

OGRIS OPERATING, LLC

# 2021 COLORADO FORMER RULE 608 COMPLIANCE REPORT RATON BASIN, COLORADO

JANUARY 2022





# 2021 COLORADO FORMER RULE 608 COMPLIANCE REPORT

RATON BASIN,  
COLORADO

OGRIS OPERATING, LLC

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# EXECUTIVE SUMMARY

WSP USA Inc. (WSP) completed the tasks for the 2021 Colorado Former Rule 608 Compliance Program (Compliance Program) on behalf of Ogris Operating, LLC. (Ogris) in association with the operator's natural gas production in Las Animas County, Colorado (Project Area). WSP completed the tasks in accordance with the Colorado Oil and Gas Conservation Commission (COGCC)-approved *Work Plan. Colorado Rule 608 Compliance, Raton Basin, Colorado* (the May 2010 Work Plan), submitted by the former operator of the assets, XTO Energy, Inc. (XTO), on May 5, 2010 per the following subsections of the COGCC Former Rule 608:

- 608(a) – Assessment and monitoring of plugged and abandoned (P&A) production wells within one-quarter mile of proposed coalbed methane (CBM) wells
- 608(b) – Water well sampling
- 608(c) – Coal outcrop and coal mine monitoring

The COGCC updated their 600 Series Rules in 2021 and coalbed methane production is now regulated under COGCC Rule 614; however, this work is conducted under the approved May 2010 Work Plan that was specific to the former Rule 608. The scope of work for the Compliance Program outlined in the May 2010 Work Plan includes four field tasks and a fifth subsequent report writing task. The 2021 Project Area was determined by a 2-mile buffer around the 2010 and 2011 proposed XTO CBM production wells and the CBM production wells XTO drilled in 2010 and 2011. Neither XTO nor Ogris have drilled any new CBM wells in the Raton Basin since 2011 and, as a result, the 2021 Project Area is identical to the 2011 Project Area. Due to the absence of any proposed 2021 CBM wells, some field tasks of the May 2010 Work Plan related to new wells were omitted from the 2021 Compliance Program. Field tasks completed included pedestrian mapping of active seep areas within the 2021 Project Area and natural spring sampling.

Three mapping areas were identified for surveying in 2021 based on the findings from 2020 and a review of historical flux surveys. Areas L-1021, 32 & L-1049, and L-1030 appear to be active seep areas.

Two natural springs (Chavez01 and Chavez02) were sampled for water quality analysis. Methane exceeding 1 milligram per liter (mg/l) was not detected in either sample. Based on water quality data from previous years, the water types appear to be predominately calcium in cationic composition and bicarbonate in anionic composition.

WSP recommends continued compliance with Rule 608 in Las Animas County in accordance with the COGCC approved May 2010 Work Plan, assuming development or production activities by Ogris continue. Based on the findings from this work and a review of historical flux surveys, WSP recommends active seep areas L-1021, 32 & L-1049, and L-1030 be surveyed, as well as the two springs, in 2022.

# 1 INTRODUCTION

WSP USA Inc. (WSP) has prepared this 2021 Colorado Former Rule 608 Compliance Report for Ogris Operating LLC (Ogris) to summarize the tasks completed in association with Ogris' natural gas operations in Las Animas County, Colorado (Project Area, Figure 1). In October 2017, Timber Creek Operating (TCO) purchased the XTO Energy, Inc. (XTO) assets in the Project Area, and Ogris took over the assets in 2020. Compliance activities were conducted in accordance with the Colorado Oil and Gas Conservation Commission (COGCC)-approved *Work Plan, Colorado Rule 608 Compliance, Raton Basin, Colorado* (the May 2010 Work Plan) previously submitted by XTO on May 5, 2010. This is the tenth annual event conducted in accordance with the Colorado Former Rule 608 Compliance Program (Compliance Program).

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## 1.1 PROJECT HISTORY

The objective of the 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 Former Rule 608 of the COGCC 600 Series Safety Regulations:

- 608(a): Assessment and monitoring of plugged and abandoned (P&A) production wells within one-quarter mile of proposed CBM wells
- 608(b): Water well sampling
- 608(c): Coal outcrop and coal mine monitoring.

In 2010, ground surveys along the Raton Formation were conducted to meet the requirements of Former Rule 608(c). The survey was completed in a manner similar to an initial baseline ground survey of methane seeps completed by Apogee Scientific, Inc. (Apogee) for the COGCC in 2000 and a more detailed survey conducted by LT Environmental, Inc. (LTE) and Apogee for the COGCC in 2007. The 2010 surveys were conducted using a 4-wheel drive vehicle equipped with an infrared-based gas detector developed by Apogee. This gas detector was designed to detect leaks in natural gas pipelines and is referred to as the Leak Detection System (LDS). A total of three suspected seep areas were identified and field-verified along 106 miles of roadway. Additionally, pedestrian mapping of six seep areas previously identified during the 2010 ground survey was conducted. Detailed mapping to field-verify the nine suspect seep areas was conducted and confirmed the presence of methane gas near all nine areas. Color infrared imagery was collected along the Vermejo Formation within the Project Area, and field verification of suspect areas identified on the imagery occurred but was limited to those areas where access was granted. No methane was detected in any of the subsurface points within the suspect areas identified by infrared mapping.

In 2011, the survey area was expanded, and ground surveys were again conducted by Apogee and field-verified by LTE. Apogee's ground survey took over two days and identified suspect seep areas over approximately 240 miles of roadway. Through the previous 2007 and 2010 investigation and the 2011 ground survey, 39 suspect seep areas within the Project Area were identified. Of the 39 suspect seep areas, nine areas (L-1021, L-1030, 32 & L-1049, L-1050, 5, 14, L-1033, 13 & L-1026, and 19) were identified as active methane seeps during the investigation and 30 suspect seep areas did not record methane or the detected methane was attributed to other potential sources, such as fugitive gases from oil and gas equipment/production.

Based on the findings in 2011, the nine seep areas were monitored annually from 2011 to 2014. In 2014, areas L-1033, 13 & L-1026, and 19 appeared to be diminished. As a result, these seep areas were omitted from future monitoring activities. The remaining six seep areas were monitored in 2015. Findings from the 2015 monitoring event identified areas L-1021, 32 & L-1049, and L-1030 to be active methane seep areas. However, areas L-1050, 5, and 14 no longer had reportable methane flux detections and had limited methane detections in previous years. These three mapping areas were characterized as diminishing methane seeps and, supported by the absence of reportable methane flux in 2015, were omitted from future monitoring activities. From 2016 through 2021, LTE

surveyed areas L-1021, 32 & L-1049, and L-1030, which appear to be continually active seep areas. Summaries of the mapping areas from 2010 to present are included in Table 1.

Natural spring monitoring initially took place at Spring01 in 2010. When sampled, the water appeared to be predominately calcium and sodium + potassium in cationic composition and carbonate + bicarbonate in anionic composition. Dissolved methane was detected in the sample at a concentration of 0.109 milligrams per liter (mg/L), which is below the 2 mg/L regulatory threshold to analyze the gas composition and carbon and hydrogen isotopes of methane. Spring01 was dry in 2012 and 2013 and stagnant from 2016 to present; therefore, no samples were collected. Springs Chavez01, Chavez02, and Chavez03 were added to the program and samples collected in 2012. All Chavez samples appear to be calcium in cationic composition and bicarbonate in anionic composition. In 2012, dissolved methane for all three spring samples was below the 2 mg/L threshold applied by the COGCC to require additional gas analysis. Chavez03 has not been sampled since 2015 due to the presence of stagnant water. Spring03 (Quiet Spring) was discovered in 2014; however, water in the spring has never been sampled due to lack of access or lack of water.

Assessment and monitoring of P&A production wells and water well sampling activities (Former Rules 608(a) and 608(b)) are described in further detail in the subsequent Section 1.4, Deviations.

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## 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 formerly defined by XTO for development of CBM. The Raton Formation outcrop is exposed over approximately 50 percent of the Project Area. The discontinuous nature of the coal beds both in the subsurface and on the surface make it difficult to identify and/or correlate individual continuous coal beds from the subsurface producing zone to the surface coal outcrop. The area originally proposed for drilling by XTO 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 two percent of the overall Project Area. The Raton and Vermejo formation outcrops are depicted on Figure 1.

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## 1.3 SCOPE OF WORK

XTO originally proposed to drill CBM production wells in the Project Area of the Raton Basin over several years starting in 2010 (red outline on Figure 2). Drilling began in 2010. However, XTO did not install any CBM production wells in the Project Area in 2012, 2013, 2014, 2015, 2016, or 2017 and sold their assets in the Project Area to TCO in late 2017. TCO was purchased by Ogris in 2020. As a result, the 2018 through 2021 Project Areas were determined by a 2-mile buffer around the 2010 and 2011 proposed CBM production wells and CBM production wells XTO installed in 2010 and 2011. The 2020 Project Area (green outline on Figure 2), proposed 2010 and 2011 CBM production well locations, recorded P&A production well locations, groundwater well locations, topography, and mine features are illustrated on Figure 2. The scope of work for the Compliance Program outlined in the May 2010 Work Plan includes 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
  - Task 5: Preparation of this report.
- 

## 1.4 DEVIATIONS

Ogris did not propose or install any new CBM production wells in 2017 to present. As a result, some tasks and subtasks were omitted from the 2021 Compliance Program as described below. Historical procedures and findings for these tasks are described in previous annual reports.

- There were no new P&A production wells within the Project Area to assess in 2021, and as a result, Task 1 was not conducted for the 2021 Compliance Program.
- A review of groundwater wells within the 2021 Project Area meeting the requirements set forth in Rule 608(b) identified 11 groundwater wells. However, no new Ogris CBM production wells were installed from 2020 to present. As a result, Task 2 was not conducted during the 2021 Compliance Program. Groundwater wells will be sampled prior to drilling of any new production wells in the Project Area.
- Ground surveys to locate suspect methane seeps on the Raton Formation outcrop and color infrared (CIR) aerial imagery with 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 2021.
- While conducting detailed mapping of methane seeps areas during 2010, 2011, 2012, and 2013, (Task 3), gas samples were collected for isotopic analysis from those areas with reportable methane flux and where existing isotopic information from the 2007 COGCC Phase II seep investigation 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 seep areas in the Raton Basin. Each methane seep area currently has an associated isotopic analysis. As a result, re-sampling for isotopic analysis of these seep areas was not necessary in 2021.
- In 2011, the COGCC informed XTO that those natural springs that overlap with other oil and gas companies conducting similar activities to comply with former Rule 608 did not need to be sampled. As a result, Task 4 was reduced from the original May 2010 Work Plan by not sampling Spring05 (Vega Canyon), Spring07 (Spring Canyon), or Spring08 (Middle Lorencito). WSP was not granted property access for Spring02, Spring03 (Quiet Spring), Spring04, Spring06, Spring09, or Spring10. As a result, natural spring water samples from these six springs were not collected in 2021.



## 2 FIELD METHODS

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### 2.1 2021 PROJECT AREA

The 2021 Project Area was determined by a 2-mile buffer around the 2010 and 2011 proposed XTO CBM production wells and the CBM production wells that XTO installed in 2010 and 2011. The 2021 Project Area is outlined in green on Figure 2. The overall Project Area is outlined in red on Figure 2.

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### 2.2 PROPERTY ACCESS

Prior to conducting 2021 field activities, WSP acquired landowner information from the Las Animas County Assessor's office. WSP cross-referenced parcel data to identify owners of parcels located in the 2021 Project Area. WSP requested access to all properties where field work was proposed. The 2021 property owner and access information is presented in Table 2.

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### 2.3 FLUX SURVEY

Flux surveys consist of using 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 100 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. Additional measurements are collected between grid nodes if methane seepage is observed. Where appropriate, photographs of vegetative conditions, visible seeps, and sensitive receptors are collected.

The 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 ( $\text{mol}/\text{m}^2\text{-day}$ ).

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/m<sup>2</sup>-day to 300 mol/m<sup>2</sup>-day. Methane fluxes below 0.2 mol/m<sup>2</sup>-day are detectable with decreased accuracy. As a result, reporting of methane fluxes will not include values less than 0.2 mol/m<sup>2</sup>-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.

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### 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. 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.

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### 2.3.2 FLUX VOLUME ESTIMATIONS

WSP 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, WSP 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 7,100 feet above mean sea level (amsl).

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:**

ft<sup>3</sup> – cubic feet

CH<sub>4</sub> – 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 changes in calculated flux values based on measurements made at only a few locations.

## 2.4 NATURAL SPRINGS MONITORING

Surveys of natural springs are conducted on a spring-by-spring basis. Only natural springs identified on United States Geological Survey (USGS) topographic maps within the 2021 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. 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 Appendix A.

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

- Alkalinity (carbonate/bicarbonate) by Method SM 2320B-2011
- Major Anions [chloride (Cl), sulfate (SO<sub>4</sub>), bromide (Br), and fluoride (F)] by EPA Method 300
- SC by Method SM 2510B-2011
- Nitrate/Nitrite as Nitrogen (N) by EPA Method 300
- TDS by Method SM2540C
- Methane by Method RSK175 Modified
- pH by Method SM 4500HB
- Hydrogen Sulfide field analysis using Hach® test kit

Neither metals nor bacteria were analyzed in 2021 due to a sampling error. Based on years of consistent analytical results and COGCC 600 Series regulatory requirements for monitoring seeps requiring only visual monitoring, resampling to obtain metals and bacteria results was deemed unnecessary.

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 (COC) documentation to Accutest Mountain States Laboratories (Accutest) in Wheat Ridge, Colorado.

WSP sampled natural springs Chavez01 and Chavez02 during the sampling event in 2021. Water samples were not collected from Spring01 and Chavez03 due to stagnation of the water from the natural springs, and water samples were not collected from Spring03 (Quiet Spring) due to lack of access in previous years.

# 3 RESULTS

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## 3.1 FLUX SURVEY

As previously stated, WSP identified three mapping areas for surveying in 2021:

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

Reportable methane flux was detected in all three mapping areas. Total reportable volumetric methane flux was calculated as 1.3 MCFD for area L-1021, 4.5 MCFD for area L-1030, and 71.5 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. Methane flux measurements are presented on Figures 3 through 5. Summaries of the mapping areas from 2010 to present are included in Table 1. Flux data is included in Appendix B. Volumetric flux calculations are included in Appendix C.

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## 3.2 NATURAL SPRINGS SURVEY

WSP identified 13 natural springs within the 2021 Project Area (Figure 2). Natural springs Spring05 (Vega Canyon), Spring07 (Spring Canyon), and Spring08 (Middle Lorencito) were excluded from the sampling list as approved by the COGCC. Six natural springs were located on private property with no access granted. Two natural springs (Chavez01 and Chavez02) were sampled on October 19, 2021. Chavez03 and Spring01 were stagnant at the time of sampling, and as a result, no water samples were collected.

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### 3.2.1 SAMPLING AND ANALYSIS

Using data from the previous 8 years, the water types in spring samples appear to be predominately calcium in cationic composition and bicarbonate + carbonate in anionic composition. This was consistent from 2012 to 2020.

During the 2021 sampling, no methane exceeding 1 mg/l was identified in either spring sampled. Laboratory analytical results for the natural spring samples are summarized in Table 4. A Stiff diagram illustrating the water type is depicted on Figure 6. Natural spring laboratory analytical reports are presented in Appendix D

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### 3.2.2 FIELD OBSERVATIONS

WSP collected field measurements from the Chavez01 and Chavez02 natural springs, which were documented in a field logbook. The following measurements are for Chavez01 and Chavez02 respectively. Specific Electrical Conductance ( $\mu\text{S}/\text{cm}$ ): 330.0, 400.0, pH: 7.29, 6.57, ORP (mV): 90.7, 83.8, Temperature ( $^{\circ}\text{C}$ ): 11.84, 12.7, and TDS (mg/L): 213.7, 261.2, H<sub>2</sub>S (ppm): 0.0, 0.0. The 2021 field observations and measurements for the natural springs are consistent with previous years' sampling events. Field observations and measurements are summarized in Table 3.



## 4 CONCLUSIONS

The 2021 Compliance Program meets the requirements of subsections a, b, and c of the COGCC Former Rule 608 and the approved May 2010 Work Plan. WSP identified, through previous investigations, three mapping areas for surveying in 2021. Based on the findings from 2021, the three mapping areas L-1021, 32 & L-1049, and L-1030 continue to be active seep areas, however; when comparing the results from 2019 to 2020, seep area 32 & L-1049 showed a significant decrease in total reportable volumetric methane flux with 780.2 MCFD in 2019 and 58 MCFD in 2020. A similar decrease in volumetric methane flux was observed in 2017; however, the flux increased in the subsequent 2018 and 2019 surveys. In 2021 there was an increase in volumetric flux from the 58 MCFD observed in 2020 to 71.5 MCFD. The increase observed was minimal and still represents a significant decrease from the 2019 survey.

WSP recommends continued compliance with the COGCC-approved May 2010 Work Plan at the three previously identified mapping areas (areas L-1021, 32 & L-1049, and L-1030) for the 2021 flux survey. If a continued reduction in volumetric methane flux is observed at areas L-1021 and L-1030 during the 2022 survey, WSP may recommend reducing the monitoring frequency. In previous years, seep areas have been omitted from the survey if no volumetric flux was observed and labelled as diminished seeps. Seeps that have been omitted from the survey in previous years showed a similar decreasing trend in volumetric flux before a zero volumetric flux was observed. After two years of reduced volumetric flux it is anticipated that the three remaining seeps will follow that trend eventually becoming diminished seeps and there will no longer be a need for annual monitoring of the seeps providing no additional drilling activities commence.

Two natural springs were sampled for water quality analysis (Chavez01 and Chavez02). Based on previous years data, the water types appear to be predominately calcium in cationic composition and bicarbonate in anionic composition, which was consistent over 9 years of sampling. There have been no significant changes in the methane concentration of the springs since sampling began. No methane exceeding 1 milligram per liter (mg/l) was detected in water samples collected in 2021. Spring monitoring, as described in the current COGCC requirements CBM regulation Rule 614b(2), requires an annual survey of spring location and aerial extent and flow rate measurement after initial water sampling. Based on these requirements and no change in water quality after 9 years of sampling with minimal to no methane detected., WSP recommends that sampling of the springs be removed from the annual survey until drilling activities resume. The springs will still be inspected per COGCC Rule 614. Finally, WSP recommends consideration of a new work plan to comply with the updated CBM regulation in the COGCC Rule 614 and eliminate reference to a former rule.

