

2015 COLORADO RULE 608 COMPLIANCE REPORT

RATON BASIN, COLORADO



OCTOBER 2015



Prepared for:

**XTO ENERGY, INC.
Trinidad, Colorado**



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Prepared for:

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EXECUTIVE SUMMARY

LT Environmental, Inc. (LTE) completed the tasks for the 2015 Colorado Rule 608 Compliance Program on behalf of XTO Energy, Inc. (XTO) with respect to XTO operations in Las Animas County, Colorado (Project Area). LTE followed the Colorado Oil and Gas Conservation Commission (COGCC)-approved *Work Plan*, dated May 5, 2010, in accordance with the following subsections of the COGCC Rule 608:

- 608(a) – Assessment and monitoring of plugged and abandoned (P&A) production wells within one-quarter ($\frac{1}{4}$) mile of proposed coalbed methane (CBM) wells;
- 608(b) – Water well sampling; and
- 608(c) – Coal outcrop and coal mine monitoring.

The 2015 Rule 608 Compliance Program meets the requirements of subsections a, b, and c of the COGCC Rule 608.

The 2015 Project Area was determined by a 2-mile buffer around the 2010 and 2011 proposed XTO CBM production wells as well as CBM production wells XTO installed in 2010 and 2011. XTO has not installed any new CBM production wells in the Raton Basin since 2011 and, as a result, the 2015 Project Area is identical to the 2011 Project Area. Due to the absence of any proposed 2015 CBM production wells by XTO, tasks 1, 2, and subtasks of task 3, 4 were omitted from the 2015 Rule 608 Compliance Program. XTO confirmed this change with the COGCC in 2015.

LTE identified, through previous investigations, six mapping areas for surveying in 2015. Based on the findings from 2015, and a review of historical flux surveys at these six mapping areas, areas L-1021, 32 & L-1049, and L-1030 appear to be active methane seep areas. Mapping areas L-1050, 5, and 14 did not have reportable methane flux in 2015 and limited methane detections in previous years. These three mapping areas have been characterized in the past as diminishing methane seeps and, with the absence of reportable methane flux in 2015, these three locations do not appear to be active methane seep areas.

Three natural springs were sampled for water quality analysis (Spring01, Chavez01, and Chavez02). The water types appear to be predominately calcium and sodium/potassium bicarbonate waters. In addition to collecting a water sample, methane flux measurements were collected in the vicinity of the natural springs. Reportable methane flux was not detected at any of the natural spring locations.

LTE recommends XTO continue conducting Rule 608 compliance activities in Las Animas County in accordance with the COGCC-approved *Work Plan* as XTO development activities expand. Based on the findings from the 2015 survey and a review of historical methane flux surveys at the six mapping areas, areas L-1021, 32 & L-1049, and L-1030 appear to be active methane seep areas. LTE recommends areas L-1021, 32 & L-1049, and L-1030 be included in the 2016 methane flux survey. Areas L-1050, 5, and 14 do not appear to be active methane seep areas, and as a result, LTE recommends these areas be omitted from future monitoring activities.

1.0 INTRODUCTION

LT Environmental, Inc. (LTE) has prepared this 2015 Colorado Rule 608 Compliance Report for XTO Energy, Inc. (XTO) to summarize the tasks completed with respect to XTO operations in Las Animas County, Colorado (Project Area) (Figure 1). Compliance activities were conducted in accordance with the Colorado Oil and Gas Conservation Commission (COGCC)-approved *Work Plan* (LTE, May 2010) previously submitted on May 5, 2010. This is the sixth annual event conducted in accordance with this compliance program.

1.1 OBJECTIVE

The objective of this Rule 608 Compliance Program is to meet compliance requirements, as discussed in the May 2010 *Work Plan*, associated with the drilling and installation of coalbed methane (CBM) production wells, specifically in Las Animas County, Colorado, which applies to the following subsections of Rule 608 from the COGCC 600 Series Safety Regulations, as amended on March 30, 2009:

- 608(a) – Assessment and monitoring of plugged and abandoned (P&A) production wells within one-quarter ($\frac{1}{4}$) mile of proposed CBM wells;
- 608(b) – Water well sampling; and
- 608(c) – Coal outcrop and coal mine monitoring.

1.2 PROJECT AREA

The Project Area is located in the Raton Basin in southern Colorado. The Raton Basin is a geologic structural basin in southern Colorado and northern New Mexico. The basin is situated in Huerfano and Las Animas counties, Colorado, and Colfax County, New Mexico. The basin has long been a source of coal production and more recently a source of CBM. Much of the regional geology presented herein was derived from the report, *A Geologic Assessment of Natural Gas from Coal Seams in the Raton and Vermejo Formations, Raton Basin* (Stevens, et.al. 1992).

The Raton Basin is an asymmetric synclinal basin with the axis of the La Veta syncline oriented roughly north-south and passing through Weston, Colorado, which is immediately east of the area defined by XTO for development of CBM. The Raton Formation outcrops over approximately 50 percent of the Project Area. The discontinuous nature of the coal beds both in the subsurface and on the surface makes it difficult to identify and/or correlate individual continuous coal beds from the subsurface producing zone to the surface coal outcrop. The XTO proposed drilling area is located on the western side of the La Veta syncline suggesting that the formations encountered within the Project Area are dipping to the east.

The Vermejo Formation consists of sandstone, interbedded siltstone, shale, carbonaceous shale, and coal accumulated above the fluvial-deltaic sequences of the Trinidad Sandstone (Stevens, et al. 1992). The Vermejo Formation outcrops along the western edge of the Raton Basin syncline basin, which is on the west side of the Project Area. Of the more than 90,000-acre Project Area,

the Vermejo Formation outcrop covers approximately 2 percent of the overall Project Area. The Raton and Vermejo formation outcrops are depicted on Figure 1.

1.3 SCOPE OF WORK

XTO has proposed to drill CBM production wells in the Project Area of the Raton Basin over the next several years (red outline on Figure 1), which began in 2010. XTO did not install any CBM production wells in the Project Area in 2012, 2013, 2014, or 2015. As a result, the 2015 Project Area was determined by a 2-mile buffer around the 2010 and 2011 proposed XTO CBM production wells and CBM production wells XTO installed in 2010 and 2011. The 2015 Project Area (green outline on Figure 2), proposed 2010 and 2011 CBM production well locations, recorded P&A production well locations, water well locations, topography, and mine features are illustrated on Figure 2.

The scope of work for the Rule 608 Compliance Program included the following tasks:

- Task 1: Assessment of applicable P&A production wells;
- Task 2: Assessment of applicable water wells;
- Task 3: Detailed mapping of known and diminishing methane seep areas;
- Task 4: Assessment of applicable natural springs; and
- Task 5: Preparation of this report.

1.4 DEVIATIONS

XTO did not propose or install any new CBM production wells in 2015. As a result, tasks 1, 2, and subtasks of task 3, 4 were omitted from the 2015 Rule 608 Compliance Program as described below. XTO confirmed this change with the COGCC as described in the 2015 Colorado Rule 608 Compliance Cost Estimate, dated June 6, 2015. Historical procedures and findings for these tasks are described in previous annual reports.

There were no new P&A production wells within the 2015 Project Area to assess in 2015 and as a result, Task 1 was not conducted for this 2015 Colorado Rule 608 Compliance Program.

A review of water wells within the 2015 Project Area meeting the requirements set forth in Rule 608(b) identified one water well (Permit Number 39685). However, the two proposed XTO CBM production wells (New Elk 22-13 and New Elk 22-14) nearest to the water well were not installed during 2015. As a result, Task 2 was not conducted during this 2015 Colorado Rule 608 Compliance Program. Water well #39685 will be sampled prior to the drilling of CBM production wells New Elk 22-13 and New Elk 22-14.

Ground surveys to locate suspect methane seeps on the Raton Formation outcrop and color infrared (CIR) aerial imagery and field verification of suspect areas along the Vermejo Formation and at the Quinto, Tercio, and Vega mines were not conducted as part of Task 3 since no new CBM production wells were proposed for 2015.

While conducting detailed mapping of methane seep areas during 2010, 2011, 2012, and 2013, (Task 3), gas samples were collected from those areas with reportable methane flux and where existing isotopic information from the 2007 *COGCC Phase II Seep Investigation* (LTE, 2007) did not exist. During the 2007 Phase II seep investigation conducted for the COGCC, gas samples were collected from many of the known and suspect methane seep areas in the Raton Basin. As a result, re-sampling at these methane seeps was not necessary in 2015. Each methane seep area currently has isotopic analysis associated with it.

The COGCC informed XTO and LTE that those natural springs that overlap with other oil and gas industry companies conducting similar activities to comply with Rule 608 did not need to be sampled. As a result, Task 4 was reduced by not sampling Spring 05 (Vega Canyon), Spring 07 (Spring Canyon), or Spring 08 (Middle Lorencito). LTE was not granted property access for Spring 03, Spring 04, Spring 06, Spring 09, or Spring 10. As a result, natural spring water samples from these eight springs were not collected in 2015.

1.5 REPORT ORGANIZATION

This report is organized into five sections including this introduction (Section 1.0), which presents the objectives and scope of work related to the project. The field methods are described in Section 2.0. The 2015 results are summarized in Section 3.0. The conclusions of the 2015 work are in Section 4.0. The report references are included in Section 5.0. Figures, tables, and appendices follow the text.

2.0 FIELD METHODS

2.1 2013 PROJECT AREA

The 2015 Project Area was determined by a 2-mile buffer around the 2010 and 2011 proposed XTO CBM production wells and CBM production wells XTO installed in 2010 and 2011. The 2015 Project Area is outlined in green on Figure 2. The overall Project Area is outlined in red on Figure 2.

2.2 PROPERTY ACCESS

Prior to conducting 2015 field activities, LTE acquired landowner information from the Las Animas County Assessor's office. LTE cross-referenced parcel data to identify owners of parcels located in the 2015 Project Area. LTE requested to gain access to all properties where field work was proposed, but was denied access to two properties and had no response for two properties. As a result, no investigation activities were conducted on properties where access was not confirmed. The 2015 property owner and access information is presented in Table 1.

2.3 FLUX SURVEY

Flux surveys of mapping areas consist of utilizing a West Systems® portable gas flux meter (flux meter) to measure the magnitude and extent of methane seepage, if detected, within the survey area. Measurements are typically collected using a sampling grid approach.

Grids for detailed mapping areas consisted of varying numbers of squares, with grid nodes spaced 50 feet to 400 feet apart, depending on historical data for previously identified methane seep areas. The smaller grid spacing is typically used to map methane seep areas of relatively small extent. A flux measurement is collected at the corner of each grid square. When methane is detected along the outer edges of the mapping area, additional grid points are developed and measured to determine the extent of methane seepage. Where appropriate, photographs of vegetative conditions, visible methane seeps, and sensitive receptors are collected.

The portable flux meter measures the flux of methane, hydrogen sulfide, and carbon dioxide by employing individual gas-specific sensors that record the increases, if any, of gas concentrations over time for a given surface area. These increases in concentration over time are proportional to the flux of each gas. For this flux survey, only methane flux rates are reported.

The flux meter components include an accumulation chamber connected by circulation tubes to the gas detector unit. At each sampling point, the accumulation chamber is placed on the ground surface to capture gas seeping from the ground. A fan in the chamber continuously mixes the gases in the chamber during the measurement process. A pump moves gases in the accumulation chamber to the detector unit. After passing through the detector unit, gases are returned to the chamber. This closed-loop process allows soil gases discharging to the chamber to increase in concentration over time. Increases in concentrations are measured and recorded automatically. No gas is allowed to escape the system nor is a vacuum created during the process. This enables measurement of natural gas seep conditions, if present. The result for each gas is reported as a mass flux in units of moles per square meter per day ($\text{mol}/\text{m}^2\cdot\text{day}$).

Flux measurement accuracy can be limited by surface conditions. One of the most important factors is the quality of the seal between the accumulation chamber base and the ground surface. To ensure a proper seal between the ground surface and the chamber, field personnel choose relatively flat surfaces where possible and place loose soil surrounding the base of the chamber to reduce the potential for gas loss at the base of the chamber. In addition, ground disturbance is minimized during the measurement process in order to maintain the natural seep conditions. In areas with heterogeneous surfaces, the seal is sometimes difficult to achieve. This scenario is evident at locations with poorly developed soil or where the soil surface is obscured by decayed organic matter on the forest floor.

The accuracy of the total flux estimation within the Project Area is influenced by the ability of the grid spacing system to represent the actual flux on a detailed level relative to the subsurface fracture system, coal quality, and stratigraphy within the Raton Formation.

The methane sensor within the flux meter unit has a range of 60 parts per million (ppm) to 50,000 ppm. The flux meter methane measurement range is 0.0 mol/m²·day to 300 mol/m²·day. Methane fluxes below 0.2 mol/m²·day are detectable with decreased accuracy. As a result, reporting of methane fluxes will not include values less than 0.2 mol/m²·day. Information on the flux meter is provided in Appendix A.

During the measurement process, gas concentrations are recorded at 1-second intervals and directly downloaded via Bluetooth[®] connection to a portable digital assistant (PDA) integrated with the Global Positioning System (GPS) unit. Other measurements recorded include barometric pressure, temperature, date, and time.

Integrated West Systems Flux Manager[®] software on the GPS unit recorded the gas measurement data. The software plots the curve of gas concentration versus time for each measurement collected. The best-fit line for the curve generated is selected. The slope of the best-fit line is proportional to the flux at the measurement point.

Full color spectrum aerial photographs were used as base maps for field use and figures for reporting. The geologic contacts depicted on the aerial photographic maps were derived from geologic maps prepared by the Colorado Geological Survey (CGS) and digitized. Accuracy of the formation contact is reduced when aerial photographs are viewed at a smaller scale.

2.3.1 Global Positioning System Data Management

Each sample location is recorded using a GPS unit. Soil gas sampling grids are created in ArcView[®] and pre-loaded into the GPS unit so field personnel can quickly and accurately position detection equipment along the Project Area. Soil gas measurements and other relevant field data are then stored as attributes in the GPS unit along with the associated position data. The data stored in the GPS unit are downloaded later for processing and reporting.

The GPS unit position data are collected in the World Geodetic System 1984 (WGS 84) and projected in Universal Transverse Mercator (UTM) Zone 13 South, North American Datum 1983 (NAD 83) for use in an ArcView[®] project file. On average, 25 GPS log points are collected for each point feature in order to obtain more accurate positioning.

Readings collected with the GPS unit can be located with 1-meter accuracy. However, the terrain and forest canopy can adversely affect GPS unit accuracy. North-facing slopes and heavily wooded areas can distort or block satellite signals. When satellite signals are limited, positioning accuracy decreases. In locations where the GPS unit cannot obtain a signal, field personnel will note measurement data on their field reference maps. Specifications of the GPS unit are included in Appendix A.

2.3.2 Flux Volume Estimations

LTE estimated the volumetric flux of methane for each mapping area where sufficient reportable methane flux data points are available. Flux data were interpolated and gridded, then contoured and processed to estimate total volumetric flux.

The results were converted to volumetric flux rates common to the natural gas production industry in units of thousand cubic feet per day (MCFD). For a better perspective of the methane flux rates, LTE converted the mass flux values into volumetric flux units of cubic feet per day (CFD), assuming equal areas. The unit conversion is based on the molecular weight of the gas and the density of the gas at approximately 6,900 feet above mean sea level.

For methane flux, the calculation is as follows:

$$\frac{\text{mol CH}_4}{\text{day}} \times \frac{16.04276 \text{ g CH}_4}{\text{mol CH}_4} \times \frac{0.0698 \text{ ft}^3 \text{ CH}_4}{\text{g CH}_4} = \frac{\text{ft}^3 \text{ CH}_4}{\text{day}}$$

For example,

$$1.0 \text{ mol/day CH}_4 = 1.12 \text{ CFD CH}_4$$

Notes:

ft³ – cubic feet

CH₄ – methane

g – gram

CFD – cubic feet per day

mol - mole

The volumetric flux values calculated are estimates and may not represent actual values for the specific areas. Interpolation calculation techniques are highly sensitive to data skewness and can result in large changes in calculated flux values based on measurements made at only a few locations.

2.4 NATURAL SPRING MONITORING

Surveys of natural springs are conducted on a well-by-well basis. Only natural springs identified on United States Geological Survey (USGS) topographic maps within the 2015 Project Area were surveyed.

Once a natural spring was identified, collection of water samples was attempted, barring any property access restrictions or lack of flow. At each natural spring, field personnel located the position and elevation using a GPS. A discharge rate was estimated, when possible, using a graduated cylinder and stopwatch. Water quality measurements, including pH, total dissolved solids (TDS), specific conductance (SC), oxidation-reduction potential (ORP), and temperature

were collected using a SMARTROLL[®] meter. The equipment specifications for the water quality field meter are provided in Attachment A.

Water samples from the natural spring were collected and analyzed for the following:

- Major Cations [dissolved sodium (Na), calcium (Ca), magnesium (Mg), potassium (K), and iron (Fe)] by Environmental Protection Agency (EPA) Method 6010/6020;
- Dissolved Metals [selenium (Se), manganese (Mn)] by EPA Method 6010/6020;
- Alkalinity (carbonate/bicarbonate) by EPA Method 300;
- Major Anions [chloride (Cl), sulfate (SO₄), bromide (Br), and fluoride (F)] by EPA Method 300;
- SC by MCA Method WW 120.1;
- Nitrate/Nitrite as Nitrogen (N) by EPA Method 353.3;
- TDS by EPA Method 160.1;
- Sodium Adsorption Ratio (SAR) by United States Department of Agriculture (USDA) Handbook 60; and
- Bacteria by Iron Reducing Bacteria (IRB) / Sulfate Reducing Bacteria (SRB) / Slime Forming Bacteria (SLYM).

Laboratory-provided sample bottles were filled with water for analysis of the parameters identified above. All water samples collected were submitted in a cooler under strict chain-of-custody documentation to Accutest Mountain States Laboratories (Accutest) located in Wheat Ridge, Colorado.

LTE sampled natural springs Spring 01, Chavez01, and Chavez02 during the sampling event in 2015. Spring02 (also known as Quiet Spring) and Chavez03 were inspected during the 2015 sample event; however, due to the stagnation of the water from the natural springs, water samples were not collected.

3.0 RESULTS

3.1 FLUX SURVEY

As a result of the 2014 Colorado Rule 608 Compliance Program, LTE identified six mapping areas for surveying in 2015. Of the six mapping areas, the following three areas had reportable methane flux detected:

- L-1021;
- 32 & L-1049;
- L-1030;

Total reportable volumetric methane flux could not be calculated for area L-1030 since the two reportable flux measurements within the area were not contiguous and therefore could not be interpolated. Total reportable volumetric methane flux for the other two areas were 6.8 MCFD for area L-1021 and 668.4 MCFD for area 32 & L-1049. Since 2011, each of the three mapping areas have had reportable methane flux detected and have been considered active seep areas.

The following mapping areas did not have reportable methane flux detected in 2015:

- L-1050;
- 5; and
- 14.

These three mapping areas had limited reportable methane flux detections in 2011, 2012, 2013, and 2014 and were characterized as diminishing seep areas.

Methane flux measurements are presented on Figures 3 through 8. Summaries of the mapping areas are included in Table 2. Flux data is included in Appendix B. Volumetric flux calculations are included in Appendix C.

3.2 NATURAL SPRING SURVEY

LTE identified 13 natural springs within the 2015 Project Area (Figure 2). Natural springs Spring 05 (Vega Canyon), Spring 07 (Spring Canyon), and Spring 08 (Middle Lorencito) were excluded from the sampling list as approved by the COGCC. Five natural springs were located on private property with no access granted. Three natural springs (Spring01, Chavez01, and Chavez02) were sampled on August 12 and August 13, 2015. Spring 02 (Quiet Spring) and Chavez 03 were stagnant at the time of sampling and as a result, no water samples were collected.

3.2.1 Field Observations

LTE collected field measurements from the Spring01, Chavez01, and Chavez02 natural springs, which were documented in the field logbook. The 2015 field observations and measurements for the natural springs are summarized in Table 3.

3.2.2 Sampling and Analysis

By plotting the major anions and major cations that are dissolved in the natural spring water samples on a Stiff diagram, the water type can be presented graphically. The water types appear to be predominately calcium and sodium/potassium bicarbonate waters.

Laboratory analytical results for the natural spring samples are summarized in Table 4. A Stiff diagram illustrating the water type is depicted on Figure 9. Natural spring analytical results are presented in Appendix D.

3.2.3 Flux Measurements

During the 2015 natural spring sampling event, flux measurements were collected near each natural spring location. Reportable methane flux was not detected in any of the flux measurement locations near the three natural springs.

4.0 CONCLUSIONS

The 2015 Rule 608 Compliance Program meets the requirements of subsections a, b, and c of the COGCC Rule 608.

LTE identified, through previous investigations, six mapping areas for surveying in 2015. Based on the findings from 2015 and a review of historical flux surveys at these six mapping areas, areas L-1021, 32 & L-1049, and L-1030 appear to be active methane seep areas. Mapping areas L-1050, 5, and 14 did not have reportable methane flux detections in 2015 and limited methane detections in previous years. These three mapping areas have been characterized in the past as diminishing methane seeps and with the absence of reportable methane flux in 2015, these three locations do not appear to be active methane seep areas.

Three natural springs were sampled for water quality analysis (Spring01, Chavez01, and Chavez02). The water types appear to be predominately calcium and sodium/potassium bicarbonate waters. In addition to collecting water samples, flux measurements were collected in the vicinity of the natural springs. Reportable methane flux was not detected at any of the measurement locations.

LTE recommends XTO continue conducting Rule 608 compliance activities in Las Animas County in accordance with the COGCC-approved *Work Plan* as XTO development activities expand. Based on the findings from 2015 and a review of historical flux surveys at the six mapping areas, areas L-1021, 32 & L-1049, and L-1030 appear to be active seep areas and LTE recommends areas L-1021, 32 & L-1049, and L-1030 be included in the 2016 flux survey. Mapping areas L-1050, 5, and 14 do not appear to be active methane seep areas and, as a result, LTE recommends these areas be omitted from future monitoring activities.

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FIGURES



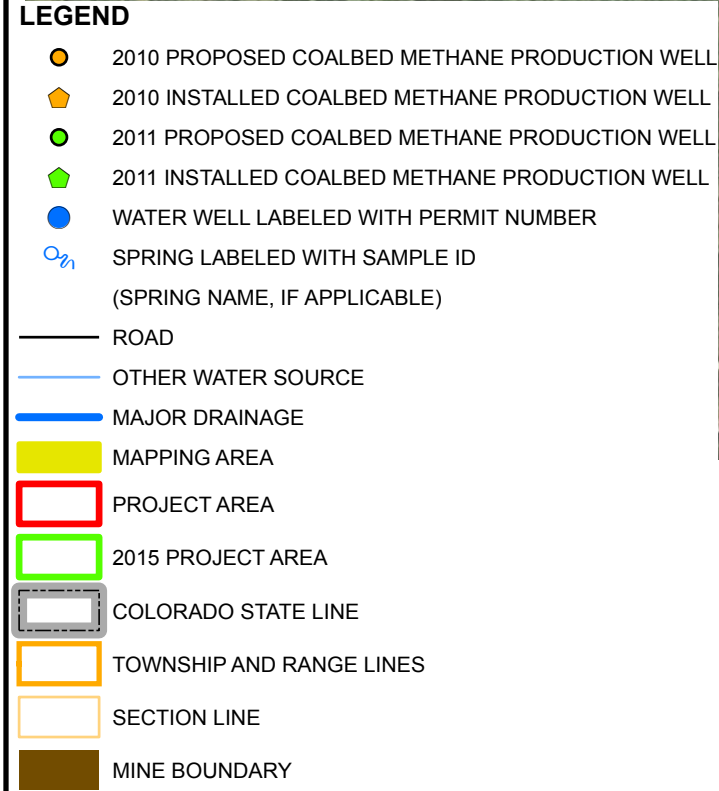
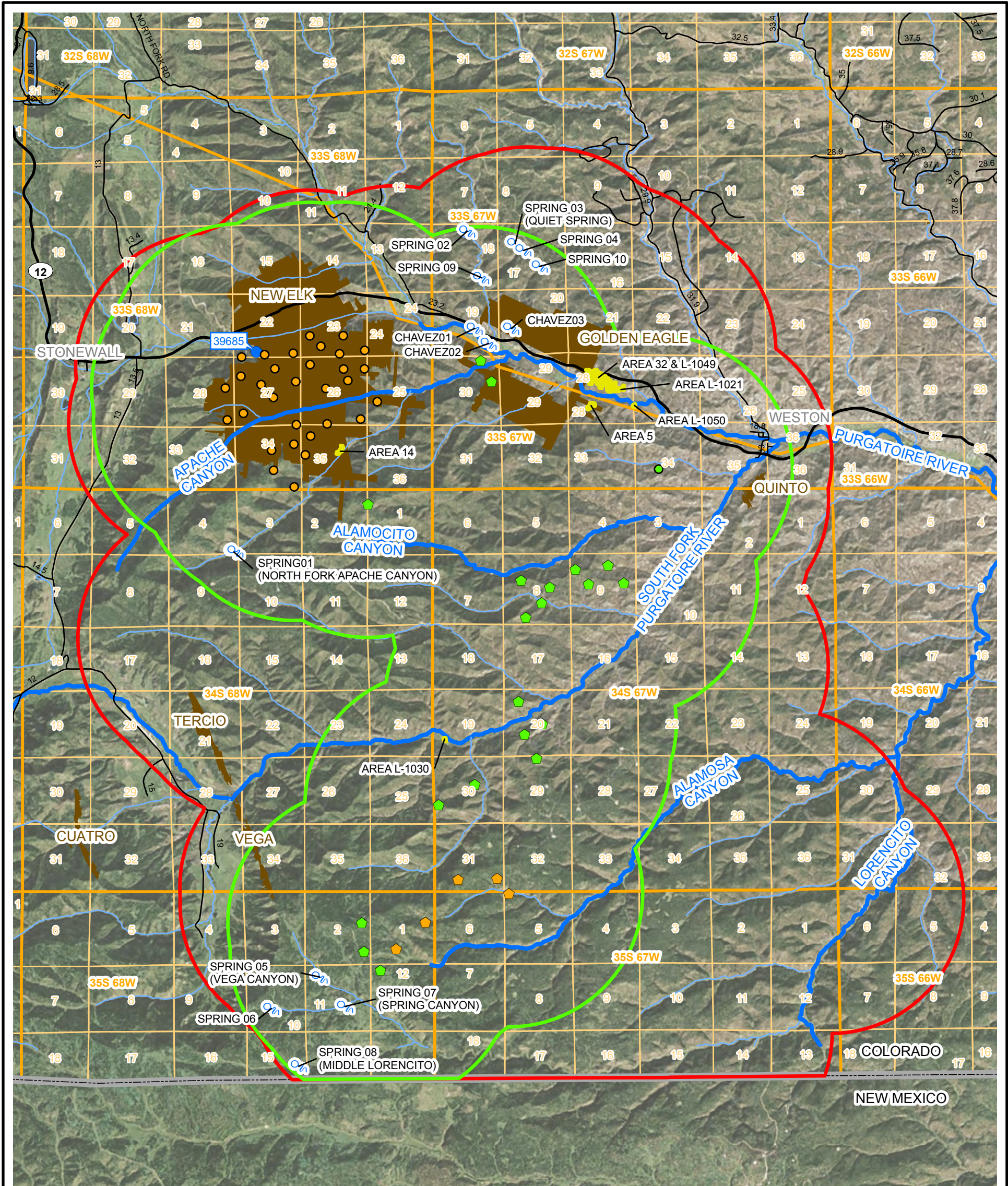


FIGURE 2
2015 PROJECT AREA MAP
2015 COLORADO RULE 608 COMPLIANCE REPORT
RATON BASIN, LAS ANIMAS COUNTY, COLORADO
XTO ENERGY, INC.





IMAGE COURTESY OF ESRI

LEGEND

2015 METHANE FLUX MEASUREMENT
(mol/m² • day)

- 0.0000 - 0.1999
- 0.2000 - 0.5000
- 0.5001 - 1.0000
- 1.0001 - 10.0000
- 10.0001 - 50.0000
- 50.0001 - 100.0000
- 100.0001 - 400.0000

- 2007 SUSPECT METHANE SEEP (ID LABELED IN BLACK)
- 2010 SUSPECT METHANE SEEP (ID LABELED IN ORANGE)
- 2011 SUSPECT METHANE SEEP (ID LABELED IN GREEN)

METHANE FLUX CONTOUR (mol/m² • day)

CONTOUR INTERVAL VARIES

mol/m² • day: MOLES PER SQUARE METER PER DAY
ONLY METHANE FLUX MEASUREMENTS GREATER
THAN OR EQUAL TO 0.2 mol/m² • day ARE LABELED

LEWICKI MINE BOUNDARY

SECTION LINE

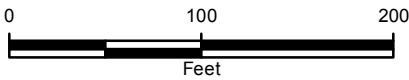


FIGURE 3
METHANE FLUX CONTOURS
MAPPING AREA L-1021
2015 COLORADO RULE 608 COMPLIANCE REPORT
RATON BASIN, LAS ANIMAS COUNTY, COLORADO
XTO ENERGY, INC.





IMAGE COURTESY OF ESRI

LEGEND

2015 METHANE FLUX MEASUREMENT
(mol/m² • day)

- 0.0000 - 0.1999
- 0.2000 - 0.5000
- 0.5001 - 1.0000
- 1.0001 - 10.0000
- 10.0001 - 50.0000
- 50.0001 - 100.0000
- 100.0001 - 400.0000

- ▲ 2007 SUSPECT METHANE SEEP (ID LABELED IN BLACK)
- ▲ 2010 SUSPECT METHANE SEEP (ID LABELED IN ORANGE)
- ▲ 2011 SUSPECT METHANE SEEP (ID LABELED IN GREEN)

— METHANE FLUX CONTOUR (mol/m² • day)
CONTOUR INTERVAL VARIES

mol/m² • day: MOLES PER SQUARE METER PER DAY
ONLY METHANE FLUX MEASUREMENTS GREATER
THAN OR EQUAL TO 0.2 mol/m² • day ARE LABELED

- LEWICKI MINE BOUNDARY
- SECTION LINE

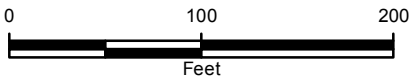


FIGURE 4
METHANE FLUX CONTOURS
MAPPING AREA L-1030
2015 COLORADO RULE 608 COMPLIANCE REPORT
RATON BASIN, LAS ANIMAS COUNTY, COLORADO
XTO ENERGY, INC.





IMAGE COURTESY OF ESRI

LEGEND

2015 METHANE FLUX MEASUREMENT
(mol/m² • day)

- 0.0000 - 0.1999
- 0.2000 - 0.5000
- 0.5001 - 1.0000
- 1.0001 - 10.0000
- 10.0001 - 50.0000
- 50.0001 - 100.0000
- 100.0001 - 400.0000

- ▲ 2007 SUSPECT METHANE SEEP (ID LABELED IN BLACK)
- ▲ 2010 SUSPECT METHANE SEEP (ID LABELED IN ORANGE)
- ▲ 2011 SUSPECT METHANE SEEP (ID LABELED IN GREEN)

— METHANE FLUX CONTOUR (mol/m² • day)
CONTOUR INTERVAL VARIES

mol/m² • day: MOLES PER SQUARE METER PER DAY
ONLY METHANE FLUX MEASUREMENTS GREATER
THAN OR EQUAL TO 0.2 mol/m² • day ARE LABELED

■ LEWICKI MINE BOUNDARY

□ SECTION LINE

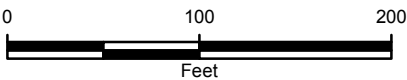


FIGURE 5
METHANE FLUX CONTOURS
MAPPING AREA L-1050
2015 COLORADO RULE 608 COMPLIANCE REPORT
RATON BASIN, LAS ANIMAS COUNTY, COLORADO
XTO ENERGY, INC.





IMAGE COURTESY OF ESRI

LEGEND

2015 METHANE FLUX MEASUREMENT
(mol/m² • day)

- 0.0000 - 0.1999
- 0.2000 - 0.5000
- 0.5001 - 1.0000
- 1.0001 - 10.0000
- 10.0001 - 50.0000
- 50.0001 - 100.0000
- 100.0001 - 400.0000

- ▲ 2007 SUSPECT METHANE SEEP (ID LABELED IN BLACK)
- ▲ 2010 SUSPECT METHANE SEEP (ID LABELED IN ORANGE)
- ▲ 2011 SUSPECT METHANE SEEP (ID LABELED IN GREEN)

— METHANE FLUX CONTOUR (mol/m² • day)
CONTOUR INTERVAL VARIES

mol/m² • day: MOLES PER SQUARE METER PER DAY
ONLY METHANE FLUX MEASUREMENTS GREATER
THAN OR EQUAL TO 0.2 mol/m² • day ARE LABELED

- LEWICKI MINE BOUNDARY
- SECTION LINE

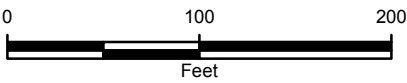


FIGURE 6
METHANE FLUX CONTOURS
MAPPING AREA 5
2015 COLORADO RULE 608 COMPLIANCE REPORT
RATON BASIN, LAS ANIMAS COUNTY, COLORADO
XTO ENERGY, INC.





IMAGE COURTESY OF ESRI

LEGEND

2015 METHANE FLUX MEASUREMENT
(mol/m² • day)

- 0.0000 - 0.1999
- 0.2000 - 0.5000
- 0.5001 - 1.0000
- 1.0001 - 10.0000
- 10.0001 - 50.0000
- 50.0001 - 100.0000
- 100.0001 - 400.0000

- 2007 SUSPECT METHANE SEEP (ID LABELED IN BLACK)
- 2010 SUSPECT METHANE SEEP (ID LABELED IN ORANGE)
- 2011 SUSPECT METHANE SEEP (ID LABELED IN GREEN)

METHANE FLUX CONTOUR (mol/m² • day)
CONTOUR INTERVAL VARIES

mol/m² • day: MOLES PER SQUARE METER PER DAY
ONLY METHANE FLUX MEASUREMENTS GREATER
THAN OR EQUAL TO 0.2 mol/m² • day ARE LABELED

- LEWICKI MINE BOUNDARY
- SECTION LINE

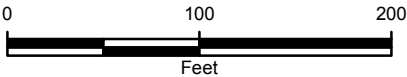
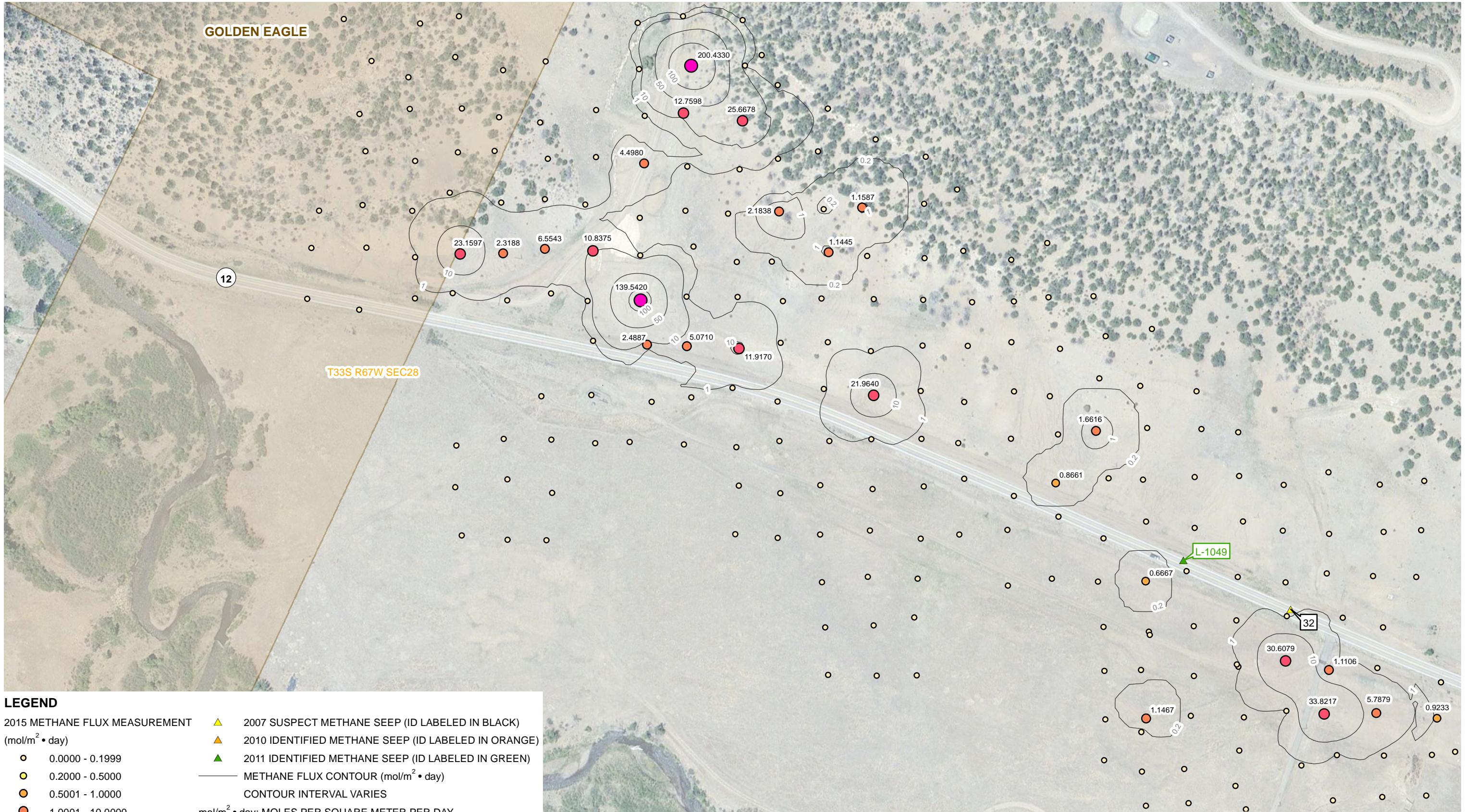


FIGURE 7
METHANE FLUX CONTOURS
MAPPING AREA 14
2015 COLORADO RULE 608 COMPLIANCE REPORT
RATON BASIN, LAS ANIMAS COUNTY, COLORADO
XTO ENERGY, INC.





LEGEND

2015 METHANE FLUX MEASUREMENT
(mol/m² • day)

- 0.0000 - 0.1999
- 0.2000 - 0.5000
- 0.5001 - 1.0000
- 1.0001 - 10.0000
- 10.0001 - 50.0000
- 50.0001 - 100.0000
- 100.0001 - 400.0000

- 2007 SUSPECT METHANE SEEP (ID LABELED IN BLACK)
- 2010 IDENTIFIED METHANE SEEP (ID LABELED IN ORANGE)
- 2011 IDENTIFIED METHANE SEEP (ID LABELED IN GREEN)

— METHANE FLUX CONTOUR (mol/m² • day)
CONTOUR INTERVAL VARIES

mol/m² • day: MOLES PER SQUARE METER PER DAY

ONLY METHANE FLUX MEASUREMENTS GREATER THAN OR EQUAL TO 0.2 mol/m² • day ARE LABELED

LEWICKI MINE BOUNDARY

SECTION LINE

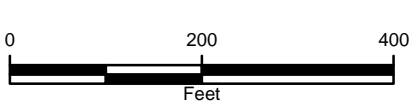
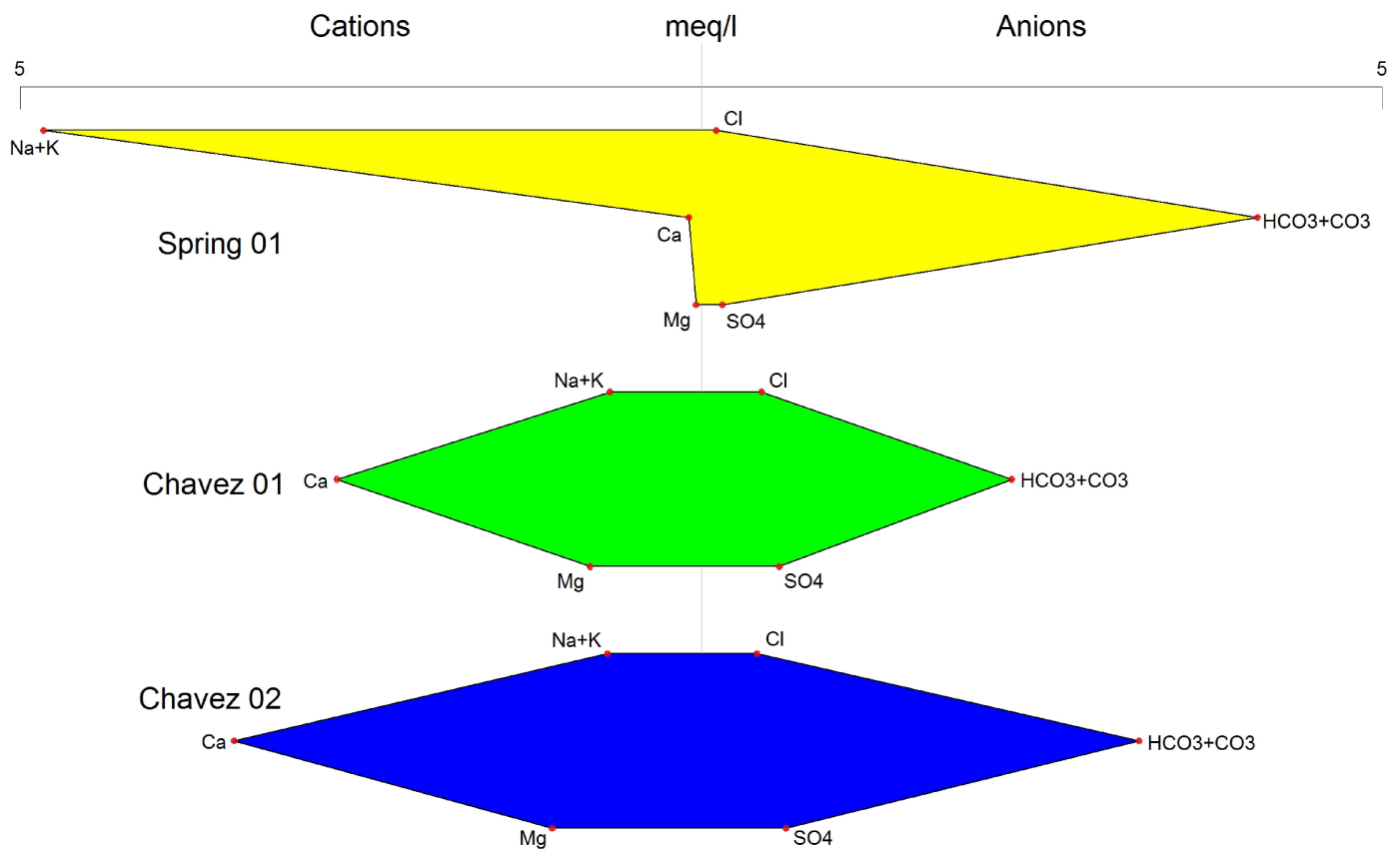


FIGURE 8
METHANE FLUX CONTOURS
MAPPING AREAS 32 & L-1049
2015 COLORADO RULE 608 COMPLIANCE REPORT
RATON BASIN, LAS ANIMAS COUNTY, COLORADO
XTO ENERGY, INC.





