



February 25, 2010

Certified Mail Return Receipt Requested # 7008 3230 0003 3235 4612

Mr. and Mrs. Nancy and Jerry Meadows  
19560 County Road 30.1  
Weston, CO 81091-9772

RE: Complaint 200221032  
Baseline Water Well Analysis  
NESW 5 33S, 66W Las Animas County, Colorado

Dear Mr. and Mrs. Meadows:

In response to your request for a continued water quality testing of your water well, the Colorado Oil and Gas Conservation Commission (COGCC) conducted a field visit to your property on October 27, 2009. Samples were collected on October 27, 2009 for general water quality parameters including dissolved methane analysis. These samples for analysis of inorganic parameters, volatile organic compounds and dissolved methane analysis were received by ALS Laboratory Group in Fort Collins, Colorado on October 28, 2009. This letter summarizes the results of this set of chemical analyses and compares the laboratory data to published water quality standards. The most recent data set is also compared to results of previous sampling and analysis events.

### **FIELD TESTING**

I visited your property on October 27, 2009. Jerry assisted me during sample collection. We pumped water from a spigot in your crawl space for approximately 22 minutes at a rate of approximately 5 gallons per minute. The water flows through a pressure tank prior to the spigot. I then collected samples for general inorganic water quality, dissolved methane and volatile organic compound analyses. I did not observe bubbles in the water as it was pumped. The water was relatively clear. I did not notice any odor of hydrogen sulfide (rotten eggs) from the water as it was pumped from the well.

### **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. The records available to the COGCC show that samples were collected on seven prior occasions in the last four years and a comparison of results is shown in Table 2 in Attachment 2. 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 ALS Laboratory were mailed to you previously at your request.

- **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 (October 2009) which is below the CDPHE human health standard.

- **Arsenic (As):** The CDPHE human health standard for arsenic is 0.01 mg/l. Arsenic is a highly poisonous metal.

Arsenic was not detected in the sample collected from your water well (October 2009).

- **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 0.25mg/l (October 2009) 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 (October 2009).

- **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 (October 2009).

- **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 (October 2009).

- **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 (October 2009).

- **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 (October 2009).

- **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 (October 2009).

- **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 (October 2009).

- **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 (October 2009).

- **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 (October 2009).

- **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 1.6mg/l (October 2009) which is below the CDPHE human health standard.

- **Nitrate (NO<sub>3</sub>)**: 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 in October 2009.

- **Nitrite (NO<sub>2</sub>)**: 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 in October 2009.

- **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 in October 2009.

- **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 (October 2009) at a concentration of 13mg/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 in October 2009.

- **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 not detected in the sample collected from your water well in October 2009.

- **Sulfate (SO<sub>4</sub>)**: 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 in October 2009 at a concentration of 4.5mg/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 (October 2009) with a value of 8.1 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.

The concentration of TDS was calculated from the other measured analytes in the water sample collected from your well in October 2009 at a concentration of 347mg/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 not detected in the sample collected from your water well in October 2009.

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 (October 2009) at a concentration of 73mg/l which is above the recommended level.

- **Boron (B)**:

Boron was not detected in the sample collected from your water well in October 2009.

- **Calcium (Ca)**:

The calcium concentration in the sample collected from your well in October 2009 was 16mg/l.

- **Magnesium (Mg):**

The magnesium concentration in the sample collected from your well in October 2009 was 2.2mg/l.

- **Potassium (K):**

Potassium was not detected in the sample collected from your well in October 2009.

- **Molybdenum (Mo):**

The concentration of molybdenum detected in the water sample collected from your well in October 2009 was 0.0025mg/l.

- **Bicarbonate (HCO<sub>3</sub>):**

Bicarbonate alkalinity was measured in the sample collected from your well in October 2009 at a concentration of 230mg/l.

- **Bromide (Br):**

Bromide was not detected in the sample collected from your water well in October 2009.

### **METHANE GAS ANALYSIS**

Methane was detected in the sample collected from your well in October 2009 at a concentration of 1.6mg/l. The concentration of methane in the water produced from the well and entering your house is above the threshold level of 1.1mg/l that could theoretically allow methane to accumulate in confined unventilated spaces and potentially be explosive.

