



HYDROGEOLOGY FRAMEWORK AND IMPACT ASSESSMENT BURNCO WEST COCHRANE #2 GRAVEL PIT

Prepared for:
BURNCO ROCK PRODUCTS LTD.

Prepared by:
MATRIX SOLUTIONS INC.

Version 1.0
September 2022
Calgary, Alberta

Suite 600, 214 - 11 Ave. SW
Calgary, AB T2R 0K1
T 403.237.0606 F 403.263.2493
www.matrix-solutions.com

HYDROGEOLOGY FRAMEWORK AND IMPACT ASSESSMENT
BURNCO WEST COCHRANE #2 GRAVEL PIT

Prepared for BURNCO Rock Products Ltd., September 2022



Ryley Killam, B.Sc., P.Geo.
Hydrogeologist



reviewed by
Goetz Aust, P.Eng.
Principal Hydrogeological Engineer

PERMIT TO PRACTICE MATRIX SOLUTIONS INC.	
RM SIGNATURE:	
RM APEGA ID #:	<u>79091</u>
DATE:	<u>September 28 2022</u>
PERMIT NUMBER: P005540	
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)	

DISCLAIMER

Matrix Solutions Inc. certifies that this report is accurate and complete and accords with the information available during the project. Information obtained during the project or provided by third parties is believed to be accurate but is not guaranteed. Matrix Solutions Inc. has exercised reasonable skill, care, and diligence in assessing the information obtained during the preparation of this report.

This report was prepared for BURNCO Rock Products Ltd. The report may not be relied upon by any other person or entity without the written consent of Matrix Solutions Inc. and of BURNCO Rock Products Ltd. Any uses of this report by a third-party, or any reliance on decisions made based on it, are the responsibility of that party. Matrix Solutions Inc. is not responsible for damages or injuries incurred by any third-party, as a result of decisions made or actions taken based on this report.

CONTRIBUTOR TABLE

Name	Job Title	Role
Ryley Killam, B.Sc., P. Geo.	Hydrogeologist	Co-author
Cameron Veilleux, M.Sc., G.I.T.	Geoscientist in Training	Co-author
Justin Bates	Environmental Technologist Student	Co-author
Goetz Aust, P.Eng.	Principal Hydrogeological Engineer	Engineering technical review

VERSION CONTROL

Version	Date	Issue Type	Filename	Description
V0.1	23-Sep-2022	Draft	26388-512x Municipal R 2022-09-23 draft V0.1.docx	Issued to client for review
V1.0	30-Sep-2022	Final	26388-512x Municipal R 2022-09-30 final V1.0.docx	Issued to client

TABLE OF CONTENTS

1	INTRODUCTION	7
2	SCOPE OF WORK	7
3	BACKGROUND	8
4	REGIONAL SETTING	8
	4.1 Physiography	8
	4.2 Geology	8
	4.3 Hydrogeology	9
5	SITE DRAINAGE AND HYDROLOGY	9
6	SITE GEOLOGY AND HYDROGEOLOGY	9
7	FIELD INVESTIGATIONS	10
	7.1 Safety	10
	7.2 2021 Drilling and Wells Completion	10
	7.3 Groundwater Sampling and Monitoring.....	11
	7.3.1 2018 Groundwater Sampling and Monitoring.....	11
	7.3.2 2021 Groundwater Sampling and Monitoring.....	11
	7.3.3 2022 Groundwater and Spring Sampling and Monitoring.....	11
	7.4 Hydraulic Conductivity Testing	12
	7.5 Soil Aggregate Sampling and Testing	12
	7.6 Field-verified Survey	12
8	LOCAL GROUNDWATER USERS	13
	8.1 Water Wells	13
	8.2 Water Diversion Licences.....	13
9	RESULTS	14
	9.1 Hydrogeology of Gravel Units	14
	9.1.1 Groundwater Elevations	14
	9.1.2 Groundwater Flow	15
	9.1.3 Precipitation and Evaporation	15
	9.2 Hydrogeology of Bedrock Units	16
	9.2.1 Groundwater Elevations	16
	9.2.2 Hydraulic Conductivity	16
	9.3 Groundwater Quality of Gravel Units	17
	9.3.1 Field-measured Parameters.....	18
	9.3.2 General and Inorganic Parameters	18
	9.3.3 Dissolved Metals	18
	9.3.4 Hydrocarbons.....	18
	9.4 Groundwater Quality of Bedrock Units	19
	9.4.1 Field-measured Parameters.....	19
	9.4.2 General and Inorganic Parameters	19

	9.4.3	Dissolved Metals	20
	9.4.4	Hydrocarbons.....	20
9.5		Groundwater Quality of Springs	20
	9.5.1	Field-measured Parameters.....	20
	9.5.2	General and Inorganic Parameters.....	21
	9.5.3	Dissolved Metals.....	21
9.6		Quality Control Sampling	21
9.7		Field-verified Survey	21
10		GROUNDWATER FLOW DISCUSSION	22
11		WATER QUALITY DISCUSSION.....	23
	11.1.1	Groundwater Quality	23
	11.1.2	Groundwater Total Metals Analyses	23
	11.1.3	Aggregate Characterization	24
	11.1.4	Potential Impact Implications.....	24
12		SUMMARY.....	25
13		POTENTIAL IMPACTS OF AGGREGATE DEVELOPMENT.....	26
14		GROUNDWATER MONITORING PROGRAM.....	27
15		REFERENCES.....	29

IN-TEXT TABLES

TABLE A	Gravel Units Groundwater Monitoring Well Water Level Summary.....	14
TABLE B	Gravel Units Available Groundwater Elevation Summary Data	15
TABLE C	Bedrock Units Groundwater Monitoring Well Water Level Summary	16
TABLE D	Bedrock Units Available Groundwater Elevation Summary Data.....	16
TABLE E	Gravel Units Water Quality Parameter Summary.....	17
TABLE F	Bedrock Units Water Quality Parameter Summary.....	19
TABLE G	Vertical Hydraulic Gradients	23
TABLE H	Groundwater Monitoring Program.....	28

FIGURES

FIGURE 1	Site Location
FIGURE 2	Study Area Topography
FIGURE 3	Bedrock Geology
FIGURE 4a	Cross-section A-A'
FIGURE 4b	Cross-section B-B'
FIGURE 5	Groundwater Monitoring Well and Spring Locations
FIGURE 6	Water Wells Within Search Area
FIGURE 7	Active Groundwater and Surface Water Diversion Licences Within a 1.61 km Radius of the Site
FIGURE 8	Saturated Gravel Thickness in the Project Area
FIGURE 9	Groundwater Flow Map - Sand and Gravel Wells October 2021
FIGURE 10a	2021 Piper Diagram - Sand and Gravel Wells
FIGURE 10b	2021 Piper Diagram - Bedrock Wells
FIGURE 10c	2022 Piper Diagram - Springs

TABLES

TABLE 1	Monitoring Well Summary
TABLE 2	Groundwater Quality Results - Field Parameters
TABLE 3	Groundwater Quality Results - General and Inorganic Parameters
TABLE 4	Groundwater Quality Results - Dissolved Metals
TABLE 5	Groundwater Quality Results - Total Metals
TABLE 6	Groundwater Quality Results - Hydrocarbons
TABLE 7a	Water Wells
TABLE 7b	Active Surface Water and Groundwater Licences
TABLE 8	Water Quality Control Sample Results - General and Inorganic Parameters

APPENDICES

APPENDIX A	2014 Levelton Groundwater Evaluation
APPENDIX B	Geologic Logs and Well Completion Details
APPENDIX C	Hydraulic Conductivity Tests
APPENDIX D	Soil Aggregate Sampling and Testing Memorandum
APPENDIX E	Field-verified Survey
APPENDIX F	Hydrographs
APPENDIX G	Preliminary Hydrogeology Inputs
APPENDIX H	Laboratory Reports

1 INTRODUCTION

BURNCO Rock Products Ltd. (BURNCO) is currently operating the West Cochrane Gravel Pit which is located approximately 5 kms west of Cochrane. This site, located within NW ¼ 13-026-05 W5M, was first opened in 2016, and provides aggregate (sand and gravel) to construction projects in the Cochrane and Calgary areas.

To meet with market needs, BURNCO is proposing to increase and secure the permitted lands, located in Sections 14 and 15 of 026-05 W5M (Figure 1), and is referred to as the BURNCO West Cochrane #2 Gravel Pit (the project). This will provide for a long-term source of aggregate for the Cochrane and Calgary areas. It is envisioned that this site will continue to supply aggregates in the years ahead and will also become a washing location which will provide high quality aggregates for use in asphalt and ready-mix production.

BURNCO retained Matrix Solutions Inc. (Matrix) to update the groundwater impact assessment of the proposed development. This report summarizes the desktop review and field assessment of the site's local and regional geology and hydrogeology including depth to groundwater, flow direction in the surficial deposits, groundwater quality and quantity, and potential impacts to groundwater quantity or quality in the shallow subsurface from gravel pit operations. The sizing of the recharge ponds for the project are provided in the stormwater management report (Matrix 2021).

2 SCOPE OF WORK

To meet the hydrogeological requirements as outlined in the *Code of Practice for Pits* (AENV 2004) and support required *Water Act* applications, Matrix undertook the following tasks in this assessment:

- reviewing geological and hydrogeological data to identify and characterize local and regional geology and develop a hydrogeological framework for the site
- reviewing all existing water wells data within a 1.6 km radius of the site
- assessing the site hydrogeological conditions including hydraulic conductivity, recharge/discharge conditions, depth to water level, baseline groundwater conditions, and flow direction in the aggregates deposit
- assessing potential impact of the gravel mining operations on groundwater resources
- assess potential effects from dewatering during operations in accordance with the *Alberta Environment Guide to Groundwater Authorization* (AENV 2011)
- drill six monitoring wells, including bedrock monitoring wells, to enhance the groundwater monitoring network and investigate the bedrock
- groundwater monitoring and sampling
- installation of permanent pressure transducers for long-term monitoring
- hydraulic conductivity testing

- update the existing conceptual site model

3 BACKGROUND

Levelton Consultants Ltd. (Levelton) conducted a groundwater evaluation of the McDougall Ranch Gravel Pit and surrounding area in 2014 (Appendix A). Matrix conducted a hydrogeological framework and investigation of the project in 2018 (Matrix 2019).

The groundwater evaluation included the existing groundwater monitoring well network located in Sections 14 and 15 of 026-05 W5M (Figure 1). Findings from the Levelton 2014 evaluation and Matrix 2018 investigation were used to update this groundwater impact assessment.

Test hole data outlining overburden, gravel thickness, depth to bedrock, and top of gravel, and bottom of gravel surfaces were supplied by BURNCO throughout the project area.

4 REGIONAL SETTING

4.1 Physiography

The regional area is located within the South Saskatchewan River Basin. Regional topography varies, with topographic highs to the west and flattening to the east. Topography within a 5 km radius of the property is variable and ranges from about 1,350 m above sea level (asl) at the ridge tops to 1,140 m asl along the Bow River valley (Figure 2). The Grand Valley Creek is located on the east side of the site and the Beaupré Creek is on the west side, both creeks drain south to the Bow River.

4.2 Geology

The Foothills of Alberta are composed of heavily deformed and faulted Cretaceous-aged bedrock (Ollerenshaw 1978). The regional upper bedrock geology comprises a foreland basin depositional environment and consists of the subcropping Paskapoo Formation (Prior et al. 2013). The upper bedrock includes the Disturbed Belt to the west, the Paskapoo, and the Upper Scollard formations (HCL 2002). The Paskapoo Formation in central-northern Alberta can be subdivided into the Dalehurst, Lacombe, and Haynes members (Demchuk and Hills 1991). It comprises greenish sandy siltstone and mudstone with light grey, thick-bedded sandstone, deposited in non-marine environment (Grasby et al. 2008).

Surficial deposits in the area are quite variable. The uplands consist of thin and discontinuous Pleistocene-aged draped moraine (till) overlying bedrock. The valleys consist of Pleistocene-aged lacustrine and fluvial deposits. Lacustrine deposits have a maximum thickness of 80 m and are located at the base of the Beaupré Creek and Grand Valley Creek valleys. The main surficial depositional processes in the study area include glacial, glaciolacustrine, glaciofluvial, and recent fluvial deposition of the modern day Bow River (Bayrock and Reimchen 1980; Fisher, T.G. 1999).

4.3 Hydrogeology

Surficial deposits are mainly less than 50 m thick, except for linear bedrock lows where the thickness of surficial deposits may exceed 100 m (HCL 2002). The Buried Calgary Valley is the main linear bedrock low in the region and other linear bedrock lows are present in the form of meltwater channels (Shetsen 1987). The main surficial aquifers are sand and gravel deposits. The lower surficial deposits include pre-glacial fluvial and lacustrine deposits and the upper surficial deposits include glacial till deposits and meltwater deposits (HCL 2002). The surficial deposits can be categorized into three hydrogeological units; the sand and gravel of the lower surficial deposits, the saturated sand and gravel of the upper surficial deposits, and the unsaturated sand and gravel deposits of the upper surficial deposits (HCL 2002). The sand and gravel deposits are associated with the Buried Calgary Valley (HCL 2002).

Generally, groundwaters of the surficial deposits have a total dissolved solids (TDS) concentration greater than 500 mg/L. Groundwaters with TDS concentrations less than 500 mg/L, mainly occur in the Disturbed Belt area (HCL 2002). The apparent yield in the upper sand and gravel aquifer can be greater than 100 m³/day, northwest of the site. Apparent yields of the lower sand and gravel aquifers range from less than 10 m³/day to greater than 100 m³/day (HCL 2002).

The upper bedrock in the area includes the Disturbed Belt, the Paskapoo, and the Upper Scollard formations. The TDS concentrations of the upper bedrock aquifers range from less than 500 mg/L to greater than 3,000 mg/L (HCL 2002). The apparent yield of the upper bedrock aquifers are generally between 10 to 75 m³/day, the areas with yields greater than 75 m³/day are associated with linear bedrock lows (HCL 2002).

5 SITE DRAINAGE AND HYDROLOGY

The site is located in the northwestern part of the Bow River Basin, which consists of an effective drainage area of 25,000 km², and is drained regionally by the Bow River and its tributaries. Major tributaries include the Elbow and Kananaskis rivers to the south. Locally, the site is drained by an unnamed creek and the Bow River to the south, the Grand Valley Creek to the east, and the Beaupré Creek to the west (Figure 1).

6 SITE GEOLOGY AND HYDROGEOLOGY

The project is located at the edge of Deformed Belt of the Western Canadian Cordillera. Most of the project overlies deformed (folded and faulted) Cretaceous to Paleogene strata of the Brazeau and Coalspur formations (Prior et al. 2013; Figure 3). Two thrust faults within these units have specifically been mapped trending north-northwest to south southeast, beneath the project site. The Paleogene-aged Paskapoo Formation subcrops beneath the site and is inferred to be less deformed than the bedrock strata on the west side. All of these bedrock units comprise interbedded layers of shale, sandstone and coal deposited in non-marine fluvial environments (Glass 1990).

Surficial deposits overlie bedrock over most of the assessment area, except where bedrock has been exposed due to erosional processes. A series of boreholes have been installed in the assessment areas, with surficial sediments thicknesses ranging from 2 m more proximal to recent erosional features, up to 10 m in non-eroded areas.

The upper most sediments at the site consist of gravel, sand and gravel, clay, silty clay, and clay till. The main surficial depositional processes in the study area include glacial, glaciolacustrine, glaciofluvial, and recent fluvial deposition of the modern day Bow River (Bayrock and Reimchen 1980; Fisher, T.G. 1999).

A west to east cross-section and a north to south cross-section illustrating the stratigraphy at site are shown on Figures 4a and 4b, respectively. Cross sections A-A' and B-B' (Figures 4a and 4b), show the overburden overlaying the sand and gravel. Across the site, the overburden thins southward, and the gravels show a slight thinning to the west.

7 FIELD INVESTIGATIONS

7.1 Safety

Matrix personnel were required to comply with legislated, Matrix, and BURNCO health and safety standards.

7.2 2021 Drilling and Wells Completion

Matrix installed six monitoring wells across the property between November 22 and November 26, 2021, with the existing 12 monitoring wells (Appendix A) west of Grand Valley Creek (Figure 5), resulting in a 18 monitoring well network to characterize site geology and hydrogeology.

Drilling and well installation was completed using an ODEX rig; the equipment and manpower to drill and complete the monitoring wells were supplied by Earth Drilling of Calgary, Alberta. Matrix field personnel examined and recorded lithology at every 1.5 m interval.

The wells were completed to depths between 9.1 and 41.2 m below ground surface (bgs) with 51 mm (2-inch) internal diameter PVC casings and slotted screens (0.010-inch) in the wellbore. The annular space between the screen and the wellbore was backfilled with 10-20 filter pack sand. Bentonite seal was placed over the sand pack, and the remainder of the annular space was filled with bentonite chips or cuttings to prevent the inflow of surface water (Appendix B). A protective metal surface casing with a locking cap was installed over the aboveground well pipe. The monitoring wells summary is included in Table 1.

Following drilling, Solinst Levellogger® (non-vented, 10 m) pressure transducers were installed in nest well pair MW21-2a and MW21-2b, approximately 1 m off the bottom of the well to continuously monitor shallow groundwater levels.

7.3 Groundwater Sampling and Monitoring

7.3.1 2018 Groundwater Sampling and Monitoring

Groundwater monitoring wells were sampled on November 7, 2018. Field-measured parameters (including temperature, pH, and electrical conductivity [EC]) were collected during sampling and are included in Table 2.

Groundwater samples were collected and submitted to AGAT Laboratories Ltd. in Calgary, Alberta, for routine chemical parameter analyses. Preservatives were added to the metals samples in the field. For the dissolved metal sample, water was filtered (using a 45 µm filter) before adding the preservative. The samples were placed in bottles supplied by AGAT and stored in coolers on ice. Groundwater sample analytical results are included in Tables 3 to 6.

7.3.2 2021 Groundwater Sampling and Monitoring

The existing well network, including one bedrock well owned by BURNCO, were sampled on October 25 and 26, 2021. The wells drilled and installed in 2021 were sampled on November 26 and 29, 2021. Field-measured parameters (including temperature, pH, and EC) were collected during sampling and are included in Table 2.

Groundwater samples were collected and submitted to Element Materials Technology Canada Inc. in Calgary, Alberta, for routine chemical parameters, dissolved metals, total metals, total suspended solids, and turbidity analyses. Dissolved petroleum hydrocarbons (benzene, toluene, ethylbenzene, and xylenes were obtained from MW21-2a and MW21-2b). Preservatives were added to the metals samples in the field. Dissolved metal samples were taken for all wells and water was filtered (using a 45 µm filter) before adding the preservative. The sample collected at MW21-1b for dissolved metals was not filtered or preserved in the field due to the groundwater being too turbid to filter. The samples were placed in bottles supplied by Element and stored in coolers on ice. Groundwater sample analytical results are included in Tables 3 to 6 and contain historical results.

7.3.3 2022 Groundwater and Spring Sampling and Monitoring

Eight springs were sampled between May 10 and May 12, 2022. Field-measured parameters (including temperature, pH, and EC) were collected during sampling and are included in Table 2.

Groundwater samples were collected and submitted to Element Materials Technology Canada Inc. in Calgary, Alberta, for routine chemical parameters, dissolved metals, total metals, total suspended solids, and turbidity analyses. Preservatives were added to the metals samples in the field. Dissolved metal samples were filtered (using a 45 µm filter) before adding the preservative. The samples were placed in bottles supplied by Element and stored in coolers on ice. Groundwater and spring sample analytical results are included in Tables 3 to 6.

7.4 Hydraulic Conductivity Testing

Hydraulic conductivity testing was conducted on November 26, 2021 at monitoring well MW21-2b. Further conductivity testing was conducted between May 11 and 12, 2022 at monitoring wells MW21-2a and MW21-1b. The hydraulic conductivity test was conducted using a slug recovery test (Appendix C). For each test conducted, an unvented pressure transducer was installed in the well. Hydraulic conductivity test analysis to determine hydraulic conductivity was facilitated using the software package AQTESOLV PRO™ 4.5 (HydroSOLVE 2007).

A conventional hydraulic conductivity test was not conducted at MW21-1b. The Waterra tubing installed in the well was removed, resulting in a displacement of the fluid level. The slow recovery during the first 3 days monitoring resulted in an estimated recovery time greater than 20 days resulting in a hydraulic conductivity of less than 10⁻⁸ m/s (Hvorslev 1951).

7.5 Soil Aggregate Sampling and Testing

A soil aggregate sampling and testing program was conducted on October 25, 2021, by BURNCO personnel. Details of the soil aggregate sampling and results are included in Appendix D.

7.6 Field-verified Survey

A field-verified survey (FVS) was conducted between June 18, 2018, and May 28 to September 16, 2019, to supplement the FVS that was conducted by Levelton in 2014 (Appendix A), and BURNCO in 2016. The FVS aimed to obtain baseline information about local water users and to establish their proximity to the site. A questionnaire modified from the *Alberta Environment Guide to Groundwater Authorization* (AENV 2011) was used to conduct an interview with the landowners. A search of well and landowner information from Alberta Environment and Parks (AEP) and AbaData™ (Abacus 2018) within a 1.61 km radius of the project site was conducted to identify residential wells. A review of the county maps and an open house meeting held by BURNCO was used to identify and contact landowners via telephone. At the discretion of the landowners, the surveys were conducted in person at the property, or over the telephone. A portion of the FVS was conducted by Ann McNabb and McKendrick Ranches Ltd. on the water sources at Ann McNabb's and McKendrick Ranches properties.

The field verification survey included:

- contacting all well owners to arrange for access the wells
- collecting GPS coordinates of the wells
- leaving a site visit letter at the property if the landowner was not present at the residence

The FVS summary, FVS documents supplied by Ann McNabb and McKendrick Ranches, the 2016 FVS completed by BURNCO, completed questionnaires, and site visit letters are included in Appendix E.

8 LOCAL GROUNDWATER USERS

Matrix updated the water well and licenced water users search from 2018, by conducting a 1.61 km radius search surrounding the project area to identify any new water wells or licences.

8.1 Water Wells

A search of well information from AEP water well database (AEP 2022a) was completed on January 27, 2022 and identified 48 records within a 1.6 km radius of the project area (Table 7a, Figure 6). These include 45 water wells and three springs. The wells ranged in depth from 18.29 to 110.00 m bgs and the majority of the wells are listed for domestic and stock use. Based on the listed completion information and associated depth to bedrock for the water wells, 25 out of the 45 wells are interpreted to be completed in the bedrock and 3 wells (GIC 2079054, 386523, 1465045; water well numbers 8, 11, and 173; Table 7a) are interpreted to be completed in sand and gravel.

The groundwater wells interpreted to be completed in the sand and gravel are located greater than 850 m to the northeast of the site, and are listed as for being used for domestic and stock use (Figure 6). The records for the remaining 17 wells did not include adequate information to determine the depth to bedrock. The water well information suggests that the surficial deposits are generally neither a dependable nor significant water supply aquifer in the area. The presence of three springs in the records and eight springs in the FVS (Matrix 2019) suggest that the site is near or within a groundwater discharge area (Table 7a; Appendix E, Table E1; Figure 6).

8.2 Water Diversion Licences

A search of active surface and groundwater licences within a 1.61 km (1 mile) radius of the project site identified 43 diversion licences as of January 28, 2021, (Table 7b, Figure 7). The search identified five active groundwater licences, sourced from unnamed aquifers, while the remaining 38 licences are granted for surface water use. Out of the 38 surface water licences, 14 are sourced from unnamed streams, six are sourced from the Bow River, 12 from Grand Valley Creek, four from Beaupré Creek, and two from surface runoff.

Of the five active groundwater diversion licences, only one is located within the project boundary. This is a registered groundwater diversions (water well) license at this location and is installed within the bedrock. There are two registered water well diversions, proximal to the site boundary, located downgradient, and completed within the bedrock. Two of the registered water well diversions are located upgradient of the site and the remaining two registered water well diversions are located downgradient of the site (Figure 7).

All six diversions on the Bow River are located downstream from the site; 11 of the unnamed streams diversions are located upgradient from the site; 10 Grand Valley Creek diversions are located upgradient

from the site all four Beupré Creek diversions are located upgradient from the site; and one surface runoff diversion is upgradient of the site (Figure 7).

9 RESULTS

9.1 Hydrogeology of Gravel Units

9.1.1 Groundwater Elevations

Matrix manually measured depths to groundwater on November 7, 2018, October 25 and 26, 2021, and May 10, 2022, and are included in Table A. A summary of all available groundwater elevation data is provided in Table B. Water levels recorded in pressure transducers installed in the monitoring wells were reviewed and compensated for atmospheric conditions. A total of 12 hydrographs, of which 11 hydrographs are for sand and gravel aquifer monitoring wells, were created based on available and usable data from July 2012 to May, 2022 (Appendix F).

The groundwater levels varied across the study area. Generally, the wells displayed seasonal fluctuations ranging between 0.4 to 0.9 m and water levels were near the base of the gravel. Numerous wells display sudden water level increases, which suggest local rapid recharge likely from spring snow melt and runoff.

TABLE A Gravel Units Groundwater Monitoring Well Water Level Summary

Well ID	Manual Water Level Depth to Groundwater on Nov. 7, 2018 (m bgs)	Groundwater Elevation on Nov.7, 2018 (m asl)	Manual Water Level Depth to Groundwater on Oct. 25/26, 2021 (m bgs)	Groundwater Elevation on Oct. 25/26, 2021 (m asl)	Minimum Depth to Water from 2012 to 2021 (m bgs)	Maximum Depth to Water from 2012 to 2021 (m bgs)
MW10-1	6.20	1,171.73	6.55	1,171.08	5.75	7.14
MW10-2	5.49	1,170.73	5.46	1,170.76	5.16	6.52
MW10-3 ²	5.73	1,170.25	6.14	1,169.84	5.66	6.14
MW12-1	7.51	1,171.19	7.55	1,171.15	7.19	7.79
MW12-2 ³	8.43	1,174.26	8.40	1,174.29	8.18	9.85
MW12-3	5.63	1,170.40	5.57	1,170.46	5.30	7.29
MW12-4 ²	4.80	1,166.39	Well removed	Well removed	4.80	5.20
MW12-5	4.98	1,166.94	4.95	1,166.97	4.06	5.14
MW12-6	10.13	1,175.27	10.13	1,175.27	9.84	10.31
MW12-7	6.78	1,172.07	Dry	Dry	5.98	7.15
MW12-8 ²	Dry	Dry	Dry	Dry	7.55	7.59
MW12-9	5.66	1,178.62	5.69	1,178.59	5.17	5.95
MW21-2A ^{1,3}	N/A	N/A	7.05	1,137.70	6.96 ²	7.11 ²

1 - water level/groundwater elevation collected on November 26, 2021

2 - water level value collected from a manual water level

3 - water level/groundwater elevation collected up to May 10, 2022

TABLE B Gravel Units Available Groundwater Elevation Summary Data

Well ID	Manual Water Levels Collected	Transducer Data Collected
MW10-1	March 2012, May 2013, November 2018, October 2021	July 2012 to November 2020
MW10-2	March 2012, May 2013, November 2018, October 2021	July 2012 to November 2020
MW10-3	March 2012, May 2013, November 2018, October 2021	None
MW12-1	March 2012, May 2013, November 2018, October 2021	July 2012 to October 2021
MW12-2	March 2012, May 2013, November 2018, October 2021, November 2021	July 2012 to October 2021
MW12-3	March 2012, May 2013, November 2018, October 2021	July 2012 to October 2021
MW12-4	March 2012, May 2013, November 2018, October 2021	None
MW12-5	March 2012, May 2013, November 2018, October 2021	July 2012 to October 2021
MW12-6	March 2012, May 2013, November 2018, October 2021	July 2012 to October 2021
MW12-7	March 2012, May 2013, November 2018, October 2021	July 2012 to November 2018
MW12-8	March 2012, May 2013, November 2018, October 2021	July 2012 to November 2020
MW12-9	March 2012, May 2013, November 2018, October 2021	July 2012 to May 2018
MW21-2A	November 2022	November 2021 to May 2022

1 - data unusable

A saturated gravel thickness contour map was generated using water elevation data and the base of sand and gravel surface supplied by BURNCO and remains relatively unchanged from 2018. There was a general decrease in water levels within the sand and gravel wells from 2018 to 2021. However, with the addition of the new MW21-2a sand and gravel well, the saturated thickness map was updated (Figure 8) The gravels were moderately saturated ranging from 1 to 2 m in the east corners of the study area, where most of the remaining area had minimal if any water saturated gravels. (Figure 8). Determining inflow in areas where mining will occur in the saturated thickness zones and estimations of required water diversion based upon saturated thickness and mining area is included in Appendix G.

9.1.2 Groundwater Flow

The sand and gravel groundwater monitoring network encountered shallow groundwater at depths ranging from 4.95 m bgs (MW12-5) to 10.13 m bgs (MW12-6) on October 25 and 26, 2021.

Groundwater elevations west of Grand Valley Creek, based upon groundwater monitoring well data and test hole data, suggests a groundwater flow to the south to southeast that generally follows topography (Figure 9).

9.1.3 Precipitation and Evaporation

Based on monthly precipitation data supplied by the Government of Canada (between 1961 and 2004), annual precipitation in the Cochrane area is approximately 450 mm (GoC 2018). The average annual areal evapotranspiration at the Calgary International Airport is 405 mm (ESRD 2013). The annual precipitation is greater than the annual evapotranspiration, suggesting that precipitation could support recharge of the shallow groundwater in the area.

9.2 Hydrogeology of Bedrock Units

9.2.1 Groundwater Elevations

Matrix manually measured depths to groundwater on November 29, 2021 and are included in Table C and a summary of all available groundwater elevation data is provided in Table D. Water levels recorded in pressure transducers installed in the monitoring wells were reviewed and compensated for atmospheric conditions. A hydrograph (MW21-2b nested with MW21-2a) was created based on available and usable data from November 29, 2021 to May 10, 2022 (Figure F11; Appendix F).

TABLE C Bedrock Units Groundwater Monitoring Well Water Level Summary

Well ID	Manual Water Level Depth to Groundwater on Nov. 29, 2021 (m bgs)	Groundwater Elevation on Nov. 29, 2021 (m asl)	Manual Water Level Depth to Groundwater on May 10/11, 2022 (m bgs)	Groundwater Elevation on May 10/11, 2022 (m asl)	Minimum Depth to Water from 2018 to 2022 (m bgs)	Maximum Depth to Water from 2018 to 2022 (m bgs)
MW21-1A	17.88	1,164.12	9.39	1,172.61	9.93	17.88
MW21-1B	11.71	1,171.71	8.82	1,174.60	8.82	11.71
MW21-2B	7.10	1,172.63	6.94	1,172.79	6.31	7.51
MW21-3	4.39	1,168.12	-	-	-	-
MW21-4	39.99	1,137.70	12.60	1,165.09	39.99	12.60
Bedrock Well 5	-		23.24	1,177.74	-	-

m bgs - metre below ground surface

m asl - metre above sea level

TABLE D Bedrock Units Available Groundwater Elevation Summary Data

Well ID	Manual Water Levels Collected	Transducer Data Collected
MW21-1A	November 2021 and May 2022	None
MW21-1B	November 2021 and May 2022	None
MW21-2B	November 2021 and May 2022	November 2021 to May 2022
MW21-3	November 2021 and May 2022	None
MW21-4	November 2021 and May 2022	None
Bedrock Well 5	May 2022	None

9.2.2 Hydraulic Conductivity

Hydraulic conductivity response tests were conducted at MW21-2b in 2021 and at MW21-2a and MW21-1b in 2022. The hydraulic conductivity values were estimated to be 1×10^{-5} m/s at groundwater well MW21-2b and 2×10^{-4} m/s at MW21-2a. A hydraulic conductivity value at MW21-1b was not calculated, but the hydraulic conductivity value is estimated to be less than 1×10^{-8} m/s based on estimated days of recovery (Hvorslev 1951) and the recovery measurements after the initial displacement.

Other bedrock wells drilled in 2021 had slow recovery observed following drilling and sampling, and the overall permeability of the bedrock in the area is likely less than 1×10^{-6} m/s; further testing is required to confirm the bedrock permeability and variability. Alternatively, hydraulic conductivity of sandstone can range between 3×10^{-10} and 6×10^{-6} m/s (Domenico and Schwartz 1990).

Hydraulic conductivity testing results are provided Appendix C and results included in Table 1.

9.3 Groundwater Quality of Gravel Units

Matrix sampled the sand and gravel wells on November 7, 2018, October 25 and 26, 2021, and November 26, 2021. The following groundwater monitoring wells were not sampled due to the wells being dry or having limited water: MW12-5, MW12-7, and MW12-8. Laboratory reports are provided in Appendix H. A summary of the water quality parameters collected at the gravel units are provided in Table E.

TABLE E Gravel Units Water Quality Parameter Summary

Well ID	Field Parameters	General and Inorganic Parameters	Dissolved Metals	Total Metals	Hydrocarbons
MW10-1	November 2018 October 2021	November 2018 October 2021	October 2021	October 2021	N/A
MW10-2	November 2018 October 2021	November 2018 October 2021	October 2021	October 2021	N/A
MW10-3	November 2018 October 2021	November 2018 October 2021	October 2021	October 2021	N/A
MW12-1	Insufficient volume				N/A
MW12-2	November 2018 October 2021	November 2018 October 2021	October 2021	October 2021	N/A
MW12-3	November 2018 October 2021	November 2018 October 2021	October 2021	October 2021	N/A
MW12-4 ¹	Insufficient volume				N/A
MW12-5	Insufficient volume	October 2021	Insufficient volume		N/A
MW12-6	November 2018 October 2021	November 2018 October 2021	October 2021	October 2021	N/A
MW12-7	November 2018	November 2018	-		N/A
MW12-8	Dry				N/A
MW12-9	November 2018 October 2021	November 2018 October 2021	October 2021	October 2021	N/A
MW21-2A	November 2021	November 2021	November 2021	November 2021	November 2021

1 - well removed between November 2018 and October 2021.

9.3.1 Field-measured Parameters

Field-measured parameters are provided in Table 2. Field-measured pH values ranged from 7.6 (MW10-3) to 8.2 (MW12-2) and were below Tier 1 guidelines. Field-measured EC values ranged from 520 $\mu\text{S}/\text{cm}$ (MW10-3) to 920 $\mu\text{S}/\text{cm}$ (MW12-3). Field-measured turbidity values ranged from 124 NTU (MW12-6) and 840 NTU (MW10-2).

9.3.2 General and Inorganic Parameters

General and inorganic parameter results for groundwater samples collected are provided in Table 3. All parameters analyzed were generally below Tier 1 guideline parameters. Groundwater samples exceeding Tier 1 guidelines are summarized below:

- nitrate-nitrogen ($\text{NO}_3\text{-N}$): exceeded Tier 1 guidelines at MW10-1 (4.79 to 11.5 mg/L), and MW12-5 (3.77 mg/L).
- TDS: exceeded Tier 1 guidelines at MW12-3 (533 to 568 mg/L), MW10-2 (568 mg/L), and MW12-6 (641 mg/L).

Turbidity results were elevated in groundwater samples from most of the wells and ranged from 6 NTU at MW12-2 to 26,800 NTU at MW21-2a. Total suspended solids (TSS) were also elevated at most wells and ranged from 16 mg/L at MW12-2 to 4,340 mg/L at MW21-2a.