LEGEND

Ca: CALCIUM
 Cl: CHLORIDE
 CO3: CARBONATE
 HCO3: BICARBONATE
 K: POTASSIUM
 Mg: MAGNESIUM
 Na: SODIUM
 SO4: SULFATE
 meq/l: MILLIEQUIVALENTS PER LITER

FIGURE 9
 STIFF DIAGRAMS
 AUGUST 12 AND 13, 2015
 2015 COLORADO RULE 608 COMPLIANCE REPORT
 RATON BASIN, LAS ANIMAS COUNTY, COLORADO
 XTO ENERGY, INC



TABLES



TABLE 1
PROPERTY OWNER AND ACCESS INFORMATION

2015 COLORADO RULE 608 COMPLIANCE REPORT
RATON BASIN, LAS ANIMAS COUNTY, COLORADO
XTO ENERGY, INC.

LANDOWNER	PARCEL ID	SECTION	TOWNSHIP	RANGE	PERMISSION GRANTED
XTO Energy, Inc.	14533300	28	33	67	Yes
	14533405	27, 28	33	67	
	14533200	27	33	67	
Red River Ranch Holdings, LLC	14182121	4, 5, 6, 7, 8	35	67	No Response
	1418210	1, 2, 3, 10, 11, 12, 13, 14, 15	35	68	
Hill Ranch LTD and Kozad Properties LTD	12220713	4, 5, 6, 7, 10	35	67	Yes
	12220714	1,2, 3, 10, 11, 12, 13, 14, 15	35	68	
	11071110	21, 22, 28	34	67	
	13432508	2, 31, 32, 33	34	67	
	14533003	28	33	67	
	13297000	27, 35	33	67	
Department of Natural Resources (care of mibe.truillo@state.co.us)	10877304 10877303	30	33	67	Yes
		2, 3, 13, 23, 24, 25, 26	34	68	
		19	34	67	
		25	33	68	
		35	33	68	
Bill R. and Rossana T. Chavez	13940200	19	33	67	Yes
Donald Mounier		17	33	67	No Response
Mr. and Mrs. Jurajda		17	33	67	Yes
Sabrina Blakeney	14239500	17	33	67	No Response
Gery Navalesi		18	33	67	Yes
Richard W Stiles		18	33	67	No
Bill Toupal		28	33	67	Yes
		27, 28	33	67	
		27	33	67	
Veronica Law		19	33	67	Yes



**TABLE 2
MAPPING AREA SUMMARIES**

**2015 COLORADO RULE 608 COMPLIANCE REPORT
RATON BASIN, LAS ANIMAS COUNTY, COLORADO
XTO ENERGY, INC.**

Area IDs	Ground Survey Conducted							2007	2010			2011			2012			2013			2014			2015		
	2007	2010	2011	2012	2013	2014	2015	Subsurface Methane Gas Detected	Total Number of Flux Points	Reportable CH ₄ Flux Points*	Total CH ₄ Flux (MCFD)**	Total Number of Sample Points	Reportable CH ₄ Flux Points*	Total CH ₄ Flux (MCFD)**	Total Number of Sample Points	Reportable CH ₄ Flux Points*	Total CH ₄ Flux (MCFD)**	Total Number of Sample Points	Reportable CH ₄ Flux Points*	Total CH ₄ Flux (MCFD)**	Total Number of Sample Points	Reportable CH ₄ Flux Points*	Total CH ₄ Flux (MCFD)**	Total Number of Sample Points	Reportable CH ₄ Flux Points*	Total CH ₄ Flux (MCFD)**
L-1021			x									44	10	129.71	47	6	6.7	46	2	NA	51	4	1.9	35	4	6.8
L-1030			x									17	3	2.19	17	3	2.2	18	1	NA	18	4	56.9	18	2	NA
L-1050			x									22	4	0.69	22	2	1.0	22	0	0.0	25	1	NA	22	0	0.0
5	x		x					x				167	16	2.16	83	6	1.9	83	0	0.0	80	3	0.8	76	0	0.0
14	x								94	16	0.56	50	7	0.34	46	0	0.00	58	3	NA	66	4	0.4	58	0	0.0
32 & L-1049	x											372	146	304.12	217	55	720.4	234	37	332.4	233	33	150.7	239	25	668.4

Notes:

CH₄ - Methane

moles/m²·day - moles per meter squared per day

MCFD - thousand cubic feet per day

NA - Not applicable

** - Volume includes only gridded values > 0.2 moles/m²·day

* - Only points where flux values were above the reporting limit of 0.2 moles/m²·day



TABLE 3
NATURAL SPRING WATER QUALITY MEASUREMENTS

2015 COLORADO RULE 608 COMPLIANCE REPORT
RATON BASIN, LAS ANIMAS COUNTY, COLORADO
XTO ENERGY, INC.

Natural Spring	Location	Latitude	Longitude	Inspection Date	Specific Electrical Conductance (µS/cm)	pH (Units)	ORP (mV)	Temperature (°C)	TDS (mg/L)
Spring01	North Fork Apache Canyon	-104.991708	37.108089	8/13/2010	381.0	9.2	140.5	22.4	247.0
				8/19/2011	408.0	7.1	-99.5	13.29	432.0
				9/4/2012	DRY - NOT MEASURED				
				8/15/2013	DRY - NOT MEASURED				
				8/21/2014	515.9	9.1	-61.8	12.4	337.2
				8/13/2015	562.4	8.8	-38.9	11.0	368.8
Chavez01	Rancho Escondido	-104.9265768	37.15615866	9/4/2012	391.0	6.8	106.5	15.7	200.7
				8/15/2013	356.0	7.0	12.0	14.9	NM
				8/21/2014	329.0	7.7	200.9	16.3	578.98
				8/12/2015	420.8	6.8	279.5	14.7	275.4
Chavez02	Rancho Escondido	-104.922814480	37.152863914	9/4/2012	414.0	6.5	105.5	16.0	207.7
				8/15/2013	417.0	6.9	NM	14.1	NM
				8/21/2014	399.3	7.5	169.7	14.4	260.2
				8/12/2015	550.6	7.1	323.4	14.1	361.2
Chavez03	Rancho Escondido	-104.916708750	37.156096546	9/4/2012	1,864.0	6.95	104.7	14.1	921.9
				8/15/2013	1,464.0	7.3	47.3	14.7	NM
				8/21/2014	1,922.9	7.6	-40.1	16.3	1,255.32
				8/12/2015	STAGNANT WATER - NOT MEASURED				
Spring03 - Quiet Spring	Rancho Escondido	-104.915474	37.174474	8/21/2014	STAGNANT WATER - NOT MEASURED				
				8/13/2015	STAGNANT WATER - NOT MEASURED				

Notes:

Blank cells indicate no measurement.
µS/cm - microSiemens per centimeter
ORP - oxidation reduction potential
mV - millivolts
mg/L - milligrams per liter

°C - degrees celsius
TDS - total dissolved solids
ppm - parts per million
NM - Not Measured
DO - dissolved oxygen



**TABLE 4
NATURAL SPRING ANALYTICAL RESULTS**

**2015 COLORADO RULE 608 COMPLIANCE REPORT
RATON BASIN, LAS ANIMAS COUNTY, COLORADO
XTO ENERGY, INC.**

Natural Spring	Location	Sample Date	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Manganese (mg/L)	Selenium (mg/L)	Carbonate (mg/L)	Bicarbonate (mg/L)	TDS (mg/L)	Specific Conductivity (umhos/cm)	pH
Spring01	North Fork Apache Canyon	8/13/2010	3.4	0.652	97.7	1.41	0.0210	<0.00080	<5.0	205	280	364	10.13
		8/19/2011	2.2	0.52	136.0	1.64	0.1260	<0.00080	<5.0	332	420	428	8.16
		9/4/2012	DRY - NOT SAMPLED										
		8/15/2013	DRY - NOT SAMPLED										
		8/21/2014	1.4	0.349	129.0	<1.0	0.0063	<0.00080	<5.0	251	338	406	NA
		8/13/2015	1.8	0.47	128.0		0.0111	<0.00080	10.9	227	304	402	8.64
Chavez01	Rancho Escondido	9/4/2012	44.5	8.12	20.4	<1.0	<0.0050	<0.0020	<5.0	157	194	323	7.28
		8/15/2013	50.2	8.59	20.8	1.07	NA	<0.0020	<5.0	171	224	358	7.4
		8/21/2014	49.8	8.92	15.0	1.23	<0.0050	<0.00080	<5.0	141	210	278	NA
		8/12/2015	53.6	9.92	15.4	<1.0	<0.0050	<0.00080	<5.0	139	220	285	7.19
Chavez02	Rancho Escondido	9/4/2012	49.3	9.56	18.2	1.43	<0.0050	<0.0020	<5.0	163	206	330	7.17
		8/15/2013	59.7	11.00	20.2	1.51	0.0055	<0.0020	<5.0	201	264	428	7.28
		8/21/2014	57.7	11.20	15.9	1.77	<0.0050	<0.00080	<5.0	167	242	318	NA
		8/12/2015	71.7	13.30	14.9	1.61	<0.0020	<0.00080	<5.0	196	291	405	7.45
Chavez03	Rancho Escondido	9/4/2012	117.0	43.20	20.8	6.25	<0.0050	<0.0020	<5.0	495	990	160	7.44
		8/15/2013	113.0	48.20	22.3	5.50	<0.0050	<0.0020	<5.0	536	1,090	1,850	7.38
		8/21/2014	117.0	53.30	241.0	5.81	0.3730	<0.00080	<5.0	539	1,160	1,660	NA
		8/12/2015	STAGNANT WATER - NOT SAMPLED										
Spring03 - Quiet Spring		8/21/2014	STAGNANT WATER - NOT SAMPLED										
		8/12/2015	STAGNANT WATER - NOT SAMPLED										

Natural Spring	Location	Sample Date	Sulfate (mg/L)	Chloride (mg/L)	Bromide (mg/L)	Fluoride (mg/L)	Hydrogen Sulfide (mg/L)	Nitrogen as Nitrate (mg/L)	Nitrogen as Nitrite (mg/L)	Iron Reducing Bacteria (cfu/ml)	Slime Forming Bacteria (cfu/ml)	Sulfate Reducing Bacteria (cfu/ml)
Spring01	North Fork Apache Canyon	8/13/2010	2.9	3.3	<0.20	0.74	<0.50	<0.23	<0.061	500	>350,000	700,000
		8/19/2011	2.7	3.7	<0.20	1.40	NA	<0.045	<0.011	9,000	350,000	700,000
		9/4/2012	DRY - NOT SAMPLED									
		8/15/2013	DRY - NOT SAMPLED									
		8/21/2014	3.5	3.7	<0.050	1.00	0.5	<0.010	<0.0040	<25	<500	<200
		8/13/2015	7.4	3.9	<0.050	0.97	<0.50	<0.020	<0.0080	<25	<500	<200
Chavez01	Rancho Escondido	9/4/2012	19.3	3.4	<0.050	0.27	0.0	0.011	<0.0040	74,500	350,000	359,000
		8/15/2013	28.7	5.8	<0.050	0.27	NA	0.012	<0.0040	74,500	66,500	1,200
		8/21/2014	21.6	5.1	<0.050	0.23	0.0	<0.010	<0.0040	9,000	66,500	700
		8/21/2015	27.5	15.7	<0.050	0.23	<0.50	<0.010	<0.0040	74,500	350,000	<200
Chavez02	Rancho Escondido	9/4/2012	20.3	4.0	<0.050	0.30	0.0	0.088	<0.0040	74,500	350,000	359,000
		8/15/2013	31.3	8.1	<0.050	0.29	NA	1.800	1.800	75,500	12,500	5,000
		8/21/2014	24.0	5.8	<0.050	0.29	0.0	0.400	<0.0040	9,000	<500	5,000
		8/12/2015	29.8	14.5	<0.050	0.27	<0.50	0.940	0.940	74,500	350,000	5,000
Chavez03	Rancho Escondido	9/4/2012	63.7	254.0	2.0	0.35	0.0	0.083	0.024	74,500	66,500	359,000
		8/15/2013	47.4	324.0	2.6	0.72	NA	0.260	0.260	9,000	350,000	359,000
		8/21/2014	42.5	342.0	2.7	<0.50	0.0	0.063	<0.020	2,300	66,500	359,000
		8/12/2015	STAGNANT WATER - NOT SAMPLED									
Spring03 - Quiet Spring		8/21/2014	STAGNANT WATER - NOT SAMPLED									
		8/12/2015	STAGNANT WATER - NOT SAMPLED									

Notes:

mg/L - milligrams per liter
TDS - Total dissolved solids
umhos/cm - Microhms per centimeter
cfu/ml - Coliform units per milliliter

< - Less than the laboratory reporting limit
NA - Not analyzed
> - greater than

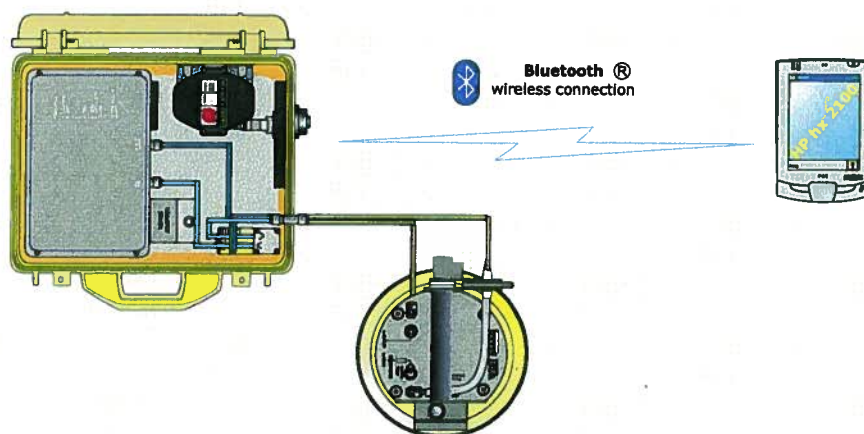


APPENDIX A
EQUIPMENT SPECIFICATIONS



WEST Systems portable soil flux meter for Carbon dioxide, Methane and Hydrogen sulfide fluxes

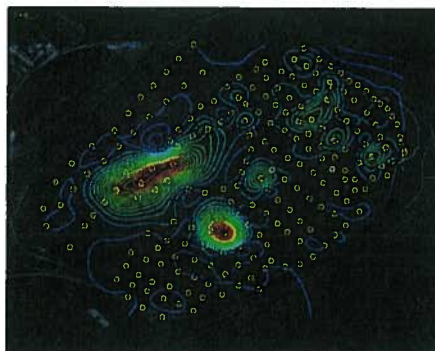
The WEST Systems Fluxmeter is a portable instrument for the measurement of soil gas diffuse degassing phenomena that uses the accumulation chamber method.



This method studied for soil respiration in agronomy (Parkinson) and for soil degassing in volcanic areas (R. Cioni et al.), has been designed by WEST Systems to obtain a portable instrument that allows the performance of measurements with very good accuracy in a short time. The instrument allows a wide range evaluation of the amount of soil gas flux and can be utilized for the evaluation of biogas degassing (landfills), for the survey of non visible degassing phenomena in volcanic and geothermal areas as well as soil respiration rate in agronomy. In the picture below, the results of the degassing survey of a landfill.



Portable fluxmeter



Methane flux contour lines



a group of researchers during a flux mapping fieldwork, using the WS-LI820 flux meter
Courtesy of United States Geological Survey

West Systems Srl
Via Molise 3 - Zona Ind. Gello - 56025 Pontedera (PI) Italy
Phone +39 0587 294216 www.westsystems.com
Fax +39 0587 296068 g.virgili@westsystems.com

WEST
Systems

Portable soil flux meter

Common physical characteristics:

Total Weight = 8.3 Kg/16 lbs. to be carried on the back using the backpack-like support vest. The field operator will also have to carry one of the accumulation chambers and the palmtop:

Warm Up

Only at instrument cold start-up a warm-up time of 20 minutes is required. The typical measurement time ranges from 2 to 4 minutes and the autonomy of the instrument is about 4 hours with a single NiMH 14.4 Volts, 2.6 A/h battery. The instrument comes with two interchangeable batteries.

Accumulation Chamber specifications:

- Accumulation chamber A diameter : 200 mm / Height: 100 mm / weight: 1.5 Kg/3.3 lbs
- Accumulation chamber B diameter : 200 mm / Height: 200mm / weight : 2.2 Kg/4.84 lbs

Palm top computer: PocketPC Color Display based on Windows Mobile operating system.

- PalmTop with cables, 0.3 Kg/0.7 lbs.
- Size 125mm (4.8") x 82mm (3.2") * 25 mm (1").

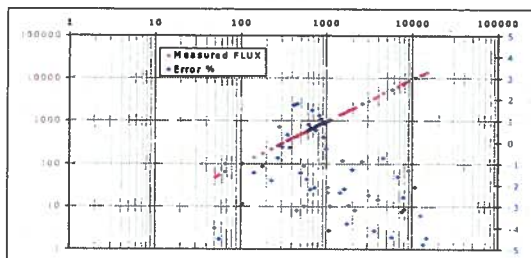
Software The instrument is supplied with a custom software, FluxManager, which allows recording and visualization of the increase in concentration of the target gas in the accumulation chamber, and then the flux calculations. The obtained measurements can be saved on the palmtop computer and then transferred to a desktop PC with a USB connection or using a SD card.

The instrument is supplied complete with:

- backpack-like support vest
- Carrying case for transport and storage
- 2 batteries NiMH 14.4 Volts 2.6 A/h and 1 NiMH battery charger
- Accumulation chamber A and B
- Palmtop Pocket PC
- User Manual, in English
- FLUX Manager Software for Windows Mobile, in English

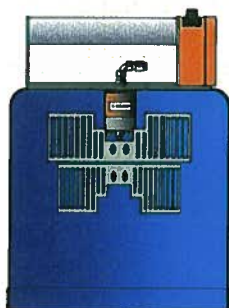
The standard flux meter configuration is supplied with a single gas detector, normally the carbon dioxide detector. The fluxmeter can host two sensors by the way special releases, based on specific customer request, it can be supplied with a maximum of 3 sensors.

Finally we improved the connection between the instrument and the palmtop that now is based on Bluetooth wireless embedded device.



The measured carbon dioxide flux vs imposed flux (grams $m^{-2} day^{-1}$);
The error % vs imposed flux (in blue).

The instrument is extremely versatile and allows measurement of flux in 2/4 minutes. In the picture: Soil bio-gas flux monitoring in a landfill.

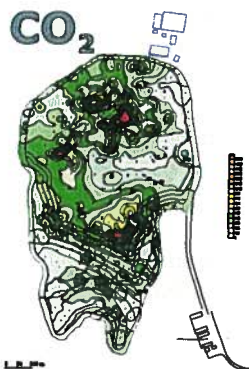


Accumulation Chamber Type B

The accumulation chambers

In the normal use of instrument only the chamber B is used. To extend the instrument sensitivity to very low fluxes the accumulation chamber A is supplied.

	Type A	Type B
net area m^2	0.0314	
net volume m^3	0.003	0.006



CO₂ - LI820

LI820 based Carbon dioxide fluxmeter

The CO₂ Fluxmeter is equipped with the LICOR LI-820 the most accurate and reliable portable carbon dioxide detector. The LI-820 is a double beam infrared sensor compensated for temperature variation in the range from -10 to 45°C and for atmospheric pressure variation in the range 660-1060 HPa. Accuracy 2% repeatability ± 5 ppm. The full scale range can be set to 1000, 2000, 5000 or 20000 ppmV of carbon dioxide. The characteristics of precision refer to the sensor set to a full scale range of 20000 ppmV. If a very high sensitivity is required, the detector can be set to 1000 or 2000 ppm full scale value to measure with very high precision fluxes in the range from 0 to 10 moles m⁻² day⁻¹

CO₂ FLUX Measurement range:

from 0 up 600 moles m⁻² day⁻¹

The accuracy depends on the measured flux:

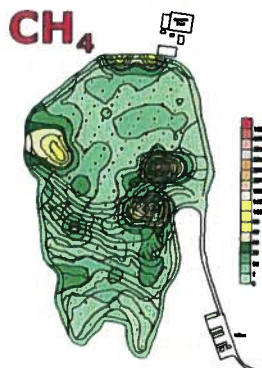
0 to 0.5 moles m ⁻² day ⁻¹	25% (Acc.ch.A)
0.5 to 1 moles m ⁻² day ⁻¹	15% (Acc.ch.A or B)
1 to 150 moles m ⁻² day ⁻¹	10% (Acc.ch.B)
150 to 300 moles m ⁻² day ⁻¹	10% (Acc.ch.B)
300 to 600 moles m ⁻² day ⁻¹	20% (Acc.ch.B)

WS-DRAGER: CO₂ Flux measurement:

A double beam infrared sensor compensated for temperature variation in the range from -20 to 65°C. Accuracy 3%. The full scale value can be set from 2,000 to 300,000 ppm of carbon dioxide. Carbon Dioxide flux measurement range from 0.5 to 1500 moles/m² per day.

The precision depends on the measured flux:

range: 0.5 - 5 moles/m ² per day	25% (Acc. chamber A)
5-350 moles/m ² /day	10% (Acc. chamber B)
350-600 moles/m ² /day	25% (Acc. chamber B)
600-1500 moles/m ² /day	25% (Acc.Ch.B / F.S.=10%)



WS-HC CH₄

Methane fluxmeter

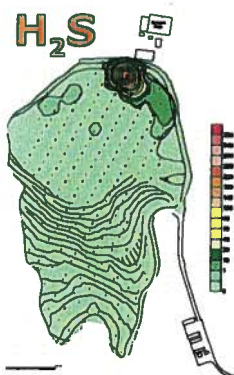
The methane sensor is an IR spectrometer. The full-scale range is 50000ppm, accuracy of 5% of reading, and repeatability is 2% of span. Detection limit 60 ppm, resolution 22 ppm. The detector was designed to measure the not controlled emissions of landfill, but it can be used to detect methane emission from coal or wherever the 0.2 moles/m²/day detection limit is acceptable.

Methane Flux measurement range

from 0.2 up 300 moles m⁻² day⁻¹

The fluxmeter is provided with 2 accumulation chambers and the accuracy depends on the measured flux:

0.2 to 10 moles m ⁻² day ⁻¹	25% (Acc.Ch.A)
10 to 150 moles m ⁻² day ⁻¹	15% (Acc.Ch.A)
150 to 300 moles m ⁻² day ⁻¹	20% (Acc.Ch.B)



H₂S - WEST

Hydrogen sulfide

The hydrogen sulphide detector is a electrochemical cell with the following specifications:

The full-scale range is 20ppm, with a precision of 3% of reading, and the repeatability is 1.5% of span with a zero offset of 0.3%.

H₂S Flux measurement range: from 0.0025 to 0.5 moles/m² per day.

The precision depends on the measured flux:

0.0025 - 0.05 moles/m ² per day	$\pm 25\%$ (Acc. Chamber A)
0.05 - 0.5 moles/m ² per day	$\pm 10\%$ (Acc. Chamber B)

NOTE: The hydrogen sulphide flux evaluation can be affected by the presence of large quantities of water in both liquid and vapour phases.

We thanks to N.Lima et al. for the maps.

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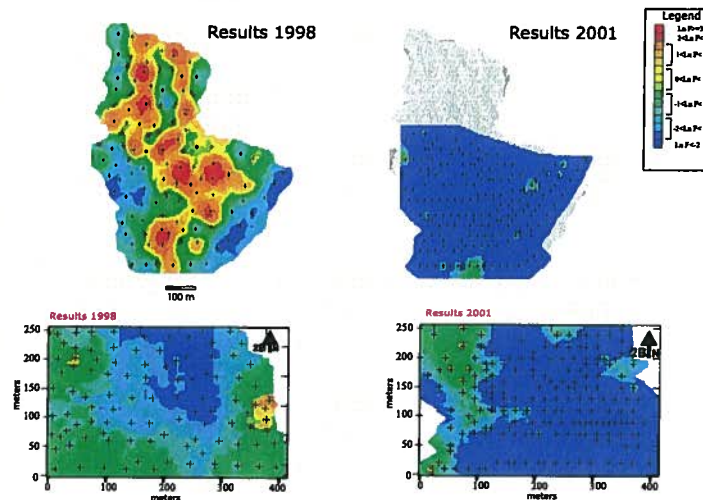
WEST
Systems

Application on a landfill: mapping the biogas non controlled emissions.

The figure shows the compare between the results of the measurement regime of a land/fill undertaken in 1998 and 2001: the mapping performed in 1998 gave clear indications of the areas which required intervention to improve the cover and the capture system.

The interventions were performed only where necessary with a significant economic savings.

The measurement regime of 2001 indicates without any doubt that the interventions were efficient and state-of-the-art.



The obtained results:

- Minor atmospheric emissions;
- Higher quantity and better quality of biogas for cogeneration;
- Optimisation of management costs.

Continuous soil flux monitoring

WEST Systems produces a soil gas station for the continuous monitoring of carbon dioxide and hydrogen sulfide flux, soil temperature, soil water content, soil pressure gradient, soil heat flux and meteorological parameters.

For more information contact your local representative, visit our web site or e-mail to: g.virgili@westsystems.com

Local sales representative

H.Q.

West Systems Srl

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Japan

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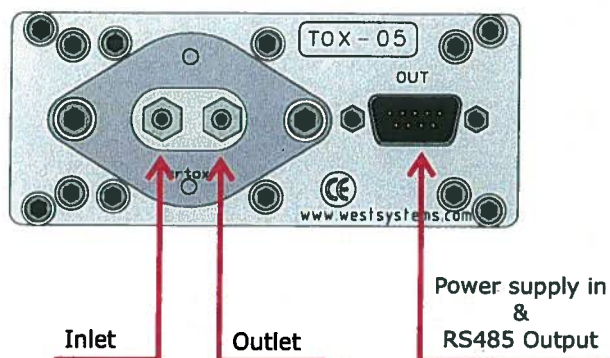
105-8432, Japan

TEL : 03-3459-5106 FAX : 03-3459-5081

WEB SITE <http://www.shoko.co.jp>

e-mail s-isotope@shoko.co.jp

Hydrogen Sulfide Detector



Pin	Signal
1	Gnd
2	+VDC
3	Gnd
4	RS485-B
5	RS485-A
6	Gnd
7	+12V
8	Gnd
9	RS485-B

Legenda

Gnd: Ground reference for power supply and RS485

+VDC: 10-28 Volts Power supply input

RS485-A: Digital signal output A

RS485-B: Digital signal output B

Sensor specifications

Ambient conditions:

Air temperature -40°C to 65 °C

Air pressure 700 hPa to 1300 hPa

Air RH 5% - 95% non condensating.

Expected sensor life > 24 months.

Chemical cell order code: WEST H2S-BH

Detector order code: WEST TOX-05-H2S-BH

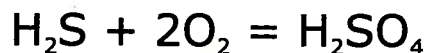
Factory calibration : 20 ppm

RMS Noise <= 0.02 ppm

Zero Offset <= 0.2 ppm

Max Overrange >= 200 ppm

The chemical cell reaction is:



the gas sample specific consumption is very low:

$$2.5 \times 10^{-10} \text{ moles/Sec per ppm}$$

Due to this consumption the H₂S flux is methodically underestimated by a -10% with the AccumulationChamber A and by a -5% when using the accumulation chamber B. Then we advise to use the accumulation chamber B except when the flux is very very low.

Appendix M

WS-HC detector

WS-HC Hydrocarbon Flux measurement:

The HydroCarbon detector is based on a double beam infrared spectrometer able to detect methane, hexane, propane and other molecules with HC linkages. The instrument comes calibrated for the methane. *The instrument requires a frequent **zero base-line** calibration that will be done using atmospheric air. The calibration requires 20 second.*

Detector specifications:

Accuracy 5%

Repeatability 2%

Resolution 22 ppm (Methane equivalent)

Full scale range is 50000 ppm of methane.

Detection limit 60 ppm.

Methane flux measurement range from 0.1 to 150 moles/m² per day.
The precision depends on the measured flux:

range	0.1	5	moles/ m ² per day	±25%
	5	150	moles/ m ² per day	±10%

The measurement of very low fluxes (< 0.1 moles/m²/day) is possible but the error will increase due to the low detector sensitivity.



RS485 Connector DB9 Male panel

Pin 1	Gnd
Pin 2	+Power supply
Pin 3	Gnd
Pin 4	RS485 B
Pin 5	RS485 A
Pin 6	Gnd
Pin 7	+Power supply
Pin 8	Gnd
Pin 9	RS485 B

The gas fittings can be used with rilsan 6x4 mm tubes or silicon 5x3.2 tubes. Please respect inlet and outlet ports.

LI-820 Specifications

CO₂ Specifications

Measurement Range: 0-1000 ppm, 0-2000 ppm with 14 cm bench; 0-5000 ppm, 0-20000 ppm with 5 cm bench

Accuracy: < 2.5% of reading with 14 cm bench; 4% of reading with 5 cm bench

Calibration Drift

¹**Zero Drift:** < 0.15 ppm / °C

²**Span Drift at 370 ppm:** < 0.03% / °C

³**Total Drift at 370 ppm:** < 0.4 ppm / °C

RMS Noise at 370 ppm with 1 sec Signal Filtering: < 1 ppm

¹ Zero drift is the change with temperature at 0 concentration

² Span drift is the change after re-zeroing following a temperature change

³ Total drift is the change with temperature without re-zeroing or re-spanning

Measurement Principle: Non-Dispersive Infrared

Traceability: Traceable gases to WMO standards from 0-3000 ppm. Traceable gases to EPA protocol gases from 3000 to 20000 ppm

Pressure Compensation Range: 15 kPa-115 kPa

Maximum Gas Flow Rate: 1 liter/minute

Output Signals: Two Analog Voltage (0-2.5 V or 0-5 V) and Two Current (4-20 mA)
Digital: TTL (0-5 V) or Open Collector

DAC Resolution: 14-bits across user-specified range

Source Life: 18000 hours

Power Requirements: Input Voltage 12-30 VDC
1.2A @ 12V (14 W) maximum during warm-up with heaters on
0.3 A @ 12 V (3.6 W) average after warm-up with heaters on

Supply Operating Range: 12-30 VDC

Operating Temperature Range: -20 to 45 °C

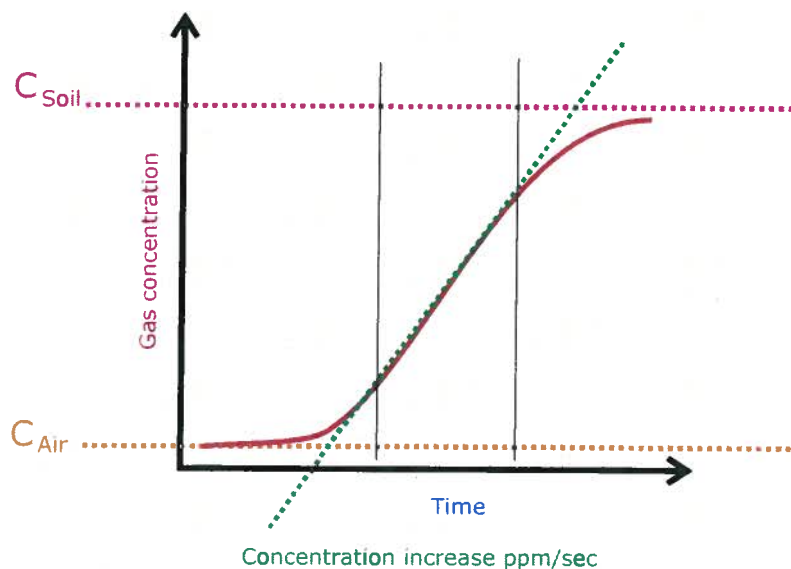
Relative Humidity Range: 0 to 95% RH, Non-Condensing

Dimensions: 8.75" x 6" x 3" (22.23 x 15.25 x 7.62 cm)

Weight: 2.2 lbs (1 kg)

Quantifying the flux

How explained in the chapter 3 the flux is proportional to the concentration increase ratio ppm/sec. The proportionality factor depends on the chamber volume/surface ratio as well as the barometric pressure and the air temperature inside the accumulation chamber.



There are two methods to carry out the field work, in both cases for each measurement you have to record the type of accumulation chamber used, the barometric pressure, and the air temperature.

The variation of few mBar of the pressure and or few degrees of temperature do not affect the evaluation of flux very much, then you can use a mean value for both parameters. Of course that depends on the accuracy you want to reach for the evaluation of flux.

The instrument measures the barometric pressure, using the embedded pressure sensor of the LICOR, with a good accuracy. A platinum Pt100 or a thermo-couple thermometer can be used to measure the air temperature as well as the soil temperature.

Choosing the flux measurement unit

The first measurements made, 10 years ago, with the accumulation chamber was expressed in cm/sec which is a speed, the speed of carbon dioxide flowing out from the soil. During the last ten years several units have been used by volcanologist and by geochemistry researchers. The most common unit is grams/squaremeter per day, but using the same instrument for two gas species to express the flux using this unit means to have two different conversion factors. Actually we use the unit **moles/squaremeter per day** that has two advantages: A single conversion factor for every gas specie and an easy conversion of the flux in grams/sm per day simply multiplying the result expressed in moles/sm per day for the molecular weight of the target gas.

From the [tools][settings] menu you can set the accumulation chamber factor in the "A.c.K." field.

If this factor is set to 1 the instrument will give you results expressed in ppm/sec, that's simply the slope of the curve in the selected interval.

If you set the A.c.K to a value different from 1 the instrument will give you the results expressed in moles per square meter per day.

Please see next page.

Quantifying the flux

Method 1: Measuring the slope

Set the Accumulation Chamber factor to 1 in order to have the flux measurement expressed in the slope unit "ppm/sec" and translate it in the desired unit with a post processing.

Using this method you can focus only on the accumulation chamber interfacing with the soil, the flux curve shape and the other aspects of the measurement, putting off choosing the correct accumulation chamber factor.

Method 2: Measuring the flux directly in moles/sm/day.

To get the results directly in moles/sm/day you have to set the Accumulation Chamber factor to the correct value, taking it from the tables.

For each measurement, if there are variations in the air temperature, or of the barometric pressure, or if you changed the accumulation chamber you have to select the [tools][settings] menu and put the correct accumulation chamber factor in the "A.c.K." field. This operation can be "critical". In any case on the saved files you'll find the results of flux evaluation expressed in both units, the raw ppm/sec and the moles/sm/day computed with the A.c.K. you set.

The accumulation chamber factors

Here following the formula used to compute the A.c.K.:

$$K = \frac{86400 \cdot P}{10^6 \cdot R \cdot T_k} \cdot \frac{V}{A}$$

Where

- **P** is the barometric pressure expressed in mBar (hPa)
- **R** is the gas constant 0.08314510 bar L K⁻¹ mol⁻¹
- **T_k** is the air temperature expressed in Kelvin degree
- **V** is the chamber net volume in cubic meters
- **A** is the chamber inlet net area in square meters.

The dimensions of the A.c.K. are

$$K = \frac{\text{moles} \cdot \text{meter}^{-2} \cdot \text{day}^{-1}}{\text{ppm} \cdot \text{sec}^{-1}}$$

In the table the conversion factors vs temperature and barometric pressure for the Accumulation Chamber Type A and B are reported.

An example:

You're using the accumulation chamber B, the slope of the flux curve is 2.5 ppm/sec, the barometric pressure is 1008 mBar (hPa) and the air temperature is 22 °C.

From the table B get the value that correspond to the barometric pressure and temperature. In this case I get the value computed for 25°C and 1013 mBar : 0.696.

Then the flux is: 2.5 x 0.696 = 1.74 moles per square meter per day.

The Gasport Gas Tester is designed for gas utility workers to detect methane and certain toxic gases. It is a reliable, simple, versatile tool to help your service technicians get the job done quickly! With multiple ranges and sensing capabilities built into one rugged housing, the Gasport Tester simplifies your work by reducing the number of meters you have to carry on the job.



Applications

The Gasport Tester's poison-tolerant methane sensor provides three measurement ranges for your daily service needs:

- Open air, safety sampling
- Small, in-home leak detection
- Street/outdoor service line leak detection

Features and Benefits

- **Proven in field use—rugged and reliable**
Less costly to maintain, less time in repair
- **Multiple functions in one instrument**
No need to buy, carry & maintain multiple instruments
- **New, poison-tolerant combustible gas sensor**
Reduces meter ownership costs
- **User-selectable, "silent" operation mode**
Reduces customer disturbances and worries
- **Fast warm up time**
Fastest warm up time in industry saves time
- **Can monitor up to four gases at a time**
Fewer instruments to carry
- **Show all gas concentrations simultaneously**
Eliminates guesswork on what reading is displayed
- **Autoranging methane sensor**
Automatically switches between 0-5% and 5-100% methane ranges
- **Gas readings recorded for later retrieval**
Can double check readings after job is done
- **Simple manual or automated calibration options**
Reduces training time and helps ensure accuracy
- **Intrinsically safe**
Meets safety standards for work in hazardous areas
- **Lifetime warranty on case and electronics**
Reduced maintenance and lifetime costs



Specifications

Gas	Range	Resolution
Methane	0-5000 ppm	50 ppm
Methane	0-100% LEL or 0-5% CH ₄	1 % LEL or 0.1% CH ₄
Methane	5-100% CH ₄	1% CH ₄
Oxygen	0-25%	0.1%
Carbon Monoxide	0-1000 ppm	1 ppm
Hydrogen Sulfide	0-100 ppm	1 ppm

Battery types:	NiCd and Alkaline
Case material:	Impact resistant, stainless-steel-fiber-filled polycarbonate
Operating temperature:	normal -10 to 40°C; extended -20 to 50°C
Operating humidity:	Continuous: 15-95% RH, non-condensing Intermittent duty: 5-95% RH, non condensing
Warm up time:	Less than 20 seconds to initial readings
Datalog capacity:	12 hours
Input:	3 clearly marked, metal domed keys
Warranty:	Case and Electronics: Lifetime Sensors and consumable parts: 1 year

The answer for gas utilities' gas detection needs

Gasport® Gas Tester

Ordering Information

Battery Chargers

Part No.	Description
494716	Omega 120 VAC 50/60Hz
495965	Omega 220 VAC 50/60Hz
801759	Omega 110/220 VAC, Five Unit, 50/60Hz
800525	Omega 8 - 24VDC for vehicle use

Battery Packs

Part No.	Description
496990	Standard NiCd Rechargeable
800526	Alkaline, Type C
711041	Alkaline, with Thumbscrews
800527	Heavy Duty NiCd Rechargeable

Sensors

Part No.	Description
813693	Combustible Gas
480566	O ₂
812389	CO
812390	H ₂ S

Protective Boots

Part No.	Description
804955	Black, for NiCd Battery Packs
802806	Orange, for NiCd Battery Packs
806751	Black, for Alkaline Battery Packs
806750	Orange, for Alkaline Battery Packs
806749	Black, for HD NiCd Battery Packs
806748	Orange, for HD NiCd Battery Packs
812833	Yellow Soft Carrying Case with Harness
711022	Black padded Vinyl Carrying Case with Harness

Sampling Equipment

Part No.	Description
800332	Probe - 1 ft., plastic
800333	Probe - 3 ft., plastic
803561	Probe - 3 ft., plastic (holes 2" from end) (bar hole probe)
803962	Probe - 3 ft., plastic (holes 2" from handle) (solid probe)
803848	Probe - Hot Gas Sampler
710465	Sampling Line - 5 ft., coiled
497333	Sampling Line - 10 ft.
497334	Sampling Line - 15 ft.
497335	Sampling Line - 25 ft.

Sampling Accessories

Part No.	Description
801582	Replacement Filter, Probe, pkg. of 10
801291	External Filter Holder
014318	Charcoal Filter
711039	Line Scrubber Filter Holder
711059	Line Scrubber Replacement Cartridges, Box of 12
808935	Dust Filter, Pump Module
802897	Water Trap (Teflon) Filter, Pump Module

Calibration Check Equipment

Part No.	Description
477149	Calibration Kit Model RP with 0.25 lpm Regulator
491041	Calibration Gas - methane, 2.5%
473180	Calibration Gas - 300 ppm CO
813718	Calibration Gas - methane, 2.5% oxygen, 15% 60 ppm CO
813720	Calibration Gas - methane, 2.5% oxygen, 15% 300 ppm CO 10 ppm H ₂ S
710288	Gasmiser™ Demand Regulator 0 - 3.0 lpm

Accessories

Part No.	Description
804679	Data Docking Module Kit. Includes the Data Docking Module, MSA Link Software and Instruction Manual

Approvals

The Gasport Gas Tester has been designed to meet intrinsic safety testing requirements in certain hazardous atmospheres.

The Gasport Gas Tester is approved by MET (an OSHA Nationally Recognized Testing Laboratory [NRTL]) for use in Class I, Division I, Groups A, B, C, D; Class II, Division I, Groups E, F, G; and Class III Hazardous locations. Gasport Gas Testers sold in Canada are approved by CSA for use in Class I, Division I, Groups A, B, C, and D locations.

