STATE OF COLORADO
OIL & GAS
CONSERVATION COMMISSION

Complaint 200092061

DEPARTMENT OF NATURAL RESOURCES
Bill Owens, Governor
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Denver, CO 80203
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July 24, 2006

Ms. Johana Hampton
5241 WCR 8
Dacono, CO 80514

RE: Complaint #200092061
SWSW Section 13 – T1N - R68W
Weld County, Colorado

Dear Ms. Hampton:

As you are aware, Colorado Oil & Gas Conservation Commission (COGCC) environmental staff collected water samples from your water well for laboratory analyses on June 23, 2006. The samples were submitted to Severn Trent Laboratories, Inc. in Arvada, Colorado, for organic and inorganic analyses.

This letter summarizes analytical results of the water samples collected from your well. Copies of the laboratory analytical reports are included with this letter.

COMPARISON OF INORGANIC ANALYTICAL RESULTS TO STANDARDS

The analytical results for the recent water sample from your well and applicable ground water and/or drinking water standards are summarized in this letter. The Water Quality Control Commission (WQCC) of the Colorado Department of Public Health and Environment (CDPHE) has established these standards. Please keep in mind that the human standards were established for public drinking water supplies, and often people use and consume ground water from private wells that exceed the standards.

- Total Dissolved Solids (TDS): The 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 2,000 mg/l for irrigation, and below 5,000 mg/l for most livestock watering.

  TDS was detected in the water sample from your well at a concentration of 1,800 mg/l. This is greater than the human drinking water standard, within the recommended maximum concentration for irrigation, and within the recommended maximum concentration for most livestock watering.

- Sodium (Na): Although the CDPHE does not have a standard for sodium, 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 at concentrations that exceed the recommended level.

Sodium was detected in the water sample from your well at a concentration of 620 mg/l, which is greater than the recommended level.

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

  Chloride was detected in the water sample from your well at a concentration of 120 mg/l, which is within the human drinking water standard.

- Sulfate (SO_4): The CDPHE sulfate standard for human drinking water is 250 mg/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 water sample from your well at a concentration of 740 mg/l, which is greater than the human drinking water standard and within the recommended level for livestock.

- Total Nitrate (NO_3) + Nitrite (NO_2) as Nitrogen (N): The CDPHE total nitrate (NO_3) + nitrite (NO_2) as nitrogen (N) standard for human drinking water is 10 mg/l. Nitrate and Nitrite are common contaminants in ground water from agricultural sources, such as fertilizer and animal wastes. They are known to cause infant cyanosis or "blue baby disease" in humans and, at concentrations greater than 100 mg/l as nitrogen, may be dangerous to livestock.

  Total nitrate (NO_3) + nitrite (NO_2) as nitrogen (N) was not detected in the water sample from your well.

- Iron (Fe): The CDPHE iron standard for human drinking water is 0.3 mg/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 water sample from your well.

- Manganese (Mn): The CDPHE manganese standard for secondary drinking water is 0.05 mg/l and for agricultural water it is 0.2 mg/l. Manganese rusts like iron but it is not magnetic.

  Manganese was not detected in the water sample from your well.

- Fluoride (Fl): The CDPHE fluoride standard for human drinking water is 4.0 mg/l and for agricultural water it is 2.0 mg/l.

  Fluoride was detected in the water sample collected from your well at a concentration of 2.0 mg/l, which is within the human drinking water standard and at the agricultural standard.

- Calcium (Ca), Potassium (K), Magnesium (Mg), Bicarbonate (HCO_3) and Carbonate (CO_3) were also tested for in your well water. There are no standards from CDPHE for these parameters.

If your water exceeded any of the CDPHE standards for human drinking water, and if you or your livestock and pets drink your water, then you may wish to discuss the possible health effects of continued consumption with your physician and/or veterinarian. In addition, it may be prudent for you to consider treating your water prior to consumption. Information is being provided to you that contain procedures recommended by the EPA.

METHANE GAS CONCENTRATION

Dissolved methane was detected in sample collected from your water well at a concentration of 0.025 mg/l. This value is well below the theoretical threshold of 2 mg/l that could allow methane to accumulate to potentially explosive levels in unventilated areas.

Methane alone is physiologically inert and non-toxic to humans. The presence of methane in drinking water does not present a known health hazard to humans or other animals by ingestion. Methane gas dissolved in water "exsolves" when exposed to the atmosphere and dissipates rapidly because it is lighter than air. If the methane occurs at a high enough concentration and if it is allowed to accumulate in a confined space, such as a well pit, crawl space, closet, etc., then an explosion hazard could exist.