### **VOLATILE ORGANIC COMPOUND ANALYSIS**

A target list of 70 volatile organic compounds (VOC) was utilized during analysis of water from your well. None of the target list compounds were present above the method detection limit in samples from your well. The target list included tert-butanol and iodomethane which were reported during one sampling and analysis earlier in 2009. No tentatively identified compounds were detected during the volatile target list analysis of water from your domestic well.

### **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 one day 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 and Photograph 3 shows the progress of the bacterial tests four days 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).

*IRB bacteria were detected in the water sample collected at this well at Moderately to Very Aggressive levels. IRB are present when an orange cloudy layer, at the bottom of the IRB tube (red cap) and foam at the top develop. The development of a foamy layer can be seen in Photograph 2.*



**Photograph 1. BART Kits October 28, 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<sub>2</sub>S) gas as they grow. In turn, the hydrogen sulfide (H<sub>2</sub>S) 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 development of black particulates at the bottom of the black capped vial in Photograph 3. The culture turns black if SRB are present. The culture remained clear for eight days of observation.*

- **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 detected at Very Aggressive levels in the water sample collected from this well as indicated by the cloudy yellow liquid seen in the green capped vial in Photograph 2 after three days.***

The BART tests indicate the presence of at least two types of bacteria in your well system. 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. Odor and taste problems with water wells are frequently caused by the presence of bacteria in the system.



**Photograph 2. BART Kits October 30, 2009**

Pamphlets published by the CDPHE that provide more information concerning water well 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 October 31, 2009**

### CONCLUSIONS

As noted in the narrative discussion and summarized in Table 1, the overall quality of water produced from your well is good. Methane concentrations measured in your water are at levels that theoretically may pose an explosion hazard if water is brought directly into your home or other confined space. Table 1 illustrates that none of the parameters tested exceed the CDPHE drinking water standards.

If water in your well had been impacted by CBM produced water I would expect the concentrations of sodium, bicarbonate and possibly chloride to have increased in water from your well. The concentrations of these three ions have remained constant within the constraints of the analytical precision and accuracy of approximately  $\pm 10-20\%$ . Analytical data from water in your well is summarized in Table 2. You indicated to me that some data provided to you by Pioneer is inconsistent with the most recent and the prior results summarized in Table 2. If you provide me with any other data you have, then I will examine that data and compare to previous results.

If water in your well had been impacted by methane from nearby CBM operations I would expect the isotopic ratios of carbon and hydrogen in the methane present in your water well to be similar to the carbon and hydrogen isotope ratios of methane from nearby CBM wells. Figure 1 included as Attachment 4 clearly indicates that the isotopic ratios of methane present in water in your well are not similar to methane produced from CBM wells in the Raton Basin. The isotopic ratios determined in 2008 are similar to those from methane from shallow coals and from surface seeps of methane associated with shallow coals. The isotopic composition of methane present in your well

in late 2009 is different from the isotopic ratios determined in 2008. The change in isotopic composition is consistent with microbial oxidation of the methane in and around your well.

Two volatile organic compounds were reported as present in a previous sampling event in 2009. Both compounds – iodomethane and tert-butanol – were reported with J flags from March 2009 samples as estimated due to the reported concentrations being less than the laboratories reporting threshold for each compound. Neither volatile compound was reported as present at any concentration in samples collected on two successive sampling events later in 2009 (September 2009 and October 2009). Since both analytes were not detected at any concentration in follow-up sampling, it is likely that the reports of the two compounds from March 2009 samples were artifacts of lab procedures or sample collection and transport processes. That is the compounds were most likely not present in your water at any sampling event even though reported by the lab. Neither compound is regulated by Colorado groundwater or drinking water standards.

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](mailto:peter.gintautas@state.co.us).