Contact MSA at 1-800-MSA-2222 for more information or with questions regarding the status of approvals.

Gasport Gas Tester Kits

	LEL Display	O ₂	CO	H ₂ S	Alarms Always	Alarms Optional	Leak Detect Page	Peak	Alkaline Battery	NiCd Battery	5ft Coiled Line	1ft Probe	Part No.
4-Gas, Selectable, NiCd	•	•	•	•	•	•	•	•	•	•	•	•	711489
4-Gas, Selectable, Alkaline	•	•	•	•	•	•	•	•	•	•	•	•	711490
3-Gas, Selectable, NiCd	•	•	•	•	•	•	•	•	•	•	•	•	711493
3-Gas, Selectable, Alkaline	•	•	•	•	•	•	•	•	•	•	•	•	711494
2-Gas, Selectable, NiCd	•	•	•	•	•	•	•	•	•	•	•	•	711495
2-Gas, Selectable, Alkaline	•	•	•	•	•	•	•	•	•	•	•	•	711496
4-Gas, Alarms On, NiCd	•	•	•	•	•	•	•	•	•	•	•	•	711491
4-Gas, Alarms On, Alkaline	•	•	•	•	•	•	•	•	•	•	•	•	711492

Assemble-to-Order (ATO) System: You Make the Choices

The ATO System makes it easy to "custom order" the Gasport Gas Tester, configured exactly the way you want it. You can choose from an extensive line of base instrument components and accessories. To obtain a copy of the "ATO System and Price Information for the Gasport Gas Tester," call toll-free 1-800-MSA-2222, and request Bulletin 0804-28. To obtain a copy of the ATO via FAX, call MSA QuickLit Information Service at 1-800-672-9010. At the prompt, request QuickLit Document #2345 (ATO for Gasport Gas Tester).

Note: This Data Sheet contains only a general description of the products shown. While uses and performance capabilities are described, under no circumstances shall the products be used by untrained or unqualified individuals and not until the product instructions including any warnings or cautions provided have been thoroughly read and understood. Only they contain the complete and detailed information concerning proper use and care of these products.

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Offices and representatives worldwide
For further information:



QRAE II User's Guide



**Covers QRAE II Diffusion & Pump Models
with Firmware Version 3.60 or higher**

QRAE II User Guide

1.2 Specifications

QRAE II Specifications

Configuration	Pumped or diffusion 4-gas with datalogging		
Dimensions:	Diffusion: 5" L x 2.8" W x 1.5" H (125mm x 72mm x 38mm)		
	Pump: 5" L x 2.8" W x 1.5" H (125mm x 72mm x 38mm)		
Weight:	Diffusion: 9 oz (250g)		
	Pump: 12 oz (350 g) with battery		
Detectors:	2 Electrochemical toxic gases sensors		
	1 Solid Polymer Electrolyte oxygen sensor		
	1 Catalytic sensor for combustible level organics		
Battery:	Rechargeable 3.7V Li-ion battery pack (6-hour charge time) or a 3 AA alkaline battery adapter.		
Operating Time:	Up to 10 hours continuous w/ Li-ion battery pack		
Display:	4-line graphical LCD with automatic LED backlight for dim lighting conditions		
Keypad:	2 programming/operation keys		
Direct Readout:	Up to 4 simultaneous values with sensor name, battery charge, high and low values for all sensors, elapsed time, and datalogging on/off state		
Sampling Method:	Diffusion or pumped (depending on model)		
Range, Resolution & Response Time:	LEL	0-100%	1 % 15 sec
	O ₂	0-30%	0.1 % 20 sec
	CO	0-1000 ppm	1 ppm 25 sec
	H ₂ S	0-100 ppm	0.1 ppm 30 sec
Alarm Settings:	Separate limits for TWA, STEL, High, Low		
Alarms:	≥95 dB @ 30 cm buzzer, flashing red LEDs, vibration alarm, LCD to indicate exceeded preset limits, low battery, or sensor failure		
Calibration:	Two-point field calibration for fresh air and standard reference gas		
Protection:	Password protected calibration settings, alarm limits, and data		
Intrinsic Safety:	CSA Class I, Division 1, Group A, B, C, D, T4 (US & Canada), SIRA ATEX II 2G Ex ia d II C T4 Gb (Europe), IECEx Ex d ia II C T4 Gb		
EM Immunity:	No effect when exposed to 0.43mW/cm ² RF interference (5-watt transmitter at 12"/10cm).		
Data Storage:	64,000 readings (64 hours, 4 channels at 1 minute interval) in non-volatile memory.		
Datalog Interval:	Programmable 1- to 3,600-second intervals		
Alarm Settings:	Separate alarm limit settings for TWA, STEL, Low and High alarm.		
Communication:	Download data to PC and upload monitor setup from PC through an RS-232 link to PC serial port		
Temperature:	-20° C to 50° C (-4° F to 122° F)		
Humidity:	0% to 95% relative humidity (non-condensing)		

Caution:

Refer to RAE Systems Technical Note TN-114 for sensor cross-sensitivities.
Refer to RAE Systems Technical Note TN-144 for LEL sensor poisoning.

KEY FEATURES

Trimble Floodlight satellite shadow reduction technology

More positions and increased accuracy in tough environments

Sunlight readable display

For unmatched clarity in bright sunlight

3.5G cellular capability

High-speed Internet connectivity in the field

5 megapixel autofocus camera

Capture high quality photographs and link directly to features

Field-swappable battery

All day operation and the convenience of swap-and-go battery replacement



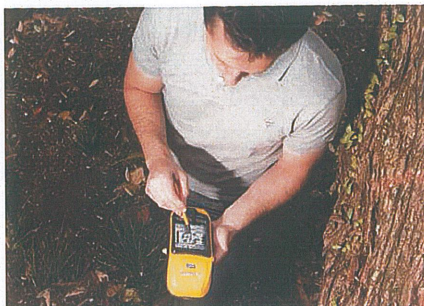
THE ACCURACY YOU NEED ANYWHERE YOU NEED IT

Bringing together the essential functionality for productive GIS data collection in one device, the Trimble® GeoExplorer® 6000 series also delivers positioning accuracy in challenging GNSS situations such as under trees and near buildings with Trimble Floodlight™ technology. Wherever you work, it just works.

Accurate, productive, reliable data collection

Integrating both a GPS/GLONASS receiver and a dual frequency GNSS antenna, the Trimble GeoExplorer 6000 series delivers accuracy you can depend on to record new assets, or reliably navigate back to previously recorded locations.

Used with Trimble's range of powerful field and office software, GeoExplorer 6000 series handhelds allow you to work faster and in more places than ever before. The Trimble GeoExplorer series can deliver down to centimeter accuracy—either postprocessed or in real time for the confidence the job is done right while still on site.



Trees and buildings create "satellite shadows", limiting the areas where you can reliably collect high-accuracy GNSS data. Using Trimble Floodlight technology, the GeoExplorer 6000 series continues to deliver productive, usable data under tree canopy or in urban canyons. You can work with fewer disruptions, meaning better data, faster, at less cost.

Designed for work, wherever you work

The Trimble GeoExplorer series works for the way you work. The built-in 5 megapixel autofocus camera, with geotagging capability, gives you one of the best ways to capture information about an asset, event, or site. A sunlight-optimized display maintains exceptional clarity in all outdoor conditions for crisp on screen text and images. And you can stay connected with an optional integrated 3.5G cellular modem for continuous network and Internet access to real-time map data, web-based services, Trimble VRS™ corrections, and live update of field information.



With the Trimble GeoExplorer 6000 series you get it all.

TRIMBLE GEOEXPLORER 6000 SERIES

PRODUCT MODELS

	GeoXH	GeoXT
Accuracy	Decimeter/Centimeter	Submeter
Floodlight	Yes	Optional
Cellular modem	Optional	Optional
Camera	5 MP	5 MP

GNSS

Receiver Trimble Maxwell™ 6 GNSS chipset
 Channels 220 channels
 Systems GPS, GLONASS¹
 WAAS/EGNOS/MSAS/GAGAN
 Update rate 1 Hz
 Time to first fix 45 s (typical)
 NMEA-0183 support Optional
 Trimble Floodlight technology Optional
 RTCM support RTCM2.x/RTCM3.x
 CMR support CMR/CMR+/CMRx

GeoXT handhelds

GPS L1C/A
 GLONASS L1C/A, L1P

GeoXH handhelds

GPS L1C/A, L2C, L2E
 GLONASS L1C/A, L1P, L2C/A, L2P

GNSS ACCURACY²

GeoXH Centimeter Edition

Real-time Centimeter output

Horizontal (external antenna)³ 1 cm + 1 ppm
 Vertical (external antenna) 1.5 cm + 2 ppm
 Horizontal (internal antenna) 2.5 cm + 1.2 ppm
 Vertical (internal antenna) 4 cm + 2 ppm

Postprocessed Centimeter output

Horizontal (external antenna)³ 1 cm + 1 ppm
 Vertical (external antenna) 1.5 cm + 1 ppm
 Horizontal (internal antenna) 2.5 cm + 1.2 ppm
 Vertical (internal antenna) 4 cm + 1.5 ppm

All GeoXH configurations

Real-time and postprocessed H-Star (Horizontal RMS)

H-Star 10 cm + 1 ppm

All GeoXH and GeoXT configurations

Real-time DGNSS (Horizontal RMS)

Code 75 cm + 1 ppm
 SBAS⁴ (WAAS/EGNOS/MSAS) typically < 1 m

Postprocessed DGNSS (Horizontal RMS)

Code 50 cm + 1 ppm
 Carrier (after 45 minutes) 1 cm + 2 ppm

ENVIRONMENTAL (MIL-STD-810G)

Drop shock 1.2 m (4 ft) to plywood over concrete
 Functional shock Method 516.6 Procedure I
 Vibration Method 514.6 Procedure I
 Relative humidity 95% non-condensing
 Maximum operating altitude 9,000 m (29,000 ft)
 Maximum storage altitude 12,000 m (40,000 ft)

TEMPERATURE

Operation -20 °C to +60 °C (-4 °F to +140 °F)
 Storage -30 °C to +70 °C (-22 °F to +158 °F)

INGRESS PROTECTION

Water/Dust IP65

SIZE AND WEIGHT

Height 234 mm (9.2 in)
 Width 99 mm (3.9 in)
 Depth 56 mm (2.2 in)
 Weight (inc. battery) 925 g (2.0 lb)

BATTERY

Type Rechargeable, removable Li-Ion
 Capacity 11.1 V 2.5 AH
 Charge time 4 hours (typical)

BATTERY RUN TIME⁵

	GeoXH	GeoXT
GNSS	9 hours	11 hours
GNSS & Wi-Fi	8 hours	9.5 hours
GNSS & cellular	6.5 hours	7 hours
Standby time (typical)	50 days	50 days

CONNECTORS & INPUTS

- Internal microphone and speaker
- Mini USB connector
- DE-9 serial via optional USB to serial converter
- External power connector
- SIM socket
- SDHC card socket

CAMERA

Still mode Autofocus 5 MP
 Still image format JPG
 Video mode Up to VGA resolution
 Video file format WMV with audio

CELLULAR⁶ & WIRELESS⁷

UMTS/HSDPA 850/900/2100 MHz
 GPRS/EDGE 850/900/1800/1900 MHz
 Wi-Fi 802.11 b/g
 Bluetooth Version 2.1 + EDR

DISPLAY

Type Transflective LED-backlit LCD
 Size 4.2" (diagonal)
 Resolution 480x640
 Luminance 280 cd/m2

HARDWARE

Processor TI OMAP 3503
 RAM 256 MB
 Flash 2 GB
 External storage SD/SDHC up to 32 GB

LANGUAGES

- English, Spanish, French, German, Italian, Portuguese (Brazilian), Chinese (Simplified), Korean, Japanese, Russian

IN THE BOX

GeoExplorer 6000 series handheld, rechargeable battery pack, pouch and strap, USB data cable, AC power adaptor, screen protector kit, spare stylus & tether, documentation

OPTIONAL ACCESSORIES

- Trimble Zephyr™ Model 2 external GNSS antenna
- Trimble Tornado™ external GNSS antenna
- Trimble Tempest™ external GNSS antenna
- Vehicle power supply
- 1.5 m & 5 m external antenna cable
- Range pole kit for external antenna
- Carbon fiber monopole kit
- Backpack kit for external antenna
- Vehicle mount
- Hard carry case
- Null modem cable
- USB to serial converter cable

SOFTWARE COMPATIBILITY

- Trimble TerraSync software
- Trimble GPS Pathfinder® Office software
- Trimble Positions™ software suite
- Trimble GPSCorrect™ extension for Esri ArcPad software
- Trimble GPS Analyst™ extension for Esri ArcGIS for Desktop software
- Trimble GPS Controller software
- Trimble GNSS Connector software
- Trimble TrimPix™ Pro system
- Custom applications built with a Mobile GIS Developer Community software development kit (SDK)
- Third party NMEA-based applications

¹ GLONASS is enabled on GeoXT and GeoXH handhelds with Floodlight technology enabled.

² Accuracy and reliability may be subject to anomalies due to multipath, obstructions, satellite geometry, and atmospheric conditions. Always follow recommended GNSS data collection practices. Specified Centimeter accuracy can normally be achieved for baselines of 30 km or less. Specified H-Star accuracy can normally be achieved for baseline lengths of 100 km or less. Centimeter and H-Star accuracy is typically achieved within 2 minutes. Carrier postprocessed accuracy is limited to data collected within 10 km of the base station used for corrections.

³ Stated accuracy is for the Zephyr Model 2 antenna.

⁴ SBAS (Satellite Based Augmentation System). Includes WAAS; available in North America only; EGNOS; available in Europe only and MSAS; available in Japan only.

⁵ Actual run time will vary with conditions and environment of use.

⁶ Not available on all configurations. The GeoXH and GeoXT 3.5G edition handhelds are PTCRB certified and can operate on supported networks that do not require carrier certification. Consult with your local reseller for more information.

⁷ Bluetooth and Wi-Fi type approvals are country specific. GeoExplorer 6000 series handhelds have Bluetooth and Wi-Fi approval in the U.S. and in most European countries. For further information please consult your local reseller.

Specifications subject to change without notice.



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Operator's Manual

SMARTROLL™ MP Handheld Instrument



General Specifications

Operating temperature	-5 to 50° C (23 to 122° F)
Storage temperature	-40 to 65° C (-40 to 149° F)
Dimensions	4.7 cm (1.85 in.) OD x 26.9 cm (10.6 in.) with restrictor installed (does not include connector)
Weight	694 g (1.53 lbs)
Wetted materials	PVC, 316 stainless steel, titanium, Acetal, Viton®, PC/PMMA
Environmental rating	IP68 with all sensors and cable attached. IP67 with sensors removed and cable detached.
Reading rate	1 reading every 10 seconds; data logged to smartphone.
Power	6 VDC from battery pack
Interface	iPhone® 4S, iPod touch® 5, or iPad® 3, 4, mini or later; iOS 6.0 or later. Bluetooth® Low Energy (BLE) radio. Purchase the iSitu™ App at the Apple® App Store.
Cable	Black polyurethane. Standard lengths available: 1.5 m, 4.6 m, 9.1 m, 30.5 m (5 ft, 15 ft, 30 ft, 100 ft)
Warranty	2-years
Notes	Specifications are subject to change without notice. Apple, iPhone, iPod touch, and iPad are trademarks of Apple Inc. registered in U.S. and other countries. Bluetooth is a registered trademark of Bluetooth SIG, Inc. Viton is a registered trademark of DuPont Performance Elastomers L.L.C.

Sensor Specifications

Level, Depth, Pressure Sensor Specifications

Accuracy	Typical $\pm 0.1\%$ FS @ 15° C; $\pm 0.3\%$ FS max. from 0 to 50° C
Range	76 m (250 ft); absolute (non-vented)
Resolution	$\pm 0.01\%$ FS or better
Sensor Type	Fixed
Response Time	Instantaneous in thermal equilibrium
Units of Measure	Pressure: psi, kPa, bar, mbar, mmHg, inHg Level: mm, cm, m, in, ft
Methodology	Piezoresistive; ceramic

Barometric Pressure Sensor Specifications (Battery Pack)

Accuracy	± 3 mbar max.
Range	300 to 1100 mbar
Resolution	0.01 mbar
Sensor Type	Fixed
Response Time	Instantaneous in thermal equilibrium
Units of Measure	psi, kPa, bar, mbar, mmHg, inHg, Torr, atm
Methodology	Piezoresistive pressure sensor

Conductivity Sensor Specifications

Accuracy	Typical $\pm 0.5\%$ + 1 $\mu\text{S}/\text{cm}$; $\pm 1\%$ max.
Range	5 to 100,000 $\mu\text{S}/\text{cm}$
Resolution	0.1 $\mu\text{S}/\text{cm}$
Sensor Type	Fixed
Response Time	Instantaneous in thermal equilibrium
Units of Measure	Actual conductivity ($\mu\text{S}/\text{cm}$, mS/cm) Specific conductivity ($\mu\text{S}/\text{cm}$, mS/cm) Salinity (PSU) Total dissolved solids (ppt, ppm) Resistivity (Ohms-cm) Density (g/cm^3)
Methodology	Std. Methods 2510 EPA 120.1

Dissolved Oxygen RDO Fast Cap (Optical Sensor) Specifications

Accuracy	± 0.1 mg/L; ± 0.2 mg/L; $\pm 10\%$ of reading
Range	0 to 8 mg/L; 8 to 20 mg/L; 20 to 50 mg/L; Full operating range: 0 to 50 mg/L
Resolution	0.01 mg/L
Sensor Type	Fixed with replaceable RDO Fast Cap (life: 1 year typical)
Response Time	T90: <30 sec. T95: <45 sec.
Units of Measure	mg/L, % saturation, ppm
Methodology	EPA-approved In-Situ Methods 1002-8-2009 1003-8-2009 1004-8-2009

ORP Sensor Specifications

Accuracy	±5.0 mV
Range	±1400 mV
Resolution	0.1 mV
Sensor Type	Replaceable pH/ORP combo sensor
Response Time	<15 sec.
Units of Measure	mV
Methodology	Std. Methods 2580

pH Sensor Specifications

Accuracy	±0.1 pH unit from 0 to 12 pH units
Range	0 to 14 pH units
Resolution	0.01 pH unit
Sensor Type	Replaceable pH/ORP combo sensor
Response Time	<15 sec., pH 7 to pH 4
Units of Measure	pH units
Methodology	Std. Methods 4500-H+ EPA 150.2

Air Temperature Sensor Specifications (Battery Pack)

Accuracy	±2° C
Range	-20 to 70° C (-4 to 158° F)
Resolution	0.1° C
Sensor Type	Fixed
Response Time	<30 sec.
Units of Measure	Celsius, Fahrenheit
Methodology	EPA 170.1

Sample Temperature Sensor Specifications (Probe)

Accuracy	±0.1° C
Range	-5 to 50° C (23 to 122° F)
Resolution	0.01° C or better
Sensor Type	Fixed
Response Time	<30 sec.
Units of Measure	Celsius, Fahrenheit
Methodology	EPA 170.1

Battery Pack Specifications

Battery Type	Four 1.5V AA lithium or alkaline batteries
Operating temperature	-5 to 50° C (23 to 122° F); 95% relative humidity, non-condensing
Storage temperature	-40 to 65° C (-40 to 149° F); 95% relative humidity, non-condensing
Dimensions & weight	9.5 x 7.6 x 5.7 cm (3.75 x 3 x 2.25 in.) (H x D x W). Weight: 165 g (5.8 oz)
Materials	PC/ABS
Environmental rating	IP67 with battery cover closed
Output options	BLE radio
Battery type	4 AA Lithium or Alkaline
Warranty on battery pack	1-year
Warranty on cable	1-year

APPENDIX B
FLUX METER DATA



APPENDIX B - FLUX DATA

SitePt	Site	AreaAbbrev	Northing	Easting	Date	CH4flux	H2Sflux	CO2flux	ACCUMULATION CHAMBER	PRESSURE (HPa)	TEMP (C°)	TIME	CH4 Slope	H2S Slope	CO2 Slope	Ack
L-1050_081215_01	L-1050	Seep32-L1050	1172713.443590000000	3179622.860970000000	8/12/2015	0.000000000000	0.006095160000	0.089720700000	A	795.7	32.1	12-08-2015 14:43:47	0.000000000000	0.025000000000	0.368000000000	0.243806000000
L-1050_081215_02	L-1050	Seep32-L1050	1172649.834070000000	3179604.698310000000	8/12/2015	0.000000000000	0.003641580000	0.273119000000	A	795.7	33.4	12-08-2015 14:48:51	0.000000000000	0.015000000000	1.125000000000	0.242772000000
L-1050_081215_03	L-1050	Seep32-L1050	1172618.446570000000	3179608.632260000000	8/12/2015	0.000000000000	0.004120100000	0.275320000000	A	795.9	34.0	12-08-2015 14:52:20	0.000000000000	0.017000000000	1.136000000000	0.242359000000
L-1050_081215_04	L-1050	Seep32-L1050	1172571.580980000000	3179599.563600000000	8/12/2015	0.000000000000	0.004102470000	0.247355000000	A	794.3	34.7	12-08-2015 14:56:57	0.000000000000	0.017000000000	1.025000000000	0.241322000000
L-1050_081215_05	L-1050	Seep32-L1050	1172571.646160000000	3179672.612240000000	8/12/2015	0.000000000000	0.001927440000	0.092276400000	A	794.3	35.2	12-08-2015 14:58:52	0.000000000000	0.008000000000	0.383000000000	0.240930000000
L-1050_081215_06	L-1050	Seep32-L1050	1172576.864420000000	3179710.702680000000	8/12/2015	0.000000000000	0.005050350000	0.158244000000	A	794.4	35.8	12-08-2015 15:03:03	0.000000000000	0.021000000000	0.658000000000	0.240493000000
L-1050_081215_07	L-1050	Seep32-L1050	1172544.432320000000	3179776.475630000000	8/12/2015	0.000000000000	0.005287500000	0.188939000000	A	794.8	36.1	12-08-2015 15:08:21	0.000000000000	0.023000000000	0.786000000000	0.240381000000
L-1050_081215_08	L-1050	Seep32-L1050	1172614.286340000000	3179765.902020000000	8/12/2015	0.000000000000	0.000720210000	0.151964000000	A	794.8	36.5	12-08-2015 15:10:15	0.000000000000	0.003000000000	0.633000000000	0.240070000000
L-1050_081215_09	L-1050	Seep32-L1050	1172625.732740000000	3179711.863370000000	8/12/2015	0.000000000000	0.003120640000	1.530070000000	A	795.5	36.8	12-08-2015 15:13:03	0.000000000000	0.013000000000	6.374000000000	0.240049000000
L-1050_081215_10	L-1050	Seep32-L1050	1172664.796620000000	3179715.045010000000	8/12/2015	0.000000000000	0.002877640000	1.140525000000	A	795.2	37.0	12-08-2015 15:16:00	0.000000000000	0.012000000000	0.586000000000	0.239804000000
L-1050_081215_11	L-1050	Seep32-L1050	1172667.880270000000	3179669.583350000000	8/12/2015	0.000000000000	0.003834110000	0.160793000000	A	795.4	37.3	12-08-2015 15:18:48	0.000000000000	0.016000000000	0.671000000000	0.239632000000
L-1050_081215_12	L-1050	Seep32-L1050	1172622.140060000000	3179666.851470000000	8/12/2015	0.000000000000	0.003589910000	0.097884900000	A	794.9	37.5	12-08-2015 15:21:41	0.000000000000	0.015000000000	0.409000000000	0.239327000000
L-1050_081215_13	L-1050	Seep32-L1050	1172667.405510000000	3179633.157560000000	8/12/2015	0.000000000000	0.004781060000	0.146779000000	A	794.5	37.7	12-08-2015 15:25:10	0.000000000000	0.020000000000	0.614000000000	0.239053000000
L-1050_081215_14	L-1050	Seep32-L1050	1172707.584350000000	3179673.278910000000	8/12/2015	0.000000000000	0.004542510000	0.452578000000	A	795.1	37.9	12-08-2015 15:28:20	0.000000000000	0.019000000000	1.893000000000	0.239000000000
L-1050_081215_15	L-1050	Seep32-L1050	1172694.762750000000	3179726.204160000000	8/12/2015	0.000000000000	0.005738230000	0.127950000000	A	795.4	38.0	12-08-2015 15:30:57	0.000000000000	0.024000000000	2.563000000000	0.239093000000
L-1050_081215_16	L-1050	Seep32-L1050	1172724.061970000000	3179718.011300000000	8/12/2015	0.000000000000	0.017920500000	0.000000000000	A	795.4	38.2	12-08-2015 15:33:33	0.000000000000	0.075000000000	-2.286000000000	0.238939000000
L-1050_081215_17	L-1050	Seep32-L1050	1172767.542910000000	3179732.627380000000	8/12/2015	0.000000000000	0.004776920000	0.071176100000	A	795.6	38.4	12-08-2015 15:36:11	0.000000000000	0.020000000000	0.298000000000	0.238846000000
L-1050_081215_18	L-1050	Seep32-L1050	1172754.861980000000	3179752.655280000000	8/12/2015	0.000000000000	0.003821220000	0.356329000000	A	796.3	38.7	12-08-2015 15:39:16	0.000000000000	0.016000000000	1.492000000000	0.238826000000
L-1050_081215_19	L-1050	Seep32-L1050	1172755.801330000000	3179786.587850000000	8/12/2015	0.000000000000	0.001431040000	0.197484000000	A	796.0	39.0	12-08-2015 15:42:00	0.000000000000	0.006000000000	0.828000000000	0.238507000000
L-1050_081215_20	L-1050	Seep32-L1050	1172714.288350000000	3179750.523260000000	8/12/2015	0.000000000000	0.004288460000	0.417788700000	A	795.9	39.3	12-08-2015 15:45:11	0.000000000000	0.018000000000	1.754000000000	0.238248000000
L-1050_081215_21	L-1050	Seep32-L1050	1172707.473310000000	3179774.598400000000	8/12/2015	0.000000000000	0.007138380000	0.167514000000	A	795.4	39.5	12-08-2015 15:47:40	0.000000000000	0.030000000000	0.704000000000	0.237946000000
L-1050_081215_22	L-1050	Seep32-L1050	1172671.963960000000	3179770.236230000000	8/12/2015	0.000000000000	0.005469260000	0.582253000000	A	795.4	39.7	12-08-2015 15:49:57	0.000000000000	0.023000000000	3.584000000000	0.237794000000
SeepArea14_081615_01	SeepArea14081615	Seep14	1169213.322950000000	3156673.831370000000	8/16/2015	0.000000000000	0.000000000000	0.000000000000	A	773.8	39.7	16-08-2015 13:28:52	0.000000000000	-0.031000000000	0.000000000000	0.231336000000
SeepArea14_081615_02	SeepArea14081615	Seep14	1169215.960550000000	3156625.575520000000	8/16/2015	0.000000000000	0.000000000000	0.029823300000	A	773.8	39.9	16-08-2015 13:32:44	0.000000000000	0.000000000000	0.129000000000	0.231188000000
SeepArea14_081615_03	SeepArea14081615	Seep14	1169229.772590000000	3156557.803300000000	8/16/2015	0.000000000000	0.000000000000	7.573870000000	A	773.4	40.0	16-08-2015 13:35:31	0.000000000000	-0.060000000000	32.788000000000	0.230995000000
SeepArea14_081615_04	SeepArea14081615	Seep14	1169220.533270000000	3156513.654770000000	8/16/2015	0.000000000000	0.000000000000	0.173726000000	A	772.7	40.1	16-08-2015 13:37:56	0.000000000000	-0.033000000000	0.753000000000	0.230712000000
SeepArea14_081615_05	SeepArea14081615	Seep14	1169172.701130000000	3156504.709960000000	8/16/2015	0.000000000000	0.000000000000	0.044955000000	A	772.6	40.3	16-08-2015 13:40:34	0.000000000000	-0.059000000000	0.195000000000	0.230535000000
SeepArea14_081615_06	SeepArea14081615	Seep14	1169168.906750000000	3156557.676130000000	8/16/2015	0.000000000000	0.000000000000	0.308839000000	A	772.8	40.5	16-08-2015 13:43:14	-0.816000000000	-0.053000000000	1.338000000000	0.230448000000
SeepArea14_081615_07	SeepArea14081615	Seep14	1169166.694000000000	3156615.971040000000	8/16/2015	0.000000000000	0.000000000000	0.182852000000	A	773.5	40.6	16-08-2015 13:45:36	0.000000000000	-0.046000000000	0.793000000000	0.230358300000
SeepArea14_081615_08	SeepArea14081615	Seep14	1169159.419630000000	3156665.699460000000	8/16/2015	0.000000000000	0.000000000000	0.091547900000	A	773.8	40.7	16-08-2015 13:47:47	0.000000000000	-0.018000000000	0.397000000000	0.230599000000
SeepArea14_081615_09	SeepArea14081615	Seep14	1169108.457300000000	3156611.249350000000	8/16/2015	0.000000000000	0.000000000000	0.832659000000	A	773.8	40.8	16-08-2015 13:49:49	0.000000000000	-0.024000000000	3.612000000000	0.230526000000
SeepArea14_081615_10	SeepArea14081615	Seep14	1169094.510030000000	3156670.935580000000	8/16/2015	0.000000000000	0.000000000000	0.174705000000	A	773.9	40.9	16-08-2015 13:52:30	0.000000000000	-0.019000000000	0.758000000000	0.230482000000
SeepArea14_081615_11	SeepArea14081615	Seep14	1169036.416620000000	3156663.110850000000	8/16/2015	0.000000000000	0.000000000000	1.866910000000	A	774.3	41.1	16-08-2015 13:56:21	0.000000000000	-0.050000000000	8.101000000000	0.230454000000
SeepArea14_081615_12	SeepArea14081615	Seep14	1169013.846500000000	3156589.434600000000	8/16/2015	0.000000000000	0.000000000000	0.606210000000	A	773.9	41.2	16-08-2015 13:59:55	0.000000000000	-0.050000000000	2.869000000000	0.230262000000
SeepArea14_081615_13	SeepArea14081615	Seep14	1168965.797100000000	3156522.048620000000	8/16/2015	0.000000000000	0.000000000000	0.294966000000	A	773.9	41.2	16-08-2015 14:02:39	0.000000000000	-0.055000000000	1.281000000000	0.230262000000
SeepArea14_081615_14	SeepArea14081615	Seep14	1169020.060810000000	3156510.601380000000	8/16/2015	0.000000000000	0.000000000000	0.159699000000	A	773.4	41.2	16-08-2015 14:04:47	0.000000000000	-0.014000000000	0.694000000000	0.230113000000
SeepArea14_081615_15	SeepArea14081615	Seep14	1169066.366950000000	3156512.682700000000	8/16/2015	0.000000000000	0.000000000000	0.055418200000	A	773.1	41.3	16-08-2015 14:07:06	0.000000000000	-0.009000000000	0.241000000000	0.229951000000
SeepArea14_081615_16	SeepArea14081615	Seep14	1169120.023320000000	3156523.756310000000	8/16/2015	0.000000000000	0.000000000000	0.337484000000	A	773.4	41.5	16-08-2015 14:09:35	-0.637000000000	-0.025000000000	1.468000000000	0.229849000000
SeepArea14_081615_17	SeepArea14081615	Seep14	1169104.848830000000	3156553.735990000000	8/16/2015	0.000000000000	0.000000000000	0.131049900000	A	773.1	41.7	16-08-2015 14:11:46	-0.025000000000	-0.028000000000	1.352000000000	0.229659000000
SeepArea14_081615_18	SeepArea14081615	Seep14	1169062.098060000000	3156454.952890000000	8/16/2015	0.000000000000	0.000000000000	0.340337000000	A	773.0	42.1	16-08-2015 14:15:42	0.000000000000	-0.031000000000	1.484000000000	0.229338000000
SeepArea14_081615_19	SeepArea14081615	Seep14	1169052.326930000000	3156417.919270000000	8/16/2015	0.000000000000	0.000000000000	0.266419000000	A	772.2	42.4	16-08-2015 14:18:00	-0.573000000000	-0.018000000000	1.164000000000	0.228883000000
SeepArea14_081615_20	SeepArea14081615	Seep14	1168995.499885000000	3156419.623780000000	8/16/20											

APPENDIX B - FLUX DATA

SitePt	Site	AreaAbbrev	Northing	Easting	Date	CH4flux	H2Sflux	CO2flux	ACCUMULATION CHAMBER	PRESSURE (HPa)	TEMP (C°)	TIME	CH4 Slope	H2S Slope	CO2 Slope	Ack
SeepArea14_081615_50	SeepArea14081615	Seep14	1169427.54457000000	3156556.78861000000	8/16/2015	0.00000000000	0.00000000000	0.21046400000	A	772.4	42.3	16-08-2015 15:35:40	-2.90800000000	-0.01300000000	0.91900000000	0.22901400000
SeepArea14_081615_51	SeepArea14081615	Seep14	1169481.45676000000	3156546.53881000000	8/16/2015	0.00000000000	0.00000000000	0.27313250000	A	772.4	42.1	16-08-2015 15:38:02	0.00000000000	-0.00200000000	1.18400000000	0.22916000000
SeepArea14_081615_52	SeepArea14081615	Seep14	1169461.79721000000	3156608.87680000000	8/16/2015	0.00000000000	0.00000000000	0.13531300000	A	772.7	41.8	16-08-2015 15:40:20	-2.26600000000	-0.02800000000	0.66900000000	0.22946700000
SeepArea14_081615_53	SeepArea14081615	Seep14	1169466.88771000000	3156667.99571000000	8/16/2015	0.00000000000	0.00000000000	0.09717650000	A	773.1	41.6	16-08-2015 15:42:47	-0.02500000000	-0.01900000000	0.42300000000	0.22973200000
SeepArea14_081615_54	SeepArea14081615	Seep14	1169414.94376000000	3156646.57623000000	8/16/2015	0.00000000000	0.00000000000	0.15746600000	A	773.1	41.4	16-08-2015 15:45:06	-0.02500000000	-0.02600000000	0.68500000000	0.22978700000
SeepArea14_081615_55	SeepArea14081615	Seep14	1169424.18268000000	3156607.49114000000	8/16/2015	0.00000000000	0.00000000000	0.03839410000	A	772.7	41.2	16-08-2015 15:47:18	-1.04000000000	-0.02800000000	0.16700000000	0.22990500000
SeepArea14_081615_56	SeepArea14081615	Seep14	1169384.91443000000	3156717.35934000000	8/16/2015	0.00000000000	0.00000000000	0.20219400000	A	773.5	41.0	16-08-2015 15:49:45	0.00000000000	-0.01800000000	0.87800000000	0.23029000000
SeepArea14_081615_57	SeepArea14081615	Seep14	1169348.08152000000	3156710.84819000000	8/16/2015	0.00000000000	0.00000000000	0.44943800000	A	773.5	40.9	16-08-2015 15:51:50	0.00000000000	-0.01800000000	1.95100000000	0.23036300000
SeepArea14_081615_58	SeepArea14081615	Seep14	1169312.26334000000	3156724.08718000000	8/16/2015	0.00000000000	0.00000000000	0.27318900000	A	773.6	40.7	16-08-2015 15:54:00	0.00000000000	-0.01800000000	1.18500000000	0.23054000000
SeepArea32L-1049_01	SeepArea32L-1049	Seep32-L1049	1174871.32833000000	3176355.22437000000	8/14/2015	0.00000000000	0.00000000000	0.10034500000	A	794.8	25.4	14-08-2015 08:41:43	-0.84200000000	-0.00400000000	0.40300000000	0.24899600000
SeepArea32L-1049_02	SeepArea32L-1049	Seep32-L1049	1174855.03685000000	3176434.36030000000	8/14/2015	0.00000000000	0.00000000000	1.20144400000	A	795.0	25.9	14-08-2015 08:44:56	0.00000000000	-0.00600000000	4.83200000000	0.24864200000
SeepArea32L-1049_03	SeepArea32L-1049	Seep32-L1049	1174963.27274000000	3176446.14420000000	8/14/2015	10.83750000000	0.00000000000	11.54230000000	A	794.9	26.4	14-08-2015 08:48:43	43.66500000000	-0.00800000000	46.50500000000	0.24819600000
SeepArea32L-1049_04	SeepArea32L-1049	Seep32-L1049	1174967.56145000000	3176341.75342000000	8/14/2015	6.55425000000	0.00000000000	3.45310000000	A	794.6	26.7	14-08-2015 08:51:35	26.44400000000	-0.00400000000	13.93200000000	0.24785400000
SeepArea32L-1049_05	SeepArea32L-1049	Seep32-L1049	1174958.01717000000	3176251.28970000000	8/14/2015	2.31883000000	0.00000000000	3.57419000000	A	794.6	27.0	14-08-2015 08:54:11	9.36500000000	-0.01500000000	14.43500000000	0.24766000000
SeepArea32L-1049_06	SeepArea32L-1049	Seep32-L1049	1174956.72389000000	3176158.05986000000	8/14/2015	23.15970000000	0.00000000000	13.17380000000	A	794.6	27.3	14-08-2015 08:56:46	93.62800000000	-0.00800000000	53.25800000000	0.24735900000
SeepArea32L-1049_07	SeepArea32L-1049	Seep32-L1049	1174949.66648000000	3176060.36213000000	8/14/2015	0.00000000000	0.00000000000	4.44376000000	A	794.9	27.5	14-08-2015 08:59:21	0.00000000000	-0.00200000000	17.97000000000	0.24728800000
SeepArea32L-1049_08	SeepArea32L-1049	Seep32-L1049	1174970.48721000000	3175954.71069000000	8/14/2015	0.00000000000	0.00000000000	3.40027000000	A	794.9	27.8	14-08-2015 09:02:01	-1.71200000000	-0.01000000000	13.76400000000	0.24704100000
SeepArea32L-1049_09	SeepArea32L-1049	Seep32-L1049	1174969.64870000000	3175835.57278000000	8/14/2015	0.00000000000	0.00000000000	0.77755400000	A	794.8	28.1	14-08-2015 09:04:44	0.00000000000	-0.00400000000	3.15100000000	0.24676400000
SeepArea32L-1049_10	SeepArea32L-1049	Seep32-L1049	1175050.26459000000	3175852.31996000000	8/14/2015	0.00000000000	0.00000000000	0.25342100000	A	794.8	28.4	14-08-2015 09:07:47	-0.51800000000	-0.00200000000	1.02800000000	0.24651900000
SeepArea32L-1049_100	SeepArea32L-1049	Seep32-L1049	1174163.37774000000	3177841.88359000000	8/14/2015	0.00000000000	0.00000000000	6.34551000000	A	794.5	30.4	14-08-2015 18:12:05	-4508.15000000000	-0.02000000000	25.92100000000	0.24480200000
SeepArea32L-1049_101	SeepArea32L-1049	Seep32-L1049	1174063.00642000000	3177846.14105000000	8/14/2015	0.00000000000	0.00000000000	2.06232000000	A	794.5	30.6	14-08-2015 18:14:33	-0.31700000000	-0.01100000000	8.43000000000	0.24464100000
SeepArea32L-1049_102	SeepArea32L-1049	Seep32-L1049	1174075.82831000000	3177948.54668000000	8/14/2015	30.60790000000	0.00000000000	7.13399000000	A	794.6	30.7	14-08-2015 18:17:09	125.13900000000	-0.01400000000	29.16700000000	0.24459100000
SeepArea32L-1049_103	SeepArea32L-1049	Seep32-L1049	1174055.95148000000	3178042.36760000000	8/14/2015	1.11060000000	0.00000000000	0.56373900000	A	794.8	30.8	14-08-2015 18:19:33	4.54100000000	-0.00500000000	2.30500000000	0.24475200000
SeepArea32L-1049_104	SeepArea32L-1049	Seep32-L1049	1174060.31454000000	3178147.53760000000	8/14/2015	0.00000000000	0.00000000000	12.31780000000	A	794.6	30.9	14-08-2015 18:22:16	-0.56200000000	-0.01000000000	50.39400000000	0.24443000000
SeepArea32L-1049_105	SeepArea32L-1049	Seep32-L1049	1173962.81863000000	3178145.34198000000	8/14/2015	5.78787000000	0.00000000000	5.41271000000	A	795.3	31.0	14-08-2015 18:24:33	23.66600000000	-0.00700000000	22.13200000000	0.24456500000
SeepArea32L-1049_106	SeepArea32L-1049	Seep32-L1049	1173951.41258000000	3178276.91266000000	8/14/2015	0.92331400000	0.00000000000	3.81154000000	A	795.0	31.1	14-08-2015 18:27:11	3.77800000000	0.00000000000	15.59600000000	0.24439200000
SeepArea32L-1049_107	SeepArea32L-1049	Seep32-L1049	1173965.50146000000	3178341.03262000000	8/14/2015	0.00000000000	0.00000000000	0.29216000000	A	794.9	31.2	14-08-2015 18:29:47	0.00000000000	-0.00300000000	1.19600000000	0.24428100000
SeepArea32L-1049_108	SeepArea32L-1049	Seep32-L1049	1173905.40157000000	3178355.23389000000	8/14/2015	0.00000000000	0.00000000000	0.82833000000	A	794.9	31.3	14-08-2015 18:32:07	0.00000000000	-0.00200000000	3.39200000000	0.24420100000
SeepArea32L-1049_109	SeepArea32L-1049	Seep32-L1049	1173878.94925000000	3178316.13026000000	8/14/2015	0.00000000000	0.00000000000	1.39902000000	A	795.0	31.5	14-08-2015 18:34:34	-0.37500000000	-0.02700000000	5.73200000000	0.24407100000
SeepArea32L-1049_110	SeepArea32L-1049	Seep32-L1049	1175062.77221000000	3175946.53039000000	8/14/2015	0.00000000000	0.00000000000	0.15372700000	A	793.8	28.7	14-08-2015 09:10:34	0.00000000000	-0.02000000000	0.62500000000	0.24396400000
SeepArea32L-1049_111	SeepArea32L-1049	Seep32-L1049	1173848.43696000000	3178359.84563000000	8/14/2015	0.00000000000	0.00000000000	1.54119000000	A	795.2	31.6	14-08-2015 18:37:01	0.00000000000	-0.00500000000	6.31500000000	0.24405300000
SeepArea32L-1049_112	SeepArea32L-1049	Seep32-L1049	1173799.62352000000	3178354.28765000000	8/14/2015	0.00000000000	0.00000000000	0.04990230000	A	795.5	32.5	14-08-2015 19:12:22	0.00000000000	-0.00300000000	0.20500000000	0.24342600000
SeepArea32L-1049_113	SeepArea32L-1049	Seep32-L1049	1173783.88980000000	3178253.46174000000	8/14/2015	0.00000000000	0.00000000000	3.81955000000	A	795.1	32.0	14-08-2015 19:16:23	0.00000000000	0.00000000000	15.67300000000	0.24370200000
SeepArea32L-1049_114	SeepArea32L-1049	Seep32-L1049	1173872.51094000000	3178265.69091000000	8/14/2015	0.00000000000	0.00000000000	0.83540800000	A	795.3	31.9	14-08-2015 19:18:49	0.00000000000	0.00000000000	3.42600000000	0.24384300000
SeepArea32L-1049_115	SeepArea32L-1049	Seep32-L1049	1173870.58023000000	3178161.68794000000	8/14/2015	0.00000000000	0.00000000000	8.37363000000	A	795.6	31.8	14-08-2015 19:21:20	0.00000000000	-0.02200000000	34.31600000000	0.24401500000
SeepArea32L-1049_116	SeepArea32L-1049	Seep32-L1049	1173780.96874000000	3178158.30843000000	8/14/2015	0.00000000000	0.00000000000	0.84091800000	A	795.9	31.9	14-08-2015 19:23:45	0.00000000000	-0.00100000000	3.44600000000	0.24402700000
SeepArea32L-1049_117	SeepArea32L-1049	Seep32-L1049	1173773.68671000000	3178051.17765000000	8/14/2015	0.00000000000	0.00000000000	0.50647400000	A	795.7	31.9	14-08-2015 19:26:08	0.00000000000	-0.00900000000	2.07600000000	0.24396600000
SeepArea32L-1049_118	SeepArea32L-1049	Seep32-L1049	1173871.66282000000	3178059.90678000000	8/14/2015	0.00000000000	0.00000000000	0.58683500000	A	795.5	31.9	14-08-2015 19:28:33	0.00000000000	-0.01600000000	2.40600000000	0.24390500000
SeepArea32L-1049_119	SeepArea32L-1049	Seep32-L1049	1173849.46784000000	3177983.00562000000	8/14/2015	0.00000000000	0.00000000000	2.31321000000	A	795.6	32.0	14-08-2015 19:31:04	0.00000000000	-0.00100000000	9.48600000000	0.24385500000
SeepArea32L-1049_120	SeepArea32L-1049	Seep32-L1049	1173960.85727000000	3178032.28580000000	8/14/2015	33.82170000000	0.00000000000	2.05447000000	A	795.5	32.0	14-08-2015 19:33:57	138.71300000000	-0.00100000000	8.42600000000	0.24382500000
SeepArea32L-1049_121	SeepArea32L-1049	Seep32-L1049	1175050.01912000000	3176054.05410000000	8/14/2015	0.00000000000	0.00000000000	0.81801500000	A	793.6	29.1	14-08-2015 09:14:55	0.00000000000	-0.00100000000	3.33100000000	0.24357600000
SeepArea32L-1049_122	SeepArea32L-1049	Seep32-L1049	1173967.45103000000	3177950.04717000000	8/14/2015	0.00000000000	0.00024364100	1.82414000000	A	794.9	32.0	14-08-2015 19:38:05	0.00000000000	0.00100000000	7.48700000000	0

