Appendix B

Garfield County Hydrogeologic Characterization Study – Phase II Field Sampling Plan for Task 2

Garfield County Hydrogeological Characterization Study- Phase II TASK 2

FIELD SAMPLING PLAN

S.S. PAPADOPULOS & ASSOCIATES, INC.
Boulder, Colorado

June 20, 2008

3100 Arapahoe Avenue, Suite 203, Boulder, Colorado 80303-1050 • (303) 939-8880

Garfield County Hydrogeological Characterization Study- Phase II

FIELD SAMPLING PLAN

Prepared for:

Garfield County Board of County Commissioners
Garfield County Oil & Gas Auditor

Prepared by:

S.S. PAPADOPULOS & ASSOCIATES, INC.
Boulder, Colorado

December 4, 2007

3100 Arapahoe Avenue, Suite 203, Boulder, Colorado 80303-1050 • (303) 939-8880

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1.0 PROJECT CONTACT INFORMATION AND DIRECTIONS

Emergency Information:

Police and Ambulance – 911

Hospitals (maps on next page):

Clagett Memorial Hospital – Rifle
707 East 5th St.
970-625-1510

Valley View Hospital – Glenwood Springs (32 miles east of Rifle)
1906 Blake Ave.
970-945-6535

Other Contacts

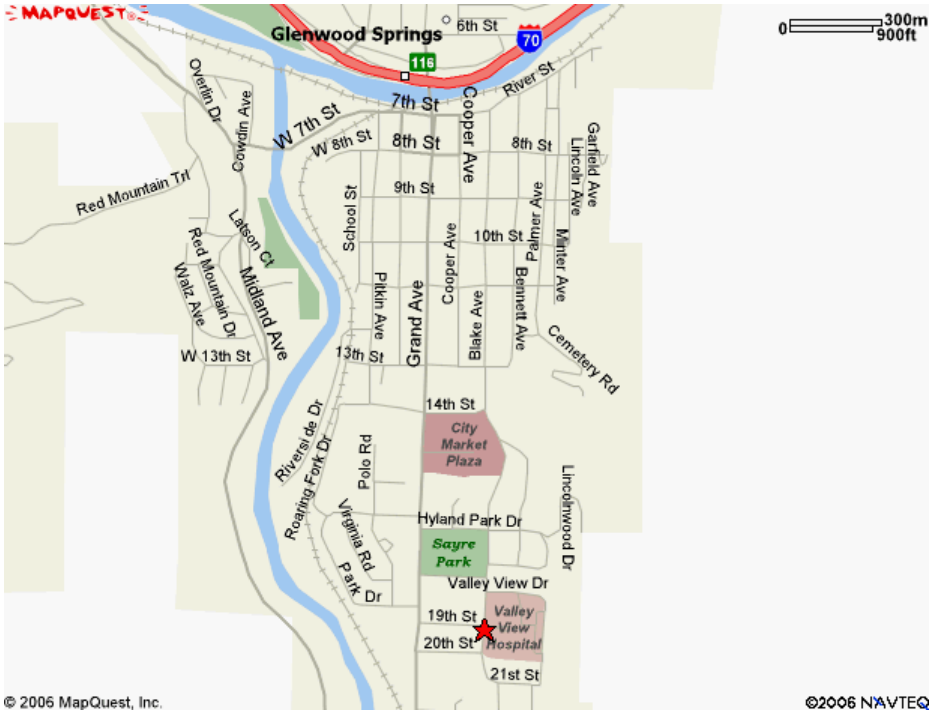
Field Environmental
800-393-4009
301 Brushton Ave., Suite A
Pittsburgh, PA 15221

ACZ laboratories
800-334-5493
2773 Downhill Drive
Steamboat Springs, CO 80487

Isotech Laboratories, Inc
217-398-3490
1308 Parkland Court
Champaign, IL 61821

Clagett Memorial Hospital – Rifle. 707 East 5th St.

Valley View Hospital – Glenwood Springs (32 miles east of Rifle). 1906 Blake Ave.



2.0 INTRODUCTION

2.1. Project Background

The Mamm Creek field covers an area of approximately 110 square miles in western Colorado. Currently, gas wells are being drilled and completed in the Upper Cretaceous Williams Fork and the Tertiary Wasatch Formations along the I-70 corridor in Garfield County. This natural gas development has been accompanied by concern from local government and the public about the potential impacts to groundwater resources. To address these concerns, Garfield County Board of County Commissioners and Garfield County Oil & Gas Auditor is conducting Hydrogeological Characterization Part II. This study involves re-sampling of domestic water wells that have been identified during past sampling events as having solutes of concern, saline water type, or methane. Producing natural gas wells located up gradient from domestic wells have been identified and will be sampled to determine if chemical signatures of producing wells are related to chemical signatures of domestic wells. The Mamm creek study area is located south of the towns of Rifle and Silt and include township ranges 6S92W, 6S93W, 7S92W, AND 7S93W. A map of this study area is shown in Figure 1.

S. S. Papadopulos & Associates, Inc. (SSPA) has been contracted by Garfield County Board of County Commissioners in conjunction with the Garfield County Oil & Gas Auditor to conduct sampling in the summer of 2007 of domestic water wells in the Mamm Creek Study area. This Field Sampling Plan (FSP) has been prepared by SSPA as a tool to ensure that field sampling personnel conduct sampling and sample-related activities in a consistent, appropriate, and efficient manner. The document is designed as a field manual for use and reference as necessary during actual sampling activities conducted in Task 2 of this project.

2.2. Objectives

The objectives of the field sampling for the Phase II Hydrogeologic Characterization of the Mamm Creek Area are to:

- Task 1: Sample domestic water wells and springs that have been identified from the Colorado Oil & Gas Conservation Commission (COGCC) database as having constituents of concern [Floride (F), Selenium (Se), and Total Nitrates (NO3)] greater than Colorado Basic Ground Water Standards (CBGWS; equivalent for these compounds to federal Maximum Contaminant Levels).