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# TABLES



TABLE 1  
MAPPING AREA SUMMARIES  
2021 RULE 608 COMPLIANCE REPORT  
RATON BASIN, LAS ANIMAS COUNTY, COLORADO

Area IDs	2007	2010			2011			2012			2013			2014			2015			2016			2017			2018			2019			2020			2021		
	Subsurface Methane Gas Detected	Total Number of Flux Points	Reportable CH <sub>4</sub> Flux Points*	Total CH <sub>4</sub> Flux (MCFD)**	Total Number of Sample Points	Reportable CH <sub>4</sub> Flux Points*	Total CH <sub>4</sub> Flux (MCFD)**	Total Number of Sample Points	Reportable CH <sub>4</sub> Flux Points*	Total CH <sub>4</sub> Flux (MCFD)**	Total Number of Sample Points	Reportable CH <sub>4</sub> Flux Points*	Total CH <sub>4</sub> Flux (MCFD)**	Total Number of Sample Points	Reportable CH <sub>4</sub> Flux Points*	Total CH <sub>4</sub> Flux (MCFD)**	Total Number of Sample Points	Reportable CH <sub>4</sub> Flux Points*	Total CH <sub>4</sub> Flux (MCFD)**	Total Number of Sample Points	Reportable CH <sub>4</sub> Flux Points*	Total CH <sub>4</sub> Flux (MCFD)**	Total Number of Sample Points	Reportable CH <sub>4</sub> Flux Points*	Total CH <sub>4</sub> Flux (MCFD)**	Total Number of Sample Points	Reportable CH <sub>4</sub> Flux Points*	Total CH <sub>4</sub> Flux (MCFD)**	Total Number of Sample Points	Reportable CH <sub>4</sub> Flux Points*	Total CH <sub>4</sub> Flux (MCFD)**	Total Number of Sample Points	Reportable CH <sub>4</sub> Flux Points*	Total CH <sub>4</sub> Flux (MCFD)**			
L-1021	-	-	-	-	44	10	129.71	47	6	6.7	46	2	2.2	51	4	1.9	35	4	6.8	35	6	14.1	35	2	7.5	35	3	193.6	35	5	17.8	28	2	3.5	36	2	4.8
L-1030	-	-	-	-	17	3	2.19	17	3	2.2	18	1	1	18	4	56.9	18	2	12.7	18	3	5.4	22	7	19.4	22	4	25.4	18	3	2.2	18	5	4.5	18	2	1.3
32 & L-1049	x	-	-	-	372	146	304.12	217	55	720.4	234	37	332.4	233	33	150.7	239	25	668.4	238	32	204.3	239	29	74.3	240	35	739.3	238	23	780.2	250	22	58	240	7	71.5
L-1050	-	-	-	-	22	4	0.69	22	2	1.0	22	0	0.0	25	1	1	22	0	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
5	-	-	-	-	167	16	2.16	83	6	1.9	83	0	0.0	80	3	0.8	76	0	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
14	-	94	16	0.563808	50	7	0.34	46	0	0.0	58	3	0.2	66	4	0.4	58	0	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
L-1033	-	-	-	-	26	1	0.02	40	4	0.1	40	0	0.0	38	0	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
13 & L-1026	-	29	8	10.74	56	2	0.03	61	1	1	61	0	0.0	38	0	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
19	-	-	-	-	23	0	0.00	15	1	1	15	0	0.0	14	0	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		

**Notes:**  
CH<sub>4</sub> - methane  
MCFD - thousand cubic feet per day  
moles/m<sup>2</sup>·day - moles per meter squared per day  
NA - not applicable  
- - not measured  
1 - not contoured, only one data point  
\*\* - volume includes only gridded values > 0.2 moles/m<sup>2</sup>·day  
\* - only points where flux values were above the reporting limit of 0.2 moles/m<sup>2</sup>·day

**TABLE 2**

**PROPERTY OWNER AND ACCESS INFORMATION  
2021 COLORADO RULE 608 COMPLIANCE REPORT  
RATON BASIN, LAS ANIMAS COUNTY, COLORADO**

<b>LANDOWNER</b>	<b>PARCEL ID</b>	<b>SECTION</b>	<b>TOWNSHIP</b>	<b>RANGE</b>	<b>PERMISSION GRANTED</b>
Ogris Operating, LLC	14533300	28	33	67	Yes
	14533405	27, 28	33	67	
	14533200	27	33	67	
Bill R. and Rossana T. Chavez	13940200	19	33	67	Yes
Bill Toupal	NA	28	33	67	Yes
		27, 28	33	67	
		27	33	67	
Veronica Law	NA	19	33	67	Yes



TABLE 3

**NATURAL SPRING WATER QUALITY MEASUREMENTS  
2021 COLORADO RULE 608 COMPLIANCE REPORT  
RATON BASIN, LAS ANIMAS COUNTY, COLORADO**

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	13.3	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
				8/25/2016	STAGNANT WATER - NOT MEASURED				
				9/6/2017	STAGNANT WATER - NOT MEASURED				
				8/20/2018	STAGNANT WATER - NOT MEASURED				
				10/23/2019	STAGNANT WATER - NOT MEASURED				
				8/26/2020	STAGNANT WATER - NOT MEASURED				
				10/19/2021	STAGNANT WATER - NOT MEASURED				
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	579.0
				8/12/2015	420.8	6.8	279.5	14.7	275.4
				8/25/2016	284.6	7.1	25.5	14.1	233.4
				9/6/2017	383.6	7.6	610	16.15	249.2
				8/20/2018	711.0	8.8	-83	18.34	494.3
				10/23/2019	216.8	8.5	-89.3	9.8	197.3
				8/26/2020	331.4	8.7	-76.8	17.2	253.8
				10/19/2021	330.0	7.3	90.7	11.84	213.7
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
				8/25/2016	381.4	7.6	44.8	17.5	291.7
				9/6/2017	554.9	7.04	544	16.1	358.8
				8/20/2018	390.0	8.67	-82.9	18.9	245.6
				10/23/2019	368.8	8.09	-90.6	12.8	309.4
				8/26/2020	345.8	8.44	-79.8	16.5	269.2
				10/19/2021	400.0	6.57	83.8	12.7	261.2
Chavez03	Rancho Escondido	-104.916708750	37.156096546	9/4/2012	1,864.0	7.0	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	1,255.3
				8/12/2015	STAGNANT WATER - NOT MEASURED				
				8/25/2016	DRY - NOT MEASURED				
				9/6/2017	STAGNANT WATER - NOT MEASURED				
				8/20/2018	STAGNANT WATER - NOT MEASURED				
				10/23/2019	STAGNANT WATER - NOT MEASURED				
				8/26/2020	STAGNANT WATER - NOT MEASURED				
				10/19/2021	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				
				8/25/2016	STAGNANT WATER - NOT MEASURED				
				9/6/2017	NO ACCESS GRANTED - NOT MEASURED				
				8/20/2018	NO ACCESS GRANTED - NOT MEASURED				
				10/23/2019	NO ACCESS GRANTED - NOT MEASURED				
				8/26/2020	NOT MEASURED				
				10/19/2021	NOT MEASURED				

**Notes:**

°C - degrees Celsius  
mg/l - milligrams per liter  
mV - millivolts  
NM - Not Measured  
ORP - oxidation reduction potential  
TDS - total dissolved solids  
µS/cm - microSiemens per centimeter

TABLE 4

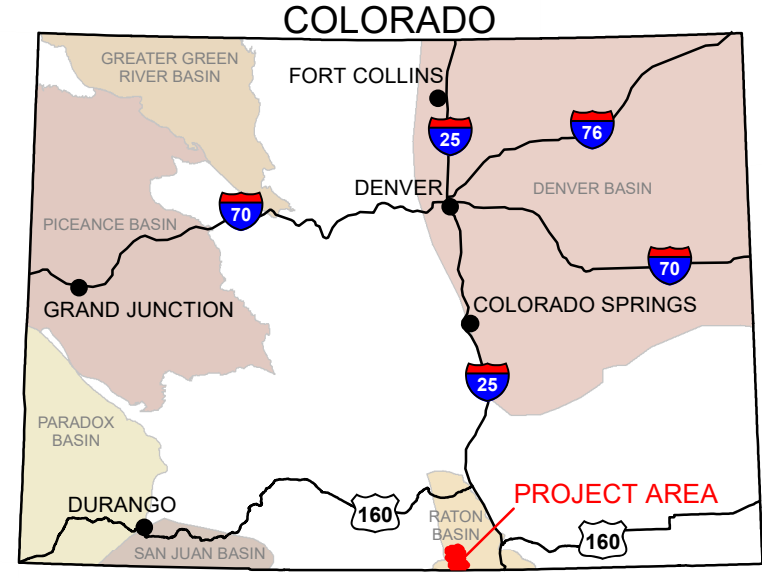
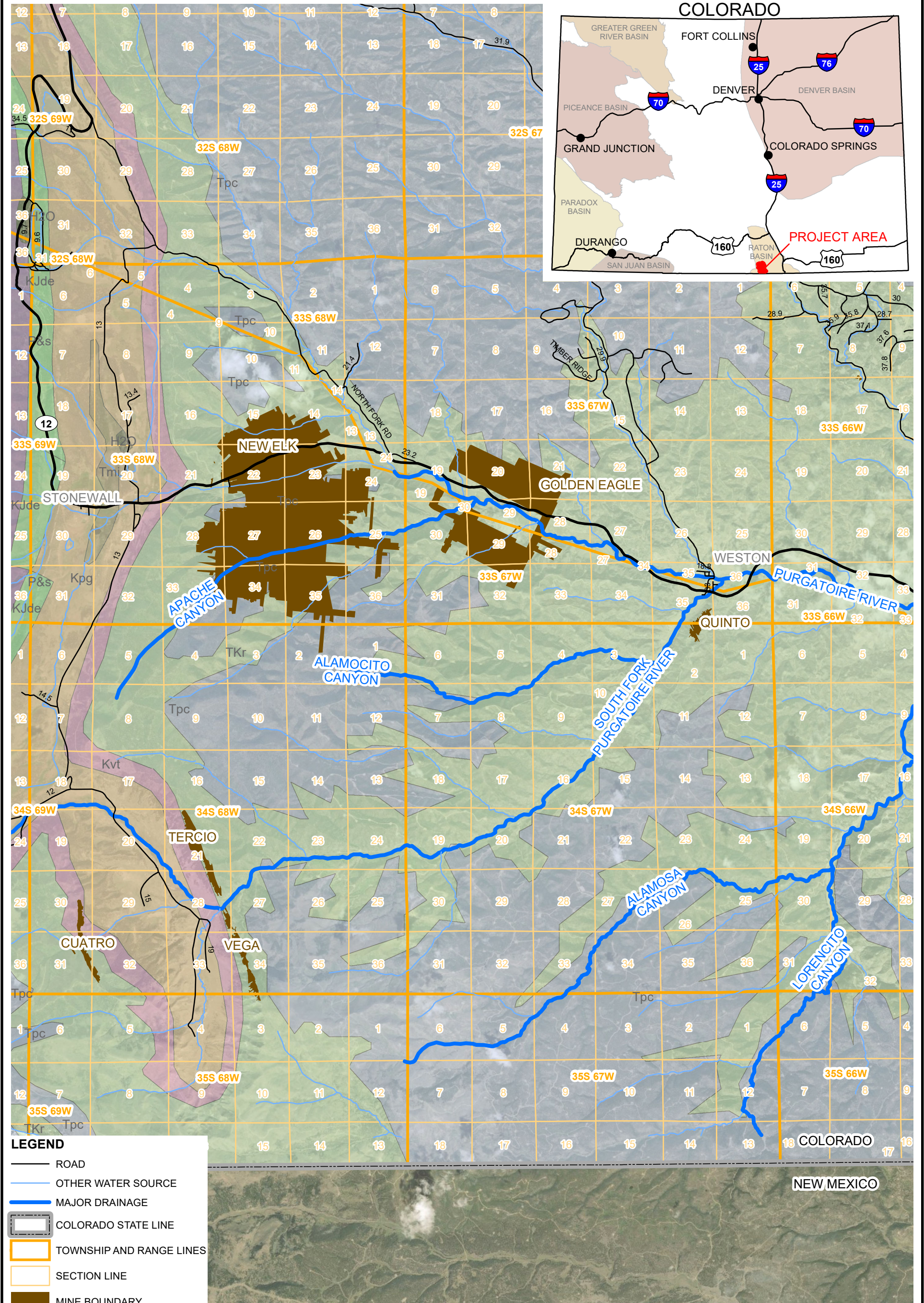
NATURAL SPRING ANALYTICAL RESULTS  
2021 COLORADO RULE 608 COMPLIANCE REPORT  
RATON BASIN, LAS ANIMAS COUNTY, COLORADO

Natural Spring	Location	Sample Date	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Potassium (mg/l)	Manganese (mg/l)	Selenium (mg/l)	Methane (mg/l)	Iron (mg/l)	Sodium Adsorption Ratio	Carbonate (mg/l)	Bicarbonate (mg/l)	TDS (mg/l)	Specific Conductivity (umhos/cm)	pH	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	3.4	0.65	97.7	1.41	0.0210	<0.00080	0.10900	1.59	11.4	<5.0	205	280	364	10.13	2.9	3.3	<0.20	0.74	<0.50	<0.23	<0.061	500	>350,000	700,000		
		8/15/2011	2.2	0.52	136.0	1.64	0.1260	<0.00080	0.277	3.660	22.2	<5.0	332	420	428	8.16	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	1.4	0.35	129.0	<1.0	0.0063	<0.00080	1.00	<0.010	25.0	<5.0	251	338	406	NA	3.5	3.7	<0.050	1.00	0.5	<0.010	<0.0040	<25	<500	<200		
		8/13/2015	1.8	0.47	128.0		0.0111	<0.00080	1.09000	0.0212	20.1	10.9	227	304	402	8.64	7.4	3.9	<0.050	0.97	<0.50	<0.020	<0.0080	<25	<500	<200		
		8/25/2016	STAGNANT WATER - NOT SAMPLED																									
		9/6/2017	STAGNANT WATER - NOT SAMPLED																									
		8/20/2018	STAGNANT WATER - NOT SAMPLED																									
		10/23/2019	STAGNANT WATER - NOT SAMPLED																									
		8/26/2020	STAGNANT WATER - NOT SAMPLED																									
		10/19/2021	STAGNANT WATER - NOT SAMPLED																									
Chavez01	Rancho Escondido	9/4/2012	44.5	8.12	20.4	<1.0	<0.0050	<0.0020	0.0012	<0.070	0.738	<5.0	157	194	323	7.28	19.3	3.4	<0.050	0.27	0.0	0.011	<0.0040	74,500	350,000	359,000		
		8/15/2013	50.2	8.59	20.8	1.07	NA	<0.0020	NA	<0.070	0.755	<5.0	171	224	358	7.4	28.7	5.8	<0.050	0.27	NA	0.012	<0.0040	74,500	66,500	1,200		
		8/21/2014	49.8	8.92	15.0	1.23	<0.0050	<0.00080	0.0035	<0.010	0.490	<5.0	141	210	278	NA	21.6	5.1	<0.050	0.23	0.0	<0.010	<0.0040	9,000	66,500	700		
		8/12/2015	53.6	9.92	15.4	<1.0	<0.0050	<0.00080	0.00250	0.0147	0.507	<5.0	139	220	285	7.19	27.5	15.7	<0.050	0.23	<0.50	<0.010	<0.0040	74,500	350,000	<200		
		8/25/2016	41.7	8.09	13.4	<1.0	8.090	0.0011	0.0022	<0.010	0.519	<5.0	141	200	291	7.13	24.6	6.7	<0.050	0.21	0.0	<0.050	<0.0054	74,500	66,500	1,200		
		9/6/2017	50.0	9.42	15.0	<1.0	0.0023	<0.00080	0.00260	<0.010	0.510	<5.0	137	202	325	7.80	25.1	8.8	<0.050	0.22	0.0	<0.010	<0.0040	74,500	350,000	5,000		
		8/20/2018	43.4	8.07	12.1	<1.0	0.003	<0.00080	0.00049	<0.010	0.442	<5.0	131	188	287	7.97	26.1	3.3	<0.050	0.25	NA	0.024	0.024	35,000	440,000	6,000		
		10/23/2019	47.9	8.35	11.5	<1.0	<0.002	<0.00080	0.0038	<0.01	0.403	<5.0	129	183	299	7.49	24.9	4.3	<0.050	0.23	NA	0.015	<0.0040	2,200	440,000	27,000		
		8/26/2020	37.6	6.79	9.68	<1.0	0.0025	<0.0008	<0.00080	<0.01	0.422	<5.0	115	166	289	7.89	22.5	2	<0.050	0.21	NA	0.027	<0.0040	35,000	440,000	27,000		
		10/19/2021	NA	NA	NA	NA	NA	NA	0.0037	NA	NA	<5.0	125	181	335	7.32	29.1	3.2	<0.050	0.24	NA	0.033	<0.0040	NA	NA	NA		
		9/4/2012	49.3	9.56	18.2	1.43	<0.0050	<0.0020	0.00030	<0.070	0.621	<5.0	163	206	330	7.17	20.3	4.0	<0.050	0.30	0.0	0.088	<0.0040	74,500	350,000	359,000		
		8/15/2013	59.7	11.00	20.2	1.51	0.0055	<0.0020	NA	<0.070	0.670	<5.0	201	264	428	7.28	31.3	8.1	<0.050	0.29	NA	1.800	1.800	75,500	12,500	5,000		
8/21/2014	57.7	11.20	15.9	1.77	<0.0050	<0.00080	0.00054	0.264	0.489	<5.0	167	242	318	NA	24.0	5.8	<0.050	0.29	0.0	0.400	<0.0040	9,000	<500	5,000				
8/12/2015	71.7	13.30	14.9	1.61	<0.0020	<0.00080	<0.00080	0.0473	0.472	<5.0	196	291	405	7.45	29.8	14.5	<0.050	0.27	<0.50	0.940	0.940	74,500	350,000	5,000				
8/25/2016	56.6	11.80	13.2	15.4	<0.0050	<0.00080	<0.00080	0.0329	0.447	<5.0	195	262	382	7.26	26.7	9.6	<0.050	0.25	0.0	0.42	0.42	74,500	66,500	18,000				
9/6/2017	73.0	14.4	16.8	1.620	0.0041	<0.00080	0.00052	0.022	0.470	<5.0	223	290	471	7.51	27.5	9.5	<0.050	0.27	0.0	0.16	<0.0040	74,500	350,000	700				
8/20/2018	46.0	9.11	12.5	1.380	0.0023	<0.00080	<0.00080	0.013	0.440	<5.0	143	208	310	8.10	28.1	4.1	<0.050	0.27	NA	0.17	0.17	35,000	440,000	6,000				
10/23/2019	72.1	13.30	12.8	1.560	0.0051	<0.00080	0.00097	0.036	0.363	<5.0	191	246	394	7.26	23.9	4.6	<0.050	0.26	NA	0.062	<0.0040	9,000	440,000	115,000				
8/26/2020	49.2	9.20	10.9	1.360	0.0056	<0.00080	<0.00080	0.077	0.367	<5.0	165	222	346	7.99	25.2	2.4	<0.050	0.22	NA	0.120	<0.0040	35,000	1,750,000	27,000				
10/19/2021	NA	NA	NA	NA	NA	NA	0.00098	NA	NA	<5.0	153	211	398	7.33	27.8	3.9	<0.050	0.28	NA	0.099	<0.0040	NA	NA	NA	NA			
Chavez03	Rancho Escondido	9/4/2012	117.0	43.20	20.8	6.25	<0.0050	<0.0020	0.0119	0.235	4.17	<5.0	495	990	160	7.44	63.7	254.0	2.0	0.35	0.0	0.083	0.024	74,500	66,500	359,000		
		8/15/2013	113.0	48.20	22.3	5.50	<0.0050	<0.0020	NA	0.200	3.91	<5.0	536	1,090	1,850	7.38	47.4	324.0	2.6	0.72	NA	0.260	0.260	9,000	350,000	359,000		
		8/21/2014	117.0	53.30	241.0	5.81	0.3730	<0.00080	0.0285	0.122	4.22	<5.0	539	1,160	1,660	NA	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																									
		8/25/2016	DRY - NOT SAMPLED																									
		9/6/2017	STAGNANT WATER - NOT SAMPLED																									
		8/20/2018	STAGNANT WATER - NOT SAMPLED																									
		10/23/2019	STAGNANT WATER - NOT SAMPLED																									
		8/26/2020	STAGNANT WATER - NOT SAMPLED																									
		10/19/2021	STAGNANT WATER - NOT SAMPLED																									
		Spring03 - Quiet Spring	Rancho Escondido	8/21/2014	STAGNANT WATER - NOT SAMPLED																							
				8/12/2015	STAGNANT WATER - NOT SAMPLED																							
8/25/2016	STAGNANT WATER - NOT SAMPLED																											
9/6/2017	NO ACCESS GRANTED - NOT SAMPLED																											
8/20/2018	NO ACCESS GRANTED - NOT SAMPLED																											
10/23/2019	NO ACCESS GRANTED - NOT SAMPLED																											
8/26/2020	NOT SAMPLED																											
10/19/2021	NOT SAMPLED																											

# FIGURES







**LEGEND**

- ROAD
- OTHER WATER SOURCE
- MAJOR DRAINAGE
- COLORADO STATE LINE
- TOWNSHIP AND RANGE LINES
- SECTION LINE
- MINE BOUNDARY

**GEOLOGIC CONTACTS (TWETO, 1979)**

- Tmi - MIDDLE TERTIARY INTRUSIVE ROCKS
- Tpc - POISON CANYON FORMATION
- TKr - RATON FORMATION
- Kvt - VERMEJO FORMATION
- Kpg - PIERRE SHALE FORMATION
- KJde - DAKOTA FORMATION
- Ps - SANGRE DE CRISTO FORMATION