SitePt	Site	AreaAbbrev	Northing	Easting	Date	CH4flux	H2Sflux	CO2flux	ACCUMULATION CHAMBER	PRESSURE (HPa)	TEMP (C°)	TIME	CH4 Slope	H2S Slope	CO2 Slope	Ack
SeepArea32L-1049 148	SeepArea32L-1049	Seep32-L1049	1174746.50306000000	3177048.96875000000	8/15/2015	0.00000000000	0.00358978000	1.51680000000	A	791.8	36.3	15-08-2015 10:11:55	0.00000000000	0.01500000000	6.33800000000	0.23931800000
SeepArea32L-1049 149	SeepArea32L-1049	Seep32-L1049	1174650.78303000000	3177054.75859000000	8/15/2015	21.96400000000	0.00287287000	5.59036000000	A	792.6	36.5	15-08-2015 10:14:34	91.74400000000	0.01200000000	23.35100000000	0.23940500000
SeepArea32L-1049 150	SeepArea32L-1049	Seep32-L1049	1175075.53339000000	3176341.94113000000	8/14/2015	0.00000000000	0.00000000000	0.04388420000	A	794.1	29.8	14-08-2015 09:24:42	0.00000000000	-0.00800000000	0.17900000000	0.24516300000
SeepArea32L-1049 151	SeepArea32L-1049	Seep32-L1049	1174659.97718000000	3177157.05401000000	8/15/2015	0.00000000000	0.00382753000	0.61264400000	A	792.5	36.7	15-08-2015 10:17:19	-0.00100000000	0.01600000000	2.56100000000	0.23922100000
SeepArea32L-1049 152	SeepArea32L-1049	Seep32-L1049	1174758.33709000000	3177161.23140000000	8/15/2015	0.00000000000	0.00334650900	0.63719000000	A	792.3	36.9	15-08-2015 10:19:49	0.00000000000	0.01400000000	2.66600000000	0.23900600000
SeepArea32L-1049 153	SeepArea32L-1049	Seep32-L1049	1174857.49145000000	3177162.59072000000	8/15/2015	0.18798900000	0.00310133000	0.88435700000	A	791.6	37.2	15-08-2015 10:23:50	0.78800000000	0.01300000000	3.70700000000	0.23856400000
SeepArea32L-1049 154	SeepArea32L-1049	Seep32-L1049	1174947.72082000000	3177165.65445000000	8/15/2015	0.00000000000	0.00285816000	0.51828100000	A	791.6	37.7	15-08-2015 10:28:38	0.00000000000	0.01200000000	2.17600000000	0.23818000000
SeepArea32L-1049 155	SeepArea32L-1049	Seep32-L1049	1174963.46897000000	3177249.63841000000	8/15/2015	0.00000000000	0.00214008000	1.83215000000	A	790.8	37.9	15-08-2015 10:31:30	0.00000000000	0.00900000000	7.70500000000	0.23778700000
SeepArea32L-1049 156	SeepArea32L-1049	Seep32-L1049	1174852.45286000000	3177268.45645000000	8/15/2015	0.00000000000	0.00213721000	0.21752000000	A	790.5	38.2	15-08-2015 10:34:32	0.00000000000	0.00900000000	0.91600000000	0.23746700000
SeepArea32L-1049 157	SeepArea32L-1049	Seep32-L1049	1174757.82527000000	3177259.22641000000	8/15/2015	0.00000000000	0.00285266000	1.59369000000	A	791.6	38.3	15-08-2015 10:37:16	0.00000000000	0.01200000000	6.70400000000	0.23772200000
SeepArea32L-1049 158	SeepArea32L-1049	Seep32-L1049	1174636.34254000000	3177251.56364000000	8/15/2015	0.00000000000	0.00689298000	3.00962000000	A	792.0	38.5	15-08-2015 10:39:50	0.00000000000	0.02900000000	12.66200000000	0.23768900000
SeepArea32L-1049 159	SeepArea32L-1049	Seep32-L1049	1174556.71706000000	3177352.68534000000	8/15/2015	0.00000000000	0.00712700000	0.36609000000	A	792.1	38.7	15-08-2015 10:42:37	0.00000000000	0.03000000000	1.54100000000	0.23756700000
SeepArea32L-1049 160	SeepArea32L-1049	Seep32-L1049	1174659.00477000000	3177359.42589000000	8/15/2015	0.00000000000	0.00213714000	0.16978400000	A	792.0	38.8	15-08-2015 10:45:03	0.00000000000	0.00900000000	0.71500000000	0.23746000000
SeepArea32L-1049 161	SeepArea32L-1049	Seep32-L1049	1175063.82662000000	3176429.66947000000	8/14/2015	0.00000000000	0.00000000000	4.87294000000	A	794.1	30.1	14-08-2015 09:27:20	-1.43400000000	-0.01600000000	19.89600000000	0.24492100000
SeepArea32L-1049 162	SeepArea32L-1049	Seep32-L1049	1174765.77761000000	3177353.78644000000	8/15/2015	0.00000000000	0.00545671000	1.48185000000	A	791.8	39.0	15-08-2015 10:47:38	0.00000000000	0.02300000000	6.24600000000	0.23724800000
SeepArea32L-1049 163	SeepArea32L-1049	Seep32-L1049	1174854.13816000000	3177359.28572000000	8/15/2015	0.00000000000	0.00568888000	3.07792000000	A	791.6	39.2	15-08-2015 10:50:17	0.00000000000	0.02400000000	12.98500000000	0.23703700000
SeepArea32L-1049 164	SeepArea32L-1049	Seep32-L1049	1174943.94645000000	3177353.57823000000	8/15/2015	0.00000000000	0.00402243000	0.18148300000	A	791.2	39.6	15-08-2015 10:53:20	0.00000000000	0.01700000000	0.76700000000	0.23661400000
SeepArea32L-1049 165	SeepArea32L-1049	Seep32-L1049	1174980.41650000000	3177431.53927000000	8/15/2015	0.00000000000	0.00165251000	0.61520500000	A	790.4	40.0	15-08-2015 10:56:42	0.00000000000	0.00700000000	2.60600000000	0.23607300000
SeepArea32L-1049 166	SeepArea32L-1049	Seep32-L1049	1174862.92771000000	3177434.19461000000	8/15/2015	0.00000000000	0.00353444000	0.90032000000	A	789.7	40.4	15-08-2015 11:00:36	-0.00100000000	0.01500000000	3.82200000000	0.23556300000
SeepArea32L-1049 167	SeepArea32L-1049	Seep32-L1049	1174865.37558000000	3177531.79493000000	8/15/2015	0.00000000000	0.00424522000	0.41461600000	A	790.9	40.5	15-08-2015 11:03:36	0.00000000000	0.01800000000	1.75800000000	0.23584500000
SeepArea32L-1049 168	SeepArea32L-1049	Seep32-L1049	1174794.44551000000	3177658.57119000000	8/15/2015	0.00000000000	0.00000000000	0.60728500000	A	790.1	40.8	15-08-2015 11:08:05	0.00000000000	0.00000000000	2.58000000000	0.23538200000
SeepArea32L-1049 169	SeepArea32L-1049	Seep32-L1049	1174778.83429000000	3177558.06766000000	8/15/2015	0.00000000000	0.00446200000	0.74210100000	A	790.8	41.8	15-08-2015 11:22:05	0.00000000000	0.01900000000	3.16000000000	0.23484200000
SeepArea32L-1049 170	SeepArea32L-1049	Seep32-L1049	1174751.51420000000	3177459.32673000000	8/15/2015	0.00000000000	0.00352040000	1.02279000000	A	790.8	42.0	15-08-2015 11:27:02	0.00000000000	0.01500000000	4.35800000000	0.23469300000
SeepArea32L-1049 171	SeepArea32L-1049	Seep32-L1049	1174648.63033000000	3177437.25211000000	8/15/2015	0.00000000000	0.00657806000	0.59085000000	A	791.6	42.0	15-08-2015 11:30:16	0.00000000000	0.02800000000	2.51500000000	0.23493100000
SeepArea32L-1049 172	SeepArea32L-1049	Seep32-L1049	1175034.94118000000	3176547.70023000000	8/14/2015	0.00000000000	0.00000000000	4.33165000000	A	794.8	30.3	14-08-2015 09:30:02	0.00000000000	-0.00500000000	17.68200000000	0.24497500000
SeepArea32L-1049 173	SeepArea32L-1049	Seep32-L1049	1174565.98562000000	3177454.95789000000	8/15/2015	0.00000000000	0.00000000000	0.79752000000	A	791.8	42.2	15-08-2015 11:34:13	0.00000000000	-0.00400000000	3.39600000000	0.23484100000
SeepArea32L-1049 174	SeepArea32L-1049	Seep32-L1049	1174470.96767000000	3177564.93980000000	8/15/2015	0.00000000000	0.00610778000	0.74491500000	A	792.3	42.3	15-08-2015 11:37:00	0.00000000000	0.02600000000	3.17100000000	0.23491500000
SeepArea32L-1049 175	SeepArea32L-1049	Seep32-L1049	1174573.60684000000	3177537.29772000000	8/15/2015	1.66155000000	0.00657387000	1.29130000000	A	792.1	42.4	15-08-2015 11:39:33	7.07700000000	0.02800000000	5.50000000000	0.23478100000
SeepArea32L-1049 176	SeepArea32L-1049	Seep32-L1049	1174687.29157000000	3177544.48362000000	8/15/2015	0.00000000000	0.00000000000	1.38107700000	A	792.0	42.5	15-08-2015 11:42:16	0.00000000000	-0.00500000000	5.88500000000	0.23467700000
SeepArea32L-1049 177	SeepArea32L-1049	Seep32-L1049	1174671.07235000000	3177633.06936000000	8/15/2015	0.00000000000	0.01031140000	0.67657100000	A	791.4	42.7	15-08-2015 11:47:21	0.00000000000	0.04400000000	2.88700000000	0.23435100000
SeepArea32L-1049 178	SeepArea32L-1049	Seep32-L1049	1174259.39687000000	3178138.29582000000	8/16/2015	0.00000000000	0.00000000000	0.11075700000	A	791.0	26.1	16-08-2015 09:23:49	0.00000000000	-0.01100000000	0.44800000000	0.24722600000
SeepArea32L-1049 179	SeepArea32L-1049	Seep32-L1049	1174265.17742000000	3178037.79121000000	8/16/2015	0.00000000000	0.00000000000	0.01973190000	A	791.0	26.8	16-08-2015 09:26:55	0.00000000000	-0.00200000000	0.08000000000	0.24664900000
SeepArea32L-1049 180	SeepArea32L-1049	Seep32-L1049	1174357.77477000000	3177942.58833000000	8/16/2015	0.00000000000	0.00000000000	0.00000000000	A	791.3	27.5	16-08-2015 09:29:27	0.00000000000	-0.00100000000	0.04618000000	0.24616800000
SeepArea32L-1049 181	SeepArea32L-1049	Seep32-L1049	1174377.56464000000	3177856.19297000000	8/16/2015	0.00000000000	0.00073617100	0.00000000000	A	790.9	28.3	16-08-2015 09:32:06	0.00000000000	0.00300000000	-1.37500000000	0.24539000000
SeepArea32L-1049 182	SeepArea32L-1049	Seep32-L1049	1174363.81158000000	3177751.08263000000	8/16/2015	0.00000000000	0.00000000000	0.00000000000	A	791.0	29.1	16-08-2015 09:34:43	-0.43500000000	-0.00200000000	-0.50300000000	0.24477200000
SeepArea32L-1049 183	SeepArea32L-1049	Seep32-L1049	1174953.73959000000	3176548.79811000000	8/14/2015	0.00000000000	0.00000000000	0.74429100000	A	794.6	30.5	14-08-2015 09:32:36	0.00000000000	-0.01000000000	3.04100000000	0.24475200000
SeepArea32L-1049 184	SeepArea32L-1049	Seep32-L1049	1174473.74368000000	3177751.07200000000	8/16/2015	0.00000000000	0.00000000000	0.00000000000	A	791.3	29.9	16-08-2015 09:37:17	0.00000000000	0.00000000000	-2.91800000000	0.24421800000
SeepArea32L-1049 185	SeepArea32L-1049	Seep32-L1049	1174468.02099000000	3177639.29772000000	8/16/2015	0.00000000000	0.00024356300	0.51952000000	A	791.0	30.6	16-08-2015 09:41:14	0.00000000000	0.00100000000	2.13300000000	0.24356300000
SeepArea32L-1049 186	SeepArea32L-1049	Seep32-L1049	1174580.19434000000	3177648.21319000000	8/16/2015	0.00000000000	0.00000000000	0.26332900000	A	791.0	31.4	16-08-2015 09:42:50	0.00000000000	0.00000000000	1.08400000000	0.24429300000
SeepArea32L-1049 187	SeepArea32L-1049	Seep32-L1049	1174577.65914000000	3177765.82975000000	8/16/2015	0.00000000000	0.00000000000	0.26873600000	A	790.6	32.0	16-08-2015 09:45:18	0.00000000000	-0.00100000000	1.10900000000	0.24232300000
SeepArea32L-1049 188	SeepArea32L-1049	Seep32-L1049	1174659.24676000000	3177755.31417000000	8/16/2015	0.00000000000	0.00000000000	0.09111210000	A	790.3	32.7	16-08-2015 09:48:39	0.00000000000	-0.00300000000	0.73700000000	0.24167700000
SeepArea32L-1049 189	SeepArea32L-1049	Seep32-L1049	1174570.82882000000	3177845.96265000000	8/16/2015	0.00000000000	0.00000000000	0.04751710000	A	790.3	33.3	16-08-2015 09:51:32	0.00000000000	0.0000		

SitePt	Site	AreaAbbrev	Northing	Easting	Date	CH4flux	H2Sflux	CO2flux	ACCUMULATION CHAMBER	PRESSURE (HPa)	TEMP (C°)	TIME	CH4 Slope	H2S Slope	CO2 Slope	Ack
SeepArea32L-1049 212	SeepArea32L-1049	Seep32-L1049	1173761.961480000000	3177645.582730000000	8/16/2015	0.000000000000	0.000000000000	0.265827000000	A	792.5	41.1	16-08-2015 11:10:30	-0.514000000000	-0.034000000000	1.127000000000	0.235871000000
SeepArea32L-1049 213	SeepArea32L-1049	Seep32-L1049	1173860.770530000000	3177554.868100000000	8/16/2015	0.000000000000	0.000000000000	0.099786100000	A	792.6	41.1	16-08-2015 11:13:05	0.000000000000	-0.039000000000	0.423590100000	0.235901000000
SeepArea32L-1049 214	SeepArea32L-1049	Seep32-L1049	1174044.277190000000	3177148.393270000000	8/16/2015	0.000000000000	0.000000000000	0.528118000000	A	792.3	41.3	16-08-2015 11:16:53	0.000000000000	-0.062000000000	2.241000000000	0.235662000000
SeepArea32L-1049 215	SeepArea32L-1049	Seep32-L1049	1174043.564960000000	3177061.387890000000	8/16/2015	0.000000000000	0.000000000000	0.418532000000	A	792.1	41.4	16-08-2015 11:19:14	0.000000000000	-0.017000000000	1.777000000000	0.235527000000
SeepArea32L-1049 216	SeepArea32L-1049	Seep32-L1049	1174045.375660000000	3176956.216940000000	8/16/2015	0.000000000000	0.000000000000	0.181826000000	A	792.6	41.6	16-08-2015 11:21:37	0.000000000000	-0.010000000000	0.772000000000	0.235526000000
SeepArea32L-1049 217	SeepArea32L-1049	Seep32-L1049	1174148.504530000000	3176949.717410000000	8/16/2015	0.000000000000	0.000000000000	0.195166000000	A	791.8	41.8	16-08-2015 11:23:55	0.000000000000	-0.043000000000	0.830000000000	0.235139000000
SeepArea32L-1049 218	SeepArea32L-1049	Seep32-L1049	1174152.734900000000	3177054.920610000000	8/16/2015	0.000000000000	0.000000000000	0.162561000000	A	791.8	42.1	16-08-2015 11:26:12	0.000000000000	-0.034000000000	0.692000000000	0.234915000000
SeepArea32L-1049 219	SeepArea32L-1049	Seep32-L1049	1174169.823350000000	3177143.341880000000	8/16/2015	0.000000000000	0.000000000000	0.224202000000	A	791.8	42.3	16-08-2015 11:28:28	-1.205000000000	-0.021000000000	0.955000000000	0.234766000000
SeepArea32L-1049 220	SeepArea32L-1049	Seep32-L1049	1174253.790820000000	3177150.642170000000	8/16/2015	0.000000000000	0.000000000000	0.278691000000	A	791.7	42.5	16-08-2015 11:30:53	0.000000000000	-0.018000000000	1.188000000000	0.234588000000
SeepArea32L-1049 221	SeepArea32L-1049	Seep32-L1049	1174257.775160000000	3177042.181880000000	8/16/2015	0.000000000000	0.000000000000	0.857543000000	A	791.7	42.8	16-08-2015 11:33:20	0.000000000000	-0.043000000000	3.659000000000	0.234365000000
SeepArea32L-1049 222	SeepArea32L-1049	Seep32-L1049	1174358.162140000000	3177046.959490000000	8/16/2015	0.000000000000	0.000000000000	0.403169000000	A	791.4	43.0	16-08-2015 11:35:51	0.000000000000	-0.017000000000	1.722000000000	0.234128000000
SeepArea32L-1049 223	SeepArea32L-1049	Seep32-L1049	1174245.954730000000	3176942.825970000000	8/16/2015	0.000000000000	0.000000000000	0.255256000000	A	791.6	43.3	16-08-2015 11:38:26	-0.557000000000	-0.043000000000	1.091000000000	0.233965000000
SeepArea32L-1049 224	SeepArea32L-1049	Seep32-L1049	1174349.520500000000	3176938.781750000000	8/16/2015	0.000000000000	0.000000000000	0.532502000000	A	791.4	43.5	16-08-2015 11:41:08	0.000000000000	-0.054000000000	2.278000000000	0.233759000000
SeepArea32L-1049 225	SeepArea32L-1049	Seep32-L1049	1174341.962190000000	3176846.875190000000	8/16/2015	0.000000000000	0.000000000000	0.141568000000	A	791.4	43.7	16-08-2015 11:43:26	0.000000000000	-0.034000000000	0.606000000000	0.233611000000
SeepArea32L-1049 226	SeepArea32L-1049	Seep32-L1049	1174350.161030000000	3176754.992660000000	8/16/2015	0.000000000000	0.000000000000	0.104078000000	A	791.4	43.9	16-08-2015 11:45:51	-0.085000000000	-0.046000000000	0.600000000000	0.233644000000
SeepArea32L-1049 227	SeepArea32L-1049	Seep32-L1049	1174438.865680000000	3176852.680520000000	8/16/2015	0.000000000000	0.000000000000	0.463688000000	A	791.3	44.0	16-08-2015 11:48:22	-2.343000000000	-0.017000000000	1.987000000000	0.233361000000
SeepArea32L-1049 228	SeepArea32L-1049	Seep32-L1049	1174455.147920000000	3176762.639200000000	8/16/2015	0.000000000000	0.000000000000	0.374568000000	A	791.6	44.1	16-08-2015 11:50:39	0.000000000000	0.000000000000	1.605000000000	0.233376000000
SeepArea32L-1049 229	SeepArea32L-1049	Seep32-L1049	1174549.601370000000	3176525.928490000000	8/16/2015	0.000000000000	0.000000000000	0.266212000000	A	791.2	44.3	16-08-2015 11:53:38	0.000000000000	-0.076000000000	1.142000000000	0.233111000000
SeepArea32L-1049 230	SeepArea32L-1049	Seep32-L1049	1174860.828890000000	3176060.169780000000	8/14/2015	0.000000000000	0.000000000000	0.231351000000	A	795.2	32.9	14-08-2015 09:48:23	0.000000000000	-0.008000000000	0.952000000000	0.234016000000
SeepArea32L-1049 230	SeepArea32L-1049	Seep32-L1049	1174546.924410000000	3176451.294710000000	8/16/2015	0.000000000000	0.000000000000	0.215080000000	A	790.9	44.3	16-08-2015 11:55:51	0.000000000000	-0.013000000000	0.923000000000	0.233022000000
SeepArea32L-1049 231	SeepArea32L-1049	Seep32-L1049	1174554.790990000000	3176355.761220000000	8/16/2015	0.000000000000	0.000000000000	0.604618000000	A	791.3	44.5	16-08-2015 11:58:12	0.000000000000	-0.054000000000	2.595000000000	0.232993000000
SeepArea32L-1049 232	SeepArea32L-1049	Seep32-L1049	1174556.520330000000	3176252.613550000000	8/16/2015	0.000000000000	0.000000000000	0.389013000000	A	790.9	44.6	16-08-2015 12:00:28	0.000000000000	-0.025000000000	1.671000000000	0.232802000000
SeepArea32L-1049 233	SeepArea32L-1049	Seep32-L1049	1174468.603530000000	3176260.569480000000	8/16/2015	0.000000000000	0.000000000000	0.241370000000	A	791.0	44.7	16-08-2015 12:02:41	0.000000000000	0.000000000000	1.037000000000	0.232758000000
SeepArea32L-1049 234	SeepArea32L-1049	Seep32-L1049	1174439.469950000000	3176357.406690000000	8/16/2015	0.000000000000	0.000000000000	0.169628000000	A	791.0	44.8	16-08-2015 12:04:58	0.000000000000	-0.042000000000	0.729000000000	0.232685000000
SeepArea32L-1049 235	SeepArea32L-1049	Seep32-L1049	1174337.119980000000	3176345.283820000000	8/16/2015	0.000000000000	0.000000000000	0.384372000000	A	791.2	44.9	16-08-2015 12:07:09	0.000000000000	-0.025000000000	1.652000000000	0.232671000000
SeepArea32L-1049 236	SeepArea32L-1049	Seep32-L1049	1174338.125580000000	3176260.904240000000	8/16/2015	0.000000000000	0.000000000000	0.501248000000	A	791.2	45.0	16-08-2015 12:09:24	0.000000000000	-0.032000000000	2.155000000000	0.232598000000
SeepArea32L-1049 237	SeepArea32L-1049	Seep32-L1049	1174347.327930000000	3176161.537220000000	8/16/2015	0.000000000000	0.000000000000	0.161888000000	A	791.2	45.0	16-08-2015 12:11:35	0.000000000000	-0.028000000000	0.696000000000	0.232598000000
SeepArea32L-1049 238	SeepArea32L-1049	Seep32-L1049	1174451.593550000000	3176147.571580000000	8/16/2015	0.000000000000	0.000000000000	0.139058000000	A	791.0	45.0	16-08-2015 12:13:46	0.000000000000	-0.018000000000	0.598000000000	0.232539000000
SeepArea32L-1049 239	SeepArea32L-1049	Seep32-L1049	1174541.917080000000	3176149.681730000000	8/16/2015	0.000000000000	0.000000000000	0.386736000000	A	790.8	44.9	16-08-2015 12:16:03	-0.600000000000	-0.038000000000	1.663000000000	0.232553000000
SeepArea32L-1049 240	SeepArea32L-1049	Seep32-L1049	1174835.988840000000	3175939.048720000000	8/14/2015	0.000000000000	0.000000000000	0.447391000000	A	795.2	33.4	14-08-2015 09:51:00	0.000000000000	-0.010000000000	1.844000000000	0.242620000000
SeepArea32L-1049 241	SeepArea32L-1049	Seep32-L1049	1174859.707700000000	3175826.507900000000	8/14/2015	0.000000000000	0.000000000000	0.168180000000	A	795.3	33.8	14-08-2015 09:53:25	0.000000000000	-0.005000000000	0.694000000000	0.242634000000
SeepArea32L-1049 242	SeepArea32L-1049	Seep32-L1049	1174864.247170000000	3176649.090490000000	8/14/2015	0.000000000000	0.000000000000	0.880991000000	A	795.5	34.6	14-08-2015 09:59:21	0.000000000000	-0.002000000000	3.644000000000	0.241765000000
SeepArea32L-1049 243	SeepArea32L-1049	Seep32-L1049	1174972.648120000000	3176664.174000000000	8/14/2015	0.000000000000	0.000241395000	0.288226000000	A	794.8	34.8	14-08-2015 10:02:03	0.000000000000	0.001000000000	1.194000000000	0.241395000000
SeepArea32L-1049 244	SeepArea32L-1049	Seep32-L1049	1175050.311100000000	3176646.923570000000	8/14/2015	0.000000000000	0.000000000000	2.645220000000	A	794.7	34.9	14-08-2015 10:04:47	-0.218000000000	-0.013000000000	10.963000000000	0.241287000000
SeepArea32L-1049 245	SeepArea32L-1049	Seep32-L1049	1175146.216500000000	3176650.997280000000	8/14/2015	0.000000000000	0.000000000000	4.999750000000	A	794.2	35.0	14-08-2015 10:07:19	0.000000000000	-0.014000000000	20.741000000000	0.241056000000
SeepArea32L-1049 246	SeepArea32L-1049	Seep32-L1049	1175152.719230000000	3176557.035680000000	8/14/2015	4.498010000000	0.000000000000	0.613486000000	A	794.4	35.2	14-08-2015 10:09:43	18.667000000000	-0.003000000000	2.546000000000	0.240961000000
SeepArea32L-1049 247	SeepArea32L-1049	Seep32-L1049	1175166.502060000000	3176452.969740000000	8/14/2015	0.000000000000	0.000000000000	1.223370000000	A	794.4	35.5	14-08-2015 10:12:29	-0.545000000000	-0.011000000000	5.082000000000	0.240727000000
SeepArea32L-1049 248	SeepArea32L-1049	Seep32-L1049	1175268.300440000000	3176453.057140000000	8/14/2015	0.000000000000	0.000000000000	0.724234000000	A	794.0	35.7	14-08-2015 10:15:13	-3.007000000000	0.000000000000	3.012000000000	0.240450000000
SeepArea32L-1049 249	SeepArea32L-1049	Seep32-L1049	1175255.666950000000	3176558.550370000000	8/14/2015	0.000000000000	0.000000000000	2.883950000000	A	794.1	36.1	14-08-2015 10:17:57	-1.698000000000	-0.027000000000	12.008000000000	0.240169000000
SeepArea32L-1049 250	SeepArea32L-1049	Seep32-L1049	1175261.675960000000	3176642.358190000000	8/14/2015	12.759800000000	0.000000000000	12.870200000000	A	794.1	36.3	14-08-2015 10:20:21	53.163000000000	-0.022000000000	53.623000000000	0.240014000000
SeepArea32L-1049 251	SeepArea32L-1049	Seep32-L1049	1175364.446510000000	3176659.199720000000	8/14/2015	200.433000000000	0.000000000000	3.864280000000								

APPENDIX B - FLUX DATA

SitePt	Site	AreaAbbrev	Northing	Easting	Date	CH4flux	H2Sflux	CO2flux	ACCUMULATION CHAMBER	PRESSURE (HPa)	TEMP (C°)	TIME	CH4 Slope	H2S Slope	CO2 Slope	Ack
SeepArea32L-1049_65	SeepArea32L-1049	Seep32-L1049	1174547.552840000000	3177238.667040000000	8/14/2015	0.000000000000	0.000000000000	0.567028000000	A	794.9	41.4	14-08-2015 12:11:37	-1.225000000000	-0.030000000000	2.399000000000	0.236360000000
SeepArea32L-1049_66	SeepArea32L-1049	Seep32-L1049	1174469.973740000000	3177251.575060000000	8/14/2015	0.000000000000	0.000000000000	3.534060000000	A	795.1	41.5	14-08-2015 12:14:26	0.000000000000	-0.025000000000	14.953000000000	0.236344000000
SeepArea32L-1049_67	SeepArea32L-1049	Seep32-L1049	1174432.665430000000	3177359.319450000000	8/14/2015	0.000000000000	0.000000000000	0.577533000000	A	794.9	41.6	14-08-2015 12:16:49	0.000000000000	-0.008000000000	2.445000000000	0.236210000000
SeepArea32L-1049_68	SeepArea32L-1049	Seep32-L1049	1174387.928530000000	3177455.800790000000	8/14/2015	0.000000000000	0.000000000000	0.639694000000	A	795.2	41.7	14-08-2015 12:19:22	-2.607000000000	-0.022000000000	2.708000000000	0.236224000000
SeepArea32L-1049_69	SeepArea32L-1049	Seep32-L1049	1174460.599140000000	3177449.171030000000	8/14/2015	0.866103000000	0.000000000000	3.762320000000	A	794.9	41.8	14-08-2015 12:22:05	3.669000000000	-0.041000000000	15.938000000000	0.236060000000
SeepArea32L-1049_70	SeepArea32L-1049	Seep32-L1049	1174340.917310000000	3177553.504650000000	8/14/2015	0.000000000000	0.000000000000	1.846810000000	A	795.1	41.9	14-08-2015 12:25:03	0.000000000000	-0.047000000000	7.824000000000	0.236044000000
SeepArea32L-1049_71	SeepArea32L-1049	Seep32-L1049	1174377.230040000000	3177645.972380000000	8/14/2015	0.000000000000	0.000000000000	2.137170000000	A	795.1	42.0	14-08-2015 12:27:50	0.000000000000	-0.002000000000	9.057000000000	0.235969000000
SeepArea32L-1049_72	SeepArea32L-1049	Seep32-L1049	1174269.903560000000	3177733.465770000000	8/14/2015	0.000000000000	0.000000000000	1.146050000000	A	794.9	42.0	14-08-2015 12:30:43	0.000000000000	-0.001000000000	4.858000000000	0.235910000000
SeepArea32L-1049_73	SeepArea32L-1049	Seep32-L1049	1174257.401060000000	3177844.841340000000	8/14/2015	0.000000000000	0.000000000000	0.328754000000	A	794.9	42.1	14-08-2015 12:33:43	0.000000000000	-0.032000000000	1.394000000000	0.235835000000
SeepArea32L-1049_74	SeepArea32L-1049	Seep32-L1049	1174245.561780000000	3177948.650290000000	8/14/2015	0.000000000000	0.000000000000	0.464919000000	A	794.9	42.2	14-08-2015 12:36:51	-2.056000000000	-0.034000000000	1.972000000000	0.235760000000
SeepArea32L-1049_75	SeepArea32L-1049	Seep32-L1049	1174172.283590000000	3177951.280390000000	8/14/2015	0.000000000000	0.000000000000	0.368584000000	A	795.1	42.0	14-08-2015 12:40:56	0.000000000000	-0.030000000000	1.562000000000	0.235969000000
SeepArea32L-1049_76	SeepArea32L-1049	Seep32-L1049	1174168.982700000000	3178072.388490000000	8/14/2015	0.000000000000	0.000000000000	0.575602000000	A	795.2	42.0	14-08-2015 12:44:05	0.000000000000	-0.051000000000	2.439000000000	0.235999000000
SeepArea32L-1049_77	SeepArea32L-1049	Seep32-L1049	1174148.403520000000	3178159.958800000000	8/14/2015	0.000000000000	0.000000000000	2.698160000000	A	795.1	42.1	14-08-2015 12:46:50	0.000000000000	-0.033000000000	11.438000000000	0.235894000000
SeepArea32L-1049_78	SeepArea32L-1049	Seep32-L1049	1174029.248040000000	3178285.669100000000	8/14/2015	0.000000000000	0.000000000000	0.876500000000	A	795.1	42.3	14-08-2015 12:50:13	0.000000000000	-0.007000000000	3.718000000000	0.235745000000
SeepArea32L-1049_79	SeepArea32L-1049	Seep32-L1049	1174047.863270000000	3178359.670860000000	8/14/2015	0.000000000000	0.000000000000	0.615608000000	A	795.4	42.5	14-08-2015 12:53:16	0.000000000000	-0.032000000000	2.612000000000	0.235684000000
SeepArea32L-1049_80	SeepArea32L-1049	Seep32-L1049	1174648.579480000000	3176334.071800000000	8/14/2015	0.000000000000	0.000000000000	0.228110000000	A	794.5	25.9	14-08-2015 17:21:02	0.000000000000	-0.029000000000	0.918000000000	0.248486000000
SeepArea32L-1049_81	SeepArea32L-1049	Seep32-L1049	1174651.412210000000	3176442.870990000000	8/14/2015	0.000000000000	0.000000000000	0.000000000000	A	794.1	26.5	14-08-2015 17:23:28	0.000000000000	-0.007000000000	-0.686000000000	0.247863000000
SeepArea32L-1049_82	SeepArea32L-1049	Seep32-L1049	1174636.752650000000	3176573.418300000000	8/14/2015	0.000000000000	0.000000000000	1.191120000000	A	793.8	27.1	14-08-2015 17:26:08	0.000000000000	-0.006000000000	4.817000000000	0.247274000000
SeepArea32L-1049_83	SeepArea32L-1049	Seep32-L1049	1174646.486020000000	3176659.358910000000	8/14/2015	0.000000000000	0.000000000000	0.699261000000	A	793.7	27.5	14-08-2015 17:28:26	-1.299000000000	-0.012000000000	2.832000000000	0.246914000000
SeepArea32L-1049_84	SeepArea32L-1049	Seep32-L1049	1174544.313370000000	3176643.503140000000	8/14/2015	0.000000000000	0.000000000000	0.253769000000	A	793.8	27.9	14-08-2015 17:30:57	0.000000000000	-0.017000000000	1.029000000000	0.246617000000
SeepArea32L-1049_85	SeepArea32L-1049	Seep32-L1049	1174538.471950000000	3176757.169710000000	8/14/2015	0.000000000000	0.000000000000	0.167575000000	A	794.0	28.2	14-08-2015 17:33:21	0.000000000000	-0.003000000000	0.688000000000	0.246434000000
SeepArea32L-1049_86	SeepArea32L-1049	Seep32-L1049	1174551.702410000000	3176850.490990000000	8/14/2015	0.000000000000	0.000000000000	0.257353000000	A	794.0	28.4	14-08-2015 17:35:45	0.000000000000	-0.005000000000	1.045000000000	0.246270000000
SeepArea32L-1049_87	SeepArea32L-1049	Seep32-L1049	1174551.671110000000	3176958.836270000000	8/14/2015	0.000000000000	0.000000000000	6.123150000000	A	794.0	28.6	14-08-2015 17:38:12	0.000000000000	-0.005000000000	24.880000000000	0.246107000000
SeepArea32L-1049_88	SeepArea32L-1049	Seep32-L1049	1174456.033230000000	3176939.042380000000	8/14/2015	0.000000000000	0.000000000000	0.140944000000	A	794.1	28.8	14-08-2015 17:40:39	0.000000000000	-0.014000000000	0.573000000000	0.245975000000
SeepArea32L-1049_89	SeepArea32L-1049	Seep32-L1049	1174447.829280000000	3177052.510460000000	8/14/2015	0.000000000000	0.000000000000	0.174035000000	A	794.1	29.0	14-08-2015 17:43:07	0.000000000000	-0.001000000000	0.708000000000	0.245812000000
SeepArea32L-1049_90	SeepArea32L-1049	Seep32-L1049	1174453.396710000000	3177163.921410000000	8/14/2015	0.000000000000	0.000000000000	0.206414000000	A	794.1	29.1	14-08-2015 17:45:31	0.000000000000	-0.007000000000	0.840000000000	0.245731000000
SeepArea32L-1049_91	SeepArea32L-1049	Seep32-L1049	1174340.537270000000	3177157.151210000000	8/14/2015	0.000000000000	0.000000000000	0.319891000000	A	794.5	29.3	14-08-2015 17:47:59	0.000000000000	-0.007000000000	1.302000000000	0.245692000000
SeepArea32L-1049_92	SeepArea32L-1049	Seep32-L1049	1174349.308890000000	3177240.821430000000	8/14/2015	0.000000000000	0.000000000000	0.280207000000	A	794.4	29.4	14-08-2015 17:50:24	0.000000000000	-0.010000000000	1.141000000000	0.245580000000
SeepArea32L-1049_93	SeepArea32L-1049	Seep32-L1049	1174359.403730000000	3177345.261680000000	8/14/2015	0.000000000000	0.000000000000	0.107283000000	A	794.4	29.5	14-08-2015 17:52:53	0.000000000000	-0.018000000000	0.437000000000	0.245499000000
SeepArea32L-1049_94	SeepArea32L-1049	Seep32-L1049	1174238.684250000000	3177346.141460000000	8/14/2015	0.000000000000	0.000000000000	0.271274000000	A	794.2	29.7	14-08-2015 17:55:25	-0.396000000000	-0.011000000000	1.106000000000	0.245275000000
SeepArea32L-1049_95	SeepArea32L-1049	Seep32-L1049	1174253.770460000000	3177441.564000000000	8/14/2015	0.000000000000	0.000000000000	0.372720000000	A	795.3	29.8	14-08-2015 17:57:50	0.000000000000	-0.002000000000	1.518000000000	0.245534000000
SeepArea32L-1049_96	SeepArea32L-1049	Seep32-L1049	1174247.419800000000	3177541.577470000000	8/14/2015	0.000000000000	0.000000000000	0.247658000000	A	794.5	29.9	14-08-2015 18:00:25	0.000000000000	-0.005000000000	1.010000000000	0.245206000000
SeepArea32L-1049_97	SeepArea32L-1049	Seep32-L1049	1174248.356310000000	3177645.005100000000	8/14/2015	0.666656000000	0.000000000000	4.290130000000	A	794.4	30.0	14-08-2015 18:02:55	2.720000000000	-0.021000000000	17.504000000000	0.245094000000
SeepArea32L-1049_98	SeepArea32L-1049	Seep32-L1049	1174132.221030000000	3177653.756980000000	8/14/2015	0.000000000000	0.000000000000	3.650960000000	A	794.4	30.2	14-08-2015 18:06:06	-0.050000000000	-0.011000000000	14.906000000000	0.244932000000
SeepArea32L-1049_99	SeepArea32L-1049	Seep32-L1049	1174150.949780000000	3177749.073300000000	8/14/2015	0.000000000000	0.000000000000	5.151350000000	A	794.5	30.3	14-08-2015 18:08:31	-0.144000000000	-0.002000000000	21.036000000000	0.244883000000
SeepAreal-1021_01	SeepAreal-1021	Seep32-L1021	1173977.350660000000	3178566.939180000000	8/14/2015	0.000000000000	0.000000000000	0.176080000000	A	795.2	42.8	14-08-2015 12:57:41	0.000000000000	-0.047000000000	0.748000000000	0.235401000000
SeepAreal-1021_02	SeepAreal-1021	Seep32-L1021	1174004.289490000000	3178560.477990000000	8/14/2015	0.000000000000	0.000000000000	0.334185000000	A	795.5	43.0	14-08-2015 13:00:58	0.000000000000	-0.045000000000	1.420000000000	0.235341000000
SeepAreal-1021_03	SeepAreal-1021	Seep32-L1021	1173966.806290000000	3178620.460460000000	8/14/2015	0.000000000000	0.000000000000	0.434483000000	A	795.4	43.1	14-08-2015 13:03:48	-0.124000000000	-0.038000000000	1.847000000000	0.235237000000
SeepAreal-1021_04	SeepAreal-1021	Seep32-L1021	1173954.759750000000	3178673.825010000000	8/14/2015	0.000000000000	0.000000000000	0.216600000000	A	795.6	43.3	14-08-2015 13:06:09	-0.124000000000	-0.016000000000	3.214000000000	0.235148000000
SeepAreal-1021_05	SeepAreal-1021	Seep32-L1021	1173902.329730000000	3178716.389720000000	8/14/2015	0.000000000000	0.000000000000	1.412720000000	A	795.6	43.5	14-08-2015 13:09:53	-0.075000000000	-0.054000000000	17.501000000000	0.234999000000
SeepAreal-1021_06	SeepAreal-1021	Seep32-L1021	1173885.013140000000	3178777.071090000000	8/14/2015	0.000000000000	0.000000000000	0.363451000000	A	795.9	43.7	14-08-2015 13:12:58	0.000000000000			

