

Cazier - DNR, Tim <tim.cazier@state.co.us>

# M1997054 Parkdale Quarry 112 (c) Permit Amendment - Water Quality Consultant's Report - Part 1 of 2

1 message

**David Bieber** <David.Bieber@martinmarietta.com> To: "Cazier - DNR, Tim" <tim.cazier@state.co.us> Cc: Erin Kunkel <Erin.Kunkel@martinmarietta.com> Tue, Jul 13, 2021 at 1:51 PM

David W. Bieber, PG Manager of Geology/Survey | West Division

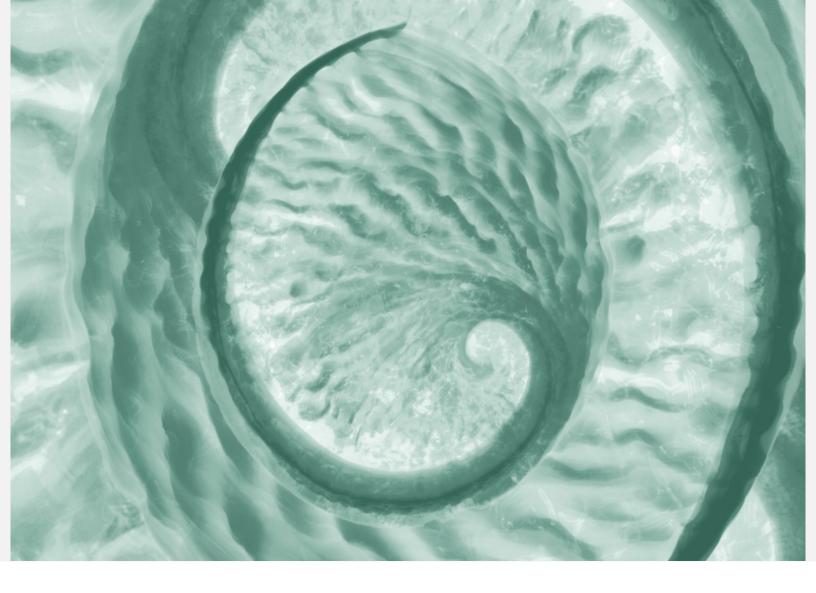
**Martin Marietta** 

1627 Cole Blvd Suite 200

Lakewood, CO 80401

t. **720-245-6423** m. 916-870-6635 f. 303-657-4351 e. david.bieber@martinmarietta.com www.martinmarietta.com

Parkdale Hydrogeologic Assessment\_April 2020 - Part 1.pdf 5812K





### Hydrogeologic Assessment

Parkdale Quarry Expansion Area

April 2020 Project No.: 0488586



#### **Signature Page**

April 2020

### Hydrogeologic Assessment

Parkdale Quarry Expansion Area

alm D. Tigger

Fred Mamill.

Al Trippel Project Director

Fred Marinelli Senior Technical Consultant

Mederallowes

Becky Moores Project Manager

Jang the

Jeremy Stariwat Senior Geologist

ERM-West, Inc. 555 17<sup>th</sup> Street, Suite 1700 Denver, CO 80202

© Copyright 2020 by ERM Worldwide Group Ltd and / or its affiliates ("ERM"). All rights reserved. No part of this work may be reproduced or transmitted in any form, or by any means, without the prior written permission of ERM.

#### CONTENTS

INTI	RODUC	CTION	1
1.	BAC	KGROUND	2
	1.1 1.2 1.3	Parkdale Quarry Expansion Geologic Setting Hydrogeologic Settings	2
2.	DAT	A COMPILATION AND REVIEW	3
3.	FIEL	D INVESTIGATION	4
	3.1 3.2 3.3 3.4 3.5	Sampling Event 1 – December 2018 Sampling Event 2 – May 2019 Sampling Event 3 – August 2019 Sampling Event 4 – November 2019 Sampling Event 5 – February 2020	4 4 5
4.	DAT	A ANALYSIS	6
	4.1 4.2	Water Quality Hydraulic Conductivity of Granite	
5.	SIMU	JLATED CURRENT (PRE-MINING) CONDITIONS	8
6.	EVA	LUATION OF QUARRY EFFECTS ON GROUNDWATER	10
	6.1 6.2 6.3 6.4 6.5	Water Quality Post-Mining Condition Transient Drawdown Analysis Quarry Inflows Geologic Cross Section Interpretation	10 11 12
7.	DISC	CUSSION	13
8.	REF	ERENCES	14

#### **FIGURES**

APPENDIX A	FIELD WATER QUALITY FORMS
APPENDIX B	ANALYTICAL REPORTS
APPENDIX C	HYDRAULIC ANALYSIS
APPENDIX D	SIMULATED CURRENT CONDITIONS
APPENDIX E	DRAWDOWN AND PIT INFLOW ANALYSIS

#### List of Tables

Table 1: Primary DWR Well Water Use within 4 Miles of the Quarry Expansion	3
Table 2: Pumping Test Results – December 2018	7

#### List of Figures (in text)

Figure 5-1: Results of Pre-Mining Analysis	.9
Figure 6-1: Results of Post-Mining Analysis Considering Recharge	11

List of Figures (as attachments) Figure 1: Site Location Figure 2: Geologic Map Figure 3: DWR Well Database Figure 4: DWR Mislocated Wells Figure 5: Geologic Cross Section

#### **Acronyms and Abbreviations**

Name	Description
µg/L	Micrograms per liter
amsl	Above mean sea level
bgs	Below ground surface
BLM	Bureau of Land Management
CDPHE	Colorado Department of Public Health & Environment
cm/sec	Centimeters per second
DO	Dissolved oxygen
DWR	Division of Water Resources
EC	Electric conductivity
EPA	Environmental Protection Agency
ERM	ERM-West, Inc.
ft/day	Feet per day
gpm	Gallons per minute
К	Hydraulic conductivity
Kn	Niobrara Formation
mg/L	Milligrams per liter
mrem	Millirem
ORP	Oxidation-reduction potential
pCi/L	Picocuries per liter
рН	Power of hydrogen
psi	Pounds per square inch
SM	Standard Method
TDS	Total dissolved solids
USGS	United States Geological Survey

#### INTRODUCTION

This report summarizes a hydrogeologic assessment that ERM-West, Inc. (ERM) completed for the area proposed for expansion of the Parkdale Quarry (hereinafter "Site") located on Bureau of Land Management (BLM) land near Cañon City, Colorado (hereinafter "Project"). ERM understands that the purpose of the investigation is to perform a scoping-level analysis to evaluate if the expanded quarry could affect the quantity and quality of the underlying groundwater system, and most notably, if water levels in existing private water wells near the Site could lower over time. Additionally, it is understood that hydrogeologic monitoring and assessment may be used to support Martin Marietta's overall permitting process for the Project, including the National Environmental Policy Act review process.

#### 1. BACKGROUND

#### 1.1 Parkdale Quarry Expansion

Martin Marietta is pursuing permits and approvals to expand the Site onto BLM lands located generally north of the current mining operations, as shown on Figure 1. As part of the expansion area investigation, Martin Marietta drilled nine 3.75-inch exploratory boreholes to a depth of 250 feet below ground surface (bgs) and completed three of the borings as 2-inch monitoring wells with screened intervals from approximately 20 to 250 feet bgs (Figure 1). From ground surface downward, these borings generally encountered: several feet of colluvium soil; up to 5 feet of decomposed granite sands; up to 15 feet of weathered and partially weathered granite; and competent fractured granite to the bottom of the borehole. At some locations on Cactus Mountain, bedrock outcrops and is visible at ground surface. Three of the wells were later converted into groundwater monitoring wells: MW-01, MW-03, and MW-10.

#### 1.2 Geologic Setting

The Site lies in the northern extent of the northwest trending Wet Mountains, a sub-range of the Sangre de Cristo Mountains, as part of the Southern Rocky Mountains physiographic region. The gneiss, schist, and granite of the Wet Mountains were exposed during the Wet Mountain uplift as part of the Laramide orogeny (Christman et. al. 1954).

Locally, the Precambrian granite of Cactus Mountain is in fault contact with the Jurassic and Cretaceous sedimentary rocks as part of the larger northwest trending subvertical IIse fault and the Parkdale fault (Wobus et. al. 1979). The sedimentary rocks, including sequences of limestone, sandstone, and shale, are found immediately south of the proposed excavation and north-northeast of Cactus Mountain (Figure 2). The historical quarry operation excavated coarse alluvium adjacent to the Arkansas River, and the current operation is excavating granite on Martin Marietta owned property north of the Arkansas River. The proposed quarry expansion onto BLM land would continue to excavate granite to be crushed for an aggregate end product.

The Tallahassee Creek Mining District, which historically produced uranium, is approximately 3 miles west of the quarry (Hon 1984), and is drained by Tallahassee Creek.

#### 1.3 Hydrogeologic Settings

The Site is located at the lower end of the Currant Creek and Tallahassee Creek watersheds, near the confluence of Tallahassee Creek and the Arkansas River (Figure 1). Groundwater in the site area is present in four hydrogeologic units: alluvium adjacent to Currant Creek, Tallahassee Creek, and the Arkansas River; sedimentary rocks; decomposed and/or weathered granite; and competent fractured granite. There are mapped faults within the granite body, and fault contacts between the granite and sedimentary rocks (Figure 2).

#### 2. DATA COMPILATION AND REVIEW

ERM conducted a desktop review of relevant publicly available data. The Colorado Division of Water Resources (DWR) well permit database identified wells of other ownership within the project vicinity. The DWR database returned 139 wells within a 4-mile radius of the proposed quarry, shown on Figure 3 and summarized in Table 1. Using this database, ERM determined distances between the proposed quarry excavation and other groundwater users, for use in the analysis.

Primary Water Use	Count
Domestic	120
Household use only	8
Stock	6
Commercial	2
Irrigation	2
Other	1
Total	139

#### Table 1: Primary DWR Well Water Use within 4 Miles of the Quarry Expansion

Available DWR Well Construction and Test Reports for private wells immediately to the north and northeast of Cactus Mountain show that all wells are drilled into Cretaceous sedimentary rocks. However, in some cases, the DWR placed wells above mapped granite. If the United States Geological Survey (USGS) mapped granite and sedimentary rock contact is accurate, this discrepancy may indicate that some of the DWR-reported wells were likely mislocated by the permit applicant or driller, as shown on Figure 4.

Based on the DWR database and a USGS geologic map covering the site area (Wobus et. al. 1979), a geologic cross section (Figure 5) was created to evaluate the underlying bedrock units. The location of the geologic cross section is shown on Figure 3. Potentially mislocated private water wells were not used to develop this geologic interpretation.

#### 3. FIELD INVESTIGATION

ERM conducted five field investigations in 2019 and 2020 at monitoring wells MW-01, MW-03, and MW-10 located within the proposed quarry expansion area. Details on each event are provided below and field notes are included as Appendix A.

#### 3.1 Sampling Event 1 – December 2018

During the initial field investigation from 10-12 December 2018, ERM:

- Conducted groundwater sampling with a Grundfos Redi-Flo 2 submersible pump capable of lifting water from 300 feet.
- Monitored water levels before, during, and after purging using a Level Troll Model 700, 100 pounds per square inch (psi) vented pressure transducer.
- Monitored field water quality parameters throughout the duration of pumping using a YSI flow through cell, including temperature, power of hydrogen (pH), electric conductivity (EC), dissolved oxygen (DO), and oxidation-reduction potential (ORP). Field forms are provided in Appendix A.
- Conducted water quality sampling for common metals, major ions, and radionuclides after water quality parameter stabilization, and delivered samples for laboratory analysis.

#### 3.2 Sampling Event 2 – May 2019

ERM conducted the second field investigation from 13-14 May 2019 similar to that described above for the initial field investigation, but did not include water level monitoring during pumping and recovery (i.e., no pumping test analysis).

#### 3.3 Sampling Event 3 – August 2019

During the third field investigation from 28-29 August 2019, ERM:

- Monitored water levels in wells MW-03 and MW-10, before, during, and after purging, using a transducer as noted above. Access to MW-01 became difficult and it was not possible to get equipment to that site for additional testing.
- Monitored field water quality parameters throughout the duration of pumping using a YSI flow through cell, including temperature, pH, EC, DO, and ORP. Field forms are provided in Appendix A.
- Conducted groundwater sampling at on-site monitoring wells MW-03 and MW-10 for:
  - Isotopic Uranium by Method HASL-300 (Alpha Sepectroscopy)
    - Uranium-233-234
    - Uranium-235/236
    - Uranium-238
  - Gross Alpha and Beta Radioactivity (Total, Suspended, and Dissolved) by Standard Method (SM) 7110 B
  - Radium-226 by SM 7500-Ra B
  - Radium-228 by Environmental Protection Agency (EPA) Ra-05
  - Total Solids by EPA 160.3
- Delivered samples for laboratory analysis.

#### 3.4 Sampling Event 4 – November 2019

During the fourth field investigation from 19-20 November 2019, ERM:

- Monitored water levels in two pumping wells, MW-03 and MW-10, before, during, and after purging, using the same vented pressure transducer as noted above.
- Deployed a permanent DI810 TD-Diver Data Logger transducer and a DI800 Baro-Diver Data Logger to compensate for barometric pressure in monitoring well MW-01 to record a data point for water level every 6 hours. This equipment was installed due to issues with access and the inability to get a pump and generator to the well location.
- Monitored field water quality parameters throughout the duration of pumping using a YSI flow through cell, including temperature, pH, EC, DO, and ORP. Field forms are provided in Appendix A.
- Conducted groundwater sampling at on-site monitoring wells MW-03 and MW-10 for:
  - Isotopic Uranium by Method HASL-300 (Alpha Sepectroscopy)
    - Uranium-233-234
    - Uranium-235/236
    - Uranium-238
  - Gross Alpha and Beta Radioactivity (Total, Suspended, and Dissolved) by SM 7110 B
  - Radium-226 by SM 7500-Ra B
  - Radium-228 by EPA Ra-05
  - Total Solids by EPA 160.3
- Delivered samples for laboratory analysis.

#### 3.5 Sampling Event 5 – February 2020

During the fifth field investigation on 26 February 2020, ERM:

- Measured static water levels at MW-03 by hand using a water level indicator every 5 minutes during the sampling event. Road conditions made vehicle access to MW-10 impossible during this site visit.
- Measured static water levels at MW-01 and MW-10.
- Downloaded transducer data from MW-01 (Appendix C).
- Monitored field water quality parameters throughout the duration of pumping using a YSI flow through cell, including temperature, pH, EC, DO, and ORP. Field forms are provided in Appendix A.

#### 4. DATA ANALYSIS

Using the collected field data, ERM compiled the laboratory water quality results, evaluated pumping/sampling results to estimate the bulk hydraulic conductivity of granite, and performed scoping-level hydraulic calculations to evaluate the effects of pit development on the groundwater system.

#### 4.1 Water Quality

ERM analyzed water quality samples for field parameters, common metals, major ions, and radionuclides, and then tabulated and presented the results in the laboratory analytical reports provided as Appendix B. Results show pH ranges from 6.64 - 7.71, and total dissolved solids (TDS) ranges from 318 - 814 milligrams per liter (mg/L), generally increasing during the 28 August 2019 sampling event. While not required for compliance purposes, the analytical results were compared to drinking water standards for informational purposes only. Common metals and major ions did not exceed drinking water standards or aquatic life (acute or chronic) limits for the sampling events where collected. The December 2018 sample from well MW-10 was reported to contain 38.2 micrograms per liter ( $\mu$ g/L) of dissolved uranium, in excess of the 30  $\mu$ g/L drinking water standard. This was the only recorded dissolved uranium exceedance. Isotopic uranium did not exceed the drinking water standard of 30 picocuries per liter (pCi/L) for the four sampling events conducted from December 2018 to November 2019. Gross alpha and beta particles exceeded the drinking water standard of 15 pCi/L and 4 millirems (mrems), respectively, for several sampling events at all wells sampled. Radium 226/228 was detected in all monitoring wells and showed a drinking water standard exceedance of 5 pCi/L at MW-03 in May 2019, and at MW-10 in both December 2018 and August 2019.

Hydrochemical facies, or water types, lie within the magnesium bicarbonate and mixed magnesium bicarbonate/calcium chloride portion of the piper diagram presented as part of Appendix B.