A piper diagram for the sand and gravel wells was generated (Figure 10a), generally the groundwater within the gravels is a sulphate-type groundwater. Wells MW12-2, and MW12-3, MW12-5 were higher in sodium-potassium and carbonate-bicarbonate concentrations compared to the other wells.

9.3.3 Dissolved Metals

Dissolved metals parameter results for groundwater samples are provided in Table 4. All parameters analyzed were generally below Tier 1 guidelines. Groundwater samples exceeding Tier 1 guidelines are summarized below:

- aluminum (Al): exceeded Tier 1 guidelines at MW10-1 (0.131 mg/L) and MW21-2a (0.558 mg/L).
- iron (Fe): exceeded Tier 1 guidelines at MW21-2a (1.3 mg/L).
- manganese (Mn): exceeded Tier 1 guidelines at MW10-3 (0.055 mg/L), MW12-9 (0.187 mg/L), and MW21-2a (0.095 mg/L).

9.3.4 Hydrocarbons

Hydrocarbon parameter results for groundwater sample collected at MW21-2a are provided in Table 6. All parameters analyzed were below Tier 1 guidelines and laboratory detection limits.

9.4 Groundwater Quality of Bedrock Units

Matrix sampled the bedrock wells in November 2021 and February, 2022. Laboratory reports are provided in Appendix H. A summary of the water quality parameters collected at the bedrock unit wells are provided in Table F.

TABLE F Bedrock Units Water Quality Parameter Summary

Well ID	Field Parameters	General and Inorganic Parameters	Dissolved Metals	Total Metals	Hydrocarbons
MW21-1A	November 2021	November 2021	November 2021	November 2021	-
MW21-1B	November 2021	November 2021	November 2021	November 2021	-
MW21-2B	November 2021	November 2021	November 2021	November 2021	November 2021
MW21-3	November 2021	November 2021	November 2021	November 2021	-
MW21-4	November 2021	November 2021	November 2021	November 2021	-
Bedrock Well 5	February 2022	February 2022	February 2022	February 2022	-

9.4.1 Field-measured Parameters

Field-measured parameters are provided in Table 2. Field-measured pH values ranged from 8.7 (MW21-4) to 9.67 (MW21-1b). MW21-1a, MW21-1b, MW21-2b, MW21-3, and MW21-4 all exceeded pH Tier 1 guidelines of 6.5 to 8.5 (Table 2; AEP 2019). Field-measured EC values ranged from 390 $\mu\text{S}/\text{cm}$ (MW21-2b) to 1,800 $\mu\text{S}/\text{cm}$ (MW21-1a), and were below Tier 1 guidelines. Field-measured turbidity values ranged from 157 NTU (MW21-4) to >1,000 NTU (MW21-1b).

9.4.2 General and Inorganic Parameters

General and inorganic parameter results for groundwater samples collected are provided in Table 3. All parameters analyzed were generally below Tier 1 guidelines parameters. Groundwater samples exceeding Tier 1 guidelines are summarized below:

- laboratory pH: concentrations exceeded Tier 1 guidelines at MW21-1a (8.69), MW21-1b (9.38), MW21-2b (9.31), and MW21-3 (8.97).
- sodium: concentrations exceeded Tier 1 guidelines at MW21-1a (388), MW21-1b (354), MW21-2b (202), MW21-3 (202), and MW21-4 (346).
- chloride: MW21-1a (125 mg/L) exceeded Tier 1 120 mg/L chloride concentration.
- TDS: exceeded Tier 1 guidelines at MW21-1a (942 mg/L), MW21-1b (872 mg/L), MW21-2b (516 mg/L) and MW21-4 (1010 mg/L), and Bedrock Well 5 (521 mg/L).

Turbidity results were elevated at some of the groundwater samples from wells and ranged from 0.6 NTU at Bedrock Well 5 to 59,300 NTU at MW21-1b. The TSS results were also elevated at some wells and ranged from <2 mg/L at Bedrock Well 5 to 25,700 mg/L at MW21-1b.

A piper diagram for the piper diagram wells was generated (Figure 10b), generally the groundwater within the gravels is a sodium-sulphate-type groundwater. Bedrock Well 5 was lower in sodium-potassium concentrations and higher magnesium concentrations.

9.4.3 Dissolved Metals

Dissolved metals parameter results for groundwater samples are provided in Table 4. All parameters analyzed were generally below Tier 1 guidelines. Groundwater samples exceeding Tier 1 guidelines are summarized below:

- aluminum: exceeded Tier 1 guidelines at MW21-1a (0.085 mg/L), MW21-1b (0.079 mg/L), MW21-2b (0.19 mg/L), and MW21-3 (0.089 mg/L).
- antimony (Sb): exceeded Tier 1 guidelines at MW21-1b (0.0166 mg/L), MW21-2b (0.0742 mg/L), MW21-4 (0.0091 mg/L).
- arsenic (As): exceeded Tier 1 guidelines at MW21-1b (0.0991 mg/L), MW21-2b (0.666 mg/L), MW21-3 (0.0837 mg/L), and MW21-4 (0.0524 mg/L).
- copper (Cu): exceeded Tier 1 guidelines at MW21-1b (0.03 mg/L).
- manganese: exceeded Tier 1 guidelines at Bedrock Well 5 (0.22 mg/L).
- selenium: exceeded Tier 1 guidelines at MW21-1a (0.0054 mg/L), MW21-1b (0.0102), MW21-2b (0.0853 mg/L), MW21-3 (0.0039 mg/L), and MW21-4 (0.0079 mg/L).
- silver: exceeded Tier 1 guidelines at Bedrock Well 5 (0.00018 mg/L).
- zinc: exceeded Tier 1 guidelines at Bedrock Well 5 (0.035 mg/L).

9.4.4 Hydrocarbons

Hydrocarbon parameter results for groundwater sample collected at MW21-2b are provided in Table 6. All parameters analyzed were below laboratory detection limits.

9.5 Groundwater Quality of Springs

Matrix sampled the known spring locations on May 10 and 12, 2022. All of the springs were sampled for general and inorganic parameters, dissolved metals, and totals metals except for Mud Spring 1. The dissolved metals were field-filtered. The Mud Spring 1 was not sampled due to the water being stagnant with no observable flow and livestock present at the spring. Laboratory reports are provided in Appendix H. A summary of the water quality parameters collected at the springs are provided in Table F.

9.5.1 Field-measured Parameters

Field-measured parameters are provided in Table 2. Field-measured pH values ranged from 7.4 (NE Spring #1) to 8.3 (South Spring) and were below Tier 1 guidelines. Field-measured EC values ranged from 555 µs/cm (NE Spring #2) to 988 µs/cm (Beaupré Spring #1). Field-measured turbidity values were

generally below 1 NTU with the highest at (Bedrock Spring #2 (4.01 NTU) followed by 3.86 NTU at the Beaupré Spring #1). The temperatures of the spring water ranged from 7.4 to 11.2 deg C.

9.5.2 General and Inorganic Parameters

General and inorganic parameter results for groundwater samples collected are provided in Table 3. All parameters analyzed were generally below Tier 1 guidelines parameters. Groundwater samples exceeding Tier 1 guidelines are summarized below:

- pH: exceeded Tier 1 8.5 pH guideline at the South Spring (8.52).
- nitrate-nitrogen ($\text{NO}_3\text{-N}$): exceeded Tier 1 guidelines at NE Spring #2 and at the South Spring.
- TDS: exceeded Tier 1 guidelines at Beaupré Spring #1, #2, and #3, and NE Spring #1.

A piper diagram for the sand and gravel wells was generated (Figure 10c); generally the groundwater from springs were a sulphate-type groundwater, with the major ions chemistry being more consistent with the sand and gravel groundwater monitoring wells than the bedrock.

9.5.3 Dissolved Metals

Dissolved metals parameter results for spring water samples are provided in Table 4 and total metal parameter analytical results are provided in Table 5. All dissolved metal parameters analyzed were below Tier 1 guidelines. For total metal parameters analyzed, only the aluminum (Al) exceeded Tier 1 guideline (guideline for aquatic life exposure) at Beaupré Spring #1, and NE Spring #1.

9.6 Quality Control Sampling

In accordance with Matrix's standard practices, quality control (QC) protocols were followed for sampling. The QC measures included the collection and analysis of a duplicate sample, as well as a review of the results for the laboratory QC samples. Duplicate samples assist in monitoring the quality of sampling and analysis, and the QC results for the duplicate is presented in Tables 8a to 8c.

The reproducibility of the duplicate sample, except for turbidity and Titanium (Ti), were judged to be acceptable, with all relative percent difference values less than 30%. The poor reproducibility of turbidity is not unexpected and dependent upon how and when the sample is collected; some of the suspended solids in the samples will settle quickly and alter the turbidity values.

9.7 Field-verified Survey

Matrix conducted a FVS of all existing water users within the 1.61 km radius of the project site between June 18, 2018 and May 28 to September 16, 2019, by contacting landowners within the 1.61 km radius. The FVS aimed to obtain baseline information about local water users and to

establish their proximity to the BURNCO assessment areas. The supporting FVS documents and results are provided in Appendix E and Table E1.

Based on information obtained from the GIC (AEP 2022a) and AbaData™ (Abacus 2018), there are 29 wells within a 1.61 km of the search radius. The FVS survey, based upon landowner responses, identified 21 wells within the search radius, as well as three springs and one dugout (Figure 6).

Only two landowners had an identifiable GIC well (Appendix E). Generally, all field-verified wells are operational and used for domestic, livestock, and gardening purposes except for Mr. Dutchik's abandoned well (not in use) and Ms. Decagny's dugout well (dry). Matrix was unable to confirm the total depth and static water levels of the wells while in the field either due to well inaccessibility or permission was not granted (landowner discretion).

Based on the well completion depths listed in Appendix E, Table E1, it is unlikely that any of the privately owned water wells within the search radius are withdrawing from the shallow gravel deposits except for Mr. Cornish's North Well, Ms. McNabb's Stock Water Well 1.

10 GROUNDWATER FLOW DISCUSSION

Groundwater flow within the sand and gravel across the site is interpreted to flow to the south to southeast and generally follows topography. In the eastern portion of the site the flow varied from south to southwest with a western component in the northern portion (Figure 9).

The bedrock groundwater monitoring network installed in November 2021 encountered groundwater at depths ranging from 4.39 m bgs (MW21-3) to 40.94 m bgs (MW21-4) The groundwater flow within the bedrock at site generally follows topography and is uncertain in localized areas due to varying water levels, and slow water level recovery in the low permeability bedrock. However, groundwater flow in the bedrock within the proximity of the current operation is expected to mirror the sand and gravel and flow to the south and east, towards the Bow River and Grand Valley Creek. Future water level monitoring will provide a better understanding of the bedrock flow regime.

Vertical hydraulic gradients were calculated based on measured water levels at nested triplicate pairs MW12-2/MW12-1a/MW12-1B and nest pairs MW21-2a and MW21-2b on November 26, 2021 and May 11, 2022. These nested well pairs include a shallow sand and gravel well and a deeper bedrock well. A summary of the results are provided in Table G.

TABLE G Vertical Hydraulic Gradients

Well ID	Vertical Gradient (m/m)		Flow Condition	
	November 2021	May 2022	November 2021	May 2022
MW12-2 and MW21-1A	1.2	0.3	Downward flow (recharge)	
MW12-2 and MW21-1B	0.16	-0.02	Downward flow (recharge)	Upward flow (discharge)
MW21-2a/b	-0.02	-0.03	Upward flow (discharge)	

Both downward and upward gradients were observed between the sand and gravel and bedrock interface across the site. The groundwater elevations at the nested well pair MW21-2a (sand and gravel) and MW21-2b (bedrock) are presented in Appendix F, Figure F11. The groundwater level at MW21-2b fluctuated approximately 1.2 m and the shallower nested well (MW21-2a), completed in the overlying sand and gravel, fluctuated approximately 0.15 m in the same time span. Vertical gradients varied at the nested well pair, displaying both upward and downward gradients between November 29, 2021 and May 10, 2022. The upward gradient was more prevalent.

Groundwater temperatures between the nested well pair differed by approximately 1.5°C in December 2021 and a decrease of approximately 0.75°C was observed at MW21-2a whereas MW21-2b had a slight increase in temperature. The varying groundwater levels observed at MW21-2b compared to MW21-2a suggests the bedrock is not significantly influencing the sand and gravel, and bedrock flow systems behave somewhat independently at this location.

11 WATER QUALITY DISCUSSION

11.1.1 Groundwater Quality

Dissolved metals parameters for groundwater samples collected across the site in 2021 exceeded Tier 1 guidelines for aluminum, antimony, arsenic, copper, iron, manganese, and selenium. These exceedances are considered to be naturally occurring within the groundwater, particularly aluminum within the sand and gravel and bedrock, manganese within the sand and gravel, and antimony, arsenic, and selenium within the bedrock.

11.1.2 Groundwater Total Metals Analyses

Total metal analyses are generally not conducted for assessing water quality of the groundwater moving through the subsurface as the total metals analyses does not reflect the actual groundwater quality. The total metals analyses of groundwater samples were undertaken to assess the potential impact of pit operations, which could result in turbid water being produced by pit activity conducted below the water table, gravel washing activities, and surface water infiltration in disturbed areas.

The high TSS concentration was likely a product of sampling the groundwater monitoring wells with dedicated bailers and Waterra tubing. Bailers and Waterra tubing create agitation within the water

column and screen section and stir up any settled particles within the well or sand pack. The TSS and turbidity concentrations could be reduced with significant well development or low flow sampling methods. However, significant well development and low flow sampling methods were not considered viable due to the limited available head within the water column.

Total metals parameter results for groundwater samples are provided in Table 5. Generally, most sand and gravel groundwater exceeded Tier 1 guidelines for freshwater aquatic life for aluminum, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver, uranium, and zinc. The total metal parameters for bedrock wells indicated that most wells exceeded Tier 1 guidelines.

There were significant increases in aluminum, arsenic, cadmium, copper, iron, lead, manganese, mercury, silver, and zinc in the total metals concentrations over the dissolved concentrations and are highly correlated to the TSS concentrations and turbidity.

11.1.3 Aggregate Characterization

The soil aggregate sample collection and laboratory testing conducted by BURNCO at the West Cochrane Gravel Pit in 2021 was undertaken to compare the sand and gravel characteristics in the pit area to the sands and gravels on the north bank of the Bow River. An overview of the sampling and testing results is presented in Appendix D.

The aggregate analyses identified the following:

- Comparison of Bow River (riverbank) sediments and operating pit area sediments salinity analyses results indicated average parameter concentrations of the chloride and potassium ions were significantly higher (150%) in the near operating pit samples and whereas the river bank samples had significantly higher (1.50%) calcium, sodium, and sulphate concentrations. None of the samples exhibited concentrations of major ions of concern.
- Pit area samples exhibited leachate metal concentrations which were significantly lower (ratio of 43 to 63% for pit area to riverbank samples) than the riverbank deposits. Similar concentrations for molybdenum and selenium were identified for pit and riverbank sediments.

11.1.4 Potential Impact Implications

The aggregate characterization indicates that the pit sands and gravels have a lower ability to release metals into the groundwater than the river bank deposits. Nevertheless, the groundwater results for the total metals analyses and the aggregate characterization highlights the need to ensure that pit operations undertake operating procedures to minimize generation of high sediment laden surface water and to control and contain turbid surface water. This is of particular concern if turbid surface water is allowed to overflow directly into an aquatic environment.

Where turbid surface water infiltrates the subsurface and recharges the groundwater, the native sand and gravel deposit will act as a suitable filter to reduce and eliminate suspended solids in water and mitigate any potential impact. Minimizing the generation of high turbid water combined with allowing the natural sand and gravel to filter the water will result in minimal, if any, impact.

12 SUMMARY

Based on information gathered and reviewed:

- Surficial deposits are Pleistocene and Holocene sands and gravels.
- The groundwater investigation and monitoring network was expanded by installing one additional sand and gravel and five bedrock groundwater monitoring wells in 2021 inside the existing operating site, to depths ranging from 9.94 to 41.16 m bgs. The top of bedrock depths ranged from 3.35 to 10.21 m bgs at the new monitoring well locations. Additionally, an onsite bedrock well has been added to the monitoring network to establish baseline conditions and provide go forward monitoring locations.
- Depths to groundwater in sand and gravel wells across site ranged from 4.06 to 12.79 m bgs between 2012 and 2022. Groundwater flows were generally south to southeast. The estimated saturated gravels are thickest in the northeast portion of the study area and saturation decreases to the west.
- Depths to groundwater in bedrock wells across site ranged from 4.39 to 11.65 m bgs between 2018 and 2022 within the current operational area.
- The shallow groundwater at site displays seasonal trends and water levels are generally near the base of the gravel deposits. Based on expected precipitation and evaporation values, the site may support recharge of shallow groundwater in the area.
- Sand and gravel groundwater was generally below Tier 1 guidelines except for nitrite- and nitrate-nitrogen, TDS, and numerous dissolved and total metals. Groundwater in sand and gravel wells is generally a sulphate-type groundwater. Groundwater in the east north area of the site had elevated chloride concentrations which likely has a groundwater flow component from bedrock. The groundwater did not meet Tier 1 aquatic life criteria.
- Bedrock groundwater was generally below Tier 1 guidelines except for pH, sodium, chloride, TDS, and numerous dissolved and total metals. Groundwater in bedrock wells is generally a sulphate -type groundwater. The groundwater did not meet Tier 1 aquatic life criteria.
- The elevated concentrations of total and dissolved metals are attributed to the suspend solids within the groundwater and is not a reflection of the true groundwater make up at site.

- Although the aggregate characterization indicates that the pit sands and gravels have a potential to release metals into the groundwater the propensity to do so is significantly lower than the Bow River riverbank sand and gravel deposits.
- Only three registered groundwater well records out of 45 and one non-registered well from the FVS was completed within sands and gravels within a 1.61 km radius of the project site. Three springs were identified within a 1.61 km radius, suggesting the site could be proximal to a groundwater discharge area.
- There were 43 groundwater and surface water licenced users identified within a 1.61 km radius of the project site. There are five active groundwater licences sourced from unnamed aquifers and 38 licences are granted for surface water use.

Based upon the information reviewed, the potential impacts of future operations on nearby groundwater and surface water resources are expected to be minimal with best management practices.

13 POTENTIAL IMPACTS OF AGGREGATE DEVELOPMENT

Potential impacts of aggregate mining operations on surrounding groundwater sources and surface water bodies can include:

- increased sediment load (particularly in surface water bodies down slope of mining area)
- chemical release (spills) into the environment (through surface water infiltration and groundwater flow)
- induced water table drawdown (from dewatering)
- increased infiltration of water from mining operations due to removal of soil cover

The removal of the silty clay (where present) at site, will remove a natural barrier to potential contamination of the groundwater from surface spills. Any contaminant spilled at surface during or after operations would preferentially flow either vertically through the porous gravel and bedrock to the water table or along preferentially pathways (secondary permeability/fractures) in the bedrock. From below the water table it would follow groundwater flow direction (south to southeast) towards Beaupré Creek and the Bow River. Any contamination could potentially flow into the underlying bedrock, posing a risk to the aquifer or any downgradient water well user in the area. There are no know residential well users within the project boundary or downgradient.

Turbid (high TSS and turbidity) surface water, as a result of gravel pit operations, entering the groundwater flow system will be naturally filtered by the sand and gravel deposits, and therefore, have limited impact on groundwater quality. Although possible but very unlikely, turbid surface water in the mining area if directly in contact with highly fractured permeable zones within the bedrock could potentially impact groundwater. However, given the lack of evidence of these highly fractured bedrock zones, groundwater

flow velocity, travel distance from mine operations to surface water bodies, and adherence to the code of practise for gravel pit operations, the risk of turbid surface water to adversely impact groundwater quality any appreciable distance (100 m) or nearby natural surface water bodies is low. Groundwater monitoring at spring locations and groundwater wells will be conducted in the operational areas to confirm groundwater quality.

Should operations occur directly on fractured bedrock especially in close proximity of water bodies, consideration should be given to minimizing infiltration of turbid water or contaminants by placing either a layer of low permeability material or a bed of suitable sand and gravel to act as a filter. A layer of the natural sand and gravel should be left in place in areas where stormwater and infiltration ponds are being proposed.

Due to the generally low saturation and shallow water table (near the base of the gravel), dewatering at site may be limited. Water well records also indicate that the wells in the vicinity of the site are completed in bedrock aquifers at various depths. As dewatering of the saturated gravels at site will be limited to the operational area, and will not significantly alter the water table, impact to users in the area will be limited. A bailing strategy for resource removal will likely result in higher TSS compared to dewatering. Potential environmental impacts can be eliminated or minimized with engineering controls implemented at construction and as part of ongoing operations.

Elevated total metals compared to dissolved metals within the groundwater was observed in 2021. The significant difference in total metals concentrations to dissolved metals concentrations were attributed to the high concentration of TSS and turbidity of the sampled groundwater and a result of the sampling method; the in situ groundwater moving through the soils would not be expected to have high TSS or turbidity.

Potential impacts of future aggregate operations on the groundwater and surface water are expected to be minimal with best management practices and a groundwater monitoring network and sampling program.

14 GROUNDWATER MONITORING PROGRAM

Matrix recommends using the existing installed groundwater monitoring wells, identified springs, and participatory landowner wells as part of a groundwater monitoring network to complete the groundwater monitoring program. As gravel operations expand beyond the current mining footprint, it is expected that additional groundwater monitoring wells will be added to the network to define the hydrogeological conditions up and downgradient of operations. Recommendations and considerations for the groundwater monitoring program are outlined in Table H.

TABLE H Groundwater Monitoring Program

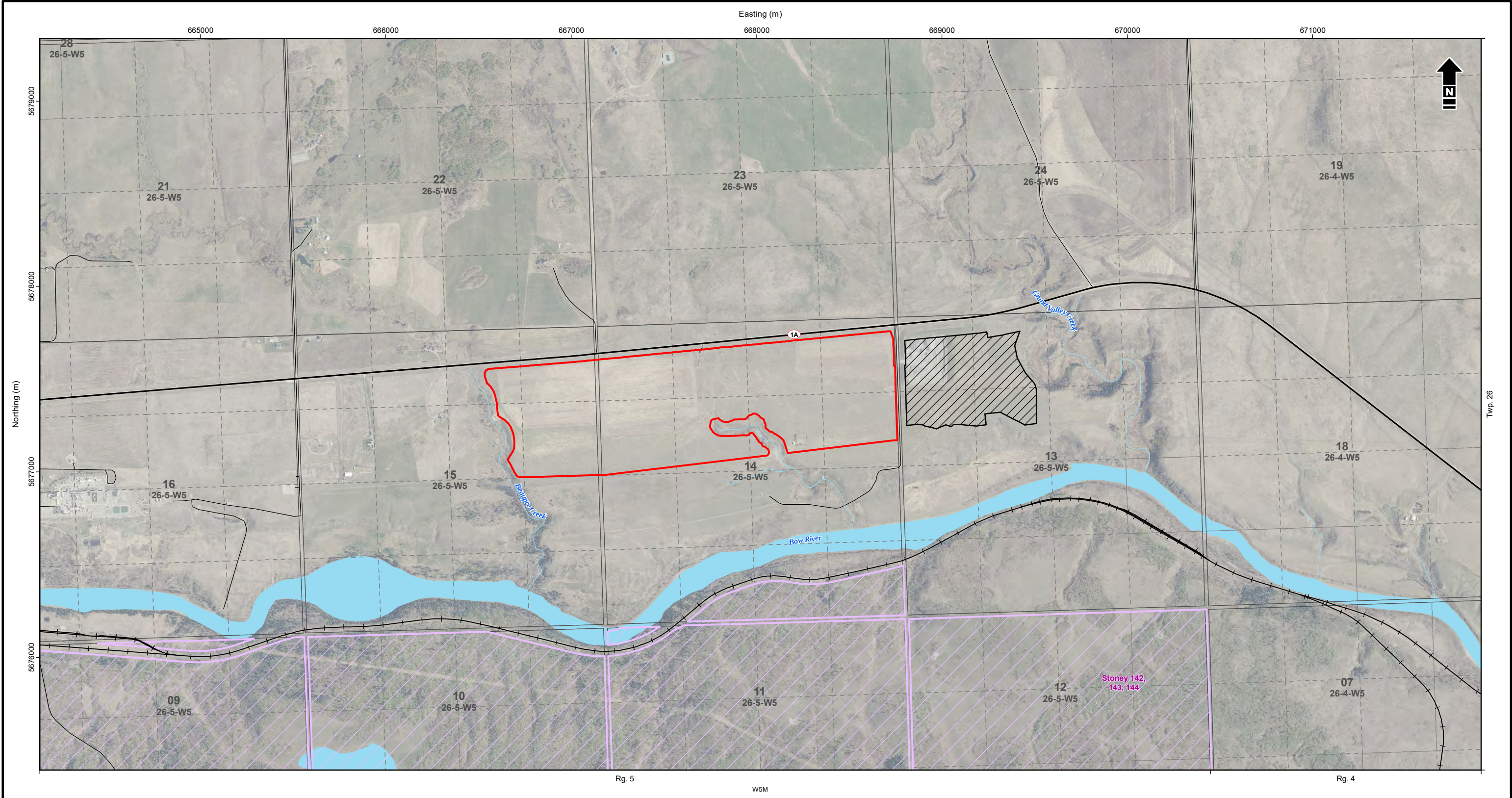
Monitoring Parameters	Considerations
Monitoring network design	• Use existing groundwater and springs network, revise and modify as major pit expansion occurs. • During gravel pit operations, if the groundwater conditions are not as expected, additional groundwater monitoring wells to assess groundwater levels and quality may be required.
Baseline monitoring	• In addition to the baseline information collected on the existing and future monitoring well locations and identified springs, BURNCO will complete a baseline monitoring program for any existing residential water well located within 400 m of the project boundary if requested by the owner. • Such baseline water monitoring shall be completed by a third-party-party consultant and for a period of two (2) years which will include the following: • A two-hour pumping test will be completed to characterize groundwater flow rates in relation to aquifer drawdown. These pumping tests will be completed once at the start of the baseline testing program. • Automatic water level recorders will be installed at each water well to determine the baseline water levels and seasonal fluctuations. Water levels will be collected for a period of two years and downloaded biannually. • Groundwater samples will be collected to characterize the water quality, including hydrocarbons, dissolved metals, general chemistry parameters and turbidity. Samples will be collected biannually for a period of two years (4 samples per location).
Assessment of monitoring results	• The monitoring results should be reviewed within a week of receiving the results to identify any groundwater quality issues. If necessary, the results should be confirmed or resampled as required.
Ongoing monitoring	• During operation of the West Cochrane Gravel Pit, BURNCO will monitor groundwater water levels and quality. Continuous monitoring will occur in no less than four locations per excavation area. This will include: • Two locations in the unconfined aquifer (sand and gravel): 1 monitoring location upgradient from the excavation area; and one monitoring location downgradient from the excavation area. • Two locations in the confined aquifer (bedrock): 1 monitoring location upgradient from the excavation area; and one monitoring location downgradient from the excavation area. • As part of this ongoing monitoring, BURNCO will retain a third-party consultant to collect ongoing groundwater information in addition the data collected as part of the baseline water monitoring: • Automatic water level recorders will be maintained at each monitoring location to monitor water levels and seasonal fluctuations. Data will be collected annually. • Groundwater samples will be collected at each monitoring location to characterize the water quality, including routine, dissolved metals, turbidity, total suspended solids, and petroleum hydrocarbon parameters. Such sampling and testing will be completed annually. • Monitoring data shall be compiled into a database and statistical methods such as control charts and trend analysis will be utilized to capture any changes from baseline conditions. • If groundwater diversion is conducted, the groundwater discharge water quality should be monitored periodically.

15 REFERENCES

- Abacus Datagraphics Ltd. (Abacus). 2018. *Original AbaData*. Accessed March 2018.
<http://www.abacusdatagraphics.com/>
- Alberta Environment and Parks (AEP). 2022a. *Alberta Water Well Information*. Provided to Matrix Solutions Inc. by the Groundwater Information Centre (GIC) January 2022. Uploaded to Prometheus Matrix Field Data Portal.
- Alberta Environment and Parks (AEP). 2022b. *Surface Water Users*. Informatics Branch, Corporate Services Division. Edmonton, Alberta. Information provided to Matrix Solutions Inc. January 4, 2022.
- Alberta Environment and Parks (AEP). 2019. *Alberta Tier 1 Soil and Groundwater Remediation Guidelines*. Land Policy Branch, Policy and Planning Division. Edmonton, Alberta. January 10, 2019. <https://open.alberta.ca/publications/1926-6243>
- Alberta Environment and Parks (AEP). 2018. *Environmental Quality Guidelines for Alberta Surface Waters*. Water Policy Branch. Edmonton, Alberta. March 28, 2018. Effective July 1, 2018.
<https://open.alberta.ca/publications/9781460138731>
- Alberta Environment and Sustainable Resource Development (ESRD). 2013. *Evaporation and Evapotranspiration in Alberta*. Edmonton, Alberta. 2013.
- Alberta Environment (AENV). 2011. *Alberta Environment Guide to Groundwater Authorization*. March 2011.
<http://aep.alberta.ca/water/education-guidelines/documents/GroundwaterAuthorization-Guide-2011.pdf>
- Alberta Environment (AENV). 2004. *A Guide to the Code of Practice for Pits*. ISBN: 0 7785 3764 1, Publication No. T/763. October 2004. Edmonton, Alberta. 2004.
<http://aep.alberta.ca/lands-forests/land-industrial/programs-and-services/default.aspx>
- Bayrock L.A. and T.H.F. Reimchen. 1980. *Surficial Geology - Alberta Foothills and Rocky Mountains*. Alberta Research Council. Scale 1:250,000. Edmonton, Alberta. 1980.
https://ags.aer.ca/document/MAP/Map_150.pdf
- Bouwer H. and R.C. Rice. 1976. "A slug test for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells." *Water Resources Research* 12 (3): 423-428. 1976.

- Dagan G. 1978. "A note on packer, slug, and recovery tests in unconfined aquifers." *Water Resources Research* 14 (5): 929-934. 1978.
- Demchuk T.D. and L.V. Hills. 1991. "A re-examination of the Paskapoo Formation in the Central Alberta Plains: the designation of three new members." *Bulletin of Canadian Petroleum Geology* 39 (3): 270-282. 1991.
- Domenico P.A. and F.W. Schwartz. 1990. *Physical and Chemical Hydrogeology*. Wiley & Sons. October 19, 1990. 824 pp.
- Fisher, T.G. 1999. "Sedimentology, stratigraphy, and geomorphology of glacial Lake Calgary at Cochrane, Alberta, Canada." *Canadian Journal of Earth Sciences* 36: 791-803. 1999.
- Glass, D.J. (Ed.). 1990. *Lexicon of Canadian Stratigraphy, Volume 4, Western Canada, Including Eastern British Columbia, Alberta, Saskatchewan and Southern Manitoba*. Canadian Society of Petroleum Geologists. Calgary, Alberta. 1990. 772 pp.
- Government of Canada (GoC). 2018. *Monthly Data Report for 2004, Cochrane, Alberta*.
http://climate.weather.gc.ca/climate_data/monthly_data_e.html?hlyRange=%7C&dlyRange=1961-08-01%7C2004-03-31&mlyRange=1961-01-01%7C2004-03-01&StationID=2230&Prov=AB&urlExtension=e.html&searchType=stnName&optLimit=yearRange&StartYear=1840&EndYear=2018&selRowPerPage=25&Line=1&searchMethod=contains&Month=12&Day=5&txtStationName=cochrane&timeframe=3&Year=2004
- Grasby S.E. et al. 2008. "Regional characterization of the Paskapoo bedrock aquifer system, southern Alberta." *Canadian Journal of Earth Sciences* 45 (12): 1501-1516. 2008.
- Health Canada. 2020. *Guidelines for Canadian Drinking Water Quality - Summary Table*. Prepared by the Federal-Provincial-Territorial Committee on Drinking Water of the Federal-Provincial-Territorial Committee on Health and the Environment. Water and Air Quality Bureau, Healthy Environments and Consumer Safety Branch. Ottawa, Ontario. September 2020.
https://www.canada.ca/content/dam/hc-sc/migration/hc-sc/ewh-semt/alt_formats/pdf/pubs/water-eau/sum_guide-res_recom/summary-table-EN-2020-02-11.pdf
- Hvorslev M.J. 1951. *Time Lag and Soil Permeability in Groundwater Observation*. U.S. Army Corps of Engineers Waterways Experimental Station Bulletin 36. Vicksburg, Mississippi. 1951.
- Hydrogeological Consultants Ltd. (HCL). 2002. *M.D. of Rocky View No. 44, Part of the South Saskatchewan River Basin, Tp 021 to 029, R 25 to 29, W4M & Tp 023 to 029, R 01 to 06, W5M, Regional Groundwater Assessment*. Prepared for the M.D. of Rocky View No. 44 in conjunction with Agriculture and Agri-food Canada and Agriculture Canada, and Prairie Farm Rehabilitation Administration. March 2002. <http://www.10704.com/pdf/rgwa/rocky.pdf>

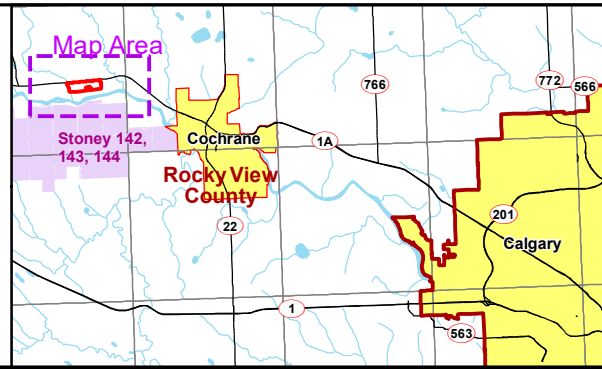
- HydroSOLVE, Inc. (HydroSOLVE). 2007. *AQTESOLV™ (Version 4.5)*. Software for Windows. Copyright 2004-2007, Glenn M. Duffield. <http://www.aqtesolv.com/>
- Levelton Consultants Ltd. (Levelton). 2014. *Groundwater Evaluation, Proposed BURNCO McDougall Ranch Gravel Pit and Surrounding Area, N1/2-14, W1/2-13 and NE-15-26-5 W5M*. Prepared for BURNCO Rock Products Ltd. June 25, 2014.
- Matrix Solutions Inc. (Matrix). 2021. *Conceptual Stormwater and Drainage Management Plan, Burnco West Cochrane Gravel Pit, NE ¼ 15-026-05 W5M TO SE ¼ 18-026-04 W5M*. Version 4.0. Prepared for Burnco Rock Products Ltd. Calgary, Alberta. December 2021.
- Matrix Solutions Inc. (Matrix). 2019. *Hydrogeology Framework and Impact Assessment, West Cochrane Gravel Pit*. Version 1.0. Prepared for BURNCO Rock Products Ltd. Calgary, Alberta. November 2019.
- Ollerenshaw N.C. 1978. *Geology - Calgary*. Geological Survey of Canada, Map 1457A (820). Scale: 1:250,000. 1978.
- Prior G.J. et al. 2013. *Bedrock Geology of Alberta*. Alberta Energy Regulator (AER) and Alberta Geological Survey (AGS). AGS Map 600. Scale: 1:1,000,000. 2013.
http://ags.aer.ca/document/Alberta_geological_map.pdf
- Shetsen I. 1987. *Quaternary Geology, Southern Alberta*. Alberta Research Council, Natural Resources Division, Terrain Sciences Department. Alberta Geological Survey (AGS) Map 207. Scale 1:50,000. 1987.