Sincerely,  
Colorado Oil and Gas Conservation Commission

Peter Gintautas  
Environmental Protection Specialist

Attachments: Attachment 1 - Table 1 - Analytical Summary October 2009  
Attachment 2 – Table 2 - Analytical Summary 2005-2009  
Attachment 3 – CDPHE water well pamphlets  
Attachment 4 - Figure 1 - Plot of Isotopic Ratios – Raton Basin

cc: David Neslin, COGCC Director w/o attachments  
Debbie Baldwin, COGCC Environmental Manager w/o attachments  
Margaret Ash, COGCC Field Inspection Manager, w/o attachments  
Steve Lindblom, COGCC Environmental Supervisor, w/o attachments  
Dave Holland, Pioneer Natural Resources, w/o attachments

**TABLE 1  
ANALYTICAL SUMMARY  
Complaint 200221032  
Meadows Water Well**

Parameter	Water Well Sample		CDPHE Standards		
	Sample Date		Domestic	Agriculture	Units
	27-Oct-09				
Result	Unit				
Antimony	0.00094	mg/l	0.006	NS	mg/l
Boron	ND(<0.1)	mg/l	NS	0.75	mg/l
Copper	ND(<0.01)	mg/l	1	0.2	mg/l
Arsenic	ND(<0.002)	mg/l	0.01	0.1	mg/l
Barium	0.25	mg/l	2.0	NS	mg/l
Beryllium	ND(<0.002)	mg/l	0.004	0.1	mg/l
Cadmium	ND(<0.0003)	mg/l	0.005	0.01	mg/l
Calcium	16	mg/l	NS	NS	
Chromium	ND(<0.01)	mg/l	0.1	0.1	mg/l
Iron	ND(<0.1)	mg/l	0.3	5	mg/l
Lead	ND(<0.0005)	mg/l	0.05	0.1	mg/l
Lithium	ND(<0.01)	mg/l	NS	NS	
Magnesium	2.2	mg/l	NS	NS	
Manganese	ND(<0.01)	mg/l	0.05	0.2	mg/l
Molybdenum	0.0025	mg/l	0.035	NS	mg/l
Nickel	ND(<0.02)	mg/l	0.1	0.2	mg/l
Potassium	ND(<1.0)	mg/l	NS	NS	
Selenium	ND(<0.001)	mg/l	0.05	0.02	mg/l
Silver	ND(<0.0001)	mg/l	0.05	NS	mg/l
Sodium	73	mg/l	NS	NS	
Strontium	0.55	mg/l	NS	NS	
Thallium	ND(<0.0002)	mg/l	0.002	NS	mg/l
Uranium	ND(<0.0001)	mg/l	0.03	NS	mg/l
Zinc	ND(<0.02)	mg/l	5	2	mg/l
Chloride	13	mg/l	250	NS	mg/l
Nitrite	ND(<0.1)	mg/l	1.0	10	mg/l
Nitrate	ND(<0.2)	mg/l	10.0	100	mg/l
Total Nitrite/Nitrate	ND(<0.1)	mg/l	10.0	100	mg/l
Fluoride	1.6	mg/l	4.0	NS	mg/l
Total Dissolved Solids (calc.)	346	mg/l	400	*1500	mg/l
pH	8.1	No units	6.5 - 8.5	6.5 - 8.5	No units
Sulfate	4.5	mg/l	250	NS	mg/l
Bromide	ND(<0.2)	mg/l	NS	NS	
Total Alkalinity	230	mg/l	NS	NS	
Bicarbonate	230	mg/l	NS	NS	
Carbonate	ND(<20)	mg/l	NS	NS	
Conductivity	441	umhos/cm	NS	NS	
methane	1.6	mg/l	NS	NS	
SAR	4.5	ratio	NS	NS	

**Notes**

<b>CDPHE</b>	Colorado Department of Public Health and the Environment.
<b>Domestic</b>	Water Quality Control Commission 5 CCR 1002-41, Regulation No. 41 - The Basic Standards For Ground
<b>Agriculture</b>	* Standards for agriculture complied from CDPHE and other of sources.
<b>mg/l</b>	milligrams per liter (ppm or parts per million).
<b>umhos/cm</b>	micromhos per centimeter
<b>NA</b>	Not analyzed.
<b>ND</b>	Not detected. <span style="color: blue;">calc.</span> = calculated from other results
<b>NS</b>	No Standard.
<b>**</b>	Health Advisory.
	Human health standard.
	Secondary standard.