#### 4.2 Hydraulic Conductivity of Granite

Water levels measured during the first investigation (December 2018) at wells MW-01, MW-03, and MW-10 were used to estimate the hydraulic conductivity of granite. The tests generally involved pumping a well as part of the purging process and measuring the associated water-level changes (drawdowns) during both the pumping and recovery periods using a vented pressure transducer and datalogger. These tests are described herein as "pumping tests", though they were performed opportunistically as part of the well sampling procedure.

Discharge flow rates were measured periodically during the pumping period using the "bucket-andstopwatch" method, or by recording the total volume of discharged water over time. Hydraulic responses were analyzed using a combination of transient and steady-state analytical solutions appropriate for the testing conditions. Where appropriate, the effects of variable flow rates during the pumping period were considered. The pumping test analyses are presented in Appendix C and summary results are provided in Table 2 below.

Monitoring Well	Well Total Depth (ft)	Static Depth- to-Water (ft)	Saturated Thickness b (ft)	Transmissivity T (ft²/day)	Hydraulic Conductivity K (ft/day)	Hydraulic Conductivity K (cm/sec)
MW-01	239	104.13	134.9	0.26	0.0019	6.7E-07
MW-03	249	47.55	201.4	0.63	0.0027	9.5E-07
MW-10	251	9.76	241.2	1.57	0.0065	2.3E-06

#### Table 2: Pumping Test Results – December 2018

Notes:

ft: feet

ft/day: feet per day

ft²/day: feet squared per day

cm/sec: centimeters per second

T = transmissivity of saturated well completion interval (from static water level to bottom of well) K = hydraulic conductivity of granite within the saturated interval, K = T / b

The core logs for the site borings are logged as "slightly to intensely fractured." The hydraulic conductivity (K) values in Table 2 range over a factor of 3.4, which is reasonably consistent for tests conducted in fractured crystalline rock. The best-estimate bulk hydraulic conductivity for competent fractured granite is taken as the arithmetic mean of the three values: 0.0037 ft/day ( $1.3 \times 10^{-6}$  cm/sec). The best-estimate value is used in subsequent hydraulic analyses to evaluate the effects of pit development on the local groundwater system. Appendix C provides further details on the data and analyses used to evaluate the transmissivity and hydraulic conductivity measured at each of the three tested monitoring wells.

#### 5. SIMULATED CURRENT (PRE-MINING) CONDITIONS

ERM performed a scoping-level analysis of current groundwater conditions at the site using existing information collected during desktop research and the results of pumping tests performed during the first investigation (December 2018), as described in Section 4.2. Groundwater flow through the proposed quarry area was simulated analytically using a modification of the one-dimensional Darcy equation for steady-state groundwater flow in a vertical cross section. The cross-section analysis was based on the interpreted geologic section (Figure 5). The cross section starts at the confluence of Currant Creek and Tallahassee Creek and extends northeast for 17,000 feet, which includes the proposed quarry expansion area, Cactus Mountain, Highway 9, and 3,500 feet past the highway. The orientation of the section is shown on Figure 3.

The analysis is documented in Appendix D and entails the following:

- Dupuit assumption for "essentially" horizontal flow in a system with variably saturated thickness and a water table at the upper boundary.
- Aerially distributed natural recharge.
- A sloping no-flow boundary at the base of what's assumed to be "permeable" rock. As a first approximation, this conforms to depths where the hydraulic conductivity of fractured granite is expected to become very low. It also conforms approximately to what is assumed to be the base of more permeable sedimentary rock. This boundary is based on professional judgement as there is no known borehole testing to these depths.
- Flow system width (perpendicular to the plane of the section) equal to 3,000 ft.
- The presence of a fault on the northeast side of Cactus Mountain that provides a contact between competent granite to the southwest and sedimentary rock to the northeast.
- Granite hydraulic conductivity (Kg) of 1.3 x 10<sup>-6</sup> cm/sec based on the results of groundwater pump test events (discussed above).
- An assumed sedimentary rock hydraulic conductivity (K<sub>s</sub>) of 1.3 x 10<sup>-4</sup> cm/sec (100 times K<sub>g</sub>). This hydraulic conductivity was not measured, but predicts that the yield to a well with a 100-foot completion interval and 50 feet of drawdown is about 10.5 gallons per minute (gpm), which is reasonable for a typical domestic well.
- A fixed hydraulic head of 5,840 feet above mean sea level (amsl) at the southwest end of the section (confluence of two streams), which conforms to the elevation of the stream channels.
- A target hydraulic head of 6,170 feet amsl at Highway 9, which is similar to water levels measured in private wells where the section crosses the highway (this water level is about 80 feet below ground surface).

The governing differential equation (a general form of the Darcy equation) was evaluated using the Mathcad® computation software based on a point-and-shoot method where both the groundwater flow rate at the southwest end of the section (x=0) and recharge were adjusted iteratively until computed water levels matched the following:

- Water level elevation of 6,170 feet amsl at Highway 9
- Water level elevation of 6,225 feet amsl measured in well MW-10

The results of the calibrated solution are shown graphically on Figure 5-1, below, and additional details are provided in Appendix D. The computed water table profile matches the water level below Highway 9 and the measured head in well MW-10. It does a poor job of matching the water level at well MW-03

because ground surface is well below the computed profile. This could indicate that in the real system, there is groundwater discharge to ground surface southwest of MW-10. However, because the computed flow rates are low (less than 5 gpm), it is unlikely that such discharge would be visually noticeable over a transverse distance of 3,000 feet.

Water table gradients (mounding) in the sedimentary rock are small compared to gradients in the granite portion of the section; an effect that is directly related to the hydraulic conductivity contrast between granite and sedimentary rock (two orders-of-magnitude).

The calibrated recharge rate is surprisingly low; 0.154 inches per year. Sensitivity analyses showed that increasing the recharge rate by small amounts over this value caused the computed water table profile to rise dramatically in the granite, which would conflict with the MW-10 water level and cause the computed water level at Highway 9 to be above ground surface. The dramatic water level rise at higher recharge rates is the result of mounding in the low hydraulic conductivity granite.

As shown on Figure 5-1, ground water flow rates in the system are quite low (less than 6 gpm). At the left (southwest) side of the section, the computed flow rate is 4 gpm to the southwest. Below Highway 9 and at the right (northwest) side of the section, the flow rates are 3 and 5 gpm, respectively, both in the northeast direction. These low flow rates are the direct result of the low hydraulic conductivity of granite and provides an indication that groundwater inflows to the excavated pit of the quarry expansion would be relatively small. Note that the computed water level at the right (northeast) side of the section is 6,150.4 feet amsl. This value is used as a boundary condition in subsequent analyses of the post-mining condition.

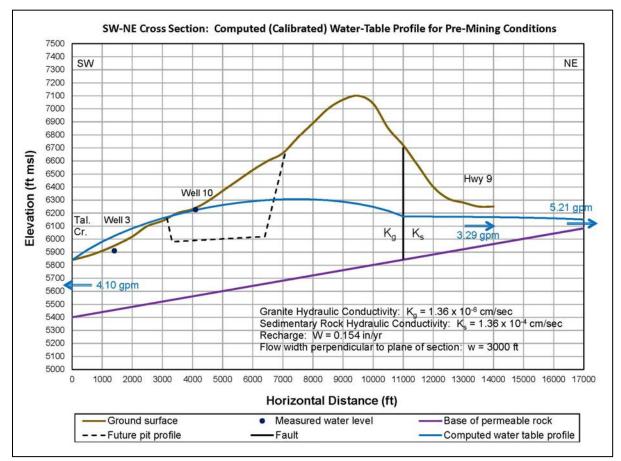


Figure 5-1: Results of Pre-Mining Analysis

#### 6. EVALUATION OF QUARRY EFFECTS ON GROUNDWATER

#### 6.1 Water Quality

Respective of Section 4.1, analytical results indicated drinking water exceedance for dissolved uranium, gross alpha, gross beta, and radium 226/228 in some of the samples analyzed (Appendix B). Radionuclides are generally found as trace elements in most granitic rocks, such as the Precambrian granite housing site groundwater, and are not unusual for the region. The general decline in these analytical parameters could be due to further well development as a result of additional pumping during the sampling. All other common ions and metals are within drinking water quality standards. Based on known rock properties for the area within the proposed quarry expansion area, it is not anticipated that the project will have a negative impact on groundwater quality in the granite or surrounding aquifers where wells of other ownership are completed. Additionally, groundwater discharges to surface waters are not anticipated to change or adversely affect current surface water quality.

The closest formerly sampled stream location is a Colorado Department of Public Health & Environment (CDPHE) well with the identifier 21COL001\_WQX-7115, located near the mouth of Tallahassee Creek and southwest of the current quarry and the planned quarry expansion. This location contained dissolved uranium at 26 and 23  $\mu$ g/L on 12 September 2005 and 20 October 2005, respectively (USGS 2020). The on-site monitoring wells generally showed lower dissolved uranium, between 13.7 and 21.2  $\mu$ g/L, except for 38.2  $\mu$ g/L at MW-10 on 12 December 2018, than surface water location 21COL001\_WQX-7115.

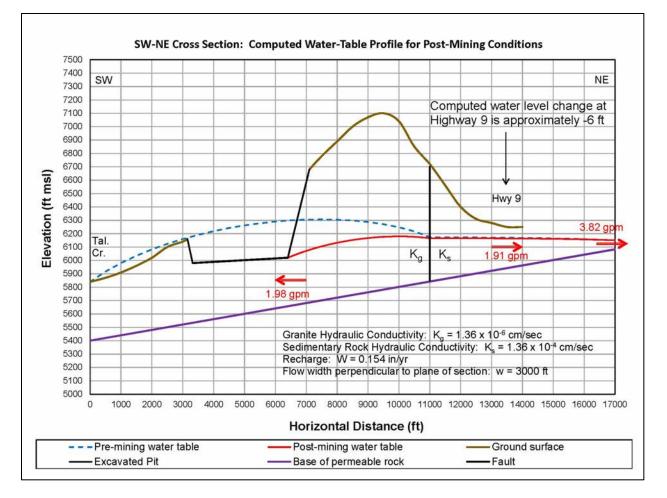
#### 6.2 **Post-Mining Condition**

The long-term post-mining effects of the excavated pit were evaluated using the same steady-state onedimensional approach described in Section 5, with the following modifications:

- The left (southwest) end of the analysis section begins at the pit highwall. At this new boundary, a fixed hydraulic head of 6,020 feet amsl is applied, which conforms to the elevation at the base of the highwall.
- The recharge rate is fixed at 0.154 inches per year, which is a result from the pre-mining analysis.
- The target head at the right (northeast) side of the section is 6,150.4 feet amsl, also a result from the pre-mining analysis. This boundary is about 2 miles northeast of the pit, a distance where the effects of the pit are presumed to be negligible.

For this analysis, the only parameter to be adjusted by iteration was the flow rate at the left side of the section, which was done until the computed water level at the right side of the section matched the target value of 6,150.4 feet amsl.

The results are shown graphically on Figure 6-1, below, where the post-mining water level profile (red) is compared to the pre-mining profile (blue dashed). The pit creates a drawdown of some 300 feet at the highwall, which has a significant long-term effect on the water levels in granite. Yet the water levels in the sedimentary rock (containing wells) are minimally affected. The lowering of the water table below Highway 9 is predicted to be only 6 feet. A conceptual explanation of this result is as follows. Granite has very low hydraulic conductivity so the changes in system flows at the pit are relatively small (on the order of several gpm). If these changes in flow are propagated into the sedimentary rock, the water level effects are almost negligible because this unit has much higher hydraulic conductivity. This concept can be applied in a more general sense to consider that water levels in any water bearing geologic unit in contact with the granite will not likely experience significant long-term dewatering due to excavation of the pit. Conceptually, the low hydraulic conductivity of the granite "insulates" higher permeability geologic units from experiencing the effects of drawdown at the pit walls.



#### Figure 6-1: Results of Post-Mining Analysis Considering Recharge

#### 6.3 Transient Drawdown Analysis

ERM performed a scoping-level analysis of the change in granite water levels due to pit excavation, using a one-dimensional transient analytical solution for linear flow towards the highwall. The analysis was based on current conditions and did not account for future mining operations currently permitted at the existing Parkdale Quarry and the potential impacts to groundwater that could result from those activities. Details of the analytical solution are provided in Appendix E. The solution assumed the following:

- The pit is instantaneously excavated to full depth at time zero.
- Granite hydraulic conductivity is 1.36 x 10<sup>-6</sup> cm/sec.
- Storage coefficient of 0.01, which is reasonable for the specific yield of fractured granite.
- Hydraulic drawdown at the quarry wall is 300 feet.
- Thickness of permeable fractured bedrock is 450 feet.
- Groundwater flow towards the quarry is strictly horizontal.

The results of this calculation are provided in Appendix E. The premise of this analysis is that drawdowns cannot occur in the sedimentary rock unit until there is a significant drawdown at the fault, which provides the contact between granite and sedimentary rock. The plot of "Time - Drawdown at Fault" in Appendix E predicts that it would take 20 years for the drawdown at the fault to reach 1 foot. It would therefore take a

minimum of two decades for the effects of the pit to be experienced in the sedimentary rock unit. This suggests that if measurable drawdowns were to ever occur in wells completed at Highway 9, the process would be very slow and there would be ample time to monitor and understand the effects so that mitigation measures could be initiation (if needed).

#### 6.4 Quarry Inflows

The drawdown analysis also provides an estimate of transient groundwater inflow at the pit highwall. As shown in Appendix E, the plot of "Time - Flow Rate at Pit High-Wall" indicates relatively high inflow rates during the first several years of operations, but these values drop off after 10 to 15 years and begin to approach flow rates similar to the post-mining steady-state analysis in Section 6.2. The relatively high inflow rates at early times are the result of water released from storage at the water table, not induced flow from the sedimentary rock unit. It is also the consequence of assuming instantaneous excavation of the final pit. In reality, the pit would be excavated gradually over time, so the actual early inflow rates are likely to be much lower than what the analysis shows. The expectation of low inflow rates is consistent with observations at the current granite quarry operated by Martin Marietta. While the current highwall has a height of approximately 270 feet, little to no water is observed at the pit bottom except after precipitation events. For the proposed quarry, it is likely that water volumes originating from rainfall, storm runoff, and snowmelt will be much larger than groundwater inflows.

#### 6.5 Geologic Cross Section Interpretation

ERM developed a geologic cross section to better understand the connection between the domestic drinking water wells and the proposed quarry expansion (Figure 5). The cross section intersects two monitoring wells within the proposed quarry expansion boundary and extends northeast across Cactus Mountain and the Parkdale fault, and ends near Highway 9 (Figure 3). No drinking water wells were identified in the granite southwest of the Parkdale Fault. ERM found that two drinking water wells shown on Figure 4 were mislocated, as the well logs do not show any granite and it is assumed these are northeast of the Parkdale fault in sedimentary rocks. ERM used four wells and a local USGS geologic map to create the geologic cross section, and included two on-site monitoring wells MW-03 and MW-10, and two domestic water wells 215395 and 198713.

The Parkdale fault, a reverse fault, divides the quarry expansion location and the domestic water well users to the northeast. Based on domestic water well depths and the USGS geologic map, the aquifer exploited for water supply is the Carlile Shale, Greenhorn Limestone, and Graneros Shale, Undivided (Kcgg) geologic unit, which contains the water-bearing "Codell Sandstone Member." The aquifer may be partially confined, as the overlying Niobrara Formation (Kn) consists of mostly shales and limestones. The static water levels in the drinking water wells are approximately 300 feet above the base of the aquifer unit and locally higher than the top of the unit. Furthermore, based on the USGS geologic map, the well users in the area are within a sedimentary syncline.

Based on the topography of the area, it is likely that the recharge zone for the domestic water well users begins at the highest elevation of Cactus Mountain and extends downslope to the northeast. This differs from the likely recharge zone of the proposed quarry expansion, which likely begins at the highest elevation of Cactus Mountain and extends downslope to the southwest.

It is unknown if the Parkdale fault operates as a flow barrier, flow conduit, or simply provides a physical contact between the granite and sedimentary rock units. Groundwater flow in the granite is assuredly fracture controlled and the nature and pervasiveness of fractures has not been investigated. However, pumping tests conducted in three monitoring wells in the quarry area reasonably confirm that the competent fractured granite has very low hydraulic conductivity.