I:\Burnco\26388\Figures\Aerial\Burnco West Cochrane #2 Gravel Pit\Figure 1 Site Location.mxd - Tabloid_L - 15-Sep-22, 04:04 PM - mpeffer - T10004

- McDougall Gravel Pit Study Area
- Disturbance Area
- Indian Reserve
- Water Body
- Watercourse (Field-Verified)
- Railway
- Highway
- Road

1:20,000 metres
150 0 150 300
NAD 1983 UTM Zone 11N



Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

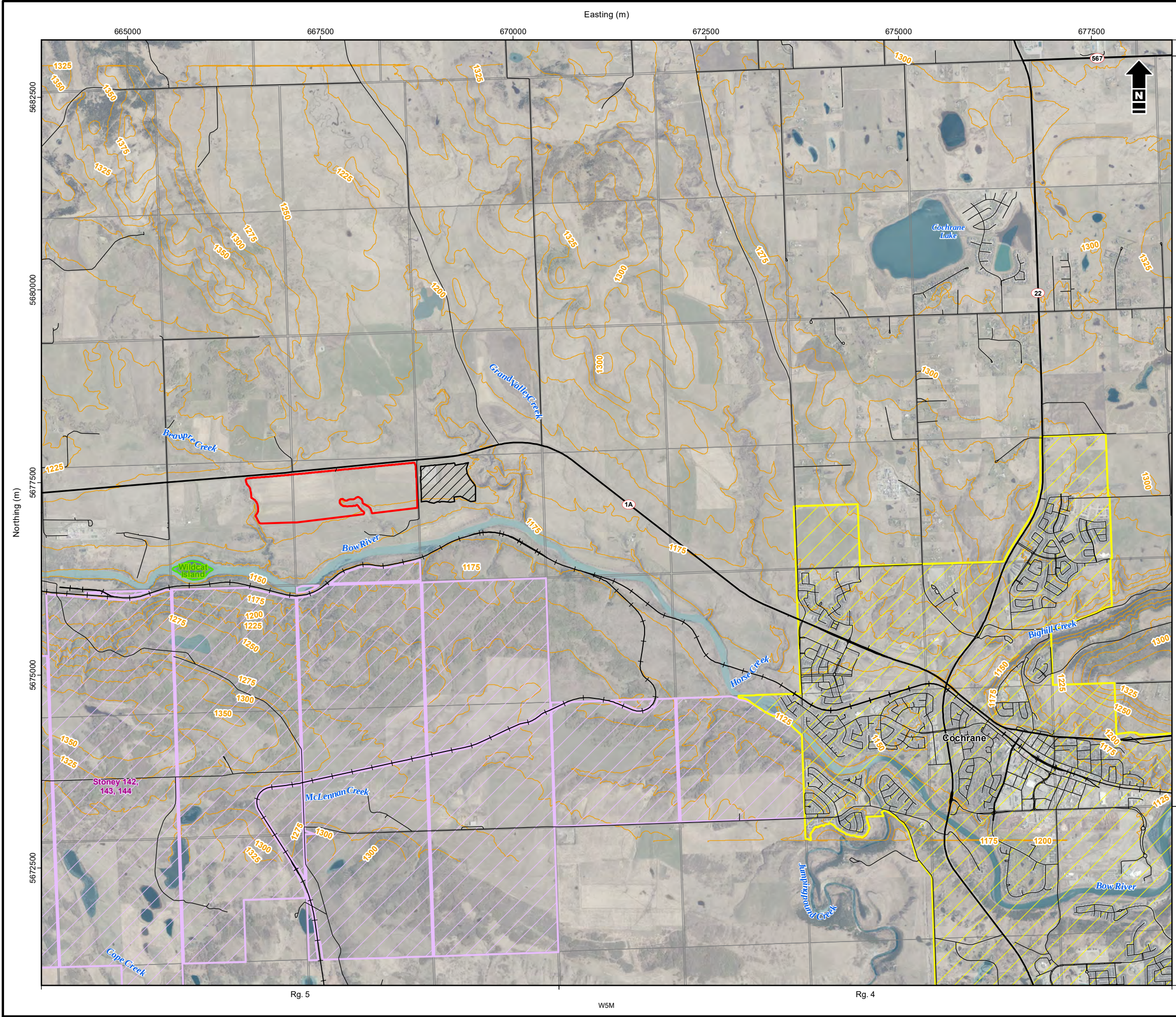
Burnco Rock Products Ltd.
Burnco West Cochrane #2 Gravel Pit

Site Location

Date: September 2022	Project: 26388	Submitter: C. Veilleux	Reviewer: R. Killam
----------------------	----------------	------------------------	---------------------

Disclaimer: The information contained herein may be compiled from numerous third party materials that are subject to periodic change without prior notification. While every effort has been made by Matrix Solutions Inc. to ensure the accuracy of the information presented at the time of publication, Matrix Solutions Inc. assumes no liability for any errors, omissions, or inaccuracies in the third party material.

Figure 1



- McDougall Gravel Pit Study Area
- Disturbance Area
- Natural Area
- Community
- Indian Reserve
- Water Body
- Highway
- Road
- Contour (25 masl)

Reference: Data obtained from AltaLIS © Government of Alberta and GeoBase® used under license. GDM transportation infrastructure data provided by IHS © 2022 used under license. Valus Image Service © (2020). Used under license.

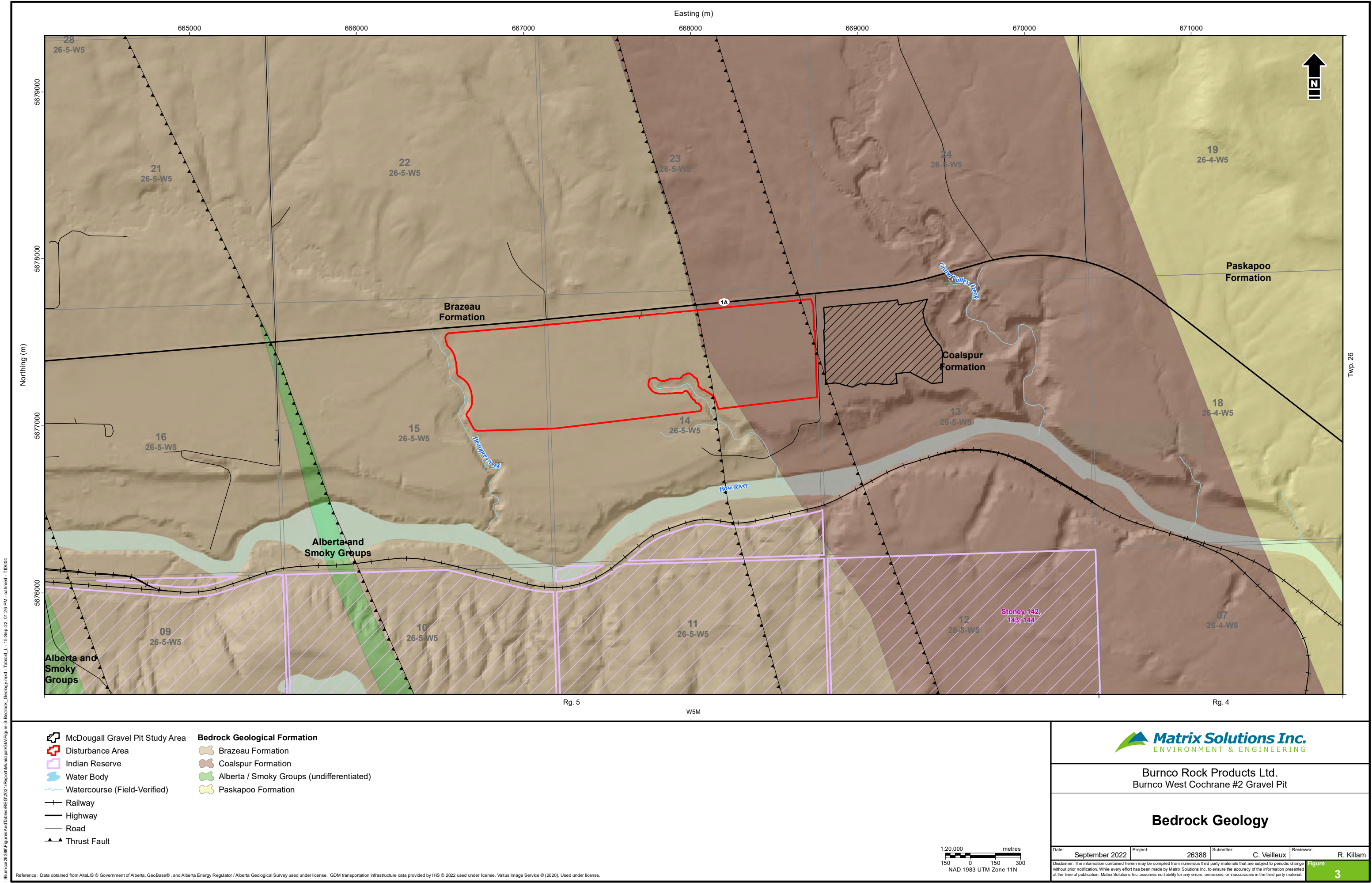


Burnco Rock Products Ltd.
Burnco West Cochrane #2 Gravel Pit

Study Area Topography

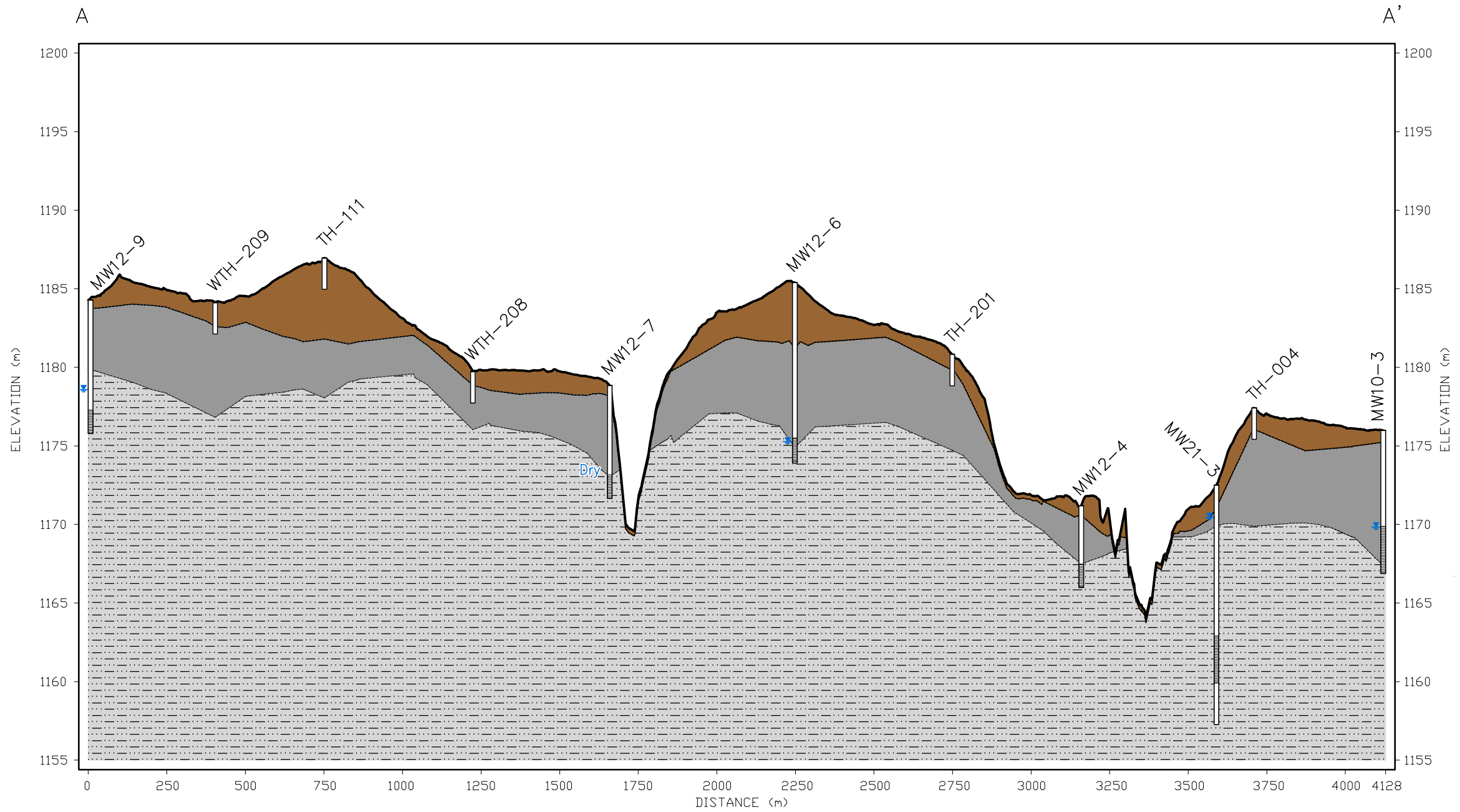
Date: September 2022 Project: 26388 Submitter: C. Veilleux Reviewer: R. Killam

Disclaimer: The information contained herein may be compiled from numerous third party materials that are subject to periodic change without prior notification. While every effort has been made by Matrix Solutions Inc. to ensure the accuracy of the information presented at the time of publication, Matrix Solutions Inc. assumes no liability for any errors, omissions, or inaccuracies in the third party material.



I:\Burnco\26388\FiguresAndTables\RE\2021\Report\Municipal\CA\Figure 3_Bedrock_Geology.mxd - Table 1 - 15-Sep-22, 01:28 PM - cveilleux - TD004

Reference: Data obtained from AltaLIS © Government of Alberta, GeoBase®, and Alberta Energy Regulator / Alberta Geological Survey used under license. GDM transportation infrastructure data provided by IHS © 2022 used under license. Valtus Image Service © (2020). Used under license.



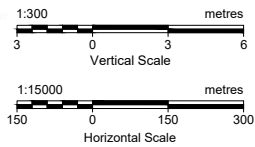
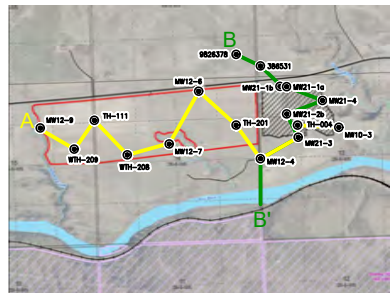
- Overburden
- Sand & Gravel
- Bedrock

Monitoring Well



Water Level - October 25-26, 2021

Monitoring Well



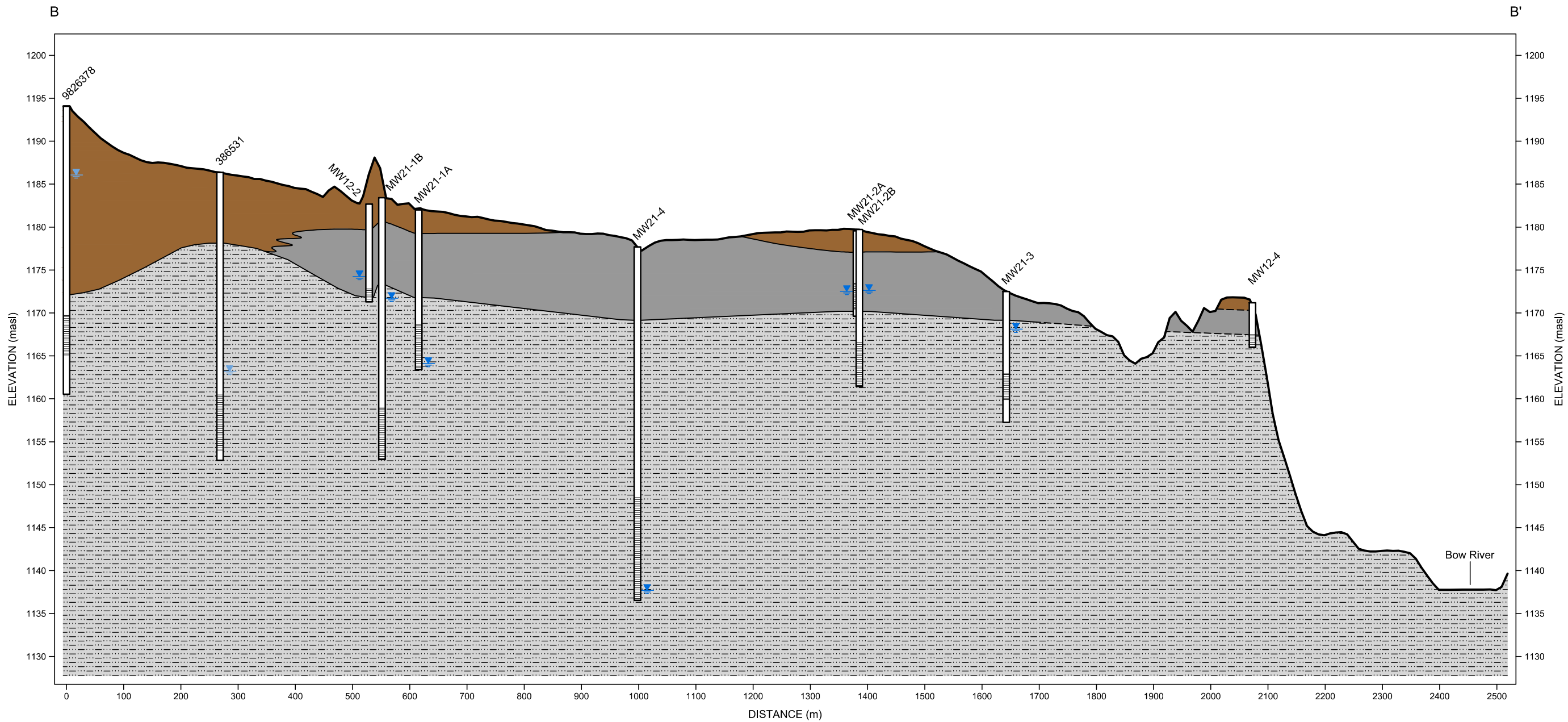
Burnco Rock Products Ltd.
Burnco West Cochrane #2 Gravel Pit

Cross-section A - A'

Date: September 2022	Project: 26388-XSC3D-22	Submitter: J. Bates	Reviewer: R. Killam
----------------------	-------------------------	---------------------	---------------------

Disclaimer: The information contained herein may be compiled from numerous third party materials that are subject to periodic change without prior notification. While every effort has been made by Matrix Solutions Inc. to ensure the accuracy of the information presented at the time of publication, Matrix Solutions Inc. assumes no liability for any errors, omissions, or inaccuracies in the third party material.

Figure 4a



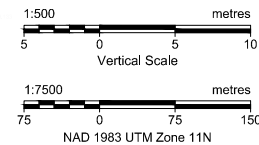
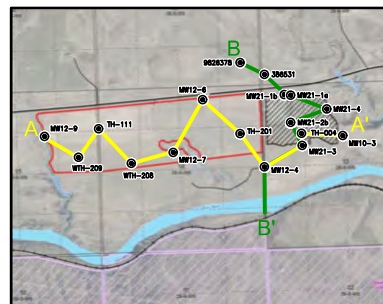
- Overburden
- Sand & Gravel
- Bedrock

Monitoring Well



Water Level - February 19, 1977
Water Level - November 29, 2021

Monitoring Well



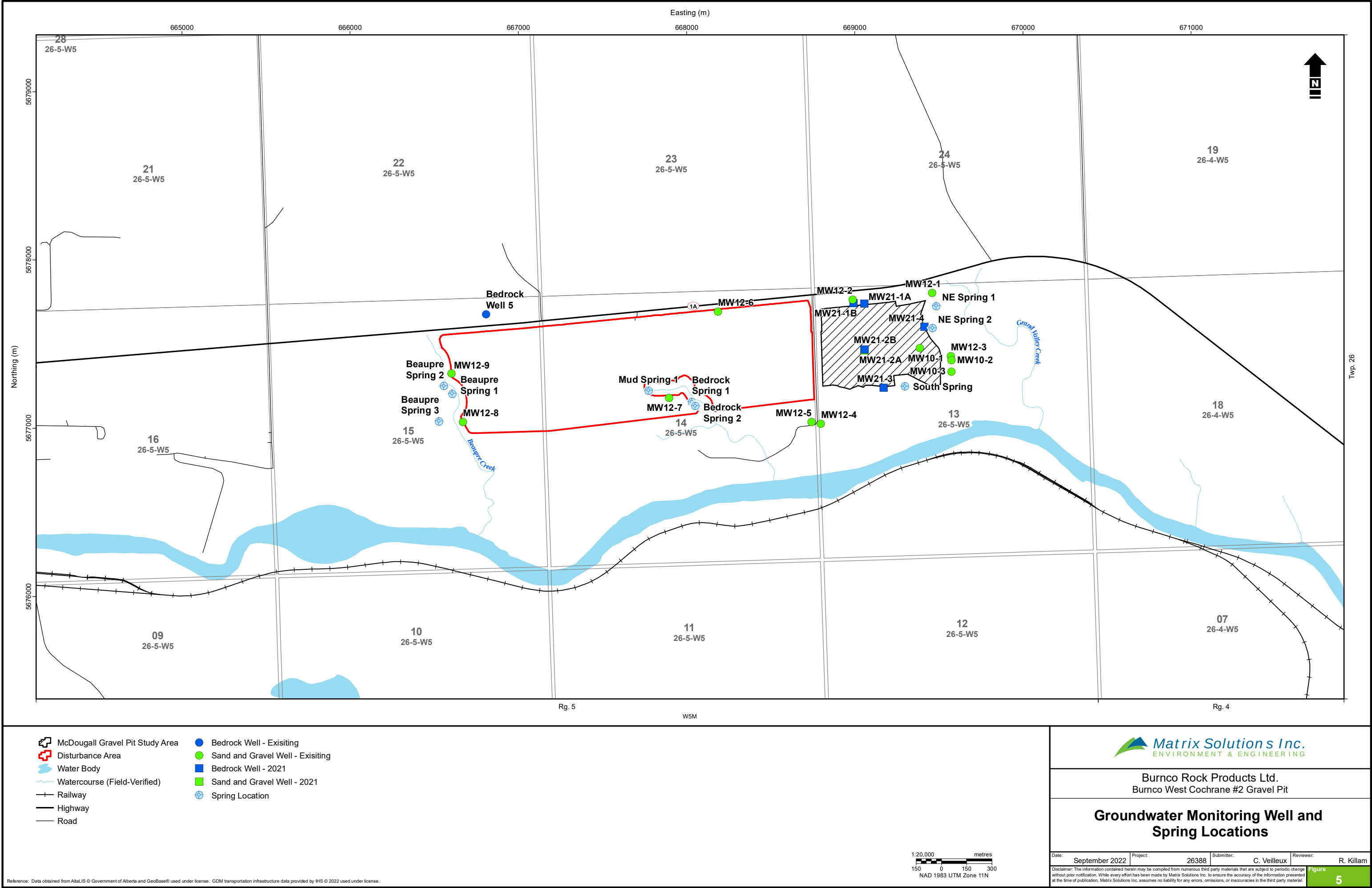
Burnco Rock Products Ltd.
Burnco West Cochrane #2 Gravel Pit

Cross-section B - B'

Date:	Project:	Submitter:	Reviewer:
September 2022	26388-XS-22	J. Bates	R. Killam

Disclaimer: The information contained herein may be compiled from numerous third party materials that are subject to periodic change without prior notification. While every effort has been made by Matrix Solutions Inc. to ensure the accuracy of the information presented at the time of publication, Matrix Solutions Inc. assumes no liability for any errors, omissions, or inaccuracies in the third party material.

Figure 4b



I:\Burnco\26388\FiguresAndTables\RE\2021\Report\Municipal\CA\Figure 5-Groundwater_Monitoring_Well_and_Spring_Locations.mxd - Tabbed_L - 15-Sep-22, 10:05 AM - oahmed - TID004

Reference: Data obtained from AltaLIS © Government of Alberta and GeoBase® used under license. GDM transportation infrastructure data provided by IHS © 2022 used under license.



Matrix Solution's Inc.
ENVIRONMENT & ENGINEERING

Burnco Rock Products Ltd.
Burnco West Cochrane #2 Gravel Pit

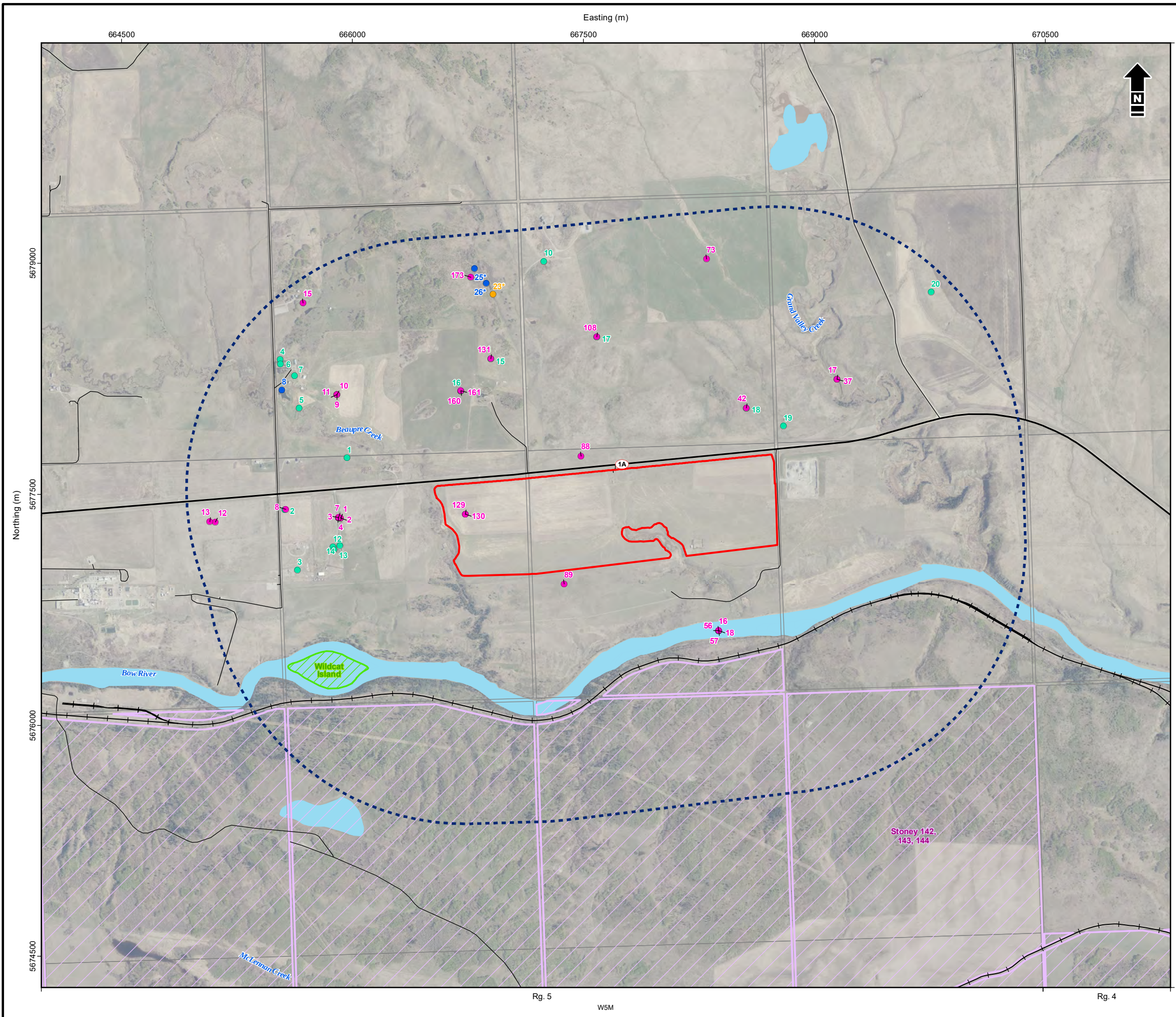
Groundwater Monitoring Well and Spring Locations

Date: September 2022	Project: 26388	Submitter: C. Veilleux	Reviewer: R. Killam
----------------------	----------------	------------------------	---------------------

Disclaimer: The information contained herein may be compiled from numerous third party materials that are subject to periodic change without prior notification. While every effort has been made by Matrix Solutions Inc. to ensure the accuracy of the information presented at the time of publication, Matrix Solutions Inc. assumes no liability for any errors, omissions, or inaccuracies in the third party material.

Figure 5

I:\Burnco\26388\FiguresAndTables\RE\2021\Report\Municipal\CA\Figure 6- Water_Wells_Search_Area.mxd - Table1_L - 15-Sep-22 03:34 PM - eahmed - TD005



Disturbance Area

Groundwater Impact Assessment Study Area

Natural Area

Indian Reserve

Water Body

Highway

Road

Groundwater Well

Field Verified Well (2018)

Field Verified Spring (2018)

Field Verified Dugout (2018)

Note: Unless marked otherwise, well and license locations are approximate and have not been field verified.

* Locations were approximated from a map supplied by Ann McNabb and McKendrick Ranches

Reference: Data obtained from AltaLIS © Government of Alberta and GeoBase® used under license. GDM transportation infrastructure data provided by IHS © 2022 used under license. Imagery (2015) obtained from Valtus © (2022) used under license.

1:25,000

metres

250 0 250 500

NAD 1983 UTM Zone 11N

Matrix Solutions Inc.

ENVIRONMENT & ENGINEERING

Burnco Rock Products Ltd.