COMPARISON OF ORGANIC ANALYTICAL RESULTS TO STANDARDS

Benzene: The CDPHE basic ground water standard for benzene is 5 ug/l. Benzene was not detected in the sample from your water well.

Toluene: The CDPHE basic ground water standard for toluene is 1,000 ug/l. Toluene was not detected in the sample from your water well.

Ethylbenzene: The CDPHE basic ground water standard for ethylbenzene is 700 ug/l. Ethylbenzene was not detected in the sample from your water well.

Xylene: The CDPHE basic ground water standard for xylene is 1,400 ug/l. Xylene was not detected in the sample from your water well.

BIOLOGICAL ACTIVITY REACTION TEST (BART) RESULTS

Additionally, water samples were also collected to conduct in-house Biological Activity Reaction Tests (BART) for iron-related bacteria (IRB), sulfate-reducing bacteria (SRB), and slime-forming bacteria (SYLM). Water samples were collected downstream of the pressure tank on June 23, 2006 and upstream of the pressure tank on June 27, 2006. Please note that these are not quantitative tests and are provided only to indicate the probable bacterial population (see attached photos). After three weeks of observation, results are as follows:

Iron Related Bacteria: Although not usually harmful, iron related bacteria (IRB) can become a nuisance by plugging well pumps, causing red staining on plumbing fixtures and laundered clothing, building up red, slimy accumulations on any surface the water touches, causing what appears to be an oily sheen on standing water. In rare cases, IRB may cause sickness.

- **Deep seated anaerobic flora with pseudomonads, IRB and enteric bacteria were present in both samples from your water well.**

Sulfate Reducing Bacteria: Sulfate reducing bacteria (SRB) are serious nuisance organisms in water since they can cause severe taste and odor problems. These bacteria reduce sulfate (SO_4) that occurs naturally in the water and generate hydrogen sulfide (H2S) gas as they grow. In turn, the hydrogen sulfide (H_2S) gas is a nuisance because it smells like rotten eggs, it initiates corrosion on metal surfaces, and it reacts with dissolved metals such as iron to generate black sulfide deposits.

- **A diverse SRB community was present in both samples from your water well.**

Slime-Forming Bacteria: Slime-forming bacteria (SLYM) are able to produce copious amounts of slime without necessarily having to use any iron. Iron bacteria also produce slime but it is usually thinner and involves the accumulation of various forms of iron. These bacteria generally produce the thickest slime formations under aerobic (oxidative) conditions.

- **Mixed aerobic flora were present in both samples from your water well.**

REVIEW OF WATER WELL RECORDS

Information on your water well and nearby water wells was obtained from the Division of Water Resources. Within an approximate ½ mile radius of your water well there are no other permitted water wells. According to available information, your water well was drilled and completed in February of 200 (permit #222779). The well was drilled to a total depth of 650 feet below ground surface (fbgs) with perforated casing from 440 fbgs to total depth.

REVIEW OF OIL/GAS WELL RECORDS

Within an approximate ½ mile radius of your water well, there are ten producing oil/gas wells, two plugged and abandoned oil/gas well, and one permitted oil/gas well. There are three types of single or dual completions of the producing geologic formations: J/Codell, J/Niobrara/Codell, and Sussex. Depth of the surface casing in these wells ranges from 229 fbgs to 842 fbgs.

DATA EVALUATION OF WATER QUALITY ANALYTICAL RESULTS

As mentioned above, there are ten producing oil/gas wells, two plugged and abandoned oil/gas wells, and one permitted oil/gas well within an approximate ½ mile radius of your water well. COGCC files contain analytical data of the produced water from the Codell. Analytical datum of a typical fracture stimulation fluid (frac fluid) is also presented. Additionally, COGCC files contain water quality data from other domestic water wells also completed in the Laramie/Fox Hills aquifer.

The data from your water well, the produced water from selected oil/gas wells, a typical frac fluid, and other Laramie/Fox Hills water wells was entered into HydroChem, a RockWare earth science computer software program. Data can then be plotted on Stiff diagrams or Piper diagrams, two types of visual presentations.

Hampton Water Well vs. Produced Waters / Frac Fluid

The Stiff diagrams of the laboratory data clearly show the differences between the cation/anion signature of the recent sample from your water well and the cation/anion signature of the produced waters and frac fluid (Exhibit 1).