#### 7. DISCUSSION

The scoping-level calculations presented in this memorandum should not be viewed as the results of a formal numerical groundwater model. They are intended to provide a general evaluation of potential groundwater effects resulting from the proposed quarry excavation. The results provide good evidence that groundwater effects at existing wells, while not negligible, will not likely result in abandonment of wells over the many decades of mine operation due to lowering of static (non-pumping) water levels. Existing wells are completed in alluvium and sedimentary rock that have much higher hydraulic conductivity than the granite that will host the proposed quarry. In a conceptual sense, the low hydraulic conductivity of the granite "insulates" higher permeability geologic units from experiencing the effects of drawdown at the pit walls.

Groundwater inflows to the quarry will likely not be of operational consequence when compared to the larger water volumes resulting from rainfall, stormwater runoff, and snow melt. Conceptually, precipitation that does not immediately run off or evapotranspirate is expected to infiltrate into decomposed and weathered granite (0-20 feet thickness), which will likely have a significantly higher hydraulic conductivity than competent granite. This may lead to shallow perched water that could flow downslope towards the quarry highwall. It is possible that perched groundwater may enter the quarry via springs along the top of the highwall. ERM's evaluation of this process was not considered in the work performed herein, but could be the subject of an additional analysis.

ERM created a geologic cross section to interpret how the geologic units between the proposed quarry and the existing water well users may be hydrologically connected. The Parkdale fault provides a geologic contact between the granite that will host the quarry and sedimentary rock within which the existing wells are completed. For calculations performed herein, the fault is a contact plane between the two rock units and is assumed to provide full hydraulic connectivity, where it is possible that the fault could operate hydrologically as a flow barrier or flow conduit. The extended quarry excavation would not intersect the fault, so the nature of groundwater flow in the fault zone, whether restricted or enhanced, would tend to further reduce the effects of the quarry on groundwater levels in the sedimentary rock unit.

Finally, water quality in the proposed quarry for most analytes tested is generally below drinking water standards (not an applicable regulatory requirement, but for informational purposes only), except for gross alpha and beta particles. Radionuclides are generally found in the granitic rock type of the area and would be expected in baseline conditions. Dissolved uranium was above the drinking water standard for one sampling event at MW-10, but is generally at least 10  $\mu$ g/L below the standard at most wells, and during most sampling that includes isotopic uranium. One CDPHE water quality stream location showed dissolved uranium between 23 and 26  $\mu$ g/L in 2005, which is generally higher than that found in the proposed quarry monitoring wells. Therefore, it is unlikely that the surface water proximal to the proposed quarry will be impacted greater than the baseline water quality condition.

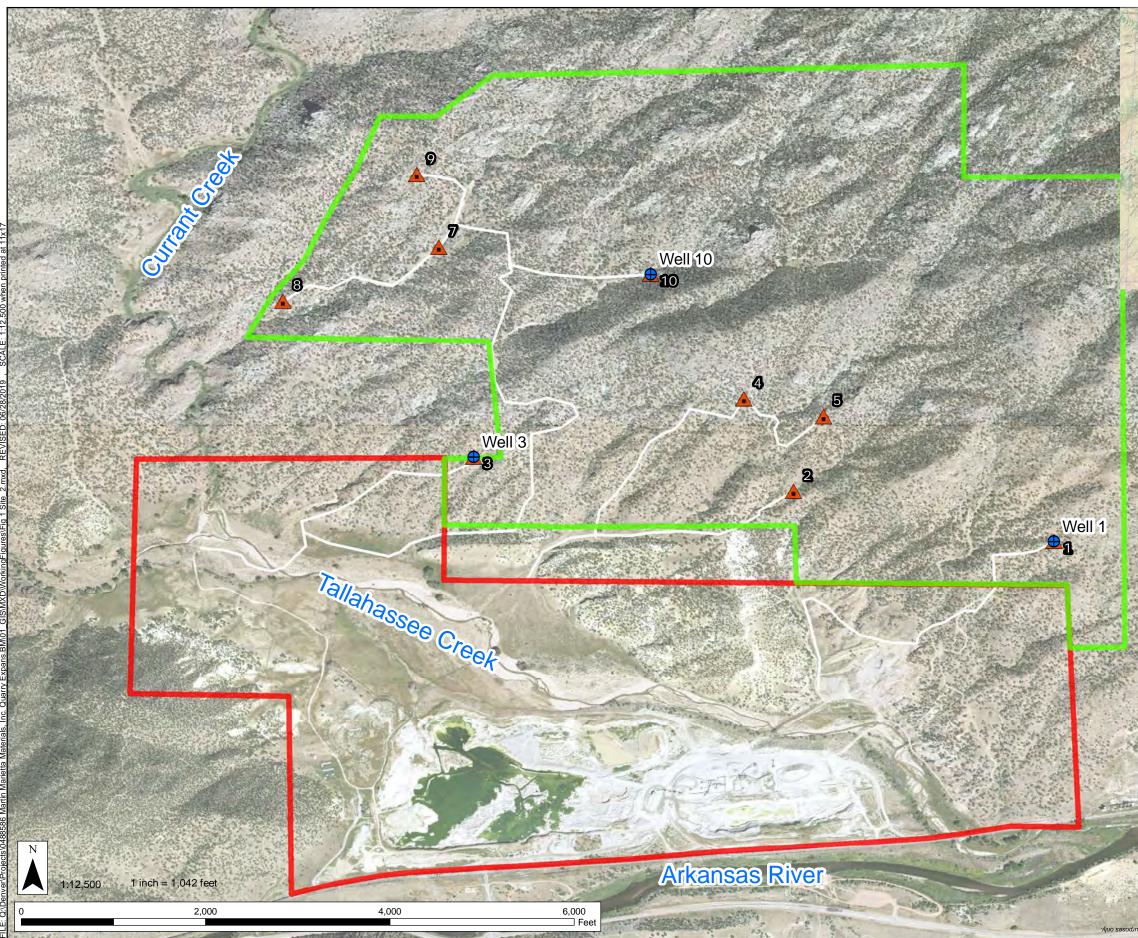
Lastly, groundwater in the granite will provide relatively small inflows to the pit, and this mine water will be discharged to surface water. Given the relatively good groundwater quality, no significant impacts to surface water quality are anticipated.

#### 8. **REFERENCES**

- Christman, R. A., M. R. Brock, R. C. Pearson, and Q. D. Singwald. 1954. "Wet Mountains, Colorado, Thorium Investigations 1952-1954." United States Department of the Interior Geologic Survey. *Trace Element Investigation Report*, 354.
- Hon, Ken. 1984. "Geology of Volcanogenic Uranium Deposits within the Tallahassee Creek Conglomerate, Tallahassee Creek Uranium District, Colorado." United States Department of the Interior Geologic Survey. Open-File Report, 84-219.
- U.S. Geological Survey. 2020. TALLAHASSEE CREEK NR MOUTH (21COL001\_WQX-7115) site data in the Water Quality Portal. Retrieved 13 April 2020 from National Water Quality Monitoring Council: https://www.waterqualitydata.us/provider/STORET/21COL001\_WQX/21COL001\_WQX-7115/.
- Wobus, Reinhard A., Rudy C. Epis, and Glen R. Scot. 1979. *Geologic Map of the Cover Mountain Quadrangle, Premont, Park, and Teller Counties, Colorado.*

FIGURES





Source: Esri - World Topoographic Map

### Parkdale

### Legend



Monitoring Well





Proposed . Expansion

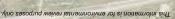
Borings

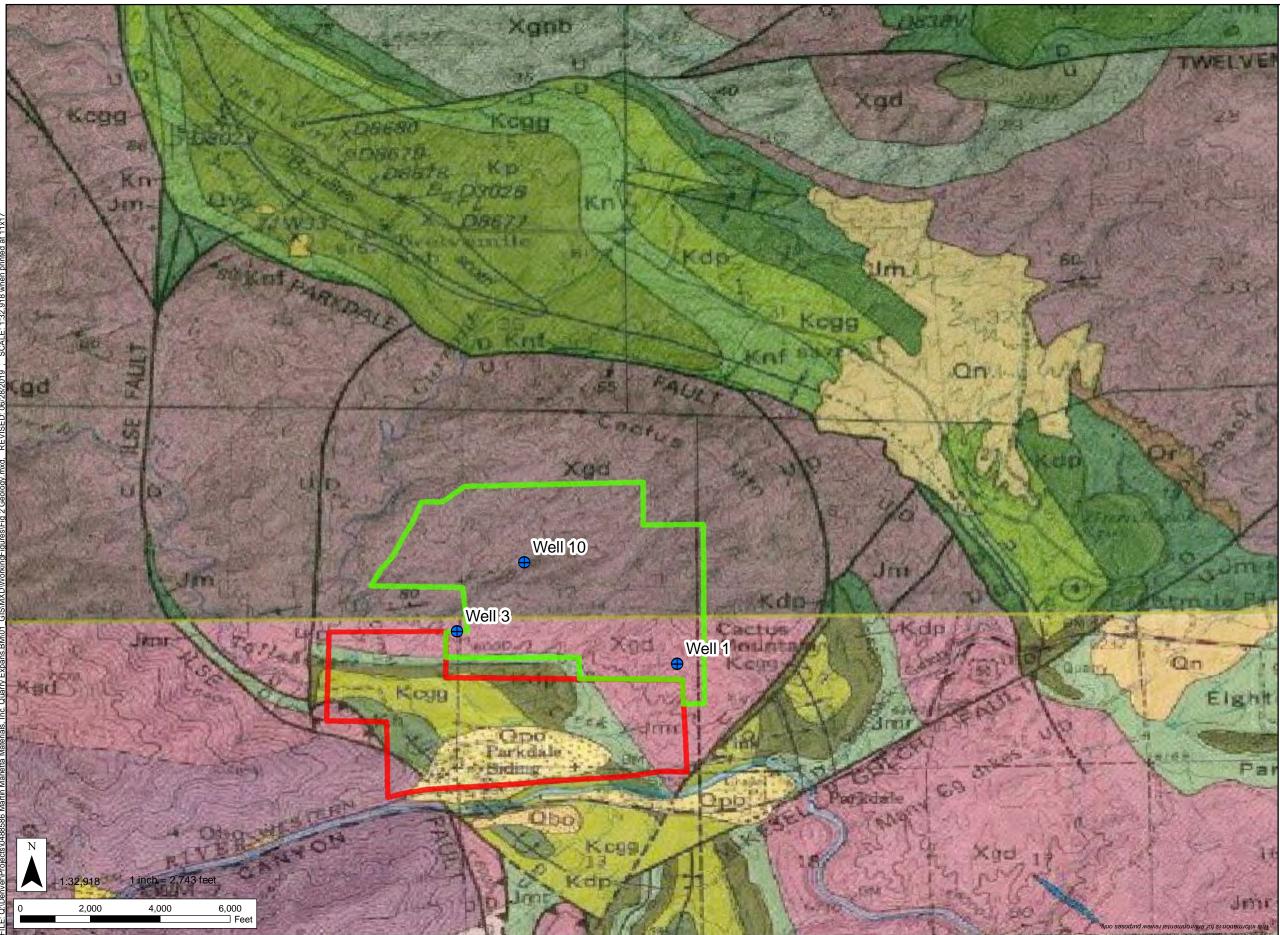
Mine Permit Boundary

Figure 1 Site Location Parkdale Quarry Expansion Martin Marietta Fremont County, Colorado









Source: Esri - World Topoographic Map

### Legend



Mine Permit Boundary

Proposed Expansion

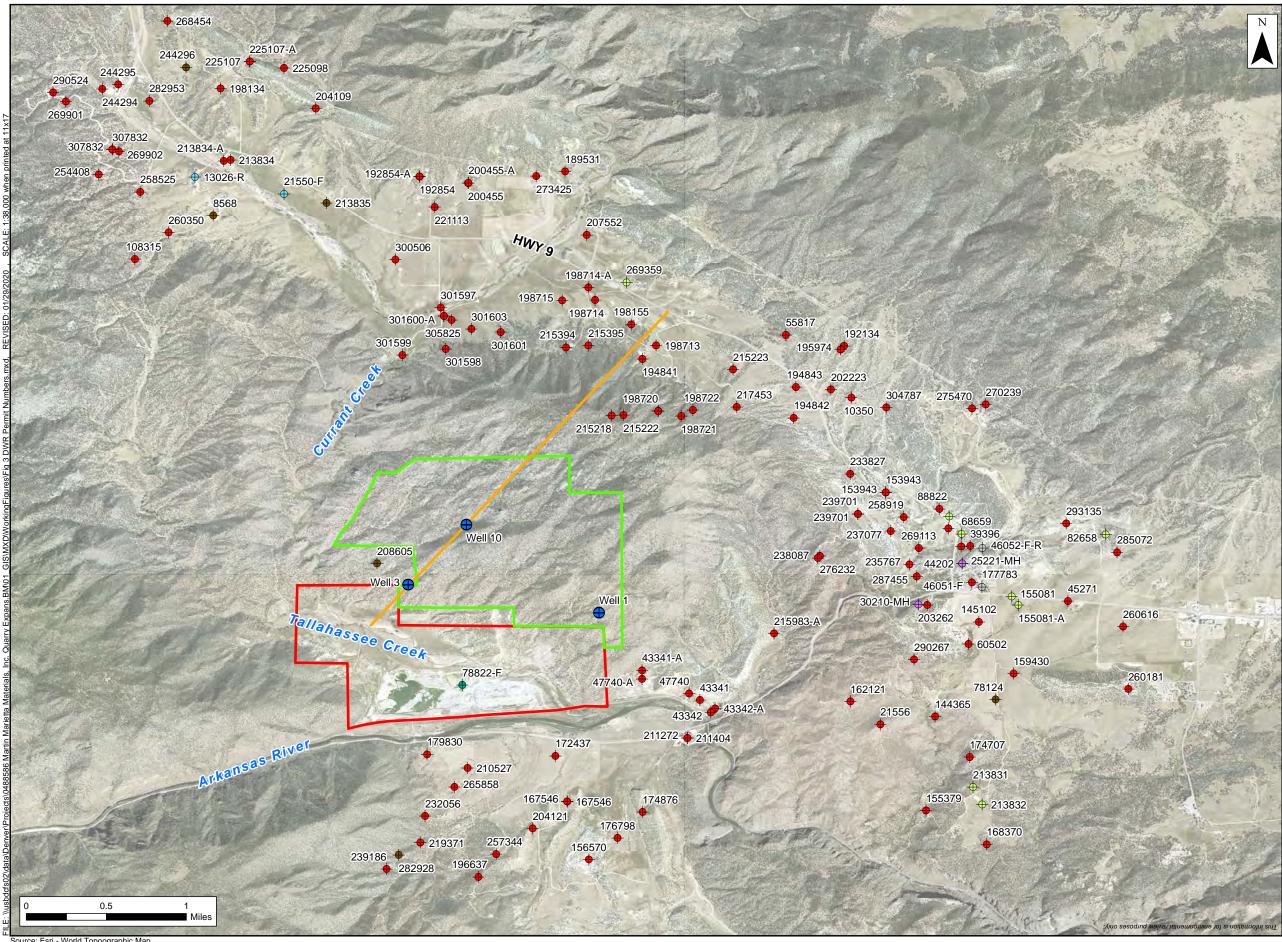
igoplus

Monitoring Well

Notes: Wobus et. al. 1979. Geologic Map of Cover Mountain Quadrangle, Premont, Park, and Teller Counties, Colorado

Figure 2 Geologic Map Parkdale Quarry Expansion Martin Marietta Fremont County, Colorado





Source: Esri - World Topoographic Map

#### Legend



Cross Section A-A'