- Task 1: Sample domestic wells identified from COGCC database as having methane concentrations above 2 mg/L and only sampled once or have never been sampled for isotopes analysis.
- Task 1: Sample domestic wells that have been identified from the COGCC database as having saline waters.
- Task 2: Identify and sample produced water from gas wells located upgradient of domestic wells where high saline levels exist; and methane thermogenic signature is required.
- Task 2: Identify and sample gas and produced water from gas wells located upgradient of domestic wells where methane concentrations have exceeded 2 mg/L and exhibit possible thermogenic origins.

2.3. Hydrogeologic Setting

The Wasatch Formation consists of mudstone with intervening lenses of fine-grained sandstone. Porosity and hydraulic conductivity are low in the Wasatch and much of the groundwater produced from Wasatch wells is likely from flow through open fractures. Wasatch wells in the study area may be several hundred feet deep; well yield varies widely, but often is fairly low (5 or fewer gallons per minute [gpm]) and depth to water in the wells commonly exceeds 100 feet.

2.4. Sampling Locations and Parameters

The target area for this sampling project is shown in Figure 1. Production wells that were selected to be sampled for water quality parameters are listed in Table 1. Production wells that are selected to be tested for water quality parameters and produced gas composition are listed in Table 2. The wells that will be sampled were selected by SSPA, in consultation with the Garfield County Oil & Gas Liaison and the COGCC, based on data from previous water sampling events, and from information gathered during Task 1 of this study. Gas wells are listed by "SSPA Location" or group numbers; groups may be an individual well or well pads.

Water from all of the wells listed in Table 1 and Table 2 will be analyzed in the laboratory for the water quality parameters listed below. All water quality parameters will be analyzed at ACZ laboratories in Steamboat Springs, CO.

- Major anions (Cl, SO4, CO3 , HCO3 , NO3, NO2)
- Major cations (Na, Ca, Mg, K, Fe)
- pH
- Total dissolved solids (TDS)
- Halides (F , Br, Se, B, and Sr)

Nine production wells, listed in Table 2, that are located near domestic wells that have elevated levels of methane will be tested for produced gas. All gas composition and stable isotope analysis samples will be analyzed at the Isotech, Inc., laboratory in Champaign, Illinois, for the following parameters:

- Fixed Gas Chromatography: H2, Ar, N2, O2, CO2, H2S
- Hydrocarbon Gas Chromatography: C1, C2, C3, iC4, nC4, iC5, nC5, and C6+
- Stable Isotopic Analysis: δ13C of C1, δD of C1, δ13C of CO2, δ13C of C2 and C3

Produced water samples from gas wells are not to be commingled. In situations were multiple wells discharge produced water into one storage tank or differentiation of water source from individual wells is not possible, no sampling will occur.

3.0 WATER AND GAS SAMPLING PROCEDURES

3.1. Field Sampling Forms and Logbook Procedures

Field sampling personnel will be responsible for collecting well information. The name of the well should be recorded. If water samples from well pads are mixed, then information about the wells will be collected but not sampled. The information in the field sampling form will be filled out as completely as possible for each well sampled. In addition, each field sampler will maintain a personal field logbook to document overall field activities.

3.2. Well and Sample Identification

Well/sample identification will be a unique identifier for each sample location. All field forms will include well and sample identifiers. Details for well and sample identification are provided below.

Well Identification: Locations will be identified using the API facility identifier provided in the COGCC database. Each well facility number is unique to a sampling location regardless if there are more than one well at a pad.

Sample Identification: Samples collected and submitted for laboratory analysis will be identified in the field on sample bottles and on sampling Chain-of-Custody forms using the same API facility identifier provided at each sampling site.

3.3. Field Parameters

Field parameters will be collected with a multiprobe field parameter sampler such as the Horiba U-10. A sample of produced water will be collected in a clean bucket, and calibrated multi-parameter probe will be put in the bucket to collect in situ measurement. The parameters that will be measured are pH, specific conductance (SC), temperature (T), and dissolved oxygen (DO).

3.4. Sample Point Selection

Sample points on the production wells will be determined with the guidance of operators of the gas company field team.

3.5. Purging Protocols

Water collected from produced waters may be collected from a tank or directly from the source. In the case that samples are collected from a tank, the water will not be purged, and the water will be assumed to be well mixed. In the case that the sample is collected directly with the source, water will be purged with the guidance of the company's employees.

3.6. Sampling Procedures

All samples will be collected at low flow rates between 0.1 gpm and 1 gpm.

3.6.1. Water Sample Collection

This section pertains to the collection of samples for major anions and cations, metals, halides, pH. These samples will be collected into the following sample containers which will be provided by ACZ Laboratories, Inc. (ACZ). Information provided by ACZ on sampling procedures is included in Appendix C.

For each water sample location, there is a prepackaged sample kit that contains sample containers wrapped in a polyethylene bag provided by ACZ. Sample kits contain all bottles necessary for each type of sample at each location. A label with the task names is located on the outside of the sample kit; task names were determined by ACZ and do not necessarily match descriptions of the type sample at each location. Refer to Figure 6 to determine task names by sample types and how each sample type should be collected.

Each bottle contained in the sampling kit is marked with colored dots on the side of the bottle, if there is no colored dot then the sample bottle is a RAW unfiltered sample. Raw samples can be collected as described above. Do not rinse any sample bottle before collecting, sample bottles have been pre-cleaned and some contain preservatives.

White and green sample bottles should be filtered with a 0.45 micron filter. In order to filter produced water samples, a parastaultic pump must be used, and equipment is not allowed within 75 feet of the pumps. Therefore in order efficiently collect samples, water will be filtered in the field.

Yellow and green sample bottles contain sulfuric acid and nitric acid preservatives, respectively. Before collecting sample, check to ensure that preservative has not leaked, if leaking occurred contact ACZ for instructions. While filling these samples bottles wear proper protective equipment including nitrile gloves, and be careful not to spill any of the preservative. Do not over fill samples, samples should be filled to the shoulder of the container.