SitePt	Site	AreaAbbrev	Northing	Easting	Date	CH4flux	H2Sflux	CO2flux	ACCUMULATION CHAMBER	PRESSURE (HPa)	TEMP (C°)	TIME	CH4 Slope	H2S Slope	CO2 Slope	Ack
SeepArea1-1030 02	SeepArea1-1030	Seep32-L1030	1146261.41784000000	3164662.92330000000	8/13/2015	0.00000000000	0.00000000000	0.00000000000	A	783.9	30.1	13-08-2015 15:36:47	0.00000000000	-0.03400000000	-7.28800000000	0.24117750000
SeepArea1-1030 03	SeepArea1-1030	Seep32-L1030	1146200.78876000000	3164670.95218000000	8/13/2015	0.00000000000	0.00000000000	0.36149300000	A	783.7	30.8	13-08-2015 15:39:13	0.00000000000	-0.03300000000	1.49900000000	0.24115600000
SeepArea1-1030 04	SeepArea1-1030	Seep32-L1030	1146214.88123000000	3164706.85204000000	8/13/2015	0.00000000000	0.00000000000	3.46746000000	A	783.5	31.6	13-08-2015 15:42:06	0.00000000000	-0.02400000000	14.42000000000	0.24046200000
SeepArea1-1030 05	SeepArea1-1030	Seep32-L1030	1146210.14563000000	3164779.98425000000	8/13/2015	0.00000000000	0.00000000000	0.30904500000	A	783.6	32.3	13-08-2015 15:44:28	-0.43400000000	-0.09900000000	1.28990420000	0.23994200000
SeepArea1-1030 06	SeepArea1-1030	Seep32-L1030	1146203.26074000000	3164822.33745000000	8/13/2015	0.00000000000	0.00000000000	0.38454200000	A	783.5	32.9	13-08-2015 15:46:46	-0.18600000000	-0.02400000000	1.60600000000	0.23944100000
SeepArea1-1030 07	SeepArea1-1030	Seep32-L1030	1146098.49708000000	3164857.70639000000	8/13/2015	0.00000000000	0.00000000000	1.20689000000	A	783.3	33.4	13-08-2015 15:49:30	0.00000000000	-0.02000000000	5.05000000000	0.23898900000
SeepArea1-1030 08	SeepArea1-1030	Seep32-L1030	1146256.86023000000	3164717.82037000000	8/13/2015	0.00000000000	0.00000000000	0.15216600000	A	783.5	34.1	13-08-2015 15:52:35	0.00000000000	-0.06400000000	0.63800000000	0.23850500000
SeepArea1-1030 09	SeepArea1-1030	Seep32-L1030	1146254.89900000000	3164756.63090000000	8/13/2015	53.43410000000	0.02216060000	2.82679000000	A	783.8	34.5	13-08-2015 15:55:20	224.24300000000	0.09300000000	11.86300000000	0.23828700000
SeepArea1-1030 10	SeepArea1-1030	Seep32-L1030	1146264.20679000000	3164819.13774000000	8/13/2015	0.00000000000	0.00000000000	0.09809660000	A	784.2	34.9	13-08-2015 15:57:47	-2.09700000000	-0.03200000000	0.41200000000	0.23809900000
SeepArea1-1030 11	SeepArea1-1030	Seep32-L1030	1146308.36387000000	3164806.55743000000	8/13/2015	0.00000000000	0.00000000000	0.33318800000	A	784.0	35.4	13-08-2015 16:00:34	0.00000000000	-0.03500000000	1.40200000000	0.23765200000
SeepArea1-1030 12	SeepArea1-1030	Seep32-L1030	1146363.46438000000	3164819.55199000000	8/13/2015	0.00000000000	0.00000000000	0.49823700000	A	784.2	35.7	13-08-2015 16:03:12	0.00000000000	-0.03100000000	2.09800000000	0.23748200000
SeepArea1-1030 13	SeepArea1-1030	Seep32-L1030	1146354.64029000000	3164761.78487000000	8/13/2015	0.00000000000	0.00000000000	0.99518500000	A	784.2	36.1	13-08-2015 16:06:02	0.00000000000	-0.01800000000	4.19600000000	0.23717500000
SeepArea1-1030 14	SeepArea1-1030	Seep32-L1030	1146306.88491000000	3164769.50499000000	8/13/2015	0.00000000000	0.00000000000	0.19375800000	A	784.2	36.5	13-08-2015 16:09:05	-0.59400000000	-0.02600000000	0.81800000000	0.23686800000
SeepArea1-1030 15	SeepArea1-1030	Seep32-L1030	1146279.79185000000	3164752.20131000000	8/13/2015	0.00000000000	0.00000000000	0.07084690000	A	780.0	36.8	13-08-2015 16:11:23	-3.14600000000	-0.03500000000	3.01000000000	0.02353720000
SeepArea1-1030 16	SeepArea1-1030	Seep32-L1030	1146314.48675000000	3164725.97025000000	8/13/2015	2.23181000000	0.00000000000	0.17466000000	A	783.9	37.0	13-08-2015 16:13:40	9.44100000000	-0.03300000000	0.73800000000	0.23639600000
SeepArea1-1030 17	SeepArea1-1030	Seep32-L1030	1146358.81357000000	3164715.51990000000	8/13/2015	0.00000000000	0.00000000000	0.89106700000	A	783.9	37.3	13-08-2015 16:16:25	-1.85900000000	-0.01800000000	3.77300000000	0.23616700000
SeepArea1-1030 18	SeepArea1-1030	Seep32-L1030	1146354.09076000000	3164662.36174000000	8/13/2015	0.00000000000	0.00000000000	0.04601710000	A	783.8	37.5	13-08-2015 16:18:58	-1.47200000000	-0.03100000000	0.19500000000	0.23598500000
SeepArea5 081715 01	SeepArea5-081715	Seep5	1172623.39553000000	3176610.88879000000	8/17/2015	0.00000000000	0.00000000000	0.24743300000	A	786.1	23.7	17-08-2015 08:00:09	0.00000000000	-0.00100000000	0.99900000000	0.24768100000
SeepArea5 081715 02	SeepArea5-081715	Seep5	1172668.62311000000	3176598.74966000000	8/17/2015	0.00000000000	0.00098839100	0.63088000000	A	786.1	24.4	17-08-2015 08:03:21	-1.89700000000	0.00400000000	24.43600000000	0.24709800000
SeepArea5 081715 03	SeepArea5-081715	Seep5	1172661.05466000000	3176553.85967000000	8/17/2015	0.00000000000	0.00098607200	1.27524000000	A	786.1	25.1	17-08-2015 08:06:16	0.00000000000	0.00400000000	5.17300000000	0.24651800000
SeepArea5 081715 04	SeepArea5-081715	Seep5	1172653.03355000000	3176507.27132000000	8/17/2015	0.00000000000	0.00077380690	0.33655900000	A	786.1	25.7	17-08-2015 08:09:00	-0.00100000000	0.00300000000	1.36800000000	0.24602300000
SeepArea5 081715 05	SeepArea5-081715	Seep5	1172699.67137000000	3176577.47787000000	8/17/2015	0.00000000000	0.00073609800	0.60531800000	A	786.1	26.5	17-08-2015 08:12:24	0.00000000000	0.00300000000	2.46700000000	0.24536600000
SeepArea5 081715 06	SeepArea5-081715	Seep5	1172704.92158000000	3176601.16152000000	8/17/2015	0.00000000000	0.00024479400	0.45654100000	A	786.1	27.2	17-08-2015 08:14:51	0.00000000000	0.00100000000	1.86500000000	0.24479400000
SeepArea5 081715 07	SeepArea5-081715	Seep5	1172758.18381000000	3176596.34153000000	8/17/2015	0.00000000000	0.00073261800	0.12723100000	A	786.3	28.0	17-08-2015 08:18:27	0.00000000000	0.00300000000	0.52100000000	0.24420600000
SeepArea5 081715 08	SeepArea5-081715	Seep5	1172751.47620000000	3176558.32685000000	8/17/2015	0.00000000000	0.00048772700	1.15152000000	A	786.5	28.5	17-08-2015 08:21:01	0.00000000000	0.00200000000	4.72200000000	0.24386300000
SeepArea5 081715 09	SeepArea5-081715	Seep5	1172716.53648000000	3176505.04909000000	8/17/2015	0.00000000000	0.00097371500	0.52458900000	A	786.4	29.0	17-08-2015 08:23:55	0.00000000000	0.00400000000	2.15500000000	0.24342900000
SeepArea5 081715 10	SeepArea5-081715	Seep5	1172753.48640000000	3176492.45250000000	8/17/2015	0.00000000000	0.00097198300	0.32585700000	A	786.3	29.5	17-08-2015 08:26:56	0.00000000000	0.00400000000	1.34100000000	0.24299600000
SeepArea5 081715 11	SeepArea5-081715	Seep5	1172749.61551000000	3176463.30378000000	8/17/2015	0.00000000000	0.00048522700	0.25037700000	A	786.1	29.9	17-08-2015 08:29:49	0.00000000000	0.00200000000	1.03200000000	0.24261300000
SeepArea5 081715 12	SeepArea5-081715	Seep5	1172801.54260000000	3176464.58274000000	8/17/2015	0.00000000000	0.00024229400	1.69727000000	A	786.1	30.3	17-08-2015 08:32:40	0.00000000000	0.00100000000	7.00500000000	0.24229400000
SeepArea5 081715 13	SeepArea5-081715	Seep5	1172820.85654000000	3176489.68250000000	8/17/2015	0.00000000000	0.00000000000	0.72923200000	A	786.8	30.6	17-08-2015 08:35:25	-0.13600000000	0.00000000000	3.01000000000	0.24227000000
SeepArea5 081715 14	SeepArea5-081715	Seep5	1172842.01982000000	3176508.90953000000	8/17/2015	0.00000000000	0.00072668000	0.13732900000	A	787.1	30.8	17-08-2015 08:38:02	0.00000000000	0.00300000000	0.56700000000	0.24220300000
SeepArea5 081715 15	SeepArea5-081715	Seep5	1172841.82016000000	3176550.11612000000	8/17/2015	0.00000000000	0.00048443100	0.50550300000	A	787.4	30.9	17-08-2015 08:40:27	-0.00600000000	0.00200000000	2.08700000000	0.24221500000
SeepArea5 081715 16	SeepArea5-081715	Seep5	1172804.94846000000	3176563.14579000000	8/17/2015	0.00000000000	0.00024182700	0.36667700000	A	786.8	31.1	17-08-2015 08:43:09	-0.12900000000	0.00100000000	1.51600000000	0.24187200000
SeepArea5 081715 17	SeepArea5-081715	Seep5	1172846.10211000000	3176456.26560000000	8/17/2015	0.00000000000	0.00145800000	0.68525600000	A	786.8	31.3	17-08-2015 08:46:05	-5.60000000000	0.00600000000	2.83500000000	0.24171730000
SeepArea5 081715 18	SeepArea5-081715	Seep5	1172849.59017000000	3176400.67660000000	8/17/2015	0.00000000000	0.00048323100	0.34309400000	A	787.0	31.5	17-08-2015 08:48:26	0.00000000000	0.00200000000	1.42000000000	0.24161500000
SeepArea5 081715 19	SeepArea5-081715	Seep5	1172850.54783000000	3176354.49570000000	8/17/2015	0.00000000000	0.00024148800	0.24341900000	A	787.1	31.7	17-08-2015 08:50:47	0.00000000000	0.00100000000	1.00800000000	0.24148800000
SeepArea5 081715 20	SeepArea5-081715	Seep5	1172817.98236000000	3176348.79715000000	8/17/2015	0.00000000000	0.00096431700	1.24850000000	A	786.8	32.1	17-08-2015 08:53:20	-0.04200000000	0.00400000000	8.91200000000	0.24107900000
SeepArea5 081715 21	SeepArea5-081715	Seep5	1172816.20815000000	3176399.89414000000	8/17/2015	0.00000000000	0.00096300300	0.73717900000	A	786.5	32.4	17-08-2015 08:55:53	0.00000000000	0.00400000000	3.06200000000	0.24075100000
SeepArea5 081715 22	SeepArea5-081715	Seep5	1172758.10122000000	3176403.26593000000	8/17/2015	0.00000000000	0.00048117800	0.80669400000	A	787.0	32.8	17-08-2015 08:58:39	0.00000000000	0.00200000000	3.35300000000	0.24058900000
SeepArea5 081715 23	SeepArea5-081715	Seep5	1172706.79188000000	3176364.21504000000	8/17/2015	0.00000000000	0.00048015700	0.33058800000	A	786.1	33.1	17-08-2015 09:01:53	0.00000000000	0.00200000000	1.37700000000	0.24007800000
SeepArea5 081715 24	SeepArea5-081715	Seep5	1172749.54317000000	3176355.21020000000	8/17/2015	0.00000000000	0.00047996500	0.19246600000	A	786.3	33.3	17-08-2015 09:04:38	0.00000000000	0.00200000000	0.80200000000	0.23998300000
SeepArea5 081715 25	SeepArea5-081715	Seep5	1172775.15341000000	3176327.63969000000	8/17/2015	0.00000000000	0.00071947800	1.48572000000	A	786.3	33.5	17-08-2015 09:07:01	0.00000000000	0.00300000000	6.19500000000	0.23982600000
SeepArea5 081715 26	SeepArea5-081715	Seep5	1172789.15231000000	3176292.93776000000	8/17/2015	0.00000000000	0.00023996100	0.44272900000	A	787.0	33.6	17-08-2015 09:09:34	0			

APPENDIX B - FLUX DATA

SitePt	Site	AreaAbbrev	Northing	Easting	Date	CH4flux	H2Sflux	CO2flux	ACCUMULATION CHAMBER	PRESSURE (HPa)	TEMP (C°)	TIME	CH4 Slope	H2S Slope	CO2 Slope	AcK
SeepArea5_081715_55	SeepArea5-081715	Seep5	1172497.61174000000	3175994.61443000000	8/17/2015	0.00000000000	0.00094896100	0.39026000000	A	786.7	37.0	17-08-2015 10:38:30	-4.10700000000	0.00400000000	1.64500000000	0.23724000000
SeepArea5_081715_56	SeepArea5-081715	Seep5	1172427.98837000000	3175989.62315000000	8/17/2015	0.00000000000	0.00071140100	0.86577500000	A	786.6	37.1	17-08-2015 10:44:06	0.00000000000	0.00300000000	3.65100000000	0.23713400000
SeepArea5_081715_57	SeepArea5-081715	Seep5	1172379.59480000000	3176001.38702000000	8/17/2015	0.00000000000	0.00118476000	0.32249300000	A	786.0	37.1	17-08-2015 10:47:06	0.00000000000	0.00500000000	1.36100000000	0.23695300000
SeepArea5_081715_58	SeepArea5-081715	Seep5	1172341.84137000000	3176018.99120000000	8/17/2015	0.00000000000	0.00189442000	0.38906600000	A	785.5	37.1	17-08-2015 10:49:53	0.00000000000	0.00800000000	1.64300000000	0.23680200000
SeepArea5_081715_59	SeepArea5-081715	Seep5	1172336.81059000000	3176066.54759000000	8/17/2015	0.00000000000	0.00094642100	0.21909600000	A	785.1	37.2	17-08-2015 10:54:19	0.00000000000	0.00400000000	0.92600000000	0.23660500000
SeepArea5_081715_60	SeepArea5-081715	Seep5	1172343.91331000000	3176107.59513000000	8/17/2015	0.00000000000	0.00212876000	1.89318000000	A	785.1	37.3	17-08-2015 10:56:02	0.00000000000	0.00900000000	8.00400000000	0.23652900000
SeepArea5_081715_61	SeepArea5-081715	Seep5	1172399.34983000000	3176093.79019000000	8/17/2015	0.00000000000	0.00118249000	1.28608000000	A	785.0	37.3	17-08-2015 10:58:51	0.00000000000	0.00500000000	5.43800000000	0.23649900000
SeepArea5_081715_62	SeepArea5-081715	Seep5	1172408.76117000000	3176045.47750000000	8/17/2015	0.00000000000	0.00142008000	0.30153000000	A	785.6	37.3	17-08-2015 11:01:27	0.00000000000	0.00600000000	1.27400000000	0.23668000000
SeepArea5_081715_63	SeepArea5-081715	Seep5	1172421.60798000000	3176059.68975000000	8/17/2015	0.00000000000	0.00047335900	0.09348850000	A	785.6	37.3	17-08-2015 11:04:13	0.00000000000	0.00200000000	0.39500000000	0.23668000000
SeepArea5_081715_64	SeepArea5-081715	Seep5	1172450.58681000000	3176042.95990000000	8/17/2015	0.00000000000	0.00260480000	0.59081600000	A	786.0	37.3	17-08-2015 11:06:23	0.00000000000	0.01100000000	2.49500000000	0.23680000000
SeepArea5_081715_65	SeepArea5-081715	Seep5	1172456.26128000000	3176099.69567000000	8/17/2015	0.00000000000	0.00165676000	1.52374000000	A	785.6	37.3	17-08-2015 11:08:33	0.00000000000	0.00700000000	6.43800000000	0.23668000000
SeepArea5_081715_66	SeepArea5-081715	Seep5	1172412.72064000000	3176149.90385000000	8/17/2015	0.00000000000	0.00094647800	0.95215600000	A	785.4	37.3	17-08-2015 11:11:02	0.00000000000	0.00400000000	4.02400000000	0.23661900000
SeepArea5_081715_67	SeepArea5-081715	Seep5	1172468.32500000000	3176146.08974000000	8/17/2015	0.00000000000	0.00165655000	0.52133900000	A	785.5	37.3	17-08-2015 11:13:17	0.00000000000	0.00700000000	2.20300000000	0.23665000000
SeepArea5_081715_68	SeepArea5-081715	Seep5	1172474.14088000000	3176196.69771000000	8/17/2015	0.00000000000	0.00142008000	0.36661700000	A	785.6	37.3	17-08-2015 11:15:45	0.00000000000	0.00600000000	1.54900000000	0.23668000000
SeepArea5_081715_69	SeepArea5-081715	Seep5	1172521.96582000000	3176205.70459000000	8/17/2015	0.00000000000	0.00189320000	0.32776000000	A	785.5	37.3	17-08-2015 11:18:35	0.00000000000	0.00800000000	1.38500000000	0.23665000000
SeepArea5_081715_70	SeepArea5-081715	Seep5	1172509.36998000000	3176254.72856000000	8/17/2015	0.00000000000	0.00094659800	0.53104200000	A	785.5	37.3	17-08-2015 11:21:18	0.00000000000	0.00400000000	2.24400000000	0.23665000000
SeepArea5_081715_71	SeepArea5-081715	Seep5	1172533.74987000000	3176291.98336000000	8/17/2015	0.00000000000	0.00142090000	0.15914000000	A	785.8	37.2	17-08-2015 11:23:42	0.00000000000	0.00600000000	0.67200000000	0.23681600000
SeepArea5_081715_72	SeepArea5-081715	Seep5	1172512.92271000000	3176292.95928000000	8/17/2015	0.00000000000	0.00071017700	0.27767900000	A	785.5	37.2	17-08-2015 11:26:38	0.00000000000	0.00300000000	1.17300000000	0.23672600000
SeepArea5_081715_73	SeepArea5-081715	Seep5	1172504.54290000000	3176347.15925000000	8/17/2015	0.00000000000	0.00047339100	1.12667000000	A	785.4	37.2	17-08-2015 11:29:50	0.00000000000	0.00200000000	4.76000000000	0.23669600000
SeepArea5_081715_74	SeepArea5-081715	Seep5	1172459.54601000000	3176313.03501000000	8/17/2015	0.00000000000	0.00260383000	1.17433000000	A	785.2	37.1	17-08-2015 11:32:14	-0.00100000000	0.01100000000	4.96100000000	0.23671200000
SeepArea5_081715_75	SeepArea5-081715	Seep5	1172456.05931000000	3176254.88121000000	8/17/2015	0.00000000000	0.00189310000	0.82302400000	A	784.7	37.0	17-08-2015 11:34:44	0.00000000000	0.00800000000	3.47800000000	0.23663700000
SeepArea5_081715_76	SeepArea5-081715	Seep5	1172416.86991000000	3176251.06370000000	8/17/2015	0.00000000000	0.00212973000	0.29579600000	A	784.7	37.0	17-08-2015 11:37:09	0.00000000000	0.00900000000	1.25000000000	0.23663700000

APPENDIX C
VOLUMETRIC FLUX CALCULATIONS



Grid Volume Computations

Fri Sep 25 16:37:30 2015

Upper Surface

Grid File Name:	P:\XTO Energy\608\2015 Survey\Surfer\Seep32-L1021_CH4_notail.grd
Grid Size:	65 rows x 72 columns
X Minimum:	3178302.787
X Maximum:	3179013.159
X Spacing:	10.005239436619
Y Minimum:	1173696.386
Y Maximum:	1174336.546
Y Spacing:	10.002500000002
Z Minimum:	0
Z Maximum:	15.248009172052

Lower Surface

Level Surface defined by $Z = 0$

Volumes

Z Scale Factor:	0.0929
-----------------	--------

Total Volumes by:

Trapezoidal Rule:	6091.2734384549
Simpson's Rule:	6096.2154883991
Simpson's 3/8 Rule:	6085.4959352285

Cut & Fill Volumes

Positive Volume [Cut]:	6091.2734384549
Negative Volume [Fill]:	0
Net Volume [Cut-Fill]:	6091.2734384549

Areas

Planar Areas

Positive Planar Area [Cut]:	288323.01090611
Negative Planar Area [Fill]:	0

Blanked Planar Area:	166428.72861398
Total Planar Area:	454751.73952009

Surface Areas

Positive Surface Area [Cut]:	288325.83387985
Negative Surface Area [Fill]:	0

Grid Volume Computations

Fri Sep 25 16:39:49 2015

Upper Surface

Grid File Name:	P:\XTO Energy\608\2015 Survey\Surfer\Seep32-L1030_CH4_notail.grd
Grid Size:	47 rows x 41 columns
X Minimum:	3164557.587
X Maximum:	3164957.707
X Spacing:	10.0030000000003
Y Minimum:	1145998.497
Y Maximum:	1146463.465
Y Spacing:	10.1080000000002
Z Minimum:	0
Z Maximum:	48.530366628535

Lower Surface

Level Surface defined by $Z = 0$

Volumes

Z Scale Factor:	0.0929
-----------------	--------

Total Volumes by:

Trapezoidal Rule:	11362.057351687
Simpson's Rule:	11368.210270933
Simpson's 3/8 Rule:	11395.100639039

Cut & Fill Volumes

Positive Volume [Cut]:	11362.057351687
Negative Volume [Fill]:	0
Net Volume [Cut-Fill]:	11362.057351687

Areas

Planar Areas

Positive Planar Area [Cut]:	117035.20003006
Negative Planar Area [Fill]:	0

Blanked Planar Area:	69007.796130036
Total Planar Area:	186042.9961601

Surface Areas

Positive Surface Area [Cut]:	117061.79963147
Negative Surface Area [Fill]:	0

Grid Volume Computations

Fri Sep 25 16:40:33 2015

Upper Surface

Grid File Name:	P:\XTO Energy\608\2015 Survey\Surfer\Seep32-L1049_CH4_notail.grd
Grid Size:	193 rows x 274 columns
X Minimum:	3175726.507
X Maximum:	3178459.846
X Spacing:	10.01223076923
Y Minimum:	1173654.342
Y Maximum:	1175571.367
Y Spacing:	9.9845052083341
Z Minimum:	0
Z Maximum:	193.356003293

Lower Surface

Level Surface defined by $Z = 0$

Volumes

Z Scale Factor:	0.0929
-----------------	--------

Total Volumes by:

Trapezoidal Rule:	596808.91681396
Simpson's Rule:	596942.72857769
Simpson's 3/8 Rule:	596758.92970453

Cut & Fill Volumes

Positive Volume [Cut]:	596808.91681396
Negative Volume [Fill]:	0
Net Volume [Cut-Fill]:	596808.91681396

Areas

Planar Areas

Positive Planar Area [Cut]:	3064293.6700538
Negative Planar Area [Fill]:	0

Blanked Planar Area:	2175585.526421
Total Planar Area:	5239879.1964748

Surface Areas

Positive Surface Area [Cut]:	3064911.4394084
Negative Surface Area [Fill]:	0

APPENDIX D
NATURAL SPRING ANALYTICAL RESULTS





08/25/15

Technical Report for

LT Environmental

Rule 608 Compliance XTO Raton Basin

Accutest Job Number: D73885

Sampling Date: 08/12/15

Report to:

LT Environmental
2243 Main Avenue Suite #3
Durango, CO 81301
dhencmann@ltenv.com

ATTN: Devin Hencmann

Total number of pages in report: **52**



Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.

A handwritten signature in black ink, appearing to read 'Scott Heideman'.

Scott Heideman
Laboratory Director

Client Service contact: Renea Jackson 303-425-6021

Certifications: CO (CO00049), ID, NE (CO00049), ND (R-027), NJ (CO 0007), OK (D9942), UT (NELAP CO00049), LA (LA150028), TX (T104704511), WY

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Test results relate only to samples analyzed.

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Sample Summary

LT Environmental

Job No: D73885

Rule 608 Compliance XTO Raton Basin

Sample Number	Collected Date	Time By	Received	Matrix Code	Type	Client Sample ID
D73885-1	08/12/15	10:30 DN	08/13/15	AQ	Ground Water	CHAVEZ_02
D73885-1A	08/12/15	10:30 DN	08/13/15	AQ	Ground Water	CHAVEZ_02
D73885-1B	08/12/15	10:30 DN	08/13/15	AQ	Ground Water	CHAVEZ_02
D73885-1F	08/12/15	10:30 DN	08/13/15	AQ	Groundwater Filtered	CHAVEZ_02

CASE NARRATIVE / CONFORMANCE SUMMARY

Client: LT Environmental

Job No D73885

Site: Rule 608 Compliance XTO Raton Basin

Report Date 8/25/2015 11:49:51 A

On 08/13/2015, 1 sample(s), 0 Trip Blank(s), and 0 Field Blank(s) were received at Accutest Mountain States (AMS) at a temperature of 3.9 °C. The samples were intact and properly preserved, unless noted below. An AMS Job Number of D73885 was assigned to the project. The lab sample ID, client sample ID, and date of sample collection are detailed in the report's Results Summary.

Specified quality control criteria were achieved for this job except as noted below. For more information, please refer to the analytical results and QC summary pages.

Volatiles by GC By Method RSK175 MOD

Matrix: AQ

Batch ID: GFB708

- All samples were analyzed within the recommended method holding time.
- Sample(s) D73923-1MS, D73923-1MSD were used as the QC samples indicated.
- All method blanks for this batch meet method specific criteria.
- D73923-1MS and D73923-1MSD: The pH of the sample was >2 at time of analysis.

Metals By Method EPA 200.7

Matrix: AQ

Batch ID: MP16639

- All samples were digested and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D73885-1FMS, D73885-1FMSD were used as the QC samples for the metals analysis.

Metals By Method EPA 200.8

Matrix: AQ

Batch ID: MP16642

- All samples were digested and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D73859-1FAMS, D73859-1FAMSD were used as the QC samples for the metals analysis.
- The blank spike (BS) recovery(s) of Selenium are outside control limits.
- MP16642-B1 for Selenium: All sample results < RL

Metals By Method SW846 6010C

Matrix: AQ

Batch ID: MP16654

- All samples were digested and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D73885-1AMS, D73885-1AMSD, D73885-1ASDL were used as the QC samples for the metals analysis.

Wet Chemistry By Method EPA 300.0/SW846 9056

Matrix: AQ

Batch ID: GP15978

- All samples were prepared and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D73904-5MS, D73904-5MSD were used as the QC samples for the Bromide, Chloride, Fluoride, Nitrogen, Nitrate, Nitrogen, Nitrite, Sulfate, Bromide analysis.

Matrix: AQ

Batch ID: R29555

- The data for EPA 300.0/SW846 9056 meets quality control requirements.
- D73885-1 for Nitrogen, Nitrate + Nitrite: Calculated as: (Nitrogen, Nitrate) + (Nitrogen, Nitrite)

Wet Chemistry By Method HACH IRB-BART

Matrix: AQ

Batch ID: MB602

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.

Wet Chemistry By Method HACH SLYM-BART

Matrix: AQ

Batch ID: MB603

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.

Wet Chemistry By Method HACH SRB-BART

Matrix: AQ

Batch ID: MB604

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.

Wet Chemistry By Method SM 2320B-2011

Matrix: AQ

Batch ID: GN31192

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D73885-1DUP, D73944-1MS, D73944-1MSD were used as the QC samples for the Alkalinity, Total as CaCO₃ analysis.

Matrix: AQ

Batch ID: GN31193

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.

Matrix: AQ

Batch ID: GN31194

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.

Wet Chemistry By Method SM 2510B-2011

Matrix: AQ

Batch ID: GP16007

- Sample(s) D73885-1DUP were used as the QC samples for the Specific Conductivity analysis.

Wet Chemistry By Method SM 2540C-2011

Matrix: AQ

Batch ID: GN31195

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D73885-1DUP were used as the QC samples for the Solids, Total Dissolved analysis.

Wet Chemistry By Method SM20 4500 S2 H

Matrix: AQ

Batch ID: GN31239

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D73885-1DUP were used as the QC samples for the Hydrogen Sulfide analysis.

Wet Chemistry By Method SM4500HB+-2011/9040C

Matrix: AQ

Batch ID: GN31218

- The following samples were run outside of holding time for method SM4500HB+-2011/9040C: D73885-1

Wet Chemistry By Method USDA HANDBOOK 60

Matrix: AQ

Batch ID: MP16654

- D73885-1A for Sodium Adsorption Ratio: Calculated as: $(\text{Na meq/L}) / \sqrt{[(\text{Ca meq/L}) + (\text{Mg meq/L})/2]}$

AMS certifies that data reported for samples received, listed on the associated custody chain or analytical task order, were produced to specifications meeting AMS's Quality System precision, accuracy and completeness objectives except as noted.

Estimated non-standard method measurement uncertainty data is available on request, based on quality control bias and implicit for standard methods. Acceptable uncertainty requires tested parameter quality control data to meet method criteria.

AMS is not responsible for data quality assumptions if partial reports are used and recommends that this report be used in its entirety. This report is authorized by AMS indicated via signature on the report cover.

Summary of Hits

Job Number: D73885
Account: LT Environmental
Project: Rule 608 Compliance XTO Raton Basin
Collected: 08/12/15

Lab Sample ID	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
---------------	------------------	-----------------	----	-----	-------	--------

D73885-1 CHAVEZ_02

Alkalinity, Bicarbonate as CaCO ₃	196	5.0			mg/l	SM 2320B-2011
Alkalinity, Total as CaCO ₃	196	5.0			mg/l	SM 2320B-2011
Chloride	14.5	0.50			mg/l	EPA 300.0/SW846 9056
Fluoride	0.27	0.10			mg/l	EPA 300.0/SW846 9056
Nitrogen, Nitrate	0.94	0.050			mg/l	EPA 300.0/SW846 9056
Nitrogen, Nitrate + Nitrite ^a	0.94	0.054			mg/l	EPA 300.0/SW846 9056
Solids, Total Dissolved	291	10			mg/l	SM 2540C-2011
Specific Conductivity	405	1.0			umhos/cm	SM 2510B-2011
Sulfate	29.8	0.50			mg/l	EPA 300.0/SW846 9056
pH	7.45				su	SM4500HB+ -2011/9040C

D73885-1A CHAVEZ_02

Calcium	71.7	2.0			mg/l	SW846 6010C
Magnesium	14.0	1.0			mg/l	SW846 6010C
Sodium	16.7	2.0			mg/l	SW846 6010C
Sodium Adsorption Ratio ^b	0.472				ratio	USDA HANDBOOK 60

D73885-1B CHAVEZ_02

Iron-Related Bacteria	74500	25			CFU/ml	HACH IRB-BART
Slime Forming Bacteria	350000	500			CFU/ml	HACH SLYM-BART
Sulfate Reducing Bacteria	5000	200			CFU/ml	HACH SRB-BART

D73885-1F CHAVEZ_02

Calcium	68700	400			ug/l	EPA 200.7
Iron	47.3	10			ug/l	EPA 200.7
Magnesium	13300	200			ug/l	EPA 200.7
Potassium	1610	1000			ug/l	EPA 200.7
Sodium	14900	400			ug/l	EPA 200.7

(a) Calculated as: (Nitrogen, Nitrate) + (Nitrogen, Nitrite)

(b) Calculated as: (Na meq/L) / sqrt [(Ca meq/L)+ (Mg meq/L)/2]

Sample Results

Report of Analysis

Report of Analysis

Page 1 of 1

Client Sample ID:	CHAVEZ_02	Date Sampled:	08/12/15
Lab Sample ID:	D73885-1	Date Received:	08/13/15
Matrix:	AQ - Ground Water	Percent Solids:	n/a
Method:	RSK175 MOD		
Project:	Rule 608 Compliance XTO Raton Basin		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	FB14967.D	1	08/17/15	JJ	n/a	n/a	GFB708
Run #2							

	Initial Volume	Headspace Volume	Volume Injected	Temperature
Run #1	39.0 ml	4.0 ml	500 ul	21.0 Deg. C
Run #2				

CAS No.	Compound	Result	RL	MDL	Units	Q
74-82-8	Methane	ND	0.00080	0.00040	mg/l	

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID: CHAVEZ_02

Lab Sample ID: D73885-1

Matrix: AQ - Ground Water

Date Sampled: 08/12/15

Date Received: 08/13/15

Percent Solids: n/a

Project: Rule 608 Compliance XTO Raton Basin

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Alkalinity, Bicarbonate as CaC	196	5.0	mg/l	1	08/17/15	JD	SM 2320B-2011
Alkalinity, Carbonate	< 5.0	5.0	mg/l	1	08/17/15 08:00	JD	SM 2320B-2011
Alkalinity, Total as CaCO ₃	196	5.0	mg/l	1	08/17/15 08:00	JD	SM 2320B-2011
Bromide	< 0.050	0.050	mg/l	1	08/13/15 11:26	BF	EPA 300.0/SW846 9056
Chloride	14.5	0.50	mg/l	1	08/13/15 11:26	BF	EPA 300.0/SW846 9056
Fluoride	0.27	0.10	mg/l	1	08/13/15 11:26	BF	EPA 300.0/SW846 9056
Hydrogen Sulfide	< 0.50	0.50	mg/l	1	08/19/15	TJ	SM20 4500 S2 H
Nitrogen, Nitrate	0.94	0.050	mg/l	5	08/13/15 18:21	BF	EPA 300.0/SW846 9056
Nitrogen, Nitrate + Nitrite ^a	0.94	0.054	mg/l	1	08/13/15 18:21	BF	EPA 300.0/SW846 9056
Nitrogen, Nitrite	< 0.0040	0.0040	mg/l	1	08/13/15 11:26	BF	EPA 300.0/SW846 9056
Solids, Total Dissolved	291	10	mg/l	1	08/17/15	AK	SM 2540C-2011
Specific Conductivity	405	1.0	umhos/cm	1	08/18/15	TJ	SM 2510B-2011
Sulfate	29.8	0.50	mg/l	1	08/13/15 11:26	BF	EPA 300.0/SW846 9056
pH	7.45		su	1	08/18/15 13:50	TB	SM4500HB+ -2011/9040C

(a) Calculated as: (Nitrogen, Nitrate) + (Nitrogen, Nitrite)

RL = Reporting Limit

Report of Analysis

Client Sample ID:	CHAVEZ_02	Date Sampled:	08/12/15
Lab Sample ID:	D73885-1A	Date Received:	08/13/15
Matrix:	AQ - Ground Water	Percent Solids:	n/a
Project:	Rule 608 Compliance XTO Raton Basin		

SAR Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Calcium	71.7	2.0	mg/l	1	08/17/15	08/18/15 JB	SW846 6010C ¹	SW846 3010A/M ²
Magnesium	14.0	1.0	mg/l	1	08/17/15	08/18/15 JB	SW846 6010C ¹	SW846 3010A/M ²
Sodium	16.7	2.0	mg/l	1	08/17/15	08/18/15 JB	SW846 6010C ¹	SW846 3010A/M ²

(1) Instrument QC Batch: MA6435
(2) Prep QC Batch: MP16654

RL = Reporting Limit

Report of Analysis

Client Sample ID:	CHAVEZ_02	Date Sampled:	08/12/15
Lab Sample ID:	D73885-1A	Date Received:	08/13/15
Matrix:	AQ - Ground Water	Percent Solids:	n/a
Project:	Rule 608 Compliance XTO Raton Basin		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Sodium Adsorption Ratio ^a	0.472		ratio	1	08/18/15 06:39	JB	USDA HANDBOOK 60

(a) Calculated as: (Na meq/L) / sqrt [(Ca meq/L)+ (Mg meq/L)/2]

RL = Reporting Limit

Report of Analysis

Client Sample ID:	CHAVEZ_02	Date Sampled:	08/12/15
Lab Sample ID:	D73885-1B	Date Received:	08/13/15
Matrix:	AQ - Ground Water	Percent Solids:	n/a
Project:	Rule 608 Compliance XTO Raton Basin		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Iron-Related Bacteria	74500	25	CFU/ml	1	08/17/15 14:00	MM	HACH IRB-BART
Slime Forming Bacteria	350000	500	CFU/ml	1	08/17/15 14:00	MM	HACH SLYM-BART
Sulfate Reducing Bacteria	5000	200	CFU/ml	1	08/17/15 14:00	MM	HACH SRB-BART

RL = Reporting Limit

Report of Analysis

Client Sample ID: CHAVEZ_02**Lab Sample ID:** D73885-1F**Matrix:** AQ - Groundwater Filtered**Date Sampled:** 08/12/15**Date Received:** 08/13/15**Percent Solids:** n/a**Project:** Rule 608 Compliance XTO Raton Basin**Dissolved Metals Analysis**

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Calcium	68700	400	ug/l	1	08/16/15	08/18/15 JB	EPA 200.7 ³	EPA 200.7 ⁵
Iron	47.3	10	ug/l	1	08/16/15	08/20/15 JB	EPA 200.7 ⁴	EPA 200.7 ⁵
Magnesium	13300	200	ug/l	1	08/16/15	08/18/15 JB	EPA 200.7 ³	EPA 200.7 ⁵
Manganese	< 2.0	2.0	ug/l	2	08/16/15	08/17/15 KV	EPA 200.8 ¹	EPA 200.8 ⁶
Potassium	1610	1000	ug/l	1	08/16/15	08/18/15 JB	EPA 200.7 ³	EPA 200.7 ⁵
Selenium	< 0.80	0.80	ug/l	2	08/16/15	08/18/15 KV	EPA 200.8 ²	EPA 200.8 ⁶
Sodium	14900	400	ug/l	1	08/16/15	08/18/15 JB	EPA 200.7 ³	EPA 200.7 ⁵

(1) Instrument QC Batch: MA6431

(2) Instrument QC Batch: MA6434

(3) Instrument QC Batch: MA6440

(4) Instrument QC Batch: MA6452

(5) Prep QC Batch: MP16639

(6) Prep QC Batch: MP16642

RL = Reporting Limit



Subcontract Lab Data

5

Report of Analysis



**industrial
LABORATORIES**

Industrial Laboratories is your independent,
third-party analytical testing laboratory

To: Accutest Mountain States (AMS)
4036 Youngfield St.

Wheat Ridge CO 80033

Attn: Renea Rooks

TEST REPORT

ACCUTEST - M

Date Received: 8/14/2015

Date Reported: 8/18/2015

PO Number: D73885X

Lab No.	Sample Description	Test Method	Result	Units	MDL	Analysis Date/By
150814006-01A	D73885X -1, 8/12/15, 10:30 AM	* Total Coliforms MPN SMEWW 9221 B	<2 fecal; 50 total	MPN/100mL		AT 8/14/2015

R. Enman

Department Manager

Samples received in good condition unless otherwise noted in case narrative.