The Piper diagram displays data on a tri-linear chart. Total Dissolved Solids (TDS) values for each datum are indicated by circles; the greater the TDS, the larger the diameter of the circle. The Piper diagram clearly shows that the produced waters and frac fluid data plot in close proximity on the chart (Exhibit 2). The datum from the recent sample from your water well plots away from the produced waters and frac fluid data. The Piper diagram also shows that the recent sample from your water well has a much lower TDS concentration than the produced waters and frac fluid.

Hampton Water Well vs. Other Laramie/Fox Hills Water Wells

The Stiff diagrams of the laboratory data shows the similarity of the cation/anion signatures between the recent sample from your water well and the Smith and Stan water wells (Exhibit 3). Your well has less alkalinity than the Smith and Stan wells. The Eskildsen and Harrison water wells have lower sodium, potassium, calcium and magnesium than in your well. Additionally, sulfate was not detected in the Eskildsen and Harrison wells.

The Piper diagram displays data on a tri-linear chart. Total Dissolved Solids (TDS) values for each datum are indicated by circles; the greater the TDS, the larger the diameter of the circle. The Piper diagram of the laboratory data shows that the recent sample from your water well and the Smith, Stan and Knissen water wells plot in close proximity to each other (Exhibit 4). The Eskildsen and Harrison water well plot away from the other wells due to the lower sodium, potassium, calcium, magnesium and sulfate concentration. Your water well indicates a similar TDS concentration to the Smith, Stan and Knissen water wells.

SUMMARY AND CONCLUSIONS

A general evaluation of the laboratory results indicates that the water in your well contains higher sodium, potassium and sulfate concentrations than other Laramie/Fox Hills water wells. The source of the higher sodium and sulfates is likely from the coal seams in the lower Laramie Formation.

Based on available information, the water in your well does not appear to have been impacted by nearby oil/gas operations. Therefore, this complaint is resolved and no further investigation will be conducted at this time.

Should you have any questions, please call me at (303) 894-2100 ext. 118.

Sincerely,

Randall H. Ferguson
Environmental Protection Specialist

Attachments
Cc: Brian Macke – COGCC Director
Debbie Baldwin – COGCC Environmental Manager

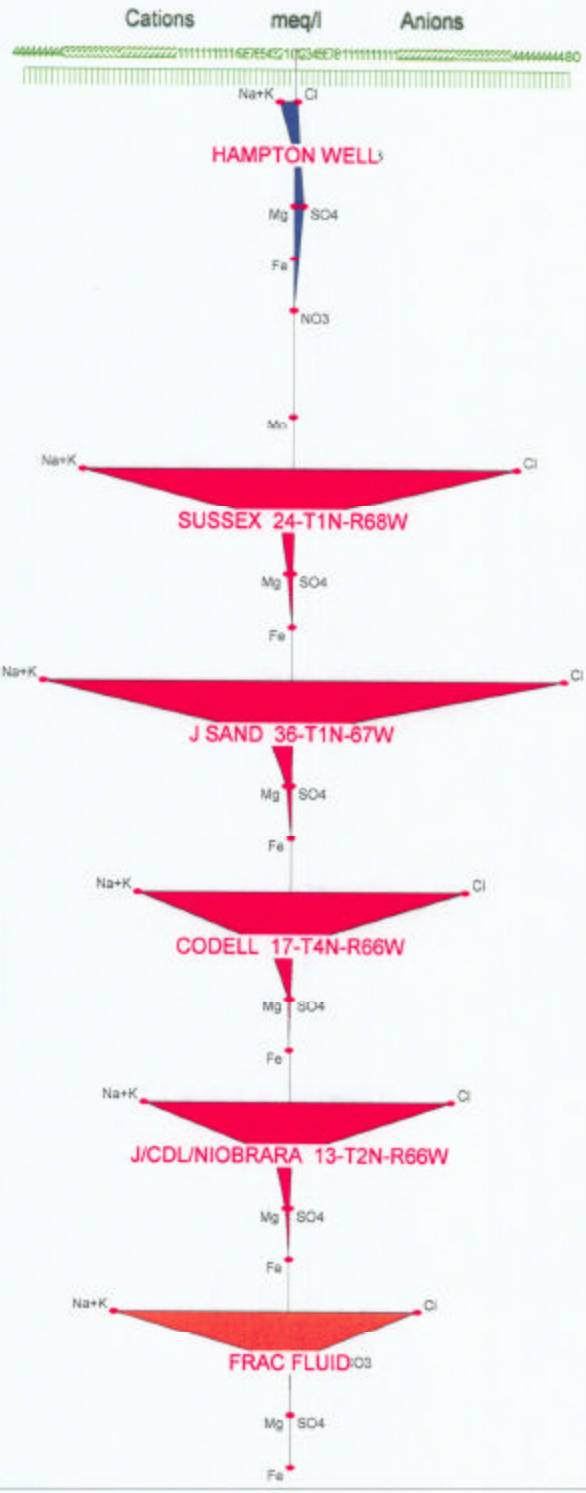

Upstream
IRB
Iron Related Bacteria
2 4 6 8 9
Days to Present
BART™
SRB
Sulfate Reducing Bacteria
2 4 6 8 9
Days to Present
BART™
SLYM
2 3 4 6 7
days to Present
BART™