If the yellow or green sample bottles are not correctly filled, the sample container(s) should be discarded and new one(s) used because they contain preservatives. All containers should be capped tightly and cleaned of debris on the outside. A water proof marker should be used to label each sample with facility identifier, sample date and time, preservative (if appropriate), filtering, and project and sampling personnel identification using the labels provided by ACZ. All bottles for each bottle kit should be retuned to the polyethylene bag and cooled to 1ºC-6º C. After collection and prior to shipping, all samples should be stored securely in a cooler on ice. Instructions for packaging and shipping the samples are provided in further detail in section 3.8.

3.6.2. Gas Composition and Stable Isotope Sampling and Shipping

All production gas samples will be collected with the assistance of operaters of natural gas companies. Safety protocols will be followed under the guidance of gas operators. The In addition, shipping of these samples, which requires special care, is described below.

Gas Composition and Stable Isotope Sampling –

Natural gas samples will be collected with a DOT approved stainless steel gas sampling container provided by Isotech labs. The sampling procedure as recommended by Isotech is attached in Appendix A.

In summary to collect produced gas samples

- Check the pressure on the well or pipeline to be sampled with a reliable pressure gauge. If the pressure exceeds 1800 psi use a regulator to collect the sample. Failure to decrease pressure could cause the collection cylinder to fail.
- Remove the end caps from both ends of a cylinder, the threads, and wrap 2 to 4 wraps of Teflon tap on one of the valves.
- Locate a valve or gauge port having a ¼" NPT female thread suitable for collecting the sample. Crack the control valve on the sampling port slightly so that you can hear a small amount of gas escaping. With the gas

still flowing slightly (to purge the air from the valve) screw the taped end of the gas cylinder valve into the sampling port and snug it down with a wrench.

- Open the control valve fully. Carefully open the inlet valve on the cylinder and allow 5 or 10 seconds for the cylinder to equilibrate with the well pressure. Close the cylinder inlet valve and then open the outlet valve to vent the gas in the cylinder. Leave the outlet valve open just until you can no longer hear gas escaping, and then close it.
- Repeat closing and opening of the gas cylinder once more to flush air has been flushed from the connecting line.
- When the cylinder has been adequately flushed, check to see that the cylinder outlet valve is firmly closed and then open the inlet valve one more time. Allow 20 or 30 seconds for the cylinder to become pressurized and then close the inlet valve by hand. **Do not use wrenches or pliers to close the valves. They have soft seats and excessive force can ruin them.**
- Close the control valve on the well or pipeline and remove the cylinder. Be sure to use an adjustable or open-end non sparking wrench on the valve body; do not use a pipe wrench on the cylinder as this could loosen the valve from the cylinder.
- Clean the used tape off of the thread, and reapply Teflon tape to the threads on both ends of the cylinder. Snug the end caps with two non sparking wrenches to snug the end caps. This is important to insure that the sample will not be lost if one of the valves should leak or accidentally open. Record the well name or number, the sample pressure, and the sampling date on the cylinder tag and return the cylinder to the shipping carton.

1

Gas Composition and Stable Isotope Sample Shipping:

All shipments should be via an overnight courier to minimize the amount of time in which the cooler containing the samples might be stored in a position other than right side up. The shipping container should be clearly marked with the contents. Shipping instructions provided by Isotech should be followed closely.

3.7. Equipment Decontamination

Any equipment, buckets, hoses, and probes that may come in contact with well water or surface sampling apparatus should be cleaned and disinfected to maintain sample integrity. The pieces requiring decontamination will be cleaned using the following protocol: For Task 2

sampling, the equipment that is necessary to be decontaminated included any dipping apparatus or beakers used to hold sampling water.

1. Clean equipment as needed with a mild detergent solution (using TSP or Alconox) and triple rinse thoroughly with distilled water;
2. Allow to air dry.

3.8. Sample Handling, Packing, and Shipping

Prior to final packing and shipping of samples to the analytical laboratory, complete all Chain-of-Custody forms, shown in Figure 5, required to be shipped with the samples. Double check both the numbers and types of bottles against the Chain-of-Custody forms to ensure consistency in both quantities and labeling. Sign all Chain-of-Custody forms prior to sealing them in ziplock bags and placing the bags in the coolers for shipment. Every cooler containing samples for analysis should contain at least one Chain-of-Custody form.

Pack the sample bottles upright (or inverted for sample bottles containing bactericide capsules in the lid) in the cooler with at least 1 to 2 times as much ice as the total volume of samples. Glass containers should be separated with plastic containers, ice packs, or padding to minimize the potential for breakage during transport. Prior to sealing the sample coolers, confirm that fully completed and signed Chain-of-Custody forms (and other laboratory-required forms) are included and are stored in sealed ziplock bags. Seal the coolers shut securely with shipping tape and with laboratory-supplied custody seals, if appropriate.

Where possible, use overnight courier services (e.g., UPS) to ship samples so that they will be received by the laboratory within 24 hours of shipment. If necessary, contact the laboratory and arrange to have laboratory personnel available to take custody of and process shipments delivered on weekends or holidays.

4.0 WELL LOCATION DOCUMENTATION

For both COGCC database construction/maintenance and future field sampling purposes it is important that all wells sampled be fully described and precisely located. For the Garfield County sampling project the following protocols will be used.

4.1. Well Location Description and Photographic Documentation

At each location sampled, a well information form will be completed. A copy of the form to be used is shown in Figure 2. In addition to completing well number, name and operator information, the form contains an area for description of the location and area around the well. It is important that this information be completed to a degree sufficient to allow future sampling personnel to locate and identify the well in the field in a situation where no one—either sampler or future operator—is familiar with previous sampling events. The description should include location relative to the nearest roads and buildings and any features or structures that may be housing or obscuring the well. In addition, the description should also include where the well was sampled and how that point is located relative to the well and/or the pressure tank or other significant features on the water supply system.

Each natural gas well sampled should be photographed by the sampler at the time of sampling. At a minimum the following photographs should be taken:

- Site locator photograph showing enough information for future sampling teams to positively identify the property being sampled.
- Well head photograph.
- Sampling location photograph.

Each photograph taken should be documented on the well information form or in the sampler's field notebook at the time the photograph is taken.