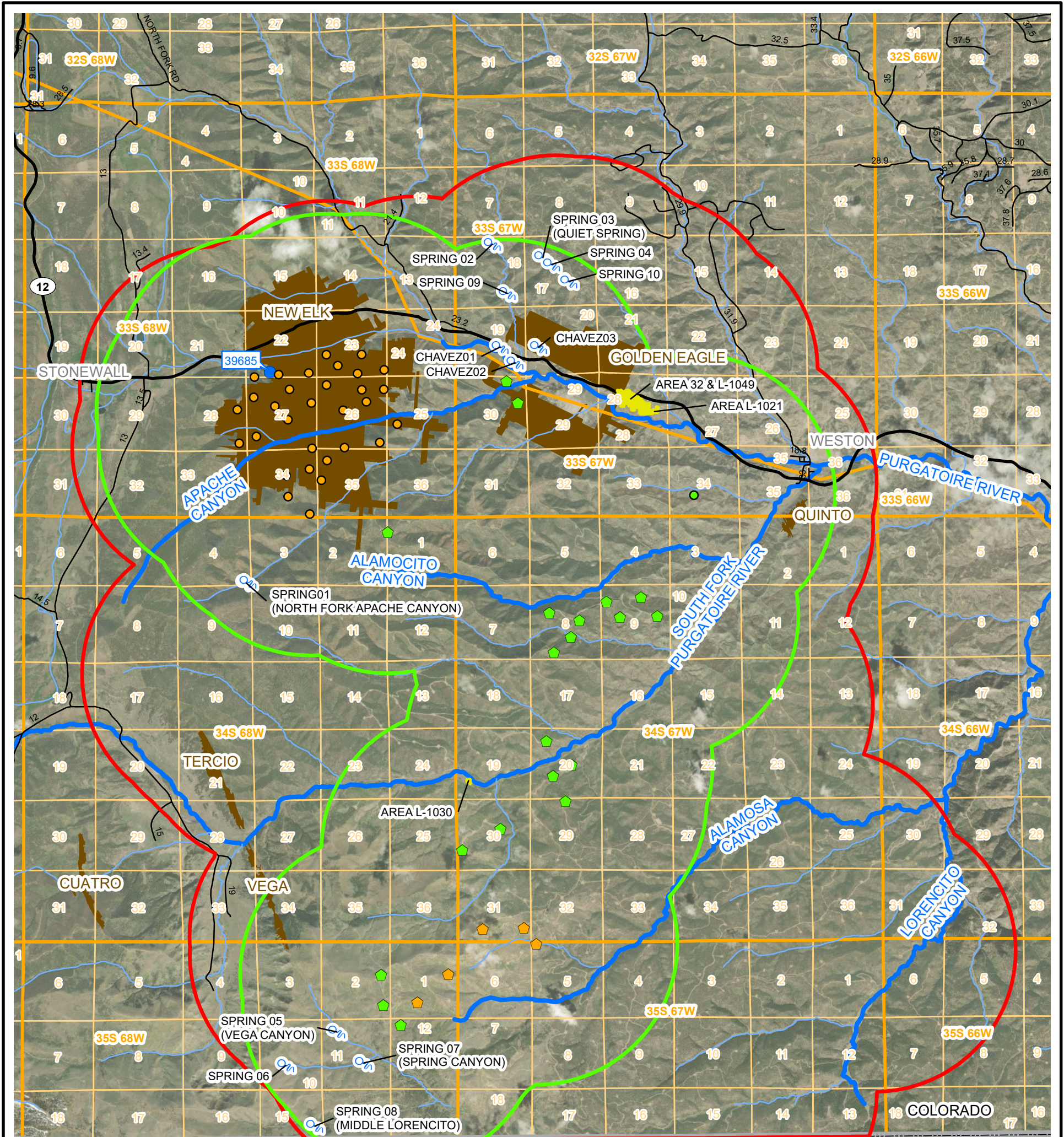


**FIGURE 1**  
**SITE LOCATION MAP**  
**2021 COLORADO RULE 608 COMPLIANCE REPORT**  
**RATON BASIN, LAS ANIMAS COUNTY, COLORADO**



OGRIS OPERATING





LEGEND

- 2010 PROPOSED COALBED METHANE PRODUCTION WELL
- 2010 INSTALLED COALBED METHANE PRODUCTION WELL
- 2011 PROPOSED COALBED METHANE PRODUCTION WELL
- 2011 INSTALLED COALBED METHANE PRODUCTION WELL
- WATER WELL LABELED WITH PERMIT NUMBER
- SPRING LABELED WITH SAMPLE ID  
(SPRING NAME, IF APPLICABLE)
- ROAD
- OTHER WATER SOURCE
- MAJOR DRAINAGE
- MAPPING AREA
- 2010 PROJECT AREA
- 2021 PROJECT AREA
- COLORADO STATE LINE
- TOWNSHIP AND RANGE LINES
- SECTION LINE
- MINE BOUNDARY



FIGURE 2  
2021 PROJECT AREA MAP  
2021 COLORADO RULE 608 COMPLIANCE REPORT  
RATON BASIN, LAS ANIMAS COUNTY, COLORADO

OGRIS OPERATING







IMAGE COURTESY OF ESRI

LEGEND

2021 METHANE FLUX MEASUREMENT  
(mol/m<sup>2</sup> • day)

- 0.0000 - 0.1999
- 0.2000 - 0.5000
- 0.5001 - 1.0000
- 1.0001 - 10.0000
- 10.0001 - 48.0000

- 2011 SUSPECT METHANE SEEP (ID LABELED IN GREEN)
- METHANE FLUX CONTOUR (mol/m<sup>2</sup> day)  
CONTOUR INTERVAL VARIES
- mol/m<sup>2</sup> • day: MOLES PER SQUARE METER PER DAY  
ONLY METHANE FLUX MEASUREMENTS GREATER  
THAN OR EQUAL TO 0.2 mol/m<sup>2</sup> • day ARE LABELED

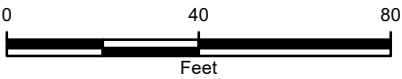


FIGURE 3  
METHANE FLUX CONTOURS  
MAPPING AREA L-1021  
2021 COLORADO RULE 608 COMPLIANCE REPORT  
RATON BASIN, LAS ANIMAS COUNTY, COLORADO  
OGRIS OPERATING







IMAGE COURTESY OF ESRI

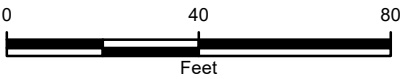
**LEGEND**

**2021 METHANE FLUX MEASUREMENT**  
(mol/m<sup>2</sup> • day)

- 0.0000 - 0.1999
- 0.2000 - 0.5000
- 0.5001 - 1.0000
- 1.0001 - 10.0000
- 10.0001 - 48.0000

- ▲ 2011 SUSPECT METHANE SEEP (ID LABELED IN GREEN)
- METHANE FLUX CONTOUR (mol/m<sup>2</sup> day)
- CONTOUR INTERVAL VARIES

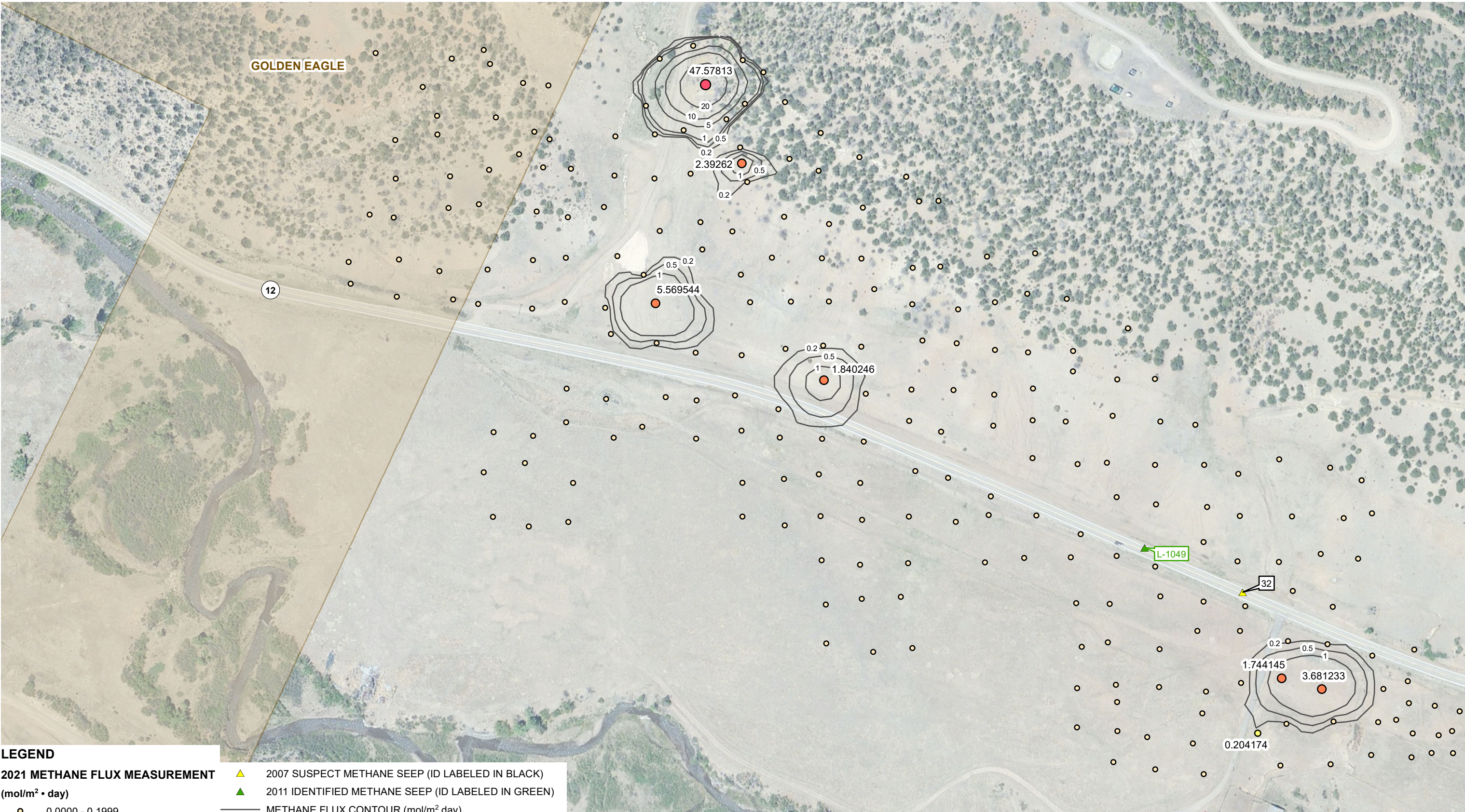
mol/m<sup>2</sup> • day: MOLES PER SQUARE METER PER DAY  
ONLY METHANE FLUX MEASUREMENTS GREATER  
THAN OR EQUAL TO 0.2 mol/m<sup>2</sup> • day ARE LABELED



**FIGURE 4**  
**METHANE FLUX CONTOURS**  
**MAPPING AREA L-1030**  
**2021 COLORADO RULE 608 COMPLIANCE REPORT**  
**RATON BASIN, LAS ANIMAS COUNTY, COLORADO**  
**OGRIS OPERATING**







**LEGEND**

**2021 METHANE FLUX MEASUREMENT**  
(mol/m<sup>2</sup> • day)

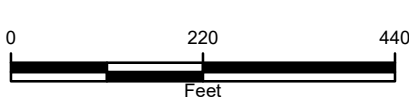
- 0.0000 - 0.1999
- 0.2000 - 0.5000
- 0.5001 - 1.0000
- 1.0001 - 10.0000
- 10.0001 - 17.0000

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

— METHANE FLUX CONTOUR (mol/m<sup>2</sup> day)  
CONTOUR INTERVAL VARIES

mol/m<sup>2</sup> • day: MOLES PER SQUARE METER PER DAY  
ONLY METHANE FLUX MEASUREMENTS GREATER  
THAN OR EQUAL TO 0.2 mol/m<sup>2</sup> • day ARE LABELED

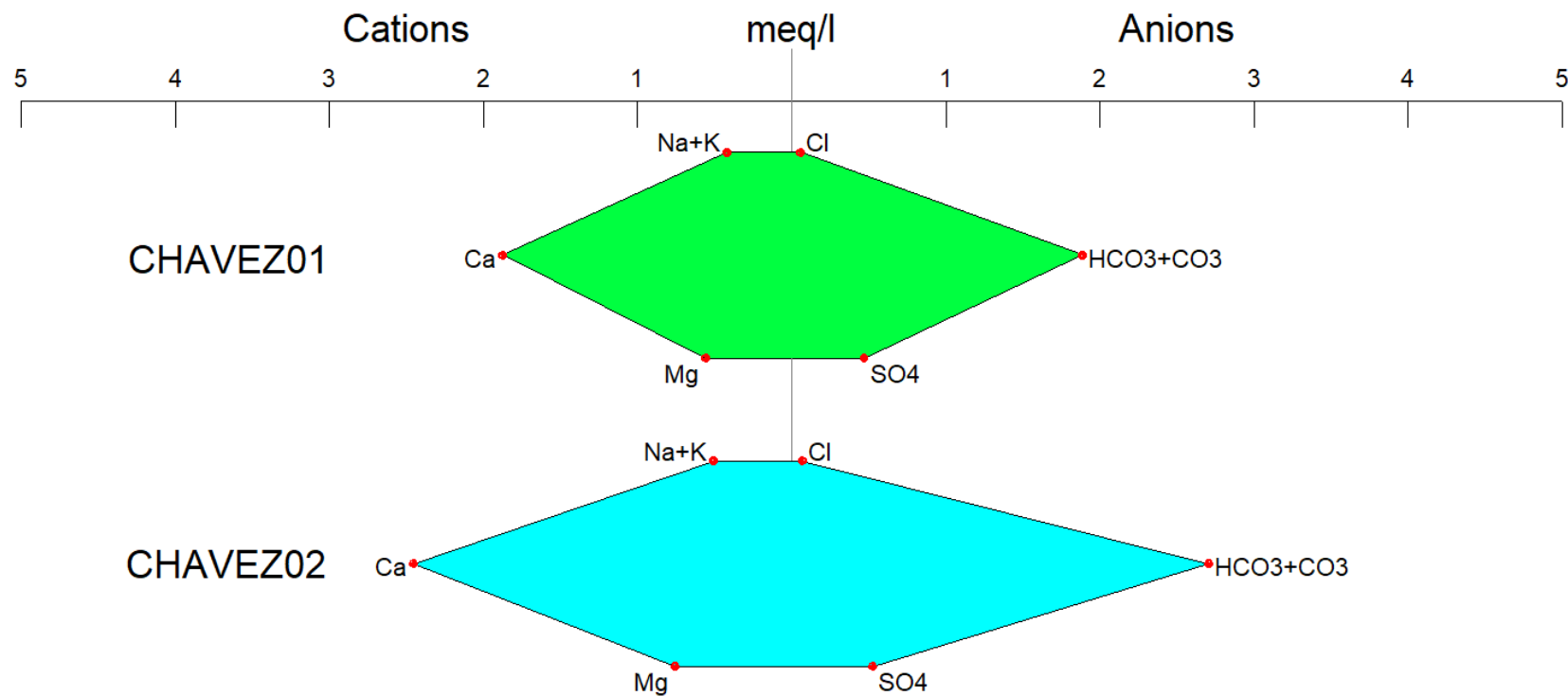
LEWICKI MINE BOUNDARY



**FIGURE 5**  
**METHANE FLUX CONTOURS**  
**MAPPING AREAS 32 & L-1049**  
**2021 COLORADO RULE 608 COMPLIANCE REPORT**  
**RATON BASIN, LAS ANIMAS COUNTY, COLORADO**  
**OGRIS OPERATING**







#### LEGEND

Ca: CALCIUM

Cl: CHLORIDE

CO3: CARBONATE

HCO3: BICARBONATE

K: POTASSIUM

Mg: MAGNESIUM

Na: SODIUM

SO4: SULFATE

meq/l: MILLIEQUIVALENTS PER LITER

FIGURE 6  
STIFF DIAGRAMS  
AUGUST 26, 2020  
2021 COLORADO RULE 608 COMPLIANCE REPORT  
RATON BASIN, LAS ANIMAS COUNTY, COLORADO



# APPENDICES



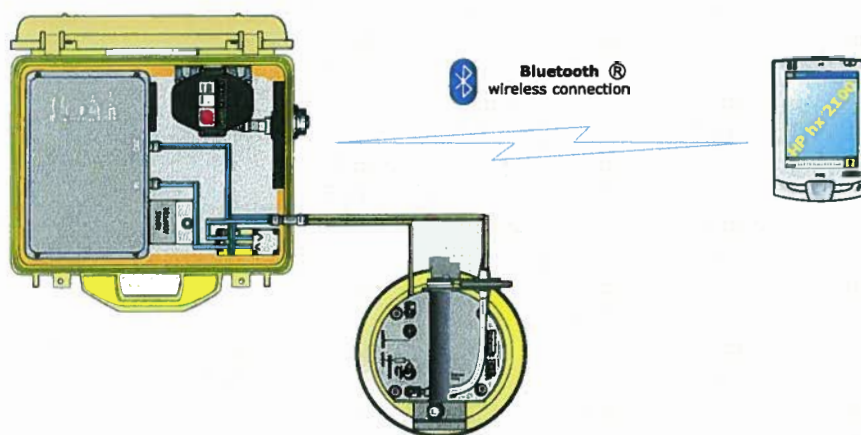
# **APPENDIX A**

## **EQUIPMENT SPECIFICATIONS**

# WEST Systems portable soil flux meter

## for Carbon dioxide, Methane and Hydrogen sulfide fluxes

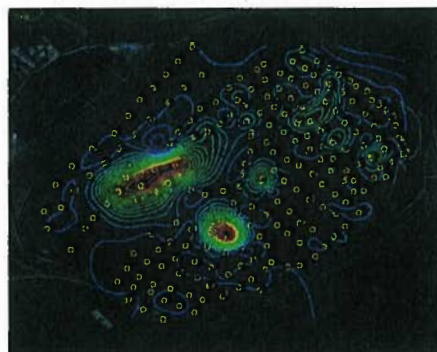
The WEST Systems Fluxmeter is a portable instrument for the measurement of soil gas diffuse degassing phenomena that uses the accumulation chamber method.



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-L1820 flux meter  
Courtesy of United States Geological Survey

West Systems Srl  
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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").

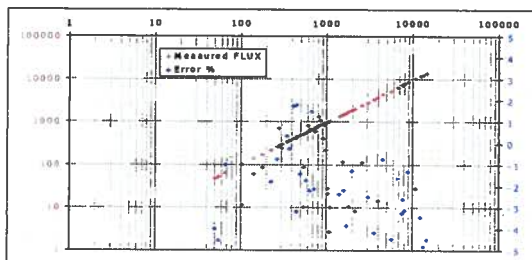
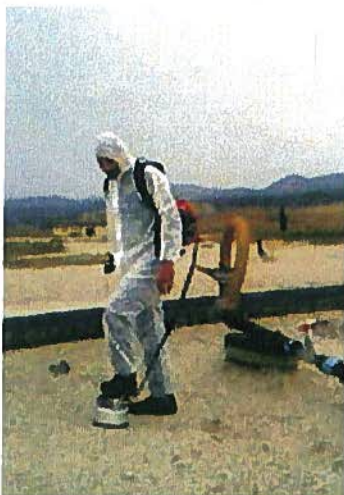
**Software** The instrument is supplied with a custom software, FluxManager, which allows recording and visualization of the increase in concentration of the target gas in the accumulation chamber, and then the flux calculations. The obtained measurements can be saved on the palmtop computer and then 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

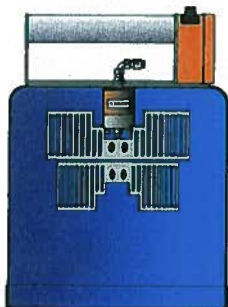
The standard flux meter configuration is supplied with a single gas detector, normally the carbon dioxide detector. The fluxmeter can host two sensors by the way special releases, based on specific customer request, it can be supplied with a maximum of 3 sensors.

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.