* = Scope Analysis

= Subcontracted Analysis

MDL = Method Detection Limit

ND = Not Detected at the Method Detection Limit

Page: 1 of 1

4046 Youngfield Street • Wheat Ridge, Colorado 80033 • (303) 287-9691 • (303) 287-0964 FAX • www.industriallabs.net

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CHAIN OF CUSTODY

4036 Youngfield St., Wheat Ridge, CO 80033
303-425-6021 FAX: 303-425-6854

Accutest Job #:	D73885X
Accutest Quote #:	0
AMS P.O. #:	
Project No.:	

[illegible]

Misc. Forms

Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody

ACCREDITED LABORATORIES Accutest Laboratories Mountain States 4036 Youngfield Street Wheat Ridge, Co 80033 TEL: 303-425-6021 877-737-4521 FAX: 303-425-6021		PED-EX Tracking # _____ Bottle Order Control # _____	
Client / Reporting Information Company Name: LT Environmental Street Address: 2243 Main City: Durango, CO State: 81301 Project Contact: Devin Hancmann E-mail: _____ Phone # (970) 385-1096 Fax # _____ Samples (s) Name(s): David Newman Phone # _____		Project Information Project Name: Rule 608 Compliance Street: _____ City: _____ Billing Information (if different from Report to): Company Name: _____ Street Address: _____ City: _____ State: _____ Zip: _____ Client PO#: _____ PO#: _____ Project Manager: Devin Hancmann Attention: _____	
Requested Analysis (see TEST CODE sheet)		Matrix Codes DW - Drinking Water GW - Ground Water WW - Water SW - Surface Water SO - Soil SL - Sludge SED - Sediment OL - Oil LQ - Other Liquid AIR - Air SOL - Other Solid WP - Wipe FB - Field Blank EB - Equipment Blank RB - Rinse Blank TB - Trip Blank	
Accutest Sample # _____ Field ID / Point of Collection: Chavez - 02 MEQ/ID Vial # _____ Date: 8-12-15 Time: 1030 Sampled by: DN Matrix: GW # of bottles: 12 Number of preserved bottles: HCl _____ NaOH _____ HNO3 _____ H2SO4 _____ NONE _____ DI Water _____ MEQH _____ ENCORE _____ Biofilm _____		LAB USE ONLY 01 02TB 02	
Turnaround Time (Business days) <input checked="" type="checkbox"/> Std. 10 Business Days <input type="checkbox"/> Std. 5 Business Days (By Contract only) <input type="checkbox"/> 5 Day / 7 SH <input type="checkbox"/> 3 Day EMERGENT <input type="checkbox"/> 2 Day EMERGENT <input type="checkbox"/> 1 Day EMERGENT		Approved By (Accutest PM): _____ Date: _____ <input type="checkbox"/> Commercial "A" (Level 1) <input type="checkbox"/> State Forms <input type="checkbox"/> Commercial "B" (Level 2) <input checked="" type="checkbox"/> EDD Format <input type="checkbox"/> Commercial "B" - Narrative <input type="checkbox"/> PDF <input type="checkbox"/> FULLT1 (Level 3+4) Commercial "A" = Results Only Commercial "B" = Results + QC Summary	
Emergency & Rush T/A data available via Lablink		Comments / Special Instructions COCC XTO LTE DHancmann@LTEnv.com	
Sample Custody must be documented below each time samples change possession, including courier delivery.			
Relinquished by: [Signature] Date Time: 1330 Relinquished by: _____ Date Time: _____ Relinquished by: _____ Date Time: _____ Relinquished by: _____ Date Time: _____		Received By: FL Received By: _____ Received By: _____ Received By: _____ Custody Seal # _____ <input checked="" type="checkbox"/> Intact <input type="checkbox"/> Preserved (photo applicable) <input type="checkbox"/> Not Intact <input type="checkbox"/> On Ice <input type="checkbox"/> Cooler Temp.	

6.1 6

D73885: Chain of Custody

Page 1 of 2

Accutest Laboratories Sample Receipt Summary

Accutest Job Number: D73885 **Client:** LT ENVIRONMENTAL **Project:** RULE 608 COMPLIANCE
Date / Time Received: 8/13/2015 9:45:00 AM **Delivery Method:** _____ **Airbill #'s:** fx
Cooler Temps (Initial/Adjusted): #1: (3.9/3.9):

Cooler Security
Y or N

- | | |
|--|---|
| 1. Custody Seals Present: <input checked="" type="checkbox"/> Y <input type="checkbox"/> N | 3. COC Present: <input checked="" type="checkbox"/> Y <input type="checkbox"/> N |
| 2. Custody Seals Intact: <input checked="" type="checkbox"/> Y <input type="checkbox"/> N | 4. Smpl Dates/Time OK: <input checked="" type="checkbox"/> Y <input type="checkbox"/> N |

Cooler Temperature
Y or N

- | | |
|---|--|
| 1. Temp criteria achieved: <input checked="" type="checkbox"/> Y <input type="checkbox"/> N | 2. Cooler temp verification: <u>Bar Therm;</u> |
| 3. Cooler media: <u>Ice (Bag)</u> | 4. No. Coolers: <u>1</u> |

Quality Control Preservation
Y or N
N/A

- | | |
|---|--|
| 1. Trip Blank present / cooler: <input checked="" type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> N/A | 2. Trip Blank listed on COC: <input checked="" type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> N/A |
| 3. Samples preserved properly: <input checked="" type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> N/A | 4. VOCs headspace free: <input checked="" type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> N/A |

Comments

Sample Integrity - Documentation
Y or N

- | | |
|---|--|
| 1. Sample labels present on bottles: <input checked="" type="checkbox"/> Y <input type="checkbox"/> N | 2. Container labeling complete: <input checked="" type="checkbox"/> Y <input type="checkbox"/> N |
| 3. Sample container label / COC agree: <input checked="" type="checkbox"/> Y <input type="checkbox"/> N | |

Sample Integrity - Condition
Y or N

- | | |
|---|---|
| 1. Sample recvd within HT: <input checked="" type="checkbox"/> Y <input type="checkbox"/> N | 2. All containers accounted for: <input checked="" type="checkbox"/> Y <input type="checkbox"/> N |
| 3. Condition of sample: <u>Intact</u> | |

Sample Integrity - Instructions
Y or N N/A

- | | |
|---|--|
| 1. Analysis requested is clear: <input checked="" type="checkbox"/> Y <input type="checkbox"/> N | 2. Bottles received for unspecified tests: <input type="checkbox"/> Y <input checked="" type="checkbox"/> N |
| 3. Sufficient volume recvd for analysis: <input checked="" type="checkbox"/> Y <input type="checkbox"/> N | 4. Compositing instructions clear: <input type="checkbox"/> Y <input type="checkbox"/> N <input checked="" type="checkbox"/> N/A |
| 5. Filtering instructions clear: <input type="checkbox"/> Y <input type="checkbox"/> N | |

GC Volatiles

QC Data Summaries

Includes the following where applicable:

- Method Blank Summaries
- Blank Spike Summaries
- Matrix Spike and Duplicate Summaries

Method Blank Summary

Job Number: D73885
Account: LTENCODU LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
GFB708-MB	FB14952.D	1	08/17/15	JJ	n/a	n/a	GFB708

The QC reported here applies to the following samples: Method: RSK175 MOD

D73885-1

CAS No.	Compound	Result	RL	MDL	Units	Q
74-82-8	Methane	ND	0.00080	0.00040	mg/l	

7.1.1
7

Blank Spike Summary

Job Number: D73885
Account: LTENCODU LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
GFB708-BS	FB14953.D	10	08/17/15	JJ	n/a	n/a	GFB708

The QC reported here applies to the following samples: Method: RSK175 MOD

D73885-1

CAS No.	Compound	Spike mg/l	BSP mg/l	BSP %	Limits
74-82-8	Methane	0.512	0.550	107	70-130

* = Outside of Control Limits.

Matrix Spike/Matrix Spike Duplicate Summary

Job Number: D73885
Account: LTENCODU LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
D73923-1MS ^a	FB14955.D	10	08/17/15	JJ	n/a	n/a	GFB708
D73923-1MSD ^a	FB14956.D	10	08/17/15	JJ	n/a	n/a	GFB708
D73923-1 ^a	FB14954.D	1	08/17/15	JJ	n/a	n/a	GFB708

The QC reported here applies to the following samples: Method: RSK175 MOD

D73885-1

CAS No.	Compound	D73923-1 mg/l	Spike Q mg/l	MS mg/l	MS %	Spike mg/l	MSD mg/l	MSD %	RPD	Limits Rec/RPD
74-82-8	Methane	ND	0.512	0.523	102	0.512	0.513	100	2	51-155/30

(a) The pH of the sample was > 2 at time of analysis.

* = Outside of Control Limits.

Metals Analysis

QC Data Summaries

Includes the following where applicable:

- Method Blank Summaries
- Matrix Spike and Duplicate Summaries
- Blank Spike and Lab Control Sample Summaries
- Serial Dilution Summaries

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: D73885
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16639
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 08/16/15

Metal	RL	IDL	MDL	MB raw	final
Aluminum	100	8.6	46		
Antimony	30	3.2	8.7		
Arsenic	25	5.2	12		
Barium	10	1.4	.2		
Beryllium	10	.8	1.6		
Boron	50	6.7	3.7		
Cadmium	10	.4	.6		
Calcium	400	2.2	22	8.5	<400
Chromium	10	.4	1		
Cobalt	5.0	.4	1.2		
Copper	10	1.2	2.9		
Iron	10	2.2	6.9	2.9	<10
Lead	50	3.6	9.1		
Lithium	5.0	1.9	1		
Magnesium	200	14	39	5.8	<200
Manganese	5.0	.01	.4		
Molybdenum	10	.8	3.6		
Nickel	30	.9	2.1		
Phosphorus	100	15	47		
Potassium	1000	130	61	14.1	<1000
Selenium	50	8.8	15		
Silicon	50	5.2	6.2		
Silver	30	.4	.9		
Sodium	400	4.9	14	73.5	<400
Strontium	5.0	.01	.3		
Thallium	10	2.9	9.1		
Tin	50	13	25		
Titanium	10	.15	2.5		
Uranium	50	3.7	4.4		
Vanadium	10	.4	.6		
Zinc	30	.6	3.5		

Associated samples MP16639: D73885-1F

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: D73885
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

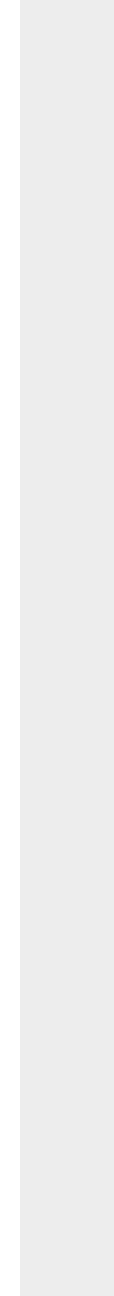
QC Batch ID: MP16639
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 08/16/15

Metal	RL	IDL	MDL	MB raw	final
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(anr) Analyte not requested



8.1.1

8

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D73885
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16639
 Matrix Type: AQUEOUS

Methods: EPA 200.7
 Units: ug/l

Prep Date: 08/16/15

Metal	D73885-1F Original MS		Spikelot ICPAL2	% Rec	QC Limits
Aluminum					
Antimony					
Arsenic					
Barium					
Beryllium					
Boron					
Cadmium					
Calcium	68700	93500	25000	99.2	70-130
Chromium					
Cobalt					
Copper					
Iron	47.3	5220	5000	103.5	70-130
Lead					
Lithium					
Magnesium	13300	38500	25000	100.8	70-130
Manganese	anr				
Molybdenum					
Nickel					
Phosphorus					
Potassium	1610	26200	25000	98.4	70-130
Selenium					
Silicon					
Silver					
Sodium	14900	38800	25000	95.6	70-130
Strontium					
Thallium					
Tin					
Titanium					
Uranium					
Vanadium					
Zinc					

Associated samples MP16639: D73885-1F

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits

8.1.2
8

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D73885
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

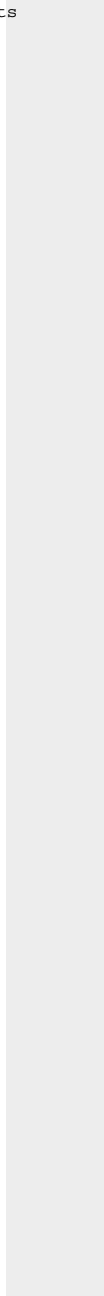
QC Batch ID: MP16639
 Matrix Type: AQUEOUS

Methods: EPA 200.7
 Units: ug/l

Prep Date: 08/16/15

Metal	D73885-1F Original MS	Spikelet ICPALL2 % Rec	QC Limits
-------	--------------------------	---------------------------	--------------

(N) Matrix Spike Rec. outside of QC limits
 (anr) Analyte not requested



8.1.2
8

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D73885
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16639
 Matrix Type: AQUEOUS

Methods: EPA 200.7
 Units: ug/l

Prep Date: 08/16/15

Metal	D73885-1F Original MSD		Spikelot ICPAL2	% Rec	MSD RPD	QC Limit
Aluminum						
Antimony						
Arsenic						
Barium						
Beryllium						
Boron						
Cadmium						
Calcium	68700	93200	25000	98.0	0.3	20
Chromium						
Cobalt						
Copper						
Iron	47.3	5180	5000	102.7	0.8	20
Lead						
Lithium						
Magnesium	13300	38200	25000	99.6	0.8	20
Manganese	anr					
Molybdenum						
Nickel						
Phosphorus						
Potassium	1610	25800	25000	96.8	1.5	20
Selenium						
Silicon						
Silver						
Sodium	14900	38300	25000	93.6	1.3	20
Strontium						
Thallium						
Tin						
Titanium						
Uranium						
Vanadium						
Zinc						

Associated samples MP16639: D73885-1F

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D73885
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

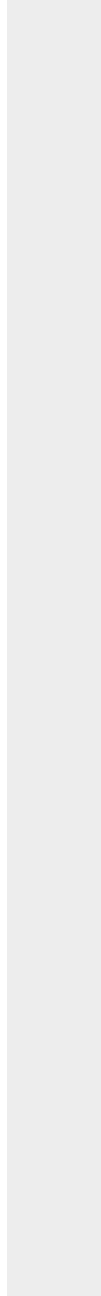
QC Batch ID: MP16639
 Matrix Type: AQUEOUS

Methods: EPA 200.7
 Units: ug/l

Prep Date: 08/16/15

Metal	D73885-1F Original MSD	SpikeLot ICPALL2 % Rec	MSD RPD	QC Limit
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(N) Matrix Spike Rec. outside of QC limits
 (anr) Analyte not requested



SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D73885

Account: LTENCODU - LT Environmental

Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16639

Methods: EPA 200.7

Matrix Type: AQUEOUS

Units: ug/l

Prep Date: 08/16/15

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
Aluminum				
Antimony				
Arsenic				
Barium				
Beryllium				
Boron				
Cadmium				
Calcium	25600	25000	102.4	85-115
Chromium				
Cobalt				
Copper				
Iron	5170	5000	103.4	85-115
Lead				
Lithium				
Magnesium	25400	25000	101.6	85-115
Manganese	anr			
Molybdenum				
Nickel				
Phosphorus				
Potassium	24200	25000	96.8	85-115
Selenium				
Silicon				
Silver				
Sodium	23800	25000	95.2	85-115
Strontium				
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc				

Associated samples MP16639: D73885-1F

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D73885
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

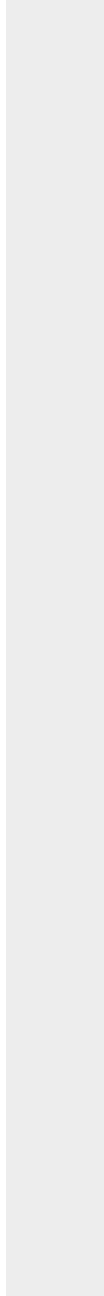
QC Batch ID: MP16639
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 08/16/15

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
-------	---------------	---------------------	-------	--------------

(anr) Analyte not requested



8.1.3

8

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: D73885
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16642
Matrix Type: AQUEOUS

Methods: EPA 200.8
Units: ug/l

Prep Date: 08/16/15

Metal	RL	IDL	MDL	MB raw	final
Aluminum	50	1.1	2		
Antimony	0.40	.0022	.011		
Arsenic	0.20	.017	.044		
Barium	2.0	.016	.079		
Beryllium	0.20	.016	.069		
Boron	40	.49	2.1		
Cadmium	0.10	.036	.042		
Calcium	400	5.6	12		
Chromium	2.0	.053	.053		
Cobalt	0.20	.0049	.015		
Copper	2.0	.06	.13		
Iron	10	3.5	4.6		
Lead	0.50	.0079	.008		
Magnesium	100	1.3	1.3		
Manganese	1.0	.12	.13	-0.13	<1.0
Molybdenum	1.0	.049	.029		
Nickel	2.0	.0088	.027		
Phosphorus	60	2.6	4.3		
Potassium	200	2.9	2.9		
Selenium	0.40	.06	.21	0.038	<0.40
Silver	0.10	.0019	.008		
Sodium	500	4.9	4.9		
Strontium	20	.01	.015		
Thallium	0.20	.0024	.005		
Tin	10	.063	1.3		
Titanium	2.0	.059	.092		
Uranium	0.20	.0017	.002		
Vanadium	1.0	.037	.2		
Zinc	10	.21	.96		

Associated samples MP16642: D73885-1F

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(anr) Analyte not requested

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D73885
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16642
 Matrix Type: AQUEOUS

Methods: EPA 200.8
 Units: ug/l

Prep Date: 08/16/15

Metal	D73859-1FA Original MS	Spikelot ICPALL2	% Rec	QC Limits
Aluminum				
Antimony				
Arsenic	anr			
Barium				
Beryllium				
Boron	anr			
Cadmium	anr			
Calcium	anr			
Chromium				
Cobalt				
Copper	anr			
Iron				
Lead	anr			
Magnesium	anr			
Manganese	1.2	96.8	100	95.6 70-130
Molybdenum	anr			
Nickel	anr			
Phosphorus				
Potassium	anr			
Selenium	3.8	218	200	107.0 70-130
Silver	anr			
Sodium	anr			
Strontium				
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc	anr			

Associated samples MP16642: D73885-1F

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits
 (N) Matrix Spike Rec. outside of QC limits
 (anr) Analyte not requested

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D73885
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16642
 Matrix Type: AQUEOUS

Methods: EPA 200.8
 Units: ug/l

Prep Date: 08/16/15

Metal	D73859-1FA		Spikelot		MSD	QC
	Original	MSD	ICPALL2	% Rec	RPD	Limit
Aluminum						
Antimony						
Arsenic	anr					
Barium						
Beryllium						
Boron	anr					
Cadmium	anr					
Calcium	anr					
Chromium						
Cobalt						
Copper	anr					
Iron						
Lead	anr					
Magnesium	anr					
Manganese	1.2	96.1	100	94.9	0.7	20
Molybdenum	anr					
Nickel	anr					
Phosphorus						
Potassium	anr					
Selenium	3.8	205	200	100.5	5.7	20
Silver	anr					
Sodium	anr					
Strontium						
Thallium						
Tin						
Titanium						
Uranium						
Vanadium						
Zinc	anr					

Associated samples MP16642: D73885-1F

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits
 (N) Matrix Spike Rec. outside of QC limits
 (anr) Analyte not requested

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D73885

Account: LTENCODU - LT Environmental

Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16642

Methods: EPA 200.8

Matrix Type: AQUEOUS

Units: ug/l

Prep Date:

08/16/15

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
Aluminum				
Antimony				
Arsenic	anr			
Barium				
Beryllium				
Boron	anr			
Cadmium	anr			
Calcium	anr			
Chromium				
Cobalt				
Copper	anr			
Iron				
Lead	anr			
Magnesium	anr			
Manganese	104	100	104.0	85-115
Molybdenum	anr			
Nickel	anr			
Phosphorus				
Potassium	anr			
Selenium	237	200	118.5*(a	85-115
Silver	anr			
Sodium	anr			
Strontium				
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc	anr			

Associated samples MP16642: D73885-1F

Results < IDL are shown as zero for calculation purposes

(*) Outside of QC limits

(anr) Analyte not requested

(a) All sample results < RL

8.2.3

8

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: D73885
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16654
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
Units: ug/l

Prep Date: 08/17/15

Metal	RL	IDL	MDL	MB raw	final
Aluminum	500	55	65		
Antimony	150	11	44		
Arsenic	130	19	60		
Barium	50	1	2		
Beryllium	50	4.5	8		
Boron	250	4	18		
Cadmium	50	1	4		
Calcium	2000	12	50	-85	<2000
Chromium	50	1.5	3.5		
Cobalt	25	2.5	6		
Copper	50	4	19		
Iron	350	7.5	35		
Lead	250	11	25		
Lithium	25	2	3.5		
Magnesium	1000	34	200	233	<1000
Manganese	25	2.5	4.5		
Molybdenum	50	2	18		
Nickel	150	2.5	14		
Phosphorus	500	75	170		
Potassium	5000	500	360		
Selenium	250	36	50		
Silicon	250	24	42		
Silver	150	1.5	3		
Sodium	2000	37	70	166	<2000
Strontium	25	.05	1.5		
Thallium	50	9	40		
Tin	250	60	60		
Titanium	50	.5	14		
Uranium	250	15	22		
Vanadium	50	2	3		
Zinc	150	2	18		

Associated samples MP16654: D73885-1A

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: D73885
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

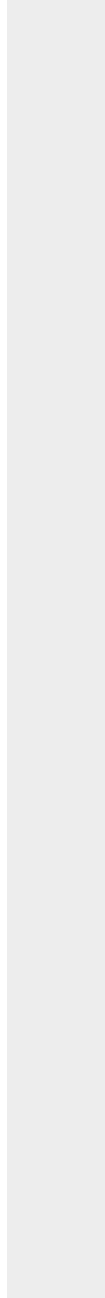
QC Batch ID: MP16654
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
Units: ug/l

Prep Date: 08/17/15

Metal	RL	IDL	MDL	MB raw	final
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(anr) Analyte not requested



8.3.1

8

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D73885
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16654
 Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
 Units: ug/l

Prep Date: 08/17/15

Metal	D73885-1A Original MS		Spikelot ICPALL2	% Rec	QC Limits
Aluminum					
Antimony					
Arsenic					
Barium					
Beryllium					
Boron					
Cadmium					
Calcium	71700	202000	125000	104.2	75-125
Chromium					
Cobalt					
Copper					
Iron					
Lead					
Lithium					
Magnesium	14000	141000	125000	101.6	75-125
Manganese					
Molybdenum					
Nickel					
Phosphorus					
Potassium					
Selenium					
Silicon					
Silver					
Sodium	16700	146000	125000	103.4	75-125
Strontium					
Thallium					
Tin					
Titanium					
Uranium					
Vanadium					
Zinc					

Associated samples MP16654: D73885-1A

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits

8.3.2
8

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D73885
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

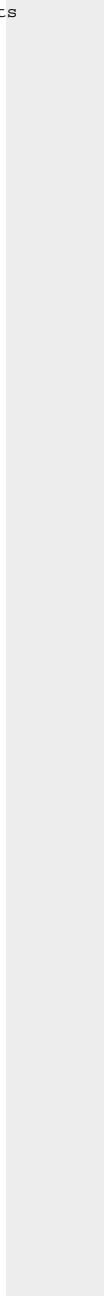
QC Batch ID: MP16654
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
Units: ug/l

Prep Date: 08/17/15

Metal	D73885-1A Original MS	SpikeLot ICPALL2	% Rec	QC Limits
-------	--------------------------	---------------------	-------	--------------

(N) Matrix Spike Rec. outside of QC limits
(anr) Analyte not requested



8.3.2

8

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D73885
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16654
 Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
 Units: ug/l

Prep Date: 08/17/15

Metal	D73885-1A Original	MSD	SpikeLot ICPAL2	% Rec	MSD RPD	QC Limit
Aluminum						
Antimony						
Arsenic						
Barium						
Beryllium						
Boron						
Cadmium						
Calcium	71700	201000	125000	103.4	0.5	20
Chromium						
Cobalt						
Copper						
Iron						
Lead						
Lithium						
Magnesium	14000	142000	125000	102.4	0.7	20
Manganese						
Molybdenum						
Nickel						
Phosphorus						
Potassium						
Selenium						
Silicon						
Silver						
Sodium	16700	147000	125000	104.2	0.7	20
Strontium						
Thallium						
Tin						
Titanium						
Uranium						
Vanadium						
Zinc						

Associated samples MP16654: D73885-1A

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D73885
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

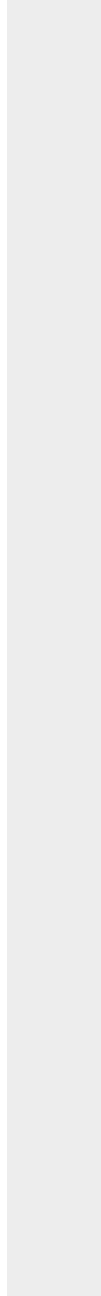
QC Batch ID: MP16654
 Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
 Units: ug/l

Prep Date: 08/17/15

Metal	D73885-1A Original MSD	SpikeLot ICPALL2 % Rec	MSD RPD	QC Limit
-------	---------------------------	---------------------------	------------	-------------

(N) Matrix Spike Rec. outside of QC limits
 (anr) Analyte not requested



8.3.2

8

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D73885

Account: LTENCODU - LT Environmental

Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16654

Methods: SW846 6010C, USDA HANDBOOK 60

Matrix Type: AQUEOUS

Units: ug/l

Prep Date:

08/17/15

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
Aluminum				
Antimony				
Arsenic				
Barium				
Beryllium				
Boron				
Cadmium				
Calcium	130000	125000	104.0	80-120
Chromium				
Cobalt				
Copper				
Iron				
Lead				
Lithium				
Magnesium	128000	125000	102.4	80-120
Manganese				
Molybdenum				
Nickel				
Phosphorus				
Potassium				
Selenium				
Silicon				
Silver				
Sodium	129000	125000	103.2	80-120
Strontium				
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc				

Associated samples MP16654: D73885-1A

Results < IDL are shown as zero for calculation purposes

(*) Outside of QC limits

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D73885
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

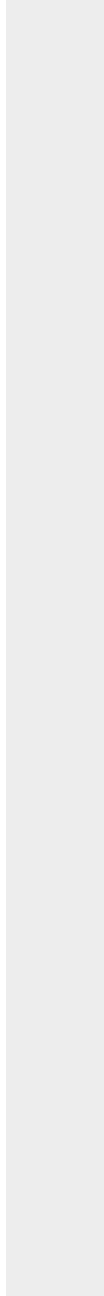
QC Batch ID: MP16654
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
Units: ug/l

Prep Date: 08/17/15

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
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(anr) Analyte not requested



SERIAL DILUTION RESULTS SUMMARY

Login Number: D73885
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16654
 Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
 Units: ug/l

Prep Date: 08/17/15

Metal		D73885-1A Original SDL 1:5		%DIF	QC Limits
Aluminum					
Antimony					
Arsenic					
Barium					
Beryllium					
Boron					
Cadmium					
Calcium	14300	14200	0.9	0-10	
Chromium					
Cobalt					
Copper					
Iron					
Lead					
Lithium					
Magnesium	2790	2920	4.6	0-10	
Manganese					
Molybdenum					
Nickel					
Phosphorus					
Potassium					
Selenium					
Silicon					
Silver					
Sodium	3340	3420	2.5	0-10	
Strontium					
Thallium					
Tin					
Titanium					
Uranium					
Vanadium					
Zinc					

Associated samples MP16654: D73885-1A

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits

SERIAL DILUTION RESULTS SUMMARY

Login Number: D73885
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

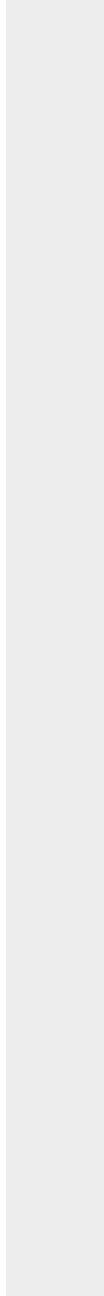
QC Batch ID: MP16654
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
Units: ug/l

Prep Date: 08/17/15

	D73885-1A		QC
Metal	Original SDL 1:5	%DIF	Limits

(anr) Analyte not requested



8.3.4

8

General Chemistry

QC Data Summaries

Includes the following where applicable:

- Method Blank and Blank Spike Summaries
- Duplicate Summaries
- Matrix Spike Summaries

METHOD BLANK AND SPIKE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: D73885
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

Analyte	Batch ID	RL	MB Result	Units	Spike Amount	BSP Result	BSP %Recov	QC Limits
Alkalinity, Bicarbonate as CaC	GN31193	5.0	0.0	mg/l	100	94.4	94.4	90-110%
Alkalinity, Carbonate	GN31194	5.0	0.0	mg/l	100	94.4	94.4	80-120%
Alkalinity, Total as CaCO3	GN31192	5.0	0.0	mg/l	100	94	94.4	90-110%
Bromide	GP15978/GN31169	0.050	0.0	mg/l	0.5	0.524	104.8	90-110%
Chloride	GP15978/GN31169	0.50	0.0	mg/l	5	5.16	103.2	90-110%
Fluoride	GP15978/GN31169	0.10	0.0	mg/l	1	1.03	103.0	90-110%
Hydrogen Sulfide	GN31239	0.50	<0.50	mg/l	3.51	3.2	91.2	60-120%
Iron-Related Bacteria	MB602	25	<25	CFU/ml				
Nitrogen, Nitrate	GP15978/GN31169	0.010	0.0	mg/l	0.1	0.105	105.0	90-110%
Nitrogen, Nitrite	GP15978/GN31169	0.0040	0.0	mg/l	0.05	0.0529	105.8	90-110%
Slime Forming Bacteria	MB603	500	<500	CFU/ml				
Solids, Total Dissolved	GN31195	10	0.0	mg/l				
Solids, Total Dissolved	GN31195	10	0.0	mg/l	400	393	98.3	90-110%
Specific Conductivity	GP16007/GN31222			umhos/cm	99.4	92.3	92.9	90-110%
Sulfate	GP15978/GN31169	0.50	0.0	mg/l	5	5.19	103.8	90-110%
Sulfate Reducing Bacteria	MB604	200	<200	CFU/ml				
pH	GN31218			su	8.00	7.98	99.8	99.1-100.9%

Associated Samples:

Batch MB602: D73885-1B
Batch MB603: D73885-1B
Batch MB604: D73885-1B
Batch GN31192: D73885-1
Batch GN31193: D73885-1
Batch GN31194: D73885-1
Batch GN31195: D73885-1
Batch GN31218: D73885-1
Batch GN31239: D73885-1
Batch GP15978: D73885-1
Batch GP16007: D73885-1
(*) Outside of QC limits

DUPLICATE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: D73885
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

Analyte	Batch ID	QC Sample	Units	Original Result	DUP Result	RPD	QC Limits
Alkalinity, Total as CaCO ₃	GN31192	D73885-1	mg/l	196	193	1.3	0-20%
Hydrogen Sulfide	GN31239	D73885-1	mg/l	<0.50	<0.50	0.0	0-20%
Solids, Total Dissolved	GN31195	D73885-1	mg/l	291	288	1.0	0-20%
Specific Conductivity	GP16007/GN31222	D73885-1	umhos/cm	405	411	1.5	0-20%

Associated Samples:

Batch GN31192: D73885-1

Batch GN31195: D73885-1

Batch GN31239: D73885-1

Batch GP16007: D73885-1

(*) Outside of QC limits

MATRIX SPIKE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: D73885
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

Analyte	Batch ID	QC Sample	Units	Original Result	Spike Amount	MS Result	%Rec	QC Limits
Alkalinity, Total as CaCO ₃	GN31192	D73944-1	mg/l	238	100	320	86.7	80-120%
Bromide	GP15978/GN31169	D73904-5	mg/l	0.025 U	0.5	0.52	104.0	80-120%
Chloride	GP15978/GN31169	D73904-5	mg/l	5.1	5	10.3	104.0	80-120%
Fluoride	GP15978/GN31169	D73904-5	mg/l	0.26	1	1.3	104.0	80-120%
Nitrogen, Nitrate	GP15978/GN31169	D73904-5	mg/l	0.0060 U	0.1	0.10	100.0	80-120%
Nitrogen, Nitrite	GP15978/GN31169	D73904-5	mg/l	0.0030 U	0.05	0.052	104.0	80-120%
Sulfate	GP15978/GN31169	D73904-5	mg/l	3.2	5	8.3	102.0	80-120%

Associated Samples:

Batch GN31192: D73885-1

Batch GP15978: D73885-1

(*) Outside of QC limits

(N) Matrix Spike Rec. outside of QC limits

MATRIX SPIKE DUPLICATE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: D73885
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

Analyte	Batch ID	QC Sample	Units	Original Result	Spike Amount	MSD Result	RPD	QC Limit
Alkalinity, Total as CaCO ₃	GN31192	D73944-1	mg/l	238	100	330	2.7	20%
Bromide	GP15978/GN31169	D73904-5	mg/l	0.025 U	0.5	0.52	0.0	20%
Chloride	GP15978/GN31169	D73904-5	mg/l	5.1	5	10.3	0.0	20%
Fluoride	GP15978/GN31169	D73904-5	mg/l	0.26	1	1.3	0.0	20%
Nitrogen, Nitrate	GP15978/GN31169	D73904-5	mg/l	0.0060 U	0.1	0.10	0.0	20%
Nitrogen, Nitrite	GP15978/GN31169	D73904-5	mg/l	0.0030 U	0.05	0.052	0.0	20%
Sulfate	GP15978/GN31169	D73904-5	mg/l	3.2	5	8.3	0.0	20%

Associated Samples:

Batch GN31192: D73885-1

Batch GP15978: D73885-1

(*) Outside of QC limits

(N) Matrix Spike Rec. outside of QC limits



08/25/15

Technical Report for

LT Environmental

Rule 608 Compliance XTO Raton Basin

012915029

Accutest Job Number: D73886

Sampling Date: 08/12/15

Report to:

LT Environmental
2243 Main Avenue Suite #3
Durango, CO 81301
dhencmann@ltenv.com

ATTN: Devin Hencmann

Total number of pages in report: **52**



Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.

A handwritten signature in black ink, appearing to read 'Scott Heideman'.

Scott Heideman
Laboratory Director

Client Service contact: Renea Jackson 303-425-6021

Certifications: CO (CO00049), ID, NE (CO00049), ND (R-027), NJ (CO 0007), OK (D9942), UT (NELAP CO00049), LA (LA150028), TX (T104704511), WY

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Test results relate only to samples analyzed.

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Sample Summary

LT Environmental

Job No: D73886

Rule 608 Compliance XTO Raton Basin
Project No: 012915029

Sample Number	Collected Date	Time By	Received	Matrix Code	Type	Client Sample ID
D73886-1	08/12/15	09:30 MWDN	08/13/15	AQ	Ground Water	CHAVEZ_01
D73886-1A	08/12/15	09:30 MWDN	08/13/15	AQ	Ground Water	CHAVEZ_01
D73886-1B	08/12/15	09:30 MWDN	08/13/15	AQ	Ground Water	CHAVEZ_01
D73886-1F	08/12/15	09:30 MWDN	08/13/15	AQ	Groundwater Filtered	CHAVEZ_01

CASE NARRATIVE / CONFORMANCE SUMMARY

Client: LT Environmental

Job No D73886

Site: Rule 608 Compliance XTO Raton Basin

Report Date 8/25/2015 11:52:42 A

On 08/13/2015, 1 sample(s), 0 Trip Blank(s), and 0 Field Blank(s) were received at Accutest Mountain States (AMS) at a temperature of 3.9 °C. The samples were intact and properly preserved, unless noted below. An AMS Job Number of D73886 was assigned to the project. The lab sample ID, client sample ID, and date of sample collection are detailed in the report's Results Summary.

Specified quality control criteria were achieved for this job except as noted below. For more information, please refer to the analytical results and QC summary pages.

Volatiles by GC By Method RSK175 MOD

Matrix: AQ

Batch ID: GFB708

- All samples were analyzed within the recommended method holding time.
- Sample(s) D73923-1MS, D73923-1MSD were used as the QC samples indicated.
- All method blanks for this batch meet method specific criteria.
- D73923-1MS and D73923-1MSD: The pH of the sample was >2 at time of analysis.

Metals By Method EPA 200.7

Matrix: AQ

Batch ID: MP16639

- All samples were digested and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D73885-1FMS, D73885-1FMSD were used as the QC samples for the metals analysis.

Metals By Method EPA 200.8

Matrix: AQ

Batch ID: MP16642

- All samples were digested and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D73859-1FAMS, D73859-1FAMSD were used as the QC samples for the metals analysis.
- The blank spike (BS) recovery(s) of Selenium are outside control limits.
- MP16642-B1 for Selenium: All sample results < RL

Metals By Method SW846 6010C

Matrix: AQ

Batch ID: MP16654

- All samples were digested and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D73885-1AMS, D73885-1AMSD, D73885-1ASDL were used as the QC samples for the metals analysis.

Wet Chemistry By Method EPA 300.0/SW846 9056

Matrix: AQ

Batch ID: GP15978

- All samples were prepared and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D73904-5MS, D73904-5MSD were used as the QC samples for the Bromide, Chloride, Fluoride, Nitrogen, Nitrate, Nitrogen, Nitrite, Sulfate, Bromide analysis.

Matrix: AQ

Batch ID: R29556

- The data for EPA 300.0/SW846 9056 meets quality control requirements.
- D73886-1 for Nitrogen, Nitrate + Nitrite: Calculated as: (Nitrogen, Nitrate) + (Nitrogen, Nitrite)

Wet Chemistry By Method HACH IRB-BART

Matrix: AQ

Batch ID: MB602

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.

Wet Chemistry By Method HACH SLYM-BART

Matrix: AQ

Batch ID: MB603

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.

Wet Chemistry By Method HACH SRB-BART

Matrix: AQ

Batch ID: MB604

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.

Wet Chemistry By Method SM 2320B-2011

Matrix: AQ

Batch ID: GN31192

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D73885-1DUP, D73944-1MS, D73944-1MSD were used as the QC samples for the Alkalinity, Total as CaCO₃ analysis.

Matrix: AQ

Batch ID: GN31193

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.

Matrix: AQ

Batch ID: GN31194

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.

Wet Chemistry By Method SM 2510B-2011

Matrix: AQ

Batch ID: GP16007

- Sample(s) D73885-1DUP were used as the QC samples for the Specific Conductivity analysis.

Wet Chemistry By Method SM 2540C-2011

Matrix: AQ

Batch ID: GN31195

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D73886-1DUP were used as the QC samples for the Solids, Total Dissolved analysis.

Wet Chemistry By Method SM20 4500 S2 H

Matrix: AQ

Batch ID: GN31239

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D73885-1DUP were used as the QC samples for the Hydrogen Sulfide analysis.

Wet Chemistry By Method SM4500HB+-2011/9040C

Matrix: AQ

Batch ID: GN31218

- The following samples were run outside of holding time for method SM4500HB+-2011/9040C: D73886-1

Wet Chemistry By Method USDA HANDBOOK 60

Matrix: AQ

Batch ID: MP16654

- D73886-1A for Sodium Adsorption Ratio: Calculated as: $(\text{Na meq/L}) / \sqrt{[(\text{Ca meq/L}) + (\text{Mg meq/L})/2]}$

AMS certifies that data reported for samples received, listed on the associated custody chain or analytical task order, were produced to specifications meeting AMS's Quality System precision, accuracy and completeness objectives except as noted.

Estimated non-standard method measurement uncertainty data is available on request, based on quality control bias and implicit for standard methods. Acceptable uncertainty requires tested parameter quality control data to meet method criteria.

AMS is not responsible for data quality assumptions if partial reports are used and recommends that this report be used in its entirety. This report is authorized by AMS indicated via signature on the report cover.