#### **DWR Primary Use**

Commercial Domestic Household Use Irrigation Monitoring Other

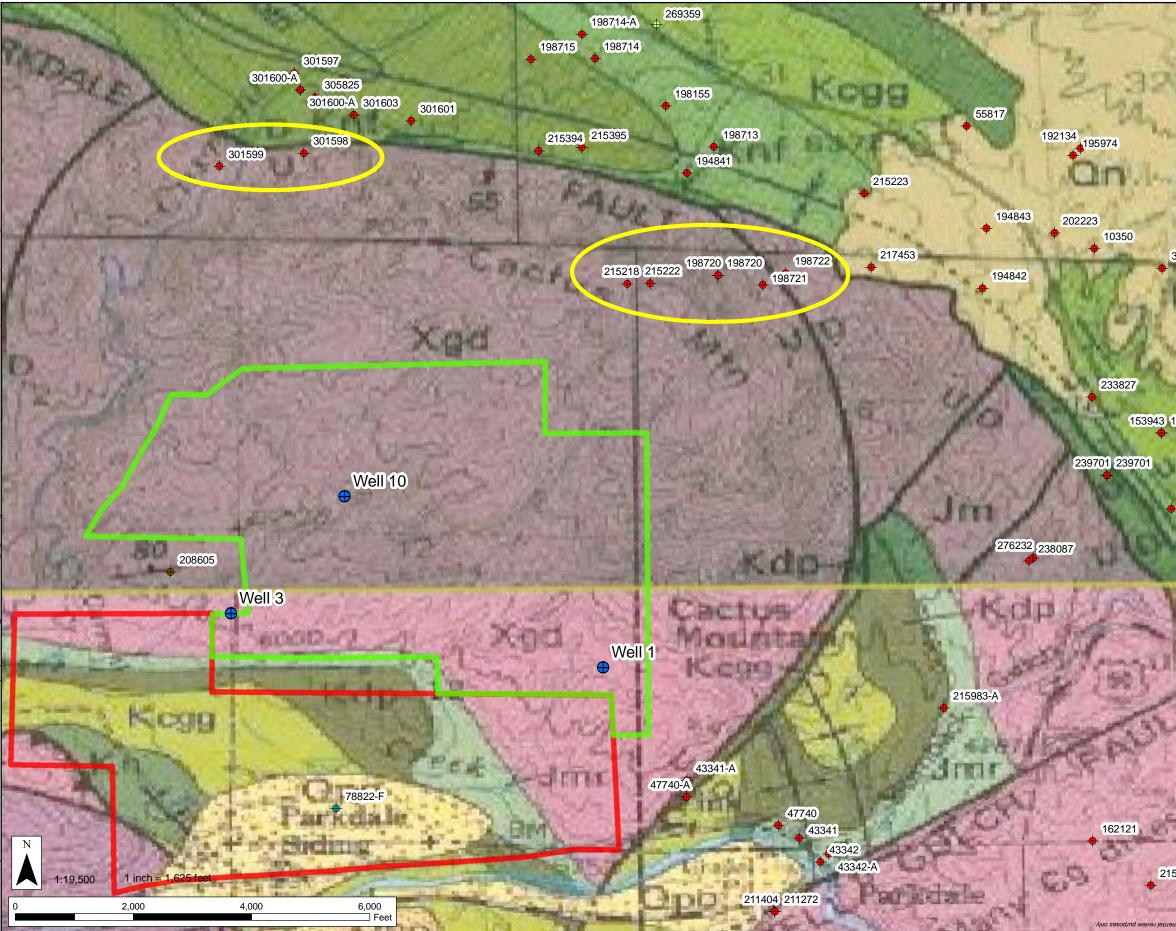
Stock

Notes:

Numbers are DWR Permit Numbers.

Figure 3 DWR Well Database Parkdale Quarry Expansion Martin Marietta Fremont County, Colorado





Source: Esri - World Topoographic Map

304787 153943 153943 88822 258919 237077 269113 235767 287455 30210-MH 203262 290267 162121, 195 144365 21556 nmental review purposes only his intormation is for envir

### Legend



- Mine Permit Boundary
- Proposed Expansion
- Possibly Mislocated
- Monitoring Well

## DWR

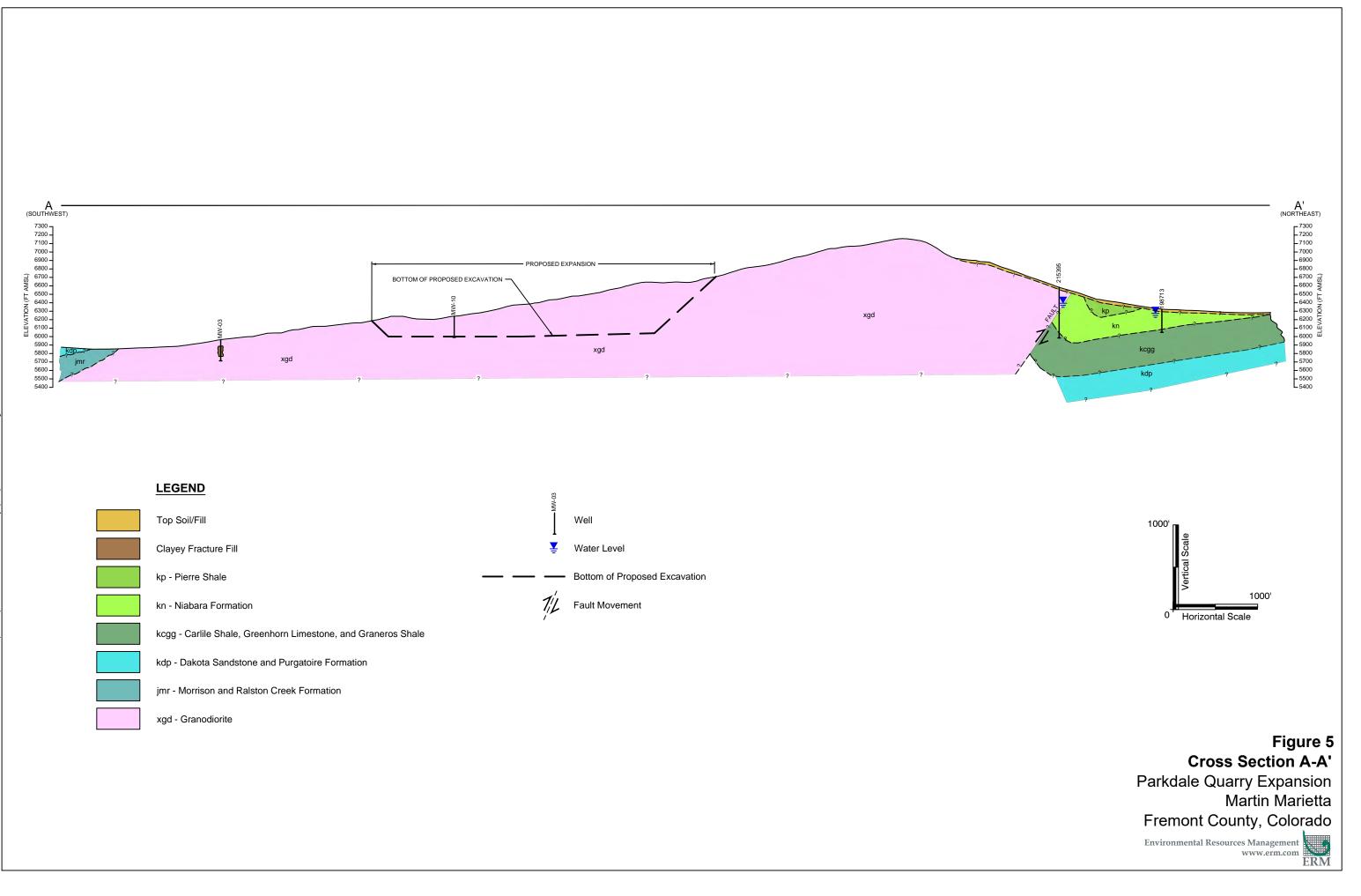
### **Primary Use**

- Commercial
- Domestic
- Household Use
- + Irrigation
- Monitoring
- Other
- Stock

Notes: Numbers are DWR Permit Numbers.

Figure 4 DWR Mislocated Wells Parkdale Quarry Expansion Martin Marietta Fremont County, Colorado





### APPENDIX A FIELD WATER QUALITY FORMS



	Project	Park/	tale 1	Juarry	Well Name	Well	
	Location	Cañon C	ity, C	0	Sample ID		
	Purpose		a na		-		
Date	Time	Temperature	pН	EC	DO	ORP	Notes
		[unit] OC		[unit] 195/cm c	[unit] myL	[unit]	Vol
12/10/1	R12.14	13.57	6.42	622	7.32	52.2	Igailon, Clouby
11	12:20	14.00	6.93	622	6.11	75.6	2.4 gal, Clark
	12:26	13.91	7.42	624	6.09	58.8	3.3 gal, Clark
	12:33	13.74	7.19	616	5.93	78.5	4.5 gol, Claudy
	12 40	13.84	751	619	6.01	74.8	5.5gel, Clord
	13:10	1	7.39	617	6.24	93.5	9-2 gal clard
	12 49	T	7.41	627	7.10	105.3	13. Eggl SI. clad
	1358	13.45	7.51	616	5,87	102.00	14 ga )
	Contraction of Contraction						)
			-				
					•1 (m. 2007)		

Page

Project Project No Location Date Well Number Method	Borehole V Total Galle	Vater (D) umn (ft. l lume (ga Volume ( ons Remo	h.) l) $(2'' = 0.1)$ gal) $(2'' = 0)$ by ed			<u>3 vols =</u>				
Field Personnel <b>F</b> Setup time: <b>09:4</b>	M + 24	·W			Sample Nı	ımber &	Time			
	tion (Minutes) Volume Temp DO				Spec. Cond. (µs/ms)	pН	ORP/ REDOX (ReL.	Turbidity (NTU)	DTW (ft btoc)	Remarks
	>	0		(118/2)	(1)	pri			(11 0100)	(114.39' statiz)
11:27		1	1468	4.37	587	7.71	127.0	743		@ 09:20
										Original Field Form blew in the wind I not recovered. This was the final Field parameters after staballization

Sample Analytes: VOCs (8260)

Semi-Volatiles (8270) Dissolved Fe and Mn (6020) (lab filtered) Total Alkalinity as CaCO<sub>3</sub> (SM 2320B) Sulfate, Nitrite, Nitrate, and Chloride (EPA 300.0) Sulfide (SM 4500S2) Ferric and Ferrous Iron (SM3500 Fe; Hach 8146) Dissolved Methane, Ethane, and Ethene (RSK175)

ofy

Project No. $0489586$ Location $Canon City C0$ Date $i2/11/10$ Well Number $Well 3$ MethodRed. Flo 2 fump							Borehole Total Gall Sample Ni	Vater (DT umn (ft. l lume (ga Volume ( ons Remo	n.) I) (2" = 0.1 gal) (2" = 0 oved Time	<u>249.0</u> <u>47.55</u> 6h, 4" = 0.6 0.73h, 4" = 1	Weather	3 vols =
		ion (Mi		Volume	Temp	DO	Spec. Cond.	ŤŤ	ORP/ REDOX	Turbidity	DTW	
Time	Surge	Pump	Bail	(gallons)	(°C)	(mg/L)	(µs/ms)	pH	(ReL.	(NTU)	(ft btoc)	Remarks
14:45:15	pr			1.0	4.50	1.81	516	6.19	125.7	SI. Clarky	Service and the service of the servi	
14:46:5	0			20					арықалары қаласы же өне басқай іст. түзірі байда басқанандан та			
14:48:00	,			3.0	14.72	0.50	497	6.72	106.2	Clarky	Salah Columnia da Calandaria Canada Calandaria Calandaria Calandaria Calandaria Calandaria Calandaria Calandari	
14:49:2				4.0	Anna aire ann an Anna Anna Anna Anna Anna Anna A					1 	constantion and a second state of the second state of the second se	TRonp rate
N:50:4				5.0	14:00	0.53	480	6.97	99.8	SI.Clady	Carrier and the second s	·
14:52:1				6.0	-Billippingeronicitation	413041217514624-04004624464895-0000		Bendugabernesseden Stammenskov Strame				T Pump vote
14:53;3	7			7.0	15:01	0.61	475	7.12	97.0	sl.clady	California and a second se	-
4:54:5				8.0	Canana and a second s	aacontroologaadabahahanan araanahahahah					4004000-001600-0640-06-000-000-0640-0640	1 Pump rate (125 12)
14:55:4				9.0	1518	0.65	475	7.21	94.0			-
14:56 :	53			[0.0]	and the second			en (skingen er general) når en stade skingen er som skinge			Anton Secondar (Secondarised and Secondaria)	
N:58:0	6			11.0	15.25	0.66	476	7.26	94.7			T Pump rate (250 Hz)
14:58:	90			2.0		anged light the space and an and the space of the space o						
15:00:	06			13.0	al and the second designed as a second designed as a second designed as a second designed as a second designed			an a	Nonaanoonnoo ay ahaa ahaa ahaa ahaa ahaa ahaa ahaa			

#### Sample Analytes: VOCs (8260)

Semi-Volatiles (8270) Dissolved Fe and Mn (6020) (lab filtered) Total Alkalinity as CaCO<sub>3</sub> (SM 2320B) Sulfate, Nitrite, Nitrate, and Chloride (EPA 300.0) Sulfide (SM 4500S2) Ferric and Ferrous Iron (SM3500 Fe; Hach 8146) Dissolved Methane, Ethane, and Ethene (RSK175)

.

							Depth							
Project	÷						Total Dept				Ind. S/N			
Project N	0.						Depth to Water (DTW) Weather							
Location							1	Water Column (ft. h.)						
Date							Casing Vo	lume (ga	l) $(2'' = 0.1)$	6h, 4" = 0.6	66h)	3 vols =		
Well Nu	mber						Borehole V	/olume (	gal) (2" = 0	.73h, 4'' = 3	1.15h)			
Method							Total Galle	ons Remo	oved					
Field Per	sonnel						Sample Nu	mber &	Time	<u> </u>				
Setup tin	ne:						· ·			• • • • • • • • • • • • • • • • • • •				
							Spec.		ORP/					
	Durat	ion (Mi	nutes)	Volume	Temp	DO	Cond.		REDOX	Turbidity	DTW			
Time	Surge	Pump	Bail	(gallons)	(°C)	(mg/L)	(µs/ms)	pН	(ReL.	(NTU)	(ft btoc)	Remarks		
5:01:10				14.0	15:33	0.6B	475	7.36	92.7	Methodosecondo anteresta en esta esta esta esta esta esta esta esta				
5:02:22				15.0	p:	entintiinentiineetaaadaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa		eto antico constante da su da casa da c		a na sa	1999-1999-1999-1999-1999-1999-1999-199	- I pump rate		
15:03:34				16.0	40000000000000000000000000000000000000		allettääksämmörrennön kenöä Lööstövään kännö suotuu			n yn hin y ser fer fer yn gener an en an de fer fer fer fer fer fer fer fer fer fe	and a sub-sector and a sub-sector and a grant and g			
15:04:41	)			17.0	15:45	0.71	475	7.42	92.1					
15:05:5	4			18.0	Manufacture and a second se	matalaise and a state of the st	an a	Elle briveste overholdstading samma av di	ennet summer för förde av eller etter som en störa som förda av söra förde	nhanisbraaniistoofiahd oyaa ahaalaa kataa taasaa kataa taa	n ga	- 1 pump rate		
15:07:0				19.0	15.52	0.72	415	7.45	92.3	550	daskersterne statistics and a statistical statistics and a statistic and a statistical statistics and a statistical statistics and a statistical statistics and a statistical statistical statistics and a statistic and a statistical statistics and a statistical statistics and a statis	8		
15:08:1				20.0	all contraction of the second s		and defendence of the second		17.5km/10.000/00/00/00/00/00/00/00/00/00/00/00/0	belanska option for the state of the	errorisetteterrorisettetetete			
15:09:	6			21.0	15.5B	0.76	475	7.50	906	Alexandersevenuereteccommission	et e pour a de la résident de la sub-a remense outra 10040000000000000000000000000000000000	-		
15:10:2				22.0	Shipherenering		a gala maaraa gagaya digalaa da aa ahaa dii soo di aa ahaa ahaa ahaa ahaa ahaa ahaa aha			571	and the second s	1 Pump vote		
15:11:3				23.0	15.64	0.78	475	7.51	91.2		energe concursion and an an	1 Rimp rate		
15:12:46				24.0	15		a particular de la companya de la co	anna faith an ann an an ann an ann an ann an ann an a	Manual and a second of Sign	629				
15:13:45	•			25.0	15.79	0.81	475	7.56	89.3					
15.15.5	3 15:1	1:53		26.0	Gliminianenanonimie	0000144/m3/001014/001014/001014/00104/0014/0014/0		Bunnennennennennen	aliineessa aan dalaa saa ahaa ahaa ahaa ahaa ahaa ahaa a	638	tinderstandsseeding blockday,			
15:1:0	3 15:1	6:03		27.0	15.86	0.90	477	7.56	90.7	B-	and a second			