4.2. GPS Location Determination

A Differential GPS instrument is not required for mapping of wells in the project. All wells in this study have been sampled previously, which suggests that accurate GPS coordinates were obtained in the past. Therefore a handheld GPS unit will be used to record the positions of wells.

For the natural gas wells sampled during the Garfield County study, a hand held Garmin eTrex GPS unit will be used. Operating instructions for the instrument are contained in the instrument carrying case and will be kept in the field at all times. Field personnel will collect measurements at the time of sampling activities and will write down the coordinate information on the Well Information Form.

5.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

5.1. Sample Chain of Custody

Chain-of-Custody forms similar to that shown in Figure 5 will be completed and provided with all samples submitted to analytical laboratories. A copy of each form will be retained by the field personnel who packages and relinquishes the sample coolers.

5.2. Field QA/QC

5.2.1. Field Equipment Calibration and Maintenance

Calibration of the water quality multi-parameter meter (measures, pH, T, SC, and DO) will be conducted at the beginning of each week of sampling and at other times if the field sampling personnel suspect that instrument errors are occurring. Calibration will be performed according to the instructions kept in the instrument carrying case.

5.2.2. Field Duplicates and Blanks

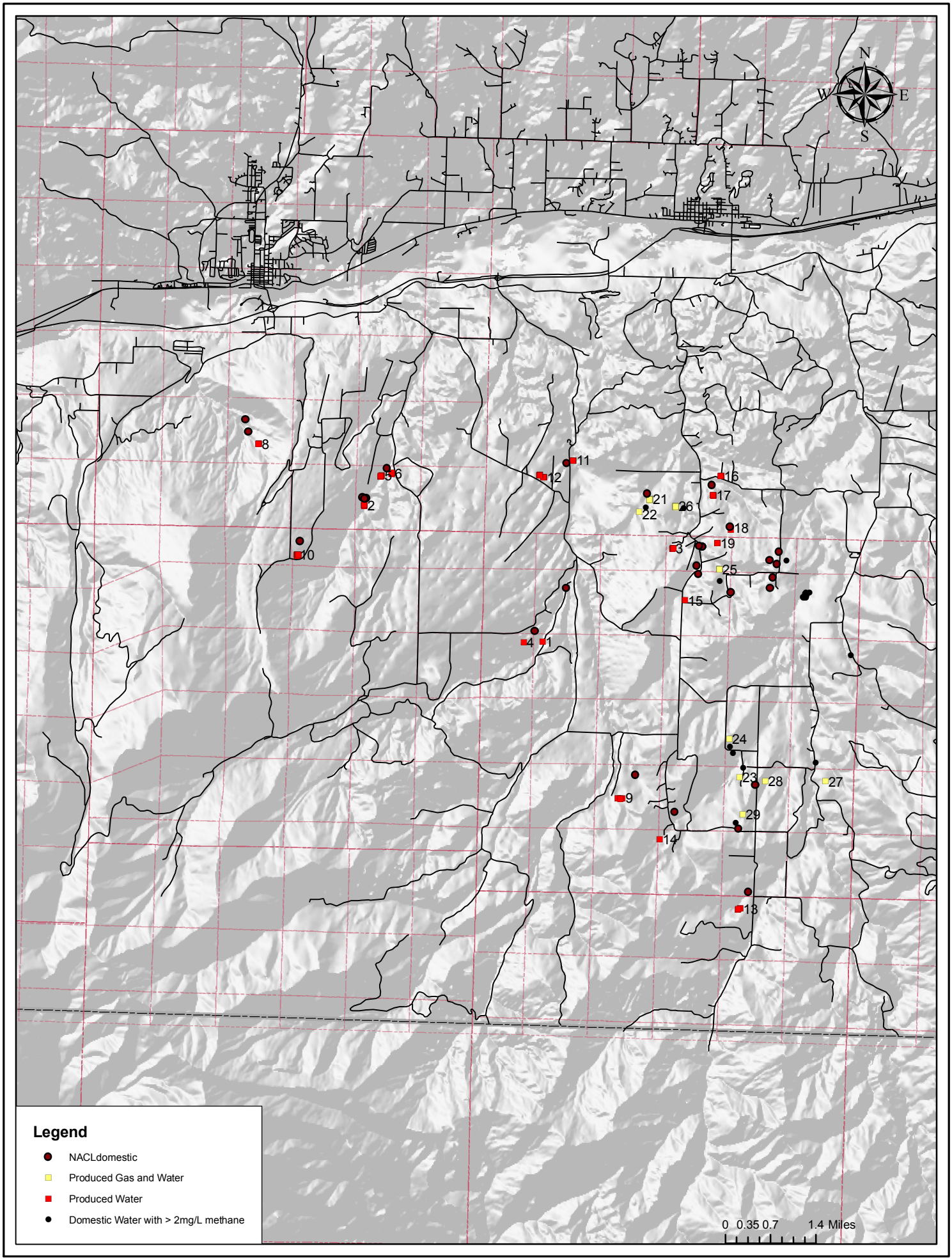
Equipment duplicated will be collected at a rate of one duplicate sample per 10 produced water samples. One trip blank will be collected during the field sampling event. No Matrix Spike/Matrix Spike duplicate field samples will be collected or analyzed.

6.0 REFERENCES

ASTM International, 2002, Standard Practice for Low-Flow Purging and Sampling for Wells and Devices Used for Ground-Water Quality Investigations. American Society for Testing and Materials, D 6771-02.

Puls, R. W., and M. J. Barcelona, 1996, Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures. U. S. Environmental Protection Agency, Office of Research and Development, Publication No. EPA/540/5-95/504, 12 pp.

URS, 2006, Phase 1 Hydrogeologic Characterization of The Mamm Creek Field Area in Garfield County, URS Corporation, Denver, CO.