## 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

Accumulation Chamber Type B





CO<sub>2</sub> - LI820

#### LI820 based Carbon dioxide fluxmeter

The CO<sub>2</sub> 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  $\pm 5$ 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<sup>-2</sup> day<sup>-1</sup>

**CO<sub>2</sub> FLUX Measurement range:**  
from 0 up 600 moles m<sup>-2</sup> day<sup>-1</sup>

The accuracy depends on the measured flux:

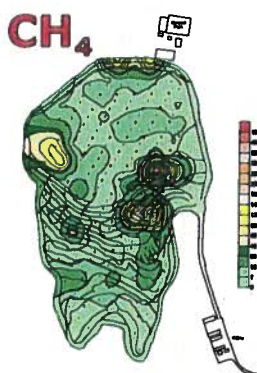
0 to 0.5 moles m <sup>-2</sup> day <sup>-1</sup>	25% (Acc.ch.A)
0.5 to 1 moles m <sup>-2</sup> day <sup>-1</sup>	15% (Acc.ch.A or B)
1 to 150 moles m <sup>-2</sup> day <sup>-1</sup>	10% (Acc.ch.B)
150 to 300 moles m <sup>-2</sup> day <sup>-1</sup>	10% (Acc.ch.B)
300 to 600 moles m <sup>-2</sup> day 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

#### WS-DRAGER: CO<sub>2</sub> 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/m<sup>2</sup> per day.

The precision depends on the measured flux:

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



WS-HC CH<sub>4</sub>

#### Methane fluxmeter

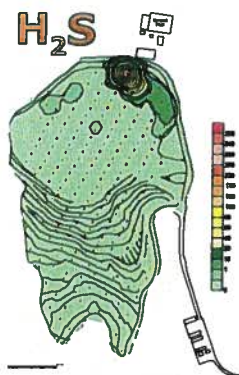
The methane sensor is an IR spectrometer. The full-scale range is 50000ppm, accuracy of 5% of reading, and repeatability is 2% of span. Detection limit 60 ppm, resolution 22 ppm. The detector was designed to measure the not controlled emissions of landfill, but it can be used to detect methane emission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

#### Methane Flux measurement range

from 0.2 up 300 moles m<sup>-2</sup> day<sup>-1</sup>

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

0.2 to 10 moles m <sup>-2</sup> day <sup>-1</sup>	25% (Acc.Ch.A)
10 to 150 moles m <sup>-2</sup> day <sup>-1</sup>	15% (Acc.Ch.A)
150 to 300 moles m <sup>-2</sup> day <sup>-1</sup>	20% (Acc.Ch.B)



H<sub>2</sub>S - 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%.

H<sub>2</sub>S Flux measurement range: from 0.0025 to 0.5 moles/m<sup>2</sup> per day.

The precision depends on the measured flux:

0.0025 – 0.05 moles/m <sup>2</sup> per day	$\pm 25\%$ (Acc. Chamber A)
0.05 – 0.5 moles/m <sup>2</sup> 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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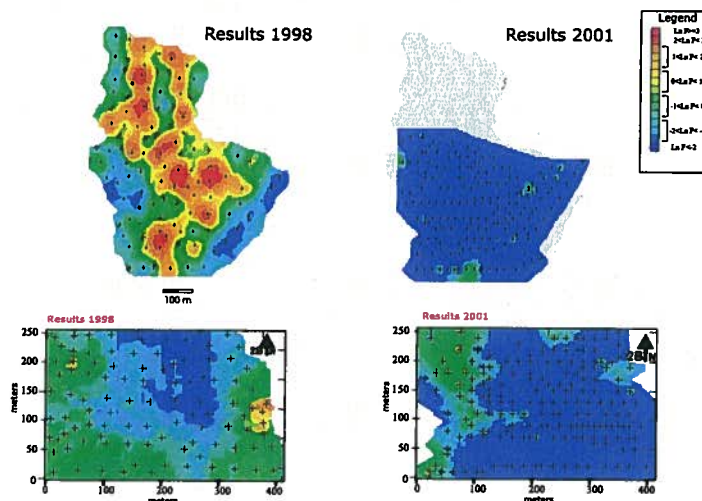
**WEST**  
Systems

## 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](mailto:g.virgili@westsystems.com)

### Local sales representative

H.Q.

#### West Systems Srl

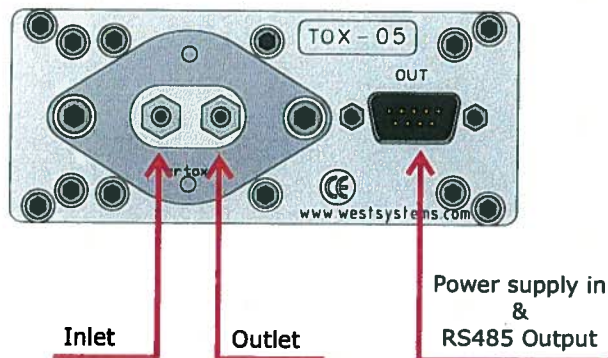
Via Molise 3 - Zona Ind. Gello - 56025 Pontedera (PI) Italy  
Phone +39 0587 294216 [www.westsystems.com](http://www.westsystems.com) (or .it)  
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Japan

#### SHOKO CO., LTD.

7-13,1-chome, Shibakoen, Minato-ku Tokyo  
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TEL : 03-3459-5106 FAX : 03-3459-5081  
WEB SITE <http://www.shoko.co.jp>  
e-mail [s-isotope@shoko.co.jp](mailto: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

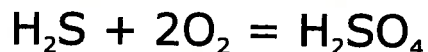
## Legenda

**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/m<sup>2</sup> per day.

The precision depends on the measured flux:

range	0.1	5	moles/ m <sup>2</sup> per day	±25%
	5	- 150	moles/ m <sup>2</sup> per day	±10%

The measurement of very low fluxes (< 0.1 moles/m<sup>2</sup>/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

## CO<sub>2</sub> 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

<sup>1</sup>**Zero Drift:** < 0.15 ppm / °C

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

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

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

<sup>1</sup> Zero drift is the change with temperature at 0 concentration

<sup>2</sup> Span drift is the change after re-zeroing following a temperature change

<sup>3</sup> 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

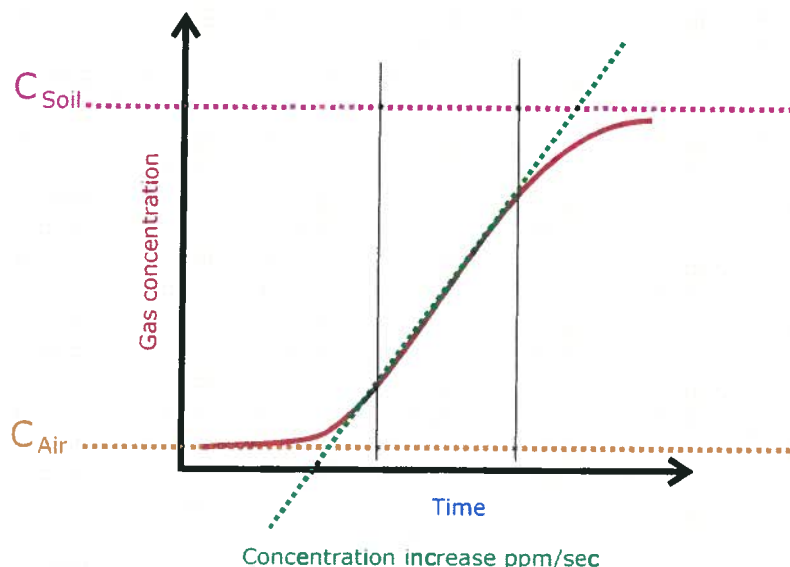
**Relative Humidity Range:** 0 to 95% RH, Non-Condensing

**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<sup>-1</sup> mol<sup>-1</sup>
- **T<sub>k</sub>** 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.



# Gasport® Gas Tester

MSA

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 <sub>4</sub>	1 % LEL or 0.1% CH <sub>4</sub>
Methane	5-100% CH <sub>4</sub>	1% CH <sub>4</sub>
Oxygen	0-25%	0.1%
Carbon Monoxide	0-1000 ppm	1 ppm
Hydrogen Sulfide	0-100 ppm	1 ppm

<b>Battery types:</b>	NiCd and Alkaline
<b>Case material:</b>	Impact resistant, stainless-steel-fiber-filled polycarbonate
<b>Operating temperature:</b>	normal -10 to 40°C; extended -20 to 50°C
<b>Operating humidity:</b>	Continuous: 15-95% RH, non-condensing Intermittent duty: 5-95% RH, non condensing
<b>Warm up time:</b>	Less than 20 seconds to initial readings
<b>Datalog capacity:</b>	12 hours
<b>Input:</b>	3 clearly marked, metal domed keys
<b>Warranty:</b>	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 <sub>2</sub>
812389	CO
812390	H <sub>2</sub> 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 <sub>2</sub> 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 <sub>2</sub>	CO	H <sub>2</sub> 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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# 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

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



# GeoXT

## The total GPS platform for all your GIS field requirements

The GeoXT™ handheld, from the GeoExplorer® series, is an essential tool for maintaining your GIS. It's all you need to collect location data, keep existing GIS information up to date, and even mobilize your GIS.

The unique GeoExplorer series combines a Trimble® GPS receiver with a rugged field-ready handheld computer running the Microsoft® Windows Mobile™ 2003 software for Pocket PCs. Plus there's an internal battery that easily lasts for a whole day of GPS operation. The result is tightly integrated, tough, and incredibly powerful.

### High-accuracy integrated GPS

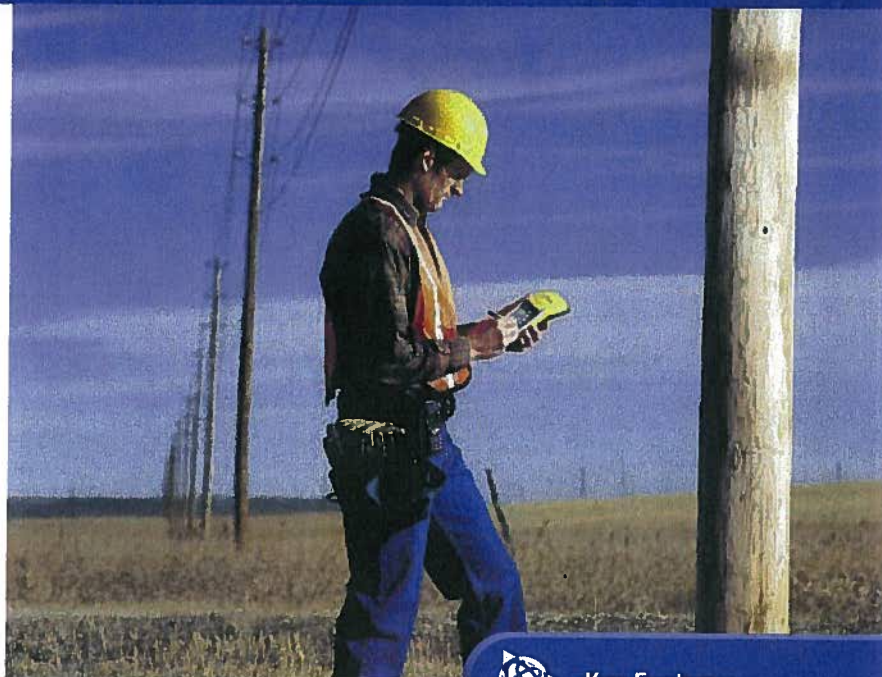
The GeoXT is optimized to provide the reliable, high-accuracy location data you need. Advanced features like EVEREST™ multipath rejection technology let you work under canopy, in urban canyons, or anywhere where accuracy is crucial.

Need submeter accuracy in real-time? Use corrections from a satellite-based augmentation system (SBAS) like WAAS<sup>1</sup> or EGNOS<sup>2</sup>. Want to get that extra edge in precision? Collect data with Trimble's TerraSync™ or GPSCorrect™ software, and then postprocess back in the office.

Because the GPS receiver and antenna are built into the handheld computer, it's never been easier to use GPS in your application. The system is more than just cable-free: it's a totally integrated solution.

### Optimized productivity

Take advantage of the power and flexibility of Windows Mobile software for Pocket PCs by choosing from the most comprehensive range of field software available—whether off-the-shelf or purpose-built. Whatever your needs, Windows



### Key Features

- High-performance submeter GPS with integrated WAAS/EGNOS
- Windows Mobile 2003 software for Pocket PCs, allowing maximum flexibility in software choice
- Rugged handheld with all-day battery
- Advanced color TFT display with backlight
- Integrated Bluetooth for wireless connectivity

Mobile lets you choose a software solution to match your workflow.

Windows Mobile includes familiar Microsoft productivity tools, including Pocket Word, Pocket Excel, and Pocket Outlook®. Pocket Outlook lets you synchronize e-mails, contacts, appointments, and data with your office computer, so whether you're in the office or in the field, you're always up to date.

Go wireless with integrated Bluetooth®\* for connection to other Bluetooth-enabled devices, including cell phones and PCs. You also have the option to use the USB support module to connect to a desktop computer, or use the optional serial clip for cabled connections in the field.

Receive a free copy of Microsoft Streets & Trips\*\* 2004 software with your GeoXT handheld, and take advantage of comprehensive map and travel information for easy navigation and route planning.

### All the memory you need

There's plenty of storage space in the GeoXT for all your GIS data. The fast processor and large memory mean even big graphics files load quickly—and they're crisp and crystal-clear on the advanced TFT outdoor color screen.

From data collection to data maintenance, to mobile GIS and beyond ... the GeoXT is the handheld of choice.

\* Bluetooth type approvals are country specific. GeoExplorer series handhelds are approved for use with Bluetooth in the USA. For a complete list of other countries with Bluetooth approval please refer to: [www.trimble.com/geo\\_bluetooth.html](http://www.trimble.com/geo_bluetooth.html).  
\*\* Microsoft Streets & Trips 2004 software available in US/Canada; Microsoft AutoRoutes® 2004 in Europe.





# GeoXT

## The total GPS platform for all your GIS field requirements

### Standard features

#### System

- Microsoft Windows Mobile 2003 software for Pocket PCs
- 206 MHz Intel StrongARM processor
- 512 MB non-volatile Flash data storage
- Outdoor color display
- Ergonomic cable-free handheld
- Rugged and water-resistant design
- All-day internally rechargeable battery
- Bluetooth wireless

#### GPS

- Submeter accuracy
- Integrated WAAS<sup>1</sup>/EGNOS<sup>2</sup>
- RTCM real-time correction support
- NMEA and TSIP protocol support
- EVEREST multipath rejection technology

#### Software

- GPS Controller for control of Integrated GPS and in-field mission planning
- GPS Connector for connecting Integrated GPS to external ports
- File Explorer, Internet Explorer, Pocket Outlook (Inbox, Calendar, Contacts, Tasks, Notes), Sprite Pocket Backup, Transcriber, Pocket Word, Pocket Excel, Pictures, Windows<sup>®</sup> Media Player, Bluetooth File Transfer, Calculator, ActiveSync<sup>®</sup>
- Microsoft Streets & Trips/AutoRoute 2004 software

#### Accessories

- Support module with power supply and USB data cable
- Getting Started Guide
- Companion CD Includes Outlook 2002 and ActiveSync 3.7.1
- Hand strap
- Pouch
- Stylus

### Optional Features

#### Software

- TerraSync
- GPScorrect for ESRI<sup>®</sup> ArcPad<sup>®</sup>
- GPS Pathfinder<sup>®</sup> Tools Software Development Kit (SDK)
- GPS Pathfinder Office
- Trimble GPS Analyst extension for ArcGIS<sup>®</sup>

#### Accessories

- Serial clip for field data and power input
- Vehicle power adaptor<sup>3</sup>
- Portable power kit<sup>3</sup>
- Hurricane antenna
- External patch antenna
- Pole-mountable ground plane
- Baseball cap with antenna sleeve
- Beacon-on-a-Belt (BoB<sup>™</sup>) differential correction receiver<sup>3</sup>
- Hard carry case
- Null modem cable<sup>3</sup>
- Backpack kit

Specifications subject to change without notice.

### Technical specifications

#### Physical

Size	21.5 cm × 9.9 cm × 7.7 cm (8.5 in × 3.9 in × 3.0 in)
Weight	0.72 kg (1.59 lb) with battery
Processor	206 MHz Intel StrongARM SA-1110
Memory	64 MB RAM and 512 MB Internal Flash disk
Power	
Low (no GPS)	0.6 Watts
Normal (with GPS)	1.4 Watts
High (with GPS, backlight, and Bluetooth)	2.5 Watts
Battery	Internal lithium-ion, rapidly rechargeable in unit, 21 Watt-hours

#### Environmental

##### Temperature

Operating	-10 °C to +50 °C (14 °F to 122 °F)
Storage	-20 °C to +70 °C (-4 °F to 158 °F)

Humidity . . . . . 99% non-condensing

Casing . . . . . Wind-driven rain and dust-resistant per IP 54 standard  
Slip-resistant grip, shock- and vibration-resistant

#### Input/output

Communications . . . . . Bluetooth for wireless connectivity  
USB via support module, serial via optional DE9 serial clip adaptor

#### Bluetooth

Certification . . . . . Bluetooth type approvals are country specific.  
GeoExplorer series handhelds are approved for use with Bluetooth in the USA.  
For a complete list of other countries with Bluetooth approval please refer to [www.trimble.com/geoxt\\_ts.asp](http://www.trimble.com/geoxt_ts.asp).

#### Profiles

Both client and host support . . . . . Serial Port, File Transfer (using OBEX)  
Client support only . . . . . Dial-Up Networking, Lan Access  
Host support only . . . . . Basic Imaging, Object Push

Display . . . . . Advanced outdoor TFT, 240 × 320 pixel, 65,536 colors, with backlight

Audio . . . . . Microphone and half duplex speaker, record and playback utilities

Interface . . . . . Anti-glare coated touch screen, Soft Input Panel (SIP) virtual keyboard  
2 hardware control keys plus 4 programmable permanent touch buttons

Handwriting recognition software, Audio system events, warnings, and notifications

#### GPS

Channels . . . . . 12

Integrated real-time . . . . . WAAS<sup>1</sup> or EGNOS<sup>2</sup>

Update rate . . . . . 1 Hz

Time to first fix . . . . . 30 sec (typical)

Protocols . . . . . NMEA (GGA, VTG, GLL, GSA, ZDA, GSV, RMC),  
TSIP (Trimble Standard Interface Protocol)

### Accuracy (RMS)<sup>4</sup> after differential correction

Postprocessed<sup>5</sup> . . . . . Submeter

Carrier postprocessed<sup>6</sup> . . . . . Submeter

With 10 minutes tracking satellites . . . . . 30 cm

Real-time . . . . . Submeter

<sup>1</sup> WAAS (Wide Area Augmentation System). Available in North America only.

For more information, see <http://gps.faa.gov/programs/index.htm>.

<sup>2</sup> EGNOS (European Geostationary Navigation Overlay System). Available in Europe only.

For more information, see <http://www.esa.int/export/esaSA/navigation.html>.

<sup>3</sup> Serial clip also required.

<sup>4</sup> Horizontal accuracy. Requires data to be collected with minimum of 4 satellites, maximum PDOP of 6, minimum SNR of 4, minimum elevation of 15 degrees, and reasonable multipath conditions. Ionospheric conditions, multipath signals or obstruction of the sky by buildings or heavy tree canopy may degrade precision by interfering with signal reception. Accuracy varies with proximity to base station by +1 ppm for postprocessing and real-time, and by +5 ppm for carrier postprocessing.

<sup>5</sup> Postprocessing with GPS Pathfinder Office software or GPS Analyst extension for ArcGIS.

<sup>6</sup> Requires collection of carrier data. (Only available with the GPS Pathfinder Office software).

#### NORTH & SOUTH AMERICA

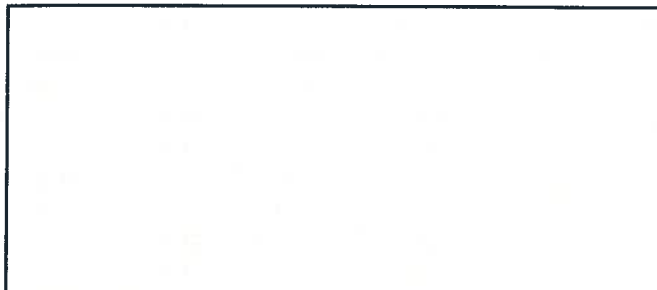
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# Operator's Manual

## SMARTROLL™ MP Handheld Instrument

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## 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.