Burnco West Cochrane #2 Gravel Pit

Water Wells Within Search Area

Date: September 2022

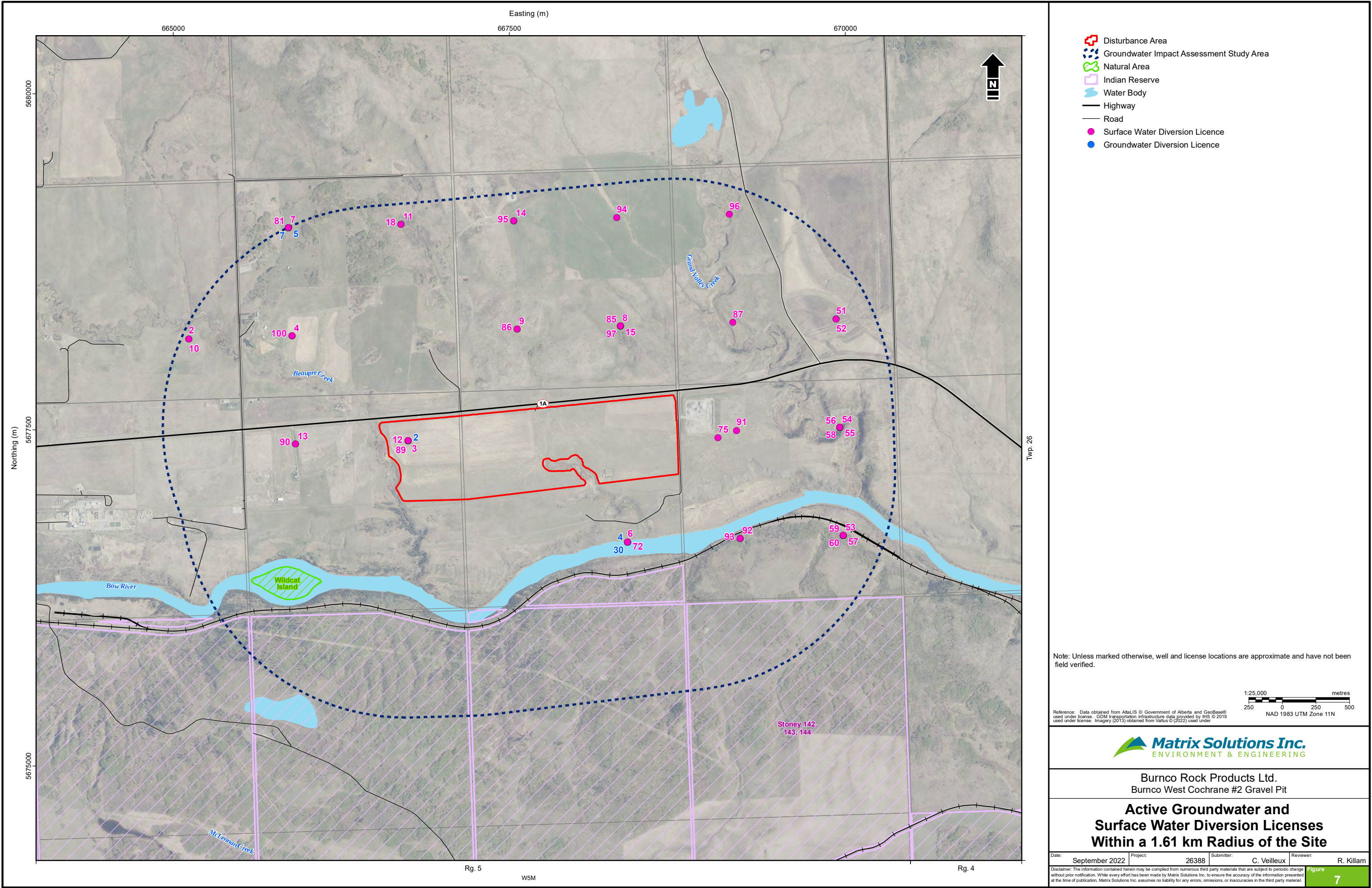
Project: 26388

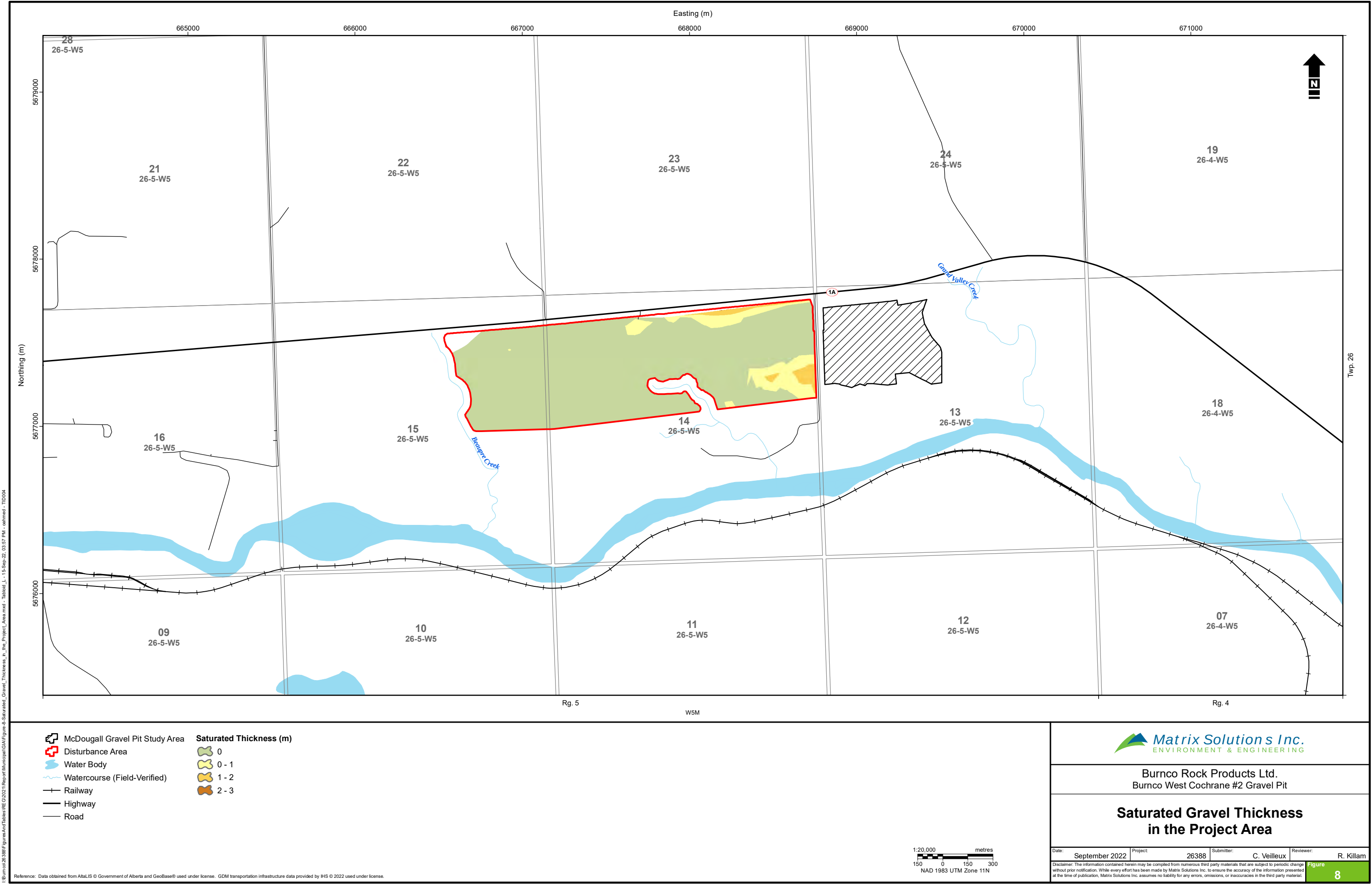
Submitter: C. Veilleux

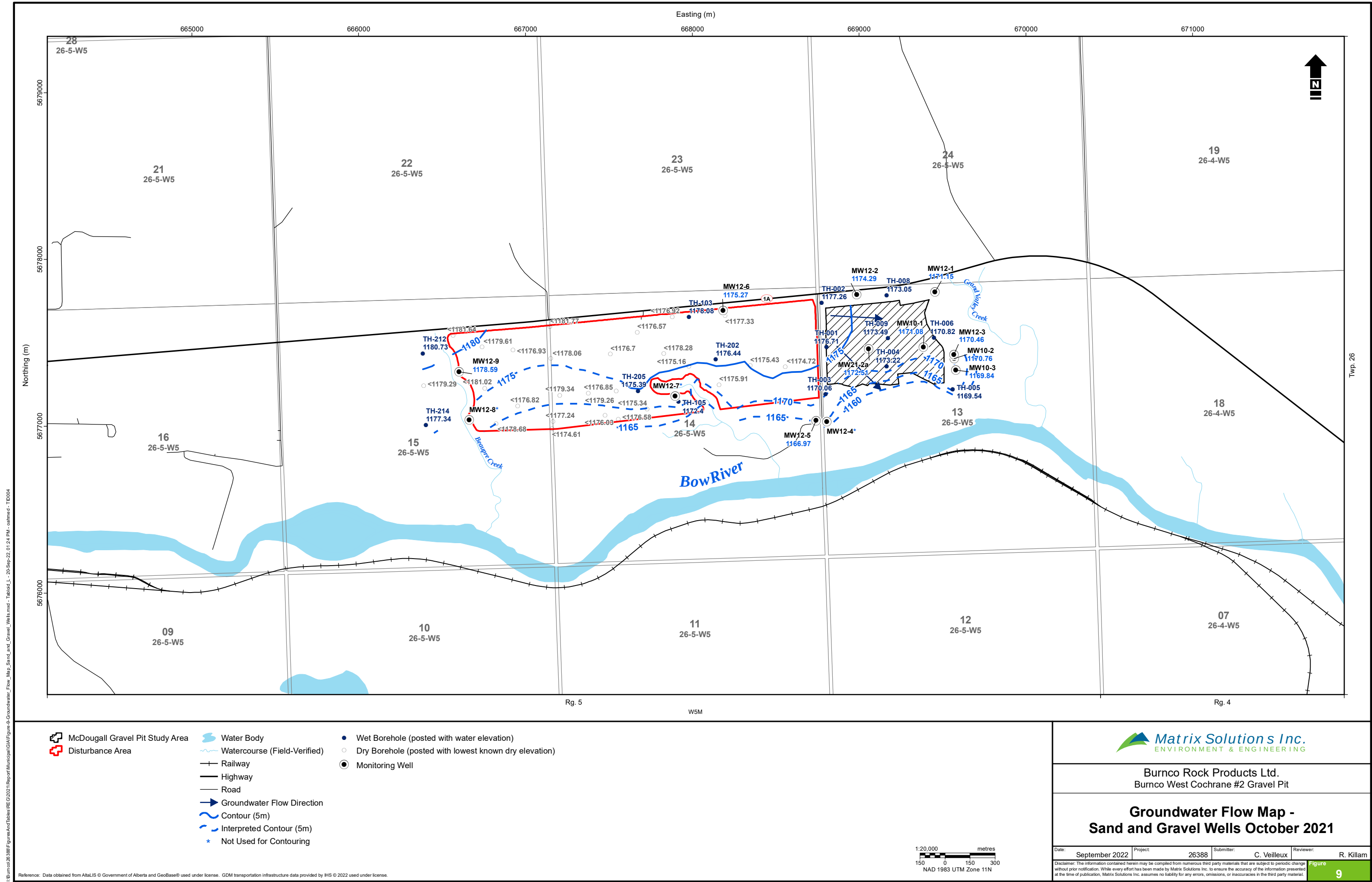
Reviewer: R. Killam

Figure 6

I:\Burnco\26388\FiguresAndTables\RE\2021\Report\Municipal\CA\Figure 7 Active Groundwater and Surface Water Diversion Licenses Within Search Area.mxd - Tab001_L_15-Sep-22 04:36 PM - aahmed - TD0005







I:\Burnco\26388\FiguresAndTables\RE\2021\Report\Municipal\CA\Figure 9 Groundwater Flow Map_Sand_and_Gravel_Wells.mxd - Tabled_L - 20-Sep-22, 01:24 PM - cahmed - TID004

Reference: Data obtained from AltaLIS © Government of Alberta and GeoBase® used under license. GDM transportation infrastructure data provided by IHS © 2022 used under license.



Matrix Solution's Inc.
ENVIRONMENT & ENGINEERING

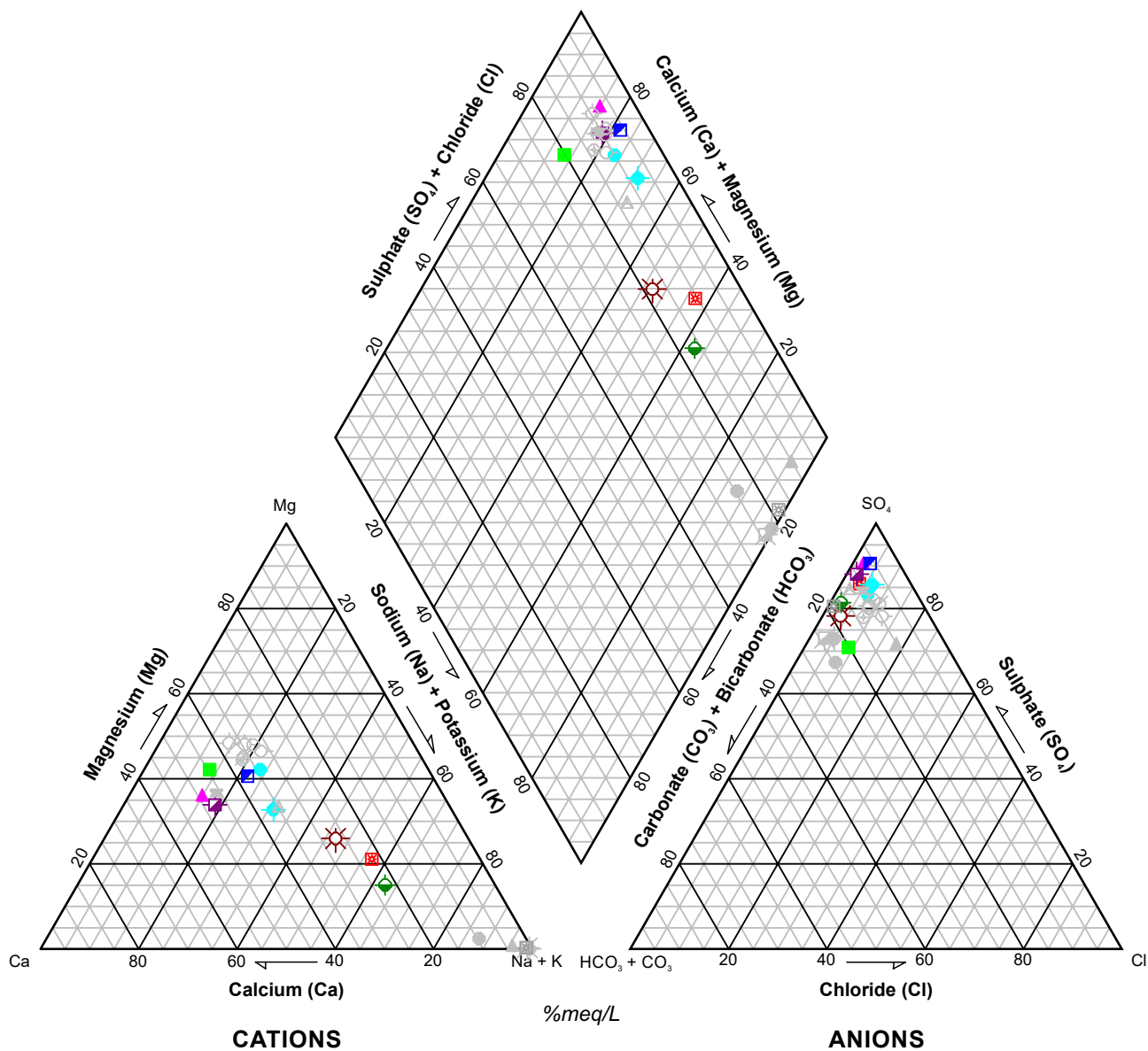
Burnco Rock Products Ltd.
Burnco West Cochrane #2 Gravel Pit

**Groundwater Flow Map -
Sand and Gravel Wells October 2021**

Date: September 2022	Project: 26388	Submitter: C. Veilleux	Reviewer: R. Killam
----------------------	----------------	------------------------	---------------------

Disclaimer: The information contained herein may be compiled from numerous third party materials that are subject to periodic change without prior notification. While every effort has been made by Matrix Solutions Inc. to ensure the accuracy of the information presented at the time of publication, Matrix Solutions Inc. assumes no liability for any errors, omissions, or inaccuracies in the third party material.

Figure 9



Sand and Gravel Wells

- MW10-1
- MW10-2
- ▲ MW10-3
- MW12-2
- ⊗ MW12-3
- ◆ MW12-5
- MW12-6
- MW12-9
- ◆ MW21-2a

Bedrock Wells

- ▲ MW21-1a
- ◆ MW21-1b
- MW21-2b
- MW21-3
- MW21-4
- ▲ Bedrock Well 5

Springs

- Beaupre Spring #1
- ⊗ Beaupre Spring #2
- ⊗ Beaupre Spring #3
- ⊗ Bedrock Spring #1
- ⊗ Bedrock Spring #2
- NE Spring #1
- NE Spring #2
- South Spring



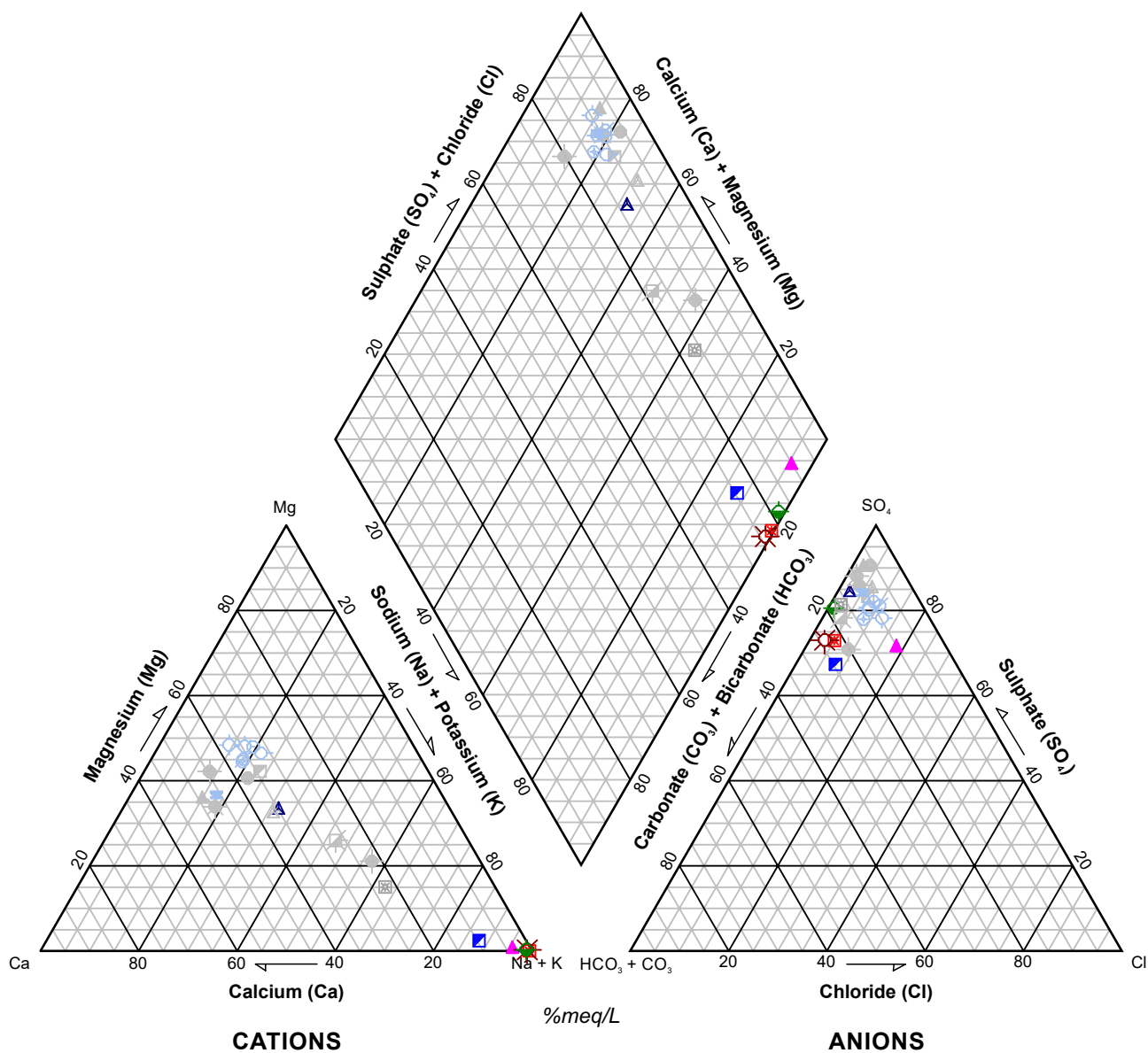
Burnco Rock Products Ltd.
Burnco West Cochrane Gravel Pit

2021/2022 Piper Diagram - Sand and Gravel Wells

Date: September 2022 Project: 26388-PD-22 Technical: R. Killam Reviewer: G. Aust

Disclaimer: The information contained herein may be compiled from numerous third party materials that are subject to periodic change without prior notification. While every effort has been made by Matrix Solutions Inc. to ensure the accuracy of the information presented at the time of publication, Matrix Solutions Inc. assumes no liability for any errors, omissions, or inaccuracies in the third party material.

Figure
10a



- | | | |
|----------------------|------------------------------|---------------------|
| Bedrock Wells | Sand and Gravel Wells | Springs |
| ▲ MW21-1a | ■ MW10-1 | ○ Beaupre Spring #1 |
| ■ MW21-1b | ● MW10-2 | ○ Beaupre Spring #2 |
| ⊗ MW21-2b | ▲ MW10-3 | ○ Beaupre Spring #3 |
| ◆ MW21-3 | ◆ MW12-2 | ⊗ Bedrock Spring #1 |
| ■ MW21-4 | ■ MW12-3 | ⊗ Bedrock Spring #2 |
| ▲ Bedrock Well 5 | ■ MW12-5 | ○ NE Spring #1 |
| | ● MW12-6 | ○ NE Spring #2 |
| | ⊗ MW12-9 | ○ South Spring |
| | ▲ MW21-2a | |



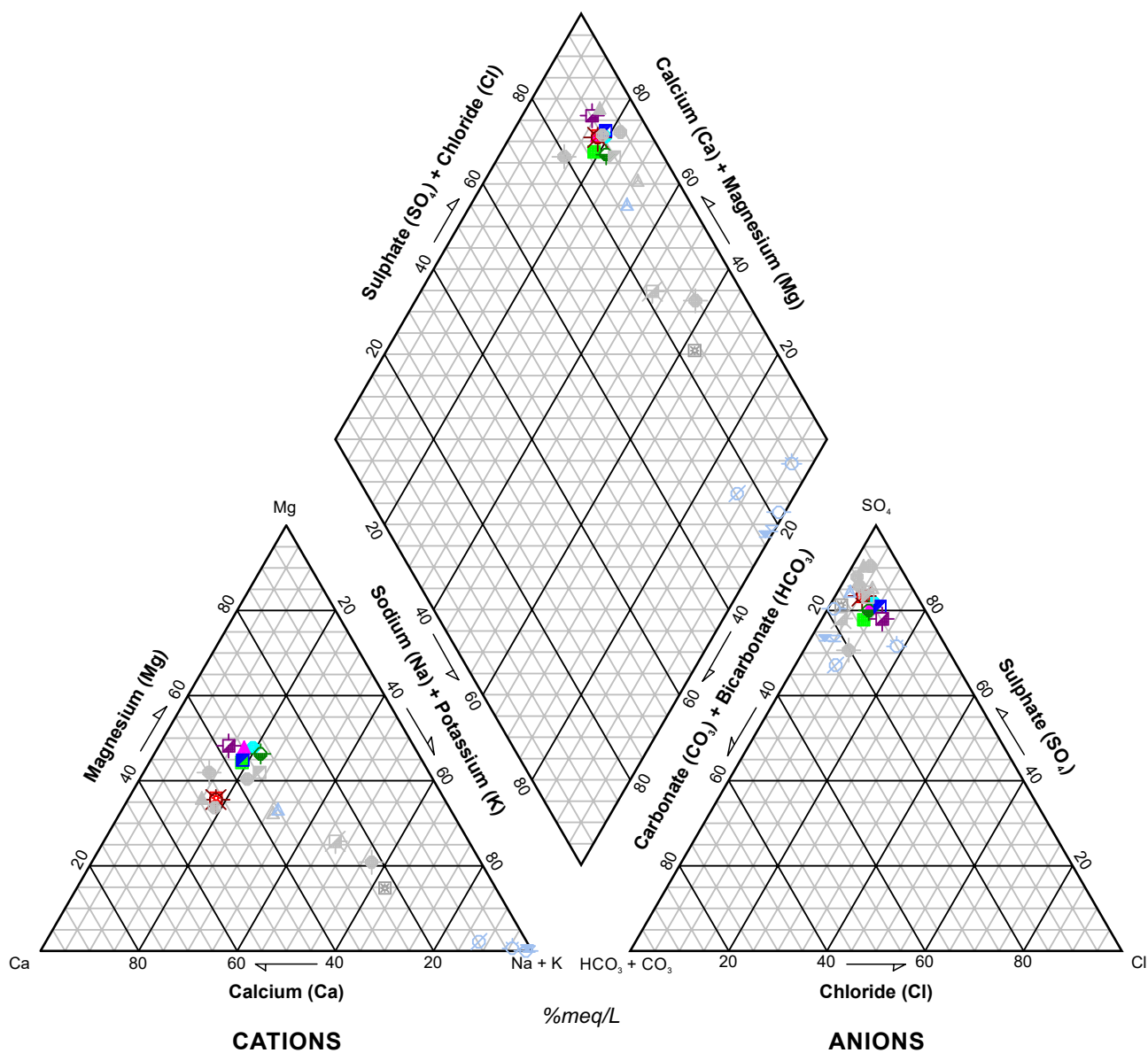
Burnco Rock Products Ltd.
Burnco West Cochrane Gravel Pit

2021/2022 Piper Diagram - Bedrock Wells

Date: September 2022	Project: 26388-PD-22	Technical: R. Killam	Reviewer: G. Aust
----------------------	----------------------	----------------------	-------------------

Disclaimer: The information contained herein may be compiled from numerous third party materials that are subject to periodic change without prior notification. While every effort has been made by Matrix Solutions Inc. to ensure the accuracy of the information presented at the time of publication, Matrix Solutions Inc. assumes no liability for any errors, omissions, or inaccuracies in the third party material.

Figure
10b



Springs

- Beaupre Spring #1
- Beaupre Spring #2
- ▲ Beaupre Spring #3
- Bedrock Spring #1
- Bedrock Spring #2
- NE Spring #1
- NE Spring #2
- South Spring

Sand and Gravel Wells

- MW10-1
- MW10-2
- MW10-3
- MW12-2
- MW12-3
- MW12-5
- MW12-6
- MW12-9
- MW21-2a

Bedrock Wells

- MW21-1a
- MW21-1b
- MW21-2b
- MW21-3
- MW21-4
- Bedrock Well 5



Burnco Rock Products Ltd.
Burnco West Cochrane Gravel Pit

2021/2022 Piper Diagram - Springs

Date: September 2022 Project: 26388-PD-22 Technical: R. Killam Reviewer: G. Aust

Disclaimer: The information contained herein may be compiled from numerous third party materials that are subject to periodic change without prior notification. While every effort has been made by Matrix Solutions Inc. to ensure the accuracy of the information presented at the time of publication, Matrix Solutions Inc. assumes no liability for any errors, omissions, or inaccuracies in the third party material.

Figure 10c

TABLE 1
Monitoring Well Summary
BURNCO Rock Products Ltd.
West Cochrane Gravel Pit

Monitoring Well	Elevation ^g (masl)					Depth (m)								Hydraulic Conductivity (m/s)	Method	Stratigraphy of Screened Interval
	Ground Surface	Top of Casing	25,26-Oct-21	29-Nov-21	11-May-22	Grnd. to Top of Screen	Grnd. to Base of Screen	25,26-Oct-21		29-Nov-21		11-May-22				
			Ground Water	Ground Water	Ground Water			Top of Casing to Water	Grnd. to Water	Top of Casing to Water	Grnd. to Water	Top of Casing to Water	Grnd. to Water			
Sand and Gravel Wells																
MW10-1	1177.63	1178.05	1171.08	---	---	6.8	9.8	6.97	6.55	---	---	---	---	---	---	sand and gravel
MW10-2	1176.22	1177.26	1170.76	---	---	5.5	8.5	6.50	5.46	---	---	---	---	---	---	sand and gravel, gravel
MW10-3	1175.98	1176.65	1169.84	---	---	6.1	9.1	6.80	6.14	---	---	---	---	---	---	sand and gravel
MW12-1	1178.70	1179.46	1171.15	---	---	6.1	7.6	8.31	7.55	---	---	---	---	2E-04	BR	sand and gravel, sandstone
MW12-2	1182.69	1183.46	1174.29	1174.24	1174.28	9.9	11.4	9.17	8.40	9.22	8.45	9.19	8.41	6E-05	BR	sand and gravel, sandstone
MW12-3	1176.03	1177.01	1170.46	---	---	6.0	7.5	6.55	5.57	---	---	---	---	---	---	sand and gravel
MW12-4	1171.19	1172.15	well removed	---	---	3.7	5.2	---	---	---	---	---	---	---	---	sand and gravel
MW12-5	1171.92	1172.78	1166.97	---	---	3.7	5.2	5.81	4.95	---	---	---	---	---	---	sand and gravel
MW12-6	1185.40	1186.19	1175.27	---	---	9.9	11.4	10.92	10.13	---	---	---	---	---	---	sand and gravel, clay till
MW12-7	1178.85	1179.78	dry	---	---	5.7	7.2	---	---	---	---	---	---	3E-04	BR	sand and gravel, sandstone
MW12-8	1183.87	1184.72	dry	---	---	6.1	7.6	---	---	---	---	---	---	---	---	sand and gravel, silty clay
MW12-9	1184.28	1185.04	1178.59	---	---	7.0	8.5	6.45	5.69	---	---	---	---	6E-05	BR	sand and gravel
MW21-2a	1179.56	1180.49	---	1172.51	1172.55	6.1	9.1	---	---	7.98	7.05	7.95	7.01	2E-04	D	gravel
Bedrock Wells																
MW21-1a	1182.00	1182.95	---	1164.12	1172.60	13.3	18.3	---	---	18.83	17.88	10.35	9.40	---	---	sandstone
MW21-1b	1183.42	1184.21	---	1171.71	1174.60	24.5	30.5	---	---	12.50	11.71	9.61	8.82	---	---	sandstone and siltstone
MW21-2b	1179.73	1180.67	---	1172.63	1172.79	13.2	18.2	---	---	8.04	7.10	7.88	6.94	---	---	sandstone
MW21-3	1172.51	1173.41	---	1168.09	1160.82	9.6	12.6	---	---	5.32	4.39	12.59	11.69	---	---	sandstone
MW21-4	1177.69	1178.64	---	1137.70	1166.04	29.2	41.2	---	---	40.94	39.99	12.60	11.65	---	---	sandstone
Bedrock Well 5	1200.98	1201.13	---	---	1177.74	---	---	---	---	---	---	23.39	23.24	---	---	---

Notes:
^g - elevations are geodetic
masl - metres above sea level
--- - not available
BR - Bouwer and Rice method (1976)
D - Dagan method (1978)

TABLE 2

Groundwater Quality Results - Field Parameters

BURNCO Rock Products Ltd.

West Cochrane Gravel Pit

Monitoring Well	Sample Date	MSI Sample Number	Field Temp °C	Field pH	Field EC ²⁵ µS/cm	Field Turbidity NTU
Sand and Gravel Wells						
MW10-1	07-Nov-18	26388181107005	5.7	8.2	700	
MW10-1	25-Oct-21	26388211025004	1.5	8.0	870	503
MW10-2	07-Nov-18	26388181107007	6.6	7.6	770	
MW10-2	25-Oct-21	26388211025002	2.5	7.7	830	840
MW10-3	07-Nov-18	26388181107008	6.9	7.6	520	
MW10-3	25-Oct-21	26388211025001	5.6	7.8	580	803
MW12-1	07-Nov-18	insufficient volume	---	---	---	
MW12-1	25-Oct-21	insufficient water	---	---	---	---
MW12-2	07-Nov-18	26388181107010	4.9	8.0	770	
MW12-2	25-Oct-21	26388211025006	8.2	8.2	820	132
MW12-3	07-Nov-18	26388181107006	5.6	7.8	840	
MW12-3	25-Oct-21	26388211025003	8.5	7.87	920	495
MW12-4	07-Nov-18	insufficient volume	---	---	---	
MW12-4	25-Oct-21	well removed	---	---	---	---
MW12-5	07-Nov-18	insufficient volume	---	---	---	
MW12-5	25-Oct-21	insufficient water	---	---	---	---
MW12-6	07-Nov-18	26388181107009	5.3	7.7	670	
MW12-6	25-Oct-21	26388211025008	7.1	7.8	780	124
MW12-7	07-Nov-18	26388181107002	4.8	7.8	750	
MW12-7	25-Oct-21	dry	---	---	---	---
MW12-8	07-Nov-18	dry	---	---	---	
MW12-8	25-Oct-21	dry	---	---	---	---
MW12-9	07-Nov-18	26388181107003	6.0	7.7	550	
MW12-9	25-Oct-21	26388211025007	4.5	7.95	660	753
MW21-2a	26-Nov-21	26388211126001	8.6	8.0	840	400
Alberta Tier 1 - Natural Areas*			NS	6.5-8.5^P	NS	NS

TABLE 2**Groundwater Quality Results - Field Parameters**

BURNCO Rock Products Ltd.

West Cochrane Gravel Pit

Monitoring Well	Sample Date	MSI Sample Number	Field Temp °C	Field pH	Field EC ²⁵ µS/cm	Field Turbidity NTU
Bedrock Wells						
MW21-1a	29-Nov-21	26388211129004	3.3	9.3	1800	740
MW21-1b	29-Nov-21	26388211129005	3.8	9.7	1420	>1000
MW21-2b	26-Nov-21	26388211126003	7.8	9.4	390	288
MW21-3	29-Nov-21	26388211129006	5.9	9.6	---	425
MW21-4	29-Nov-21	26388211129007	6.8	8.7	1550	157
Bedrock Wells						
Beaupre Spring #1	10-May-22	26388220510105	9.3	8.0	988	3.86
Beaupre Spring #2	10-May-22	26388220510104	7.4	7.8	785	0.45
Beaupre Spring #3	10-May-22	26388220510106	8.4	7.6	902	0.28
Bedrock Spring #1	12-May-22	26388220512108	7.5	7.8	778	0
Bedrock Spring #2	12-May-22	26388220512107	8.4	7.8	781	4.01
NE Spring #1	10-May-22	26388220510102	8	7.4	902	0.52
NE Spring #2	10-May-22	26388220510101	7.7	7.8	555	0.044
South Spring	10-May-22	26388220510103	11.2	8.3	767	1.03
Alberta Tier 1 - Natural Areas*			NS	6.5-8.5^P	NS	NS

Notes:

--- - not analyzed

NS - not specified

²⁵ - field EC corrected to 25°C^P - indicates guideline for Potable Groundwater exposure pathway* - *Alberta Tier 1 Soil and Groundwater Remediation Guidelines* (AEP 2019)**Italics** - indicates values do not meet applicable guidelines

TABLE 3

Groundwater Quality Results - General and Inorganic Parameters

BURNCO Rock Products Ltd.

West Cochrane Gravel Pit

Monitoring Well	Sample Date	MSI Sample Number	Lab pH	Lab EC $\mu\text{S}/\text{cm}$	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Cl mg/L	SO ₄ mg/L	NO ₂ -N mg/L	NO ₃ -N mg/L	NO ₂ -N+NO ₃ -N mg/L	T-Alkalinity mg/L	HCO ₃ mg/L	Hardness mg/L	Turbidity NTU	TSS mg/L	TDS mg/L
Sand and Gravel Wells																			
MW10-1	28-Mar-12	862756-1	8.08	679	46.8	41.1	40.9	3.9	12.8	59.5	<0.005	1.22	1.22	305	372	286	---	---	388
MW10-1	07-Nov-18	26388181107005	8.03	752	51.8	39.8	43.7	3.5	16.7	54.8	<0.01	4.79	4.79	314	383	293	---	---	420
MW10-1	25-Oct-21	26388211025004	7.91	777	60.6	45.3	46.2	3	21	54.9	<0.005	11.5	11.5	294	358	338	697	563	407
MW10-2	28-Mar-12	862756-5	7.96	922	92.5	49.4	31.2	4.1	60.6	193	<0.005	0.01	0.01	230	280	434	---	---	568
MW10-2	07-Nov-18	26388181107007	7.97	796	75.9	40.9	23.2	3.1	40.4	119	<0.01	<0.02	<0.02	256	312	358	---	---	456
MW10-2	25-Oct-21	26388211025002	7.84	742	73.5	42.2	23.3	3.4	28.5	111	<0.005	0.01	0.01	251	306	357	7740	4220	432
MW10-3	07-Nov-18	26388181107008	8.07	545	61.9	28.4	18	1.5	6.2	35.6	<0.01	0.42	0.42	253	309	272	---	---	305
MW10-3	25-Oct-21	26388211025001	7.8	520	55.2	24.7	18.3	1.5	5.1	31.2	<0.005	0.91	0.91	250	305	240	3990	3110	286
MW12-2	28-Mar-12	862756-3	8.08	764	39.8	9	126	3.2	10.4	89.4	0.045	0.33	0.375	322	393	140	---	---	471
MW12-2	13-May-13	935496-12	8.29	757	28.7	11.8	138	2.9	5.6	61.6	0.005	0.02	0.025	386	471	120	---	---	480
MW12-2	13-May-13	935496-13	8.29	753	27.8	11.6	134	2.8	5.3	64.3	<0.005	0.02	0.02	385	470	117	---	---	477
MW12-2	13-May-13	935496-14	8.31	756	27.6	11.4	140	2.8	5.2	61.8	<0.005	0.05	0.05	386	470	116	---	---	480
MW12-2	07-Nov-18	26388181107010	8.14	783	42.7	23.9	98.3	2.8	17.7	79.6	0.23	1.03	1.25	313	381	205	---	---	458
MW12-2	25-Oct-21	26388211025006	7.97	711	34.6	20.1	101	2.7	12.1	59.3	<0.005	0.15	0.15	314	383	169	6	16	418
MW12-3	28-Mar-12	862756-4	7.95	926	91.2	49.1	30.3	4	59.4	196	<0.005	0.02	0.02	230	281	430	---	---	568
MW12-3	07-Nov-18	26388181107006	8.09	877	53.5	32	99.9	3	14.2	135	<0.01	0.03	0.03	325	397	265	---	---	533
MW12-3	25-Oct-21	26388211025003	7.98	791	46.9	27.4	92.2	2.9	12.8	109	<0.005	0.05	0.05	304	371	230	4090	4430	474
MW12-5	25-Oct-21	26388211025005	7.97	550	26	10.6	81.9	2.8	4.8	62.9	<0.005	3.77	3.77	201	245	109	2050	1020	310
MW12-6	02-Apr-12	863229-1	7.82	714	280	53	31	4.4	27	44	<0.005	0.66	0.66	336	410	917	9740	---	641
MW12-6	13-May-13	935496-7	8.1	691	60.3	41	33.3	2.6	17.5	36.8	<0.005	0.68	0.68	375	457	319	---	---	416
MW12-6	13-May-13	935496-8	8.08	703	59.7	42.3	32.9	2.5	17.7	36.8	<0.005	0.72	0.72	356	435	323	---	---	406
MW12-6	07-Nov-18	26388181107009	7.95	688	61.2	38	36.8	2.4	10.9	31.9	<0.01	0.33	0.33	355	433	309	---	---	396
MW12-6	25-Oct-21	26388211025008	7.8	692	60.1	39.4	38.7	2.5	12	35.2	<0.005	0.33	0.33	346	422	312	5870	3220	396
MW12-7	28-Mar-12	862756-2	7.88	643	61.2	14.9	56.7	5	23.7	85.6	<0.005	0.81	0.81	222	271	214	---	---	380
MW12-7	07-Nov-18	26388181107002	7.96	780	68.7	30.3	59.2	3.3	22.9	55.9	<0.01	0.27	0.27	337	411	296	---	---	444
MW12-9	02-Apr-12	836229-2	7.97	573	86	20.9	25.4	3.4	8.3	57.8	0.024	0.17	0.194	255	310	301	545	---	355
MW12-9	13-May-13	935496-10	8.16	543	60.7	24	25.3	3.1	6.1	39.2	<0.005	0.02	0.02	277	337	250	---	---	324
MW12-9	13-May-13	935496-11	8.18	544	59.8	23.6	25.7	3.2	6.7	40.5	<0.005	0.03	0.03	282	344	246	---	---	329
MW12-9	07-Nov-18	26388181107003	7.98	578	59.2	26.8	25.5	2.8	6.4	37.8	<0.01	<0.02	<0.02	271	330	258	---	---	321
MW12-9	25-Oct-21	26388211025007	7.86	581	60.6	26.2	25.6	2.7	5.5	46.6	<0.005	0.06	0.06	267	326	259	416	437	328
MW21-2a	26-Nov-21	26388211126001	8.12	826	71.7	39.3	68.3	3.8	24	52.2	0.005	2.31	2.32	358	437	341	26800	4340	474
Alberta Tier 1 - Natural Areas*			6.5-8.5 ^P	NS	NS	NS	200 ^{P,AO}	NS	120 ^A	H ^{LAP,***}	Cl ^{A,***}	3 ^A	NS	NS	NS	NS	NS	NS	500 ^{P,AO}

TABLE 3

Groundwater Quality Results - General and Inorganic Parameters

BURNCO Rock Products Ltd.