Proposed Produced Water Sampling Locations

Well Sampling Form

Well Operatorr: **Date:** _____

Well Name: **Time:** _____

Well Location: **Staff:** _____

API Number/FACILITY ID: _____

Pre-Sampling Information

Water Color: _____

Water Clarity: _____

Odor: _____

Effervescence: _____

Produced Sediment: _____

Bacterial Fouling: _____

Notes: _____

_____

_____

Water Quality Sampling?: YES____ NO__ **# Samples:** _____

Dissolved Gas Sampling?: YES____ NO____

Well Purging and Water Quality Sampling

Time _____

pH _____

Temp (C) _____

SC (t-uS/cm) _____

DO (mg/L) _____

Notes _____

_____

_____

EnCana Produced Water Sampling Locations
(Garfield County - Phase 2 Hydrogeologic Characterization Study)

SSPA Location	API Number	Operator	Well Number	Well Name	Well Status	QtrQtr	Sec	Twp	Rng	Comment
1	05-045-07366	EnCana	17-4	COUEY	PR	NWNW	17	7S	92W	
2	05-045-06934	EnCana	35-12	KELL	PR	NWSW	35	6S	93W	
2	05-045-07604	EnCana	35-11 (L35)	KELL	PR	NWSW	35	6S	93W	
2	05-045-07605	EnCana	35-13 (L35)	GMU	PR	NWSW	35	6S	93W	
2	05-045-07606	EnCana	35-5 (L 35)	GMU	PR	NWSW	35	6S	93W	
2	05-045-07607	EnCana	35-14 (L35)	GMU	PR	NWSW	35	6S	93W	
3	05-045-06948	EnCana	7-16	KRK LTD	PR	SESE	7	7S	92W	
4	05-045-07157	EnCana	18-1	PITMAN	PR	NENE	18	7S	92W	
5	05-045-07584	EnCana	26-14 (C35)	GMU	PR	NENW	35	6S	93W	
5	05-045-07585	EnCana	35-7 (C35)	BENZEL	SI/PR	NENW	35	6S	93W	PR 7/07
5	05-045-10283	EnCana	35-6A (C35)	CRAIG	PR	NENW	35	6S	93W	
5	05-045-10284	EnCana	35-5A (C35)	CRAIG	PR	NENW	35	6S	93W	
5	05-045-13440	EnCana	35-4A1(C35)	GMU	PR	NENW	35	6S	93W	
6	05-045-09152	EnCana	35-4D(B35W	KELL	PR	NWNE	35	6S	93W	
6	05-045-09155	EnCana	35-4A (B35W)	KELL	PR	NWNE	35	6S	93W	
6	05-045-09157	EnCana	35-3B (B35W)	KELL	PR	NWNE	35	6S	93W	
6	05-045-09158	EnCana	35-3D (B35W)	KELL	PR	NWNE	35	6S	93W	
7	05-045-07797	EnCana	9-1 (M3)	HMU	PR	SWSW	3	7S	93W	
7	05-045-07798	EnCana	10-4 (M3)	HMU	PR	SWSW	3	7S	93W	
8	05-045-07933	EnCana	28-7 (K28)	GMR	PR	NESW	28	6S	93W	
8	05-045-07935	EnCana	28-11 (K 28)	BENJAMIN	PR	NESW	28	6S	93W	
8	05-045-10106	EnCana	28-14D (K28)	GMU	PR	NESW	28	6S	93W	
9-W	05-045-09270	EnCana	28-6B (K28E)	MALONE	SI	NESW	28	7S	92W	Last PR 11/05
9-W	05-045-09271	EnCana	28-11B (K28E)	MALONE	SI	NESW	28	7S	92W	Last PR 11/05
9-C	05-045-09269	EnCana	28-7B (K28E)	MALONE	SI	NESW	28	7S	92W	Last PR 11/05, 1 water spl
9-C	05-045-09272	EnCana	28-10B (K28E)	MALONE	PR	NESW	28	7S	92W	
9-E	05-045-09040	EnCana	28-11A (K28E)	MALONE	SI/PR	NESW	28	7S	92W	PR 7/07

EnCana Produced Water Sampling Locations
(Garfield County - Phase 2 Hydrogeologic Characterization Study)

10	05-045-09042	EnCana	4-16D (M3A)	GMR	PR	SWSW	3	7S	93W	
10	05-045-09043	EnCana	3-11B (M3A)	GMR	PR	SWSW	3	7S	93W	
10	05-045-09045	EnCana	4-9D (M3A)	GMR	PR	SWSW	3	7S	93W	
10	05-045-09047	EnCana	3-13A (M3A)	GMR	PR	SWSW	3	7S	93W	
10	05-045-09050	EnCana	3-14B (M34)	HMU	PR	SWSW	3	7S	93W	
10	05-045-10260	EnCana	3-12D (M3A)	GMR	PR	SWSW	3	7S	93W	
10	05-045-10261	EnCana	3-13C (M3A)	GMR	PR	SWSW	3	7S	93W	
10-S	05-045-09044	EnCana	9-1D (M3A)	GMR	PR	SWSW	3	7S	93W	
10-S	05-045-09046	EnCana	3-13D (M3A)	GMR	PR	SWSW	3	7S	93W	
10-S	05-045-09048	EnCana	3-13B (M3A)	GMR	PR	SWSW	3	7S	93W	
10-S	05-045-09049	EnCana	10-3B (M3A)	HMU	PR	SWSW	3	7S	93W	
10-S	05-045-09051	EnCana	3-14D (M3A)	HMU	PR	SWSW	3	7S	93W	
11	05-045-09160	EnCana	29-14 (029)	SHIDELER	PR	SWSE	29	6S	92W	
11	05-045-09162	EnCana	29-15 (029)	SHIDELER	PR	SWSE	29	6S	92W	
11	05-045-11855	EnCana	29-14C (O29NE)	SHIDELER	PR	SWSE	29	6S	92W	PR as of 6/07
12-NW	05-045-08109	EnCana	31-8A2 (D32)	COUEY	PR	NWNW	32	6S	92W	
12-NW	05-045-08110	EnCana	32-3B2 (D32)	COUEY	PR	NWNW	32	6S	92W	
12-NW	05-045-08111	EnCana	32-5C4 (D32)	COUEY	PR	NWNW	32	6S	92W	
12-NW	05-045-08113	EnCana	32-542 (D32)	COUEY	PR	NWNW	32	6S	92W	
12-NW	05-045-08149	EnCana	29-13 (D32)	COUEY	PR	NWNW	32	6S	92W	
12-SE	05-045-07627	EnCana	32-4	COUEY	PR	NWNW	32	6S	92W	
12-SE	05-045-07628	EnCana	31-1 (D32)	COUEY	PR	NWNW	32	6S	92W	
12-SE	05-045-07629	EnCana	32-5 (D32)	SHIDELER	PR	NWNW	32	6S	92W	
12-SE	05-045-07630	EnCana	32-3 (D32)	COUEY	PR	NWNW	32	6S	92W	
13	05-045-09170	EnCana	2-6A (C2)	GALLOWAY	SI	NENW	2	8S	92W	Last PR 11/05, 2 gas spls
13	05-045-09171	EnCana	2-5A (C2)	GALLOWAY	SI	NENW	2	8S	92W	Last PR 11/05
13	05-045-09173	EnCana	35-13D (C2)	GALLOWAY	SI	NENW	2	8S	92W	Last PR 2/06
13	05-045-09174	EnCana	2-3A (C2)	GALLOWAY	SI	NENW	2	8S	92W	Last PR 11/05
14	05-045-09353	EnCana	34-4C (D34SE)	O'CONNELL	SI	NWNW	34	7S	92W	Last PR 12/05