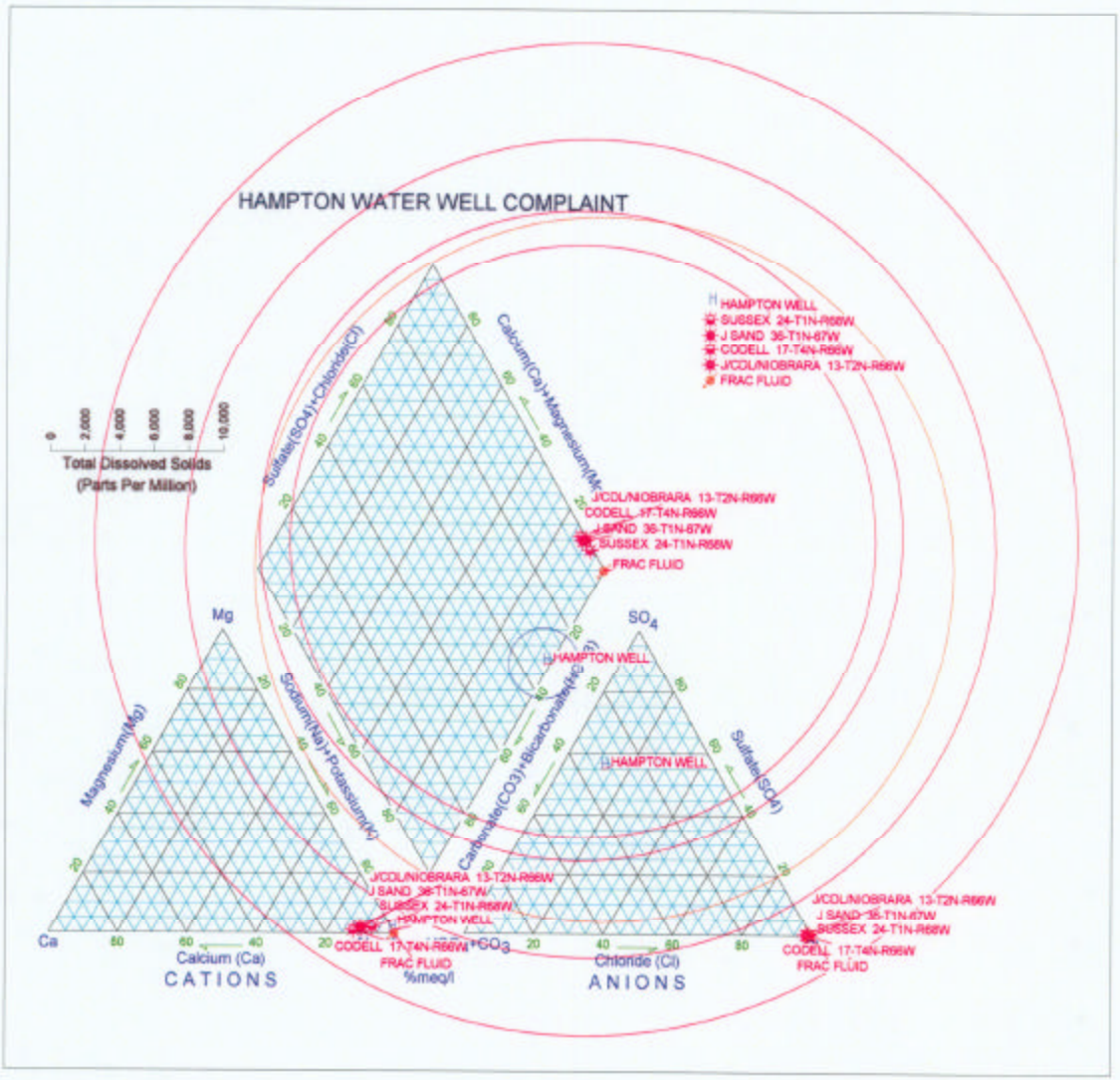

Upstream
Brown slime, foam, and/or dirty brown
No Black
Black top or bottom
No growth