#### Sample Analytes: VOCs (8260)

Semi-Volatiles (8270) Dissolved Fe and Mn (6020) (lab filtered) Total Alkalinity as CaCO<sub>3</sub> (SM 2320B) Sulfate, Nitrite, Nitrate, and Chloride (EPA 300.0) Sulfide (SM 4500S2) Ferric and Ferrous Iron (SM3500 Fe; Hach 8146)

Dissolved Methane, Ethane, and Ethene (RSK175)

3 of 4

#### Well Development / Purge Form

Project										Depth Ind. S/N	1		
lo.	04	8856	36			Depth to Water (DTW)			Weather			····	
	Car	wn C	ity c	O		Water Col	Water Column (ft. h.)						
	12/11/18						Casing Volume (gal) $(2'' = 0.16h, 4'' = 0.66h)$ 3 vols =						
						1			).73h, 4" = 1	1.15h)	No		
						Sample Ni	umber &	Time	well	3: Park	dale	@ 15	-: 35
ne:			1				1		1				
Durat	ion (Mi	nutor)	Volumo	Temn	DO	-			Truchiditer	DTW			
	<u>`</u>		-				рН		-			Remarks	
				Texture construction	(		P**	(1102)				Romurks	
										the state of the s			11.
	CONFORT DE LA			a ser la ser	1	A A		~~ <sup>2</sup>			100	reading S	1 tome
				15-85	1.07	478	7.59	89.3	C110			, mer	
					an na fan gener gener fan de fan d				547	Cardina and the state of the second state of t			
-8			32.0	400000000000000000000000000000000000000		n Davis signala na anna anna anna anna anna anna a				etholonuseinen och eta sin som eta sin			
4			33.0	16.23	1.09	482	7.64	86.9	<b>WINGSONGCOMPERATION</b>	an a			
50			34:0	Generalitics	12/2010-00-00-00-00-00-00-00-00-00-00-00-00-	n Singd Optimization (control of the control of the	-		n kalen alaman kalaka dikan ditarra kalen dari kalen dari kalen dari kalen dari kalen dari kalen dari kalen da	Maadamadoo Maalada (MASSAG) oo Maara			
			35.0	16.27	1.05	481	7.60	88.5	422	Chromotopolice and a second		- ///	
				-aggopterior.com/anterioriante	an fan Talanta a la talanta da mana a sana talanta a sana talanta da mana sa s	adeures/constructions/constructions/construction/con		gaanstandstatististististista and and a statististististististististististististist	alacandori (100 alana ana ang tang sa ang	gy constant of the second s			
				16.35	0.99	4BU	7.63	BR 6	635	Metalonense ta anna angele constante	4		
			38.0	State Stat	nerdatafterskinssissistettersensetter			· · · · ·			*********		
			39.0	1640	0.95	480	7.65	88.5	71000				
1a 1			400	States of the second			00106010100000000000000000000000000000	nen sie gewonnen en sie het werden ster der sie der seine seine ster der sie der seine seine seine seine seine	an a				
											1 Rote	for sam	em.
	nber sonnel ne: Durat Surge	nber $12/1$ nber $12/1$ sonnel puration (Mir Surge Pump Surge Pump 2 4 4 50 52 16 20 26 4 4 4 4 4 4 4 4	$\frac{Canon C}{ 2 1 18}$ mber $\frac{ 2 11 18}{ 48 3}$ sonnel $\frac{12 11}{ 48 3}$ sonnel $\frac{12 11}{ 48 3}$ sonnel $\frac{12 11 18}{ 48 3}$ sonnel $\frac{12 111 18}{ 48 3}$ sonnel $\frac{12 111 18}{ 48 3}$ sonnel $\frac{12 118}{ 48 3}$ sonnel $1$	$\begin{array}{c c} \hline Canon City, C \\ \hline 12 [11] 18 \\ \hline 12 [11]$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Io. $\bigcirc \forall \forall 85\% b$ Depth to V         Canon C: $\forall \gamma$ , CO       Water Col         Iz. [1] 18       Casing Vc         mber $\bigcup Ull$ 3       Borehole V         sonnel       Sample Number       Spec.         Duration (Minutes)       Volume       Temp       DO       Cond.         Surge       Pump       Bail (gallons)       (°C)       (mg/L) $(\mu s/ms)$ 28.0       29.0       30.0       15.85       1.04 $\forall 78$ Surge       31.0       32.0       16.23       1.04 $\forall 82$ So       32.0       16.23       1.04 $\forall 82$ So       35.0       16.27       1.05 $\forall 8/$ So       35.0       16.27       1.05 $\forall 8/$ So       37.0       16.35       0.99 $\forall 80$ So       37.0       16.40       0.95 $\forall 80$	Coron       City       Co $12 [11] 18$ Casing Volume (ga         nber       Intervention (Minutes)       Borehole Volume (ga         sonnel       Sample Number &         ne:       Sample Number &         Duration (Minutes)       Volume       Temp         Surge       Pump       Bail         (gallons)       (°C)       (mg/L)       (µs/ms)         28.0       Cond.         29.0       Cond.         29.0       Spec.         30.0       15.85         1.04       478         7.59       Spec.         31.0       Spec.         20       35.0         34.0       Spec.         35.0       16.27         37.0       16.25         38.0       Spec.         39.0       16.40         39.0	Io. $\bigcirc 408586$ Depth to Water (DTW)         Caron C:44, CO       Water Column (ft. h.)         I2/11/18       Casing Volume (gal) (2" = 0.1         mber       I2/11/18         IV.U       3         sonnel       Sorehole Volume (gal) (2" = 0.1         Borehole Volume (gal) (2" = 0.1         Total Gallons Removed         Sample Number & Time         ne:         Duration (Minutes)         Volume       Temp         DO       Cond.         (Igallons)       (°C)         (mg/L)       (µs/ms)         pH       (ReL.         28.0       -         29.0       -         30.0       15.05         1.04       478         7.59       89.3         31.0       -         22       35.0         31.0       -         32.0       16.23         4       33.0         35.0       16.27         36.0       -         37.0       16.27         38.0       -         39.0       16.27         38.0       -         39.0       16.40 </td <td>No.       <math>0 498586</math>       Depth to Water (DTW)         Correst Carge Carge Carge       Water Column (ft. h.)         12       11       18         nber       12       11         12       11       18         no       12       10         10       12       10         11       18       100         11       11       18         11       18       100         11       16       100       100         12       100       100       100       100         11       16.23       1.04       478       7.59       89.3         12       32.0       16.23       1.04       482       7.64       86.9      </td> <td>Total Depth       Ind. S/N         No.       Total Depth       Ind. S/N         Weter (DTW)       Weather         Correst Colspan="2"&gt;Correst Colspan="2"&gt;Correst Colspan="2"&gt;Correst Colspan="2"&gt;Correst Colspan="2"         Ind. S/N         Water Column (ft. h.)         Casing Volume (gal) (2" = 0.16h, 4" = 0.66h)         Borehole Volume (gal) (2" = 0.73h, 4" = 1.15h)         Total Gallons Removed         Sample Number &amp; Time       Well 3 : Well</td> <td>Total Depth       Ind. S/N         Total Depth       Ind. S/N         Coron       City       Water (DTW)       Weather         Water Column (ft, h.)       Casing Volume (gal) (2" = 0.16h, 4" = 0.66h)       3 vols =         Borehole Volume (gal) (2" = 0.73h, 4" = 1.15h)       Total Gallons Removed         sonnel       Sample Number &amp; Time       Well 3 :       Outbould Signal         Buration (Minutes)       Volume       Temp       DO       Spec.       ORP/ Cond.       REDOX       Turbidity       DTW         Surge       Pump       Bail       (gallons)       (°C)       (mg/L)       <math>4'' = 0.66h</math> <math>3</math> vols =         Borehole Volume (gal) (2" = 0.73h, 4" = 1.15h)       Total Gallons Removed       Sample Number &amp; Time       Well 3 :       <math>0.060000000000000000000000000000000000</math></td> <td>Total Depth       Ind. S/N         io.       <math>\nabla UPR 58 b</math>       Depth to Water (DTW)       Weather         Caron Cidy, co       Water Column (fa. h.)         ILE / IPR       Caron Cidy, co         Water Column (gal) (2" = 0.16h, 4" = 0.66h)       3 vols =         ILE // IPR       Caron Cidy, co         Water Column (gal) (2" = 0.73h, 4" = 1.15h)         Total Gallons Removed         Sample Number &amp; Time       Well 3 : Volume (gal) (2" = 0.73h, 4" = 1.15h)         Total Gallons Removed         Sample Number &amp; Time       Well 3 : Volume (gal) (2" = 0.73h, 4" = 1.15h)         Total Gallons Removed         Sample Number &amp; Time       Well 3 : Volume (gal) (2" = 0.73h, 4" = 1.15h)         Duration (Minutes)       Volume (gal) (2" = 0.73h, 4" = 1.15h)         Sample Number &amp; Time       Well 3 : Volume (gal) (2" = 0.73h, 4" = 1.15h)         Duration (Minutes)       Volume (gal) (2" = 0.73h, 4" = 1.15h)         Sample Number &amp; Time       Well 3 : Volume (gal) (2" = 0.73h, 4" = 1.15h)         Sample Number &amp; Time       Outhot</td>	No. $0 498586$ Depth to Water (DTW)         Correst Carge Carge Carge       Water Column (ft. h.)         12       11       18         nber       12       11         12       11       18         no       12       10         10       12       10         11       18       100         11       11       18         11       18       100         11       16       100       100         12       100       100       100       100         11       16.23       1.04       478       7.59       89.3         12       32.0       16.23       1.04       482       7.64       86.9	Total Depth       Ind. S/N         No.       Total Depth       Ind. S/N         Weter (DTW)       Weather         Correst Colspan="2">Correst Colspan="2">Correst Colspan="2">Correst Colspan="2">Correst Colspan="2"         Ind. S/N         Water Column (ft. h.)         Casing Volume (gal) (2" = 0.16h, 4" = 0.66h)         Borehole Volume (gal) (2" = 0.73h, 4" = 1.15h)         Total Gallons Removed         Sample Number & Time       Well 3 : Well	Total Depth       Ind. S/N         Total Depth       Ind. S/N         Coron       City       Water (DTW)       Weather         Water Column (ft, h.)       Casing Volume (gal) (2" = 0.16h, 4" = 0.66h)       3 vols =         Borehole Volume (gal) (2" = 0.73h, 4" = 1.15h)       Total Gallons Removed         sonnel       Sample Number & Time       Well 3 :       Outbould Signal         Buration (Minutes)       Volume       Temp       DO       Spec.       ORP/ Cond.       REDOX       Turbidity       DTW         Surge       Pump       Bail       (gallons)       (°C)       (mg/L) $4'' = 0.66h$ $3$ vols =         Borehole Volume (gal) (2" = 0.73h, 4" = 1.15h)       Total Gallons Removed       Sample Number & Time       Well 3 : $0.060000000000000000000000000000000000$	Total Depth       Ind. S/N         io. $\nabla UPR 58 b$ Depth to Water (DTW)       Weather         Caron Cidy, co       Water Column (fa. h.)         ILE / IPR       Caron Cidy, co         Water Column (gal) (2" = 0.16h, 4" = 0.66h)       3 vols =         ILE // IPR       Caron Cidy, co         Water Column (gal) (2" = 0.73h, 4" = 1.15h)         Total Gallons Removed         Sample Number & Time       Well 3 : Volume (gal) (2" = 0.73h, 4" = 1.15h)         Total Gallons Removed         Sample Number & Time       Well 3 : Volume (gal) (2" = 0.73h, 4" = 1.15h)         Total Gallons Removed         Sample Number & Time       Well 3 : Volume (gal) (2" = 0.73h, 4" = 1.15h)         Duration (Minutes)       Volume (gal) (2" = 0.73h, 4" = 1.15h)         Sample Number & Time       Well 3 : Volume (gal) (2" = 0.73h, 4" = 1.15h)         Duration (Minutes)       Volume (gal) (2" = 0.73h, 4" = 1.15h)         Sample Number & Time       Well 3 : Volume (gal) (2" = 0.73h, 4" = 1.15h)         Sample Number & Time       Outhot

Sample Analytes: VOCs (8260)

Semi-Volatiles (8270) Dissolved Fe and Mn (6020) (lab filtered) Total Alkalinity as CaCO<sub>3</sub> (SM 2320B) Sulfate, Nitrite, Nitrate, and Chloride (EPA 300.0) Sulfide (SM 4500S2) Ferric and Ferrous Iron (SM3500 Fe; Hach 8146)

Dissolved Methane, Ethane, and Ethene (RSK175)

4.84

#### Well Development / Purge Form

Project No. Location Canon Cily, CO Date (2/11/18 Well Number Well 3 Method							Depth Ind. S/N Depth to Water (DTW)Depth Ind. S/N WeatherWater Column (ft. h.) Casing Volume (gal) (2" = 0.16h, 4" = 0.66h) Borehole Volume (gal) (2" = 0.73h, 4" = 1.15h)3 vols =Total Gallons Removed Sample Number & Time3 vols =						
Time		ion (Mir Pump	nutes) Bail	Volume (gallons)	Temp (°C)	DO (mg/L)	Spec. Cond. (µs/ms)	pН	ORP/ REDOX (ReL.	Turbidity (NTU)	DTW (ft btoc)	Remarks	
15:57: 15:5P				48.5	(+ 50	mple Samp	2					Stopped Stopped	

Sample Analytes: VOCs (8260)

Semi-Volatiles (8270) Dissolved Fe and Mn (6020) (lab filtered) Total Alkalinity as CaCO<sub>3</sub> (SM 2320B) Sulfate, Nitrite, Nitrate, and Chloride (EPA 300.0) Sulfide (SM 4500S2) Ferric and Ferrous Iron (SM3500 Fe; Hach 8146) Dissolved Methane, Ethane, and Ethene (RSK175)

					-	· 1	Vell Devel	opment	/Purge F	orm			
Project Parkdale Quarry 9 Project No. 0488586								h Vater (D1	ny /36 F				
Locatio	n			ty.co	)		Water Colu	umn (ft. 1	h.)			ł	0 /
Date			-118		:		Casing Vo	lume (ga	l) $(2'' = 0.1)$	$\overline{6h, 4'' = 0.6}$	56h)	3 vols =	
Well N	umber	Well	1		<u> </u>		Borehole V	/olume (	gal) $(2'' = 0)$	).73h, 4" = 1	l.15h)		
Metho	1			ledi Flo	J		Total Gall	ons Rem	oved				······································
Field P	ersonnel		+ Zh				Sample Nu	mber &	Time			O	10:52
Setup t	ime: (	<u> 7:20</u>									·····		
-	Duration (Minutes)			Volume	Temp	DO	Spec. Cond.		ORP/ REDOX	2	DTW		
Time	Surge	Pump	Bail	(gallons)	(°C)	(mg/L)	(µs/ms)	pН	(ReL.	(NTU)	(ft btoc)		Remarks
09:44	1	-0-	anna an ann an an ann an an ann an an an	0	and a second state of the second state of the second states of the secon			60000000000000000000000000000000000000			and a second	Start	pump
09:50:1	1			and the second se	12.42	1.19	669	8.05	-15.6	Clarky	danna tolanno secta analarez	silty	
09:51:	24			2	Constant Constant Section Constant			a ha a chuir an	and the state of the	2			
09:52:4				3	attanganutanononnonia			60999011721997026726689928999999999999999	annon ann an a		State Contraction and Contraction	1 Pump	rate
09:53				Y	(2.73	0.30	646	7.96	-34.5	andy	Constantine constant		
09:55				5	dalarsananan ana		a gy pasan ta ka gasa ka siya manan na kana da	Ministration and a second s			1	1 Pump	at
09:56	:25			6	12.90	0.29	627	7.91	-38.0	Cloudy		79	-
09:57:	29			ang	Reinsteinen von von sonnen von	and the construction of th	a orthon the active opportunity population of the second statements of the		an i feanil stil bolchgaan on son oo saalaan saa		Mannanianananananananananananananananana	80 	
09:58	34			8	13.01	0.60	617	7.88	-37.8	Clordy	Constant Constant Constant		. · · · · · · · · · · · · · · · · · · ·
09:59:	35			9	ýmieniesennistrautore			New York and a factor of the second		y Managementering and a second	an a		
10:00:	36			10	Management of the second secon	######################################					an construction of the second second and the second and the second second second second second second second se		
10:01:	1			- 11	1321	1.35	613	7.83	-32.0	Cloudy	(fighter a construction of the second		
10:02	:33			2	-Office and a state of the stat	annooliitaannaturkaalaannooliinaalaannool		Notikeepatticationing and the second second	a ha followen a service participant of a service mandem in the following of the service many service s	annessanna an		57 <b></b>	
10:03	:20			13	13.24	1.70	611	7.81	-28.1	Glovely-		1	