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## 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	$\pm 3$ 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

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## 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 ( $\mu\text{S}/\text{cm}$ , $\text{mS}/\text{cm}$ ) Specific conductivity ( $\mu\text{S}/\text{cm}$ , $\text{mS}/\text{cm}$ ) Salinity (PSU) Total dissolved solids (ppt, ppm) Resistivity (Ohms-cm) Density ( $\text{g}/\text{cm}^3$ )
Methodology	Std. Methods 2510 EPA 120.1

## Dissolved Oxygen RDO Fast Cap (Optical Sensor) Specifications

Accuracy	$\pm 0.1$ mg/L; $\pm 0.2$ 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

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## 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

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## 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



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## 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**

## Individual Flux Measurements and Calculations

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
Rule608SeepAreaL 102021_01	1173858	3178883	A	791.9	20.4	10/20/2021	-0.879	-0.016	-11.559	0.2523128	0.000000	0.000000	0.000000
Rule608SeepAreaL 102021_02	1173874	3178825	A	791.3	21.3	10/20/2021	-4.041	-0.001	0.637	0.2513511	0.000000	0.000000	0.160111
Rule608SeepAreaL 102021_03	1173885	3178775	A	791.1	22.0	10/20/2021	-0.83	0.004	0.443	0.2506916	0.000000	0.001003	0.111056
Rule608SeepAreaL 102021_04	1173901	3178713	A	791.1	22.8	10/20/2021	-0.354	0	2.594	0.2500139	0.000000	0.000000	0.648536
Rule608SeepAreaL 102021_05	1173913	3178667	A	791.1	23.6	10/20/2021	-1.301	0.002	2.208	0.2493399	0.000000	0.000499	0.550542
Rule608SeepAreaL 102021_06	1173925	3178611	A	791.1	24.4	10/20/2021	-0.197	0	4.568	0.2486695	0.000000	0.000000	1.135922
Rule608SeepAreaL 102021_07	1173935	3178570	A	791.0	25.2	10/20/2021	-1.342	0.005	1.597	0.2479714	0.000000	0.001240	0.396010
Rule608SeepAreaL 102021_08	1173994	3178574	A	790.7	26.2	10/20/2021	-0.697	0.005	0.641	0.2470493	0.000000	0.001235	0.158359
Rule608SeepAreaL 102021_09	1173976	3178638	A	793.2	27.0	10/20/2021	-0.145	0.007	0.56	0.2471698	0.000000	0.001730	0.138415
Rule608SeepAreaL 102021_10	1173964	3178683	A	790.9	27.7	10/20/2021	-1.054	-0.004	0.943	0.2458797	0.000000	0.000000	0.231865
Rule608SeepAreaL 102021_11	1173957	3178724	A	790.9	28.3	10/20/2021	-0.002	0.01	3.37	0.2453903	0.000000	0.002454	0.826965
Rule608SeepAreaL 102021_12	1173929	3178823	A	791.3	29.0	10/20/2021	56.053	0.004	18.491	0.2449456	13.729940	0.000980	4.529289
Rule608SeepAreaL 102021_13	1173921	3178875	A	791.4	29.6	10/20/2021	7.891	0.006	4.211	0.2444911	1.929279	0.001467	1.029552
Rule608SeepAreaL 102021_14	1173907	3178905	A	791.3	30.0	10/20/2021	-0.9	0.005	2.181	0.2441376	0.000000	0.001221	0.532464
Rule608SeepAreaL 102021_15	1173961	3178832	A	791.1	30.7	10/20/2021	-1.07	0.002	2.29	0.2435136	0.000000	0.000487	0.557646
Rule608SeepAreaL 102021_16	1173975	3178800	A	790.6	31.1	10/20/2021	-0.648	0.005	0.272	0.2430398	0.000000	0.001215	0.066107
Rule608SeepAreaL 102021_17	1173978	3178893	A	790.3	31.7	10/20/2021	-0.683	0.005	0.577	0.2424694	0.000000	0.001212	0.139905

## Individual Flux Measurements and Calculations (Continued)

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
Rule608SeepAreaL 102021_18	1174018	3178876	A	790.3	32.2	10/20/2021	-2.752	0.006	0.523	0.2420723	0.000000	0.001452	0.126604
Rule608SeepAreaL 102021_19	1174217	3178917	A	789.8	32.8	10/20/2021	-1.182	0.005	0.967	0.2414448	0.000000	0.001207	0.233477
Rule608SeepAreaL 102021_20	1174237	3178843	A	789.1	33.3	10/20/2021	-0.926	0.001	0.393	0.2408372	0.000000	0.000241	0.094649
Rule608SeepAreaL 102021_21	1174030	3178836	A	789.3	34.0	10/20/2021	-0.271	-0.001	0.245	0.2403492	0.000000	0.000000	0.058886
Rule608SeepAreaL 102021_22	1174026	3178777	A	789.9	34.5	10/20/2021	-1.205	0.006	-0.047	0.240141	0.000000	0.001441	0.000000
Rule608SeepAreaL 102021_23	1174019	3178732	A	790.2	34.9	10/20/2021	-1.27	-0.007	0.232	0.2399203	0.000000	0.000000	0.055661
Rule608SeepAreaL 102021_24	1174016	3178676	A	790.2	35.2	10/20/2021	-0.835	0.003	0.057	0.2396868	0.000000	0.000719	0.013662
Rule608SeepAreaL 102021_25	1174020	3178618	A	790.3	35.5	10/20/2021	-1.968	-0.003	0.264	0.2394842	0.000000	0.000000	0.063224
Rule608SeepAreaL 102021_26	1174017	3178566	A	790.3	35.8	10/20/2021	-1.231	-0.001	0.072	0.2392516	0.000000	0.000000	0.017226
Rule608SeepAreaL 102121_27	1173917	3178416	A	793.7	22.5	10/21/2021	-1.645	-0.007	-0.438	0.2510901	0.000000	0.000000	0.000000
Rule608SeepAreaL 102121_28	1173904	3178475	A	793.7	23.0	10/21/2021	-0.959	-0.005	-0.456	0.2506662	0.000000	0.000000	0.000000
Rule608SeepAreaL 102121_29	1173901	3178517	A	793.7	23.3	10/21/2021	-0.269	0	-2.965	0.2504125	0.000000	0.000000	0.000000
Rule608SeepAreaL 102121_30	1173915	3178569	A	793.7	23.6	10/21/2021	-0.708	-0.002	-10.3	0.2501594	0.000000	0.000000	0.000000
Rule608SeepAreaL 102121_31	1173851	3178515	A	794.1	23.8	10/21/2021	-0.427	-0.004	-1.526	0.2501169	0.000000	0.000000	0.000000
Rule608SeepAreaL 102121_32	1173857	3178457	A	794.1	24.1	10/21/2021	-0.423	0	-0.517	0.2498644	0.000000	0.000000	0.000000
Rule608SeepAreaL 102121_33	1173847	3178425	A	794.1	24.3	10/21/2021	0	0	0.138	0.2496964	0.000000	0.000000	0.034458
Rule608SeepAreaL 102121_34	1173805	3178408	A	794.1	24.6	10/21/2021	-0.443	0.002	-0.058	0.2494448	0.000000	0.000499	0.000000

## Individual Flux Measurements and Calculations (Continued)

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
Rule608SeepAreaL-102121_35	1173805	3178459	A	794.1	25.0	10/21/2021	-1.155	0.001	0.079	0.2491102	0.000000	0.000249	0.019680
Rule608SeepAreaL-102121_36	1173801	3178527	A	794.1	25.4	10/21/2021	-0.963	0.001	0.104	0.2487764	0.000000	0.000249	0.025873
SeepAreaL-1030102221_02	1146087	3164881	A	779.8	18.6	10/22/2021	-1.341	-0.007	-2.376	0.2499905	0.000000	0.000000	0.000000
SeepAreaL-1030102221_03	1146194	3164829	A	779.3	19.1	10/22/2021	-0.628	0	0.139	0.2494028	0.000000	0.000000	0.034667
SeepAreaL-1030102221_04	1146203	3164786	A	781.4	19.7	10/22/2021	0	0.001	0.087	0.2495625	0.000000	0.000250	0.021712
SeepAreaL-1030102221_05	1146211	3164719	A	779.4	20.2	10/22/2021	-0.374	-0.006	0.122	0.2484994	0.000000	0.000000	0.030317
SeepAreaL-1030102221_06	1146206	3164684	A	779.4	20.6	10/22/2021	-1.242	-0.001	0.205	0.2481611	0.000000	0.000000	0.050873
SeepAreaL-1030102221_07	1146255	3164674	A	779.4	21.1	10/22/2021	-0.699	0	0.13	0.2477394	0.000000	0.000000	0.032206
SeepAreaL-1030102221_08	1146248	3164724	A	779.5	21.7	10/22/2021	-0.766	-0.001	0.55	0.247267	0.000000	0.000000	0.135997
SeepAreaL-1030102221_09	1146250	3164763	A	779.5	22.2	10/22/2021	-0.442	-0.001	0.13	0.2468484	0.000000	0.000000	0.032090
SeepAreaL-1030102221_1	1146258	3164826	A	779.8	17.8	10/22/2021	-1.75	-0.023	-3.638	0.2506779	0.000000	0.000000	0.000000
SeepAreaL-1030102221_10	1146263	3164761	A	781.4	22.8	10/22/2021	20.646	0.001	0.416	0.2469484	5.098496	0.000247	0.102731
SeepAreaL-1030102221_11	1146258	3164826	A	779.5	23.4	10/22/2021	-47.685	-0.003	-1.561	0.2458495	0.000000	0.000000	0.000000
SeepAreaL-1030102221_12	1146304	3164816	A	779.6	23.9	10/22/2021	-0.365	0.005	0.487	0.2454672	0.000000	0.001227	0.119543
SeepAreaL-1030102221_13	1146311	3164764	A	779.6	24.4	10/22/2021	7.068	0	1.241	0.2450547	1.732046	0.000000	0.304113
SeepAreaL-1030102221_14	1146307	3164731	A	779.6	24.8	10/22/2021	0	0.001	0.287	0.2447257	0.000000	0.000245	0.070236
SeepAreaL-1030102221_15	1146347	3164671	A	779.7	25.3	10/22/2021	-0.934	-0.007	0.337	0.244347	0.000000	0.000000	0.082345



## Individual Flux Measurements and Calculations (Continued)

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
SeepAreaL-1030102221_16	1146359	3164715	A	779.6	25.8	10/22/2021	-0.5	0.001	0.214	0.2439071	0.000000	0.000244	0.052196
SeepAreaL-1030102221_17	1146350	3164767	A	779.8	26.2	10/22/2021	-0.361	-0.004	0.223	0.2436436	0.000000	0.000000	0.054333
SeepAreaL-1030102221_18	1146356	3164828	A	779.8	26.6	10/22/2021	-0.48	0.002	0.324	0.2433185	0.000000	0.000487	0.078835
Rule608SeepArea32 L102021_01	1174152	3178174	A	790.3	36.8	10/20/2021	-0.403	0.003	0.446	0.2384797	0.000000	0.000715	0.106362
Rule608SeepArea32 L102021_02	1174267	3178234	A	789.9	37.3	10/20/2021	-0.667	-0.009	-1.396	0.2379751	0.000000	0.000000	0.000000
Rule608SeepArea32 L102021_03	1174375	3178267	A	789.4	37.7	10/20/2021	-0.421	-0.005	0.248	0.2375185	0.000000	0.000000	0.058905
Rule608SeepArea32 L102021_04	1174453	3178242	A	789.1	38.1	10/20/2021	-1.221	0.006	0.467	0.2371231	0.000000	0.001423	0.110736
Rule608SeepArea32 L102021_05	1174483	3178167	A	789.0	38.4	10/20/2021	-0.516	0.005	0.434	0.2368647	0.000000	0.001184	0.102799
Rule608SeepArea32 L102021_06	1174363	3178200	A	789.1	38.8	10/20/2021	-1.493	-0.018	0.441	0.236591	0.000000	0.000000	0.104337
Rule608SeepArea32 L102021_07	1174278	3178145	A	789.4	39.0	10/20/2021	-1.1	0.007	0.113	0.2365293	0.000000	0.001656	0.026728
Rule608SeepArea32 L102021_08	1174190	3178079	A	789.6	39.3	10/20/2021	-7.263	-0.018	-1.229	0.236362	0.000000	0.000000	0.000000
Rule608SeepArea32 L102021_09	1174259	3178046	A	789.9	39.4	10/20/2021	-2.318	-0.013	0.748	0.2363762	0.000000	0.000000	0.176809
Rule608SeepArea32 L102021_10	1174367	3178077	A	789.6	39.6	10/20/2021	-1.916	0.007	0.468	0.2361353	0.000000	0.001653	0.110511
Rule608SeepArea32 L102021_11	1174503	3178046	A	789.4	39.8	10/20/2021	-1.599	0.002	0.38	0.2359246	0.000000	0.000472	0.089651
Rule608SeepArea32 L102021_12	1174468	3177950	A	791.1	40.0	10/20/2021	-0.004	0.012	0.44	0.2362817	0.000000	0.002835	0.103964
Rule608SeepArea32 L102021_13	1174368	3177953	A	789.3	40.1	10/20/2021	-1.1	-0.007	0.347	0.2356688	0.000000	0.000000	0.081777
Rule608SeepArea32 L102021_14	1174260	3177947	A	789.6	40.2	10/20/2021	-1.381	-0.009	0.776	0.2356832	0.000000	0.000000	0.182890

## Individual Flux Measurements and Calculations (Continued)

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
Rule608SeepArea32 L102021_15	1174306	3177867	A	789.8	40.3	10/20/2021	-2.37	-0.007	0.723	0.2356676	0.000000	0.000000	0.170388
Rule608SeepArea32 L102021_16	1174389	3177875	A	789.4	40.3	10/20/2021	-0.598	0.003	0.489	0.2355483	0.000000	0.000707	0.115183
Rule608SeepArea32 L102021_17	1174490	3177868	A	789.3	40.4	10/20/2021	-2.376	-0.01	0.201	0.2354433	0.000000	0.000000	0.047324
Rule608SeepArea32 L102021_18	1174585	3177848	A	788.8	40.4	10/20/2021	-1.395	-0.01	0.379	0.2352942	0.000000	0.000000	0.089176
Rule608SeepArea32 L102021_19	1174694	3177751	A	788.4	40.5	10/20/2021	-2.196	-0.016	0.711	0.2350999	0.000000	0.000000	0.167156
Rule608SeepArea32 L102021_20	1174593	3177764	A	788.3	40.6	10/20/2021	-2.541	-0.008	0.152	0.2349952	0.000000	0.000000	0.035719
Rule608SeepArea32 L102021_21	1174490	3177752	A	790.7	40.7	10/20/2021	-0.001	0.012	0.673	0.2356355	0.000000	0.002828	0.158583
Rule608SeepArea32 L102021_22	1174396	3177754	A	789.1	40.8	10/20/2021	-5.073	-0.005	0.875	0.2350838	0.000000	0.000000	0.205698
Rule608SeepArea32 L102021_23	1174413	3177660	A	789.3	40.9	10/20/2021	-4.412	-0.013	0.697	0.2350685	0.000000	0.000000	0.163843
Rule608SeepArea32 L102021_24	1174495	3177637	A	789.1	40.9	10/20/2021	-3.855	-0.003	0.76	0.2350089	0.000000	0.000000	0.178607
Rule608SeepArea32 L102021_25	1174606	3177651	A	790.7	40.9	10/20/2021	-1.191	0.026	0.635	0.2354854	0.000000	0.006123	0.149533
Rule608SeepArea32 L102021_26	1174693	3177662	A	788.4	40.9	10/20/2021	-1.887	0.005	0.795	0.2348005	0.000000	0.001174	0.186666
Rule608SeepArea32 L102021_27	1174814	3177687	A	787.8	40.9	10/20/2021	-1.705	-0.019	0.075	0.2346218	0.000000	0.000000	0.017597
Rule608SeepArea32 L102021_28	1174884	3177542	A	787.0	40.8	10/20/2021	-1.683	-0.023	0.19	0.2344582	0.000000	0.000000	0.044547
Rule608SeepArea32 L102021_29	1174992	3177467	A	786.0	40.8	10/20/2021	-0.734	0.011	0.515	0.2341602	0.000000	0.002576	0.120593
Rule608SeepArea32 L102021_30	1174985	3177352	A	785.6	40.8	10/20/2021	-2.265	0.007	0.31	0.2340411	0.000000	0.001638	0.072553
Rule608SeepArea32 L102021_31	1175117	3177237	A	786.0	40.9	10/20/2021	-2.161	-0.014	-0.061	0.2340857	0.000000	0.000000	0.000000

## Individual Flux Measurements and Calculations (Continued)

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
Rule608SeepArea32 L102021_32	1175116	3177191	A	784.7	41.0	10/20/2021	-0.57	0.01	0.347	0.2336241	0.000000	0.002336	0.081068
Rule608SeepArea32 L102021_33	1175174	3177161	A	784.5	41.0	10/20/2021	-1.633	0.007	0.817	0.2335646	0.000000	0.001635	0.190822
Rule608SeepArea32 L102021_34	1175221	3177049	A	784.4	40.9	10/20/2021	-2.518	-0.017	0.248	0.2336092	0.000000	0.000000	0.057935
Rule608SeepArea32 L102021_35	1175278	3176957	A	784.1	40.9	10/20/2021	-0.957	0.002	0.453	0.2335198	0.000000	0.000467	0.105784
Rule608SeepArea32 L102021_36	1175352	3176873	A	784.0	40.8	10/20/2021	-1.139	-0.015	0.101	0.2335644	0.000000	0.000000	0.023590
Rule608SeepArea32 L102021_37	1175422	3176821	A	784.0	40.8	10/20/2021	-1.127	0.005	0.453	0.2335644	0.000000	0.001168	0.105805
Rule608SeepArea32 L102021_38	1175452	3176772	A	784.7	40.8	10/20/2021	-2.038	-0.015	0.188	0.233773	0.000000	0.000000	0.043949
Rule608SeepArea32 L102021_39	1175486	3176655	A	785.5	40.8	10/20/2021	-1.962	0.012	1.2	0.2340113	0.000000	0.002808	0.280814
Rule608SeepArea32 L102021_40	1175393	3176684	A	787.0	40.8	10/20/2021	202.928	0.005	0.979	0.2344582	47.578130	0.001172	0.229535
Rule608SeepArea32 L102021_41	1175311	3176733	A	786.5	40.8	10/20/2021	-1.012	-0.003	0.279	0.2343092	0.000000	0.000000	0.065372
Rule608SeepArea32 L102021_42	1175348	3176778	A	786.4	40.8	10/20/2021	-1.866	0.006	1.014	0.2342794	0.000000	0.001406	0.237559
Rule608SeepArea32 L102021_43	1175217	3176884	A	785.6	40.6	10/20/2021	-2.367	-0.01	0.734	0.2341903	0.000000	0.000000	0.171896
Rule608SeepArea32 L102021_44	1175188	3176952	A	785.2	40.6	10/20/2021	-1.044	0.008	0.348	0.234071	0.000000	0.001873	0.081457
Rule608SeepArea32 L102021_45	1175101	3177057	A	785.1	40.6	10/20/2021	-1.335	0.011	0.519	0.2340412	0.000000	0.002574	0.121467
Rule608SeepArea32 L102021_46	1174958	3177176	A	785.5	40.5	10/20/2021	-0.362	-0.017	1.828	0.2342351	0.000000	0.000000	0.428182
Rule608SeepArea32 L102021_47	1174961	3177242	A	786.3	40.5	10/20/2021	-2.046	-0.006	-0.837	0.2344737	0.000000	0.000000	0.000000
Rule608SeepArea32 L102021_48	1174876	3177371	A	786.1	40.4	10/20/2021	-2.745	-0.024	-1.442	0.2344888	0.000000	0.000000	0.000000