Down stream
IRB
Iron Related Bacteria
2 4 6 8 9
Days to Present
BART™
SRB
Sulfate Reducing Bacteria
2 4 6 8 9
Days to Present
BART™
SLYM
Slime Forming Bacteria
2 3 4 6 7
days to Present
BART™


Downstream
No
Black
No
growth

HAMPTON WATER WELL COMPLAINT




HAMPTON WATER WELL COMPLAINT
HAMPTON WELL
SUSSEX 24-T1N-R66W
J SAND 36-T1N-67W
CODELL 17-T4N-R66W
J/CDL/NIOBRARA 13-T2N-R66W
FRAC FLUID
0
2,000
4,000
6,000
8,000
10,000
Total Dissolved Solids
(Parts Per Million)
Sulfate(SO4)+Chloride(Cl)
Calcium(Ca)+Magnesium(Mg)
Carbonate(CO3)+Bicarbonate(HCO3)
Sodium(Na)+Potassium(K)
Magnesium(Mg)
Sulfate(SO4)
Mg
SO4
Ca
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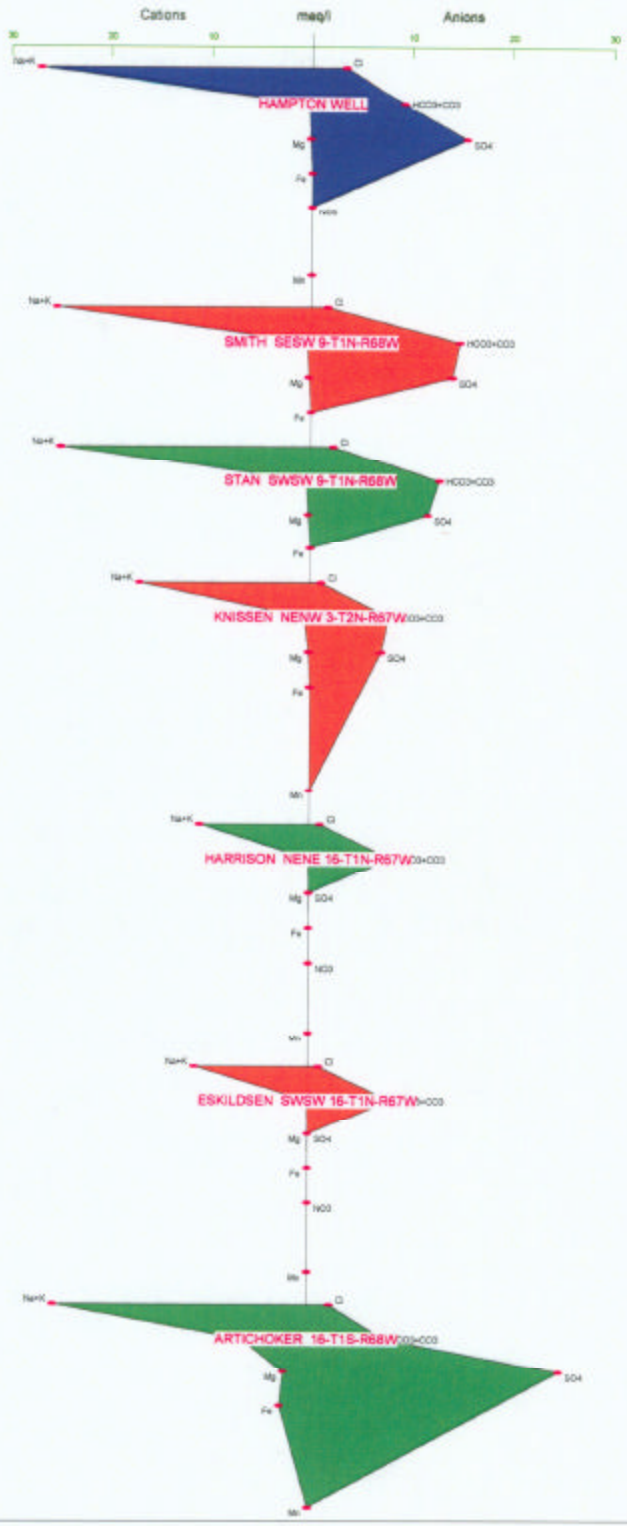
CO3
Cl
Calcium (Ca)
CATIONS
%meq/l
Chloride (Cl)
ANIONS

HAMPTON WATER WELL COMPLAINT



HAMPTON WATER WELL COMPLAINT