West Cochrane Gravel Pit

Monitoring Well	Sample Date	MSI Sample Number	Lab pH	Lab EC $\mu\text{S}/\text{cm}$	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Cl mg/L	SO ₄ mg/L	NO ₂ -N mg/L	NO ₃ -N mg/L	NO ₂ -N+NO ₃ -N mg/L	T-Alkalinity mg/L	HCO ₃ mg/L	Hardness mg/L	Turbidity NTU	TSS mg/L	TDS mg/L
Bedrock Wells																			
MW21-1a	29-Nov-21	26388211129004	8.69	1580	12.6	1.9	388	3.3	125	47.3	<0.005	<0.01	<0.01	606	667	39.3	609	595	942
MW21-1b	29-Nov-21	26388211129005	9.38	1610	1.7	<0.2	354	2.4	34.7	37.3	0.067	0.19	0.26	737	680	4.2	59300	25700	872
MW21-2b	26-Nov-21	26388211126003	9.31	857	1.5	0.3	202	0.7	12.3	34.3	0.155	0.05	0.21	442	404	5	5210	2230	516
MW21-3	29-Nov-21	26388211129006	8.97	837	1.9	0.3	202	1.2	4.3	33.2	0.009	0.07	0.08	421	424	6	7530	4720	495
MW21-4	29-Nov-21	26388211129007	8.33	1720	33	5.1	346	4.8	52.3	276	0.085	0.78	0.87	487	594	103	157	266	1010
Bedrock Well 5	04-Feb-22	26388220204001	7.92	868	68.8	40.2	68.9	9.3	9.4	92.2	<0.005	<0.01	<0.01	387	472	337	0.6	<2	<5
Beaupre Spring #1	10-May-22	26388220510105	8.34	960	73.7	65.5	48.6	2.4	39.7	76.8	<0.005	2.61	2.61	428	521	453	6.8	6	563
Beaupre Spring #2	10-May-22	26388220510104	8.49	910	78.8	58.1	45	2.6	37.6	74	<0.005	2.19	2.19	411	471	436	0.9	5	542
Beaupre Spring #3	10-May-22	26388220510106	8.39	880	71.1	60.2	40.1	2.4	35	67.5	<0.005	2.04	2.04	395	468	426	1.1	3	513
Bedrock Spring #1	12-May-22	26388220512108	8.2	788	83.3	39.6	34.6	3.8	21.1	71.2	<0.005	1.17	1.17	350	426	371	0.2	<3	463
Bedrock Spring #2	12-May-22	26388220512107	8.09	800	85.8	40.2	35.8	3.8	20.3	73.8	<0.005	1.04	1.04	357	435	380	1.7	4	474
NE Spring #1	10-May-22	26388220510102	8.42	877	66.4	58.7	49.9	3	35.4	67	<0.005	2.35	2.35	390	459	408	0.7	11	514
NE Spring #2	10-May-22	26388220510101	8.43	760	62.6	47.2	35.6	2.5	35.8	38.8	<0.005	4.16	4.16	329	387	351	0.4	6	420
South Spring	10-May-22	26388220510103	8.52	748	64.5	50.6	26.7	2.4	42.2	36.2	<0.005	3.19	3.19	323	370	369	0.6	6	416
Alberta Tier 1 - Natural Areas*			6.5-8.5 ^P	NS	NS	NS	200 ^{P, AO}	NS	120 ^A	H ^{LAP, ***}	Cl ^{A, ***}	3 ^A	NS	NS	NS	NS	NS	NS	500 ^{P, AO}

Notes:

NS - not specified

^A - indicates guideline for Aquatic Life exposure pathway^{AO} - aesthetic objective from Guidelines for Canadian Drinking Water Quality-Summary Table (Health Canada 2020)

Cl - dependent on chloride value

H - dependent on hardness value

^{LAP} - lowest of Aquatic Life and Potable Groundwater exposure pathways^P - indicates guideline for Potable Groundwater exposure pathway[^] - MW21-2a was collected for assessment of high turbidity samples

* - Alberta Tier 1 Soil and Groundwater Remediation Guidelines (AEP 2019)

*** - Environmental Quality Guidelines for Alberta Surface Waters (AEP 2018)

Italics - indicates values do not meet applicable guidelines

TABLE 4

Groundwater Quality Results - Dissolved Metals

BURNCO Rock Products Ltd.
West Cochrane Gravel Pit

Monitoring Well	Sample Date	MSI Sample Number	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	B mg/L	Cd mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mn mg/L	Hg mg/L	Mo mg/L	Ni mg/L	Se mg/L	Si mg/L	Ag mg/L	Sr mg/L	Tl mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L
Sand and Gravel Wells																													
MW10-1	25-Oct-21	26388211025004	0.131	<0.0002	0.0004	0.094	<0.0001	0.042	0.00002	0.0006	0.0003	0.003	0.27	0.0002	0.017	0.016	<0.000005	0.003	0.0016	0.001	4.53	<0.00001	0.82	<0.00005	<0.001	0.0017	0.0033	0.0004	0.005
MW10-2	25-Oct-21	26388211025002	0.005	<0.0002	0.0004	0.044	<0.0001	0.037	0.00002	<0.0005	0.0002	<0.001	<0.01	<0.0001	0.016	0.05	<0.000005	0.006	0.006	<0.0002	3.43	<0.00001	1.01	<0.00005	<0.001	<0.0005	0.0033	0.0002	0.002
MW10-3	25-Oct-21	26388211025001	0.019	<0.0002	0.0005	0.09	<0.0001	0.016	<0.00001	<0.0005	0.0004	0.006	0.03	<0.0001	0.009	0.055	<0.000005	0.002	0.0008	0.0005	3.67	<0.00001	0.362	<0.00005	<0.001	0.0007	0.002	<0.0001	0.001
MW12-2	25-Oct-21	26388211025006	0.003	0.0004	0.0008	0.029	<0.0001	0.069	0.00003	<0.0005	<0.0001	0.002	<0.01	<0.0001	0.021	0.03	<0.000005	0.013	0.0014	<0.0002	3.72	<0.00001	0.581	<0.00005	<0.001	<0.0005	0.0057	0.0002	0.004
MW12-3	25-Oct-21	26388211025003	0.006	<0.0002	0.0005	0.03	<0.0001	0.036	0.00001	<0.0005	0.0002	0.002	<0.01	<0.0001	0.024	0.033	<0.000005	0.003	0.0017	<0.0002	3.71	<0.00001	0.646	<0.00005	<0.001	<0.0005	0.0059	0.0002	0.002
MW12-6	25-Oct-21	26388211025008	<0.002	<0.0002	0.0002	0.147	<0.0001	0.044	<0.00001	<0.0005	<0.0001	<0.001	<0.01	<0.0001	0.014	<0.005	<0.000005	0.001	<0.0005	0.0007	4.48	<0.00001	0.818	<0.00005	<0.001	<0.0005	0.0026	<0.0001	<0.001
MW12-9	25-Oct-21	26388211025007	<0.002	<0.0002	0.0004	0.082	<0.0001	0.037	0.00004	<0.0005	0.0004	<0.001	0.01	<0.0001	0.007	0.187	<0.000005	0.002	0.0014	<0.0002	4.48	<0.00001	0.77	<0.00005	<0.001	<0.0005	0.0022	0.0002	0.001
MW21-2a	26-Nov-21	26388211126001	0.558	0.0004	0.0013	0.141	<0.0001	0.06	0.00006	0.0014	0.0015	0.005	1.3	0.0012	0.02	0.094	<0.000005	0.007	0.005	0.0014	5.24	<0.00001	0.574	<0.00005	<0.001	0.0076	0.0031	0.0017	0.008
Bedrock Wells																													
MW21-1a	29-Nov-21	26388211129004	0.085	0.0018	0.0049	0.081	<0.0001	0.318	0.00004	0.0006	0.0004	0.003	0.11	0.0001	0.049	0.013	<0.000005	0.018	0.004	0.0054	2.61	<0.00001	0.103	<0.00005	0.002	0.0025	0.0078	0.001	0.002
MW21-1b	29-Nov-21	26388211129005	0.079	0.0166	0.0991	0.098	<0.0001	0.276	0.00002	<0.0005	<0.0001	0.03	0.01	0.0001	0.039	<0.005	<0.000005	0.068	0.0013	0.0102	2.16	<0.00001	0.087	<0.00005	<0.001	<0.0005	0.0095	0.0098	0.003
MW21-2b	26-Nov-21	26388211126003	0.19	0.0742	0.666	0.055	<0.0001	0.112	0.00004	<0.0005	0.0002	0.001	0.1	0.0001	0.034	<0.005	<0.000005	0.159	0.0041	0.0853	2.63	<0.00001	0.038	<0.00005	<0.001	0.0032	0.013	0.009	0.001
MW21-3	29-Nov-21	26388211129006	0.089	0.0053	0.0837	0.047	<0.0001	0.188	<0.00001	<0.0005	0.0002	0.007	0.07	0.0001	0.031	<0.005	<0.000005	0.027	0.0033	0.0039	2.68	<0.00001	0.045	<0.00005	<0.001	0.0024	0.0042	0.0016	0.002
MW21-4	29-Nov-21	26388211129007	0.023	0.0091	0.0524	0.095	<0.0001	0.159	0.00002	<0.0005	0.0004	0.004	0.02	<0.0001	0.034	0.012	<0.000005	0.08	0.0092	0.0079	3.04	<0.00001	0.258	<0.00005	0.004	<0.0005	0.0149	0.0008	0.002
Bedrock Well 5	04-Feb-22	26388220204001	<0.002	<0.0002	0.0007	0.033	<0.0001	0.096	<0.00001	<0.0005	0.0004	0.001	<0.01	<0.0001	0.018	0.22	<0.000005	0.002	<0.0005	<0.0002	4.74	0.00018	1.43	<0.00005	<0.001	<0.0005	<0.0005	<0.0001	0.035
Springs																													
Beaupre Spring #1	10-May-22	26388220510105	0.006	<0.0002	0.0002	0.112	<0.0001	0.055	<0.00001	<0.0005	<0.0001	0.001	<0.01	<0.0001	0.024	<0.005	<0.000005	0.002	<0.0005	0.0009	4.61	<0.00001	0.901	<0.00005	<0.001	<0.0005	0.004	<0.0001	<0.001
Beaupre Spring #2	10-May-22	26388220510104	<0.002	<0.0002	0.0002	0.135	<0.0001	0.05	<0.00001	<0.0005	<0.0001	<0.001	<0.01	<0.0001	0.021	<0.005	<0.000005	0.002	<0.0005	0.0009	4.64	<0.00001	0.86	<0.00005	<0.001	<0.0005	0.0036	<0.0001	<0.001
Beaupre Spring #3	10-May-22	26388220510106	<0.002	<0.0002	0.0002	0.102	<0.0001	0.049	<0.00001	<0.0005	<0.0001	<0.001	<0.01	<0.0001	0.022	<0.005	<0.000005	0.001	<0.0005	0.0009	4.66	<0.00001	0.808	<0.00005	<0.001	<0.0005	0.0034	<0.0001	<0.001
Bedrock Spring #1	12-May-22	26388220512108	<0.002	<0.0002	0.0002	0.175	<0.0001	0.038	<0.00001	<0.0005	<0.0001	0.005	<0.01	<0.0001	0.013	<0.005	<0.000005	0.001	<0.0005	0.0016	5.25	<0.00001	0.848	<0.00005	<0.001	<0.0005	0.0019	<0.0001	0.002
Bedrock Spring #2	12-May-22	26388220512107	<0.002	<0.0002	<0.0002	0.173	<0.0001	0.036	<0.00001	<0.0005	<0.0001	<0.001	<0.01	<0.0001	0.013	<0.005	<0.000005	0.001	<0.0005	0.0017	5.41	<0.00001	0.88	<0.00005	<0.001	<0.0005	0.0019	<0.0001	<0.001
NE Spring #1	10-May-22	26388220510102	0.004	<0.0002	<0.0002	0.153	<0.0001	0.044	0.00001	<0.0005	<0.0001	0.005	<0.01	<0.0001	0.02	<0.005	<0.000005	0.002	<0.0005	0.0011	4.52	<0.00001	0.767	<0.00005	<0.001	<0.0005	0.0049	<0.0001	0.001
NE Spring #2	10-May-22	26388220510101	<0.002	<0.0002	0.0002	0.156	<0.0001	0.041	0.00001	<0.0005	<0.0001	0.002	0.01	<0.0001	0.018	<0.005	<0.000005	0.002	0.0006	0.0008	4.37	<0.00001	0.777	<0.00005	<0.001	<0.0005	0.0032	<0.0001	0.001
South Spring	10-May-22	26388220510103	<0.002	<0.0002	<0.0002	0.217	<0.0001	0.022	<0.00001	<0.0005	<0.0001	<0.001	<0.01	<0.0001	0.012	<0.005	<0.000005	0.001	<0.0005	0.0008	4.03	<0.00001	0.613	<0.00005	<0.001	<0.0005	0.0021	<0.0001	<0.001
Alberta Tier 1 - Natural Areas*			Al ^{A,***}	0.006 ^P	0.005 ^A	1 ^P	NS	1.5 ^A	H ^{A,***}	0.05 ^P	NS	0.007 ^A	0.3 ^{A,P}	H ^{A,***}	NS	0.05 ^P	0.000005 ^A	NS	H ^{A,***}	0.002 ^A	NS	0.0001 ^A	NS	NS	NS	NS	0.015 ^A	NS	0.03 ^A

Notes:

- - not analyzed
- NS - not specified
- ^A - indicates guideline for Aquatic Life exposure pathway
- Al - guideline value is 0.05 mg/L or pH dependent if pH <6.5
- H - dependent on hardness value
- ^P - indicates guideline for Potable Groundwater exposure pathway
- * - Alberta Tier 1 Soil and Groundwater Remediation Guidelines (AEP 2019)
- *** - Environmental Quality Guidelines for Alberta Surface Waters (AEP 2018)
- Italics* - indicates values do not meet applicable guidelines

TABLE 5
Groundwater Quality Results - Total Metals
BURNCO Rock Products Ltd.
West Cochrane Gravel Pit

Monitoring Well	Sample Date	MSI Sample Number	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	B mg/L	Cd mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mn mg/L	Hg mg/L	Mo mg/L	Ni mg/L	Se mg/L	Si mg/L	Ag mg/L	Sr mg/L	Tl mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L	
Sand and Gravel Wells																														
MW10-1	25-Oct-21	26388211025004	5.75	0.0002	0.0037	0.243	0.0003	0.047	0.00020	0.0098	0.0043	0.012	9.7	0.0049	0.025	0.3	0.00019	0.004	0.0139	0.001	14.4	0.00007	0.921	0.0001	<0.001	0.0435	0.004	0.0142	0.065	
MW10-2	25-Oct-21	26388211025002	25.2	0.0005	0.0185	0.751	0.001	0.045	0.00086	0.0535	0.0311	0.052	52.4	0.0222	0.046	2.19	0.000057	0.007	0.0738	0.0021	37.7	0.00024	1.33	0.0004	<0.001	0.192	0.0051	0.07	0.159	
MW10-3	25-Oct-21	26388211025001	32	0.0003	0.0227	1.18	0.0016	0.031	0.00090	0.0579	0.0405	0.072	67.2	0.0352	0.051	1.91	0.000043	0.002	0.0896	0.0014	46.3	0.00043	0.689	0.0006	<0.001	0.148	0.0045	0.0818	0.238	
MW12-2	25-Oct-21	26388211025006	0.1	0.0004	0.0009	0.033	<0.0001	0.069	0.00008	0.0078	0.0004	0.003	0.36	0.0002	0.02	0.092	<0.000005	0.014	0.0063	<0.0002	3.85	<0.00001	0.568	<0.00005	<0.001	0.0045	0.0057	0.0005	0.008	
MW12-3	25-Oct-21	26388211025003	22.7	0.0006	0.0219	0.741	0.0012	0.044	0.00088	0.0484	0.0398	0.06	56.9	0.0258	0.047	1.99	0.000068	0.004	0.0772	0.0013	38.9	0.00037	0.912	0.0005	0.001	0.199	0.0089	0.0692	0.178	
MW12-6	25-Oct-21	26388211025008	14.5	0.0007	0.013	0.59	0.0007	0.065	0.00120	0.0415	0.019	0.029	33.9	0.016	0.042	1.58	0.000035	0.003	0.0375	0.001	32.8	0.00023	1.7	0.0005	<0.002	0.0904	0.0047	0.0472	0.15	
MW12-9	25-Oct-21	26388211025007	8.24	0.0006	0.0101	0.352	0.0006	0.04	0.00079	0.0188	0.0124	0.021	26.4	0.0086	0.016	1.18	0.000033	0.002	0.026	0.0004	17	0.00007	0.823	0.0003	0.001	0.224	0.0031	0.0268	0.071	
MW21-2a	26-Nov-21	26388211126001	62.6	0.0006	0.0482	2.36	0.0028	0.069	0.00306	0.156	0.0868	0.175	140	0.0816	0.105	3.62	0.000023	0.007	0.223	0.002	66.5	0.00087	2.05	0.0016	0.001	0.206	0.0088	0.15	0.605	
Bedrock Wells																														
MW21-1a	29-Nov-21	26388211129004	30.1	0.0012	0.0214	0.687	0.0013	0.261	0.00088	0.0496	0.0188	0.066	56.8	0.0403	0.071	0.926	---	0.012	0.053	0.003	45.3	0.00026	0.258	0.0008	0.005	0.122	0.0086	0.0541	0.151	
MW21-1b	29-Nov-21	26388211129005	592	<0.0040	0.243	23.3	0.036	0.48	0.00910	0.677	0.357	0.93	884	0.412	0.85	18.7	---	<0.020	0.986	0.01	632	0.0041	6.71	0.0087	<0.020	0.083	0.042	0.674	2.06	
MW21-2b	26-Nov-21	26388211126003	69.7	0.0063	0.675	2.35	0.0059	0.124	0.00103	0.0953	0.05	0.123	87.6	0.0708	0.125	1.7	0.000017	0.106	0.156	0.0811	91.8	0.00051	0.88	0.0009	<0.001	0.0832	0.0191	0.13	0.292	
MW21-3	29-Nov-21	26388211129006	61.8	<0.0020	0.12	2.16	0.004	0.19	0.00280	0.097	0.058	0.26	105	0.085	0.12	1.36	---	0.01	0.153	0.005	68.7	0.0008	0.57	0.0014	<0.010	0.091	0.01	0.099	0.52	
MW21-4	29-Nov-21	26388211129007	1.83	0.0084	0.0392	0.122	<0.0001	0.155	0.00006	0.0032	0.0014	0.007	3.07	0.0012	0.038	0.075	---	0.087	0.0125	0.0073	6.09	0.00002	0.337	<0.00005	0.005	0.0296	0.0146	0.005	0.009	
Bedrock Well 5	04-Feb-22	26388220204001	<0.02	<0.0002	0.0007	0.031	<0.0001	0.094	<0.00001	<0.0005	0.0004	0.002	0.09	0.0002	0.018	0.218	<0.000005	0.002	<0.0005	<0.0002	4.81	<0.00001	1.31	<0.00005	<0.001	<0.0005	<0.0005	<0.0001	0.032	
Springs																														
Beaupre Spring #1	10-May-22	26388220510105	0.15	<0.0002	0.0002	0.112	<0.0001	0.053	<0.00001	<0.0005	0.0001	<0.001	0.14	0.0002	0.025	0.006	<0.000005	0.001	0.0006	0.0008	5	<0.00001	0.951	<0.00005	<0.001	0.0027	0.004	0.0003	<0.004	
Beaupre Spring #2	10-May-22	26388220510104	<0.02	<0.0002	0.0002	0.142	<0.0001	0.048	<0.00001	<0.0005	<0.0001	<0.001	<0.05	<0.0001	0.022	<0.005	<0.000005	0.001	<0.0005	0.0008	4.85	<0.00001	0.92	<0.00005	<0.001	<0.0005	0.0037	0.0001	<0.004	
Beaupre Spring #3	10-May-22	26388220510106	<0.02	<0.0002	0.0002	0.104	<0.0001	0.048	<0.00001	<0.0005	<0.0001	<0.001	<0.05	<0.0001	0.023	<0.005	<0.000005	0.001	<0.0005	0.0008	4.79	<0.00001	0.908	<0.00005	<0.001	<0.0005	0.003	<0.0001	<0.004	
Bedrock Spring #1	12-May-22	26388220512108	<0.02	<0.0002	<0.0002	0.173	<0.0001	0.034	<0.00001	<0.0005	<0.0001	<0.001	<0.05	<0.0001	0.013	<0.005	<0.000005	<0.001	0.0005	0.0015	5.42	<0.00001	0.931	<0.00005	<0.001	<0.0005	0.0019	<0.0001	<0.004	
Bedrock Spring #2	12-May-22	26388220512107	0.03	<0.0002	0.0002	0.176	<0.0001	0.034	<0.00001	<0.0005	<0.0001	<0.001	<0.05	<0.0001	0.013	<0.005	<0.000005	<0.001	<0.0005	0.0014	5.45	<0.00001	0.918	<0.00005	<0.001	<0.0005	0.0019	0.0001	<0.004	
NE Spring #1	10-May-22	26388220510102	0.08	<0.0002	<0.0002	0.153	<0.0001	0.042	<0.00001	<0.0005	<0.0001	<0.001	0.09	<0.0001	0.02	<0.005	<0.000005	0.002	0.0007	0.001	4.7	<0.00001	0.81	<0.00005	<0.001	0.0012	0.0051	0.0002	<0.004	
NE Spring #2	10-May-22	26388220510101	<0.02	<0.0002	<0.0002	0.157	<0.0001	0.039	<0.00001	0.0005	<0.0001	<0.001	<0.05	<0.0001	0.018	<0.005	<0.000005	0.002	0.0008	0.0008	4.52	<0.00001	0.843	<0.00005	<0.001	<0.0005	0.0036	<0.0001	<0.004	
South Spring	10-May-22	26388220510103	0.03	<0.0002	<0.0002	0.21	<0.0001	0.021	<0.00001	<0.0005	<0.0001	<0.001	<0.05	<0.0001	0.012	<0.005	<0.000005	0.001	<0.0005	0.0007	4.22	<0.00001	0.631	<0.00005	<0.001	<0.0005	0.0021	0.0002	<0.004	
Alberta Tier 1 - Natural Areas*			Al ^{A,***}	0.006 ^{P,MAC}	0.005 ^A	1 ^P	NS	1.5 ^A	H ^{A,***}	0.05 ^P	NS	0.007 ^A	0.3 ^{A,P,AO}	H ^{A,***}	NS	0.05 ^{P,AO}	0.000005 ^A	NS	H ^{A,***}	0.002 ^A	NS	0.0001 ^A	NS	NS	NS	NS	0.015 ^A	NS	0.03 ^A	

Notes:

- NS - not specified
- ^A - indicates guideline for Aquatic Life exposure pathway
- Al - guideline value is 0.05 mg/L or pH dependent if pH <6.5
- ^{AO} - aesthetic objective from Guidelines for Canadian Drinking Water Quality-Summary Table (Health Canada 2020)
- H - dependent on hardness value
- ^{MAC} - maximum acceptable concentration from Guidelines for Canadian Drinking Water Quality-Summary Table (Health Canada 2020)
- ^P - indicates guideline for Potable Groundwater exposure pathway
- * - Alberta Tier 1 Soil and Groundwater Remediation Guidelines (AEP 2019)
- *** - Environmental Quality Guidelines for Alberta Surface Waters (AEP 2018)
- Italics* - indicates values do not meet applicable guidelines

TABLE 6**Groundwater Quality Results - Hydrocarbons**

BURNCO Rock Products Ltd.

West Cochrane Gravel Pit

Monitoring Well	Sample Date	MSI Sample Number	Benzene mg/L	Toluene mg/L	Ethylbenzene mg/L	Xylenes mg/L	F1 C ₆ -C ₁₀ - BTEX mg/L	F2 C _{>10} -C ₁₆ mg/L
Sand and Gravel Wells								
MW21-2a	26-Nov-21	26388211126001	<0.001	<0.0004	<0.0010	<0.001	<0.1	<0.1
Bedrock Wells								
MW21-2b	26-Nov-21	26388211126003	<0.001	<0.0004	<0.0010	<0.001	<0.1	<0.1
Alberta Tier 1 - Coarse-grained Soils - Natural Areas*			0.005 ^{P,MAC}	0.021 ^A	0.0016 ^{P,AO}	0.02 ^{P,AO}	2.2 ^P	1.1 ^P
Alberta Tier 1 - Fine-grained Soils - Natural Areas*			0.005 ^{P,MAC}	0.024 ^{P,AO}	0.0016 ^{P,AO}	0.02 ^{P,AO}	2.2 ^P	1.1 ^P

Notes:

- ^A - indicates guideline for Aquatic Life exposure pathway
- ^{AO} - aesthetic objective from Guidelines for Canadian Drinking Water Quality-Summary Table (Health Canada 2020)
- ^{MAC} - maximum acceptable concentration from Guidelines for Canadian Drinking Water Quality-Summary Table (Health Canada 2020)
- ^P - indicates guideline for Potable Groundwater exposure pathway
- * - *Alberta Tier 1 Soil and Groundwater Remediation Guidelines (AEP 2019)*

Italics - indicates values do not meet applicable guidelines

TABLE 7a**Water Wells**

BURNCO Rock Products Ltd.
West Cochrane Gravel Pit

Water Well Number	Well ID*	Location	Well Owner	Total Depth m	Top of Screen m	Bottom of Screen m	Top of Perforation m	Bottom of Perforation m	Bottom of Casing m	Depth to Water m	Bedrock Depth m	Date of Information	Proposed Use For Well	Type of Work
Within 1.6 km Radius of N 15-026 05 W5M														
1	1200620	NW-15-26-5-W5M	---	---	---	---	---	---	---	---	---	---	---	---
2	1200621	NW-15-26-5-W5M	---	---	---	---	---	---	---	---	---	---	---	---
3	1465008	NW-15-26-5-W5M	Lewis, Dwayne	67.06	---	---	48.77	67.06	30.79	---	30.48	2004/07/17	Domestic	New Well
4	1260005	NW-15-26-5-W5M	K-Country Excavating	109.73	---	---	79.25	91.44	21.34	9.40	19.81	2003/06/10	Domestic	New Well
7	2101004	NW-15-26-5-W5M	---	---	---	---	---	---	---	---	---	---	---	---
8	2079054	13-15-26-5-W5M	Cornish, Kathleen	19.81	7.62	19.81	7.62	19.81	12.19	11.43	16.46	2015/02/11	Domestic	New Well
9	386521	SW-22-26-5-W5M	McDougall, D.M. #2	31.09	---	---	21.03	28.04	21.03	10.67	22.25	1968/05/10	Stock	New Well
10	386522	SW-22-26-5-W5M	McDougall, D.H. #1	20.73	---	---	---	---	20.42	10.67	---	1968/04/24	Domestic	New Well
11	386523	SW-22-26-5-W5M	Dutchik, George	18.29	---	---	12.19	18.29	6.10	13.72	17.98	1989/11/07	Domestic & Stock	New Well
12	386459	NE-16-26-5-W5M	Stoney Band Ranch #1	27.43	---	---	6.10	27.43	8.53	6.10	7.01	1976/07/22	Domestic & Stock	New Well
13	1465037	NE-16-26-5-W5M	Young, Wendell	24.38	---	---	---	---	18.90	9.26	9.14	2007/07/21	Domestic	New Well
15	386525	12-22-26-5-W5M	Racieot, Bruce	67.06	---	---	39.62	48.77	9.14	27.43	9.14	1977/05/10	Unknown	New Well
16	386455^	SE-14-26-5-W5M	King, Harry	80.00	---	---	---	---	---	---	---	29840	Stock	New Well
17	386531^	SW-24-26-5-W5M	Baldwin, C.	110.00	---	---	---	---	---	---	---	28175	Stock	New Well
18	416458^	SE-14-26-5-W5M	King, Harvey #Well 1	100.00	---	---	---	---	---	---	---	29833	Domestic	New Well
37	386531	SW-24-26-5-W5M	Baldwin, C.	33.53	---	---	25.91	32.31	8.23	23.17	7.32	1977/02/19	Stock	New Well
42	9826378	1-23-26-5-W5M	McKendrick Ranches Ltd	33.53	---	---	24.38	28.96	24.38	8.00	21.95	2019/06/06	Domestic	New Well
56	386455	SE-14-26-5-W5M	King, Harry	24.38	---	---	18.90	22.86	9.14	3.05	8.23	1981/09/11	Stock	New Well
57	416458	SE-14-26-5-W5M	King, Harvey#Well 1	30.48	---	---	24.38	29.26	9.14	9.14	7.93	1981/09/04	Domestic	New Well
73	1066247	NE-23-26-5-W5M	Dave 11 McDougall	36.58	---	---	27.43	33.53	26.52	27.43	25.91	2010/07/17	Domestic	New Well
88	1066146	13-14-26-5-W5M	Gertner, Harold	109.73	---	---	18.29	21.34	16.46	17.68	15.85	2010/06/08	Domestic	New Well
89	466127	5-14-26-5-W5M	Bedry, Mervin	18.29	---	---	12.50	13.72	---	6.92	7.62	1996/04/26	Domestic	New Well
108	9826181	6-23-26-5-W5M	McKendrick Ranches Ltd	30.48	---	---	22.56	27.43	18.29	14.33	16.46	2017/12/05	Stock	New Well
129	1066120	NE-15-26-5-W5M	Dutchik, Dave	97.54	---	---	42.67	48.77	11.28	15.24	5.49	2010/06/04	Domestic	New Well
130	1066121	NE-15-26-5-W5M	Dutchik, Dave	18.29	---	---	10.67	15.24	9.14	3.66	7.01	2010/06/05	Domestic	New Well
131	386518	8-22-26-5-W5M	McNabb, Grant/Ann #2	25.91	---	---	22.56	24.99	22.56	19.81	---	1983/11/09	Stock	New Well
160	386517	SE-22-26-5-W5M	McNabb, Grant/Ann	68.58	---	---	51.82	57.91	44.20	30.48	43.59	1983/11/01	Stock	New Well
161	386519	SE-22-26-5-W5M	McNabb, Grant/Ann	54.86	---	---	---	---	42.98	32.00	42.98	1989/11/08	Domestic & Stock	New Well
173	1465045	9-20-26-4-W5M	Schmunk, David	28.04	---	---	---	---	27.43	20.80	---	2011/11/29	Domestic	New Well

Notes:

--- - not available

^ - data from Groundwater Evaluation Proposed BURNCO McDougall Ranch Gravel Pit and Surrounding Area (Levelton 2014)

TABLE 7b

Active Surface Water and Groundwater Licences

BURNCO Rock Products Ltd.