Bill Barrett Corp Produced Water Sampling Locations
(Garfield County - Phase 2 Hydrogeologic Characterization Study)

15	05-045-10521	Barrett	34B-27-692	FERGUSON	PR	SWSE	27	6S	92W	
15	05-045-10522	Barrett	44D-27-692	FERGUSON	PR	SWSE	27	6S	92W	
15	05-045-10523	Barrett	44B-27-692	FERGUSON	PR	SWSE	27	6S	92W	
15	05-045-10524	Barrett	34D-27-692	FERGUSON	PR	SWSE	27	6S	92W	
16	05-045-10760	Barrett	41B-34-692	LOUTHAN	PR	NENE	34	6S	92W	
16	05-045-10761	Barrett	31B-34-692	LOUTHAN	PR	NENE	34	6S	92W	
16	05-045-10762	Barrett	41D-34-692	LOUTHAN	PR	NENE	34	6S	92W	
16	05-045-10763	Barrett	31D-34-692	LOUTHAN	PR	NENE	34	6S	92W	
17	05-045-10815	Barrett	42D-34-692	STONE	PR	SWNE	34	6S	92W	
17	05-045-10816	Barrett	42B-34-692	STONE	PR	SWNE	34	6S	92W	
17	05-045-10817	Barrett	32D-34-692	STONE	PR	SWNE	34	6S	92W	
17	05-045-10818	Barrett	32B-34-692	STONE	PR	SWNE	34	6S	92W	
18	05-045-09418	Barrett	39328	LAST DANCE	PR	SESE	34	6S	92W	2 gas spls
19	05-045-11401	Barrett	43A-3-792	LAST DANCE	PR	NESE	3	7S	92W	
19	05-045-11402	Barrett	43C-3-792	LAST DANCE	PR	NESE	3	7S	92W	
19	05-045-11403	Barrett	33C-3-792	LAST DANCE	PR	NESE	3	7S	92W	

EnCana Gas (+Water) Sampling Locations
(Garfield County - Phase 2 Hydrogeologic Characterization Study)

SSPA Location	API Number	Operator	Well Number	Well Name	Well Status	QtrQtr	Sec	Twp	Rng	Comment
21	05-045-07651	EnCana	33-2 (G33)	BOULTON	SI (PR 7/07)	SWNE	33	6S	92W	Dev 1569N, 512W, 6 gas spls
21	05-045-07652	EnCana	33-7 (G-33)	BOULTON	SI (PR 7/07)	SWNE	33	6S	92W	Dev 447N, 545W, 7g/1w spls
21	05-045-07653	EnCana	33-9 (G33)	BOULTON	SI (PR 7/07)	SWNE	33	6S	92W	Dev 998S, 764E, 6g/1w spls
21	05-045-07654	EnCana	33-8 (G33)	BOULTON	SI (PR 7/07)	SWNE	33	6S	92W	Dev 367N, 802E, 3 gas spls
21	05-045-10264	EnCana	33-8A(G33NE)	BOULTON	PR	SWNE	33	6S	92W	Dev 856N, 728E, 3 gas spls
21	05-045-13527	EnCana	33-10A2(G33NE)	BOULTON	PR	SWNE	33	6S	92W	Dev 685S, 460W
22	05-045-07155	EnCana	33-10	BOULTON	PR	NWSE	33	6S	92W	
23	05-045-08197	EnCana	26-4D1 (D26)	FAZZI	SI	NWNW	26	7S	92W	Last PR 3/04
24	05-045-09111	EnCana	24-12B (H23)	DIVIDE CREEK L&C	SI	NWSW	23	7S	92W	Last PR 11/06
25	05-045-09118	EnCana	3-16C (P3)	ARBANEY	PR	SESE	3	7S	92W	5 gas spls
25	05-045-09461	EnCana	10-1A (P3)	MAGIC	PR	SESE	3	7S	92W	Dev 358S, 893E, 1 gas spl
25	05-045-09462	EnCana	10-1(P3)	MAGIC	PR	SESE	3	7S	92W	Dev 850S, 316E, 2 gas spls
25	05-045-09463	EnCana	10-2 (P3)	MAGIC	PR	SESE	3	7S	92W	Dev 851S, 980E, 3 gas spls
26	05-045-09153	EnCana	34-5 (L34)	MAGNALL	PR	NWSW	34	6S	92W	Dev 860N, 25E. 2 gas spls
26	05-045-09154	EnCana	34-6 (L34)	MAGNALL	PR	NWSW	34	6S	92W	Dev 658N, 1368E, 2 gas spls
26	05-045-09156	EnCana	34-12 (L34)	MAGNALL	PR	NWSW	34	6S	92W	Dev 391S, 34E
26	05-045-09159	EnCana	34-11 (L34)	MAGNALL	PR	NWSW	34	6S	92W	Dev 437S, 1360E
26	05-045-13445	EnCana	34-6C(L34)	SCHICKLING	PR	NWSW	34	6S	92W	Dev 216N, 1328E
26	05-045-13446	EnCana	34-5C(L34)	SCHICKLING	PR	NWSW	34	6S	92W	Dev 190N, 20W
27	05-045-09195	EnCana	25-2C (B25E)	DIVIDE CREEK L&C	SI	NWNE	25	7S	92W	Last PR 2/06
28	05-045-09206	EnCana	26-2D (B26E)	DIVIDE CREEK L&C	PR	NWNE	26	7S	92W	
29	05-045-09211	EnCana	26-11C (K26E)	FAZZI	SI	NESW	26	7S	92W	Last PR 2/06, 2 gas spls