## Individual Flux Measurements and Calculations (Continued)

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
Rule608SeepArea32 L102021_49	1174896	3177448	A	786.8	40.3	10/20/2021	-0.632	0.009	0.559	0.2347725	0.000000	0.002113	0.131238
Rule608SeepArea32 L102021_50	1174760	3177557	A	786.0	40.2	10/20/2021	-2.903	0.015	0.743	0.2346086	0.000000	0.003519	0.174314
Rule608SeepArea32 L102021_51	1174712	3177557	A	787.1	40.1	10/20/2021	-2.708	0.025	0.771	0.235012	0.000000	0.005875	0.181194
Rule608SeepArea32 L102021_52	1174593	3177539	A	787.6	40.1	10/20/2021	-1.012	0.014	0.609	0.2351612	0.000000	0.003292	0.143213
Rule608SeepArea32 L102021_53	1174491	3177568	A	788.0	40.1	10/20/2021	-2.313	0.011	3.009	0.2352807	0.000000	0.002588	0.707960
Rule608SeepArea32 L102021_54	1174506	3177461	A	788.3	40.1	10/20/2021	-2.071	0.006	1.09	0.2353702	0.000000	0.001412	0.256554
Rule608SeepArea32 L102021_55	1174596	3177461	A	788.2	40.1	10/20/2021	-1.647	-0.01	0.172	0.2353404	0.000000	0.000000	0.040479
Rule608SeepArea32 L102021_56	1174583	3177368	A	787.9	40.1	10/20/2021	-1.63	-0.009	0.242	0.2352508	0.000000	0.000000	0.056931
Rule608SeepArea32 L102021_57	1174569	3177244	A	788.0	40.1	10/20/2021	-2.261	-0.011	0.034	0.2352807	0.000000	0.000000	0.008000
Rule608SeepArea32 L102021_58	1174863	3176446	A	788.0	38.5	10/20/2021	-2.906	-0.021	-9.549	0.2364886	0.000000	0.000000	0.000000
Rule608SeepArea32 L102021_59	1174800	3176459	A	787.6	38.5	10/20/2021	-2.231	-0.001	0.385	0.2363686	0.000000	0.000000	0.091002
Rule608SeepArea32 L102021_60	1174779	3176568	A	787.6	38.6	10/20/2021	-1.015	0.004	0.486	0.2362927	0.000000	0.000945	0.114838
Rule608SeepArea32 L102021_61	1174756	3176661	A	787.9	38.7	10/20/2021	-1.135	-0.009	0.496	0.2363069	0.000000	0.000000	0.117208
Rule608SeepArea32 L102021_62	1174750	3176770	A	787.9	38.8	10/20/2021	-2.83	0.005	1.677	0.2362312	0.000000	0.001181	0.396160
Rule608SeepArea32 L102021_63	1174765	3176874	A	787.9	38.9	10/20/2021	-2.671	-0.006	0.161	0.2361555	0.000000	0.000000	0.038021
Rule608SeepArea32 L102021_64	1174773	3176963	A	787.5	39.1	10/20/2021	-0.734	0.014	0.513	0.2358844	0.000000	0.003302	0.121009
Rule608SeepArea32 L102021_65	1174691	3176965	A	787.8	39.2	10/20/2021	7.801	0.017	3.527	0.2358987	1.840246	0.004010	0.832015

## Individual Flux Measurements and Calculations (Continued)

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
Rule608SeepArea32 L102021_66	1174659	3177065	A	787.9	39.4	10/20/2021	-6.053	0.011	0.691	0.2357777	0.000000	0.002594	0.162922
Rule608SeepArea32 L102021_67	1174668	3177173	A	787.8	39.6	10/20/2021	-1.1	0.025	1.113	0.235597	0.000000	0.005890	0.262219
Rule608SeepArea32 L102121_100	1173959	3177567	A	793.0	38.2	10/21/2021	-1.281	-0.01	0.326	0.2382185	0.000000	0.000000	0.077659
Rule608SeepArea32 L102121_101	1174057	3177577	A	792.8	38.3	10/21/2021	-2.956	-0.007	0.145	0.2380819	0.000000	0.000000	0.034522
Rule608SeepArea32 L102121_102	1174068	3177640	A	792.8	38.3	10/21/2021	-0.382	0.002	3.159	0.2380819	0.000000	0.000476	0.752101
Rule608SeepArea32 L102121_103	1174052	3177762	A	792.8	38.4	10/21/2021	-1.145	0.003	0.357	0.2380055	0.000000	0.000714	0.084968
Rule608SeepArea32 L102121_104	1174095	3177852	A	792.6	38.5	10/21/2021	-3.728	-0.008	0.752	0.2378691	0.000000	0.000000	0.178878
Rule608SeepArea32 L102121_105	1174165	3177867	A	792.4	38.6	10/21/2021	-2.585	-0.009	1.259	0.2377328	0.000000	0.000000	0.299306
Rule608SeepArea32 L102121_106	1174177	3177764	A	792.2	38.7	10/21/2021	-2.172	-0.008	0.756	0.2375966	0.000000	0.000000	0.179623
Rule608SeepArea32 L102121_107	1174248	3177752	A	791.9	38.9	10/21/2021	-1.27	0.006	0.421	0.2373544	0.000000	0.001424	0.099926
Rule608SeepArea32 L102121_108	1174273	3177661	A	792.1	39.1	10/21/2021	-4.081	-0.004	3.873	0.2372623	0.000000	0.000000	0.918917
Rule608SeepArea32 L102121_109	1174159	3177644	A	792.4	39.3	10/21/2021	-1.509	-0.011	0.088	0.2372002	0.000000	0.000000	0.020874
Rule608SeepArea32 L102121_110	1174161	3177564	A	792.4	39.5	10/21/2021	-1.371	-0.011	0.173	0.2370485	0.000000	0.000000	0.041009
Rule608SeepArea32 L102121_111	1174270	3177552	A	792.2	39.6	10/21/2021	-2.549	-0.008	0.135	0.2369129	0.000000	0.000000	0.031983
Rule608SeepArea32 L102121_112	1174325	3177575	A	792.2	39.8	10/21/2021	-0.296	0.011	1.746	0.2367615	0.000000	0.002604	0.413386
Rule608SeepArea32 L102121_113	1174369	3177470	A	791.8	39.9	10/21/2021	-1.4	-0.021	1.018	0.2365663	0.000000	0.000000	0.240825
Rule608SeepArea32 L102121_114	1174269	3177441	A	792.1	40.0	10/21/2021	-1.486	-0.018	0.103	0.2365804	0.000000	0.000000	0.024368



## Individual Flux Measurements and Calculations (Continued)

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
Rule608SeepArea32 L102121_115	1174258	3177348	A	792.2	40.1	10/21/2021	-1.636	-0.013	0.171	0.2365347	0.000000	0.000000	0.040447
Rule608SeepArea32 L102121_116	1174370	3177356	A	792.1	40.1	10/21/2021	-2.181	-0.019	0.392	0.2365049	0.000000	0.000000	0.092710
Rule608SeepArea32 L102121_117	1174415	3177362	A	792.1	40.1	10/21/2021	-1.909	0.004	1	0.2365049	0.000000	0.000946	0.236505
Rule608SeepArea32 L102121_118	1174354	3177278	A	791.9	40.1	10/21/2021	-0.94	-0.016	0.106	0.2364451	0.000000	0.000000	0.025063
Rule608SeepArea32 L102121_119	1174459	3177260	A	791.9	40.1	10/21/2021	-4.859	-0.032	0.238	0.2364451	0.000000	0.000000	0.056274
Rule608SeepArea32 L102121_120	1174475	3177182	A	791.8	40.1	10/21/2021	-0.922	-0.016	0.303	0.2364153	0.000000	0.000000	0.071634
Rule608SeepArea32 L102121_121	1174545	3177060	A	791.7	40.2	10/21/2021	-3.814	-0.023	0.599	0.23631	0.000000	0.000000	0.141550
Rule608SeepArea32 L102121_122	1174552	3176961	A	791.7	40.3	10/21/2021	-3.473	-0.027	0.164	0.2362346	0.000000	0.000000	0.038742
Rule608SeepArea32 L102121_123	1174467	3176953	A	791.8	40.3	10/21/2021	-0.768	-0.014	0.155	0.2362644	0.000000	0.000000	0.036621
Rule608SeepArea32 L102121_124	1174447	3177051	A	791.7	40.4	10/21/2021	-0.521	-0.018	0.136	0.2361593	0.000000	0.000000	0.032118
Rule608SeepArea32 L102121_125	1174367	3177167	A	791.8	40.4	10/21/2021	-1.429	-0.023	0.567	0.2361891	0.000000	0.000000	0.133919
Rule608SeepArea32 L102121_126	1174359	3177056	A	791.8	40.4	10/21/2021	-1.429	-0.023	0.567	0.2361891	0.000000	0.000000	0.133919
Rule608SeepArea32 L102121_127	1174368	3176957	A	791.9	40.4	10/21/2021	-3.009	-0.034	0.385	0.2362189	0.000000	0.000000	0.090944
Rule608SeepArea32 L102121_128	1174263	3176960	A	791.9	40.4	10/21/2021	-1.691	0.006	0.394	0.2362189	0.000000	0.001417	0.093070
Rule608SeepArea32 L102121_129	1174252	3177051	A	791.9	40.4	10/21/2021	-3.253	-0.028	2.077	0.2362189	0.000000	0.000000	0.490627
Rule608SeepArea32 L102121_130	1174256	3177165	A	792.1	40.3	10/21/2021	-1.585	-0.022	0.152	0.2363539	0.000000	0.000000	0.035926
Rule608SeepArea32 L102121_131	1174176	3177148	A	792.1	40.2	10/21/2021	-0.951	-0.013	0.146	0.2364294	0.000000	0.000000	0.034519

## Individual Flux Measurements and Calculations (Continued)

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
Rule608SeepArea32 L102121_132	1174171	3177055	A	792.2	40.1	10/21/2021	-1.962	-0.021	0.467	0.2365347	0.000000	0.000000	0.110462
Rule608SeepArea32 L102121_133	1174158	3176970	A	792.1	40.0	10/21/2021	-2.835	-0.016	0.107	0.2365804	0.000000	0.000000	0.025314
Rule608SeepArea32 L102121_134	1174065	3176971	A	792.2	40.0	10/21/2021	-1.529	-0.018	0.209	0.2366102	0.000000	0.000000	0.049452
Rule608SeepArea32 L102121_135	1174045	3177082	A	792.1	39.9	10/21/2021	-2.991	-0.018	0.107	0.236656	0.000000	0.000000	0.025322
Rule608SeepArea32 L102121_136	1174054	3177175	A	792.2	39.9	10/21/2021	-0.87	-0.008	0.132	0.2366858	0.000000	0.000000	0.031243
Rule608SeepArea32 L102121_137	1174346	3176872	A	792.1	39.9	10/21/2021	-6.882	-0.037	0.285	0.236656	0.000000	0.000000	0.067447
Rule608SeepArea32 L102121_138	1174367	3176772	A	791.7	39.8	10/21/2021	-4.938	-0.019	0.446	0.236612	0.000000	0.000000	0.105529
Rule608SeepArea32 L102121_139	1174456	3176870	A	791.4	39.8	10/21/2021	-1.974	-0.022	0.11	0.2365224	0.000000	0.000000	0.026017
Rule608SeepArea32 L102121_140	1174447	3176772	A	791.4	39.8	10/21/2021	-0.703	-0.009	-0.02	0.2365224	0.000000	0.000000	0.000000
Rule608SeepArea32 L102121_141	1174554	3176860	A	791.4	39.8	10/21/2021	-1.516	-0.026	0.442	0.2365224	0.000000	0.000000	0.104543
Rule608SeepArea32 L102121_142	1174622	3176857	A	791.1	39.7	10/21/2021	-1.215	-0.01	0.519	0.2365083	0.000000	0.000000	0.122748
Rule608SeepArea32 L102121_143	1174571	3176769	A	791.3	39.7	10/21/2021	-1.898	-0.019	0.102	0.2365681	0.000000	0.000000	0.024130
Rule608SeepArea32 L102121_144	1174655	3176754	A	791.1	39.7	10/21/2021	-0.987	-0.011	0.415	0.2365083	0.000000	0.000000	0.098151
Rule608SeepArea32 L102121_145	1174552	3176662	A	791.0	39.6	10/21/2021	-0.985	-0.025	0.305	0.236554	0.000000	0.000000	0.072149
Rule608SeepArea32 L102121_146	1174643	3176663	A	791.1	39.6	10/21/2021	-0.843	-0.014	0.321	0.2365839	0.000000	0.000000	0.075943
Rule608SeepArea32 L102121_147	1174650	3176589	A	790.9	39.5	10/21/2021	-1.351	-0.009	0.21	0.2365997	0.000000	0.000000	0.049686
Rule608SeepArea32 L102121_148	1174580	3176534	A	791.0	39.5	10/21/2021	-1.693	-0.007	0.492	0.2366296	0.000000	0.000000	0.116422

## Individual Flux Measurements and Calculations (Continued)

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
Rule608SeepArea32 L102121_149	1174554	3176466	A	791.0	39.4	10/21/2021	-2.382	-0.012	-0.026	0.2367054	0.000000	0.000000	0.000000
Rule608SeepArea32 L102121_150	1174646	3176448	A	791.0	39.3	10/21/2021	-0.785	-0.014	-0.041	0.2367811	0.000000	0.000000	0.000000
Rule608SeepArea32 L102121_151	1174671	3176354	A	790.9	39.2	10/21/2021	-1.053	-0.011	0.205	0.236827	0.000000	0.000000	0.048550
Rule608SeepArea32 L102121_152	1174591	3176353	A	790.9	39.0	10/21/2021	-1.983	-0.01	0.253	0.2369787	0.000000	0.000000	0.059956
Rule608SeepArea32 L102121_153	1174559	3176275	A	791.1	38.9	10/21/2021	-1.199	-0.01	0.302	0.2371146	0.000000	0.000000	0.071609
Rule608SeepArea32 L102121_154	1174567	3176181	A	791.1	38.8	10/21/2021	-1.218	-0.011	0.312	0.2371906	0.000000	0.000000	0.074003
Rule608SeepArea32 L102121_155	1174472	3176157	A	791.1	38.7	10/21/2021	-1.128	-0.022	0.577	0.2372667	0.000000	0.000000	0.136903
Rule608SeepArea32 L102121_156	1174366	3176179	A	791.3	38.6	10/21/2021	-1.309	-0.01	0.36	0.2374028	0.000000	0.000000	0.085465
Rule608SeepArea32 L102121_157	1174343	3176264	A	791.3	38.5	10/21/2021	-1.611	-0.012	0.277	0.237479	0.000000	0.000000	0.065782
Rule608SeepArea32 L102121_158	1174354	3176358	A	791.3	38.5	10/21/2021	-1.91	-0.018	0.756	0.237479	0.000000	0.000000	0.179534
Rule608SeepArea32 L102121_159	1174447	3176369	A	791.1	38.4	10/21/2021	-1.766	-0.017	0.142	0.2374952	0.000000	0.000000	0.033724
Rule608SeepArea32 L102121_160	1174494	3176255	A	791.1	38.4	10/21/2021	-1.971	-0.023	0.164	0.2374952	0.000000	0.000000	0.038949
Rule608SeepArea32 L102121_161	1174874	3176565	A	790.3	25.7	10/21/2021	22.518	-0.008	4.911	0.2473374	5.569544	0.000000	1.214674
Rule608SeepArea32 L102121_162	1174911	3176656	A	789.8	26.4	10/21/2021	-91.658	-0.006	-8.93	0.2466033	0.000000	0.000000	0.000000
Rule608SeepArea32 L102121_163	1174942	3176768	A	789.8	27.2	10/21/2021	0	0.004	0.44	0.2459465	0.000000	0.000984	0.108216
Rule608SeepArea32 L102121_164	1174876	3176790	A	790.3	30.7	10/21/2021	-0.34	-0.006	0.088	0.2432674	0.000000	0.000000	0.021408
Rule608SeepArea32 L102121_165	1174878	3176887	A	789.8	31.1	10/21/2021	-0.319	0.016	0.877	0.2427938	0.000000	0.003885	0.212930

## Individual Flux Measurements and Calculations (Continued)

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
Rule608SeepArea32 L102121_166	1174878	3176977	A	789.5	31.5	10/21/2021	-1.35	-0.014	0.31	0.2423829	0.000000	0.000000	0.075139
Rule608SeepArea32 L102121_167	1174770	3177054	A	789.5	32.0	10/21/2021	-1.106	-0.005	0.45	0.2419858	0.000000	0.000000	0.108894
Rule608SeepArea32 L102121_168	1174594	3177167	A	789.8	32.5	10/21/2021	-0.369	-0.011	0.235	0.2416817	0.000000	0.000000	0.056795
Rule608SeepArea32 L102121_169	1174668	3177273	A	790.1	33.0	10/21/2021	-0.801	-0.011	0.275	0.2413787	0.000000	0.000000	0.066379
Rule608SeepArea32 L102121_170	1174656	3177370	A	789.6	33.3	10/21/2021	-0.155	-0.009	0.202	0.2409898	0.000000	0.000000	0.048680
Rule608SeepArea32 L102121_171	1174671	3177462	A	789.8	33.7	10/21/2021	-0.478	-0.011	0.486	0.2407366	0.000000	0.000000	0.116998
Rule608SeepArea32 L102121_172	1174757	3177450	A	789.5	34.1	10/21/2021	-0.867	-0.015	1.251	0.2403319	0.000000	0.000000	0.300655
Rule608SeepArea32 L102121_173	1174763	3177372	A	789.4	34.5	10/21/2021	-0.708	0.012	0.835	0.239989	0.000000	0.002880	0.200391
Rule608SeepArea32 L102121_174	1174779	3177281	A	789.4	34.8	10/21/2021	-1.05	0.025	1.573	0.2397552	0.000000	0.005994	0.377135
Rule608SeepArea32 L102121_175	1174785	3177199	A	791.4	35.1	10/21/2021	-0.903	0.015	0.237	0.2401287	0.000000	0.003602	0.056910
Rule608SeepArea32 L102121_176	1174859	3177284	A	789.3	35.4	10/21/2021	-0.651	-0.016	0.701	0.2392587	0.000000	0.000000	0.167720
Rule608SeepArea32 L102121_177	1174871	3177175	A	789.1	35.7	10/21/2021	-1.964	-0.013	0.234	0.2389657	0.000000	0.000000	0.055918
Rule608SeepArea32 L102121_178	1174907	3177085	A	789.3	35.9	10/21/2021	-0.828	0.013	2.865	0.2388716	0.000000	0.003105	0.684367
Rule608SeepArea32 L102121_179	1174980	3177054	A	788.8	36.0	10/21/2021	-0.719	-0.004	0.735	0.238643	0.000000	0.000000	0.175403
Rule608SeepArea32 L102121_180	1174981	3176960	A	788.8	36.2	10/21/2021	-0.485	-0.012	0.816	0.2384887	0.000000	0.000000	0.194607
Rule608SeepArea32 L102121_181	1175062	3176977	A	788.8	36.4	10/21/2021	-1.327	0.016	1.877	0.2383347	0.000000	0.003813	0.447354
Rule608SeepArea32 L102121_182	1175079	3176871	A	788.7	36.5	10/21/2021	-0.81	-0.012	1.419	0.2382275	0.000000	0.000000	0.338045

## Individual Flux Measurements and Calculations (Continued)

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
Rule608SeepArea32 L102121_183	1174982	3176842	A	789.0	36.7	10/21/2021	-0.494	-0.012	2.806	0.2381643	0.000000	0.000000	0.668289
Rule608SeepArea32 L102121_68	1173795	3178361	A	794.1	26.0	10/21/2021	-0.753	-0.006	0.054	0.2482775	0.000000	0.000000	0.013407
Rule608SeepArea32 L102121_69	1173852	3178364	A	793.8	26.6	10/21/2021	-0.46	0	0.152	0.2476869	0.000000	0.000000	0.037648
Rule608SeepArea32 L102121_70	1173924	3178355	A	793.6	27.0	10/21/2021	-0.478	0.005	0.343	0.2472945	0.000000	0.001236	0.084822
Rule608SeepArea32 L102121_71	1173975	3178352	A	793.6	27.5	10/21/2021	-0.001	0.003	0.821	0.2468832	0.000000	0.000741	0.202691
Rule608SeepArea32 L102121_72	1173957	3178294	A	793.3	28.0	10/21/2021	-0.776	0.005	0.94	0.2463801	0.000000	0.001232	0.231597
Rule608SeepArea32 L102121_73	1173884	3178325	A	793.4	28.7	10/21/2021	-0.481	-0.003	-1.833	0.2458398	0.000000	0.000000	0.000000
Rule608SeepArea32 L102121_74	1173878	3178281	A	793.7	29.4	10/21/2021	-1.88	0.001	0.448	0.2453637	0.000000	0.000245	0.109923
Rule608SeepArea32 L102121_75	1173800	3178265	A	793.8	30.0	10/21/2021	-1.496	0.005	0.267	0.2449089	0.000000	0.001225	0.065391
Rule608SeepArea32 L102121_76	1173778	3178169	A	793.8	30.8	10/21/2021	-0.11	-0.006	0.156	0.2442643	0.000000	0.000000	0.038105
Rule608SeepArea32 L102121_77	1173775	3178049	A	794.1	31.6	10/21/2021	-0.001	0.002	0.41	0.2437152	0.000000	0.000487	0.099923
Rule608SeepArea32 L102121_78	1173852	3177996	A	793.8	32.3	10/21/2021	0.84	0	0.393	0.2430648	0.204174	0.000000	0.095524
Rule608SeepArea32 L102121_79	1173874	3178064	A	793.8	32.8	10/21/2021	-0.001	0.003	0.977	0.2426676	0.000000	0.000728	0.237086
Rule608SeepArea32 L102121_80	1173880	3178176	A	793.7	33.5	10/21/2021	-0.839	0.001	0.888	0.2420831	0.000000	0.000242	0.214970
Rule608SeepArea32 L102121_81	1173957	3178148	A	793.4	34.1	10/21/2021	15.242	0.002	3.972	0.2415191	3.681233	0.000483	0.959314
Rule608SeepArea32 L102121_82	1174064	3178161	A	793.0	34.7	10/21/2021	-2.804	-0.007	-0.332	0.2409268	0.000000	0.000000	0.000000
Rule608SeepArea32 L102121_83	1174071	3178067	A	793.0	35.2	10/21/2021	0	0.005	1.352	0.2405361	0.000000	0.001203	0.325205