Summary of Hits

Page 1 of 1

Job Number: D73886
Account: LT Environmental
Project: Rule 608 Compliance XTO Raton Basin
Collected: 08/12/15

Lab Sample ID	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
---------------	------------------	-----------------	----	-----	-------	--------

D73886-1 CHAVEZ_01

Methane	0.0025	0.00080	0.00040	mg/l	RSK175 MOD
Alkalinity, Bicarbonate as CaCO ₃	139	5.0		mg/l	SM 2320B-2011
Alkalinity, Total as CaCO ₃	139	5.0		mg/l	SM 2320B-2011
Chloride	15.7	0.50		mg/l	EPA 300.0/SW846 9056
Fluoride	0.23	0.10		mg/l	EPA 300.0/SW846 9056
Solids, Total Dissolved	220	10		mg/l	SM 2540C-2011
Specific Conductivity	285	1.0		umhos/cm	SM 2510B-2011
Sulfate	27.5	0.50		mg/l	EPA 300.0/SW846 9056
pH	7.19			su	SM4500HB+ -2011/9040C

D73886-1A CHAVEZ_01

Calcium	53.6	2.0		mg/l	SW846 6010C
Magnesium	9.92	1.0		mg/l	SW846 6010C
Sodium	15.4	2.0		mg/l	SW846 6010C
Sodium Adsorption Ratio ^a	0.507			ratio	USDA HANDBOOK 60

D73886-1B CHAVEZ_01

Iron-Related Bacteria	74500	25		CFU/ml	HACH IRB-BART
Slime Forming Bacteria	350000	500		CFU/ml	HACH SLYM-BART
Sulfate Reducing Bacteria	< 200	200		CFU/ml	HACH SRB-BART

D73886-1F CHAVEZ_01

Calcium	50400	400		ug/l	EPA 200.7
Iron	14.7	10		ug/l	EPA 200.7
Magnesium	9090	200		ug/l	EPA 200.7
Sodium	13200	400		ug/l	EPA 200.7

(a) Calculated as: (Na meq/L) / sqrt [(Ca meq/L)+ (Mg meq/L)/2]

Sample Results

Report of Analysis

Report of Analysis

Page 1 of 1

Client Sample ID:	CHAVEZ_01	Date Sampled:	08/12/15
Lab Sample ID:	D73886-1	Date Received:	08/13/15
Matrix:	AQ - Ground Water	Percent Solids:	n/a
Method:	RSK175 MOD		
Project:	Rule 608 Compliance XTO Raton Basin		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	FB14968.D	1	08/17/15	JJ	n/a	n/a	GFB708
Run #2							

	Initial Volume	Headspace Volume	Volume Injected	Temperature
Run #1	39.0 ml	4.0 ml	500 ul	21.0 Deg. C
Run #2				

CAS No.	Compound	Result	RL	MDL	Units	Q
74-82-8	Methane	0.0025	0.00080	0.00040	mg/l	

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID: CHAVEZ_01	Date Sampled: 08/12/15
Lab Sample ID: D73886-1	Date Received: 08/13/15
Matrix: AQ - Ground Water	Percent Solids: n/a
Project: Rule 608 Compliance XTO Raton Basin	

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Alkalinity, Bicarbonate as CaC	139	5.0	mg/l	1	08/17/15	JD	SM 2320B-2011
Alkalinity, Carbonate	< 5.0	5.0	mg/l	1	08/17/15 08:00	JD	SM 2320B-2011
Alkalinity, Total as CaCO ₃	139	5.0	mg/l	1	08/17/15 08:00	JD	SM 2320B-2011
Bromide	< 0.050	0.050	mg/l	1	08/13/15 11:10	BF	EPA 300.0/SW846 9056
Chloride	15.7	0.50	mg/l	1	08/13/15 11:10	BF	EPA 300.0/SW846 9056
Fluoride	0.23	0.10	mg/l	1	08/13/15 11:10	BF	EPA 300.0/SW846 9056
Hydrogen Sulfide	< 0.50	0.50	mg/l	1	08/19/15	TJ	SM20 4500 S2 H
Nitrogen, Nitrate	< 0.010	0.010	mg/l	1	08/13/15 11:10	BF	EPA 300.0/SW846 9056
Nitrogen, Nitrate + Nitrite ^a	< 0.014	0.014	mg/l	1	08/13/15 11:10	BF	EPA 300.0/SW846 9056
Nitrogen, Nitrite	< 0.0040	0.0040	mg/l	1	08/13/15 11:10	BF	EPA 300.0/SW846 9056
Solids, Total Dissolved	220	10	mg/l	1	08/17/15	AK	SM 2540C-2011
Specific Conductivity	285	1.0	umhos/cm	1	08/18/15	TJ	SM 2510B-2011
Sulfate	27.5	0.50	mg/l	1	08/13/15 11:10	BF	EPA 300.0/SW846 9056
pH	7.19		su	1	08/18/15 13:50	TB	SM4500HB+ -2011/9040C

(a) Calculated as: (Nitrogen, Nitrate) + (Nitrogen, Nitrite)

RL = Reporting Limit

Report of Analysis

Client Sample ID:	CHAVEZ_01	Date Sampled:	08/12/15
Lab Sample ID:	D73886-1A	Date Received:	08/13/15
Matrix:	AQ - Ground Water	Percent Solids:	n/a
Project:	Rule 608 Compliance XTO Raton Basin		

SAR Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Calcium	53.6	2.0	mg/l	1	08/17/15	08/18/15 JB	SW846 6010C ¹	SW846 3010A/M ²
Magnesium	9.92	1.0	mg/l	1	08/17/15	08/18/15 JB	SW846 6010C ¹	SW846 3010A/M ²
Sodium	15.4	2.0	mg/l	1	08/17/15	08/18/15 JB	SW846 6010C ¹	SW846 3010A/M ²

(1) Instrument QC Batch: MA6435
(2) Prep QC Batch: MP16654

RL = Reporting Limit

Report of Analysis

Client Sample ID:	CHAVEZ_01	Date Sampled:	08/12/15
Lab Sample ID:	D73886-1A	Date Received:	08/13/15
Matrix:	AQ - Ground Water	Percent Solids:	n/a
Project:	Rule 608 Compliance XTO Raton Basin		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Sodium Adsorption Ratio ^a	0.507		ratio	1	08/18/15 07:08	JB	USDA HANDBOOK 60

(a) Calculated as: (Na meq/L) / sqrt [(Ca meq/L)+ (Mg meq/L)/2]

RL = Reporting Limit

Report of Analysis

Client Sample ID:	CHAVEZ_01	Date Sampled:	08/12/15
Lab Sample ID:	D73886-1B	Date Received:	08/13/15
Matrix:	AQ - Ground Water	Percent Solids:	n/a
Project:	Rule 608 Compliance XTO Raton Basin		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Iron-Related Bacteria	74500	25	CFU/ml	1	08/17/15 14:00	MM	HACH IRB-BART
Slime Forming Bacteria	350000	500	CFU/ml	1	08/17/15 14:00	MM	HACH SLYM-BART
Sulfate Reducing Bacteria	< 200	200	CFU/ml	1	08/17/15 14:00	MM	HACH SRB-BART

RL = Reporting Limit

Report of Analysis

Client Sample ID: CHAVEZ_01**Lab Sample ID:** D73886-1F**Matrix:** AQ - Groundwater Filtered**Date Sampled:** 08/12/15**Date Received:** 08/13/15**Percent Solids:** n/a**Project:** Rule 608 Compliance XTO Raton Basin**Dissolved Metals Analysis**

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Calcium	50400	400	ug/l	1	08/16/15	08/18/15 JB	EPA 200.7 ²	EPA 200.7 ³
Iron	14.7	10	ug/l	1	08/16/15	08/18/15 JB	EPA 200.7 ²	EPA 200.7 ³
Magnesium	9090	200	ug/l	1	08/16/15	08/18/15 JB	EPA 200.7 ²	EPA 200.7 ³
Manganese	< 5.0	5.0	ug/l	1	08/16/15	08/18/15 JB	EPA 200.7 ²	EPA 200.7 ³
Potassium	< 1000	1000	ug/l	1	08/16/15	08/18/15 JB	EPA 200.7 ²	EPA 200.7 ³
Selenium	< 0.80	0.80	ug/l	2	08/16/15	08/18/15 KV	EPA 200.8 ¹	EPA 200.8 ⁴
Sodium	13200	400	ug/l	1	08/16/15	08/18/15 JB	EPA 200.7 ²	EPA 200.7 ³

(1) Instrument QC Batch: MA6434

(2) Instrument QC Batch: MA6440

(3) Prep QC Batch: MP16639

(4) Prep QC Batch: MP16642

RL = Reporting Limit



Subcontract Lab Data

5

Report of Analysis



**industrial
LABORATORIES**

Industrial Laboratories is your independent,
third-party analytical testing laboratory

To: Accutest Mountain States (AMS)
4036 Youngfield St.

Wheat Ridge CO 80033

Attn: Renea Rooks

TEST REPORT

ACCUTEST - M

Date Received: 8/14/2015

Date Reported: 8/18/2015

PO Number: D73886X

Lab No.	Sample Description	Test Method	Result	Units	MDL	Analysis Date/By
150814007-01A	D73886X -1, 8/12/15, 9:30 AM	* Total Coliforms MPN SMEWW 9221 B	<2 fecal; 7 total	MPN/100mL		AT 8/14/2015

Department Manager

* = Scope Analysis

= Subcontracted Analysis

MDL = Method Detection Limit

ND = Not Detected at the Method Detection Limit

Page: 1 of 1

Samples received in good condition unless otherwise noted in case narrative.

4046 Youngfield Street • Wheat Ridge, Colorado 80033 • (303) 287-9691 • (303) 287-0964 FAX • www.industriallabs.net

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ACCUTEST®

4036 Youngfield St., Wheat Ridge, CO 80033
303-425-6021 FAX: 303-425-6854

Accutest Job #:	D73886X
Accutest Quote #:	0
AMS P.O. #:	
Project No.:	

[illegible]

Misc. Forms

Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody

[illegible]

6.1

D73886: Chain of Custody

Page 1 of 2

Accutest Laboratories Sample Receipt Summary

Accutest Job Number: D73886 **Client:** LT ENVIRONMENTAL **Project:** RULE 608
Date / Time Received: 8/13/2015 9:45:00 AM **Delivery Method:** _____ **Airbill #'s:** fxe
Cooler Temps (Initial/Adjusted): #1: (3.9/3.9):

Cooler Security
Y or N

- | | |
|--|---|
| 1. Custody Seals Present: <input checked="" type="checkbox"/> <input type="checkbox"/> | 3. COC Present: <input checked="" type="checkbox"/> <input type="checkbox"/> |
| 2. Custody Seals Intact: <input checked="" type="checkbox"/> <input type="checkbox"/> | 4. Smpl Dates/Time OK: <input checked="" type="checkbox"/> <input type="checkbox"/> |

Cooler Temperature
Y or N

- | | |
|---|--|
| 1. Temp criteria achieved: <input checked="" type="checkbox"/> <input type="checkbox"/> | |
| 2. Cooler temp verification: <u>Bar Therm;</u> | |
| 3. Cooler media: <u>Ice (Bag)</u> | |
| 4. No. Coolers: <u>1</u> | |

Quality Control Preservation
Y or N
N/A

- | | |
|---|--|
| 1. Trip Blank present / cooler: <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | |
| 2. Trip Blank listed on COC: <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | |
| 3. Samples preserved properly: <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | |
| 4. VOCs headspace free: <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | |

Comments

Sample Integrity - Documentation
Y or N

- | | |
|---|--|
| 1. Sample labels present on bottles: <input checked="" type="checkbox"/> <input type="checkbox"/> | |
| 2. Container labeling complete: <input checked="" type="checkbox"/> <input type="checkbox"/> | |
| 3. Sample container label / COC agree: <input checked="" type="checkbox"/> <input type="checkbox"/> | |

Sample Integrity - Condition
Y or N

- | | |
|---|--|
| 1. Sample recvd within HT: <input checked="" type="checkbox"/> <input type="checkbox"/> | |
| 2. All containers accounted for: <input checked="" type="checkbox"/> <input type="checkbox"/> | |
| 3. Condition of sample: <u>Intact</u> | |

Sample Integrity - Instructions
Y or N N/A

- | | |
|--|--|
| 1. Analysis requested is clear: <input checked="" type="checkbox"/> <input type="checkbox"/> | |
| 2. Bottles received for unspecified tests: <input type="checkbox"/> <input checked="" type="checkbox"/> | |
| 3. Sufficient volume recvd for analysis: <input checked="" type="checkbox"/> <input type="checkbox"/> | |
| 4. Compositing instructions clear: <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> | |
| 5. Filtering instructions clear: <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> | |

GC Volatiles

QC Data Summaries

Includes the following where applicable:

- Method Blank Summaries
- Blank Spike Summaries
- Matrix Spike and Duplicate Summaries

Method Blank Summary

Job Number: D73886
Account: LTENCODU LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
GFB708-MB	FB14952.D	1	08/17/15	JJ	n/a	n/a	GFB708

The QC reported here applies to the following samples: Method: RSK175 MOD

D73886-1

CAS No.	Compound	Result	RL	MDL	Units	Q
74-82-8	Methane	ND	0.00080	0.00040	mg/l	

7.1.1
7

Blank Spike Summary

Job Number: D73886
Account: LTENCODU LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
GFB708-BS	FB14953.D	10	08/17/15	JJ	n/a	n/a	GFB708

The QC reported here applies to the following samples: Method: RSK175 MOD

D73886-1

CAS No.	Compound	Spike mg/l	BSP mg/l	BSP %	Limits
74-82-8	Methane	0.512	0.550	107	70-130

* = Outside of Control Limits.

Matrix Spike/Matrix Spike Duplicate Summary

Job Number: D73886
Account: LTENCODU LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
D73923-1MS ^a	FB14955.D	10	08/17/15	JJ	n/a	n/a	GFB708
D73923-1MSD ^a	FB14956.D	10	08/17/15	JJ	n/a	n/a	GFB708
D73923-1 ^a	FB14954.D	1	08/17/15	JJ	n/a	n/a	GFB708

The QC reported here applies to the following samples: Method: RSK175 MOD

D73886-1

CAS No.	Compound	D73923-1 mg/l	Q	Spike mg/l	MS mg/l	MS %	Spike mg/l	MSD mg/l	MSD %	RPD	Limits Rec/RPD
74-82-8	Methane	ND		0.512	0.523	102	0.512	0.513	100	2	51-155/30

(a) The pH of the sample was > 2 at time of analysis.

* = Outside of Control Limits.

Metals Analysis

QC Data Summaries

Includes the following where applicable:

- Method Blank Summaries
- Matrix Spike and Duplicate Summaries
- Blank Spike and Lab Control Sample Summaries
- Serial Dilution Summaries

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: D73886
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16639
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 08/16/15

Metal	RL	IDL	MDL	MB raw	final
Aluminum	100	8.6	46		
Antimony	30	3.2	8.7		
Arsenic	25	5.2	12		
Barium	10	1.4	.2		
Beryllium	10	.8	1.6		
Boron	50	6.7	3.7		
Cadmium	10	.4	.6		
Calcium	400	2.2	22	8.5	<400
Chromium	10	.4	1		
Cobalt	5.0	.4	1.2		
Copper	10	1.2	2.9		
Iron	10	2.2	6.9	2.9	<10
Lead	50	3.6	9.1		
Lithium	5.0	1.9	1		
Magnesium	200	14	39	5.8	<200
Manganese	5.0	.01	.4	0.10	<5.0
Molybdenum	10	.8	3.6		
Nickel	30	.9	2.1		
Phosphorus	100	15	47		
Potassium	1000	130	61	14.1	<1000
Selenium	50	8.8	15		
Silicon	50	5.2	6.2		
Silver	30	.4	.9		
Sodium	400	4.9	14	73.5	<400
Strontium	5.0	.01	.3		
Thallium	10	2.9	9.1		
Tin	50	13	25		
Titanium	10	.15	2.5		
Uranium	50	3.7	4.4		
Vanadium	10	.4	.6		
Zinc	30	.6	3.5		

Associated samples MP16639: D73886-1F

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: D73886
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

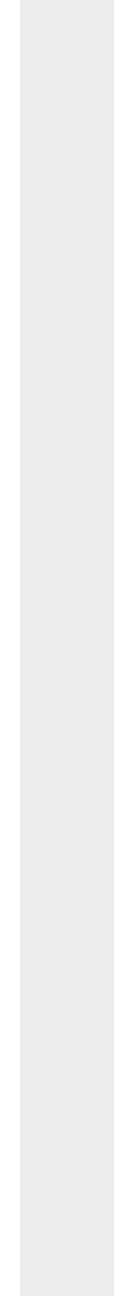
QC Batch ID: MP16639
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 08/16/15

Metal	RL	IDL	MDL	MB raw	final
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(anr) Analyte not requested



8.1.1

8

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D73886
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16639
 Matrix Type: AQUEOUS

Methods: EPA 200.7
 Units: ug/l

Prep Date: 08/16/15

Metal	D73885-1F Original MS		Spikelot ICPAL2	% Rec	QC Limits
Aluminum					
Antimony					
Arsenic					
Barium					
Beryllium					
Boron					
Cadmium					
Calcium	68700	93500	25000	99.2	70-130
Chromium					
Cobalt					
Copper					
Iron	47.3	5220	5000	103.5	70-130
Lead					
Lithium					
Magnesium	13300	38500	25000	100.8	70-130
Manganese	0.90	539	500	107.6	70-130
Molybdenum					
Nickel					
Phosphorus					
Potassium	1610	26200	25000	98.4	70-130
Selenium					
Silicon					
Silver					
Sodium	14900	38800	25000	95.6	70-130
Strontium					
Thallium					
Tin					
Titanium					
Uranium					
Vanadium					
Zinc					

Associated samples MP16639: D73886-1F

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits

8.1.2
8

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D73886
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

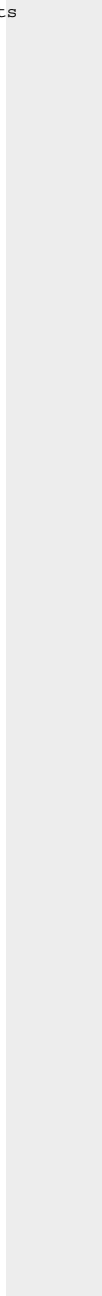
QC Batch ID: MP16639
 Matrix Type: AQUEOUS

Methods: EPA 200.7
 Units: ug/l

Prep Date: 08/16/15

Metal	D73885-1F Original MS	SpikeLot ICPALL2	% Rec	QC Limits
-------	--------------------------	---------------------	-------	--------------

(N) Matrix Spike Rec. outside of QC limits
 (anr) Analyte not requested



MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D73886
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16639
 Matrix Type: AQUEOUS

Methods: EPA 200.7
 Units: ug/l

Prep Date: 08/16/15

Metal	D73885-1F Original MSD		Spikelot ICPAL2	% Rec	MSD RPD	QC Limit
Aluminum						
Antimony						
Arsenic						
Barium						
Beryllium						
Boron						
Cadmium						
Calcium	68700	93200	25000	98.0	0.3	20
Chromium						
Cobalt						
Copper						
Iron	47.3	5180	5000	102.7	0.8	20
Lead						
Lithium						
Magnesium	13300	38200	25000	99.6	0.8	20
Manganese	0.90	534	500	106.6	0.9	20
Molybdenum						
Nickel						
Phosphorus						
Potassium	1610	25800	25000	96.8	1.5	20
Selenium						
Silicon						
Silver						
Sodium	14900	38300	25000	93.6	1.3	20
Strontium						
Thallium						
Tin						
Titanium						
Uranium						
Vanadium						
Zinc						

Associated samples MP16639: D73886-1F

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D73886
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

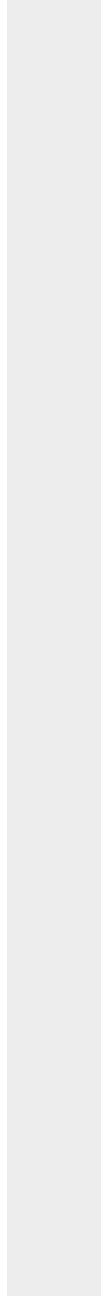
QC Batch ID: MP16639
 Matrix Type: AQUEOUS

Methods: EPA 200.7
 Units: ug/l

Prep Date: 08/16/15

Metal	D73885-1F Original MSD	SpikeLot ICPALL2 % Rec	MSD RPD	QC Limit
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(N) Matrix Spike Rec. outside of QC limits
 (anr) Analyte not requested



8.1.2

8

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D73886
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16639
 Matrix Type: AQUEOUS

Methods: EPA 200.7
 Units: ug/l

Prep Date: 08/16/15

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
Aluminum				
Antimony				
Arsenic				
Barium				
Beryllium				
Boron				
Cadmium				
Calcium	25600	25000	102.4	85-115
Chromium				
Cobalt				
Copper				
Iron	5170	5000	103.4	85-115
Lead				
Lithium				
Magnesium	25400	25000	101.6	85-115
Manganese	544	500	108.8	85-115
Molybdenum				
Nickel				
Phosphorus				
Potassium	24200	25000	96.8	85-115
Selenium				
Silicon				
Silver				
Sodium	23800	25000	95.2	85-115
Strontium				
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc				

Associated samples MP16639: D73886-1F

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D73886
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

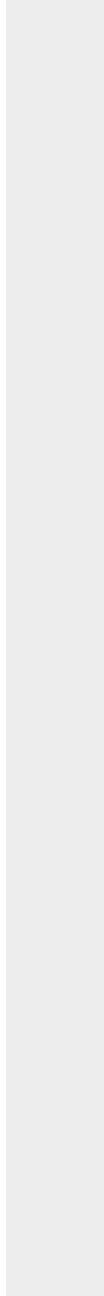
QC Batch ID: MP16639
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 08/16/15

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
-------	---------------	---------------------	-------	--------------

(anr) Analyte not requested



BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: D73886
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16642
Matrix Type: AQUEOUS

Methods: EPA 200.8
Units: ug/l

Prep Date: 08/16/15

Metal	RL	IDL	MDL	MB raw	final
Aluminum	50	1.1	2		
Antimony	0.40	.0022	.011		
Arsenic	0.20	.017	.044		
Barium	2.0	.016	.079		
Beryllium	0.20	.016	.069		
Boron	40	.49	2.1		
Cadmium	0.10	.036	.042		
Calcium	400	5.6	12		
Chromium	2.0	.053	.053		
Cobalt	0.20	.0049	.015		
Copper	2.0	.06	.13		
Iron	10	3.5	4.6		
Lead	0.50	.0079	.008		
Magnesium	100	1.3	1.3		
Manganese	1.0	.12	.13		
Molybdenum	1.0	.049	.029		
Nickel	2.0	.0088	.027		
Phosphorus	60	2.6	4.3		
Potassium	200	2.9	2.9		
Selenium	0.40	.06	.21	0.038	<0.40
Silver	0.10	.0019	.008		
Sodium	500	4.9	4.9		
Strontium	20	.01	.015		
Thallium	0.20	.0024	.005		
Tin	10	.063	1.3		
Titanium	2.0	.059	.092		
Uranium	0.20	.0017	.002		
Vanadium	1.0	.037	.2		
Zinc	10	.21	.96		

Associated samples MP16642: D73886-1F

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(anr) Analyte not requested

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D73886
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16642
 Matrix Type: AQUEOUS

Methods: EPA 200.8
 Units: ug/l

Prep Date: 08/16/15

Metal	D73859-1FA Original MS	Spikelot ICPAL2	% Rec	QC Limits
Aluminum				
Antimony				
Arsenic	anr			
Barium				
Beryllium				
Boron	anr			
Cadmium	anr			
Calcium	anr			
Chromium				
Cobalt				
Copper	anr			
Iron				
Lead	anr			
Magnesium	anr			
Manganese	anr			
Molybdenum	anr			
Nickel	anr			
Phosphorus				
Potassium	anr			
Selenium	3.8	218	200	107.0 70-130
Silver	anr			
Sodium	anr			
Strontium				
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc	anr			

Associated samples MP16642: D73886-1F

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits
 (N) Matrix Spike Rec. outside of QC limits
 (anr) Analyte not requested

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D73886
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16642
 Matrix Type: AQUEOUS

Methods: EPA 200.8
 Units: ug/l

Prep Date: 08/16/15

Metal	D73859-1FA Original MSD	Spikelot ICPAL2	% Rec	MSD RPD	QC Limit
Aluminum					
Antimony					
Arsenic	anr				
Barium					
Beryllium					
Boron	anr				
Cadmium	anr				
Calcium	anr				
Chromium					
Cobalt					
Copper	anr				
Iron					
Lead	anr				
Magnesium	anr				
Manganese	anr				
Molybdenum	anr				
Nickel	anr				
Phosphorus					
Potassium	anr				
Selenium	3.8	205	200	100.5	5.7
Silver	anr				20
Sodium	anr				
Strontium					
Thallium					
Tin					
Titanium					
Uranium					
Vanadium					
Zinc	anr				

Associated samples MP16642: D73886-1F

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits
 (N) Matrix Spike Rec. outside of QC limits
 (anr) Analyte not requested

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D73886

Account: LTENCODU - LT Environmental

Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16642

Methods: EPA 200.8

Matrix Type: AQUEOUS

Units: ug/l

Prep Date:

08/16/15

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
Aluminum				
Antimony				
Arsenic	anr			
Barium				
Beryllium				
Boron	anr			
Cadmium	anr			
Calcium	anr			
Chromium				
Cobalt				
Copper	anr			
Iron				
Lead	anr			
Magnesium	anr			
Manganese	anr			
Molybdenum	anr			
Nickel	anr			
Phosphorus				
Potassium	anr			
Selenium	237	200	118.5*(a	85-115
Silver	anr			
Sodium	anr			
Strontium				
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc	anr			

Associated samples MP16642: D73886-1F

Results < IDL are shown as zero for calculation purposes

(*) Outside of QC limits

(anr) Analyte not requested

(a) All sample results < RL

8.2.3

8

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: D73886
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16654
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
Units: ug/l

Prep Date: 08/17/15

Metal	RL	IDL	MDL	MB raw	final
Aluminum	500	55	65		
Antimony	150	11	44		
Arsenic	130	19	60		
Barium	50	1	2		
Beryllium	50	4.5	8		
Boron	250	4	18		
Cadmium	50	1	4		
Calcium	2000	12	50	-85	<2000
Chromium	50	1.5	3.5		
Cobalt	25	2.5	6		
Copper	50	4	19		
Iron	350	7.5	35		
Lead	250	11	25		
Lithium	25	2	3.5		
Magnesium	1000	34	200	233	<1000
Manganese	25	2.5	4.5		
Molybdenum	50	2	18		
Nickel	150	2.5	14		
Phosphorus	500	75	170		
Potassium	5000	500	360		
Selenium	250	36	50		
Silicon	250	24	42		
Silver	150	1.5	3		
Sodium	2000	37	70	166	<2000
Strontium	25	.05	1.5		
Thallium	50	9	40		
Tin	250	60	60		
Titanium	50	.5	14		
Uranium	250	15	22		
Vanadium	50	2	3		
Zinc	150	2	18		

Associated samples MP16654: D73886-1A

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: D73886
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

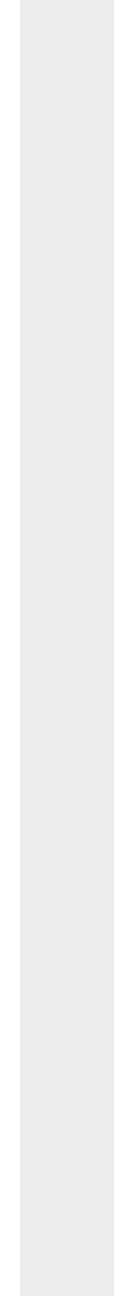
QC Batch ID: MP16654
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
Units: ug/l

Prep Date: 08/17/15

Metal	RL	IDL	MDL	MB raw	final
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(anr) Analyte not requested



8.3.1

8

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D73886
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16654
 Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
 Units: ug/l

Prep Date: 08/17/15

Metal	D73885-1A Original MS		Spikelot ICPALL2	% Rec	QC Limits
Aluminum					
Antimony					
Arsenic					
Barium					
Beryllium					
Boron					
Cadmium					
Calcium	71700	202000	125000	104.2	75-125
Chromium					
Cobalt					
Copper					
Iron					
Lead					
Lithium					
Magnesium	14000	141000	125000	101.6	75-125
Manganese					
Molybdenum					
Nickel					
Phosphorus					
Potassium					
Selenium					
Silicon					
Silver					
Sodium	16700	146000	125000	103.4	75-125
Strontium					
Thallium					
Tin					
Titanium					
Uranium					
Vanadium					
Zinc					

Associated samples MP16654: D73886-1A

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits

8.3.2
8

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D73886
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

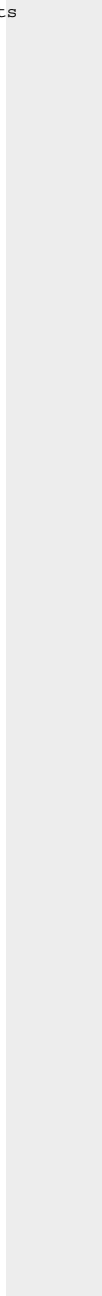
QC Batch ID: MP16654
 Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
 Units: ug/l

Prep Date: 08/17/15

Metal	D73885-1A Original MS	Spikelot ICPALL2 % Rec	QC Limits
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(N) Matrix Spike Rec. outside of QC limits
 (anr) Analyte not requested



8.3.2

8

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D73886
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16654
 Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
 Units: ug/l

Prep Date: 08/17/15

Metal	D73885-1A Original	MSD	SpikeLot ICPAL2	% Rec	MSD RPD	QC Limit
Aluminum						
Antimony						
Arsenic						
Barium						
Beryllium						
Boron						
Cadmium						
Calcium	71700	201000	125000	103.4	0.5	20
Chromium						
Cobalt						
Copper						
Iron						
Lead						
Lithium						
Magnesium	14000	142000	125000	102.4	0.7	20
Manganese						
Molybdenum						
Nickel						
Phosphorus						
Potassium						
Selenium						
Silicon						
Silver						
Sodium	16700	147000	125000	104.2	0.7	20
Strontium						
Thallium						
Tin						
Titanium						
Uranium						
Vanadium						
Zinc						

Associated samples MP16654: D73886-1A

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D73886
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

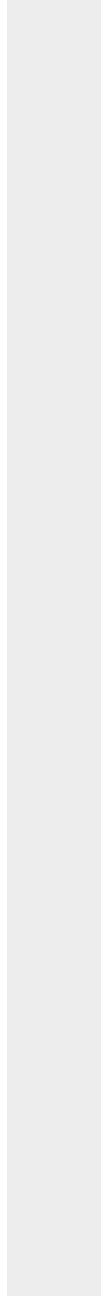
QC Batch ID: MP16654
 Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
 Units: ug/l

Prep Date: 08/17/15

Metal	D73885-1A Original MSD	SpikeLot ICPALL2 % Rec	MSD RPD	QC Limit
-------	---------------------------	---------------------------	------------	-------------

(N) Matrix Spike Rec. outside of QC limits
 (anr) Analyte not requested



8.3.2

8

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D73886
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16654
 Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
 Units: ug/l

Prep Date: 08/17/15

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
Aluminum				
Antimony				
Arsenic				
Barium				
Beryllium				
Boron				
Cadmium				
Calcium	130000	125000	104.0	80-120
Chromium				
Cobalt				
Copper				
Iron				
Lead				
Lithium				
Magnesium	128000	125000	102.4	80-120
Manganese				
Molybdenum				
Nickel				
Phosphorus				
Potassium				
Selenium				
Silicon				
Silver				
Sodium	129000	125000	103.2	80-120
Strontium				
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc				

Associated samples MP16654: D73886-1A

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits

8.3.3
8

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D73886
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

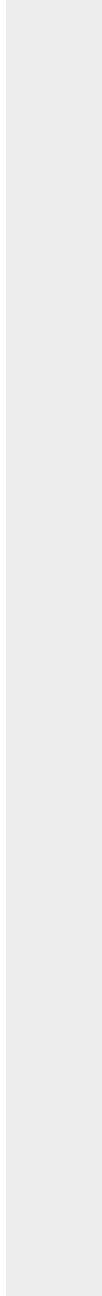
QC Batch ID: MP16654
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
Units: ug/l

Prep Date: 08/17/15

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
-------	---------------	---------------------	-------	--------------

(anr) Analyte not requested



SERIAL DILUTION RESULTS SUMMARY

Login Number: D73886
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16654
 Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
 Units: ug/l

Prep Date: 08/17/15

Metal		D73885-1A Original SDL 1:5		%DIF	QC Limits
Aluminum					
Antimony					
Arsenic					
Barium					
Beryllium					
Boron					
Cadmium					
Calcium	14300	14200	0.9	0-10	
Chromium					
Cobalt					
Copper					
Iron					
Lead					
Lithium					
Magnesium	2790	2920	4.6	0-10	
Manganese					
Molybdenum					
Nickel					
Phosphorus					
Potassium					
Selenium					
Silicon					
Silver					
Sodium	3340	3420	2.5	0-10	
Strontium					
Thallium					
Tin					
Titanium					
Uranium					
Vanadium					
Zinc					

Associated samples MP16654: D73886-1A

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits

8.3.4
8

SERIAL DILUTION RESULTS SUMMARY

Login Number: D73886
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

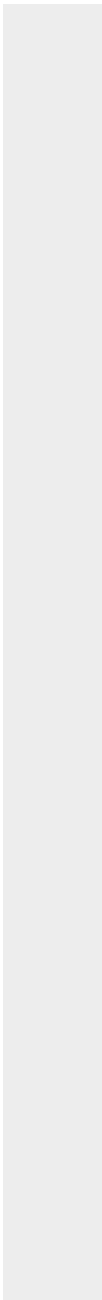
QC Batch ID: MP16654
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
Units: ug/l

Prep Date: 08/17/15

	D73885-1A		QC
Metal	Original SDL 1:5	%DIF	Limits

(anr) Analyte not requested



8.3.4
8

General Chemistry

QC Data Summaries

Includes the following where applicable:

- Method Blank and Blank Spike Summaries
- Duplicate Summaries
- Matrix Spike Summaries

METHOD BLANK AND SPIKE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: D73886
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

Analyte	Batch ID	RL	MB Result	Units	Spike Amount	BSP Result	BSP %Recov	QC Limits
Alkalinity, Bicarbonate as CaC	GN31193	5.0	0.0	mg/l	100	94.4	94.4	90-110%
Alkalinity, Carbonate	GN31194	5.0	0.0	mg/l	100	94.4	94.4	80-120%
Alkalinity, Total as CaCO3	GN31192	5.0	0.0	mg/l	100	94	94.4	90-110%
Bromide	GP15978/GN31169	0.050	0.0	mg/l	0.5	0.524	104.8	90-110%
Chloride	GP15978/GN31169	0.50	0.0	mg/l	5	5.16	103.2	90-110%
Fluoride	GP15978/GN31169	0.10	0.0	mg/l	1	1.03	103.0	90-110%
Hydrogen Sulfide	GN31239	0.50	<0.50	mg/l	3.51	3.2	91.2	60-120%
Iron-Related Bacteria	MB602	25	<25	CFU/ml				
Nitrogen, Nitrate	GP15978/GN31169	0.010	0.0	mg/l	0.1	0.105	105.0	90-110%
Nitrogen, Nitrite	GP15978/GN31169	0.0040	0.0	mg/l	0.05	0.0529	105.8	90-110%
Slime Forming Bacteria	MB603	500	<500	CFU/ml				
Solids, Total Dissolved	GN31195	10	0.0	mg/l				
Solids, Total Dissolved	GN31195	10	0.0	mg/l	400	393	98.3	90-110%
Specific Conductivity	GP16007/GN31222			umhos/cm	99.4	92.3	92.9	90-110%
Sulfate	GP15978/GN31169	0.50	0.0	mg/l	5	5.19	103.8	90-110%
Sulfate Reducing Bacteria	MB604	200	<200	CFU/ml				
pH	GN31218			su	8.00	7.98	99.8	99.1-100.9%

Associated Samples:

Batch MB602: D73886-1B
Batch MB603: D73886-1B
Batch MB604: D73886-1B
Batch GN31192: D73886-1
Batch GN31193: D73886-1
Batch GN31194: D73886-1
Batch GN31195: D73886-1
Batch GN31218: D73886-1
Batch GN31239: D73886-1
Batch GP15978: D73886-1
Batch GP16007: D73886-1
(*) Outside of QC limits

DUPLICATE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: D73886
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

Analyte	Batch ID	QC Sample	Units	Original Result	DUP Result	RPD	QC Limits
Alkalinity, Total as CaCO ₃	GN31192	D73885-1	mg/l	196	193	1.3	0-20%
Hydrogen Sulfide	GN31239	D73885-1	mg/l	<0.50	<0.50	0.0	0-20%
Solids, Total Dissolved	GN31195	D73886-1	mg/l	220	219	0.5	0-20%
Specific Conductivity	GP16007/GN31222	D73885-1	umhos/cm	405	411	1.5	0-20%

Associated Samples:

Batch GN31192: D73886-1

Batch GN31195: D73886-1

Batch GN31239: D73886-1

Batch GP16007: D73886-1

(*) Outside of QC limits

MATRIX SPIKE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: D73886
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

Analyte	Batch ID	QC Sample	Units	Original Result	Spike Amount	MS Result	%Rec	QC Limits
Alkalinity, Total as CaCO ₃	GN31192	D73944-1	mg/l	238	100	320	86.7	80-120%
Bromide	GP15978/GN31169	D73904-5	mg/l	0.025 U	0.5	0.52	104.0	80-120%
Chloride	GP15978/GN31169	D73904-5	mg/l	5.1	5	10.3	104.0	80-120%
Fluoride	GP15978/GN31169	D73904-5	mg/l	0.26	1	1.3	104.0	80-120%
Nitrogen, Nitrate	GP15978/GN31169	D73904-5	mg/l	0.0060 U	0.1	0.10	100.0	80-120%
Nitrogen, Nitrite	GP15978/GN31169	D73904-5	mg/l	0.0030 U	0.05	0.052	104.0	80-120%
Sulfate	GP15978/GN31169	D73904-5	mg/l	3.2	5	8.3	102.0	80-120%

Associated Samples:

Batch GN31192: D73886-1

Batch GP15978: D73886-1

(*) Outside of QC limits

(N) Matrix Spike Rec. outside of QC limits

MATRIX SPIKE DUPLICATE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: D73886
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

Analyte	Batch ID	QC Sample	Units	Original Result	Spike Amount	MSD Result	RPD	QC Limit
Alkalinity, Total as CaCO ₃	GN31192	D73944-1	mg/l	238	100	330	2.7	20%
Bromide	GP15978/GN31169	D73904-5	mg/l	0.025 U	0.5	0.52	0.0	20%
Chloride	GP15978/GN31169	D73904-5	mg/l	5.1	5	10.3	0.0	20%
Fluoride	GP15978/GN31169	D73904-5	mg/l	0.26	1	1.3	0.0	20%
Nitrogen, Nitrate	GP15978/GN31169	D73904-5	mg/l	0.0060 U	0.1	0.10	0.0	20%
Nitrogen, Nitrite	GP15978/GN31169	D73904-5	mg/l	0.0030 U	0.05	0.052	0.0	20%
Sulfate	GP15978/GN31169	D73904-5	mg/l	3.2	5	8.3	0.0	20%

Associated Samples:

Batch GN31192: D73886-1

Batch GP15978: D73886-1

(*) Outside of QC limits

(N) Matrix Spike Rec. outside of QC limits



08/25/15

Technical Report for

LT Environmental

Rule 608 Compliance XTO Raton Basin

012915029

Accutest Job Number: D73944

Sampling Date: 08/13/15

Report to:

LT Environmental
2243 Main Avenue Suite #3
Durango, CO 81301
dhencmann@ltenv.com

ATTN: Devin Hencmann

Total number of pages in report: **56**



Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.

A handwritten signature in black ink, appearing to read "Scott Heideman".

Scott Heideman
Laboratory Director

Client Service contact: Renea Jackson 303-425-6021

Certifications: CO (CO00049), ID, NE (CO00049), ND (R-027), NJ (CO 0007), OK (D9942), UT (NELAP CO00049), LA (LA150028), TX (T104704511), WY

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Test results relate only to samples analyzed.

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Sample Summary

LT Environmental

Job No: D73944

Rule 608 Compliance XTO Raton Basin
Project No: 012915029

Sample Number	Collected Date	Time By	Received	Matrix Code	Type	Client Sample ID
D73944-1	08/13/15	10:15 DN	08/14/15	AQ	Ground Water	SPRING-01
D73944-1A	08/13/15	10:15 DN	08/14/15	AQ	Ground Water	SPRING-01
D73944-1B	08/13/15	10:15 DN	08/14/15	AQ	Ground Water	SPRING-01
D73944-1F	08/13/15	10:15 DN	08/14/15	AQ	Groundwater Filtered	SPRING-01

CASE NARRATIVE / CONFORMANCE SUMMARY

Client: LT Environmental

Job No D73944

Site: Rule 608 Compliance XTO Raton Basin

Report Date 8/25/2015 12:00:24 P

On 08/14/2015, 1 sample(s), 0 Trip Blank(s), and 0 Field Blank(s) were received at Accutest Mountain States (AMS) at a temperature of 4.9 °C. The samples were intact and properly preserved, unless noted below. An AMS Job Number of D73944 was assigned to the project. The lab sample ID, client sample ID, and date of sample collection are detailed in the report's Results Summary.

Specified quality control criteria were achieved for this job except as noted below. For more information, please refer to the analytical results and QC summary pages.

Volatiles by GC By Method RSK175 MOD

Matrix: AQ

Batch ID: GFB708

- All samples were analyzed within the recommended method holding time.
- Sample(s) D73923-1MS, D73923-1MSD were used as the QC samples indicated.
- All method blanks for this batch meet method specific criteria.
- D73923-1MS and D73923-1MSD: The pH of the sample was >2 at time of analysis.

Metals By Method EPA 200.7

Matrix: AQ

Batch ID: MP16650

- All samples were digested and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D73873-11MS, D73873-11MSD were used as the QC samples for the metals analysis.
- The matrix spike (MS) recovery(s) of Calcium are outside control limits. Spike amount low relative to the sample amount. Refer to lab control or spike blank for recovery information.
- MP16650-MB1 for Sodium: All sample results >10x method blank concentration or <RL.

Metals By Method EPA 200.8

Matrix: AQ

Batch ID: MP16647

- All samples were digested and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D73964-1FMS, D73964-1FMSD were used as the QC samples for the metals analysis.
- The blank spike (BS) recovery(s) of Selenium are outside control limits.
- MP16647-B1 for Selenium: All sample results < RL

Matrix: AQ

Batch ID: MP16690

- All samples were digested and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D73965-1FAMS, D73965-1FAMSD were used as the QC samples for the metals analysis.

Metals By Method SW846 6010C

Matrix: AQ

Batch ID: MP16654

- All samples were digested and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D73885-1AMS, D73885-1AMSD, D73885-1ASDL were used as the QC samples for the metals analysis.

Wet Chemistry By Method EPA 300.0/SW846 9056

Matrix: AQ

Batch ID: GP15986

- All samples were prepared and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D73943-5MS, D73943-5MSD were used as the QC samples for the Bromide, Chloride, Fluoride, Nitrogen, Nitrate, Nitrogen, Nitrite, Sulfate, Bromide analysis.
- D73944-1 for Nitrogen, Nitrite: Elevated detection limit due to matrix interference.
- D73944-1 for Nitrogen, Nitrate: Elevated detection limit due to matrix interference.

Matrix: AQ

Batch ID: R29659

- The data for EPA 300.0/SW846 9056 meets quality control requirements.
- D73944-1 for Nitrogen, Nitrate + Nitrite: Calculated as: (Nitrogen, Nitrate) + (Nitrogen, Nitrite)

Wet Chemistry By Method HACH IRB-BART

Matrix: AQ

Batch ID: MB602

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.

Wet Chemistry By Method HACH SLYM-BART

Matrix: AQ

Batch ID: MB603

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.

Wet Chemistry By Method HACH SRB-BART

Matrix: AQ

Batch ID: MB604

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.

Wet Chemistry By Method SM 2320B-2011

Matrix: AQ

Batch ID: GN31192

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D73885-1DUP, D73944-1MS, D73944-1MSD were used as the QC samples for the Alkalinity, Total as CaCO₃ analysis.

Matrix: AQ

Batch ID: GN31193

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.

Matrix: AQ

Batch ID: GN31194

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.

Wet Chemistry By Method SM 2510B-2011

Matrix: AQ

Batch ID: GP16007

- Sample(s) D73885-1DUP were used as the QC samples for the Specific Conductivity analysis.

Wet Chemistry By Method SM 2540C-2011

Matrix: AQ

Batch ID: GN31195

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D73885-1DUP were used as the QC samples for the Solids, Total Dissolved analysis.

Wet Chemistry By Method SM20 4500 S2 H

Matrix: AQ

Batch ID: GN31239

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D73885-1DUP were used as the QC samples for the Hydrogen Sulfide analysis.

Wet Chemistry By Method USDA HANDBOOK 60

Matrix: AQ

Batch ID: MP16654

- D73944-1A for Sodium Adsorption Ratio: Calculated as: $(\text{Na meq/L}) / \sqrt{[(\text{Ca meq/L}) + (\text{Mg meq/L})/2]}$

AMS certifies that data reported for samples received, listed on the associated custody chain or analytical task order, were produced to specifications meeting AMS's Quality System precision, accuracy and completeness objectives except as noted.