West Cochrane Gravel Pit

Licence Number	User Number	Applicant	Interim Licence Number	Approval ID	Water Allocation ID	Legal Location	Source	Quantity (m³)	PUMP RATE (Surface Water - m³/sec Ground Water - m³/day)	Consumptive Use (m³)	Specific Purpose	Licence Type	Licensed Date	Expiry Date
Groundwater Users														
Within 1.6 km of N 15-026-05 W5M														
2	19981227745	David H. McDougall Ranch Limited	00181834 00 00	181834	131984	NE 15-026-05 W5M	Unnamed Aquifer - Unclassified	295	---	295	REGISTRY	WAREG	26-Mar-04	---
4	19700501027	King, Harvey	00075461 00 00	75461	92605	SE 14-026-05 W5M	Unnamed Aquifer - Unclassified	558	---	558	REGISTRY	WAREG	08-May-02	---
5	19961231239	Dutchik, Carol & David	00181842 00 00	181842	68531	NW 22-026-05 W5M	Unnamed Aquifer - Unclassified	125	---	125	REGISTRY	WAREG	14-Mar-02	---
7	19961231239	Dutchik, Carol & David	00181842 00 00	181842	68531	NW 22-026-05 W5M	Unnamed Aquifer - Unclassified	125	---	125	REGISTRY	WAREG	14-Mar-02	---
30	19700501027	King, Harvey	00075461 00 00	75461	92605	SE 14-026-05 W5M	Unnamed Aquifer - Unclassified	558	---	558	REGISTRY	WAREG	08-May-02	---
Surface Water Users														
Within 1.6 km of N 15-026-05 W5M														
2	19301231313	Bar 50 Ranch	00159666 00 00	159666	65662	SE 21-026-05 W5M	Beaupre Creek	598	---	598	REGISTRY	WAREG	11-Mar-02	---
3	19301231314	Bar 50 Ranch	00159666 00 00	159666	65665	SE 21-026-05 W5M	Unnamed Stream - Unclassified	1149	---	1149	REGISTRY	WAREG	11-Mar-02	---
4	19610515001	Canlin Energy Corporation	04157	39409	20216	SW 16-026-05 W5M	Bow River	123350	0.014	123350	OTHR	WRLIC	18-Feb-85	---
6	19961231240	Dutchik, Carol & David	00181842 00 00	181842	68532	NW 22-026-05 W5M	Surface Runoff	125	---	125	REGISTRY	WAREG	14-Mar-02	---
7	19981227741	David H. McDougall Ranch Limited	00181834 00 00	181834	131978	SE 23-026-05 W5M	Grand Valley Creek	214	---	214	REGISTRY	WAREG	26-Mar-04	---
8	19981227742	David H. McDougall Ranch Limited	00181834 00 00	181834	131979	SW 23-026-05 W5M	Grand Valley Creek	214	---	214	REGISTRY	WAREG	26-Mar-04	---
9	19981227744	David H. McDougall Ranch Limited	00181834 00 00	181834	131983	NE 15-026-05 W5M	Beaupre Creek	295	---	295	REGISTRY	WAREG	26-Mar-04	---
10	19981227746	David H. McDougall Ranch Limited	00181834 00 00	181834	131986	NE 15-026-05 W5M	Unnamed Stream - Unclassified	322	---	322	REGISTRY	WAREG	26-Mar-04	---
11	18941231162	Mcnabb, Grant	00174128 00 00	174128	66774	NE 22-026-05 W5M	Unnamed Stream - Unclassified	1685	---	1685	REGISTRY	WAREG	12-Mar-02	---
13	19981227752	David H. McDougall Ranch Limited	00181834 00 00	181834	131992	NW 23-026-05 W5M	Unnamed Stream - Unclassified	306	---	306	REGISTRY	WAREG	26-Mar-04	---
14	19981227754	David H. McDougall Ranch Limited	00181834 00 00	181834	131994	SE 23-026-05 W5M	Unnamed Stream - Unclassified	306	---	306	REGISTRY	WAREG	26-Mar-04	---
15	19981230474	Dutchik, George	00181840 00 00	181840	79877	SW 22-026-05 W5M	Beaupre Creek	2025	---	2025	REGISTRY	WAREG	23-Mar-02	---
18	18941231162	Mcnabb, Grant	00174128 00 00	174128	66774	NE 22-026-05 W5M	Unnamed Stream - Unclassified	1685	---	1685	REGISTRY	WAREG	12-Mar-02	---
51	18941231557	Mckendrick Ranches Ltd.	00173566 00 00	173566	129464	SE 24-026-05 W5M	Grand Valley Creek	7	---	7	REGISTRY	WAREG	20-Feb-04	---
52	18941231557	Mckendrick Ranches Ltd.	00312501 00 00	312501	223764	SE 24-026-05 W5M	Grand Valley Creek	12	---	12	REGISTRY	WAREG	20-Aug-12	---
53	18941231558	Mckendrick Ranches Ltd.	00173566 00 00	173566	129465	SE 13-026-05 W5M	Unnamed Stream - Unclassified	45	---	45	REGISTRY	WAREG	20-Feb-04	---
54	18941231558	Wiechnik Land & Cattle Co. Ltd.	00312485 00 00	312485	223749	NE 13-026-05 W5M	Unnamed Stream - Unclassified	45	---	45	REGISTRY	WAREG	20-Aug-12	---
55	18941231559	Mckendrick Ranches Ltd.	00173566 00 00	173566	129466	NE 13-026-05 W5M	Grand Valley Creek	45	---	45	REGISTRY	WAREG	20-Feb-04	---
56	18941231559	Wiechnik Land & Cattle Co. Ltd.	00312485 00 00	312485	223750	NE 13-026-05 W5M	Grand Valley Creek	170	---	170	REGISTRY	WAREG	20-Aug-12	---
57	18941231560	Mckendrick Ranches Ltd.	00173566 00 00	173566	129467	SE 13-026-05 W5M	Grand Valley Creek	45	---	45	REGISTRY	WAREG	20-Feb-04	---
58	18941231560	Wiechnik Land & Cattle Co. Ltd.	00312485 00 00	312485	223751	SE 13-026-05 W5M	Grand Valley Creek	45	---	45	REGISTRY	WAREG	20-Aug-12	---
59	18941231561	Mckendrick Ranches Ltd.	00173566 00 00	173566	129468	SE 13-026-05 W5M	Bow River	45	---	45	REGISTRY	WAREG	20-Feb-04	---
60	18941231561	Wiechnik Land & Cattle Co. Ltd.	00312485 00 00	312485	223752	SE 13-026-05 W5M	Bow River	100	---	100	REGISTRY	WAREG	20-Aug-12	---
72	19700501028	King, Harvey	00075461 00 00	75461	92606	SE 14-026-05 W5M	Bow River	372	---	372	REGISTRY	WAREG	08-May-02	---
75	19800403001	Burnco Rock Products Ltd.	00396954 00 00	396954	338660	NW 13-026-05 W5M	Bow River	55507	0.002	55507	AGGWSH	WALIC	12-Dec-18	11-Dec-28
81	19961231240	Dutchik, Carol & David	00181842 00 00	181842	68532	NW 22-026-05 W5M	Surface Runoff	125	---	125	REGISTRY	WAREG	14-Mar-02	---
85	19981227741	David H. McDougall Ranch Limited	00181834 00 00	181834	131978	SE 23-026-05 W5M	Grand Valley Creek	214	---	214	REGISTRY	WAREG	26-Mar-04	---
86	19981227742	David H. McDougall Ranch Limited	00181834 00 00	181834	131979	SW 23-026-05 W5M	Grand Valley Creek	214	---	214	REGISTRY	WAREG	26-Mar-04	---
87	19981227743	David H. McDougall Ranch Limited	00181834 00 00	181834	131981	SW 24-026-05 W5M	Grand Valley Creek	214	---	214	REGISTRY	WAREG	26-Mar-04	---
90	19981227747	David H. McDougall Ranch Limited	00181834 00 00	181834	131987	NW 15-026-05 W5M	Unnamed Stream - Unclassified	322	---	322	REGISTRY	WAREG	26-Mar-04	---
91	19981227748	David H. McDougall Ranch Limited	00181834 00 00	181834	131988	NW 13-026-05 W5M	Grand Valley Creek	127	---	127	REGISTRY	WAREG	26-Mar-04	---
92	19981227749	David H. McDougall Ranch Limited	00181834 00 00	181834	131989	SW 13-026-05 W5M	Bow River	127	---	127	REGISTRY	WAREG	26-Mar-04	---
93	19981227750	David H. McDougall Ranch Limited	00181834 00 00	181834	131990	SW 13-026-05 W5M	Unnamed Stream - Unclassified	127	---	127	REGISTRY	WAREG	26-Mar-04	---
94	19981227751	David H. McDougall Ranch Limited	00181834 00 00	181834	131991	NE 23-026-05 W5M	Unnamed Stream - Unclassified	306	---	306	REGISTRY	WAREG	26-Mar-04	---
95	19981227752	David H. McDougall Ranch Limited	00181834 00 00	181834	131992	NW 23-026-05 W5M	Unnamed Stream - Unclassified	306	---	306	REGISTRY	WAREG	26-Mar-04	---
96	19981227753	David H. McDougall Ranch Limited	00181834 00 00	181834	131993	NW 24-026-05 W5M	Unnamed Stream - Unclassified	306	---	306	REGISTRY	WAREG	26-Mar-04	---
97	19981227754	David H. McDougall Ranch Limited	00181834 00 00	181834	131994	SE 23-026-05 W5M	Unnamed Stream - Unclassified	306	---	306	REGISTRY	WAREG	26-Mar-04	---
100	19981230474	Dutchik, George	00181840 00 00	181840	79877	SW 22-026-05 W5M	Beaupre Creek	2025	---	2025	REGISTRY	WAREG	23-Mar-02	---

Notes:

--- - not available

- Alberta Environment and Parks (AEP). 2021. *Surface Water Users*. Informatics Branch, Corporate Services Division. Edmonton, Alberta. Information provided to Matrix Solutions Inc. January 28, 2022.

- this information was extracted directly from an existing database and was not verified by Matrix personnel

WAREG - Traditional Agricultural Users, Water Act Registration

WALIC - Water Act Licence

WRLIC - Licences

AGGWSH - Aggregate Washing

OTHR - Other (Abattoirs, dust control, bridge washing, hydroseeding)

REGISTRY - Traditional Agriculture User Registration Program

TABLE 8**Water Quality Control Sample Results - General and Inorganic Parameters**

BURNCO Rock Products Ltd.

West Cochrane Gravel Pit

Sample Point	Sample Date	MSI Sample Number	Lab pH	Lab EC $\mu\text{S}/\text{cm}$	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Cl mg/L	SO ₄ mg/L	NO ₂ -N mg/L	NO ₃ -N mg/L	NO ₂ /NO ₃ -N mg/L	T-Alkalinity mg/L	HCO ₃ mg/L	Hardness mg/L	Turbidity NTU	TSS mg/L	TDS mg/L
MW21-2a	26-Nov-21	26388211126001	8.12	826	71.7	39.3	68.3	3.8	24	52.2	0.005	2.31	2.32	358	437	341	26800	4340	474
MW21-2a	26-Nov-21	26388211126002	---	---	---	---	---	---	---	---	---	---	---	---	---	---	44400	---	---
Detection Limit (DL)			---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.1	---	---
Reliable Detection Limit (RDL)**			---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.5	---	---
Absolute Difference*			---	---	---	---	---	---	---	---	---	---	---	---	---	---	17600	---	---
Absolute Relative Percent Difference (RPD)*			---	---	---	---	---	---	---	---	---	---	---	---	---	---	49	---	---
Duplicate Sample Results Evaluation			---	---	---	---	---	---	---	---	---	---	---	---	---	---	Poor	---	---

Notes:

--- - not applicable

* - non-detectable concentrations are assessed at 95% of the detection limit

** - the reliable detection limit (RDL) or practical detection limit (PDL) is defined as 5 times the DL

Good - evaluation indicates acceptable reproducibility

Poor - evaluation indicates poor reproducibility**Evaluation of Duplicate Analyses:**

- reproducibility is unacceptable if RPD is > 30% for inorganic waters and > 40% for soils and organics

- if RPD is not applicable (---), reproducibility is evaluated based on Absolute Difference (unacceptable if > 2 x RDL)

- if Absolute Difference is not applicable (---), reproducibility is evaluated based on the parameter concentration (unacceptable if > 2 x RDL)

- pH is evaluated based on Absolute Difference (unacceptable if > 0.5)

APPENDIX A

2014 Levelton Groundwater Evaluation



BURNCO Rock Products Ltd
Groundwater Evaluation
Proposed BURNCO McDougall Ranch Gravel Pit and
Surrounding Area
N ½-14, W ½-13 and NE-15-26-5 W5M

Submitted by:
Levelton Consultants Ltd.
203-6919 32 Avenue NW
Calgary AB T3B 0K6
T: 403.247.1813
F: 403.247.1814
calgary@levelton.com

To:
BURNCO Rock Products Ltd
c/o Twerdoff & Associates Inc.
200, 155 Glendeer Circle SE
Box 1480 Station T
Calgary AB T2H 2P9

Attention: Mr. Dennis Twerdoff

June 25, 2014

Levelton File: AB12-0253-00 Rev. 5

Executive Summary

On behalf of BURNCO Rock Products Ltd, Levelton Consultants Ltd. (Levelton) undertook a hydrogeologic evaluation of the McDougall Ranch property and surrounding area located in N ½-14, W ½-13 and NE-15-26-5 W5M in Rocky View County, Alberta. The purpose of the evaluation was to establish baseline hydrogeological conditions and to assess if operations at the gravel pit will have adverse effects on the springs or other water well users in the area. Thirteen monitoring wells were installed within the study area and water well records and published and unpublished reports were reviewed to characterize the nature of the strata and groundwater in the area. Solinst Levellogger Edge electronic data loggers were installed in 11 of the 13 wells to take daily water level readings.

The area is underlain by Pleistocene and Holocene aged fluvial deposits of fine sand, silt and clay (~1 m) underlain by minor gravel deposits to approximately 11 m below surface. Grain size analyses indicated that the surficial deposits average 65% gravel, 28% sand and 8% silt/clay. Bedrock sandstones and mudstones of the Brazeau Formation provide aquifers to well users within the area.

The water table underlying the proposed gravel pit is located at depths ranging from 5 to 10 m below grade. The water levels within the monitoring wells showed small fluctuations that appeared to be seasonal. Levelton calculated groundwater flow direction and determined it was towards the south and east at a velocity of approximately 128 m/year. There is also likely a vertical component of groundwater flow from the bedrock into the surficial gravel deposit. Given the depths to the Disturbed Belt Aquifer which have a strata combination (including the Brazeau Formation), it is unlikely that the groundwater within the gravel deposits is recharging the bedrock.

Based on published annual mean precipitation, mean annual calculated lake evaporation maps produced by Alberta Environment and Sustainable Resources Development and annual unit runoff, net water balance estimates indicated that there would be a net gain or net loss depending on the size of the end pit lake, if developed through wet pit excavation; however, based on the proposed depth of excavation below the water table and the thickness of the overburden, an end pit lake is not anticipated as there is sufficient overburden to backfill any wet pit areas to an elevation higher than the water table.

Levelton collected groundwater samples on two occasions. The total dissolved solids (TDS) content of the groundwater ranged from 324 to 641 mg/L, indicating the groundwater is generally of good quality. Bicarbonate is the dominant anion and calcium, magnesium, and sodium are present in varying amounts. Slightly elevated chloride concentrations are present in the water. Elevated concentrations of chloride have been reported by others in the study area region. The water chemistry in samples collected from the springs and wells was similar, implying a common source. Differences in water temperatures in samples from the springs and the wells are interpreted as indicating that groundwater from the bedrock recharges the gravel deposits, via upward flow. Springs are found in the coulee immediately to the south east of the gravel pit. The assessed groundwater flow direction indicated that the springs are located downgradient from the proposed gravel pit area. Levelton undertook a search of the Alberta Well Water Database and found that water wells in the proposed gravel pit region (1.6 km radius) are drilled to a minimum 15.85 m.

It appears that vertical recharge from the bedrock into the gravels is expected and the proposed gravel operation should have no discernible impacts on either existing well users or the springs.

Table of Contents

	page
EXECUTIVE SUMMARY	i
1 INTRODUCTION.....	1
1.1 Site Location	1
1.2 Project Purpose and Scope	2
2 MONITORING WELL INSTALLATION	2
2.1 Grain Size Analysis	4
2.2 Monitoring Water Levels	4
3 GEOLOGY.....	5
4 HYDROGEOLOGY OF GRAVEL UNITS.....	9
4.1 Groundwater Depths	9
4.2 Groundwater Flow Directions	10
4.3 Groundwater Velocities	11
4.4 Precipitation and Evapotranspiration.....	12
4.5 Impacts of End Pit Lake	12
4.6 Hydrogeological Discussion	13
5 WATER CHEMISTRY.....	14
6 GROUNDWATER USERS IN AREA	17
7 ENERGY AND CONSERVATION BOARD (ERCB) RECORDS	17
8 CONCLUSIONS	18
9 RECOMMENDATIONS	19
10 CLOSURE.....	20
11 REFERENCES	21
APPENDIX A MONITORING WELL LOGS AND WATER WELL LOGS.....	A
APPENDIX B SIEVE ANALYSIS REPORTS	B
APPENDIX C ERCB AND GRAVEL THICKNESS MAPS	C
APPENDIX D WATER DISPLACEMENT WITH TIME GRAPHS AND CALCULATED HYDRAULIC CONDUCTIVITY...D	D
APPENDIX E WATER CHEMISTRY REPORT AND PIPER PLOT	E
APPENDIX F WATER WELL RECONNAISSANCE REPORT.....	F

List of Figures

Figure 1: Aerial photograph showing study area	1
Figure 2: Air Photo Plan Showing Well Drilling Locations.....	3
Figure 3: Subject Site Shown in the Brazeau Formation	6
Figure 4: Subject Site Shown in the Disturbed Belt Aquifer Region	7
Figure 5: West to East Surficial Geology Cross Section, along Bow Valley Trail	8
Figure 6: Location of Cross Section	9
Figure 7: Groundwater Flow Directions in Gravel	11
Figure 8: Locations of Springs Observed Around the Study Area.....	14
Figure 9: Elevated Chloride Areas in the Disturbed Belt Aquifer Region	15

List of Tables

Table 1: Summary of Strata	3
Table 2: Summary of Sieve Analysis.....	4
Table 3: Edge Levellogger Serial Numbers	4
Table 4: Depths to Groundwater.....	10
Table 5: Summary of Water Quality Analysis, March 2012	15
Table 6: Summary of Well Water Quality Analyses, McDougall Ranch Study Area.....	16
Table 7: Summary of Spring Water Quality Analyses, McDougall Ranch Study Area.....	16

© 2014 ALL RIGHTS RESERVED

THIS DOCUMENT IS PROTECTED BY COPYRIGHT LAW AND MAY NOT BE REPRODUCED IN ANY MANNER, OR FOR ANY PURPOSE, EXCEPT BY WRITTEN PERMISSION OF LEVELTON CONSULTANTS LTD.

1 Introduction

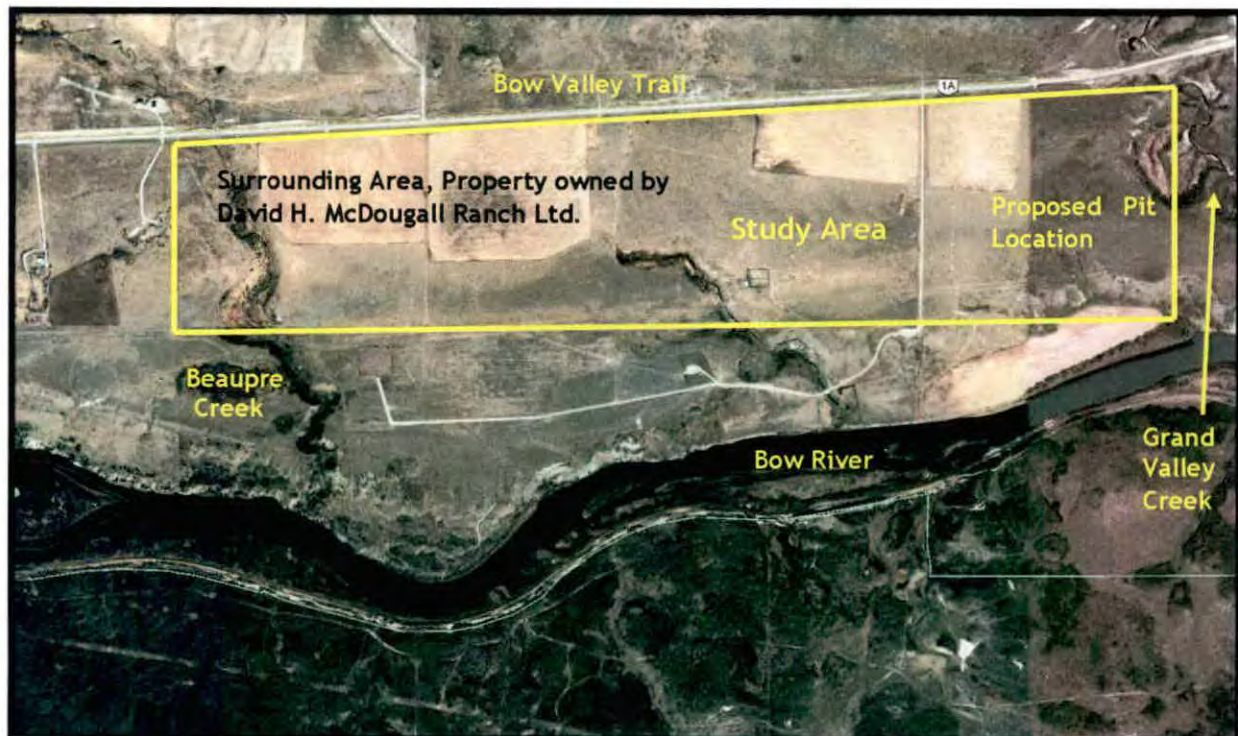
Levelton Consultants Ltd (Levelton) was retained by BURNCO Rock Products Ltd (BURNCO) to undertake a groundwater assessment of the McDougall Ranch property west near Wildcat, Alberta, roughly 10 km west of Cochrane. The scope and purpose of the groundwater assessment, discussed more fully below, were presented in Levelton's proposal dated December 22, 2011 and were subsequently amended in April 2013. This report supersedes previous reports dated August 22, 2011 and February 11 and July 12, 2013.

1.1 Site Location

The study area is on a parcel of land located in the N ½-14, W ½-13 and NE-15-26-5 W5M in Rocky View County, Alberta. It is located immediately south of Highway 1A (Bow Valley Trail) and north of the Bow River on a relatively flat terrace above the Bow River; which is found immediately south of the study area and approximately 30 m topographically lower. Two deeply incised creeks are found immediately east and west of the study area; Grand Valley Creek is located east of the Site and Beaupre Creek is on the west. The study area location is shown on the aerial photograph for the area in Figure 1.

The study area is underlain by Pleistocene and Holocene fine-grained sediments, including fine sand, silt and clay¹. The fine-grained sediments, in turn, are underlain by coarse sand and gravel deposits.

Figure 1: Aerial photograph showing study area



¹ Shetsen, 1987

1.2 Project Purpose and Scope

The hydrogeological assessment of the study area, as per Levelton's December 22, 2011 proposal, had the following purposes:

- Establish baseline groundwater conditions, including water levels, groundwater flow direction and velocity and the nature of strata;
- Determine the source and nature of springs in the study area;
- Determine the potential impacts on the groundwater during pit dewatering on other groundwater users in the area,
- Address the impacts to groundwater on development of an end pit lake; and
- Install a network of monitoring wells to allow for continuous groundwater elevation measurements.

In order to meet the objectives, the same proposal presented a scope of work that consisted of the following:

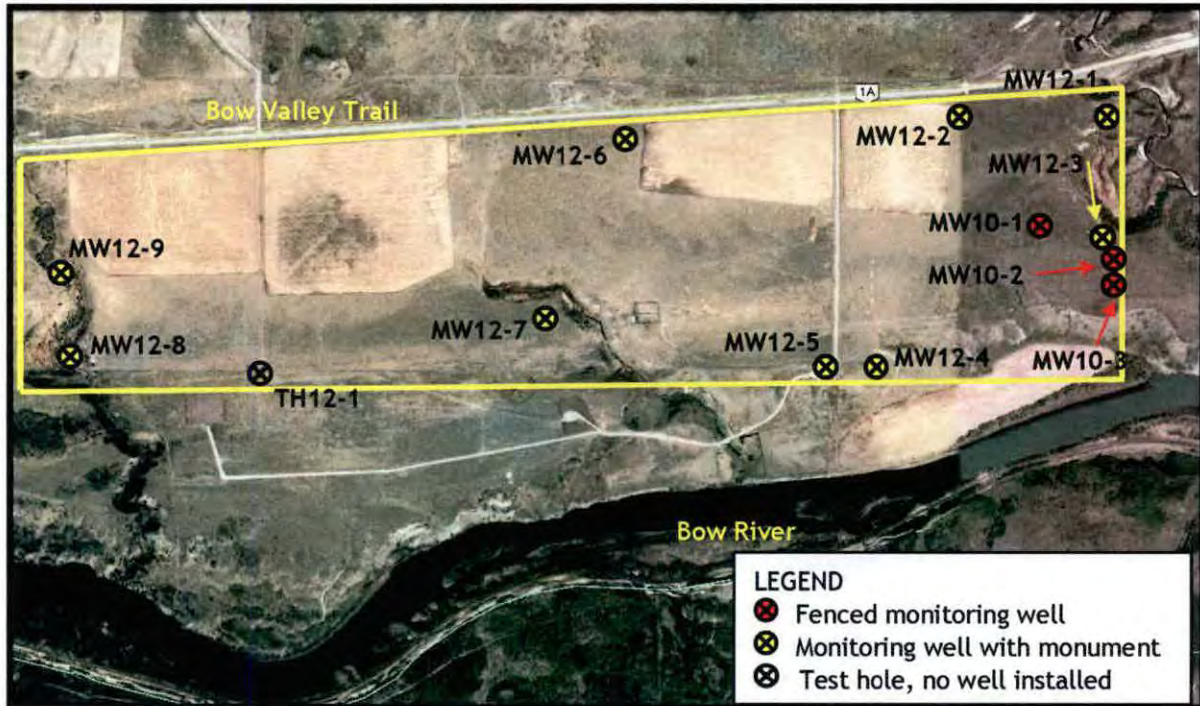
- Install 13 wells in the study area to the depth of bedrock;
- Collect soil samples for grain size analyses;
- Equip selected monitoring wells with electronic data loggers to allow for weekly reading of water levels;
- Collect groundwater samples from the monitoring wells for baseline water quality assessment;
- Hydraulic conductivity testing on the monitoring wells;
- Review local water well logs to determine depths of wells and aquifers utilized by the water wells;
- Examine spring discharge points and collecting water quality samples from the springs;
- Map the gravel thickness in the area to assess both the total thickness and thickness above the water table, and
- Complete a field verified survey for local wells in the area.

2 Monitoring Well Installation

There are 13 monitoring wells within the study area. Three wells (MW10-1, MW10-2 and MW10-3) were installed in May 2010 by Sabatini Earth Technologies Inc. An additional ten wells were completed in March, 2012 by Levelton; with drilling by personnel from Beck Drilling. A Becker hammer rig was used to install the wells due to the gravel nature of the area. The soil strata were logged during drilling along with indication of groundwater in ten of the 13 wells. Monitoring wells which consisted of 52 mm diameter PVC pipe with machine cut slots over the lowermost 1.5 m of the pipe were installed in nine of the boreholes drilled in 2012. Clean sand was placed in the annulus between the screened pipes and well bore walls and bentonite chips were placed around the solid portion of the pipes to act as surface seals.

The PVC pipes were extended above-grade and steel casing protectors were placed around the above-ground PVC pipes. Details of the strata encountered, monitoring well design and water levels are shown on the borehole logs in Appendix A. An air photo showing monitoring well locations is shown in Figure 2.

Figure 2: Air Photo Plan Showing Well Drilling Locations



In most wells, a thin topsoil layer was observed at surface. The topsoil was underlain by silty clay in wells MW12-1, MW12-2, MW12-3, MW12-6 and MW10-1. Silty clay was not observed in wells MW12-4, MW12-5, MW12-7, MW12-8, MW12-9, MW10-2, MW10-3 or TH12-1. The silty clay ranged in thickness from roughly 4 m in MW12-6 to 0.75 m in MW12-1.

Underlying the surficial material was a layer of mixed sand and gravel that ranged in thickness from 4 m in MW12-4 to roughly 9 m in MW10-3. The sand and gravel was underlain, in turn, by a thin layer of clay till, underlain by bedrock, in wells MW12-5, MW12-6, MW12-8, TH12-1, MW10-1, MW10-2 and MW10-3. Clay till was not reported in the other six wells. A summary of the nature of strata encountered is shown in Table 1.

Table 1: Summary of Strata

WELL	MW12-1	MW12-2	MW12-3	MW12-4	MW12-5	MW12-6	MW12-7
Well Depth	7.64	11.5	7.5	5.2	5.2	11.5	7.25
Depth to Water	Dry	9.36	7.33	Dry	Dry	10.2	6.82
Silty Clay	0 - 0.75	0 - 3.0	0 - 1.5	-	-	0 - 4.0	-
Gravel and Sand	0.75 - 7.0	3.0 - 11.0	1.5 - 7.5	0 - 4.2	0 - 4.0	4.0 - 11.0	0 - 6.3
Clay Till	-	-	-	-	4.0 - 4.2	11.0 - 11.5	-
Bedrock	7.0 - 7.6	11.0 - 11.5	-	4.2 - 5.2	4.2 - 5.2	-	6.3 - 7.25
WELL	MW12-8	MW12-9	TH12-1	MW10-1	MW10-2	MW10-3	
Well Depth	8.5	8.5	8.5	8.5	8.5	8.5	
Depth to Water	7.59	5.72	Dry	6.15	5.29	4.59	
Silty Clay	-	-	-	0 - 1.8	-	-	
Gravel and Sand	0 - 6.9	0 - 8.5	0 - 4.0	1.8 - 9.1	0 - 7.6	0 - 9.1	
Clay Till	6.9 - 8.5	-	4.0 - 8.5	9.1 - 9.75	7.6 - 8.5	9.1	
Bedrock	-	-	-	9.75	8.5	-	

Note: All depths in metres, top soil not included. MW10-1, MW10-2 and MW10-3 installed by Sabatini Earth Technologies Inc.

At the time of drilling, the water table was found near the base of the gravel. This is a generally observed feature in gravel as water within gravel is relatively free to drain into the coulees east and west of the Site with the result that only a relatively thin layer of saturated gravel is present. A gravel thickness of up to 8 m is found on the north side of the Site, thinning to approximately 4 m on the south side. The unsaturated gravel thickness ranges from 4 to 6 m throughout the study area.

2.1 Grain Size Analysis

Levelton conducted a grain size analysis was conducted on representative gravel samples on nine of the 13 wells. A summary of the results are below in Table 2.

Table 2: Summary of Sieve Analysis

WELL	MW12-1	MW12-2	MW12-3	MW12-4	MW12-5	MW12-6	MW12-7	MW12-8	MW12-9
Depth of Sample	3.0	4.5	3.4, 5.0	2.5	2.0	5.2	3.6	3.0	4.0 - 5.0
Gravel (%)	66.7	55.9	56	63.2	67.8	70.4	71.8	66.2	63.7
Sand (%)	25.2	32.4	34.2	27.3	26.1	23.9	23.6	29.7	27.3
Silt/Clay (%)	8.1	11.7	9.8	9.5	6	5.7	4.6	4.1	9.0

Note: All depths in metres, depth of sample indicates the depth in which sample was collected.

A generalization of the grain size analysis indicates 65% gravel, 28% sand and 8% silt/clay. The sieve analysis reports are included in Appendix B.

2.2 Monitoring Water Levels

Levelton installed Solinst Levellogger Edge electronic data loggers in eleven of the 13 monitoring wells on-Site, including wells that were dry at the time of drilling. The rationale behind putting data loggers into dry wells is to record water levels in the event that groundwater is present on a temporary or seasonal basis.

The data loggers allow for reading of water levels with time. Based on a 1-minute sampling rate, the battery life of the data loggers is ten years and has memory for up to 120,000 readings. Levelton has set the data loggers to take water level readings once a day; as contractually agreed. Levelton will download the data from the well locations twice a year. Each monitoring well with its corresponding Edge Levellogger serial number is presented in Table 3.

Table 3: Edge Levellogger Serial Numbers

Well	Serial Number
MW12-1	0032007100
MW12-2	0032005579
MW12-3	0032005585
MW12-4	0032007089
MW12-5	0032007094
MW12-6	0032005576
MW12-7	0032005574
MW12-8	0032007080
MW12-9	0032007078
MW10-1	0032007065
MW10-2	0032005588

3 Geology

As discussed, published mapping indicates that the uppermost sediments consist of gravel, gravel and sand, fine to coarse-grained sand, and minor silt beds. These units have been mapped as consisting of units deposited as preglacial meltwater channel and valley infill deposits from the Pleistocene and Holocene². According to the water well drillers logs, the thickness of these units is approximately 7.5 m. Gravel clasts are composed of quartzite, limestone, and dolomite fragments from the Rocky Mountains west of the Site.

These units extend in an east-west direction roughly parallel to the Bow River from west of Canmore to east of Strathmore. Gravel erosion has occurred in some areas along the Bow Valley and gravel is entirely eroded south of the Site.

Below the base of the gravels are greenish grey, thick bedded, chloritic and feldspathic sandstone and blocky grey mudstone; some tuff and thin coal beds, of the Brazeau Formation. The Brazeau Formation is an upper Cretaceous aged unit consisting of greenish grey, thick-bedded, chloritic and feldspathic sandstone and blocky grey mudstone; some tuff and thin coal beds. The Brazeau Formation is non-marine and is shown in Figure 3³.

The study area overlies a portion of the Disturbed Belt region of Alberta, which is the uppermost bedrock in the western portion of the Rocky View County. The Disturbed Belt boundary was defined on the *Geological Map of Alberta*⁴. The Disturbed Belt is an area of the east Rocky Mountains and Foothills that has been deformed by thrusting and faulting. Structural geological mapping near the study area has indicated that the bedrock dips to the west, at angles ranging from 10° to 45°, although local dips eastward of up to 50° have also been reported⁵. The eastern edge of the Disturbed Belt has been mapped as a fault boundary, coincidental with Grand Valley Creek, on the eastern edge of the Site. A second, smaller fault has been mapped in the area of Beaupre Creek, just to the west of the Site.

The Disturbed Belt aquifers⁶ have a strata combination (including the Brazeau Formation) of permeable and impermeable layers. The inferred extent of Disturbed Belt Aquifer in Rocky View County is shown in Figure 4.

² Ibid.

³ Alberta Energy and Utilities Board and Alberta Geologic Survey.

⁴ Hamilton et al. 1999.

⁵ Rutherford, 1927; Ozoray and Barnes, 1977.

⁶ Hydrogeological Consultants Ltd., 2002.

Figure 3: Subject Site Shown in the Brazeau Formation

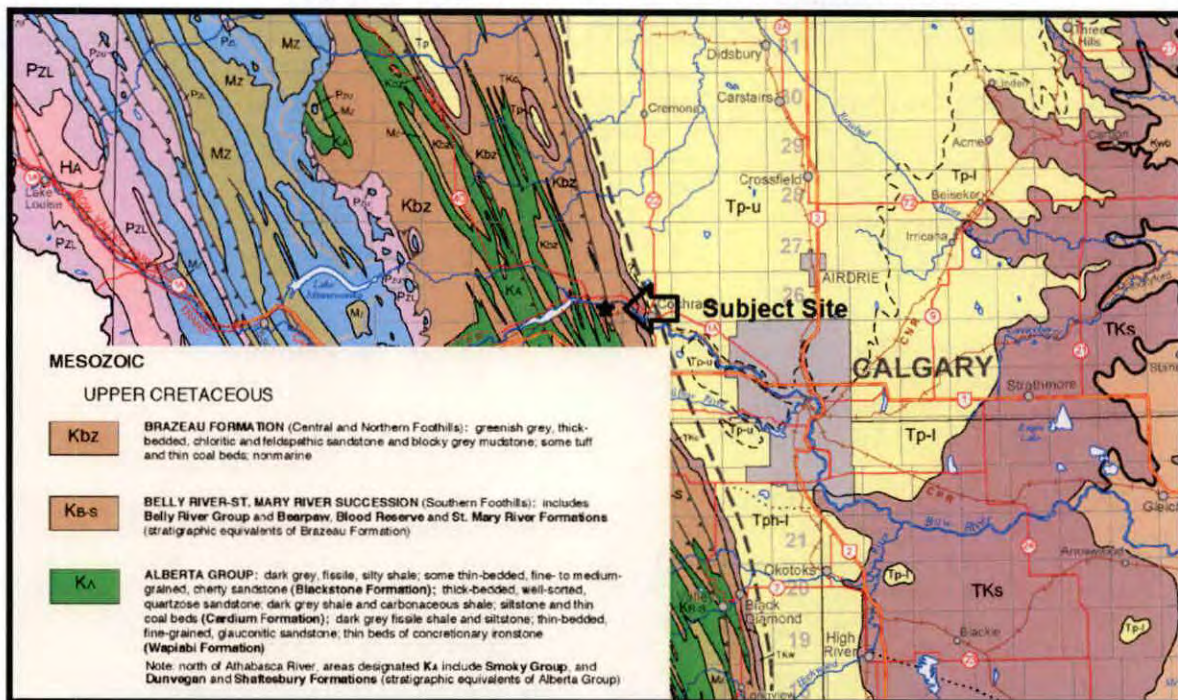
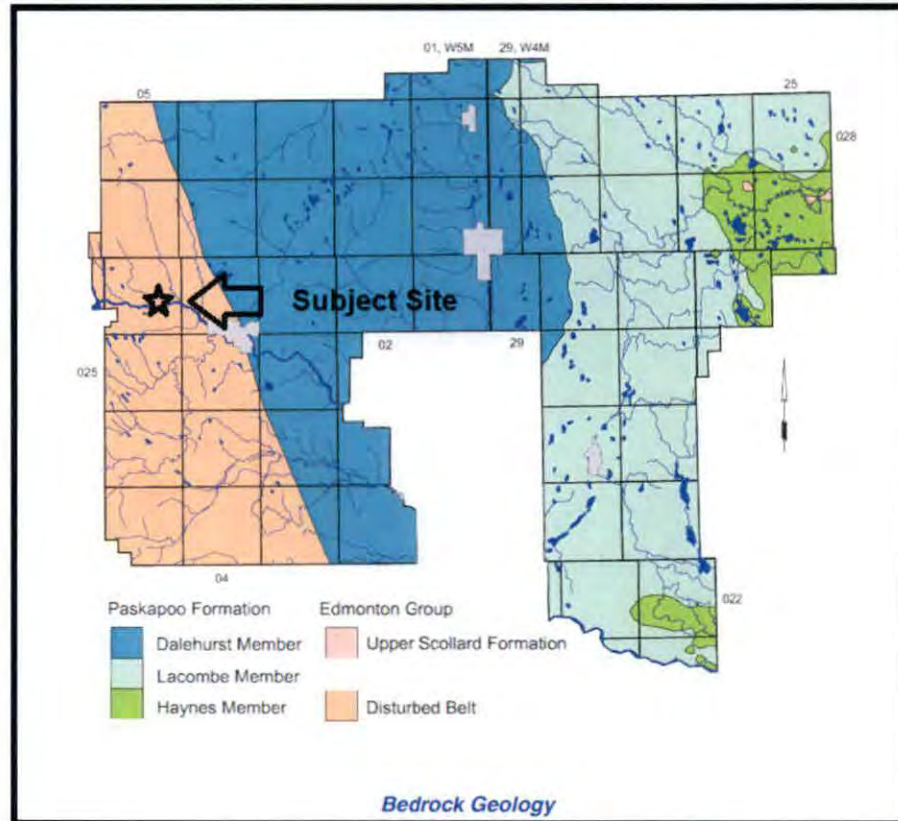


Figure 4: Subject Site Shown in the Disturbed Belt Aquifer Region



There are relatively few water wells found within the Disturbed Belt Aquifer, compared to other aquifers within the county⁷. Yields are generally low and range from 17 to 75 m³/day; dry holes are relatively common. Published reports indicate that the depth from the ground surface to the top of the Disturbed Belt is approximately 30 m⁸ and the groundwater chemistry in the bedrock are bicarbonate type waters with concentrations of sulphate generally less than 100 mg/L, and total dissolved solids of less than 1,000 mg/L⁹. This is generally the same for the water chemistries found in the water wells in Section 5.