Appendix A
Isotech Stainless Steel Gas Sampling Tube Instructions

ISOTECH®
ISOTECH LABORATORIES INC
1308 Parkland Court Champaign, IL 61821 • (877) 362-4190 • www.isotechlabs.com

Collection of Gas Samples With Double-Ended Gas Cylinders

1. Check the pressure on the well or pipeline to be sampled with a reliable pressure gauge. If the pressure exceeds 1800 psi, **STOP**, a pressure reduction regulator **must** be used to collect the sample as the **maximum rated pressure** for these gas cylinders is **1800 psi**.

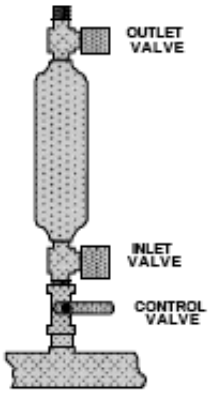
2. Remove the end caps from both ends of a cylinder and clean off the threads. Using the Teflon tape provided, place 2 to 4 wraps of tape on the threads on one of the valves.

3. Locate a valve or gauge port having a ¼" NPT female thread suitable for collecting the sample. Crack the control valve on the sampling port slightly so that you can hear a small amount of gas escaping.

4. With the gas still flowing slightly (to purge the air from the valve) screw the taped end of the gas cylinder valve into the sampling port as shown on the drawing and snug it down with a wrench. The control valve can now be fully opened.

5. Carefully open the inlet valve on the cylinder and allow 5 or 10 seconds for the cylinder to become pressurized up to the well pressure.

6. Close the cylinder inlet valve and then open the outlet valve to vent the gas in the cylinder. Leave the outlet valve open just until you can no longer hear gas escaping, and then close it.



7. Although these cylinders are fully evacuated before sending them to the field, it is advisable to repeat steps 5 and 6 once or twice to insure that all air has been flushed from the connecting line.

8. When the cylinder has been adequately flushed, check to see that the cylinder outlet valve is firmly closed and then open the inlet valve one more time. Allow 20 or 30 seconds for the cylinder to become pressurized and then close the inlet valve. **Do not use wrenches or pliers to close the valves. They have soft seats and excessive force can ruin them.**

9. Close the control valve on the well or pipeline and remove the cylinder. Be sure to use an adjustable or open-end wrench on the valve body; do not use a pipe wrench on the cylinder as this could loosen the valve from the cylinder. Clean the used tape off of the thread.

10. Wrap the threads on both ends of the cylinder with Teflon tape and replace the end caps. Use two wrenches to snug the end caps. This is important to insure that the sample will not be lost if one of the valves should leak or accidentally open.

11. Record the well name or number, the sample pressure, and the sampling date on the cylinder tag and returnthe cylinder to the shipping carton. Ship the samples to Isotech as explained in the enclosed shipping instructions.

Appendix B

Specification Sheets for Multiprobe and Filter

FIELD Environmental Instruments

Equipment Rental and Field Supplies

"Your Needs Are Our Business"

Toll-Free
800-393-4009

VOSS Technologies

Single Sample
Disposable 0.45 Filter

The Single Sample® Groundwater Cartridge features 1/8" NPT threaded inlet and outlets with stepped hose adapter on the inlet side for in line filtering of pumped samples with up to 3/8 ID tubing.

An optional stepped barb can be threaded on each end for use of up to 1/2" tubing.

- A true membrane element.
- Certification for 67 metals and 2 anions.
- Completely inert components and assembly process.
- Ready to use.
- Individually sealed packaging.
- 1/8" NPT treaded ends with stepped hose adapter on inlet side.
- .45µm, 1µm and 5 µm elements available.

ORDERING INFORMATION

Field Environmental Instruments
99 Miller Avenue
Braddock, PA 15104

For Orders or Inquiries:
800-393-4009
Fax 412-271-5083

Visit us soon on the web
www.fieldenvironmental.com

Appendix C

ACZ Bottle Orders and Sampling Information

A C Z Laboratories, Inc.

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Bottle Order Packing List

Account: S.S. Papaodopulos Assoc.
Bottle Order: BO17244
Internal Note:

Bill to Account: Bill to ACZ
Ship Date Requested: 05/31/2007
Request Placed at: 05/31/2007 09:06
Service Requested: UPS Ground

Sampling supplies

PACK	Qty	ACZ ID	Type	Description
	2	COC	Chain of Custody	Chain of Custody, 1 for 10 samples.
	2	SEAL	Custody Seal	Custody seals for cooler, two for each cooler.
	1	RETURN	Return Address	Return Address label, one for each cooler.
	150	LABELS	Sample Labels	ACZ supplied labels for sample containers

Quote number: GARFIELD-GW
Garfield County: 70 groundwater wells July - August 2006

Sample Quantity: 15
Client is responsible for necessary field filtering

PACK	Qty	Type	Size	Filter/Raw/Preserve	Instructions
	1	RAW	500 ML	Raw	Wet Chemistry (analyses that do not require preservative or filtration) - Completely fill container.
	1	WHITE	250 ML	Filtered	Wet chemistry (dissolved) - Filter sample with .45 micron filter. Completely fill container.
	1	RED PC	250 ML	Red pre-cleaned Raw/Nitric	Metals (total including ICPMS) - Do not overfill as there is Nitric Acid in the bottle.
	3	VIAL P	40 ML	Raw/HCl	VOA, BTEX, TVH - Do not overfill and make sure sample contains no bubbles.
	1	YELLOW	250 ML	Raw/Sulfuric	For total wet chemistry analyses. Do not overfill as there is Sulfuric Acid in the bottle.
	3	VIAL UP	40 ML	Raw	VOA & Radon - Do not overfill and make sure sample contains no bubbles.