## Individual Flux Measurements and Calculations (Continued)

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
Rule608SeepArea32 L102121_84	1173983	3178052	A	793.2	35.7	10/21/2021	7.261	0	2.595	0.2402073	1.744145	0.000000	0.623338
Rule608SeepArea32 L102121_85	1174154	3177966	A	792.9	36.3	10/21/2021	-0.929	-0.008	0.421	0.2396509	0.000000	0.000000	0.100893
Rule608SeepArea32 L102121_86	1174095	3177953	A	792.9	36.7	10/21/2021	-3.954	0.006	1.606	0.2393415	0.000000	0.001436	0.384382
Rule608SeepArea32 L102121_87	1173972	3177956	A	793.0	37.2	10/21/2021	-0.63	-0.002	0.456	0.238986	0.000000	0.000000	0.108978
Rule608SeepArea32 L102121_88	1173951	3177873	A	793.2	37.5	10/21/2021	-1.038	-0.012	0.201	0.2388155	0.000000	0.000000	0.048002
Rule608SeepArea32 L102121_89	1173899	3177864	A	793.2	37.8	10/21/2021	-2.681	0.001	0.721	0.2385851	0.000000	0.000239	0.172020
Rule608SeepArea32 L102121_90	1173828	3177842	A	793.4	38.0	10/21/2021	-0.856	-0.005	0.51	0.2384918	0.000000	0.000000	0.121631
Rule608SeepArea32 L102121_91	1173755	3177867	A	793.6	38.2	10/21/2021	-1.341	0.002	0.057	0.2383987	0.000000	0.000477	0.013589
Rule608SeepArea32 L102121_92	1173766	3177752	A	793.4	38.3	10/21/2021	-1.1	-0.011	0.06	0.2382621	0.000000	0.000000	0.014296
Rule608SeepArea32 L102121_93	1173783	3177653	A	793.4	38.3	10/21/2021	-0.972	-0.003	0.145	0.2382621	0.000000	0.000000	0.034548
Rule608SeepArea32 L102121_94	1173866	3177566	A	793.3	38.3	10/21/2021	-1.121	-0.007	0.056	0.2382321	0.000000	0.000000	0.013341
Rule608SeepArea32 L102121_95	1173857	3177662	A	793.3	38.3	10/21/2021	-1.263	-0.004	0.139	0.2382321	0.000000	0.000000	0.033114
Rule608SeepArea32 L102121_96	1173843	3177733	A	793.3	38.3	10/21/2021	-0.001	0.003	0.308	0.2382321	0.000000	0.000715	0.073375
Rule608SeepArea32 L102121_97	1173961	3177761	A	793.0	38.2	10/21/2021	-0.899	-0.008	0.302	0.2382185	0.000000	0.000000	0.071942
Rule608SeepArea32 L102121_98	1173967	3177659	A	792.9	38.2	10/21/2021	-0.327	0.006	0.256	0.2381884	0.000000	0.001429	0.060976
Rule608SeepArea32 L102121_99	1173926	3177662	A	795.0	38.2	10/21/2021	-0.427	0.006	0.326	0.2388193	0.000000	0.001433	0.077855
Rule608SeepArea32 L102221_186	1174861	3176272	A	788.4	35.7	10/22/2021	-2.192	-0.015	-0.592	0.2387537	0.000000	0.000000	0.000000



## Individual Flux Measurements and Calculations (Continued)

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
Rule608SeepArea32 L102221_187	1174877	3176350	A	787.4	35.9	10/22/2021	-0.592	-0.006	0.055	0.2382966	0.000000	0.000000	0.013106
Rule608SeepArea32 L102221_188	1174986	3176475	A	787.0	36.2	10/22/2021	-1.91	0.002	1.197	0.2379445	0.000000	0.000476	0.284820
Rule608SeepArea32 L102221_189	1174941	3176537	A	787.0	36.3	10/22/2021	-0.351	0.008	1.149	0.2378676	0.000000	0.001903	0.273310
Rule608SeepArea32 L102221_190	1175046	3176575	A	786.7	36.5	10/22/2021	-1.25	-0.009	0.315	0.2376234	0.000000	0.000000	0.074851
Rule608SeepArea32 L102221_191	1175001	3176676	A	786.7	36.7	10/22/2021	-0.491	-0.002	0.171	0.23747	0.000000	0.000000	0.040607
Rule608SeepArea32 L102221_192	1175066	3176672	A	786.5	36.9	10/22/2021	-0.366	-0.005	0.249	0.2372565	0.000000	0.000000	0.059077
Rule608SeepArea32 L102221_193	1175044	3176748	A	786.4	37.1	10/22/2021	-0.668	-0.005	0.6	0.2370734	0.000000	0.000000	0.142244
Rule608SeepArea32 L102221_194	1175162	3176783	A	786.0	37.4	10/22/2021	-1.191	-0.006	1.118	0.2367239	0.000000	0.000000	0.264657
Rule608SeepArea32 L102221_195	1175206	3176770	A	785.3	37.7	10/22/2021	10.126	0.006	1.184	0.2362848	2.392620	0.001418	0.279761
Rule608SeepArea32 L102221_196	1175244	3176766	A	785.3	37.9	10/22/2021	-1.604	-0.004	-0.058	0.2361329	0.000000	0.000000	0.000000
Rule608SeepArea32 L102221_197	1175181	3176649	A	784.9	38.2	10/22/2021	-3.349	-0.04	0.292	0.2357852	0.000000	0.000000	0.068849
Rule608SeepArea32 L102221_198	1175285	3176632	A	786.3	38.5	10/22/2021	-0.951	-0.008	1.028	0.2359784	0.000000	0.000000	0.242586
Rule608SeepArea32 L102221_199	1175455	3176575	A	785.8	38.7	10/22/2021	-1.084	-0.018	0.316	0.2356771	0.000000	0.000000	0.074474
Rule608SeepArea32 L102221_200	1175343	3176543	A	785.8	38.9	10/22/2021	-1.145	-0.012	0.387	0.2355261	0.000000	0.000000	0.091149
Rule608SeepArea32 L102221_201	1175275	3176564	A	787.9	39.1	10/22/2021	-1.274	0.008	1.273	0.2360042	0.000000	0.001888	0.300433
Rule608SeepArea32 L102221_202	1175170	3176563	A	786.0	39.3	10/22/2021	-0.771	-0.008	0.772	0.2352844	0.000000	0.000000	0.181640
Rule608SeepArea32 L102221_203	1175102	3176443	A	786.0	39.6	10/22/2021	-1.236	-0.013	0.435	0.2350587	0.000000	0.000000	0.102251

## Individual Flux Measurements and Calculations (Continued)

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
Rule608SeepArea32 L102221_204	1175177	3176468	A	785.9	39.8	10/22/2021	-1.415	0.019	2.111	0.2348786	0.000000	0.004463	0.495829
Rule608SeepArea32 L102221_205	1175270	3176470	A	786.0	40.0	10/22/2021	-1.181	0.017	2.124	0.2347585	0.000000	0.003991	0.498627
Rule608SeepArea32 L102221_206	1175193	3176364	A	785.5	40.2	10/22/2021	-3.872	-0.032	-12.024	0.2344594	0.000000	0.000000	0.000000
Rule608SeepArea32 L102221_207	1175196	3176298	A	784.3	40.3	10/22/2021	-0.686	-0.007	0.13	0.2340265	0.000000	0.000000	0.030423
Rule608SeepArea32 L102221_208	1175263	3176314	A	784.2	40.5	10/22/2021	-1.391	-0.015	0.213	0.2338475	0.000000	0.000000	0.049810
Rule608SeepArea32 L102221_209	1175281	3176277	A	783.8	40.7	10/22/2021	-0.89	0.025	0.727	0.2335792	0.000000	0.005839	0.169812
Rule608SeepArea32 L102221_210	1175391	3176311	A	783.1	40.9	10/22/2021	-0.913	0.009	0.539	0.233222	0.000000	0.002099	0.125707
Rule608SeepArea32 L102221_211	1175397	3176251	A	782.7	41.1	10/22/2021	-1.439	-0.017	0.499	0.2329545	0.000000	0.000000	0.116244
Rule608SeepArea32 L102221_212	1175442	3176172	A	781.6	41.3	10/22/2021	-1.527	-0.051	0.378	0.2324792	0.000000	0.000000	0.087877
Rule608SeepArea32 L102221_213	1175476	3176157	A	780.9	41.5	10/22/2021	-1.088	-0.014	0.632	0.2321233	0.000000	0.000000	0.146702
Rule608SeepArea32 L102221_214	1175455	3176081	A	780.8	41.7	10/22/2021	-3.278	-0.035	1.548	0.2319462	0.000000	0.000000	0.359053
Rule608SeepArea32 L102221_215	1175468	3175901	A	781.5	42.0	10/22/2021	-3.959	-0.032	0.108	0.2319331	0.000000	0.000000	0.025049
Rule608SeepArea32 L102221_216	1175387	3176012	A	780.5	42.1	10/22/2021	-135.948	-0.021	0.94	0.2315629	0.000000	0.000000	0.217669
Rule608SeepArea32 L102221_217	1175319	3176046	A	781.2	42.3	10/22/2021	-1.109	-0.01	0.331	0.2316236	0.000000	0.000000	0.076667
Rule608SeepArea32 L102221_218	1175275	3176047	A	782.7	42.4	10/22/2021	-1.373	-0.029	0.082	0.2319948	0.000000	0.000000	0.019024
Rule608SeepArea32 L102221_219	1175262	3175947	A	782.5	42.5	10/22/2021	-2.816	-0.033	0.475	0.231862	0.000000	0.000000	0.110134
Rule608SeepArea32 L102221_220	1175315	3176186	A	782.2	42.5	10/22/2021	-4.786	-0.06	0.599	0.2317732	0.000000	0.000000	0.138832

## Individual Flux Measurements and Calculations (Continued)

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
Rule608SeepArea32 L102221_221	1175228	3176241	A	783.0	42.5	10/22/2021	-2.865	-0.037	0.276	0.2320102	0.000000	0.000000	0.064035
Rule608SeepArea32 L102221_222	1175191	3176170	A	784.0	42.5	10/22/2021	-2.057	-0.023	0.243	0.2323065	0.000000	0.000000	0.056450
Rule608SeepArea32 L102221_223	1175175	3176077	A	784.0	42.5	10/22/2021	-1.102	-0.015	0.913	0.2323065	0.000000	0.000000	0.212096
Rule608SeepArea32 L102221_224	1175170	3175948	A	783.4	42.4	10/22/2021	-0.622	0.013	1.254	0.2322023	0.000000	0.003019	0.291182
Rule608SeepArea32 L102221_225	1175084	3175886	A	783.4	42.4	10/22/2021	-1.518	-0.028	0.461	0.2322023	0.000000	0.000000	0.107045
Rule608SeepArea32 L102221_226	1175077	3175943	A	783.4	42.5	10/22/2021	-1.599	-0.015	0.473	0.2321287	0.000000	0.000000	0.109797
Rule608SeepArea32 L102221_227	1175100	3176074	A	784.2	42.6	10/22/2021	-3.085	-0.028	0.921	0.2322922	0.000000	0.000000	0.213941
Rule608SeepArea32 L102221_228	1175109	3176146	A	783.9	42.7	10/22/2021	-1.15	0.024	0.326	0.2321298	0.000000	0.005571	0.075674
Rule608SeepArea32 L102221_229	1175092	3176283	A	784.0	42.9	10/22/2021	-3.481	-0.053	0.23	0.2320125	0.000000	0.000000	0.053363
Rule608SeepArea32 L102221_230	1175078	3176357	A	784.6	43.0	10/22/2021	-1.912	-0.016	0.33	0.2321166	0.000000	0.000000	0.076598
Rule608SeepArea32 L102221_231	1174982	3176352	A	786.6	43.2	10/22/2021	-3.781	0.012	0.224	0.2325612	0.000000	0.002791	0.052094
Rule608SeepArea32 L102221_232	1174976	3176274	A	785.0	43.4	10/22/2021	-1.027	0.031	0.742	0.2319415	0.000000	0.007190	0.172101
Rule608SeepArea32 L102221_233	1174954	3176166	A	785.0	43.6	10/22/2021	-0.252	-0.036	1.022	0.231795	0.000000	0.000000	0.236895
Rule608SeepArea32 L102221_234	1174950	3176052	A	785.2	43.8	10/22/2021	-0.883	0.023	1.307	0.2317078	0.000000	0.005329	0.302842
Rule608SeepArea32 L102221_235	1174978	3175956	A	785.1	43.9	10/22/2021	-2.998	0.028	1.746	0.2316052	0.000000	0.006485	0.404383
Rule608SeepArea32 L102221_236	1174972	3175836	A	785.2	44.0	10/22/2021	-2.135	-0.027	0.351	0.2315617	0.000000	0.000000	0.081278
Rule608SeepArea32 L102221_237	1174920	3175841	A	785.4	43.9	10/22/2021	-2.726	-0.059	0.599	0.2316937	0.000000	0.000000	0.138785

## Individual Flux Measurements and Calculations (Continued)

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
Rule608SeepArea32 L102221_238	1174889	3175951	A	785.5	43.9	10/22/2021	-1.676	-0.026	0.284	0.2317232	0.000000	0.000000	0.065809
Rule608SeepArea32 L102221_239	1174883	3176084	A	785.5	43.9	10/22/2021	-1.133	0.008	0.338	0.2317232	0.000000	0.001854	0.078322
Rule608SeepArea32 L102221_240	1174872	3176144	A	785.4	43.9	10/22/2021	-3.197	-0.023	0.586	0.2316937	0.000000	0.000000	0.135773
SeepArea32L10222 1_184	1174037	3178268	A	780.0	35.0	10/22/2021	-3.082	0.006	-5.805	0.2367465	0.000000	0.001420	0.000000
SeepArea32L10222 1_185	1174051	3178367	A	788.3	35.2	10/22/2021	-1.739	-0.016	-4.09	0.2391105	0.000000	0.000000	0.000000

## **APPENDIX C**

# **VOLUMETRIC FLUX CALCULATIONS**

---

# Grid Volume Computations

---

Fri Jan 14 12:14:33 2022

## Upper Surface

Grid File Name:	C:\WSP\2021 Rule 608\Surfer\L1049CH4_2021notail.grd
Grid Size:	69 rows x 100 columns
X Minimum:	3175786.418
X Maximum:	3178417.289
X Spacing:	26.574454545453
Y Minimum:	1173704.974
Y Maximum:	1175535.517
Y Spacing:	26.919750000001
Z Minimum:	0
Z Maximum:	41.588247671822

## Lower Surface

Level Surface defined by  $Z = 0$

## Volumes

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

### Total Volumes by:

Trapezoidal Rule:	63837.495510926
Simpson's Rule:	63812.197367919
Simpson's 3/8 Rule:	63718.919856845

### Cut & Fill Volumes

Positive Volume [Cut]:	63837.495510926
Negative Volume [Fill]:	0
Net Volume [Cut-Fill]:	63837.495510926

## Areas

### Planar Areas

Positive Planar Area [Cut]:	2881898.9546733
Negative Planar Area [Fill]:	0



NoData Planar Area:	1934023.5382796
Total Planar Area:	4815922.4929528

### **Surface Areas**

Positive Surface Area [Cut]:	2881920.6591469
Negative Surface Area [Fill]:	0

---

# Grid Volume Computations

---

Fri Jan 14 12:17:31 2022

## Upper Surface

Grid File Name:	C:\WSP\2021 Rule 608\Surfer\L1021CH4_2021notail.grd
Grid Size:	49 rows x 56 columns
X Minimum:	3178388.381
X Maximum:	3178937.204
X Spacing:	9.9785999999974
Y Minimum:	1173780.639
Y Maximum:	1174256.845
Y Spacing:	9.9209583333335
Z Minimum:	0
Z Maximum:	12.042587568362

## Lower Surface

Level Surface defined by  $Z = 0$

## Volumes

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

### Total Volumes by:

Trapezoidal Rule:	4295.083420203
Simpson's Rule:	4300.731152998
Simpson's 3/8 Rule:	4297.0330472478

### Cut & Fill Volumes

Positive Volume [Cut]:	4295.083420203
Negative Volume [Fill]:	0
Net Volume [Cut-Fill]:	4295.083420203

## Areas

### Planar Areas

Positive Planar Area [Cut]:	139437.66159098
Negative Planar Area [Fill]:	0

NoData Planar Area:	121915.14394696
Total Planar Area:	261352.80553794

### **Surface Areas**

Positive Surface Area [Cut]:	139439.45600803
Negative Surface Area [Fill]:	0

---

# Grid Volume Computations

---

Fri Jan 14 12:18:55 2022

## Upper Surface

Grid File Name:	C:\WSP\2021 Rule 608\Surfer\L1030CH4_2021notail.grd
Grid Size:	32 rows x 26 columns
X Minimum:	3164650.92
X Maximum:	3164900.681
X Spacing:	9.9904399999976
Y Minimum:	1146067.099
Y Maximum:	1146379.037
Y Spacing:	10.062516129035
Z Minimum:	0
Z Maximum:	4.6046322720596

## Lower Surface

Level Surface defined by  $Z = 0$

## Volumes

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

### Total Volumes by:

Trapezoidal Rule:	1116.7482798191
Simpson's Rule:	1121.6181266548
Simpson's 3/8 Rule:	1122.8202263995

### Cut & Fill Volumes

Positive Volume [Cut]:	1116.7482798191
Negative Volume [Fill]:	0
Net Volume [Cut-Fill]:	1116.7482798191

## Areas

### Planar Areas

Positive Planar Area [Cut]:	38904.708927183
Negative Planar Area [Fill]:	0

NoData Planar Area:	39005.237890819
Total Planar Area:	77909.946818002

### **Surface Areas**

Positive Surface Area [Cut]:	38904.985996895
Negative Surface Area [Fill]:	0

## **APPENDIX D**

# **NATURAL SPRINGS LABORATORY ANALYTICAL REPORTS**



The results set forth herein are provided by SGS North America Inc.

*e-Hardcopy 2.0*  
*Automated Report*

## Technical Report for

**WSP**

**2021 Rule 608**

**SGS Job Number: DA38379**

**Sampling Date: 10/19/21**

### Report to:

LT Environmental  
848 E 2nd Ave Suite #3  
Durango, CO 81301  
deven.hencmann@wsp.com

**ATTN: Devin Hencmann**

**Total number of pages in report: 23**



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.



**Jason Savoie**  
**General Manager**

**Client Service contact: Carissa Cumine 303-425-6021**

Certifications: CO (CO00049), NE (NE-OS-06-04), ND (R-027), UT (NELAP CO00049)  
LA (LA150028), TX (T104704511), WY (8TMS-L)

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Test results relate only to samples analyzed.

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Sample Summary

WSP

2021 Rule 608

Job No: DA38379

Sample Number	Collected Date	Time By	Received	Matrix Code	Type	Client Sample ID
DA38379-1	10/19/21	12:30 BM	10/20/21	AQ	Water	CHAVEZ-01
DA38379-2	10/19/21	11:50 BM	10/20/21	AQ	Water	CHAVEZ-02



## CASE NARRATIVE / CONFORMANCE SUMMARY

2

**Client:** WSP

**Job No:** DA38379

**Site:** 2021 Rule 608

**Report Date** 10/31/2021 12:50:42 P

On 10/20/2021, 2 Sample(s), 0 Trip Blank(s) and 0 Field Blank(s) were received at SGS North America Inc. at a maximum corrected temperature of 3.9 C. Samples were intact and chemically preserved, unless noted below. A SGS North America Inc. Job Number of DA38379 was assigned to the project. Laboratory sample ID, client sample ID and dates of sample collection are detailed in the report's Results Summary Section.