**TABLE 2**  
**ANALYTICAL SUMMARY 2005 to 2009**  
**Complaint 200221032**  
**Meadows Water Well**

Parameter	Water Well Sample										CDPHE Standards		
	Sample Date	Sample Date	Sample Date	Sample Date	Sample Date	Sample Date	Sample Date	Sample Date	Sample Date	Sample Date			
	10-Nov-05	20-Jun-06	15-Feb-07	7-Apr-08	23-Jul-08	30-Mar-09	14-May-09	3-Sep-09	27-Oct-09	Unit	Domestic	Agriculture	Units
Antimony	NA	NA	NA	NA	NA	0.00056	NA	ND(<0.002)	0.00094	mg/l	0.006	NS	mg/l
Boron	NA	ND(<0.1)	ND(<0.05)	ND(<0.05)	NA	ND(<0.1)	NA	ND(<0.02)	ND(<0.1)	mg/l	NS	0.75	mg/l
Copper	NA	ND(<0.15)	ND(<0.1)	ND(<0.1)	NA	ND(<0.01)	NA	ND(<0.005)	ND(<0.01)	mg/l	1	0.2	mg/l
Arsenic	ND(<0.01)	ND(<0.01)	ND(<0.05)	ND(<0.05)	NA	ND(<0.002)	NA	ND(<0.002)	ND(<0.002)	mg/l	0.01	0.1	mg/l
Barium	0.36	0.27	0.29	0.27	NA	0.2	NA	0.212	0.25	mg/l	2.0	NS	mg/l
Beryllium	NA	NA	NA	NA	NA	ND(<0.002)	NA	0.000471	ND(<0.002)	mg/l	0.004	0.1	mg/l
Cadmium	ND(<0.005)	ND(<0.005)	ND(<0.005)	ND(<0.005)	NA	ND(<0.0003)	NA	ND(<0.0005)	ND(<0.0003)	mg/l	0.005	0.01	mg/l
Calcium	27	17	20.7	18.6	NA	13	NA	14.9	16	mg/l	NS	NS	
Chromium	ND(<0.01)	ND(<0.01)	ND(<0.01)	ND(<0.01)	NA	ND(<0.01)	NA	ND(<0.01)	ND(<0.01)	mg/l	0.1	0.1	mg/l
Iron	ND(<0.1)	ND(<0.1)	ND(<0.05)	ND(<0.05)	NA	ND(<0.1)	NA	ND(<0.07)	ND(<0.1)	mg/l	0.3	5	mg/l
Lead	ND(<0.003)	ND(<0.003)	ND(<0.009)	ND(<0.009)	NA	ND(<0.0005)	NA	ND(<0.001)	ND(<0.0005)	mg/l	0.05	0.1	mg/l
Lithium	NA	NA	NA	NA	NA	0.011	NA	0.00566	ND(<0.01)	mg/l	NS	NS	
Magnesium	4.7	2.4	2.8	2.5	NA	1.7	NA	1.86	2.2	mg/l	NS	NS	
Manganese	ND(<0.01)	ND(<0.01)	ND(<0.01)	ND(<0.01)	NA	ND(<0.01)	NA	ND(<0.005)	ND(<0.01)	mg/l	0.05	0.2	mg/l
Molybdenum	NA	NA	ND(<0.02)	ND(<0.02)	NA	0.006	NA	ND(<0.005)	0.0025	mg/l	0.035	NS	mg/l
Nickel	NA	NA	ND(<0.04)	ND(<0.04)	NA	ND(<0.02)	NA	ND(<0.03)	ND(<0.02)	mg/l	0.1	0.2	mg/l
Potassium	ND(<3)	ND(<3)	ND(<5)	ND(<5)	NA	1.4	NA	0.887	ND(<1)	mg/l	NS	NS	
Selenium	ND(<0.005)	ND(<0.005)	ND(<0.015)	ND(<0.015)	NA	ND(<0.001)	NA	ND(<0.002)	ND(<0.001)	mg/l	0.05	0.02	mg/l
Silver	ND(<0.01)	ND(<0.01)	ND(<0.01)	ND(<0.01)	NA	ND(<0.0001)	NA	ND(<0.0002)	ND(<0.0001)	mg/l	0.05	NS	mg/l
Sodium	84	89	81.9	95.6	NA	87	NA	97.6	73	mg/l	NS	NS	
Strontium	NA	NA	NA	NA	NA	0.44	NA	0.47	0.55	mg/l	NS	NS	
Thallium	NA	NA	NA	NA	NA	ND(<0.0002)	NA	ND(<0.001)	ND(<0.0002)	mg/l	0.002	NS	mg/l
Uranium	NA	NA	NA	NA	NA	ND(<0.0001)	NA	ND(<0.001)	ND(<0.0001)	mg/l	0.03	NS	mg/l
Zinc	NA	NA	ND(<0.02)	ND(<0.02)	NA	ND(<0.02)	NA	ND(<0.03)	ND(<0.02)	mg/l	5	2	mg/l

