roger Vanderwall
PO Box 7
Bon Carbo, CO 81024-0007

RE: Complaint 200194004
Baseline Water Well Analysis
Well Permit 117203
SWSE 20 32S, 65W Las Animas County, Colorado

Dear Carol and Roger:

In response to your request for a baseline water quality testing of your water well before additional drilling takes place in the vicinity of your home, the Colorado Oil and Gas Conservation Commission (COGCC) conducted a field visit to your property on January 3, 2008. Samples were collected on August 20, 2008 for general water quality parameters including dissolved methane analysis. These samples for analysis of inorganic parameters and dissolved methane analysis were received by Paragon Analytics (PA) in Fort Collins, Colorado on August 21, 2008. This letter summarizes the results of the chemical analyses and compares the laboratory data to published water quality standards. The most recent results of sampling and analysis of water from your well are also compared to previous results dating back to 1982.

FIELD TESTING

I visited your property on August 20, 2008. I pumped water from an outdoor hydrant for 6 minutes after I arrived at your home. The hydrant is fed from a vented outdoor cistern. Two wells provide water to the cistern. I then collected samples for general inorganic water quality and dissolved methane tests. I did not observe bubbles in the water as it was pumped. The water was clear and I did not notice any odors from the water.

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 laboratory data reports from Paragon Analytics 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 detected in the sample collected from your water well at a concentration of 0.00094mg/l which is below the CDPHE human health standard.

- **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 0.21mg/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.

- **Molybdenum (Mo):** The CDPHE human health standard for molybdenum is 0.035mg/l.

Molybdenum was detected in the sample collected from your water well at a concentration of 0.0024mg/l which is below the CDPHE human health standard.

- **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 detected in the sample collected from your water well at a concentration of 0.00011mg/l which is below the CDPHE human health standard.

- **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 uranium is 0.03 mg/l. Uranium typically occurs in groundwater due to erosion of natural deposits.

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 3.6mg/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 not detected in the sample collected from your water well.

- **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 detected in the sample collected from your water well at a concentration of 0.018mg/l which is below the CDPHE human health standard.

- **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 110mg/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 0.028mg/l which is below the CDPHE drinking water 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 19mg/l which is below the CDPHE drinking water 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 7.82 which is within the CDPHE drinking water and agricultural standard.

- **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 430mg/l which is below 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 detected in the sample collected from your water well at a concentration of 0.14mg/l which is below the CDPHE drinking water standard.

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 140mg/l which is above the recommended level.

- **Boron (B):**

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

- **Calcium (Ca):**

The calcium concentration in the sample collected from your well was 16mg/l.

- **Magnesium (Mg):**

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

- **Potassium (K):**

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

- **Bicarbonate (HCO₃):**

Bicarbonate alkalinity was measured in the sample collected from your well at a concentration of 210mg/l.

- **Bromide (Br):**

Bromide was measured in the sample collected from your well at a concentration of 0.62mg/l.

METHANE GAS ANALYSIS

Methane was detected in the sample collected from your well at a concentration of 4.6mg/l. The concentration of methane in the water produced from the well and entering your house from your well is above the threshold level of 1.1mg/l that could allow methane to accumulate in confined unventilated spaces and potentially be explosive.

CONCLUSIONS

As noted in the narrative discussion and summarized in Table 1, the overall quality of water produced from your well is good. None of the tested analytes exceed the CDPHE groundwater standards. The concentrations of methane present in your water are at levels that may pose an explosion hazard if water is brought directly into your home or other confined space. The vented outdoor cistern that you have will lessen the risk of introduction of methane into your home.

Your well system has been sampled and analyzed several times by different agencies or organizations. I have summarized the results dating back to samples collected in 1981. That summary is presented in Table 2 in Attachment 3. The results of the most recent testing are similar to data from the sample collected in 1981. The 2005 and 2007 sampling and analyses showed that water from your wells contained more calcium than previous or current samples. I believe that the 1981 sample was obtained from a well that no longer exists. The changes in chemistry of samples collected from your cistern reflect the different chemistries of water from two individual wells and the relative proportions of water in the cistern from each source.

Roger Vanderwall
Complaint 200194004
September 24, 2008

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 .