1

Sample Analytes: VOCs (8260)

ക

Semi-Volatiles (8270) Dissolved Fe and Mn (6020) (lab filtered) Total Alkalinity as CaCO<sub>3</sub> (SM 2320B)

Sulfate, Nitrite, Nitrate, and Chloride (EPA 300.0) Sulfide (SM 4500S2)

Ferric and Ferrous Iron (SM3500 Fe; Hach 8146)

Dissolved Methane, Ethane, and Ethene (RSK175)

Project								Depth Fotal Depth Ind. S/N					
-	т		- 10 mm 100	,			1 ^				Ind. S/N		
Project N	<u> </u>	858				1 1	Depth to Water (DTW) Weather						
Location		<u>Con</u>	un C	ity, C	0		Water Colu	· ·	and the second s		<del></del>		
Date		12/13	2/18				-	-	~~000000	6h, 4" = 0.6		3 vols =	
Well Nu	nber	Wel	1 10			<i>.</i>	Borehole V	/olume (	gal)(2'' = 0)	).73h, 4" = 1	.15h)		
Method		Gant	nd fos	Red; A	an 2 .	n igal	Total Gall	ons Remo	oved				
Field Per	sonnel		* 2			MIN	Sample Nu	mber &	Time				
Setup tin		<u> </u>	<u> </u>				-						
				·			Spec.		ORP/				
	Durat	ion (Mi	nutes)	Volume	Temp	DO	Cond.		REDOX	Turbidity	DTW		
Time		Pump		(gallons)	(°C)	(mg/L)	(µs/ms)	pН	(ReL.	(NTU)	(ft btoc)	Remarks	
10:04:15	-			14	Captolic Case of Management and Colorism of Sciences	11200000201202202000000000000000000000	an a faith an	1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	nen Maren margine, Galden an State (Stranger, State)	an yaan amaa ka k	Announces of the second s		
10:05:13				15	13.25	2.00	607	8.03	-26.1	Clarky	Contraction of the second s		
10:06:14				16	-	annonaataadoonayaanaadoodooyayaiiidaa	1999-1200-140-140-140-140-140-140-140-140-140-1		au la California de C		nerveryn yw Lander yn neren a'r o'r aran y friferin yw enen		
10:67:18				17	13:28	221	585	7.74	- 15.1	Clady	and the second		
10:08:18	1			18	Million and an and an and an and an and an			asabattenderformanskerrendskatter opportenskatetede	1922-2017 (Investmentations)	a na sa			
10:07:19	-			19	3.30	2.25	568	7.72	-9.9	Claidy	Contraction and the second s		
10:10:29				20	Management and the second	and the second	a na stand a st		er forman juge gegegegegegen der der bester er der bester for der bester for	4 10105000000000000000000000000000000000			
10:11:29				21	13.29	2.36	604	7.70	-3.4	Clardy	Marcaners Converting of Converting		
10:12:30	2			22	(Bitanencourreductoria)	Careford and a state of the sta							
10:13:30	p			23				nan de la constituit de la				1 Pump rate	
10:14:38				24	13.34	2.52	602	7.66	-4.9	Clarky	Calescontenting		
10:15:38				25	001550000000220000000								
10:16:40				26	13.57	2.77	603	7.66	9.0	Clardy	Concerning and a second se		
10:17:34				27		สารางครองสาราว์การรางการทำการทำให้ได้ได้ได้ได้ไ			ppaggyananadistddawebiolithociaiditaaeetol	2 2			

#### Sample Analytes: VOCs (8260)

Semi-Volatiles (8270) Dissolved Fe and Mn (6020) (lab filtered) Total Alkalinity as CaCO<sub>3</sub> (SM 2320B) Sulfate, Nitrite, Nitrate, and Chloride (EPA 300.0) Sulfide (SM 4500S2) Ferric and Ferrous Iron (SM3500 Fe; Hach 8146) Dissolved Methane, Ethane, and Ethene (RSK175)

Project Project N Location Date		12/	12/18				DepthTotal DepthInd. S/NDepth to Water (DTW)WeatherWater Column (ft. h.)Casing Volume (gal) $(2" = 0.16h, 4" = 0.66h)$ 3 vo					3 vols =		-
Well Nu	nber	wei	1/0							1.73h, 4'' = 1	l.15h)			
Method Field Per	sonnel						Total Gall Sample Nu							
Setup tin			· · · ·				Sample N		1 mile		-			••••••••••••••••••••••••••••••••••••••
Time	Duration (Minutes)			Volume (gallons)	Temp (°C)	DO (mg/L)	Spec. Cond. (µs/ms)	pН	ORP/ REDOX (ReL.	Turbidity (NTU)	DTW (ft btoc)		De	marks
	Surge	rump	Bail	28	13.47	(IIIg/L) 3.02	(µs/ms) 504	рп 7.66	(Rel. 13.4	(NTU) Clarky			Ke	marks
10:18:40 10:19:45				29	12.77/		501	/•00	1.21					
10:20:3				30	13.44	3.04	570	7.65	17.2	Clardy	Concerner on the Concerner of the Concer			
10:22:0				31	Satural and a second se	S1000000000000000000000000000000000000	1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -	a for a general and the second of	ສມີກາວັນການປີ ສຕີ້ກໍ່ນັ້ນ ກໍ່ກໍ່ເປັນສາມາດຸດດັ່ງກ່ຽງຊີວິດັນການເຮັດຊຸດໃນປະເຊລາງານ		ana			
10:23:10				32	13.45	3.15	579	7.64	21.8	Claudy	Körebrephissonnen, verionsverigg			
10:25:10	>			34	13.46	3.29	576	7.62	24.8	71000	Name and Antonia			
10:27:1	>			36	13.49	3.47	575	7.60	27.4	71000	Seaannen en son aan aan aan aan aan aan aan aan aan a			· · · · · · · · · · · · · · · · · · ·
10:29:11				38	(3.48	3.69	574	7.60	29.9	71000	Citricitations and a second se			
10:31:2:				40	13.51	3.96	587	7.59	32.5	71000	digition demonstration of the state of the s			
10:34:1			-	43	13.59	4.26	591	7.58	34.3	71000	Contraction of the second seco			
10:36:0	7			45	13.63	4.46	594	7.57	36.3	71000	Applemented Statement			
(0:37:5		NDN00000000000000000000000000000000000	88875558456625885684990568856884568456	140900000000000000000000000000000000000	1999/1995000000 miles and 199500 miles and 1999				nan da kanangan kana	1993-1993-1994 - Landardan, yeyayogo (1997-1994), ayunan 2004	della provenzione di contra	J	Pump	rate
10:38::				47	13.56	4.48	596	7.59	36.8	71000				
10:40:	27			48	13.36	4.48	597	7.57	39.2	71000	Quantum and the second second			

Sample Analytes: VOCs (8260)

Semi-Volatiles (8270) Dissolved Fe and Mn (6020) (lab filtered) Total Alkalinity as CaCO<sub>3</sub> (SM 2320B) Sulfate, Nitrite, Nitrate, and Chloride (EPA 300.0) Sulfide (SM 4500S2) Ferric and Ferrous Iron (SM3500 Fe; Hach 8146)

Dissolved Methane, Ethane, and Ethene (RSK175)

Ferrous Iron (field test) = \_\_\_\_ mg/L

3

						, V	Vell Devel	lopment	/ Purge F	<sup>7</sup> orm		4		
							Depth Total Depth Ind. S/N							
5											Ind. S/N Weather			
	-	<u></u>	~ 1				Depth to V	-	-		w cather			
								umn (ft. l	,	(1 411 0 4				
Date		12 [[					Ŭ	.0	, .	6h, 4" = 0.6		<u>3 vols =</u>		
Well Nur	nber -	Wel	1 10				· · · · ·			1.73h, 4'' = 1	l.15n)	<u>b</u>		
Method							Total Gall							
Field Per	-	PM 1	t 24	V			Sample Nı	imber &	Time			@ 10:52		
Setup tin	ne:			1				I			٤			
	D	(\C-		Volume	Temp	DO	Spec. Cond.		ORP/ REDOX	Turbidity	DTW			
Time	Surge	on (Mir		(gallons)	(°C)	(mg/L)	(µs/ms)	pН	(ReL.	(NTU)	(ft btoc)	Remarks		
	1	1 ump	Dan	49	13.33	4.47	597	7.49	44.2	7/000	(11 0:000)			
10:41:49	1			50	(2.0-	1. 1		1. 7.7	9.1.0	71000				
10:43:2						1107	,	Again Stilling	# t	-	Riscontration			
10:44:4	9			5/	13.39	435	600	7.52	45.0	71000	Marchide Produce Construction			
10:46:2	3			52	13.40	4.29	601	7.52	46.4	71000	August State Contraction of Contract	-		
10: 47:	52			53	13.41	4.23	602	7.55	47.6	71000	- aggreget and a share a share on the			
10:49:				54	13.43	4.20	602	7.55	48.7	71000	<ul> <li>A State Sta</li></ul>	Very Turbid		
10:52				Viennassensessaansensensensensense	n de la compañía de l			an a	NTE Estamationservationet/commercialserv	a ann a sun na mar an daoine a	gyggaesennik eine ster ster ster ster ster ster ster ste	COLLECT SAMPLE		
11:09:0	50			63.5	(15	ample	voli	me x	(2)					
11:10:				65					* .			17 Rotie		
11:12:				67	,							- 		
11: 13:38												1 R.t.		
11:14:11				70										
11: 17:15				75										
11:20:14	1			80										

Sample Analytes: VOCs (8260)

Semi-Volatiles (8270) Dissolved Fe and Mn (6020) (lab filtered) Total Alkalinity as CaCO<sub>3</sub> (SM 2320B) Sulfate, Nitrite, Nitrate, and Chloride (EPA 300.0) Sulfide (SM 4500S2) Ferric and Ferrous Iron (SM3500 Fe; Hach 8146)

Dissolved Methane, Ethane, and Ethene (RSK175)

	Well Development / Purge Form												
Project	Ŧ	<u>MM</u>	Sprir	leg Gint	Sam	ipinej		al Depth oth to Wate		2.39 123.99	Depth. Ind. S/N Weather SUMNU Shap WUT07		
Project N		VINON	$\frac{1}{11}$	) rdad	A Au		^	ter Columi		115.0)	Weather WWWWWWWWWW		
Location	L	SIVI	17010	Crvicden		ang			e (gal) (2" = 0		(Gh) = 1 (R (M R))		
Date		0/19	1011			·····		-	ume (gal) (2" = 0		~ ()		
Well Nu	mber	uell-						al Gallons	. –	-0.7540, + -			
Method	1	pump		160, 11	1 12 100	afan	·		er & Time	<u></u>			
Field Pe	rsonnel	ant	- Wor	ITER V	WYJE	ntam				i			
Time	Dura Surge	ation (Min Pump	utes) Bail	Volume (gallons)	Temp (°C)	DO (mg/L)	Spec Cond. <del>(µs/ms</del> )	pН	ORP/ REDOX (ReL. MV)	Turbidity (NTU)	Remarks		
1215	0-	F. F.		2	15.61	13.55	.484	7.49	178	NA SHEED BALLER WITH BUILDING	Nevy turbs of Matter		
1233				ч	1.5.30	12.53	.489	-151	165		pump technical articities		
1253				Ú	17.61	6.02	.485	7.3	158		move technical difficults		
1305				Q V	13.99	4.71	.482	7.10	16147	520			
1313				10	19.98	4.89	°483	7.13	137	701			
13(9			×.	12	19.74	4,50	.480	7.13	131	020			
1325				14	19:58	1.52	.481	31 7.14 125 7			Since tubing was exposed to sublight when pump was polled up, tempo maybe off.		
Sample	Analytes	: BTEX Nitra		Napthalene ( Glycols	8020)		gas) 8015m Metals F	15mod TEPH (diesel) 8015 mod Napthalene (8270) PAHs (610			Napthalene (8270) PAHs (610)		

						Well	Develop	ment / P	urge Form					
Project		<u>MM</u> «	Sprina	JGWL SO	ampli	nez	Tota	l Depth		<u>239</u> Inc	epth. 1. S/N			
Project N			1	/	¥	<u> </u>	Dep	th to Wate			Veather			
Locatior	ı	PANCO	CON R	QUAN	Λ		Wat	er Colum	n (ft. h.)	115.01				
Date	5/14/2019							ing Volum	e (gal) (2" = 0	0.16h, 4" = 0.66l	h) <u>19 aal</u>			
Well Nu	11 Number <u>Well - I</u>							ehole Volu	ume (gal) (2" :	= 0.73h, 4″ = 1.1	(5h)			
Method	ethod ownprof								Removed					
	rsonnel	Zeek	, wa	Her, MI	avgan	Hame,	Sam							
Time	Dura Surge	ation (Min Pump		Volume (gallons)	Temp (°C)	DO (mg/L)	Spec Cond. MS/CVM (µ <del>\$/ms)</del>	pН	ORP/ REDOX (ReL. MV)	Turbidity (NTU)	Remarks			
1320	Juige	1 unip	Duii	10	19.97		.479	7.15	126	845	-			
1388				18	20.26	3.98	.475	.7.16	127	920				
<u>.</u>														
						<u> </u>								
Sample	Analytes	:: BTEX Nitra		Napthalene Glycols	(8020)		gas) 8015m Metals F		TEPH (dies VOC (8260	el) 8015 mod	Napthalene (8270) PAHs (610) Semi-Volatiles (8270)			

						Well I	Developm	nent / Pu	rge Form	2110 . 0.011	EDIA MAN			
Project Project No		Martin	i Mavie	ter Sprine	y GW SO	impluez		Depth h to Water	• •	5.38ft	Weather SUNNY ISLIGHT DMCZL			
Location	,. (	Canulli	1 City				₩ate	Water Column (ft. h.) $249 - 38.38 = FL$ Casing Volume (gal) (2" = 0.16h, 4" = 0.66h) $(2599 - 0.38.38)$						
Date		5/13/2	< 3			·······	Casii	Casing Volume (gal) $(2'' = 0.73h, 4'' = 0.66h)$						
Well Nun	nber	MIN-	3					Total Gallons Removed						
Method			. 15.	·····	a Fail	2201	I ota Sam							
Field Pers	onnel	ZACK	Walter	MOVOR	<u>A FAU</u>	Viev			ORP/	[]				
	Dura	ation (Min	utes)	Volume	Temp	DO	Spec Cond (US/Ins)	pН	REDOX (ReL. MV)	Turbidity (NTU)	Remarks			
Time	Surge	Pump	Bail	(gallons)	(°C)	(mg/L)				315				
1218	-				14.80	20.36	.380 MS/CM	7.39	162	-317				
1220				3	14.07	14.43		7.07	113	89:1				
1222				5	15.13	12.47	, 380	6.84	109	175				
1224				.7	6,23	11.20	. 300							
1227				9	(5.3)	10:30	.379	6.63	132	80.0				
12-29				11	1539	9.72	. 379	6.66	132	92.5				
1231				13	15.47	9.23	,379	7.51	8	96,1				
Sample	Analyte			Napthalene Glycols er Chemistry		RCRA	IIIIH (gas) 8015 modTEPH (diesel) 8015 modNapthalene (8270)A Metals F N/FVOC (8260)Semi-Volatiles (8270)ganese, anions, chloride, sulfate, bicarbonate, and total alkalinity)				Semi-Volatiles (8270)			