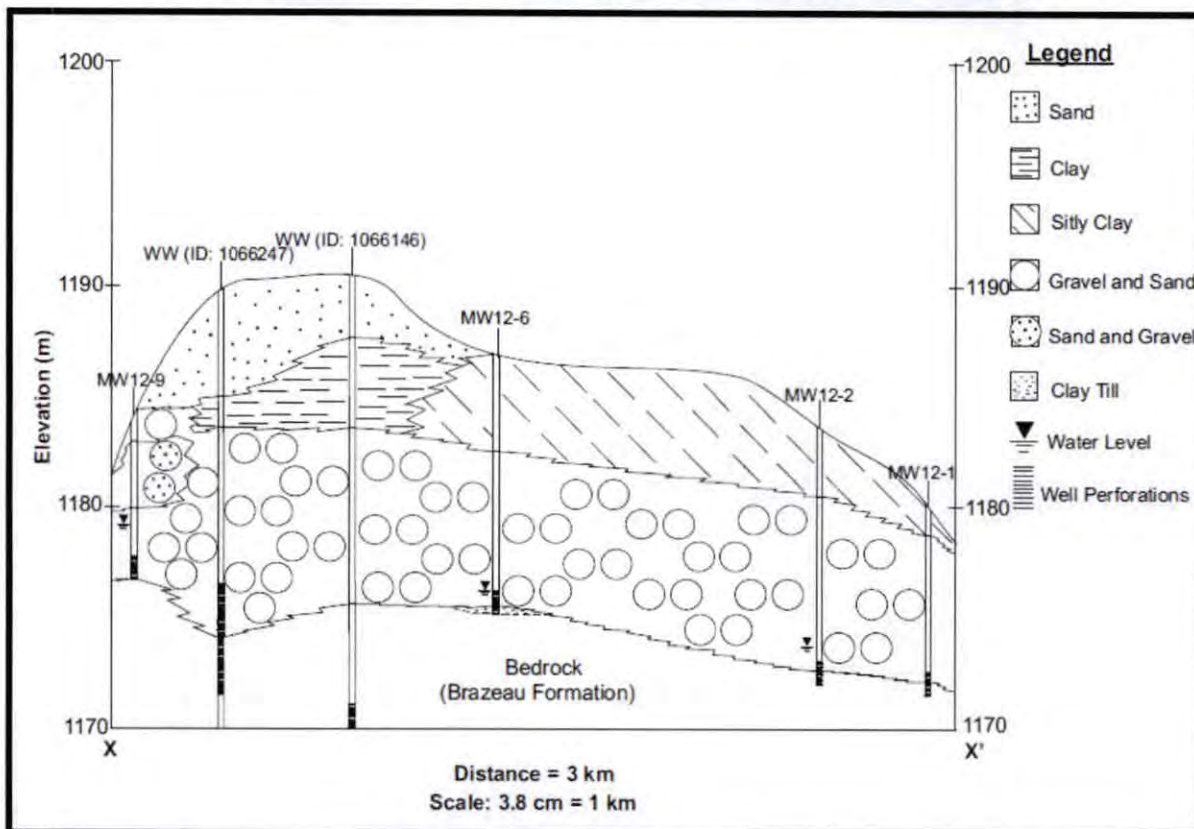
A west to east cross section illustrating the strata and topography utilizing the well data from the Site is shown in Figure 5. Two adjacent upgradient wells, completed in the underlying bedrock (ID 1066247 and ID 1066146), that appear to be used primarily as irrigation wells, were also used to develop the cross-section.

⁷ *ibid.*

⁸ *ibid.*

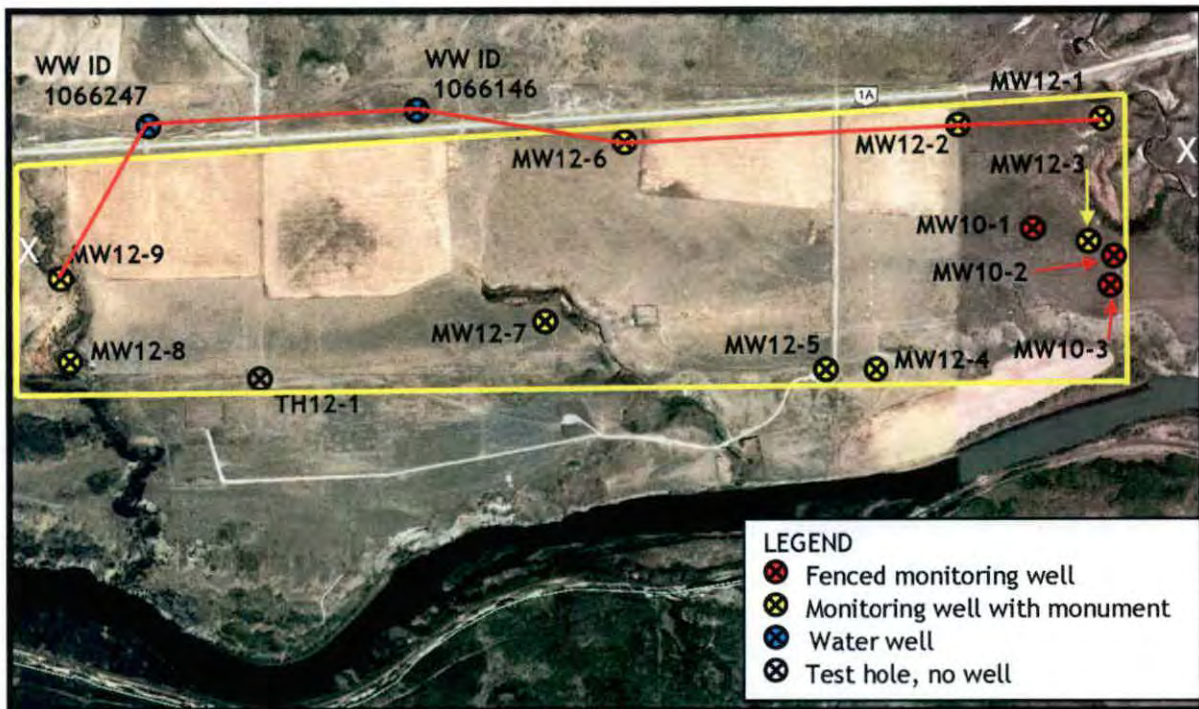
⁹ *ibid.*

Figure 5: West to East Surficial Geology Cross Section, along Bow Valley Trail



The location of the cross section is shown on the air photo of the area on Figure 6. The cross section shows the gravels are in places overlain by a till from a glacial event. The cross section also shows the gravel deposits have a higher sand percentage on the western side of the Site, which can also be seen in the grain size analysis and well logs (Sections 2 and 2.1). The well data shows approximately 1 m of silty clay underlain by gravel and sand to depths of around 7.5 m with sandstone bedrock below. The well data shows Well MW12-6 has clay till beneath the sand and gravel layer.

Figure 6: Location of Cross Section



Two isopach maps showing gravel thickness and unsaturated gravel thickness are included in Appendix C. These isopach maps show that the gravel thickens towards the north and ranges from 6 to 8 m thick through much of the Site. The thickness of unsaturated gravel (gravel above the water table) in the area is roughly 6 m.

Levelton understands that the gravel extraction is currently planned for the unsaturated zone, above the water table and that BURNCO has not applied for wet pit excavations. However, there may be some gravel reserves below the water table, depending on geological conditions. If sufficient reserves exist, BURNCO may pursue wet pit excavation. Based on an initial material balance assessment, there may be enough overburden available to backfill excavations above the elevation of the water table.

4 Hydrogeology of Gravel Units

4.1 Groundwater Depths

As listed in Table 4, Levelton has manually measured the depths to groundwater on two occasions, March 28, 2012 and May 10, 2013. The groundwater depths measured on May 10, 2013 may not reflect actual static conditions, as the wells were pumped on May 9, 2013 and water levels may not have fully recovered by the time of measurement.

Levelton also reviewed the water levels recorded in data loggers installed in the 11 wells listed in Table 3. As shown on hydrographs in Appendix D, groundwater levels were recorded in 11 wells since the data loggers were installed.

The hydrographs in Appendix D show that groundwater levels varied across the study area. Most of the wells showed small fluctuations in water levels that appeared to be seasonal. The water level in MW12-3 showed a steady decline of approximately 1.75 m from the time of installation, until May 2013. The reason for this decline is unclear.

The water levels in three wells - MW12-4, MW12-5 and MW12-9 - showed a roughly 1 m drop in water level over a 12 to 14 day period, starting in the middle of June 2012. The three wells then showed a long, slow recovery period that started at the end of June 2012 and continued through May 2013. The hydrograph for MW12-8 showed an approximate 2 m drop in groundwater level in June 2013; however, there was a sudden increase in water level in late December 2012 and early January 2013. Levelton has observed similar and rapid changes in groundwater levels in wells influenced by nearby pumping wells. Since the local wells are all developed in bedrock, it would appear that pumping of these wells may influence the recharge from the bedrock into the overlying gravel layer.

4.2 Groundwater Flow Directions

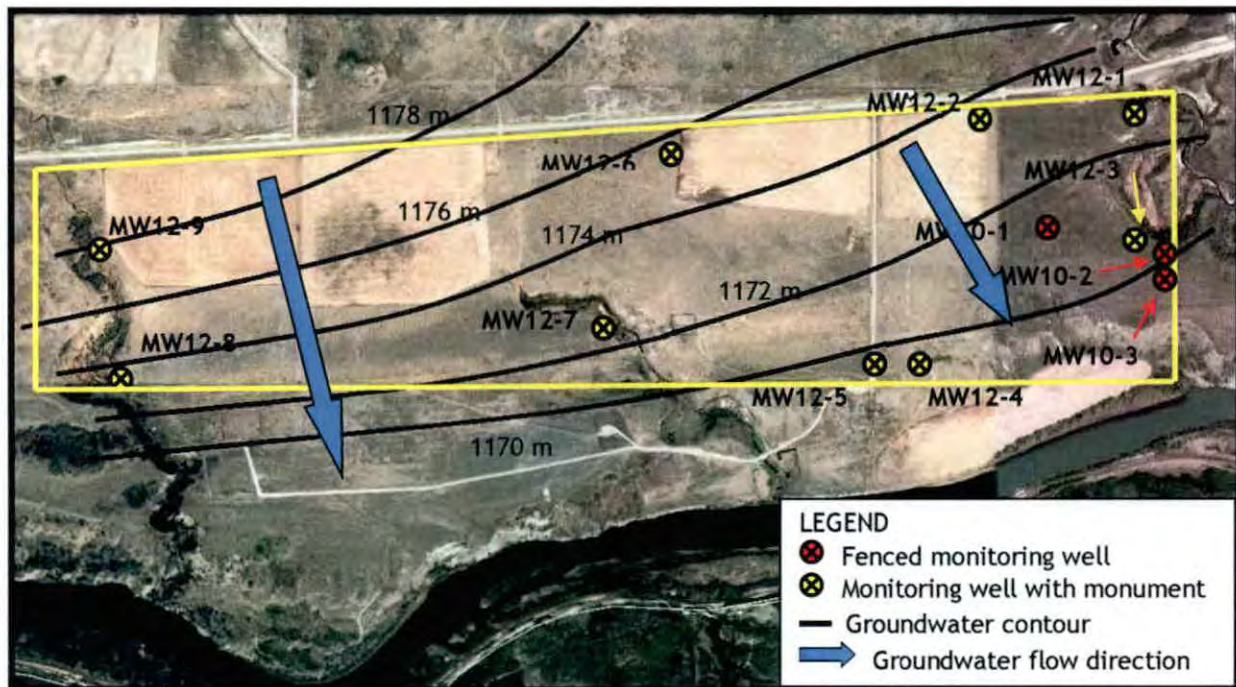
The depth to groundwater is presented in Table 4. Generally groundwater levels were near the base of the gravel unit at depths of approximately 7 m below grade (mbg). The depth to groundwater and elevation of the well heads were used to estimate groundwater elevations in the monitoring wells and the elevation of the water table. Figure 7 includes a contour map showing groundwater flow directions in the surficial gravel layer that underlies the study area.

Table 4: Depths to Groundwater

Well	Depth to Groundwater (mbg)	
	28 March 2012	10 May 2013
MW12-1	7.64	6.55
MW12-2	9.36	9.20
MW12-3	7.33	7.00
MW12-4	5.20	5.00
MW12-5	5.50	5.01
MW12-6	10.20	10.17
MW12-7	6.82	6.78
MW12-8	7.59	7.55
MW12-9	5.72	7.51
MW10-1	6.21	6.24
MW10-2	6.51	6.05
MW10-3	5.66	5.95

Groundwater flow in the bedrock is unknown as there were no wells installed within the bedrock within the study area. Groundwater typically follows topography; however, the orientation of bedding planes may also exert some control on groundwater flow in bedrock. In the area of the Site, groundwater flow in the bedrock is expected to be southward towards the Bow River valley. There is also likely a vertically upward component of flow, along the inclined bedding discussed earlier. The springs along the edges of the Site appear to be fed by groundwater discharging from the bedrock at the gravel/bedrock contact, rather than lateral groundwater flow from the overlying gravels.

Figure 7: Groundwater Flow Directions in Gravel



Groundwater flow directions in the gravel follow topography and are south to south east with flow both towards the Bow River and Grand Valley Creek to the southeast.

According to data found in a water well south of the work area (Well ID: 466127), the gravel deposit pinches out and does not extend to the Bow River. As a result no direct groundwater connection between the gravels and river is present. The location of the water well (Well ID: 466127) can be seen on the gravel thickness map which is included in Appendix C.

4.3 Groundwater Velocities

Levelton performed hydraulic conductivity (slug) tests on the monitoring wells in order to determine the hydraulic conductivity (K) of the underlying site. The tests were undertaken utilizing a Solinst pressure transducer that was set to record water levels on a one second interval.

Only four of the wells produced usable slug test data to determine the hydraulic conductivity (MW12-1, MW12-2, MW12-7 and MW12-9). The remaining wells produced unusable slug test data because the water levels were below the tops of the well screens. The data from MW12-1, MW12-2, MW12-7 and MW12-9 were interpreted utilizing the AQTESOLV computer program developed by HydroSoft Inc. An unconfined aquifer model and the Bouwer-Rice solution method were used. Graphs showing water displacement with time and calculated hydraulic conductivity are included in Appendix D.

An average hydraulic conductivity of 13.1 m/day is calculated. Published data¹⁰ for gravels show ranges of hydraulic conductivity of 100 to 100,000 m/day indicating that this value is lower than expected. However, the grain size analysis (Section 2.1) indicates a relatively high concentration of sand which could result in lower hydraulic conductivity.

¹⁰ Freeze & Cherry, 1979.

Groundwater flow velocities can be calculated through these hydraulic conductivity values and the hydraulic head gradient as follows:

$$\text{Velocity} = \frac{\text{Hydraulic conductivity} \times \text{hydraulic gradient}}{\text{Porosity}}$$

The porosity for sandy gravel is estimated at 0.3 and the hydraulic gradient as 0.008. Substituting these values result in a groundwater velocity of 0.35 m/day, or approximately 128 m/year. These are relatively fast velocities for groundwater flow but reflect the relatively permeable nature of the gravels and the relatively steep hydraulic gradient in the area.

4.4 Precipitation and Evapotranspiration

Levelton reviewed annual mean precipitation maps and mean annual evaporation data¹¹ produced by Alberta Environment and Sustainable Resources Development (ESRD). The mapping indicated that the study area receives an average of 500 to 550 mm of precipitation annually and that the mean annual evapotranspiration, estimated from Calgary data, was approximately 400 mm¹¹. The annual precipitation was slightly higher than the annual evaporation, implying that some precipitation may be available to act as recharge to the shallow groundwater near the base of the gravel in the study area.

4.5 Impacts of End Pit Lake

To assess the potential impacts of an end pit lake, if developed, Levelton used the annual mean precipitation maps (discussed above) and in conjunction with mean annual calculated lake evaporation maps produced by ESRD. The maps indicated that the study area receives an average of 500 to 550 mm of precipitation annually. The mapping also indicated that the mean annual calculated lake evaporation rate for the study area has been mapped as 675 to 725 mm, a greater rate than the annual average precipitation.

If wet pit excavation occurred, as discussed in Section 3, there is potential for an end pit lake to be created in the reclaimed landscape. At this time, however, BURNCO has no plans for an end pit lake since there will likely be sufficient overburden available to backfill the excavation to an elevation above the water table. However, for the purposes of assessing losses generated from an end pit lake, net evaporation is evaluated. Based on the precipitation and evaporation data reviewed by Levelton, we have estimated the net evaporative losses from a water body as 2,000 m³/year per ha. Based on the following equation:

$$\frac{(700 \text{ mm/yr} - 500 \text{ mm/yr})}{1000} \times 10,000 \text{ m}^2 = 2,000 \text{ m}^3/\text{yr}$$

To assess potential surface water recharge to an end pit lake, Levelton used published data (from an empirical study)¹² and assumed all annual unit runoff from the reclaimed area would be directed into the lake, to offset evaporative losses. Using a 50% Median Probability of Exceedence¹³ the following volume of water would potentially be available to recharge an end pit lake of 1 ha. in a pit that was 37.5 ha in size:

Pit size - 36.5 ha. or .365 km² (minus 1 ha. end pit lake)

Annual unit run-off - 35 dam³/ km² (from Figure 12¹³)

$$0.365 \text{ km}^2 \times 35 \text{ dam}^3/\text{km}^2 \times 1,000 (\text{m}^3 \text{ per dam}^3) - 2,000 \text{ m}^3/\text{yr} (\text{net evaporative losses}) = 10,775 \text{ m}^3/\text{yr}$$

¹¹ Abraham, 1999.

¹² Prairie Farm Rehabilitation Administration, 1994.

¹³ *ibid*, Figure 12.

Using the same equation, the recharge from annual unit runoff to an end pit lake that covered 5 ha. (of the 37.5 ha. pit) would be approximately 1,375 m³/yr:

$$0.325 \text{ km}^2 \times 35 \text{ dam}^3 / \text{km}^2 \times 1,000 - (5 \times 2,000 \text{ m}^3 / \text{yr (net evaporation over 5 ha)}) = 1,375 \text{ m}^3 / \text{yr}$$

These calculations imply that volume of water lost from an end pit lake is highly dependent on the size of the lake. However, if the gravel pit is backfilled with layer of overburden approximately 1.7 m thick, the final ground surface elevation will be above the water table elevation.

4.6 Hydrogeological Discussion

The study area is underlain by a Pleistocene to Holocene age sand and gravel deposit, with an average content of 65% gravel, 28% sand and 8% silt/clay. The gravel thickness ranges from approximately 8 m on the northern portion of the study area to less than 2 m in the south and has a higher sand content in the western portion of the study area. The gravel does not extend south to the Bow River.

Monitoring wells installed in the study area indicate depths to groundwater range from 5 to 10.2 m below surface and show seasonal fluctuations. Groundwater is generally found near the base of the gravel. Groundwater flow in the gravel is south to south east, although locally here may be components of flow towards the coulees located east and west of the study area. There is no direct groundwater connection between the study area and the Bow River through the gravel deposit. The groundwater velocity through the gravel is estimated to be approximately 130 m/year.

Underlying the surficial deposits are greenish grey, thick bedded, chloritic and feldspathic sandstone and blocky grey mudstone, tuff and thin coal beds of the Brazeau Formation. The study area overlies part of the Disturbed Belt region of Alberta, a linear feature east Rocky Mountains and Foothills that has been deformed by thrusting and faulting. Structural geological mapping has revealed that bedrock in the vicinity of the study area dips westerly, at angles ranging from 10° to 45 and that local eastward dips of up to 50° may also be present. The eastern edge of the Disturbed Belt appears to coincide with Grand Valley Creek, on the eastern edge of the Site. A second, smaller fault has been mapped in the area of Beaupre Creek, just to the west of the Site. The depth from ground surface to the top of the Disturbed Belt aquifer¹⁴ is approximately 30 m, inferring that the Disturbed Belt aquifer may be overlain by as much as 30 m of overburden.

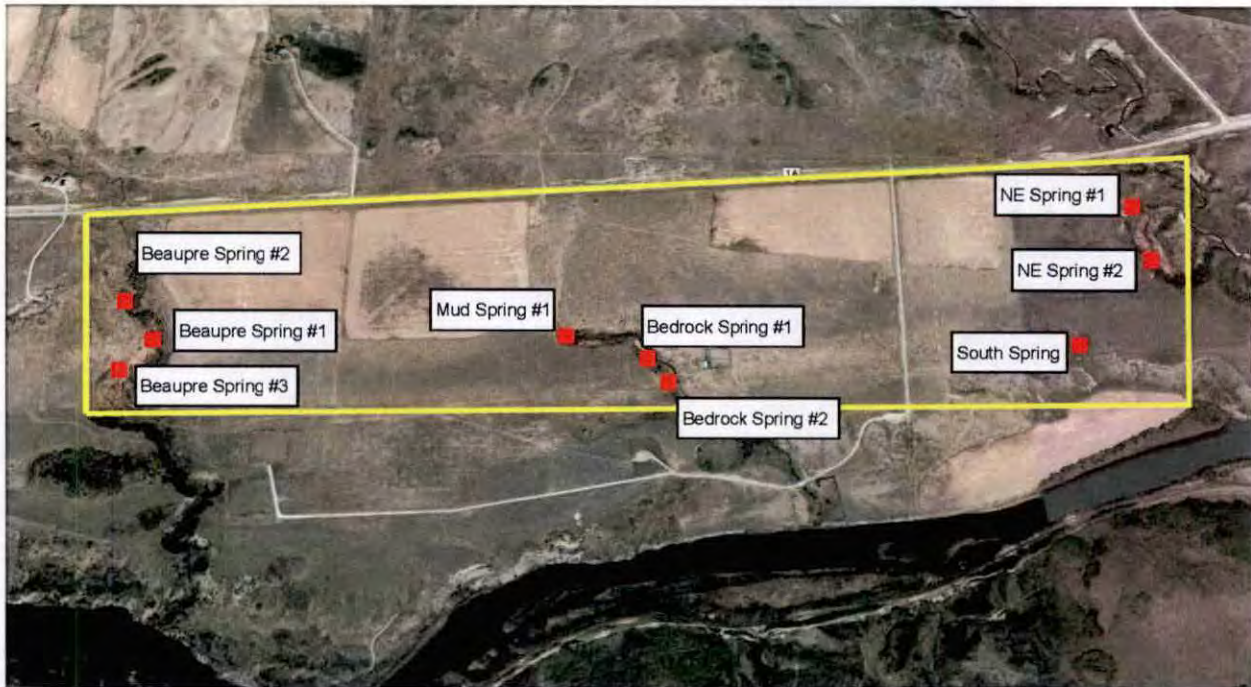
Yields of well completed within the Disturbed Belt aquifers are generally low and dry holes are common; although there are relatively few wells completed in this aquifer. The groundwater chemistry is generally bicarbonate type water, with sulphate concentrations of roughly 100 mg/L and total dissolved solids of approximately 1,000 mg/L.

Several springs have been observed in the coulees east and west of the study area, as shown in Figure 8. There may also be seeps or springs along the southern edge of the study area, where the Bow River valley has eroded through the gravels deposits. Based on geological mapping and the temperature data measured during sampling of the groundwater and springs, there appears to be an upward component of groundwater recharge from the bedrock into the gravel. Accordingly, operation of the gravel pit is not anticipated to impact the springs. Similarly, given the depth to the Disturbed Belt aquifer and the lack of bedrock wells south of the study area, operation of the gravel pit is not anticipated to impact local water wells completed in the bedrock.

As BURNCO is planning gravel excavation in the unsaturated zone, wet pit extraction is not anticipated. However, if sufficient gravel reserves below the water table are observed, BURNCO may apply to remove this material. Based on an initial material balance assessment, there may be enough overburden available to backfill the excavations below the water table. In either scenario, no end pit lake is anticipated for this Site.

¹⁴ Hydrogeological Consultants Ltd., 2002.

Figure 8: Locations of Springs Observed Around the Study Area.



5 Water Chemistry

In March 2012, Levelton collected water samples for water quality analysis from seven of the 13 wells for analysis of routine dissolved constituents. The lab report is included in Appendix E¹⁵. The data was used to construct a Piper Plot in order to determine the distribution of the water chemistry. The Piper Plot graph is included in Appendix E. The total dissolved solids (TDS) content of the water ranged from 355 to 641 mg/L. Ninety percent of groundwater sampled from the Disturbed Belt Aquifers have TDS concentrations of less than 1,000 mg/L¹⁶. Bicarbonate was the dominant anion and calcium, magnesium, and sodium are present in varying amounts. Some elevated chloride was present in the water. A summary of the water analysis is as shown in Table 5.

Chloride concentrations exceeding 50 mg/L in groundwater have previously been reported in the Site region, which is shown in Figure 9¹⁷. As shown in Table 5, the chloride concentrations on MW12-3 and MW10-2 were 59.4 and 60.6 mg/L respectively, in March 2012. These two wells were installed at the eastern end of the study area. These two samples contained higher chloride concentrations than samples collected from all other wells.

¹⁵ Sample for NE Spring labelled as East Spring in Appendix 5.

¹⁶ Shetson, 1990.

¹⁷ Hydrogeological Consultants Ltd., 2002.

Figure 9: Elevated Chloride Areas in the Disturbed Belt Aquifer Region

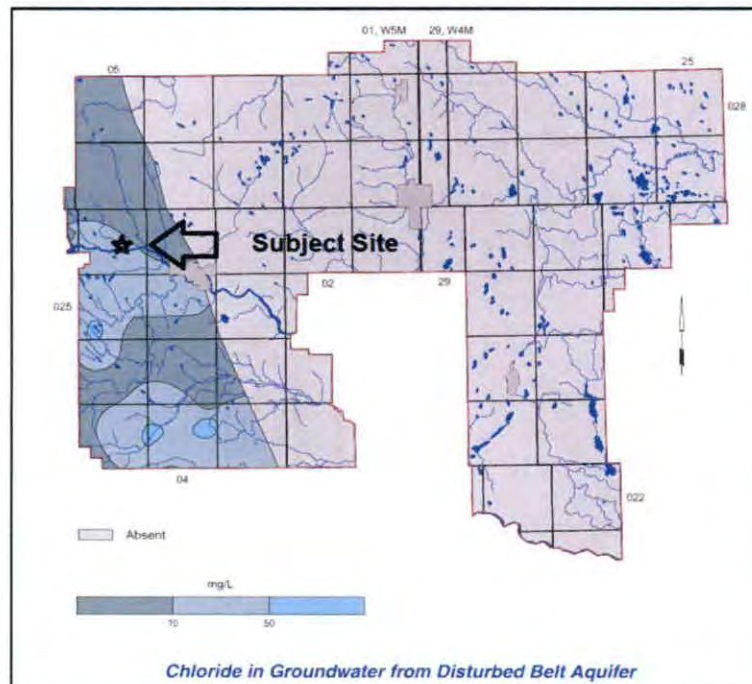


Table 5: Summary of Water Quality Analysis, March 2012

Well	MW10-1	MW10-2	MW12-2	MW12-3	MW12-6	MW12-7	MW12-9
Calcium	46.8	92.5	39.8	91.2	280	61.2	86.0
Magnesium	41.1	49.4	9.0	49.1	53.0	14.9	20.9
Sodium	40.9	31.2	126	30.3	31.0	56.7	25.4
Potassium	3.9	4.1	3.2	4.0	4.4	5.0	3.4
Iron	<0.01	<0.01	<0.01	<0.01	0.79	<0.01	0.50
Manganese	0.066	0.319	0.033	0.219	0.349	0.159	0.361
Chloride	12.8	60.6	10.4	59.4	27.0	23.7	8.3
Fluoride	No Data	No Data	No Data	No Data	0.16	No Data	0.22
Nitrate	1.22	0.01	0.33	0.02	0.66	0.81	0.17
Nitrite	<0.005	<0.005	0.045	<0.005	<0.005	<0.005	0.024
Sulphate	59.5	193	89.4	196	44.0	85.6	57.8
Bicarbonate	372	280	393	281	410	271	310
Total Dissolved Solids	388	568	471	568	641	380	355
Total Alkalinity (as CaCO ₃)	305	230	322	230	336	222	255
pH	8.08	7.96	8.08	7.95	7.82	7.88	7.97
Electrical Conductance	679	922	764	926	714	643	573
Hardness	286	434	140	430	917	214	301

Note: All units is mg/L, except pH (pH units) and conductivity (µS/cm).

As shown in Table 5 and in the Piper diagrams (Appendix E), there were significant variations in water chemistry in the samples collected in March 2012. The March 2012 did not appear to originate from a single source, but appeared to reflect different sources. The differences in the water quality results are attributed to natural variations.

Levelton conducted a second round of water quality sampling in May 2013. A total of fourteen samples were collected from four springs and three monitoring wells, as shown in Tables 6 and 7. Levelton measured the temperature of the samples at the time of collection. As listed in Table 6, the temperatures in the well samples were 7.7 and 8.1°C. As shown in Table 7, the temperatures in the samples collected from the springs ranged from 4.4 to 6.1°C. The analytical results, listed in Appendix E, indicate that the sample temperatures were 5.4°C upon arrival at the laboratory.

Table 6: Summary of Well Water Quality Analyses, McDougall Ranch Study Area.

Well	MW12-2			MW12-6		MW12-9	
	May 2013			May 2013		May 2013	
	#1	#2	#3	#1	#2	#1	#2
Temperature (°C)	6.2	6.2	6.2	7.7	7.7	8.1	8.1
Calcium	28.7	27.8	27.6	60.3	59.7	60.7	59.8
Magnesium	11.8	11.6	11.4	41	42.3	24	23.6
Sodium	138	134	140	33.3	32.9	25.3	25.7
Potassium	2.9	2.8	2.8	2.6	2.5	3.1	3.2
Iron	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Manganese	0.077	0.083	0.069	0.035	0.013	0.194	0.096
Chloride	5.6	5.3	5.2	17.5	17.7	6.1	6.7
Fluoride	-	-	-	-	-	-	-
Nitrate	0.02	0.02	0.05	0.68	0.72	0.02	0.03
Nitrite	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Sulphate	61.6	64.3	61.8	36.8	36.8	39.2	40.5
Bicarbonate	471	470	470	457	435	337	344
Total Dissolved Solids	480	477	480	416	406	324	329
Total Alkalinity (as CaCO ₃)	386	385	386	375	356	277	282
pH	8.29	8.29	8.31	8.10	8.08	8.16	8.18
Electrical Conductance	757	753	756	691	703	543	544
Hardness	120	117	116	319	323	250	246

Table 7: Summary of Spring Water Quality Analyses, McDougall Ranch Study Area.

Well	Beaupre Spring		Bedrock Spring		Mud Spring		NE Spring	
	#1	#2	#1	#2	#1	#2	May 2010	May 2013
Temperature (°C)	4.4	4.4	5.1	5.1	-	-	-	6.3
Calcium	71.6	71.7	82.8	79.7	74.9	76.3	69.5	66.5
Magnesium	54.3	46.1	36.5	36.7	35.5	36.2	60.2	58.8
Sodium	37.5	32.3	31.4	31.8	30.6	30.9	52.6	49.5
Potassium	2.3	2.3	3.8	3.5	3.3	3.4	2.73	2.7
Iron	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01
Manganese	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	<0.005
Chloride	38.8	28.6	21.4	21.5	21.2	34.7	41.2	34.7
Fluoride	-	-	-	-	-	-	-	-
Nitrate	2.94	2.09	1.12	1.11	2.92	2.9	2.81	7.2
Nitrite	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.005
Sulphate	63.1	60.2	56.9	57.2	54.2	53.2	86.8	77.7
Bicarbonate	475	459	438	445	425	422	500	496
Total Dissolved Solids	501	467	448	449	429	429	471	534
Total Alkalinity (as CaCO ₃)	390	376	359	365	348	346	410	407
pH	8.19	8.18	8.1	8.08	8.13	8.14	8.1	8.23
Electrical Conductance	843	784	753	739	718	715	947	909
Hardness	402	369	357	350	333	340	421	408

The chloride concentrations in well samples collected in May 2013 had chloride concentrations that ranged from 5.3 to 17.5 mg/L. The Beaupre Spring, Bedrock Spring and NE Spring samples, however, had chloride concentrations that were generally higher than the well samples and ranged from 21 to 41 mg/L.

As presented in Tables 6 and 7 and on the Piper diagrams in Appendix E, the May 2013 samples from the springs could not be differentiated, on a water chemistry basis, from the May 2013 samples collected from the wells, with the exception of the calcium and magnesium concentrations in the MW12-2 samples. This implies that the samples have a common source. However, on the basis of the temperature data, it appears that groundwater from the bedrock is migrating vertically upwards and recharging the gravel rather than groundwater from the gravel recharging the bedrock.

The water quality data from the samples collected from the NE Spring in March 2010 and May 2013 was reasonably consistent, and indicated that the water likely originated from a consistent source. The small differences in the concentrations of some dissolved species are attributed to natural variation.

Levelton was unable to sample the springs that are reported to be present in the Grand Valley Creek coulee east of the study area. Levelton would like to collect groundwater quality samples and measure water temperature in the springs to compare to data from the study area; however, the owner of the adjacent property has not granted access permission to this area.

6 Groundwater Users in Area

Levelton conducted a reconnaissance report (included in Appendix F) on the Alberta Water Well Information Database at a 1.6 km radius surrounding the study area. The report indicates 41 water wells in the area have been drilled to depths between 15.85 and 149.35 m. The majority of the wells are completed in bedrock at a depth of approximately 45 m and have been drilled for domestic/stock use. There was only one well record for a well located south of the study area, in the Bow River valley. All other well records were located north or west of the proposed gravel pit location.