Sincerely,
Colorado Oil and Gas Conservation Commission

Peter Gintautas
Environmental Protection Specialist

Attachments: Attachment 1 - Table 1 - Analytical Summary
Attachment 2 – Paragon Analytics Data Reports
Attachment 3 – Table 2 – Comparison of Current and Previous Results

cc: David Neslin, Acting COGCC Director w/o attachments
Debbie Baldwin, COGCC Environmental Protection Manager w/o attachments
Margaret Ash, COGCC Environmental Protection Supervisor w/o attachments

**TABLE 1
ANALYTICAL SUMMARY
Complaint 200194004
Vanderwall Water Well**

Parameter	Sample Date		CDPHE Standards		
	20-Aug-08		Domestic	Agriculture	Units
	Result	Unit			
Antimony	0.00094	mg/l	0.006	NS	mg/l
Boron	ND	mg/l	NS	0.75	mg/l
Copper	0.018	mg/l	1	0.2	mg/l
Arsenic	ND	mg/l	0.01	0.1	mg/l
Barium	0.21	mg/l	2.0	NS	mg/l
Beryllium	ND	mg/l	0.004	0.1	mg/l
Cadmium	ND	mg/l	0.005	0.01	mg/l
Calcium	16	mg/l	NS	NS	
Chromium	ND	mg/l	0.1	0.1	mg/l
Iron	ND	mg/l	0.3	5	mg/l
Lead	ND	mg/l	0.05	0.1	mg/l
Lithium	0.024	mg/l	NS	NS	
Magnesium	ND	mg/l	NS	NS	
Manganese	0.028	mg/l	0.05	0.2	mg/l
Molybdenum	0.0024	mg/l	0.035	NS	mg/l
Nickel	ND	mg/l	0.1	0.2	mg/l
Potassium	ND	mg/l	NS	NS	
Selenium	ND	mg/l	0.05	0.02	mg/l
Silver	0.00011	mg/l	0.05	NS	mg/l
Sodium	140	mg/l	NS	NS	
Strontium	0.42	mg/l	NS	NS	
Thallium	ND	mg/l	0.002	NS	mg/l
Uranium	ND	mg/l	0.03	NS	mg/l
Zinc	0.14	mg/l	5	2	mg/l
Chloride	110	mg/l	250	NS	mg/l
Nitrite	ND	mg/l	1.0	10	mg/l
Nitrate	ND	mg/l	10.0	100	mg/l
Total Nitrite/Nitrate	ND	mg/l	10.0	100	mg/l
Fluoride	3.6	mg/l	4.0	NS	mg/l
Total Dissolved Solids	430	mg/l	400	*1500	mg/l
pH	7.82	No units	6.5 - 8.5	6.5 - 8.5	No units
Sulfate	19	mg/l	250	NS	mg/l
Bromide	0.62	mg/l	NS	NS	
Total Alkalinity	210	mg/l	NS	NS	
Bicarbonate	210	mg/l	NS	NS	
Carbonate	ND	mg/l	NS	NS	
Conductivity	746	umhos/cm	NS	NS	
methane	4.6	mg/l	NS	NS	
Total Organic Carbon	2	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 compiled 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.
Secondary standard.