	Well Development / Purge Form													
Project Project N		Martin	Mariek	a Spring	GIVI .	Samplin		al Depth oth to Wate	er	<u>249.</u> h	Depth. nd. S/N Weather			
Locatior	L	Cany	in cit	ų			Wat	er Colum	n (ft. h.)					
Date		5113	7009	<u> </u>		t	Cas	ing Volum	e (gal) (2" = (	).16h, 4" = 0.6	6h) <u>33.7 gel</u>			
Well Nu	mber	MIN-					Borehole Volume (gal) (2" = 0.73h, 4" = 1.15h)							
Method		<u></u>				· · · · · · · · · · · · · · · · · · ·	Total Gallons Removed							
Field Pe	rsonnel	Moral	2117 Far	Mer, Zo	UL M	enter	Sam	nple Numb	er & Time					
Time	Dura Surge	tion (Min Pump	utes) Bail	Volume (gallons)	Temp (°C)	DO (mg/L)	Spec Cond (µs/ms)	pН	ORP/ REDOX (ReL. MV)	Turbidity (NTU)	Remarks			
10:41		1 ump	Dan	15	1556		, 380	753	89	95.0				
,2 37				17	15.60	8.67	. 390	7.52	39	101.				
12:40				19	1530	0,36	,380	7.53	26	110				
1243				21	F. 38	8.12	, 380	7.54	82	117				
1247				23	15.95	8.04	.301	7.26	કેવ	138				
1253		25 1409 0.36						7.07	018	157				
				27	16.04	200	331	70,07	99	.153				
Sample	Analytes	Nitrat	te	Napthalene ( Glycols		RCRA N	gas) 8015m Metals F 1	N/F	VOC (8260)		Napthalene (8270) PAHs (610) Semi-Volatiles (8270) otal alkalinity)			

pg2

	Well Development / Purge Form												
Project Project N		Mavitr	n Mai	rieta spr	ing GTW	<u>Samplr</u>	Tota	l Depth th to Water	-		Depth. Ind. S/N Weather		
Location		Canyov	n City				Wat	er Column	(ft. h.)				
Date		Cangor	1 00101	)			Casi	ng Volume	e (gal) (2" = 0	0.16h, 4'' = 0.16h	66h) <u>337 gal</u>		
Well Nu	mber	MW.	. 3				Borehole Volume (gal) (2" = 0.73h, 4" = 1.15h)						
Method		,					Total Gallons Removed						
Field Per	sonnel	Maral	in Fam	12, Zal	K WO	itter	Sample Number & Time						
Time		ation (Minu Pump		Volume (gallons)	Temp (°C)	DO (mg/L)	Spec Cond (KS/ pas)	pН	ORP/ REDOX (ReL. MV)	Turbidity (NTU)	Remarks		
1256	Surge	Tump	Duii	29	16.24		. 381	6,95		168			
1258				31	16.21	7.90	.381	.6.93	103	190			
1301			-	33,	16.30	7,63	.340	6.914	101	190			
1304				35	1638	7.51	,379	6.97	av	205			
1308				37	16.44	7.28	. 380	7.22	35	222			
1311				39	16,50	7.13	,380	7.60	. 45	216			
1314				41	16:53	707	,3%\	7.35	9T	.222			
Sample	Analytes	s: BTEX Nitra		Napthalene Glycols	(8020)		gas) 8015n Metals F	N/F	VOC (8260	-	d Napthalene (8270) PAHs (610) Semi-Volatiles (8270)		

	Well Development / Purge Form													
Project Project N		Mautin	n Ma	meter s	priney (s	W Seint		al Depth oth to Wate		<u>249.0</u> 38.38	Depth. Ind. S/N Weather			
Location		CIAMI	en c	ИЛ			^	ter Columr	·					
Date		0.00	7219	<u> </u>				ing Volum	.66h)					
Well Nu:	mbor	MW	San Salar	,				Borehole Volume (gal) (2" = 0.73h, 4" = 1.15h)						
Method	litter	10 100 10	<u>q</u>					al Gallons I						
Field Per	rsonnel	Zael	wout	ar, Mar	openi	Farm		Sample Number & Time						
	Dura	tion (Minu	utes)	Volume	Temp	DO	Spec Cond.		ORP/ REDOX	Turbidity	Remarks			
Time	Surge	Pump	Bail	(gallons)	(°C)	(mg/L)	(HS/ms)	pН	(ReL. MV)	(NTU)	Remarks			
1316	-			43	16,74	4:82	,380	7:09	81	209				
1318		·		45	16.66	7.38	- 380	.7.01	86	005				
1321				47	(6.73	7.02	.380	7.00	87	256				
1324				49	16.90	6.71	.379	7.05	85	429				
1326				57	ille 17.00	6.41	. 379	7.12	70	821				
				59	17.13	6:20	. 374	7.71	49	0-0				
										•				
Sample	Analytes:	BTEX Nitra		l Napthalene ( Glyçols	(8020)		gas) 8015m √Ietals F		TEPH (dies VOC (8260)	•	d Napthalene (8270) PAHs (610) Semi-Volatiles (8270)			

						Well I	Developm	ient/Pu	rge Form					
			1 2	1		1 C A					epth. nd. S/N			
roject	0	Aavhn	Mar	ieta SR	ing a	<u>al Sam</u>		l Depth	-					
roject N	0.				V		Dep	th to Wate	r -		Weather			
ocation		Parked		quem	<u>Ч</u>		······	er Column		<u> </u>				
Date			2019	V	<u> </u>					0.16h, 4" = 0.6				
Vell Nu	mber	MIN-						Borehole Volume (gal) (2" = 0.73h, 4" = 1.15h)						
lethod ·	_	pump	29	a. a. C. J.	nov . :	nlla		Total Gallons Removed       Sample Number & Time						
ield Per	sonnel	Mage	WT EON	mer, Ze	WE U	RATTV		ipie Numb						
Time	Dura Surge	tion (Minu Pump	utes) Bail	Volume (gallons)	Temp (°C)	DO (mg/L)	Spec Cond. (##/ms)	pН	ORP/ REDOX (ReL. MIV)	Turbidity (NTU)	Remarks			
ull	Jurge			44	12.93	5.20	.481	6.63	107	503				
6 13				46	12.92	5.22	,480	6.62	103	450				
614				48	12.55	SIZ	×480	6.62	109	419				
616				50	12,86	5.05	. 480	6.64	110	478				
									44					
										J				
Sample	Analytes	: BTEX Nitra		Napthalene Glycols	(8020)		(gas) 8015m Metals F		TEPH (dies VOC (8260	sel) 8015 mod )	Napthalene (8270) PAHs (610) Semi-Volatiles (8270)			

ł

	Well Development / Purge Form													
Project	-	Mart	Marketter Sprug hul Samplu     Total Depth     Depth.       Depth to Water     10.17     Weather											
Project N		On Ald	010	A LANG	1				-					
Location				Quain	1				e (gal) (2" = 0	) 16h $4'' = 0.0$				
Date		5/13/2			)				e (gal) (2 = 0 me (gal) (2" =					
Well Nu	mber	MWI-II												
Method	_	fump		10 D.C. "	7 0 0 11	i.p.lb		al Gallons I		<u></u>				
Field Pe	rsonnel	<u>Morgan Famer, Zarele Weller</u> Sample Number & Time												
Time	Dura Surge													
1557	-			30	1300	5.93	.498	6.62	108	656				
K.00				32	13.04	5.72	,491	6.62	105	777				
6.02				34	13.05	5.05	,485	6.65	106	926				
1603				36	13.06	5.48	,482	6.63	105	906				
165				38	13.9	5.41	:480	6.64	104	779				
16,00				40	13.00	S.HI	.480	6.64	165	651				
1609				42	12:99	5.24	,480	6.62	107	\$70				
Sample	Analytes	Nitra	te (	Napthalene Glycols	(8020)	TVPH ( RCRA N	gas) 8015π Metals F ese, anions	N/F	VOC (8260)		Semi-Volatiles (8270)			
			General Water Chemistry (cations plus manganese, anions, chloride, sulfate, bicarbonate, and total alkalinity)											

F	Well Development / Purge Form													
Project Project I	No.	Martiv	1 Manit	etter Spri	ng Fil	4 Samp	11	al Depth oth to Wate	er -		Depth. Ind. S/N Weather			
Locatior		Parkale	ale G	Warry			······	ter Columi	-		· · · · · · · · · · · · · · · · · · ·			
Date		5/13/2					Cas	ing Volum	e (gal) (2" = 0	0.16h, 4'' = 0.4	66h)			
Well Nu	mber	MW-	10				Bor	Borehole Volume (gal) (2" = 0.73h, 4" = 1.15h)						
Method		pump					Tot	Total Gallons Removed						
Field Pe	rsonnel	Talle	water	, morga	ntavi	Ner	San	Sample Number & Time						
Time	Dura Surge	tion (Min Pump	utes) Bail	Volume (gallons)	Temp (°C)	DO (mg/L)	Spec Cond (##9/ms)	pН	ORP/ REDOX (ReL. MV)	Turbidity (NTU)	Remarks			
1545	-			16	13.29	7.79	.502	6-73	507					
5.46		·		(8	1.3:26	7,50	.502	4.71	102	st. company of the second s				
1549				20	13.27	7,12	, 302	2 6.70 100 -						
1551				22	13,22	6.36	. 500	6.06	105					
1552				24	13.27	5-30	. 494	6.64	105	Ø918				
15 54				26	13,14	6.28	.497	6.64	001	946				
15 56				28	13,09	4.17	.496	6.63	108	691				
Sample	Analytes:	BTEX Nitrat		Napthalene ( Glyçols	8020)		gas) 8015m ⁄Ietals F 1		TEPH (diese VOC (8260)	el) 8015 mod	Napthalene (8270) PAHs (610) Semi-Volatiles (8270)			

pump on 15 30

Well Development / Purge Form

Project		Martin	Manie	etta sonv	YEIN	Sample	10 Tot	tal Depth			Depth. Ind. S/N	
Project N	No.	<b>.</b>					J De	pth to Wate	5 <b>1</b>	T1.01	Weather	
Locatior	ı	Partial	ale au	avra			Wa	iter Colum	m (ft. h.)			
Date		5/13	12010	<u>}</u>			Ca	sing Volur	ne (gal) (2" = (	0.16h, 4'' = 0	.66h)	
Well Nu	mber	MIL-	-10				Bo	rehole Volu	ıme (gal) (2" :	= 0.73h, 4" =	1.15h)	
Method		AMP	NA				Tot	Total Gallons Removed				
Field Pe	rsonnel	Marge	intar	mer, Ze	ek ir	alter	Sai	nple Numł	oer & Time			
	Dura	ition (Min	utes)	Volume	Ψ	<b>D</b> O	Spec	<u> </u>	ORP/	T 1:14		
Time	Surge	Pump	Bail	(gallons)	Temp (°C)	DO (mg/L)	Cond.	pH	REDOX (ReL. MV)	Turbidity (NTU)	Remarks	
1532	-	2 13.13 15.2						7.22	32	÷	-	
15.34				Ĺ-j	13.22	12.46	,509	.7.05	36	<del>ì de fac</del>		
1530				6	13.78	10,43	.504	6.96	33	1000	1000 flogning	
15 38				H	12.94	9.53	. SU4	6.87	68	in-monogenetis	very two of water	
15 40				ĮŌ	13,11	8.80	.504	6.81	87	e calcing 158mb		
1542				12	13.16	8.10	. 305	6.81	94	a.amanaa	waiter stoutney to clear	
1543							. 502	6.79	ióð	•		
Sample	Analytes:	BTEX Nitrat		Napthalene ( Glycols	8020)		gas) 8015m 1etals F		TEPH (diese VOC (8260)	,	Napthalene (8270) PAHs (610) Semi-Volatiles (8270)	

General Water Chemistry (cations plus manganese, anions, chloride, sulfate, bicarbonate, and total alkalinity)

29

	Project Location Purpose	MWM Part	Ldale		Well Name Sample ID	- Well SWL 36	10 - 18.69	
Date	Time	Temperature	pН	EC	DO		Notes	
8/28		[unit] 6		[unit] m5/cm	[unit] mg/L	[unit] mV		
1828	Y. Pur	NO ON					WL 16.81	
19:32	18:32	23.50	681	.493	1.80	107	2.56	
18:38	18:39	14-81	6.46	.601	2.32	80	56	
8/28	18:43	14.29	6.28	. 608	2.29	89	7.56	
8128	18:46	14.65	6.33	.607	2.31	44	106	
8(23	18:49	14.73	6.46	,609	2.42	57	12,56	
8/28	18:52	14:67	6.71	.609	2.59	60	15 G	
8/28	18:54	14.66	6.50	.609	2.70	72	17.5 G	4 . 1
8/28	18:58	14.64	6.78	,611	3,60	65	206 Multiprote shut di 22.56	own and had
8/28	19:01	14.58	6.71	.613	3,38	78	22.56	ON again.
8/28	14:03	14.59	6.94	, 615	3,9(	66	25.6	/ )
8/28	19:69	14.61	6.70	.617	4.19	72	27.5G	
8/29	19:09	14,66	6.93	, 616	4.43	65	30 G	
8/28	19:01	14.72	6.89	,616	4.67	64	32.5 G	
8/28	19:14	14.71	6.91	.617	4.87	64	35, G #330 NT	UK
	19:25	Pum		1AP			~43 gal total	
			V	s 33				

Well 3 Well Name Project Partidalp Sample ID Location 47.19 SITU) 30 gal / vell volume 11:59 Purpose gal Tota Notes ORP Temperature pH EC DO Time Date [unit] m<sup>5</sup>/cm [unit] ~9/L [unit] ORPm/ 0, [unit] DTW 46-86 LEAT PHILD 12:43 2.68 7,29 1.bal 445 -18 14:10 6.14% 8 2 ,70 ,434 2 4:15 6.61 49 Ъ Gallon 5 28 25 7.2 2 10 129 4:20 98 .416 Ga power surge on generator · <u>, 2</u>4 23 Time delay 9 8/28 .414 5 Ga 14:23 due to 6 .415 5 24 14:37 8/28 1.0 7 9 (Ta) 2 20 .88 29 Ga 4:4 7, 2 412 2 3 22 . 8 5 8/28 4: .4 12 9 50 0 7a 79 25 9 14: 9 .412 Z 58 Ga N. Com *Å* 27. 7.08 5:04 7 14 .4 de la Ga 7. Y 92 30 7,69 <u>. 6</u>2 い 7. 99 (Ia 5:11 ,410 О 21  $\mathcal{O}$ 32.5 ga 90 7.1 X 19 51 3 0411 10 7. additional Gal 5:36 5. durric MD 1A in 5:50 Fansducer 'sack aMD

.../

Page

199

age .	
-------	--

	Project	MM			_Well Name	Worl	)
,	Location Purpose	Park Hydro	MIE Whic-	Testing	_Sample ID	Nom	
Date	Time	Temperature		EC	DO	ORP	Notes
		[unit]		[unit]	[unit]	[unit]	
8/29	12:51						Pamp oy
/							Equipment un dermenuered, unable te
							Equipment underpowered; unable to complete pumping
29-00 K							
*							
•••••				-			
		3					
····.							