**TABLE 2**  
**ANALYTICAL SUMMARY 2005 to 2009**  
**Complaint 200221032**  
**Meadows Water Well**

Chloride	12	14	11.3	11.1	NA	16	NA	13	13	mg/l	250	NS	mg/l
Nitrite	ND(<0.5)	ND(<0.5)	NA	NA	NA	ND(<0.1)	NA	ND(<0.2)	ND(<0.1)	mg/l	1.0	10	mg/l
Nitrate	ND(<0.5)	ND(<0.5)	NA	NA	NA	ND(<0.2)	NA	ND(<0.2)	ND(<0.2)	mg/l	10.0	100	mg/l
Total Nitrite/Nitrate	ND(<0.5)	ND(<0.5)	NA	NA	NA	ND(<0.1)	NA	ND(<0.2)	ND(<0.1)	mg/l	10.0	100	mg/l
Fluoride	1.1	1.6	NA	NA	NA	2.1	NA	3.3	1.6	mg/l	4.0	NS	mg/l
Total Dissolved Solids	250	270	251	239	NA	270	NA	382	346	mg/l	400	*1500	mg/l
pH	7.8	7.9	7.8	8	NA	8.37	NA	7.93	8.1	No units	6.5 - 8.5	6.5 - 8.5	No units
Sulfate	6.5	ND(<5.0)	5.3	ND(<5.0)	NA	2.2	NA	2.23	4.5	mg/l	250	NS	mg/l
Bromide	ND(<0.20)	ND(<0.20)	ND(<0.20)	ND(<0.20)	NA	ND(<0.2)	NA	ND(<0.2)	ND(<0.2)	mg/l	NS	NS	
Total Alkalinity	220	220	227	228	NA	230	NA	216	230	mg/l	NS	NS	
Bicarbonate	220	220	227	228	NA	230	NA	NA	230	mg/l	NS	NS	
Carbonate	ND(<5.0)	ND(<5.0)	ND(<5.0)	ND(<5.0)	NA	ND(<20)	NA	NA	ND(<20)	mg/l	NS	NS	
Conductivity	460	450	471	469	NA	455	NA	412	441	µmhos/cm	NS	NS	
methane	0.14	0.25	0.076	0.69	1.9	2.5	0.28	2.3	1.6	mg/l	NS	NS	
Total Organic Carbon	NA	NA	NA	NA	NA	ND(<1)	NA	NA	NA	mg/l	NS	NS	

**Notes**

<b>CDPHE</b>	Colorado Department of Public Health and the Environment.
<b>Domestic</b>	Water Quality Control Commission 5 CCR 1002-41, Regulation No. 41 - The Basic Standards For Groundwater.
<b>Agriculture</b>	* Standards for agriculture complied from CDPHE and other of sources.
<b>mg/l</b>	milligrams per liter (ppm or parts per million).
<b>µmhos/cm</b>	micromhos per centimeter
<b>NA</b>	Not analyzed.
<b>ND</b>	Not detected. <span style="float: right;">calc. = calculated from other results</span>
<b>NS</b>	No Standard.
<b>**</b>	Health Advisory.
	Human health standard.
	Secondary standard.

# Isotopic Composition of Methane Raton Basin