TABLE 2
Comparison of Current and Previous Results

COMPLAINT #200106867
VANDERWALL WATER WELL

Parameter	Water Well Sample										CDPHE Standards		
	Sample Date		Sample Date		Sample Date		Sample Date		Sample Date				
	22-Jul-81		January-02		05-May-05		19-Apr-07		20-Aug-08		Domestic	Agriculture	Units
	Result	Unit	Result	Unit	Result	Unit	Result	Unit	Result	Unit			
Boron	0.01	mg/l	NA	mg/l	ND	mg/l	0.04	mg/l	ND	mg/l	NS	0.75	mg/l
Copper	P	mg/l	<0.02	mg/l	0.018	mg/l	ND	mg/l	0.018	mg/l	1	0.2	mg/l
Arsenic	0.001	mg/l	ND	mg/l	ND	mg/l	ND	mg/l	ND	mg/l	0.01	0.1	mg/l
Barium	NA	mg/l	0.27	mg/l	0.21	mg/l	0.18	mg/l	0.21	mg/l	2.0	NS	mg/l
Cadmium	NA	mg/l	ND	mg/l	NA	mg/l	ND	mg/l	ND	mg/l	0.005	0.01	mg/l
Calcium	25	mg/l	20.1	mg/l	43	mg/l	50.1	mg/l	16	mg/l	NS	NS	
Chromium	NA	mg/l	ND	mg/l	NA	mg/l	0.005	mg/l	ND	mg/l	0.1	0.1	mg/l
Iron	0.03	mg/l	0.06	mg/l	0.71	mg/l	ND	mg/l	ND	mg/l	0.3	5	mg/l
Lead	ND	mg/l	ND	mg/l	0.0017	mg/l	ND	mg/l	ND	mg/l	0.05	0.1	mg/l
Magnesium	0.8	mg/l	0.4	mg/l	2.1	mg/l	2.55	mg/l	ND	mg/l	NS	NS	
Manganese	0.04	mg/l	0.02	mg/l	0.13	mg/l	0.167	mg/l	0.028	mg/l	0.05	0.2	mg/l
Potassium	1.3	mg/l	0.9	mg/l	0.69	mg/l	0.833	mg/l	ND	mg/l	NS	NS	
Selenium	ND	mg/l	ND	mg/l	NA	mg/l	ND	mg/l	ND	mg/l	0.05	0.02	mg/l
Silver	NA	mg/l	ND	mg/l	NA	mg/l	ND	mg/l	0.00011	mg/l	0.05	NS	mg/l
Sodium	130	mg/l	184	mg/l	140	mg/l	157	mg/l	140	mg/l	NS	NS	
Chloride	120	mg/l	94	mg/l	66	mg/l	72.8	mg/l	110	mg/l	250	NS	mg/l
Nitrite	NA	mg/l	ND	mg/l	NA	mg/l	ND	mg/l	ND	mg/l	1.0	10	mg/l
Nitrate	NA	mg/l	ND	mg/l	ND	mg/l	ND	mg/l	ND	mg/l	10.0	100	mg/l
Total Nitrite/Nitrate	0.18	mg/l	ND	mg/l	NA	mg/l	ND	mg/l	ND	mg/l	10.0	100	mg/l
Fluoride	2.8	mg/l	3.7	mg/l	1.4	mg/l	1.6	mg/l	3.6	mg/l	4.0	2	mg/l
Total Dissolved Solids	410	mg/l	454	mg/l	540	mg/l	574	mg/l	430	mg/l	400	*1500	mg/l
pH	7.6	No units	7.5	No units	7.2	No units	7.41	No units	7.82	No units	6.5 - 8.5	6.5 - 8.5	No units
Sulfate	18	mg/l	38	mg/l	72	mg/l	80.2	mg/l	19	mg/l	250		mg/l
Sulfide	NA	mg/l	NA	mg/l	ND	mg/l	ND	mg/l	ND	mg/l	NS		
Bromide	NA	mg/l	<1	mg/l	NA	mg/l	0.44	mg/l	0.62	mg/l	NS		
Total Alkalinity	NA	mg/l	290	mg/l	290	mg/l	293	mg/l	210	mg/l	NS		
Bicarbonate	NA	mg/l	289	mg/l	290	mg/l	293	mg/l	210	mg/l	NS		
Carbonate	NA	mg/l	0.8	mg/l	ND	mg/l	ND	mg/l	ND	mg/l	NS		
Conductivity	770	umhos/cm	578	umhos/cm	NA	umhos/cm	885	umhos/cm	746	umhos/cm	NS		
methane	NA	mg/l	0.16	mg/l	1.2	mg/l	1.1	mg/l	4.6	mg/l	NS		

TABLE 2
Comparison of Current and Previous Results

COMPLAINT #200106867
VANDERWALL WATER WELL

Notes	
CDPHE	Colorado Department of Public Health and the Environment.
Domestic	Standards for Domestic Water Supply, Human Health and Drinking Water Standards.
Agriculture	* Standards for agriculture complied from CDPHE and other of sources.
mg/l	Milligrams per liter (equals parts per million).
CDPHE Standards	Water Quality Control Commission 5 CCR 1002-41, Regulation No. 41 - The Basic Standards For Groundwater.
µmhos/cm	micromhos per centimeer
NA	Not analyzed.
ND	Not detected.
NS	No Standard.
**	Health Advisory.
	Human health standard.
	Secondary standard.
P	Present, not quantified