S. Strange

. Ц .

al al al constanting states are also

Ŧ

				-		Well	l Devel	opment/P	urge Form	1			DIS Pro	59	
Project Project I Location Date Well Nu Method Field Pe	n Imber	Cann "/19 (Nel	64885 00 ( 119 1- 3	Quarry 581. City , Each	(0			Total Depth Depth to Wat Water Colum Casing Volum Borehole Volu Total Gallons Sample Numl	n (ft. h.) ne (gal) (2" = nme (gal) (2" Removed	0.16h, 4" = 0 = 0.73h, 4" =	_ Weather 0.66h) = 1.15n)	60	Sunny		
Time		tion (Min Pump		Volume (gallons)	Temp (°C)	DO (mg/L)	Spec Cond (µs/m		ORP/ REDOX (ReL. MV)	Turbidity (NTU)			Remarks		
853	00180	0		0	14.3	4.52	460	8.11	125.1	34.70					_
856		3		3	15.5	6.52	479-	5 7.64	60.0	26.70					
859		6		7	15.8	0.63	463	0 7.67	30.5	23.47					
902		9		10.3	15.9	0.74	458.8	3 7.65	27.0	22.68				~	
905		12		13.5	16.1	6.75	458.	8 7:64	25.40	21.52	. <				
903		(5			14.1	0.74	458.	0 7.64	29,1	17.43					
911		18		19.5	16.2	6.74	457.	5 7.64	30.3	16.12	*				
Sample A	Analytes:	BTEX		l Napthalene (8 Glycols Chemistry (c		TVPH (g RCRA N us mangane	Aetals F		VOC (8260)		Sen		(8270) les (8270) (	PAHs (610) \$9 - 9	00

		Park	elah	Quary th and Hold	CN		Total Depth		Purge F	250	Depth Ind. S/N _	2354	309 - 92 359 - 9		
roject	-				yow		Depth to Wa		W)	41.90	Weather _		409 9		
Project N	<b>.</b>			88586			Water Colu	mn (ft. h	.)	45					
ocation		Commer		,.CO			Casing Volu	me (gal	(2'' = 0.10)	6h, 4'' = 0.66		3 vols =			
Date	-	11/19/1					Borehole V	olume (g	(2" = 0	.73h, 4'' = 1	.15h) _	1			
Well Nur	nber _	hell	- 3				Total Gallo	ns Remo	ved		and the second				
Method		<u> </u>	4				Sample Nu			well.	3 7 3	0			
		Nize V	AIFN	East	wake										
Setup tin		ion (Mir	nutes)	Volume	Temp	DO	Spec. Cond.	pН	ORP/ REDOX (ReL.	Turbidity (NTU)	DTW (ft btoc)	Remarks	\$		
Time		Pump		(gallons)		(mg/L)	(µs/ms)	7.64	31.7	14.56					
914		21	1	21.5	16.3	0.74			30.6	15.34					
917		24		29.5	16-3	0.74		7.64	29.3	13.38		Increase rate			
		27		26.0	16.4	0.75		7.64	21.5	15.24					
920		30		28.0	14.5	6.75		7.64							
923	1000	33	-	29.5	16.7	0.76	458.6	7.64	27.3	13.38					
925		30		32.5	16.67	6.83	455,6	7,63	25,7	10.33					
728		-	-	39.0	168	6.97	4621	7.62	323	12.16					
731		39	1		16.7	1.13	466.5	7.00	329	11.32					
934		42	-	10-		1,14	467.0	7.59	35, 1	11.92					
737		45		39.0	17.0	1.09	466.1	7.59	34.0	12.30		1			
940		48		41.5	17.1			7.60	34.2	13.40					
943		51		43.0	17.1	1.04		7.61	32.3	15.03					
946		54		45.0	17.2	0.96	1			10.L					
110		57		47.0	17.3	6.20 mph	-	70							
949	• •														

Sample Analytes: VOCs - Site Specific (8260B) Dissolved Fe (200.7) (field filtered)

Pump off@ 10.03

Notes:

						**	ell Develo	pment /				Pg 10				
Project	Ŧ		kick le SI-48t	Quer			Fotal Depth		_	+4.00-1		2354				
Project N	lo. 🔒	396407	0.48	8586		1	Depth to Wa	ater (DTV	N) _	14.28	Veather _					
Location	(	ommer	ee City	8586 ;CO			Water Colu		-							
Date		"/15/	119				0	asing Volume (gal) $(2'' = 0.16h, 4'' = 0.66h)$ <u>3 vols =</u>								
Well Nur	nber	well	- 10				Borehole V	olume (g	al) $(2'' = 0.$	.73h, 4'' = 1	15h) _					
Method		-					Total Gallo	ns Remov	ved .							
Field Per	sonnel	nnel Nich A King Zach watter Sample Number & Time Well-10 1255														
Setup tin																
	Durati	on (Mir	utes)	Volume	Temp	DO	Spec. Cond.		ORP/ REDOX	Turbidity	DTW		Sandy			
Time	Surge			(gallons)	(°C)	(mg/L)	(µs/ms)	pН	(ReL.	(NTU)	(ft btoc)		Remarks			
1203		0		0	13.9	5.85	725	7.38	155.7	841.2						
1200		3		4	14.2	4.17	720	6.76	122.3	763.4						
1209		4		7	14.2	4.13	721	6.93	117,3	597.4						
12:12		9		ia. Ø	14.2	4.21	720	6.92	114.5	387.6						
1215		12		13.5	14,2	4.27	722	6.90	112.2	295.6						
1218		15		16	14,2	4,43	722	6.89	111.6	286.5	V					
1221		18		18.5	14.2	4.56	723	06.87	111.3	212.4						
1224		21		21	14.3	4.84	725	6.89	111, 1	195.6						
1227		21		23.5	14.2	5.04	726	6.88	1126	141.9	1					
1230		27		26	14.2	5.08	724	6.88		125.2		-				
1233		30		29	14.2	4.98	721	6.89		115.4						
1234		33		31,5	14.2	5.00		6.88		111.7						
1237		34		34	14,2			6.89		120, 2						
1412		39		36.5	14,3	5.33	727	6.8	99.7	78.4						

5 gul - 1207 10 25 gul - 1228.80 10 Jul - 121200 50 gul - 1234.00 15 Jul 1217 15 35 gul 12400 20 Jul 122300 35 gul 12400

Sample Analytes: VOCs - Site Specific (8260B)

Dissolved Fe (200.7) (field filtered)

Notes:

							Well Deve	opment	/ Purge F		Depth	P3 2062				
Locatio Date Well Nu Method Field Pe	roject No. $\frac{0396407 - 04885}{04885}$ ocation Commerce City, CO Canon city (3) rell Number $\frac{191243}{10243}$ rell Number $\frac{191243}{10243}$ ethod ethod eld Personnel Nick Alfre Zeyb, Walker							Total Depth $250$ Ind. S/N $2354$ Depth to Water (DTW) $14.25$ WeatherWater Column (ft. h.) $14.25$ WeatherCasing Volume (gal) (2" = 0.16h, 4" = 0.66h) $3$ vols =Borehole Volume (gal) (2" = 0.73h, 4" = 1.15h) $3$ vols =Total Gallons Removed $4$ Sample Number & Time $4$ <								
Setup tir	Durat	ion (Mi		Volume	Temp	DO	Spec. Cond.	pН	ORP/ REDOX (ReL.	Turbidity (NTU)	DTW (ft btoc)	Remarks				
Time	Surge	Pump	Bail	(gallons)	-	(mg/L)	(µs/ms)		99.1	70.8						
1245		42		39	14.3	5.54	728	6.89	99.5	47.1						
248		45			143	5.72	731		96.2	36.4						
251		48		44.5		5.83		6.89	98.7	28.5						
1.54		51		47.5	14.3	5.91	735	1.	10.1	20.0						
255				50	(	ollect	Jar	rple								
				-						>						
										-						
						/			NSTE							
						20						- Oft				
mple An	alytes: \ E	/OCs - S Dissolved	ite Spec I Fe (200	eific (8260E 0.7) (field f	3) iltered)			40 ge	al - 12	15 45		1302 pumpofr				
tes:								509	al - 12.	2130	1 6 F					

Notes:

·						Well	Deve	lop	ment / P	urge Form	·				
Project Project N Locatior Date Well Nu Method Field Pe	mber	Park 2-2 We	-dale 26-20 11-3	claire	· · · · · · · · · · · · · · · · · · ·			Dep Wat Casi Boro Tota	ehole Volu 11 Gallons	n (ft. h.) 1e (gal) (2″ = ( 1me (gal) (2″ :	Depth. Ind. S/N $49.35^{V}$ Weather So Supry 0.16h, 4" = 0.66h) = 0.73h, 4" = 1.15h)				
Time	Dura Surge	tion (Min Pump	utes) Bail	Volume (gallons)	Temp (°C)	DO (mg/L)	Spe Con (µs/1	ď.	pН	ORP/ REDOX (ReL. MV)	Turbidity (NTU)	Remarks			
н:07 <del>4:04</del> со	o	Ó		0	<u> </u>					Bi de la		Starl Pumping			
lt:n			·	5	15.7	3.3	- Su	۱	7-38	148.0	7	Starl Pumping 250 mL = 4 sec			
11 : ICe					16.1	1.79	.48	52	7.50	127.9		reduced flow			
1118												stop pumping			
			·····,					-				83.1 atw@14:59			
												· · ·			
Sample .	Analytes:	lytes: BTEX Napthalene (8020) TVPH (gas						15ma	od	I TEPH (diese	el) 8015 mod	Napthalene (8270) PAHs (610)			
		Nitrate Glycols RCRA Metal								VOC (8260)		Semi-Volatiles (8270)			
		General Water Chemistry (cations plus manganese, anions, chloride, s						sulfate, bicarl	bonate, and I	total alkalinity)					

1			•			Well	Develo	pment / P	urge Form					
Project		MM	Park	daleQ	MƏRR		T	otal Depth			Depth. Ind. S/N			· ·
Project I	No.	0489	8594	,			D	epth to Wate	21	52.6	Weather	50°P	Sur	ing
Locatior	ı	Parkd					W	Vater Colum						)
Date		2/20	0/20				С	asing Volum	ie (gal) (2" = 1	0.16h, 4" = 0	.66h)		-	
Well Nu	mber	Well-					В	orehole Volu	ime (gal) (2"	= 0.73h, 4" =	1.15h)			
Method							T	otal Gallons	Removed					
Field Pe	rsonnel	NICK	Alfin	s z Clair	e 0'T	Donnell	S;	ample Numb	er & Time			······································		
Time		ation (Min	<u> </u>	Volume	Temp	DO	Spec Cond.	-TT	ORP/ REDOX	Turbidity				
	Surge	Pump	Bail	(gallons)	(°C)	(mg/L)	(µs/ms	) pH	(ReL. MV)	(NTU)		Kem	arks	
12:17		0	:	0	·									
12:22				5	ts.s	0.33	.475	7.65	- 85.1	,	inigter le	ver at 72	. 65	12:24
12:27				9	16.1	.38	्यऽऽ	7.59	-25.2			- = 7 5 = 0		12:28
12:32				13	16.5	0.40	rų so		-7,7		250 mL:			
12:37				1,			.451	7.58	_		250 mL=	6 sec		15 gallons@ 12:35
				14	16.S	0.48	-450				250 ml = 9		(	20 gallons @12:45
12:42									·····		250 mL	= 9.5 se	د	
12:47				21	16:8	0.53	.450	7.58	0.71		materle	ves = 94.9	2	·····
Sample	Analytes:	BTEX Nitrat		Napthalene ( Glycols	(8020)			as) 8015mod TEPH (diesel) 8015 mod Napthalene (8270) etals F N/F VOC (8260) Semi-Volatiles (8270)				PAHs (610)		
				Chemistry (	cations pl			,				•		

.

х х.

.

i di <sup>ari</sup>												
* <b>*</b> *						Well	Devel	opment/P	urge Form		· ·	
Project			Darkda	le Quar	<u>(1</u>		ť.	rotal Depth			Depth. Ind. S/N	
Project N	Jo	04885		nc wyan	- <b>-</b>		,	Depth to Wat	or		Weather	
Location		Park-do		2				Water Colum			Weatter	
Date	L				···	<del></del>			. ,			
		2/26/						0	(gal) (2'' = 0)			
Well Nu	møer	Well	3						ıme (gal) (2" -	= 0.73n, 4 =	1.150)	
Method			(A) 1					Total Gallons				
Field Pe	rsonnel	NICK P	thing 9	Claire				Sample Num	ber & Time	<u> </u>		
	Dura	ation (Min	utes)	Volume	Temp	DO	Spec Cond		ORP/ REDOX	Turbidity		
Time	Surge	Pump	Bail	(gallons)	(°C)	(mg/L)	(µs/m		(ReL. MV)	(NTU)	Remarks	
											250 mL = 9.5 sec	
12:52				24	16.9	0.51	0.449	7.58	18.3		Nater Level: 95.67	
										,	250 mL = 6 seconds @ 12: 54 increased rate	
12:57				25.5	17.4	.48	.44	9 7.59	17.7		250 mL=16 seconds dtw=98tt	
											12:59 pump donivi	
<del>13:0</del> 2											13:09 pump on A set back to	
											voriginal setting water evel 87.17@13:12.250ml =7 sec	
13:14	,			29	17.6	<u>, S1</u>	0.451	7.61	1.9		Frater level 90.08@ 13:14	
						• • •				-	250 mL=9. Ssec 30gallong @ 13=18	
13:19				33	17.2	.49	0.4SL	17.60	11.4		dtw-94.8++	
											250 mL=10.5 Sec.	
13:24		34 17.1 .43						9 7.61	17.5		dtw = 96.4 ft	
-0		25 1411									250  mL = 12  sec	
13:29		35 17 .44						7 7.61	20.5	<u> </u>	dtnl = 97.5ft	
Sample	mple Analytes: BTEX Napthalene (8020) TVPH (gas)							5mod	TEPH (diese	EPH (diesel) 8015 mod Napthalene (8270) PAHs (610)		
		Nitra	te	Glycols		RCRA N	Metals 1	F N/F	VOC (8260)		Semi-Volatiles (8270)	
		General Water Chemistry (cations plus manganese, anions, chloride, sulfate, bicarbonate, and total alkalinity)								bonate, and	total alkalinity)	

Υ.

.

.

e 🥳 en j			· .			Well	Develo	pment / P	urge Form		
Project		MMT	ark-dal	e Quarr	U		, Tc	tal Depth			Depth. Ind. S/N
Project N	Io.	04885			)		De	epth to Wate	er		Weather
Location		Parkde					w	ater Colum	n (ft. h.)		
Date		226					Ca	sing Volum	te (gal) (2″ = (	0.16h, 4" = 0.	.66h)
Well Nu	mber	Well 2		L			Bo	orehole Volu	ıme (gal) (2"	= 0.73h, 4" =	1.15h)
Method							To	tal Gallons	Removed		
Field Per	rsonnel	Nick	Alfino ·	a Claive	O'Don	nell	Sa	mple Numł	oer & Time		
Time	Dura Surge	tion (Min Pump	utes) Bail	Volume (gallons)	Temp (°C)	DO (mg/L)	Spec Cond. (µs/ms)	pH	ORP/ REDOX (ReL. MV)	Turbidity (NTU)	Remarks
		1 unip					(µ0/ 110)	1	(1002:111)		91W= 98.4 ft
13:34				38	17.0	.48	.447	7.61	23.6	-	2SUML = 12 Sec
			******							,	dtw= 99.42 40 gall@ 13:43
13:39				39	170	.52	.448	7.61	26 1		250mL=12 sec
13:44				41	17.0	• \$\$	.448	7.61	30.5		$\frac{4tw}{=100}, \frac{42}{2}$
					17.0	- 0					$4t_{\rm N} = 100.9$
13:49				43	16.9	.57	.૫૫૪	7.61	33		250 mL = 12 sec
											dtw = 101.27 45gal@13:5
13:54				44	17.1	<u>.</u> 59	. 448	7.61	34		250 ml = 12 sec
13:59			ı	46	1.4	.62	.44	8 7.61	38.3		dtw = 101.5 250 mL=12 ce c
14:04				47	17.1	. 65	-449		41.3		atw=102 250mL=13 sec
Sample /	Analytes:	lytes: BTEX Napthalene (8020) TVPH (gas						nod	TEPH (dies	el) 8015 mod	
		Nitrate Glycols RCRA Metals F							VOC (8260)		Semi-Volatiles (8270)

Ν.

			• .			Well	Develop	ment / P	urge Form		
Project Project N Location Date Well Nu Method Field Pe	No. 1 Imber	04880 Parkde 2126 Well 3	596 16 CO 120 3	ale Qua Uaire O			Dep Wa Cas Bor Tot		Depth. Ind. S/N Weather .66h) 1.15h)		
Time	Dura Surge	tion (Min Pump	utes) Bail	Volume (gallons)	Temp (°C)	DO (mg/L)	Spec Cond. (µs/ms)	pH	ORP/ REDOX (ReL. MV)	Turbidity (NTU)	Remarks
14:08				49 50	17 16.9	. 67	<u>.५५</u> ९ .५५१	7.62	43.7	,	dtwi= 102.45 2.50 mL = 13.52. dtw = - 102.45. 2.50 mL = PUMP off at 14:29 on In Situ DTW 102.45 14:30 actual DTW 90.00 2:42 pm DTW 90.00 2:42 pm PUL pump
							gas) 8015m Ietals F 1 ese, anions	N/F	TEPH (diese VOC (8260) sulfate, bicart	·	Semi-Volatiles (8270)