A C Z **Laboratories, Inc.**
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Bottle Order Packing List

Account: **S.S. Papaodopulos Assoc.**
Bottle Order: **BO17244**
Internal Note:

Bill to Account: **Bill to ACZ**
Ship Date Requested: **05/31/2007**
Request Placed at: **05/31/2007 09:06**
Service Requested: **UPS Ground**

General Sampling Techniques and Instructions

Inspect the sample containers provided in the sample kits. If any of the preservative has leaked notify your project manager or client services contact as soon as possible.

The sample containers are packaged in separate polyurethane bags or in bubble wrap for larger sample containers representing the total number of samples you need to collect. Ten bags of bottles equal 10 samples to be collected. Treat each sample container package as a set, sample from the same place and at the same time for all containers in the set.

The sample containers can be identified by the colored dot on the side of the container. A RED container type will have a red dot on its side. Raw/unpreserved container types do not have a colored dot.

Except for RAW container types, each container has a preservative specific to the analysis you have requested. Do not rinse any container and take care not to lose any of the preservative when filling containers with your sample.

Some samples collected for inorganic constituents should be field filtered. If you are unable to perform the filtration in the field please notify your project manager so the samples can be properly prepared when they arrive at the lab. The "Filter/Raw/Preserve" column above shows what containers should be field filtered. There are many techniques for field filtering, however, when using tubing or pumps, please ensure your equipment is as clean as possible to diminish contamination affects. The filter should typically be .45 um pore size unless otherwise stated in "Sampling Instruction Specifics" page of this packet. You may also send a "Field Blank" with your sample (using the same equipment for sample filtering) to determine any field contamination problems.

Completely fill containers with your sample to the shoulder of the container. All 40 mL vials require "Zero Headspace"; make sure no air is present in the container for these samples.

Make sure all caps are tight for shipment. Clean any debris from the outside of the containers. Label all containers with the provided labels for your sample. Use a waterproof marker to write on the label. For each label fill in at a minimum the Company, Sample ID, Sample Date and Time. Also check whether the sample was filtered or not.

Place the entire sample set back into the original polyurethane bag. Cool the samples to 0ºC to 4ºC, place upright in a similar configuration within the cooler provided. Place the frozen ice packets around the samples and seal for return shipment. All samples other than Red, Green and Tan should be cooled to 0ºC to 6ºC for return shipment. For sample sets with short hold times please send the cooler via an overnight shipping company to ACZ.

In ACZ's ongoing effort to improve quality the use of custody seals (CS) has been implemented. For security purposes the CS should be applied to the sample cooler and cooler lid when samples are shipped back to ACZ. The condition of the seal, upon receipt, is indicative if the cooler has been tampered with during the time in transit. Apply the CS on the opening side of the container, sign and date the CS, and cover the CS with clear packing tape. Upon receipt of the container at the lab any damage will be reported to the QA/QC Officer.

Appendix D

Chain of Custody Forms

Send Data and Invoice to

Name: _____

Company: _____

Address: _____

_____

Phone: _____

Fax: _____

Email: _____

Project: _____

Location: _____

Sampled by: _____

Circle one:

Standard

Priority

Rush

ISOTECH

Isotech Laboratories, Inc.

1308 Parkland Court

Champaign, IL 61821

Phone: 217-398-3490

Fax: 217-398-3493

www.isotechlabs.com

mail@isotechlabs.com

Analysis Package Codes on Back

Sample Description

Container Number	Sample Identification	Date Sampled	Time	Analyses Requested			Comments

Chain-of-Custody Record

Signature	Company	Date	Time
Relinquished by			
Received by			
Relinquished by			
Received by			
Relinquished by			
Received by			

EXPLANATION OF ANALYSIS CODES

Natural Gas Characterization

NG-1; level 1 analysis - composition, $\delta^{13}C$ and δD of CH_4

NG-2; level 2 analysis - NG-1 plus $\delta^{13}C$ of C_2H_6, and C_3H_8

NG-3; level 3 analysis - NG-2 plus $\delta^{13}C$ of $i\text{-}C_4H_{10}$, and $n\text{-}C_4H_{10}$

Bacterial Gas Characterization

BG-1; level 1 analysis - composition, $\delta^{13}C$ of CH_4 and CO_2, δD of CH_4

BG-2; level 2 analysis - BG-1 plus ^{14}C in CH_4

BG-3; level 3 analysis - BG-2 plus ^{3}H in CH_4

Water Analysis

SIW; stable isotopes of water - δD and $\delta^{18}O$ of H_2O, and $\delta^{13}C$ of dissolved inorganic carbon (DIC)

RAG; radiocarbon analysis of groundwater - $\delta^{13}C$ and ^{14}C of dissolved inorganic carbon (DIC)

TAG; tritium analysis of groundwater - low-level ^{3}H in H_2O

ACZ Laboratories, Inc.

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Report to:

Name:	Address:
Company:	
E-mail:	Telephone:

Copy of Report to:

Name:	E-mail:
Company:	Telephone:

Invoice to:

Name:	Address:
Company:	
E-mail:	Telephone:

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☐ NO ☐

If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified.

PROJECT INFORMATION

Quote #:

Project/PO #:

Reporting state for compliance testing:

Sampler's Name:

Are any samples NRC licensable material?

ANALYSES REQUESTED *(attach list or use quote number)*

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers								

Matrix: SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY:	DATE:TIME	RECEIVED BY:	DATE:TIME