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.

### GC Volatiles By Method RSK175 MOD

**Matrix:** AQ

**Batch ID:** GFK200

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

### General Chemistry By Method EPA300.0

**Matrix:** AQ

**Batch ID:** GP29933

- All samples were prepared within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA38366-1MS, DA38366-1MSD were used as the QC samples for Bromide, Chloride, Fluoride, Nitrogen, Nitrate, Nitrogen, Nitrite, Sulfate, Bromide.

### General Chemistry By Method SM 2320B-2011

**Matrix:** AQ

**Batch ID:** GN54418

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA38350-18DUP, DA38392-1MS, DA38392-1MSD were used as the QC samples for Alkalinity, Total as CaCO<sub>3</sub>.

**Matrix:** AQ

**Batch ID:** GN54419

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

**Matrix:** AQ

**Batch ID:** GN54420

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

### General Chemistry By Method SM 2510B-2011

**Matrix:** AQ

**Batch ID:** GP29937

- The data for SM 2510B-2011 meets quality control requirements.

Sunday, October 31, 2021

Page 1 of 2

## General Chemistry By Method SM 2540C-2011

**Matrix:** AQ

**Batch ID:** GN54390

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA38438-1DUP were used as the QC samples for Solids, Total Dissolved.
- RPD(s) for Duplicate for Solids, Total Dissolved are outside control limits for sample GN54390-DUP1. RPD acceptable due to low duplicate and sample concentrations.

**Matrix:** AQ

**Batch ID:** GN54415

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA38379-2DUP were used as the QC samples for Solids, Total Dissolved.

## General Chemistry By Method SM4500HB+-2011/9040C

**Matrix:** AQ

**Batch ID:** GN54383

- The data for SM4500HB+-2011/9040C meets quality control requirements.
- The following samples were run outside of holding time for method SM4500HB+-2011/9040C: DA38379-1, DA38379-2
- DA38379-1 for pH: Field parameter analyzed by the laboratory upon request.
- DA38379-2 for pH: Field parameter analyzed by the laboratory upon request.

SGS North America Inc. certifies that data reported for samples received, listed on the associated custody chain or analytical task order, were produced to specifications meeting the 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.

SGS North America Inc. is not responsible for data quality assumptions if partial reports are used and recommends that this report be used in its entirety. Data release is authorized by SGS North America Inc indicated via signature on the report cover

## Summary of Hits

Page 1 of 1

**Job Number:** DA38379  
**Account:** WSP  
**Project:** 2021 Rule 608  
**Collected:** 10/19/21

Lab Sample ID	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
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### DA38379-1 CHAVEZ-01

Methane	0.0037	0.00080	0.00070	mg/l	RSK175 MOD
Fluoride	0.24	0.10		mg/l	EPA300.0
Chloride	3.2	0.50		mg/l	EPA300.0
Nitrogen, Nitrate	0.033	0.010		mg/l	EPA300.0
Sulfate	29.1	0.50		mg/l	EPA300.0
Alkalinity, Bicarbonate as CaCO <sub>3</sub>	125	5.0		mg/l	SM 2320B-2011
Alkalinity, Total as CaCO <sub>3</sub>	125	5.0		mg/l	SM 2320B-2011
Solids, Total Dissolved	181	10		mg/l	SM 2540C-2011
Specific Conductivity	335	1.0		umhos/cm	SM 2510B-2011
pH <sup>a</sup>	7.32			su	SM4500HB+ -2011/9040C

### DA38379-2 CHAVEZ-02

Methane	0.00098	0.00080	0.00070	mg/l	RSK175 MOD
Fluoride	0.28	0.10		mg/l	EPA300.0
Chloride	3.9	0.50		mg/l	EPA300.0
Nitrogen, Nitrate	0.099	0.050		mg/l	EPA300.0
Sulfate	27.8	0.50		mg/l	EPA300.0
Alkalinity, Bicarbonate as CaCO <sub>3</sub>	153	5.0		mg/l	SM 2320B-2011
Alkalinity, Total as CaCO <sub>3</sub>	153	5.0		mg/l	SM 2320B-2011
Solids, Total Dissolved	211	10		mg/l	SM 2540C-2011
Specific Conductivity	398	1.0		umhos/cm	SM 2510B-2011
pH <sup>a</sup>	7.33			su	SM4500HB+ -2011/9040C

(a) Field parameter analyzed by the laboratory upon request.



Wheat Ridge, CO

Section 4

4

Sample Results

Report of Analysis



Report of Analysis

<b>Client Sample ID:</b>	CHAVEZ-01		
<b>Lab Sample ID:</b>	DA38379-1	<b>Date Sampled:</b>	10/19/21
<b>Matrix:</b>	AQ - Water	<b>Date Received:</b>	10/20/21
<b>Method:</b>	RSK175 MOD	<b>Percent Solids:</b>	n/a
<b>Project:</b>	2021 Rule 608		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	FK2796.D	1	10/22/21 16:06	CB	n/a	n/a	GFK200
Run #2							

	Initial Volume	Headspace Volume	Volume Injected	Temperature
Run #1	39.0 ml	4.0 ml	500 ul	26.3 Deg. C
Run #2				

CAS No.	Compound	Result	RL	MDL	Units	Q
74-82-8	Methane	0.0037	0.00080	0.00070	mg/l	

ND = Not detected      MDL = Method Detection Limit      J = Indicates an estimated value  
RL = Reporting Limit      B = Indicates analyte found in associated method blank  
E = Indicates value exceeds calibration range      N = Indicates presumptive evidence of a compound

## Report of Analysis

<b>Client Sample ID:</b>	CHAVEZ-01	<b>Date Sampled:</b>	10/19/21
<b>Lab Sample ID:</b>	DA38379-1	<b>Date Received:</b>	10/20/21
<b>Matrix:</b>	AQ - Water	<b>Percent Solids:</b>	n/a
<b>Project:</b>	2021 Rule 608		

## General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
<b>300.0</b>							
Fluoride	0.24	0.10	mg/l	1	10/20/21 12:37	MM	EPA300.0
Chloride	3.2	0.50	mg/l	1	10/20/21 12:37	MM	EPA300.0
Nitrogen, Nitrite	< 0.0040	0.0040	mg/l	1	10/20/21 12:37	MM	EPA300.0
Bromide	< 0.050	0.050	mg/l	1	10/20/21 12:37	MM	EPA300.0
Nitrogen, Nitrate	0.033	0.010	mg/l	1	10/20/21 12:37	MM	EPA300.0
Sulfate	29.1	0.50	mg/l	1	10/20/21 12:37	MM	EPA300.0
Alkalinity, Bicarbonate as CaC	125	5.0	mg/l	1	10/27/21	JD	SM 2320B-2011
Alkalinity, Carbonate	< 5.0	5.0	mg/l	1	10/27/21	JD	SM 2320B-2011
Alkalinity, Total as CaCO <sub>3</sub>	125	5.0	mg/l	1	10/27/21	JD	SM 2320B-2011
Solids, Total Dissolved	181	10	mg/l	1	10/25/21	SB	SM 2540C-2011
Specific Conductivity	335	1.0	umhos/cm	1	10/21/21	SB	SM 2510B-2011
pH <sup>a</sup>	7.32		su	1	10/21/21	TH	SM4500HB+ -2011/9040C

(a) Field parameter analyzed by the laboratory upon request.

RL = Reporting Limit

Report of Analysis

<b>Client Sample ID:</b>	CHAVEZ-02	<b>Date Sampled:</b>	10/19/21
<b>Lab Sample ID:</b>	DA38379-2	<b>Date Received:</b>	10/20/21
<b>Matrix:</b>	AQ - Water	<b>Percent Solids:</b>	n/a
<b>Method:</b>	RSK175 MOD		
<b>Project:</b>	2021 Rule 608		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	FK2797.D	1	10/22/21 16:15	CB	n/a	n/a	GFK200
Run #2							

	Initial Volume	Headspace Volume	Volume Injected	Temperature
Run #1	39.0 ml	4.0 ml	500 ul	26.3 Deg. C
Run #2				

CAS No.	Compound	Result	RL	MDL	Units	Q
74-82-8	Methane	0.00098	0.00080	0.00070	mg/l	

ND = Not detected      MDL = Method Detection Limit      J = Indicates an estimated value  
RL = Reporting Limit      B = Indicates analyte found in associated method blank  
E = Indicates value exceeds calibration range      N = Indicates presumptive evidence of a compound

## Report of Analysis

**Client Sample ID:** CHAVEZ-02  
**Lab Sample ID:** DA38379-2  
**Matrix:** AQ - Water  
**Project:** 2021 Rule 608

**Date Sampled:** 10/19/21  
**Date Received:** 10/20/21  
**Percent Solids:** n/a

## General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
<b>300.0</b>							
Fluoride	0.28	0.10	mg/l	1	10/20/21 12:51	MM	EPA300.0
Chloride	3.9	0.50	mg/l	1	10/20/21 12:51	MM	EPA300.0
Nitrogen, Nitrite	< 0.0040	0.0040	mg/l	1	10/20/21 12:51	MM	EPA300.0
Bromide	< 0.050	0.050	mg/l	1	10/20/21 12:51	MM	EPA300.0
Nitrogen, Nitrate	0.099	0.050	mg/l	5	10/20/21 18:17	MM	EPA300.0
Sulfate	27.8	0.50	mg/l	1	10/20/21 12:51	MM	EPA300.0
Alkalinity, Bicarbonate as CaC	153	5.0	mg/l	1	10/27/21	JD	SM 2320B-2011
Alkalinity, Carbonate	< 5.0	5.0	mg/l	1	10/27/21	JD	SM 2320B-2011
Alkalinity, Total as CaCO <sub>3</sub>	153	5.0	mg/l	1	10/27/21	JD	SM 2320B-2011
Solids, Total Dissolved	211	10	mg/l	1	10/27/21	SB	SM 2540C-2011
Specific Conductivity	398	1.0	umhos/cm	1	10/21/21	SB	SM 2510B-2011
pH <sup>a</sup>	7.33		su	1	10/21/21	TH	SM4500HB+ -2011/9040C

(a) Field parameter analyzed by the laboratory upon request.

RL = Reporting Limit

## Misc. Forms

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### Custody Documents and Other Forms

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Includes the following where applicable:

- Chain of Custody

## CHAIN OF CUSTODY

SGS North America Inc. - Wheat Ridge

4036 Youngfield Street, Wheat Ridge, CO 80033

TEL: 303-425-6021 FAX: 303-425-6854

[www.sgs.com/ehsusa](http://www.sgs.com/ehsusa)

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EHSA-QAC-0027-01-FORM-Wheat Ridge - COC: RV 9/2/21

## DA38379: Chain of Custody

Page 1 of 3

# Bottle Configuration Sheet For Order #: TM-101321-76

Sample Set 1	5	AQ	BRO, CHL, F, PH, SCON, SO4, TDS, VRSK175CH4, XCARBICALK, NO2, NO3O,
Test Code			# of containers to fill per sample
-BRO			(1) 250ml Poly - NP - 52
CHL, NO3O, SO4, F, NO2, 360			(1) 125ml Poly - NP
PH			(1) 125ml Poly - NP - 52
SCON, PH			(1) 125ml Poly - NP
TDS			(1) 500ml Poly - NP
VRSK175CH4			(3) 40ml Vial - HCL
XCARBICALK			(1) 250ml Poly - NP
Sample Set 2			5
AQ			SAR, IRBAC, SFBAC, SO4BAC, D, METALS,
Test Code			# of containers to fill per sample
D, METALS			(1) 250ml Poly - NP
IRBAC, SFBAC, SO4BAC			(1) 110ml Sterile - NP
SAR			(1) 500ml Poly - NP



Control #: TM-101321-76 CSR: TERRIM  
TM-101321-76 Date/Time: 10/14/2021 7:41:55 AM

Delivery and Pick Up Request  
**THIS FORM MUST BE RETURNED WITH COOLER**

Client: WSP Project #: \_\_\_\_\_  
Requested By: Josh Adams Project: RULE 608 Compliance  
Delivery Mode: Ship Shipping Mode: FED-X P1  
Tracking #: \_\_\_\_\_

Date and Time to: Ship Date: 10/14/2021 Time: AM  
Earliest Date: Earliest Time:

Deliver bottle order to: WSP/ Raton Basin  
Address: 848 East 2nd Ave  
City: Durango State: Colorado Zipcode: 81301  
Delv Contact: Josh Adams Phone: 303-517-8437

Deliverable Package: TAT: ( in Days )  
Include with the order: ☐ Extra Labels ☒ COC's ☒ Pre-Paid return labels ☐ Client Welcome Kit  
Special Instructions: 3-Regular COC. D. Met: CA,FE,K,MG,NA,SEMS,MNMS

1. Prepared / Relinquished By: 1. Date / Time 1. Received By  
2. Relinquished By: 2. Date / Time 2. Received By

# of Samples	Matrix	Analyses Requested	Special Kits Requested
5	AQ	BRO,CHL,F,PH,SCON,SO4,TDS,VRSK175CH4,XCARBI CALK,NO2,NO3O,	
5	AQ	SAR,IRBAC,SFBAC,SO4BAC,D,METALS,	

Water and Non Methanol Field Blanks Special Trip Blanks

Date: Time: Initials: Date: Time: Initials:  
# of Coolers in order: Custody Seal #s: Client to note return seal number(s) on Chain of Custody  
<http://www.sgs.com/en/terms-and-conditions>



## GC Volatiles

## QC Data Summaries

Includes the following where applicable:

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

## Method Blank Summary

Page 1 of 1

**Job Number:** DA38379  
**Account:** LTENCODU WSP  
**Project:** 2021 Rule 608

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
GFK200-MB	FK2790.D	1	10/22/21	CB	n/a	n/a	GFK200

The QC reported here applies to the following samples:

Method: RSK175 MOD

DA38379-1, DA38379-2

CAS No.	Compound	Result	RL	MDL	Units	Q
74-82-8	Methane	ND	0.00080	0.00070	mg/l	

Blank Spike/Blank Spike Duplicate Summary

Job Number: DA38379  
Account: LTENCODU WSP  
Project: 2021 Rule 608

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
GFK200-BS	FK2791.D	10	10/22/21	CB	n/a	n/a	GFK200
GFK200-BSD	FK2792.D	10	10/22/21	CB	n/a	n/a	GFK200

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

DA38379-1, DA38379-2

CAS No.	Compound	Spike mg/l	BSP mg/l	BSP %	BSD mg/l	BSD %	RPD	Limits Rec/RPD
74-82-8	Methane	0.512	0.585	114	0.580	113	1	70-130/30

\* = Outside of Control Limits.

## General Chemistry

### QC Data Summaries

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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: DA38379  
Account: LTENCODU - WSP  
Project: 2021 Rule 608

Analyte	Batch ID	RL	MB Result	Units	Spike Amount	BSP Result	BSP %Recov	QC Limits
Alkalinity, Bicarbonate as CaC	GN54419	5.0	0.0	mg/l	100	100	100.0	90-110%
Alkalinity, Carbonate	GN54420	5.0	0.0	mg/l	100	100	100.0	90-110%
Alkalinity, Total as CaCO3	GN54418	5.0	0.0	mg/l	100	100	100.0	90-110%
Bromide	GP29933/GN54384	0.050	0.0	mg/l	0.5	0.510	102.0	90-110%
Chloride	GP29933/GN54384	0.50	0.0	mg/l	5	5.11	102.2	90-110%
Fluoride	GP29933/GN54384	0.10	0.0	mg/l	1	0.972	97.2	90-110%
Nitrogen, Nitrate	GP29933/GN54384	0.010	0.0	mg/l	0.1	0.102	102.0	90-110%
Nitrogen, Nitrite	GP29933/GN54384	0.0040	0.0	mg/l	0.05	0.0506	101.2	90-110%
Solids, Total Dissolved	GN54390	10	0.0	mg/l	250	250	98.8	90-110%
Solids, Total Dissolved	GN54390	10	0.0	mg/l	250	247	98.8	90-110%
Solids, Total Dissolved	GN54415	10	0.0	mg/l	250	240	96.0	90-110%
Specific Conductivity	GN54391			umhos/cm	xxxxxxx	9880	99.0	90-110%
Sulfate	GP29933/GN54384	0.50	0.0	mg/l	5	5.03	100.6	90-110%

Associated Samples:

Batch GN54390: DA38379-1  
Batch GN54391: DA38379-1, DA38379-2  
Batch GN54415: DA38379-2  
Batch GN54418: DA38379-1, DA38379-2  
Batch GN54419: DA38379-1, DA38379-2  
Batch GN54420: DA38379-1, DA38379-2  
Batch GP29933: DA38379-1, DA38379-2  
(\*) Outside of QC limits

DUPLICATE RESULTS SUMMARY  
GENERAL CHEMISTRY

Login Number: DA38379  
Account: LTENCODU - WSP  
Project: 2021 Rule 608

Analyte	Batch ID	QC Sample	Units	Original Result	DUP Result	RPD	QC Limits
Alkalinity, Total as CaCO <sub>3</sub>	GN54418	DA38350-18	mg/l	50.0	50.0	0.0	0-20%
Solids, Total Dissolved	GN54390	DA38438-1	mg/l	243	249	5.4 (a)	0-5%
Solids, Total Dissolved	GN54415	DA38379-2	mg/l	211	211	0.0	0-5%
Specific Conductivity	GN54391	DA38419-1	umhos/cm	1470	1470	0.2	0-20%

Associated Samples:

Batch GN54390: DA38379-1

Batch GN54391: DA38379-1, DA38379-2

Batch GN54415: DA38379-2

Batch GN54418: DA38379-1, DA38379-2

(\*) Outside of QC limits

(a) RPD acceptable due to low duplicate and sample concentrations.



MATRIX SPIKE RESULTS SUMMARY  
GENERAL CHEMISTRY

Login Number: DA38379  
Account: LTENCODU - WSP  
Project: 2021 Rule 608

Analyte	Batch ID	QC Sample	Units	Original Result	Spike Amount	MS Result	%Rec	QC Limits
Alkalinity, Total as CaCO <sub>3</sub>	GN54418	DA38392-1	mg/l	110	100	225	115.0	80-120%
Bromide	GP29933/GN54384	DA38366-1	mg/l	0.0	5	5.1	102.0	80-120%
Chloride	GP29933/GN54384	DA38366-1	mg/l	34.3	50	88.2	107.8	80-120%
Fluoride	GP29933/GN54384	DA38366-1	mg/l	1.0	10	10.5	95.0	80-120%
Nitrogen, Nitrate	GP29933/GN54384	DA38366-1	mg/l	0.52	1	1.6	108.0	80-120%
Nitrogen, Nitrite	GP29933/GN54384	DA38366-1	mg/l	0.0	0.5	0.51	102.0	80-120%
Sulfate	GP29933/GN54384	DA38366-1	mg/l	240	50	296	112.0	80-120%

Associated Samples:

Batch GN54418: DA38379-1, DA38379-2

Batch GP29933: DA38379-1, DA38379-2

(\*) Outside of QC limits

(N) Matrix Spike Rec. outside of QC limits

7.3

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MATRIX SPIKE DUPLICATE RESULTS SUMMARY  
GENERAL CHEMISTRY

Login Number: DA38379  
Account: LTENCODU - WSP  
Project: 2021 Rule 608

Analyte	Batch ID	QC Sample	Units	Original Result	Spike Amount	MSD Result	RPD	QC Limit
Alkalinity, Total as CaCO <sub>3</sub>	GN54418	DA38392-1	mg/l	110	100	225	0.0	20%
Bromide	GP29933/GN54384	DA38366-1	mg/l	0.0	5	5.1	0.0	20%
Chloride	GP29933/GN54384	DA38366-1	mg/l	34.3	50	88.4	0.2	20%
Fluoride	GP29933/GN54384	DA38366-1	mg/l	1.0	10	10.5	0.0	20%
Nitrogen, Nitrate	GP29933/GN54384	DA38366-1	mg/l	0.52	1	1.6	0.0	20%
Nitrogen, Nitrite	GP29933/GN54384	DA38366-1	mg/l	0.0	0.5	0.50	2.0	20%
Sulfate	GP29933/GN54384	DA38366-1	mg/l	240	50	296	0.0	20%

Associated Samples:

Batch GN54418: DA38379-1, DA38379-2

Batch GP29933: DA38379-1, DA38379-2

(\*) Outside of QC limits

(N) Matrix Spike Rec. outside of QC limits