Estimated non-standard method measurement uncertainty data is available on request, based on quality control bias and implicit for standard methods. Acceptable uncertainty requires tested parameter quality control data to meet method criteria.

AMS is not responsible for data quality assumptions if partial reports are used and recommends that this report be used in its entirety. This report is authorized by AMS indicated via signature on the report cover.

Summary of Hits

Page 1 of 1

Job Number: D73944
Account: LT Environmental
Project: Rule 608 Compliance XTO Raton Basin
Collected: 08/13/15

Lab Sample ID	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
---------------	------------------	-----------------	----	-----	-------	--------

D73944-1 SPRING-01

Methane	1.09	0.0040	0.0020	mg/l	RSK175 MOD
Alkalinity, Bicarbonate as CaCO ₃	227	5.0		mg/l	SM 2320B-2011
Alkalinity, Carbonate	10.9	5.0		mg/l	SM 2320B-2011
Alkalinity, Total as CaCO ₃	238	5.0		mg/l	SM 2320B-2011
Chloride	3.9	0.50		mg/l	EPA 300.0/SW846 9056
Fluoride	0.97	0.10		mg/l	EPA 300.0/SW846 9056
Solids, Total Dissolved	304	10		mg/l	SM 2540C-2011
Specific Conductivity	402	1.0		umhos/cm	SM 2510B-2011
Sulfate	7.4	0.50		mg/l	EPA 300.0/SW846 9056
pH	8.64			su	SM4500HB+ -2011/9040C

D73944-1A SPRING-01

Sodium	128	2.0		mg/l	SW846 6010C
Sodium Adsorption Ratio ^a	20.1			ratio	USDA HANDBOOK 60

D73944-1B SPRING-01

Iron-Related Bacteria	< 25	25		CFU/ml	HACH IRB-BART
Slime Forming Bacteria	< 500	500		CFU/ml	HACH SLYM-BART
Sulfate Reducing Bacteria	< 200	200		CFU/ml	HACH SRB-BART

D73944-1F SPRING-01

Calcium	1830	400		ug/l	EPA 200.7
Iron	21.2	10		ug/l	EPA 200.7
Magnesium	465	200		ug/l	EPA 200.7
Manganese	11.1	2.0		ug/l	EPA 200.8
Sodium	111000	400		ug/l	EPA 200.7

(a) Calculated as: (Na meq/L) / sqrt [(Ca meq/L)+ (Mg meq/L)/2]

Sample Results

Report of Analysis

Report of Analysis

Page 1 of 1

Client Sample ID:	SPRING-01	Date Sampled:	08/13/15
Lab Sample ID:	D73944-1	Date Received:	08/14/15
Matrix:	AQ - Ground Water	Percent Solids:	n/a
Method:	RSK175 MOD		
Project:	Rule 608 Compliance XTO Raton Basin		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	FB14971.D	5	08/17/15	JJ	n/a	n/a	GFB708
Run #2							

	Initial Volume	Headspace Volume	Volume Injected	Temperature
Run #1	39.0 ml	4.0 ml	500 ul	21.0 Deg. C
Run #2				

CAS No.	Compound	Result	RL	MDL	Units	Q
74-82-8	Methane	1.09	0.0040	0.0020	mg/l	

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID: SPRING-01	Date Sampled: 08/13/15
Lab Sample ID: D73944-1	Date Received: 08/14/15
Matrix: AQ - Ground Water	Percent Solids: n/a
Project: Rule 608 Compliance XTO Raton Basin	

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Alkalinity, Bicarbonate as CaC	227	5.0	mg/l	1	08/17/15	JD	SM 2320B-2011
Alkalinity, Carbonate	10.9	5.0	mg/l	1	08/17/15 08:00	JD	SM 2320B-2011
Alkalinity, Total as CaCO ₃	238	5.0	mg/l	1	08/17/15 08:00	JD	SM 2320B-2011
Bromide	< 0.050	0.050	mg/l	1	08/14/15 12:31	JB	EPA 300.0/SW846 9056
Chloride	3.9	0.50	mg/l	1	08/14/15 12:31	JB	EPA 300.0/SW846 9056
Fluoride	0.97	0.10	mg/l	1	08/14/15 12:31	JB	EPA 300.0/SW846 9056
Hydrogen Sulfide	< 0.50	0.50	mg/l	1	08/19/15	TJ	SM20 4500 S2 H
Nitrogen, Nitrate ^a	< 0.020	0.020	mg/l	2	08/14/15 16:47	JB	EPA 300.0/SW846 9056
Nitrogen, Nitrate + Nitrite ^b	< 0.028	0.028	mg/l	1	08/14/15 16:47	JB	EPA 300.0/SW846 9056
Nitrogen, Nitrite ^a	< 0.0080	0.0080	mg/l	2	08/14/15 16:47	JB	EPA 300.0/SW846 9056
Solids, Total Dissolved	304	10	mg/l	1	08/17/15	AK	SM 2540C-2011
Specific Conductivity	402	1.0	umhos/cm	1	08/18/15	TJ	SM 2510B-2011
Sulfate	7.4	0.50	mg/l	1	08/14/15 12:31	JB	EPA 300.0/SW846 9056
pH	8.64		su	1	08/14/15 15:00	TB	SM4500HB+ -2011/9040C

(a) Elevated detection limit due to matrix interference.

(b) Calculated as: (Nitrogen, Nitrate) + (Nitrogen, Nitrite)

RL = Reporting Limit

Report of Analysis

Client Sample ID:	SPRING-01	Date Sampled:	08/13/15
Lab Sample ID:	D73944-1A	Date Received:	08/14/15
Matrix:	AQ - Ground Water	Percent Solids:	n/a
Project:	Rule 608 Compliance XTO Raton Basin		

SAR Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Calcium	< 2.0	2.0	mg/l	1	08/17/15	08/18/15 JB	SW846 6010C ¹	SW846 3010A/M ²
Magnesium	< 1.0	1.0	mg/l	1	08/17/15	08/18/15 JB	SW846 6010C ¹	SW846 3010A/M ²
Sodium	128	2.0	mg/l	1	08/17/15	08/18/15 JB	SW846 6010C ¹	SW846 3010A/M ²

(1) Instrument QC Batch: MA6435
(2) Prep QC Batch: MP16654

RL = Reporting Limit

Report of Analysis

Client Sample ID:	SPRING-01	Date Sampled:	08/13/15
Lab Sample ID:	D73944-1A	Date Received:	08/14/15
Matrix:	AQ - Ground Water	Percent Solids:	n/a
Project:	Rule 608 Compliance XTO Raton Basin		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Sodium Adsorption Ratio ^a	20.1		ratio	1	08/18/15 07:15	JB	USDA HANDBOOK 60

(a) Calculated as: (Na meq/L) / sqrt [(Ca meq/L)+ (Mg meq/L)/2]

RL = Reporting Limit

Report of Analysis

Client Sample ID:	SPRING-01	Date Sampled:	08/13/15
Lab Sample ID:	D73944-1B	Date Received:	08/14/15
Matrix:	AQ - Ground Water	Percent Solids:	n/a
Project:	Rule 608 Compliance XTO Raton Basin		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Iron-Related Bacteria	< 25	25	CFU/ml	1	08/17/15 14:00	MM	HACH IRB-BART
Slime Forming Bacteria	< 500	500	CFU/ml	1	08/17/15 14:00	MM	HACH SLYM-BART
Sulfate Reducing Bacteria	< 200	200	CFU/ml	1	08/17/15 14:00	MM	HACH SRB-BART

RL = Reporting Limit

Report of Analysis

Client Sample ID: SPRING-01	Date Sampled: 08/13/15
Lab Sample ID: D73944-1F	Date Received: 08/14/15
Matrix: AQ - Groundwater Filtered	Percent Solids: n/a
Project: Rule 608 Compliance XTO Raton Basin	

Dissolved Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Calcium	1830	400	ug/l	1	08/17/15	08/18/15 JB	EPA 200.7 ²	EPA 200.7 ⁶
Iron	21.2	10	ug/l	1	08/17/15	08/20/15 JB	EPA 200.7 ³	EPA 200.7 ⁶
Magnesium	465	200	ug/l	1	08/17/15	08/18/15 JB	EPA 200.7 ²	EPA 200.7 ⁶
Manganese	11.1	2.0	ug/l	2	08/20/15	08/21/15 JB	EPA 200.8 ⁴	EPA 200.8 ⁷
Potassium	< 1000	1000	ug/l	1	08/17/15	08/18/15 JB	EPA 200.7 ²	EPA 200.7 ⁶
Selenium	< 0.80	0.80	ug/l	2	08/17/15	08/19/15 KV	EPA 200.8 ¹	EPA 200.8 ⁵
Sodium	111000	400	ug/l	1	08/17/15	08/18/15 JB	EPA 200.7 ²	EPA 200.7 ⁶

(1) Instrument QC Batch: MA6438

(2) Instrument QC Batch: MA6440

(3) Instrument QC Batch: MA6452

(4) Instrument QC Batch: MA6457

(5) Prep QC Batch: MP16647

(6) Prep QC Batch: MP16650

(7) Prep QC Batch: MP16690

RL = Reporting Limit



Subcontract Lab Data

5

Report of Analysis



Industrial LABORATORIES

Industrial Laboratories is your independent,
third-party analytical testing laboratory

To: Accutest Mountain States (AMS)
4036 Youngfield St.

Wheat Ridge CO 80033

Attn: Renea Rooks

TEST REPORT

ACCUTEST - M

Date Received: 8/14/2015

Date Reported: 8/17/2015

PO Number: D73944X

Lab No.	Sample Description	Test Method	Result	Units	MDL	Analysis Date/By
150814008-01A	D73944X -1, 8/13/15, 10:15AM	* Total Coliforms MPN SMEWW 9221 B	<2 fecal; <2 total	MPN/100mL		AT 8/14/2015

K. J. J. J.

Department Manager

Samples received in good condition unless otherwise noted in case narrative.

* = Scope Analysis

= Subcontracted Analysis

MDL = Method Detection Limit

ND = Not Detected at the Method Detection Limit

Page: 1 of 1

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CHAIN OF CUSTODY

4036 Youngfield St., Wheat Ridge, CO 80033
303-425-6021 FAX: 303-425-6854

Accutest Job #:	D73944X
Accutest Quote #:	0
AMS P.O. #:	
Project No.:	

[illegible]

Misc. Forms

Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody

Accutest Laboratories Sample Receipt Summary

Accutest Job Number: D73944 **Client:** LT ENVIRONMENTAL **Project:** RULE 608 COMPLIANCE
Date / Time Received: 8/14/2015 1:20:00 PM **Delivery Method:** _____ **Airbill #'s:** fxe
Cooler Temps (Initial/Adjusted): #1: (4.9/4.9):

Cooler Security
Y or N

- | | |
|--|---|
| 1. Custody Seals Present: <input checked="" type="checkbox"/> <input type="checkbox"/> | 3. COC Present: <input checked="" type="checkbox"/> <input type="checkbox"/> |
| 2. Custody Seals Intact: <input checked="" type="checkbox"/> <input type="checkbox"/> | 4. Smpl Dates/Time OK: <input checked="" type="checkbox"/> <input type="checkbox"/> |

Cooler Temperature
Y or N

- | | |
|---|--|
| 1. Temp criteria achieved: <input checked="" type="checkbox"/> <input type="checkbox"/> | |
| 2. Cooler temp verification: <u>Bar Therm;</u> | |
| 3. Cooler media: <u>Ice (Bag)</u> | |
| 4. No. Coolers: <u>1</u> | |

Quality Control Preservation
Y or N
N/A

- | | |
|---|--|
| 1. Trip Blank present / cooler: <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | |
| 2. Trip Blank listed on COC: <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | |
| 3. Samples preserved properly: <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | |
| 4. VOCs headspace free: <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | |

Comments

Sample Integrity - Documentation
Y or N

- | | |
|---|--|
| 1. Sample labels present on bottles: <input checked="" type="checkbox"/> <input type="checkbox"/> | |
| 2. Container labeling complete: <input checked="" type="checkbox"/> <input type="checkbox"/> | |
| 3. Sample container label / COC agree: <input checked="" type="checkbox"/> <input type="checkbox"/> | |

Sample Integrity - Condition
Y or N

- | | |
|---|--|
| 1. Sample recvd within HT: <input checked="" type="checkbox"/> <input type="checkbox"/> | |
| 2. All containers accounted for: <input checked="" type="checkbox"/> <input type="checkbox"/> | |
| 3. Condition of sample: <u>Intact</u> | |

Sample Integrity - Instructions
Y or N N/A

- | | |
|--|--|
| 1. Analysis requested is clear: <input checked="" type="checkbox"/> <input type="checkbox"/> | |
| 2. Bottles received for unspecified tests: <input type="checkbox"/> <input checked="" type="checkbox"/> | |
| 3. Sufficient volume recvd for analysis: <input checked="" type="checkbox"/> <input type="checkbox"/> | |
| 4. Compositing instructions clear: <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> | |
| 5. Filtering instructions clear: <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> | |

GC Volatiles

QC Data Summaries

Includes the following where applicable:

- Method Blank Summaries
- Blank Spike Summaries
- Matrix Spike and Duplicate Summaries

Method Blank Summary

Job Number: D73944
Account: LTENCODU LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
GFB708-MB	FB14952.D	1	08/17/15	JJ	n/a	n/a	GFB708

The QC reported here applies to the following samples: Method: RSK175 MOD

D73944-1

CAS No.	Compound	Result	RL	MDL	Units	Q
74-82-8	Methane	ND	0.00080	0.00040	mg/l	

7.1.1
7

Blank Spike Summary

Job Number: D73944
Account: LTENCODU LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
GFB708-BS	FB14953.D	10	08/17/15	JJ	n/a	n/a	GFB708

The QC reported here applies to the following samples: Method: RSK175 MOD

D73944-1

CAS No.	Compound	Spike mg/l	BSP mg/l	BSP %	Limits
74-82-8	Methane	0.512	0.550	107	70-130

* = Outside of Control Limits.

Matrix Spike/Matrix Spike Duplicate Summary

Job Number: D73944
Account: LTENCODU LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
D73923-1MS ^a	FB14955.D	10	08/17/15	JJ	n/a	n/a	GFB708
D73923-1MSD ^a	FB14956.D	10	08/17/15	JJ	n/a	n/a	GFB708
D73923-1 ^a	FB14954.D	1	08/17/15	JJ	n/a	n/a	GFB708

The QC reported here applies to the following samples: Method: RSK175 MOD

D73944-1

CAS No.	Compound	D73923-1 mg/l	Q	Spike mg/l	MS mg/l	MS %	Spike mg/l	MSD mg/l	MSD %	RPD	Limits Rec/RPD
74-82-8	Methane	ND		0.512	0.523	102	0.512	0.513	100	2	51-155/30

(a) The pH of the sample was > 2 at time of analysis.

* = Outside of Control Limits.

Metals Analysis

QC Data Summaries

Includes the following where applicable:

- Method Blank Summaries
- Matrix Spike and Duplicate Summaries
- Blank Spike and Lab Control Sample Summaries
- Serial Dilution Summaries

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: D73944
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16647
Matrix Type: AQUEOUS

Methods: EPA 200.8
Units: ug/l

Prep Date: 08/17/15

Metal	RL	IDL	MDL	MB raw	final
Aluminum	50	1.1	2		
Antimony	0.40	.0022	.011		
Barium	2.0	.016	.079		
Boron	40	.49	2.1		
Calcium	400	5.6	12		
Chromium	2.0	.053	.053		
Cobalt	0.20	.0049	.015		
Copper	2.0	.06	.13		
Iron	10	3.5	4.6		
Lead	0.50	.0079	.008		
Magnesium	100	1.3	1.3		
Manganese	1.0	.12	.13		
Molybdenum	1.0	.049	.029		
Nickel	2.0	.0088	.027		
Phosphorus	60	2.6	4.3		
Potassium	200	2.9	2.9		
Selenium	0.40	.06	.21	-0.036	<0.40
Silver	0.10	.0019	.008		
Sodium	500	4.9	4.9		
Strontium	20	.01	.015		
Thallium	0.20	.0024	.005		
Tin	10	.063	1.3		
Titanium	2.0	.059	.092		
Uranium	0.20	.0017	.002		
Vanadium	1.0	.037	.2		
Zinc	10	.21	.96		

Associated samples MP16647: D73944-1F

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(anr) Analyte not requested

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D73944
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16647
 Matrix Type: AQUEOUS

Methods: EPA 200.8
 Units: ug/l

Prep Date: 08/17/15

Metal	D73964-1F Original MS	Spikelot ICPALL2	% Rec	QC Limits
Aluminum	anr			
Antimony	anr			
Barium	anr			
Boron				
Calcium				
Chromium	anr			
Cobalt				
Copper	anr			
Iron	anr			
Lead	anr			
Magnesium				
Manganese	anr			
Molybdenum	anr			
Nickel	anr			
Phosphorus				
Potassium				
Selenium	4.5	231	200	113.3 70-130
Silver	anr			
Sodium				
Strontium				
Thallium	anr			
Tin				
Titanium				
Uranium	anr			
Vanadium				
Zinc	anr			

Associated samples MP16647: D73944-1F

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits
 (N) Matrix Spike Rec. outside of QC limits
 (anr) Analyte not requested

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D73944
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16647
 Matrix Type: AQUEOUS

Methods: EPA 200.8
 Units: ug/l

Prep Date: 08/17/15

Metal	D73964-1F Original MSD	Spikelot ICPALL2	% Rec	MSD RPD	QC Limit
Aluminum	anr				
Antimony	anr				
Barium	anr				
Boron					
Calcium					
Chromium	anr				
Cobalt					
Copper	anr				
Iron	anr				
Lead	anr				
Magnesium					
Manganese	anr				
Molybdenum	anr				
Nickel	anr				
Phosphorus					
Potassium					
Selenium	4.5	228	200	111.8	1.3
Silver	anr				20
Sodium					
Strontium					
Thallium	anr				
Tin					
Titanium					
Uranium	anr				
Vanadium					
Zinc	anr				

Associated samples MP16647: D73944-1F

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits
 (N) Matrix Spike Rec. outside of QC limits
 (anr) Analyte not requested

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D73944
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16647
 Matrix Type: AQUEOUS

Methods: EPA 200.8
 Units: ug/l

Prep Date: 08/17/15

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
Aluminum	anr			
Antimony	anr			
Barium	anr			
Boron				
Calcium				
Chromium	anr			
Cobalt				
Copper	anr			
Iron	anr			
Lead	anr			
Magnesium				
Manganese	anr			
Molybdenum	anr			
Nickel	anr			
Phosphorus				
Potassium				
Selenium	240	200	120.0*(a	85-115
Silver	anr			
Sodium				
Strontium				
Thallium	anr			
Tin				
Titanium				
Uranium	anr			
Vanadium				
Zinc	anr			

Associated samples MP16647: D73944-1F

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits
 (anr) Analyte not requested
 (a) All sample results < RL

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: D73944
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16650
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 08/17/15

Metal	RL	IDL	MDL	MB raw	final
Aluminum	100	8.6	46		
Antimony	30	3.2	8.7		
Arsenic	25	5.2	12		
Barium	10	1.4	.2		
Beryllium	10	.8	1.6		
Boron	50	6.7	3.7		
Cadmium	10	.4	.6		
Calcium	400	2.2	22	10.7	<400
Chromium	10	.4	1		
Cobalt	5.0	.4	1.2		
Copper	10	1.2	2.9		
Iron	10	2.2	6.9	3.5	<10
Lead	50	3.6	9.1		
Lithium	5.0	1.9	1		
Magnesium	200	14	39	12.0	<200
Manganese	5.0	.01	.4		
Molybdenum	10	.8	3.6		
Nickel	30	.9	2.1		
Phosphorus	100	15	47		
Potassium	1000	130	61	27.1	<1000
Selenium	50	8.8	15		
Silicon	50	5.2	6.2		
Silver	30	.4	.9		
Sodium	400	4.9	14	250	* (a)
Strontium	5.0	.01	.3		
Thallium	10	2.9	9.1		
Tin	50	13	25		
Titanium	10	.15	2.5		
Uranium	50	3.7	4.4		
Vanadium	10	.4	.6		
Zinc	30	.6	3.5		

Associated samples MP16650: D73944-1F

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: D73944
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16650
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 08/17/15

Metal	RL	IDL	MDL	MB raw	final
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(anr) Analyte not requested

(a) All sample results >10x method blank concentration or <RL.

8.2.1

8

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D73944
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16650
 Matrix Type: AQUEOUS

Methods: EPA 200.7
 Units: ug/l

Prep Date: 08/17/15

Metal	D73873-11 Original MS	Spikelot ICPAL2	% Rec	QC Limits
Aluminum				
Antimony				
Arsenic	anr			
Barium				
Beryllium				
Boron	anr			
Cadmium				
Calcium	399000	409000	25000	40.0 (a) 70-130
Chromium	anr			
Cobalt	anr			
Copper	anr			
Iron	90.6	5090	5000	100.0 70-130
Lead	anr			
Lithium				
Magnesium	67500	91700	25000	96.8 70-130
Manganese	anr			
Molybdenum	anr			
Nickel	anr			
Phosphorus				
Potassium	11300	36500	25000	100.8 70-130
Selenium				
Silicon				
Silver				
Sodium	166000	187000	25000	84.0 70-130
Strontium	anr			
Thallium				
Tin	anr			
Titanium				
Uranium				
Vanadium				
Zinc	anr			

Associated samples MP16650: D73944-1F

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D73944
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16650
 Matrix Type: AQUEOUS

Methods: EPA 200.7
 Units: ug/l

Prep Date: 08/17/15

Metal	D73873-11 Original MS	Spikelot ICPALL2	% Rec	QC Limits
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(N) Matrix Spike Rec. outside of QC limits

(anr) Analyte not requested

(a) Spike amount low relative to the sample amount. Refer to lab control or spike blank for recovery information.

8.2.2

8

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D73944
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16650
 Matrix Type: AQUEOUS

Methods: EPA 200.7
 Units: ug/l

Prep Date: 08/17/15

	D73873-11		Spikelot		MSD	QC
Metal	Original MSD		ICPALL2	% Rec	RPD	Limit
Aluminum						
Antimony						
Arsenic	anr					
Barium						
Beryllium						
Boron	anr					
Cadmium						
Calcium	399000	405000	25000	24.0 (a)	1.0	20
Chromium	anr					
Cobalt	anr					
Copper	anr					
Iron	90.6	5100	5000	100.2	0.2	20
Lead	anr					
Lithium						
Magnesium	67500	91100	25000	94.4	0.7	20
Manganese	anr					
Molybdenum	anr					
Nickel	anr					
Phosphorus						
Potassium	11300	36500	25000	100.8	0.0	20
Selenium						
Silicon						
Silver						
Sodium	166000	185000	25000	76.0	1.1	20
Strontium	anr					
Thallium						
Tin	anr					
Titanium						
Uranium						
Vanadium						
Zinc	anr					

Associated samples MP16650: D73944-1F

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D73944
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16650
 Matrix Type: AQUEOUS

Methods: EPA 200.7
 Units: ug/l

Prep Date: 08/17/15

Metal	D73873-11 Original MSD	SpikeLot ICPALL2 % Rec	MSD RPD	QC Limit
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(N) Matrix Spike Rec. outside of QC limits

(anr) Analyte not requested

(a) Spike amount low relative to the sample amount. Refer to lab control or spike blank for recovery information.

8.2.2

8

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D73944
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16650
 Matrix Type: AQUEOUS

Methods: EPA 200.7
 Units: ug/l

Prep Date: 08/17/15

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
Aluminum				
Antimony				
Arsenic	anr			
Barium				
Beryllium				
Boron	anr			
Cadmium				
Calcium	25200	25000	100.8	85-115
Chromium	anr			
Cobalt	anr			
Copper	anr			
Iron	5170	5000	103.4	85-115
Lead	anr			
Lithium				
Magnesium	25100	25000	100.4	85-115
Manganese	anr			
Molybdenum	anr			
Nickel	anr			
Phosphorus				
Potassium	24000	25000	96.0	85-115
Selenium				
Silicon				
Silver				
Sodium	23900	25000	95.6	85-115
Strontium	anr			
Thallium				
Tin	anr			
Titanium				
Uranium				
Vanadium				
Zinc	anr			

Associated samples MP16650: D73944-1F

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D73944
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

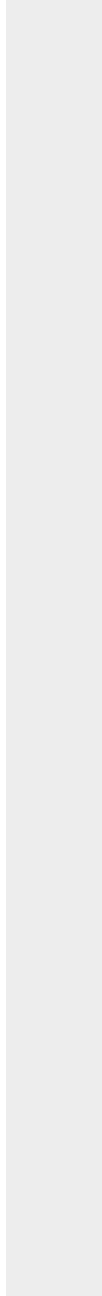
QC Batch ID: MP16650
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 08/17/15

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
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(anr) Analyte not requested



82.3

8

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: D73944
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16654
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
Units: ug/l

Prep Date: 08/17/15

Metal	RL	IDL	MDL	MB raw	final
Aluminum	500	55	65		
Antimony	150	11	44		
Arsenic	130	19	60		
Barium	50	1	2		
Beryllium	50	4.5	8		
Boron	250	4	18		
Cadmium	50	1	4		
Calcium	2000	12	50	-85	<2000
Chromium	50	1.5	3.5		
Cobalt	25	2.5	6		
Copper	50	4	19		
Iron	350	7.5	35		
Lead	250	11	25		
Lithium	25	2	3.5		
Magnesium	1000	34	200	233	<1000
Manganese	25	2.5	4.5		
Molybdenum	50	2	18		
Nickel	150	2.5	14		
Phosphorus	500	75	170		
Potassium	5000	500	360		
Selenium	250	36	50		
Silicon	250	24	42		
Silver	150	1.5	3		
Sodium	2000	37	70	166	<2000
Strontium	25	.05	1.5		
Thallium	50	9	40		
Tin	250	60	60		
Titanium	50	.5	14		
Uranium	250	15	22		
Vanadium	50	2	3		
Zinc	150	2	18		

Associated samples MP16654: D73944-1A

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: D73944
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

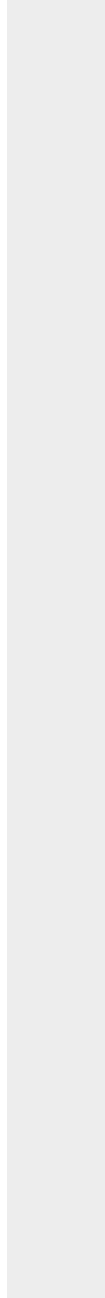
QC Batch ID: MP16654
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
Units: ug/l

Prep Date: 08/17/15

Metal	RL	IDL	MDL	MB raw	final
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(anr) Analyte not requested



8.3.1

8

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D73944
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16654
 Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
 Units: ug/l

Prep Date: 08/17/15

Metal	D73885-1A Original MS		Spikelot ICPAL2	% Rec	QC Limits
Aluminum					
Antimony					
Arsenic					
Barium					
Beryllium					
Boron					
Cadmium					
Calcium	71700	202000	125000	104.2	75-125
Chromium					
Cobalt					
Copper					
Iron					
Lead					
Lithium					
Magnesium	14000	141000	125000	101.6	75-125
Manganese					
Molybdenum					
Nickel					
Phosphorus					
Potassium					
Selenium					
Silicon					
Silver					
Sodium	16700	146000	125000	103.4	75-125
Strontium					
Thallium					
Tin					
Titanium					
Uranium					
Vanadium					
Zinc					

Associated samples MP16654: D73944-1A

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits

8.3.2
8

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D73944
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

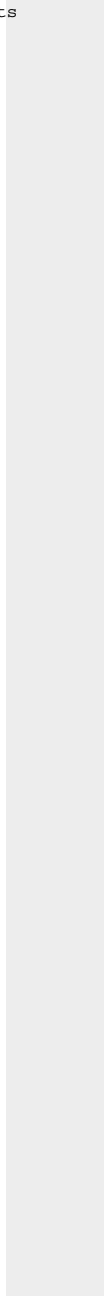
QC Batch ID: MP16654
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
Units: ug/l

Prep Date: 08/17/15

Metal	D73885-1A Original MS	Spikelot ICPALL2	% Rec	QC Limits
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(N) Matrix Spike Rec. outside of QC limits
(anr) Analyte not requested



8.3.2

8

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D73944
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16654
 Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
 Units: ug/l

Prep Date: 08/17/15

Metal	D73885-1A Original	MSD	Spikelot ICPAL2	% Rec	MSD RPD	QC Limit
Aluminum						
Antimony						
Arsenic						
Barium						
Beryllium						
Boron						
Cadmium						
Calcium	71700	201000	125000	103.4	0.5	20
Chromium						
Cobalt						
Copper						
Iron						
Lead						
Lithium						
Magnesium	14000	142000	125000	102.4	0.7	20
Manganese						
Molybdenum						
Nickel						
Phosphorus						
Potassium						
Selenium						
Silicon						
Silver						
Sodium	16700	147000	125000	104.2	0.7	20
Strontium						
Thallium						
Tin						
Titanium						
Uranium						
Vanadium						
Zinc						

Associated samples MP16654: D73944-1A

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D73944
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

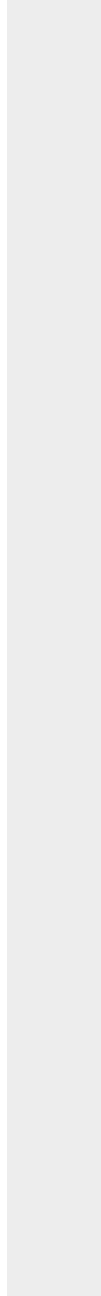
QC Batch ID: MP16654
 Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
 Units: ug/l

Prep Date: 08/17/15

Metal	D73885-1A Original MSD	Spielot ICPALL2 % Rec	MSD RPD	QC Limit
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(N) Matrix Spike Rec. outside of QC limits
 (anr) Analyte not requested



8.3.2

8

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D73944

Account: LTENCODU - LT Environmental

Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16654

Methods: SW846 6010C, USDA HANDBOOK 60

Matrix Type: AQUEOUS

Units: ug/l

Prep Date:

08/17/15

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
Aluminum				
Antimony				
Arsenic				
Barium				
Beryllium				
Boron				
Cadmium				
Calcium	130000	125000	104.0	80-120
Chromium				
Cobalt				
Copper				
Iron				
Lead				
Lithium				
Magnesium	128000	125000	102.4	80-120
Manganese				
Molybdenum				
Nickel				
Phosphorus				
Potassium				
Selenium				
Silicon				
Silver				
Sodium	129000	125000	103.2	80-120
Strontium				
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc				

Associated samples MP16654: D73944-1A

Results < IDL are shown as zero for calculation purposes

(*) Outside of QC limits

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D73944
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

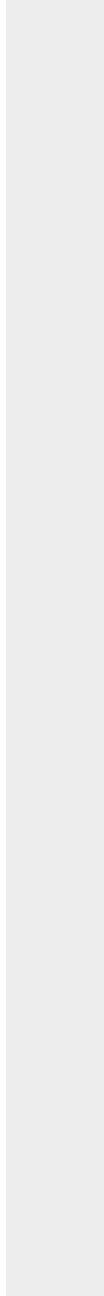
QC Batch ID: MP16654
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
Units: ug/l

Prep Date: 08/17/15

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
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(anr) Analyte not requested



SERIAL DILUTION RESULTS SUMMARY

Login Number: D73944
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16654
 Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
 Units: ug/l

Prep Date: 08/17/15

Metal	D73885-1A Original SDL 1:5		%DIF	QC Limits
Aluminum				
Antimony				
Arsenic				
Barium				
Beryllium				
Boron				
Cadmium				
Calcium	14300	14200	0.9	0-10
Chromium				
Cobalt				
Copper				
Iron				
Lead				
Lithium				
Magnesium	2790	2920	4.6	0-10
Manganese				
Molybdenum				
Nickel				
Phosphorus				
Potassium				
Selenium				
Silicon				
Silver				
Sodium	3340	3420	2.5	0-10
Strontium				
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc				

Associated samples MP16654: D73944-1A

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits

8.3.4
8

SERIAL DILUTION RESULTS SUMMARY

Login Number: D73944
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

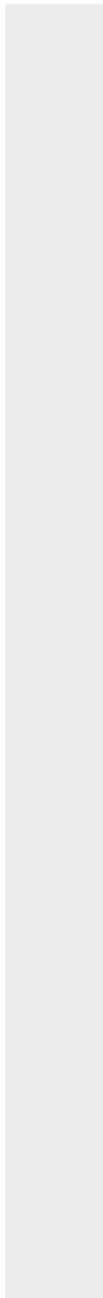
QC Batch ID: MP16654
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60
Units: ug/l

Prep Date: 08/17/15

	D73885-1A		QC
Metal	Original SDL 1:5	%DIF	Limits

(anr) Analyte not requested



8.3.4

8

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: D73944
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16690
Matrix Type: AQUEOUS

Methods: EPA 200.8
Units: ug/l

Prep Date: 08/20/15

Metal	RL	IDL	MDL	MB raw	final
Aluminum	50	1.1	2		
Antimony	0.40	.0022	.011		
Arsenic	0.20	.017	.044		
Barium	2.0	.016	.079		
Beryllium	0.20	.016	.069		
Boron	40	.49	2.1		
Cadmium	0.10	.036	.042		
Calcium	400	5.6	12		
Chromium	2.0	.053	.053		
Cobalt	0.20	.0049	.015		
Copper	2.0	.06	.13		
Iron	10	3.5	4.6		
Lead	0.50	.0079	.008		
Magnesium	100	1.3	1.3		
Manganese	1.0	.12	.13	0.044	<1.0
Molybdenum	1.0	.049	.029		
Nickel	2.0	.0088	.027		
Phosphorus	60	2.6	4.3		
Potassium	200	2.9	2.9		
Selenium	0.40	.06	.21		
Silver	0.10	.0019	.008		
Sodium	500	4.9	4.9		
Strontium	20	.01	.015		
Thallium	0.20	.0024	.005		
Tin	10	.063	1.3		
Titanium	2.0	.059	.092		
Uranium	0.20	.0017	.002		
Vanadium	1.0	.037	.2		
Zinc	10	.21	.96		

Associated samples MP16690: D73944-1F

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(anr) Analyte not requested

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D73944
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16690
 Matrix Type: AQUEOUS

Methods: EPA 200.8
 Units: ug/l

Prep Date: 08/20/15

Metal	D73965-1FA Original MS	Spikelot ICPALL2	% Rec	QC Limits
Aluminum				
Antimony				
Arsenic	anr			
Barium	anr			
Beryllium	anr			
Boron				
Cadmium	anr			
Calcium				
Chromium				
Cobalt				
Copper				
Iron				
Lead				
Magnesium				
Manganese	45.4	142	100	96.6 70-130
Molybdenum				
Nickel				
Phosphorus				
Potassium				
Selenium	anr			
Silver				
Sodium				
Strontium				
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc				

Associated samples MP16690: D73944-1F

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits
 (N) Matrix Spike Rec. outside of QC limits
 (anr) Analyte not requested

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: D73944
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16690
 Matrix Type: AQUEOUS

Methods: EPA 200.8
 Units: ug/l

Prep Date: 08/20/15

Metal	D73965-1FA Original MSD	Spikelot ICPAL2	% Rec	MSD RPD	QC Limit
Aluminum					
Antimony					
Arsenic	anr				
Barium	anr				
Beryllium	anr				
Boron					
Cadmium	anr				
Calcium					
Chromium					
Cobalt					
Copper					
Iron					
Lead					
Magnesium					
Manganese	45.4	143	100	97.6	0.7
Molybdenum					
Nickel					
Phosphorus					
Potassium					
Selenium	anr				
Silver					
Sodium					
Strontium					
Thallium					
Tin					
Titanium					
Uranium					
Vanadium					
Zinc					

Associated samples MP16690: D73944-1F

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits
 (N) Matrix Spike Rec. outside of QC limits
 (anr) Analyte not requested

8.4.2
8

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: D73944
 Account: LTENCODU - LT Environmental
 Project: Rule 608 Compliance XTO Raton Basin

QC Batch ID: MP16690
 Matrix Type: AQUEOUS

Methods: EPA 200.8
 Units: ug/l

Prep Date: 08/20/15

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
Aluminum				
Antimony				
Arsenic	anr			
Barium	anr			
Beryllium	anr			
Boron				
Cadmium	anr			
Calcium				
Chromium				
Cobalt				
Copper				
Iron				
Lead				
Magnesium				
Manganese	108	100	108.0	85-115
Molybdenum				
Nickel				
Phosphorus				
Potassium				
Selenium	anr			
Silver				
Sodium				
Strontium				
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc				

Associated samples MP16690: D73944-1F

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits
 (anr) Analyte not requested

8.4.3
8

General Chemistry

QC Data Summaries

Includes the following where applicable:

- Method Blank and Blank Spike Summaries
- Duplicate Summaries
- Matrix Spike Summaries

METHOD BLANK AND SPIKE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: D73944
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

Analyte	Batch ID	RL	MB Result	Units	Spike Amount	BSP Result	BSP %Recov	QC Limits
Alkalinity, Bicarbonate as CaC	GN31193	5.0	0.0	mg/l	100	94.4	94.4	90-110%
Alkalinity, Carbonate	GN31194	5.0	0.0	mg/l	100	94.4	94.4	80-120%
Alkalinity, Total as CaCO3	GN31192	5.0	0.0	mg/l	100	94	94.4	90-110%
Bromide	GP15986/GN31180	0.050	0.0	mg/l	0.5	0.500	100.0	90-110%
Chloride	GP15986/GN31180	0.50	0.0	mg/l	5	4.97	99.4	90-110%
Fluoride	GP15986/GN31180	0.10	0.0	mg/l	1	0.990	99.0	90-110%
Hydrogen Sulfide	GN31239	0.50	<0.50	mg/l	3.51	3.2	91.2	60-120%
Iron-Related Bacteria	MB602	25	<25	CFU/ml				
Nitrogen, Nitrate	GP15986/GN31180	0.010	0.0	mg/l	0.1	0.0998	99.8	90-110%
Nitrogen, Nitrite	GP15986/GN31180	0.0040	0.0	mg/l	0.05	0.0508	101.6	90-110%
Slime Forming Bacteria	MB603	500	<500	CFU/ml				
Solids, Total Dissolved	GN31195	10	0.0	mg/l				
Solids, Total Dissolved	GN31195	10	0.0	mg/l	400	393	98.3	90-110%
Specific Conductivity	GP16007/GN31222			umhos/cm	99.4	92.3	92.9	90-110%
Sulfate	GP15986/GN31180	0.50	0.0	mg/l	5	4.91	98.2	90-110%
Sulfate Reducing Bacteria	MB604	200	<200	CFU/ml				
pH	GN31177			su	8.00	7.98	99.8	99.1-100.9%

Associated Samples:

Batch MB602: D73944-1B
Batch MB603: D73944-1B
Batch MB604: D73944-1B
Batch GN31177: D73944-1
Batch GN31192: D73944-1
Batch GN31193: D73944-1
Batch GN31194: D73944-1
Batch GN31195: D73944-1
Batch GN31239: D73944-1
Batch GP15986: D73944-1
Batch GP16007: D73944-1
(*) Outside of QC limits

DUPLICATE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: D73944
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

Analyte	Batch ID	QC Sample	Units	Original Result	DUP Result	RPD	QC Limits
Alkalinity, Total as CaCO3	GN31192	D73885-1	mg/l	196	193	1.3	0-20%
Hydrogen Sulfide	GN31239	D73885-1	mg/l	<0.50	<0.50	0.0	0-20%
Solids, Total Dissolved	GN31195	D73885-1	mg/l	291	288	1.0	0-20%
Specific Conductivity	GP16007/GN31222	D73885-1	umhos/cm	405	411	1.5	0-20%

Associated Samples:

Batch GN31192: D73944-1

Batch GN31195: D73944-1

Batch GN31239: D73944-1

Batch GP16007: D73944-1

(*) Outside of QC limits

MATRIX SPIKE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: D73944
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

Analyte	Batch ID	QC Sample	Units	Original Result	Spike Amount	MS Result	%Rec	QC Limits
Alkalinity, Total as CaCO ₃	GN31192	D73944-1	mg/l	238	100	320	86.7	80-120%
Bromide	GP15986/GN31180	D73943-5	mg/l	0.0	0.5	0.50	100.0	80-120%
Chloride	GP15986/GN31180	D73943-5	mg/l	0.0	5	5.1	102.0	80-120%
Fluoride	GP15986/GN31180	D73943-5	mg/l	0.21	1	1.2	99.0	80-120%
Nitrogen, Nitrate	GP15986/GN31180	D73943-5	mg/l	0.016	0.1	0.12	104.0	80-120%
Nitrogen, Nitrite	GP15986/GN31180	D73943-5	mg/l	0.0	0.05	0.051	102.0	80-120%
Sulfate	GP15986/GN31180	D73943-5	mg/l	10.1	5	15.1	100.0	80-120%

Associated Samples:

Batch GN31192: D73944-1

Batch GP15986: D73944-1

(*) Outside of QC limits

(N) Matrix Spike Rec. outside of QC limits

MATRIX SPIKE DUPLICATE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: D73944
Account: LTENCODU - LT Environmental
Project: Rule 608 Compliance XTO Raton Basin

Analyte	Batch ID	QC Sample	Units	Original Result	Spike Amount	MSD Result	RPD	QC Limit
Alkalinity, Total as CaCO ₃	GN31192	D73944-1	mg/l	238	100	330	2.7	20%
Bromide	GP15986/GN31180	D73943-5	mg/l	0.0	0.5	0.51	2.0	20%
Chloride	GP15986/GN31180	D73943-5	mg/l	0.0	5	5.1	0.0	20%
Fluoride	GP15986/GN31180	D73943-5	mg/l	0.21	1	1.2	0.0	20%
Nitrogen, Nitrate	GP15986/GN31180	D73943-5	mg/l	0.016	0.1	0.12	0.0	20%
Nitrogen, Nitrite	GP15986/GN31180	D73943-5	mg/l	0.0	0.05	0.052	1.9	20%
Sulfate	GP15986/GN31180	D73943-5	mg/l	10.1	5	15.2	0.7	20%

Associated Samples:

Batch GN31192: D73944-1

Batch GP15986: D73944-1

(*) Outside of QC limits

(N) Matrix Spike Rec. outside of QC limits