Levelton also conducted a search for licensed water users within the sections of the study area (13, 14 and 15). Three records were obtained; they do not indicate (on the website) whether the following water licences, all of which have no expiry, are for surface or groundwater: David H. McDougall Ranch Limited (issued March 26, 2004), McKendrick Ranches Ltd (issued February 20, 2004) and Harvey King (issued May 8, 2002).

7 Energy and Conservation Board (ERCB) Records

Levelton conducted an Abacus Datagraphics Database search of the Alberta Energy and Conservation Board (now Alberta Energy Regulator or AER) records to obtain information regarding active, suspended or abandoned oil and/or gas wells, and/or pipelines located within the quarter section of the study area.

There is record of wells and pipelines within the same quarter section as the Site. Natural gas pipelines owned by Chinook Energy Ltd., Nova Gas Transmission Ltd., Intra Pipeline Extraction Ltd. transverse through the Site. There is record of an abandoned well south of the Site owned by Shell Canada (abandoned 14/9/2004), and an active gas flowing well south of the Site owned by Chinook Energy. The AER map is contained in Appendix C.

8 Conclusions

Based on the information regarding the hydrogeological assessment of the proposed BURNCO McDougall Gravel Pit, Levelton has drawn the following conclusions:

1. The study area is located in Rocky View County, Alberta, and is located between two deeply incised creeks immediately east and west of the Site; Grand Valley Creek is located east of the Site and Beaupre Creek is on the west.
2. Published mapping showed surficial deposits are as Pleistocene to Holocene gravel, gravel and sand, fine- to coarse-grained sand, and minor silt beds. Grain size analyses indicated that the surficial deposits contained an average of 65% gravel, 28% sand and 8% silt/clay.
3. Geological mapping indicated bedrock underlying the study area were greenish grey, thick bedded, chloritic and feldspathic sandstone and blocky grey mudstone; some tuff and thin coal beds, of the Brazeau Formation. The deformed bedrock dips to the west, at angles ranging from 10° to 45°, although local dips eastward of up to 50° have also been mapped.
4. On-site drilling revealed a gravel thickness of up to 8 m on the north side, thinning to less than 2 m on the south side of the Site. The unsaturated gravel thickness ranges from 4 to 6 m throughout the Site, and the water table is found near the base of the gravel.
5. The cross section (Figure 5) shows the gravels are in places overlain by a till from a glacial event and the gravel deposits have a higher sand percentage on the western side of the study area.
6. The Site overlies the Disturbed Belt aquifers which have a strata combination (including the Brazeau Formation) of permeable and impermeable layers. There are relatively few water wells reported within the Disturbed Belt Aquifer Region. Well yields tend to be low and range from 17 to 75 m³/day; dry holes are relatively common. The groundwater chemistry in the bedrock are bicarbonate type with concentrations of sulphate generally less than 100 mg/L, and total dissolved solids of less than 1,000 mg/L.
7. Regional groundwater flow directions in the gravel deposits are south to south east with flow both towards the Bow River and the Grande Valley Coulee to the southeast.
8. Hydraulic conductivity (slug) tests completed by Levelton in three monitoring wells indicated an average hydraulic conductivity of 13.1 m/day.
9. There appears to be a vertical component of groundwater flow in the study area, as reported for other areas underlain by Disturbed Belt aquifers, from the bedrock into the surficial gravel deposit. Based on temperature data collected during the May 2013 sampling, it appeared that groundwater within the bedrock was recharging the groundwater contained in the surficial gravel deposit.
10. Hydrographs plotted for the monitoring wells indicated that most of the wells showed small, seasonal fluctuations in groundwater levels. The hydrographs for four wells, MW12-4, MW12-5, MW12-8 and MW12-9 showed large decreases in groundwater levels in mid- to late June. Levelton has observed similar fluctuations in water levels in wells influenced by pumping wells.
11. Based on the proposed depth of excavation, the depth below surface to the saturated zone within the gravel and the thickness of overburden an end pit lake upon reclamation is unlikely. However, based on estimated mean annual precipitation, mean annual calculated lake evaporation and annual unit run-off, net water balance estimations indicated that there may be either a net gain or net loss, depending on the size of an end pit lake.
12. Levelton collected groundwater samples on two occasions. The total dissolved solids (TDS) content of the groundwater ranged from 355 to 641 mg/L in the 2012 samples and from 234 to 641 mg/L in the 2013 samples. Bicarbonate is the dominant anion and calcium, magnesium, and sodium are present in varying amounts. Some elevated chloride is present in the water. Elevated levels of chloride have been reported in the study area region.

13. The water chemistry in samples collected from the springs and wells in 2013 was similar, implying a common source. Differences in water temperatures in samples collected from area springs and the wells are interpreted as indicating that groundwater from the bedrock recharges the gravel deposits, via upward flow. Levelton was unable to sample springs reported on the adjacent property to compare to the study area results, as the neighbouring landowner has not granted access permission.
14. The Alberta Water Well Information Database listed 41 water wells within a 1.6 km radius surrounding the study area. The wells ranged in depth from 15.85 to 149.35 m. The majority of the wells are completed in bedrock at a depth of approximately 45 m and appear to have been drilled for domestic/stock use.
15. There were three licensed water users within the sections of the study area; however, there was no indication of whether the water licences, all of which have no expiry, are for surface or groundwater.
16. As the wells within a 1.6 km radius of the study area are completed in bedrock, at depths of approximately 45 m, it is unlikely that they are in direct hydraulic connection with the gravel deposit underlying the study area.
17. The Abacus Datagraphics Database search of the Alberta Energy and Conservation Board ERCB records contained a record of wells and pipelines within the same quarter section as the study area.

9 Recommendations

Based on the conclusions regarding the hydrogeology proposed BURNCO McDougall Gravel Pit presented above, Levelton offers the following recommendations:

1. This report should be submitted to Rocky View County in support of the gravel pit permit application process.
2. Levelton should continue to monitor the groundwater conditions to assess any other potential impacts to the groundwater in the area.
3. BURNCO should try and obtain access permission from the adjacent landowner to allow for sampling of springs east of the study area to assess water quality and temperature.
4. The results of the groundwater monitoring program should be assessed by Levelton and adjusted or discontinued, based on the assessment of the monitoring data.
5. If BURNCO plans gravel excavation below the level of groundwater, replacing the extracted material with 1 to 1.5 m of granular backfill to maintain a porous media for groundwater flow at the bedrock / gravel interface should be considered.

10 Closure

This report has been prepared for the exclusive use of BURNCO Rock Products Ltd for application to a study area within the N1/2 of 13, W1/2 14, NE-15-26-5 W5M near Cochrane, Alberta. The conclusions and recommendations are based on information provided to Levelton Consultants Ltd. This report has been prepared with the attached Terms of Reference for Geotechnical Reports.

We trust that this report meets your needs and expectations and we look forward to continuing to work with you on this project. Please do not hesitate to contact us if you have any questions or require further information.

Respectfully submitted,

KR
per

Per: Kent Reed, BSc
Environmental Scientist
kreed@levelton.com

Reviewed by:

Lee Ringham

Per: Lee Ringham, P.Geol.
Senior Hydrogeologist
lringham@levelton.com



KR/LR/ycr



11 References

- 1 Shetsen, I., 1987. *Quaternary Geology, Southern Alberta*. Map 207 1:500,000 Scale. Alberta Research Council, Natural Resources Division.
- 2 Hydrogeological Consultants Ltd, 2002. *Regional Groundwater Assessment M.D. of Rocky View No. 44*. Prepared on behalf of Agriculture and Agri-Foods Canada.
- 3 Freeze, R. Allen and John A. Cherry, 1979. *Groundwater*. Prentice-Hall Inc., Englewood Cliffs, New Jersey.
- 4 Hamilton, Wylie N., Monica C. Price and C. William Langenberg, 1999. *Geological Map of Alberta*. Alberta Geological Survey, Alberta Energy and Utilities Board, Map No. 236, scale 1:1,000,000
- 5 Rutherford, Ralph L., 1927. *Geology Along the Bow River Between Cochrane and Kananaskis, Alberta*. Report Number 17, Scientific and Industrial Research Council, Province of Alberta, Geological Survey Division.
- 6 Ozoray, G.F. and R. Barnes, 1977. *Hydrogeology of the Calgary-Golden Area, Alberta*. Alberta Research Council, Edmonton Alberta.
- 7 Prairie Farm Administration, Engineering and Sustainability Service, Hydrology Branch, 1994. *Annual Unit Runoff on the Canadian Prairies*. Hydrology Report 135, Regina, Saskatchewan.
- 8 Abraham, C., 1999. *Evaporation and Evapotranspiration in Alberta Report 1912 - 1985, Data 1912 - 1996*. Alberta Environmental Protection, Water Management Division, Water Sciences Branch.



LEVELTON

TERMS OF REFERENCE FOR GEOTECHNICAL REPORTS ISSUED BY LEVELTON CONSULTANTS LTD.

1. STANDARD OF CARE

Levelton Consultants Ltd. ("Levelton") prepared and issued this geotechnical report (the "Report") for its client (the "Client") in accordance with generally-accepted engineering consulting practices for the geotechnical discipline. No other warranty, expressed or implied, is made. Unless specifically stated in the Report, the Report does not address environmental issues.

The terms of reference for geotechnical reports issued by Levelton (the "Terms of Reference") contained in the present document provide additional information and caution related to standard of care and the use of the Report. The Client should read and familiarize itself with these Terms of Reference.

2. COMPLETENESS OF THE REPORT

All documents, records, drawings, correspondence, data, files and deliverables, whether hard copy, electronic or otherwise, generated as part of the services for the Client are inherent components of the Report and, collectively, form the instruments of professional services (the "Instruments of Professional Services"). The Report is of a summary nature and is not intended to stand alone without reference to the instructions given to Levelton by the Client, the communications between Levelton and the Client, and to any other reports, writings, proposals or documents prepared by Levelton for the Client relative to the specific site described in the Report, all of which constitute the Report.

TO PROPERLY UNDERSTAND THE INFORMATION, OBSERVATIONS, FINDINGS, SUGGESTIONS, RECOMMENDATIONS AND OPINIONS CONTAINED IN THE REPORT, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. LEVELTON CANNOT BE RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT AND ITS VARIOUS COMPONENTS.

3. BASIS OF THE REPORT

Levelton prepared the Report for the Client for the specific site, development, building, design or building assessment objectives and purpose that the Client described to Levelton. The applicability and reliability of any of the information, observations, findings, suggestions, recommendations and opinions contained in the Report are only valid to the extent that there was no material alteration to or variation from any of the said descriptions provided by the Client to Levelton unless the Client specifically requested Levelton to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information, observations, findings, suggestions, recommendations and opinions contained in the Report, or any component forming the Report, are for the sole use and benefit of the Client and the team of consultants selected by the Client for the specific project that the Report was provided. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION OR COMPONENT WITHOUT THE WRITTEN CONSENT OF LEVELTON. Levelton will consent to any reasonable request by the Client to approve the use of this Report by other parties designated by the Client as the "Approved Users". As a condition for the consent of Levelton to approve the use of the Report by an Approved User, the Client must provide a copy of these Terms of Reference to that Approved User and the Client must obtain written confirmation from that Approved User that the Approved User will comply with these Terms of Reference, such written confirmation to be provided separately by each Approved User prior to beginning use of the Report. The Client will provide Levelton with a copy of the written confirmation from an Approved User when it becomes available to the Client, and in any case, within two weeks of the Client receiving such written confirmation.

The Report and all its components remain the copyright property of Levelton and Levelton authorises only the Client and the Approved Users to make copies of the Report, but only in such quantities as are reasonably necessary for the use of the Report by the Client and the Approved Users. The Client and the Approved Users may not give, lend, sell or otherwise disseminate or make the Report, or any portion thereof, available to any party without the written permission of Levelton. Any use which a third party makes of the Report, or any portion of the Report, is the sole responsibility of such third parties. Levelton accepts no responsibility for damages suffered by any third party resulting from the use of the Report. The Client and the Approved Users acknowledge and agree to indemnify and hold harmless Levelton, its officers, directors, employees, agents, representatives or sub-consultants, or any or all of them, against any claim of any nature whatsoever brought against Levelton by any third parties, whether in contract or in tort, arising or related to the use of contents of the Report.

TERMS OF REFERENCE FOR GEOTECHNICAL REPORTS ISSUED BY LEVELTON CONSULTANTS LTD. (continued)

5. INTERPRETATION OF THE REPORT

- a. **Nature and Exactness of Descriptions:** The classification and identification of soils, rocks and geological units, as well as engineering assessments and estimates have been based on investigations performed in accordance with the standards set out in Paragraph 1 above. The classification and identification of these items are judgmental in nature and even comprehensive sampling and testing programs, implemented with the appropriate equipment by experienced personnel, may fail to locate some conditions. All investigations or assessments utilizing the standards of Paragraph 1 involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and all persons making use of such documents or records should be aware of, and accept, this risk. Some conditions are subject to changes over time and the parties making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or when the Client has special considerations or requirements, the Client must disclose them to Levelton so that additional or special investigations may be undertaken, which would not otherwise be within the scope of investigations made by Levelton or the purposes of the Report.
- b. **Reliance on information:** The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site investigation and field review and on the basis of information provided to Levelton. Levelton has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Levelton cannot accept responsibility for any deficiency, misstatement or inaccuracy contained in the report as a result of misstatements, omissions, misrepresentations or fraudulent acts of persons providing information.
- c. **Additional Involvement by Levelton:** To avoid misunderstandings, Levelton should be retained to assist other professionals to explain relevant engineering findings and to review the geotechnical aspects of the plans, drawings and specifications of other professionals relative to the engineering issues pertaining to the geotechnical consulting services provided by Levelton. To ensure compliance and consistency with the applicable building codes, legislation, regulations, guidelines and generally-accepted practices, Levelton should also be retained to provide field review services during the performance of any related work. Where applicable, it is understood that such field review services must meet or exceed the minimum necessary requirements to ascertain that the work being carried out is in general conformity with the recommendations made by Levelton. Any reduction from the level of services recommended by Levelton will result in Levelton providing qualified opinions regarding adequacy of the work.

6. ALTERNATE REPORT FORMAT

When Levelton submits both electronic and hard copy versions of the Instruments of Professional Services, the Client agrees that only the signed and sealed hard copy versions shall be considered final and legally binding upon Levelton. The hard copy versions submitted by Levelton shall be the original documents for record and working purposes, and, in the event of a dispute or discrepancy, the hard copy versions shall govern over the electronic versions; furthermore, the Client agrees and waives all future right of dispute that the original hard copy signed and sealed versions of the Instruments of Professional Services maintained or retained, or both, by Levelton shall be deemed to be the overall originals for the Project.

The Client agrees that the electronic file and hard copy versions of Instruments of Professional Services shall not, under any circumstances, no matter who owns or uses them, be altered by any party except Levelton. The Client warrants that the Instruments of Professional Services will be used only and exactly as submitted by Levelton.

The Client recognizes and agrees that Levelton prepared and submitted electronic files using specific software or hardware systems, or both. Levelton makes no representation about the compatibility of these files with the current or future software and hardware systems of the Client, the Approved Users or any other party. The Client further agrees that Levelton is under no obligation, unless otherwise expressly specified, to provide the Client, the Approved Users and any other party, or any or all of them, with specific software and hardware systems that are compatible with any electronic submitted by Levelton. The Client further agrees that should the Client, an Approved User or a third party require Levelton to provide specific software or hardware systems, or both, compatible with the electronic files prepared and submitted by Levelton, for any reason whatsoever included but not restricted to an order from a court, then the Client will pay Levelton for all reasonable costs related to the provision of the specific software or hardware systems, or both. The Client further agrees to indemnify and hold harmless Levelton, its officers, directors, employees, agents, representative or sub-consultant, or any or all of them, against any claim or any nature whatsoever brought against Levelton, whether in contract or in tort, arising or related to the provision or use of any specific software or hardware provided by Levelton.

APPENDIX A
Monitoring Well Logs and Water Well Logs



LEVELTON

LEVELTON CONSULTANTS LTD.

BURNCO Rock Products c/o Twerdoff & Associates Inc.
N 1/2-14, W 1/2-13 and NE-15-26-5 W5M,

MW10-01

Pg 1 of 1

Project No: AB12-0253-00

Depth (ft) (m)	Description	Symbol	Depth (m)	Sample		Well and Backfill Details	Headspace Vapour Concentration			Laboratory Analysis /Comments
				Number/ ID	Type		▲ (ppm _v) ▲ 10 100 1000			
5	Black, silty TOPSOIL		1.8							
2	SAND and GRAVEL , rounded, well sorted, dry									
10										
4										
15										
20										
6										
25										
8										
30	Grey, SILT		9.1							
			9.8							
10	at 9.8m weathered bedrock (refusal)									
35	Bottom of hole at 9.80 meters									
40										
12										
45										
14										
50										
16										
55										
18										
60										
65										
20										

Sample Symbols	Backfill Symbols	Soil Symbols	Notes	Logged By	Ken Hugo
				Drilled/ Excavated By	
				Date Drilled or Excavated	01/05/2010
				Elevation (grade)	
				Water Level Recorded On	01/05/2010
				Drill Method	Solid Stem Auger

This log is for environmental purposes only.
This log is the sole property of Levelton Consultants Ltd. and cannot
be used or duplicated in anyway without express written permission.



LEVELTON

LEVELTON CONSULTANTS LTD.

BURNCO Rock Products c/o Twerdoff & Associates Inc.
N 1/2-14, W 1/2-13 and NE-15-26-5 W5M,

MW10-02

Pg 1 of 1

Project No: AB12-0253-00

Depth (ft) (m)	Description	Symbol	Depth (m)	Sample		Well and Backfill Details	Headspace Vapour Concentration			Laboratory Analysis /Comments
				Number/ ID	Type		▲ (ppm _v) ▲ 10 100 1000			
5 2 10 4 15 6 20 25 8	SAND and GRAVEL , rounded, dry	</								

Sample Symbols

Backfill Symbols

Soil Symbols

Notes

Logged By

Ken Hugo

Drilled/
Excavated ByDate Drilled
or Excavated

01/05/2010

Elevation (grade)

Water Level
Recorded On

01/05/2010

Drill Method

Solid Stem Auger

This log is for environmental purposes only.
This log is the sole property of Levelton Consultants Ltd. and cannot
be used or duplicated in anyway without express written permission.



LEVELTON CONSULTANTS LTD.

Pg 1 of 1

Project No: AB12-0253-00

HAZMAT R613-1291.GPJ LEVELTON DATA TEMPLATE.GDT 13/10/25



Levelton Consultants Ltd.

Boring/Well Construction Log

Project McDougall Gravel Pit	Project No. AB12-0253-00	Boring/Well TH12-1
Location Northeast Portion of NW-14-26-5 W5M	Logged By AN	Date Drilled 03/15/12
Drill Method Hammer	Drill Co. Beck Drilling	Water Level read on N/A
Sample Method N/A	Rig Type Becker Hammer	Boring Depth 8.5 m
Borehole Diameter 0.17 m	Driller Nathan Horvath	Well Depth N/A
Casing Elevation N/A	Ground Elevation N/A	Water Table Depth: N/A
		Water Table Elevation: N/A

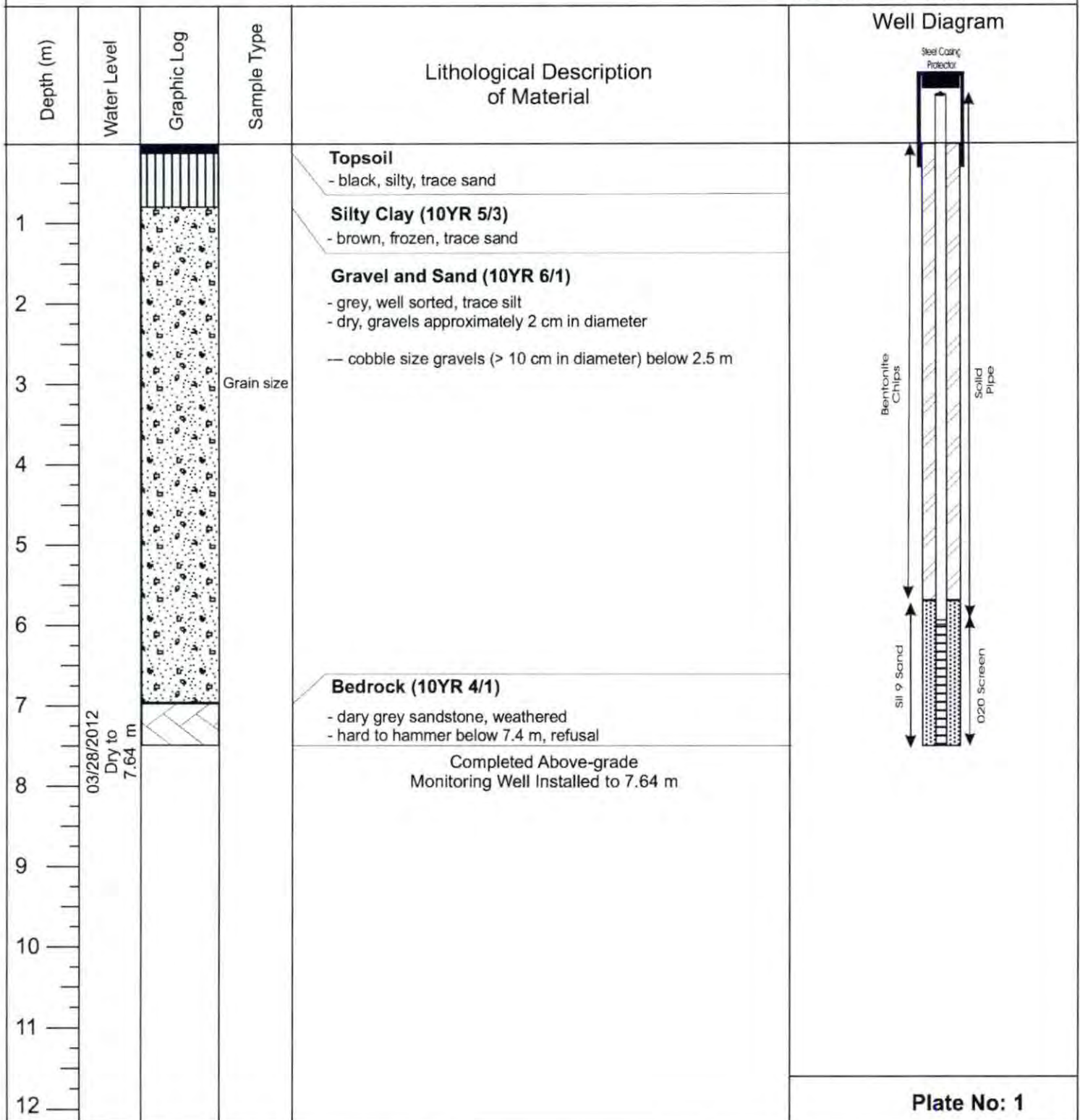
Depth (m)	Water Level	Graphic Log	Sample Type	Lithological Description of Material	Well Diagram
1			Grain size	Topsoil - black, silty, trace sand	No Monitoring Well Installed
2				Gravel with Sand (10YR 5/3) - grey, dry, well sorted, trace silt - gravels up to 2 cm in diameter — cobble size below 2.0 m	
3					
4					
5				Clay Till (10YR 4/1) - dark grey, very stiff, damp - gravel, iron, sulphate inclusions — rafted bedrock from 5.0 to 5.5 m — increased gravel contact at ~ 6.6 m, gravels up to 2 cm in diameter — from 7.5 to 8.5 m very tight and difficult to hammer, no obvious moisture	
6					
7					
8					
9				Backfilled with Cuttings Bentonite Seal Near Surface	
10					
11					
12					



Levelton Consultants Ltd.

Boring/Well Construction Log

Project <u>McDougall Gravel Pit</u>	Project No. <u>AB12-0253-00</u>	Boring/Well <u>MW12-1</u>
Location <u>Northeast Portion of NW-13-26-5 W5M</u>	Logged By <u>AN</u>	Date Drilled <u>03/14/12</u>
Drill Method <u>Hammer</u>	Drill Co. <u>Beck Drilling</u>	Water Level read on <u>03/28/12</u>
Sample Method <u>N/A</u>	Rig Type <u>Becker Hammer</u>	Boring Depth <u>7.64 m</u>
Borehole Diameter <u>0.17 m</u>	Driller <u>Nathan Horvath</u>	Well Depth <u>7.64 m</u>
Casing Elevation <u>1180.48 m</u>	Ground Elevation <u>1179.07 m</u>	Water Table Depth: <u>Dry to 7.64 m</u>
		Water Table Elevation: <u>N/A</u>

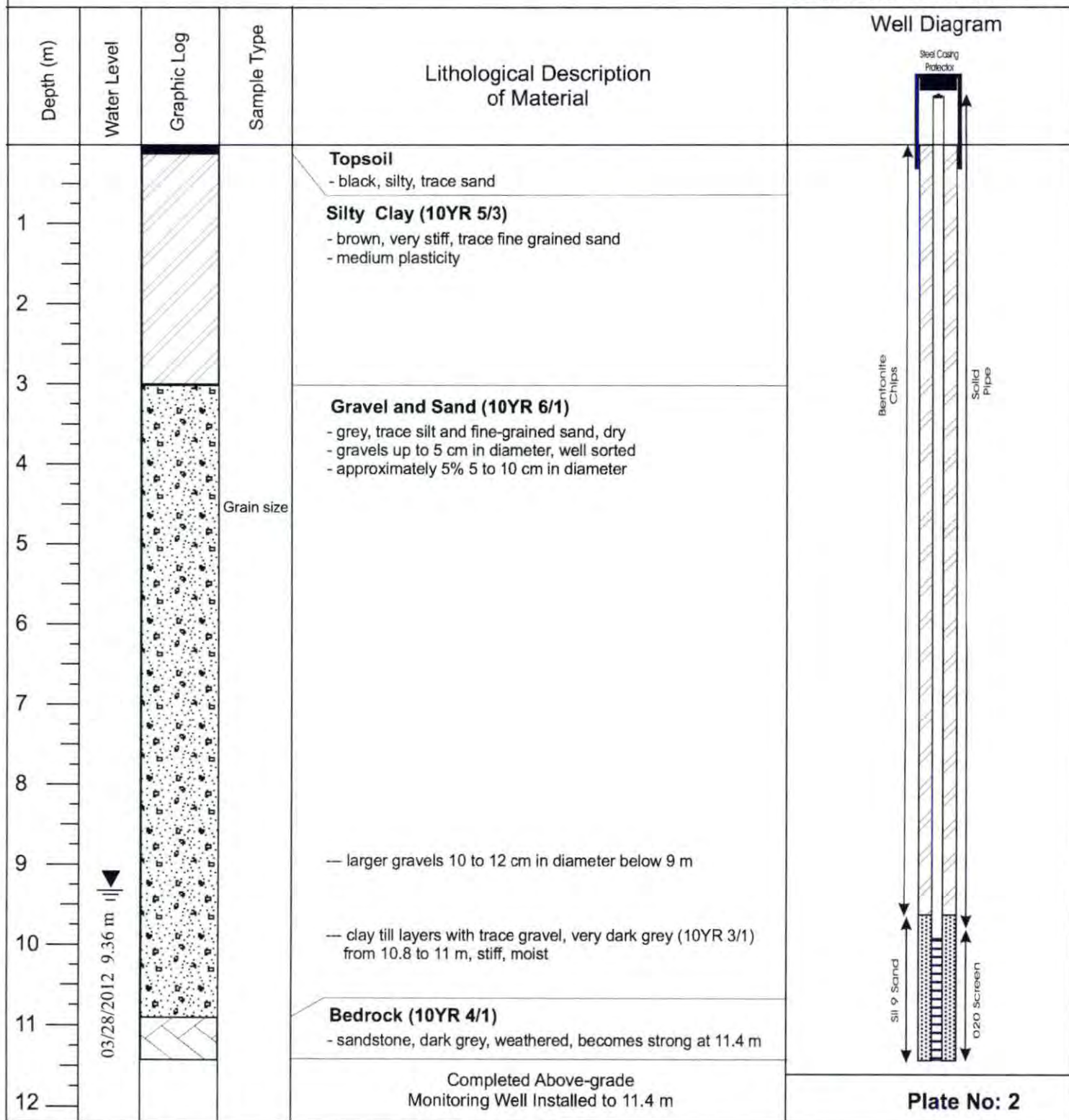




Levelton Consultants Ltd.

Boring/Well Construction Log

Project McDougall Gravel Pit	Project No. AB12-0253-00	Boring/Well MW12-2
Location Northwest Portion of NW-13-26-5 W5M	Logged By AN	Date Drilled 03/14/12
Drill Method Hammer	Drill Co. Beck Drilling	Water Level read on 03/28/12
Sample Method N/A	Rig Type Becker Hammer	Boring Depth 11.4 m
Borehole Diameter 0.17 m	Driller Nathan Horvath	Well Depth 11.4 m
Casing Elevation 1183.67 m	Ground Elevation 1182.84 m	Water Table Depth: 9.36 m
		Water Table Elevation: 1173.48 m

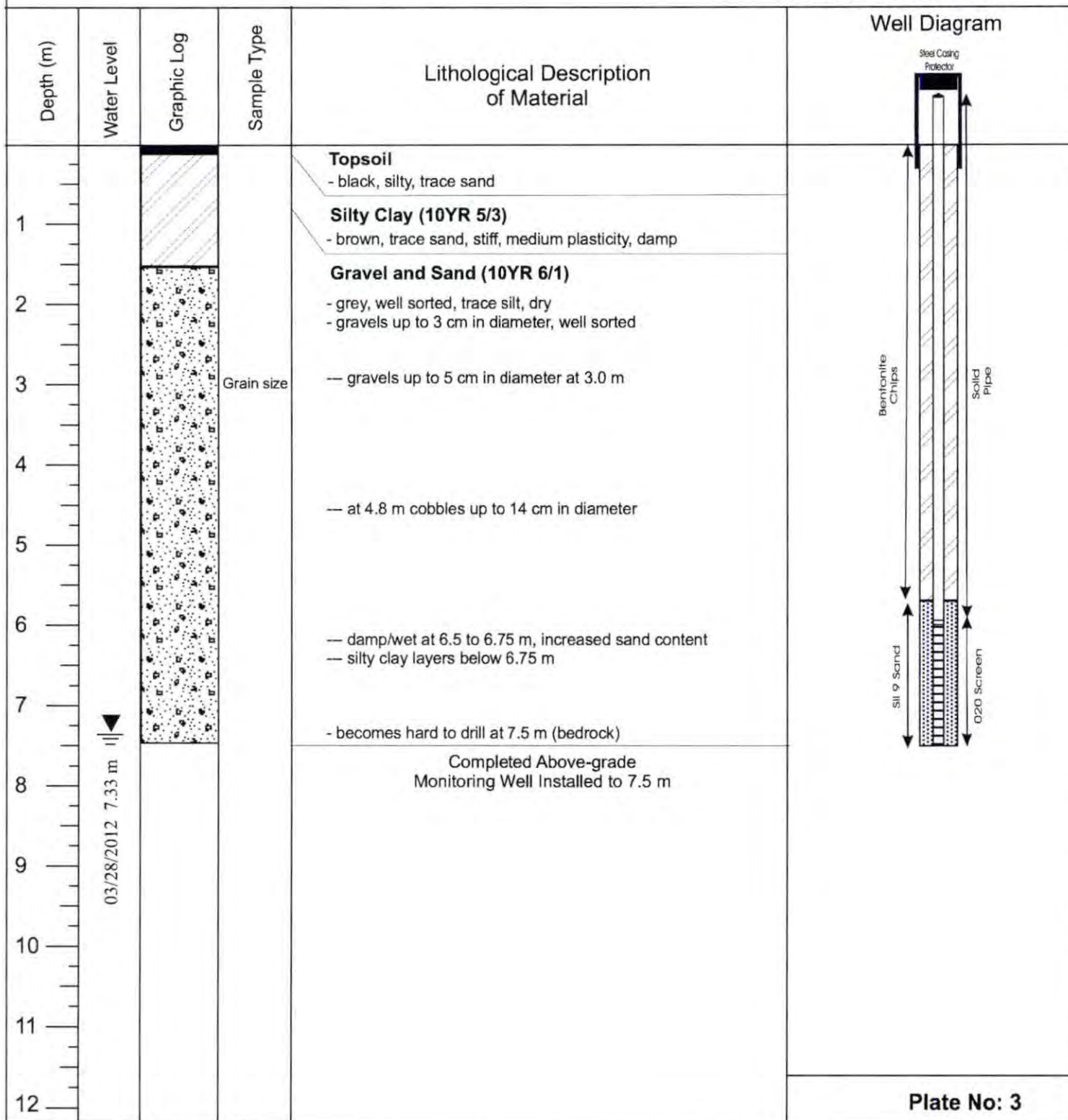




Levelton Consultants Ltd.

Boring/Well Construction Log

Project McDougall Gravel Pit	Project No. AB12-0253-00	Boring/Well MW12-3
Location Northeast Portion of NW-13-26-5 W5M	Logged By AN	Date Drilled 03/14/12
Drill Method Hammer	Drill Co. Beck Drilling	Water Level read on 03/28/12
Sample Method N/A	Rig Type Becker Hammer	Boring Depth 7.5 m
Borehole Diameter 0.17 m	Driller Nathan Horvath	Well Depth 7.5 m
Casing Elevation 1177.62 m	Ground Elevation 1176.69 m	Water Table Depth: 7.33 m
		Water Table Elevation: 1169.36 m





Levelton Consultants Ltd.

Boring/Well Construction Log

Project <u>McDougall Gravel Pit</u>	Project No. <u>AB12-0253-00</u>	Boring/Well <u>MW12-4</u>
Location <u>Southwest Portion of NW-13-26-5 W5M</u>	Logged By <u>AN</u>	Date Drilled <u>03/15/12</u>
Drill Method <u>Hammer</u>	Drill Co. <u>Beck Drilling</u>	Water Level read on <u>03/28/12</u>
Sample Method <u>N/A</u>	Rig Type <u>Becker Hammer</u>	Boring Depth <u>5.2 m</u>
Borehole Diameter <u>0.17 m</u>	Driller <u>Nathan Horvath</u>	Well Depth <u>5.2 m</u>
Casing Elevation <u>1172.86 m</u>	Ground Elevation <u>1171.94 m</u>	Water Table Depth: <u>Dry to 5.2 m</u>
		Water Table Elevation: <u>N/A</u>

Depth (m)	Water Level	Graphic Log	Sample Type	Lithological Description of Material	Well Diagram
1	03/28/2012 Dry to 5.2 m		Grain size	Gravel and Sand (10YR 6/1) - grey, well sorted, trace silt, dry - gravel up to 2 cm in diameter — gravels and cobbles up to 8 cm in diameter below 1.5 m, trace silty sand	
2					
3					
4					
5				Gravel and Sand (10YR 5/2) - greyish brown sandstone, moist - refusal at 5.2 m	
6		Completed Above-grade Monitoring Well Installed to 5.2 m			
7					
8					
9					
10					
11					
12					

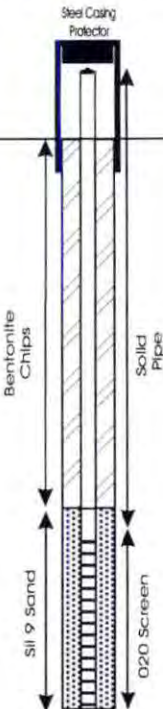
Plate No: 4



Levelton Consultants Ltd.

Boring/Well Construction Log

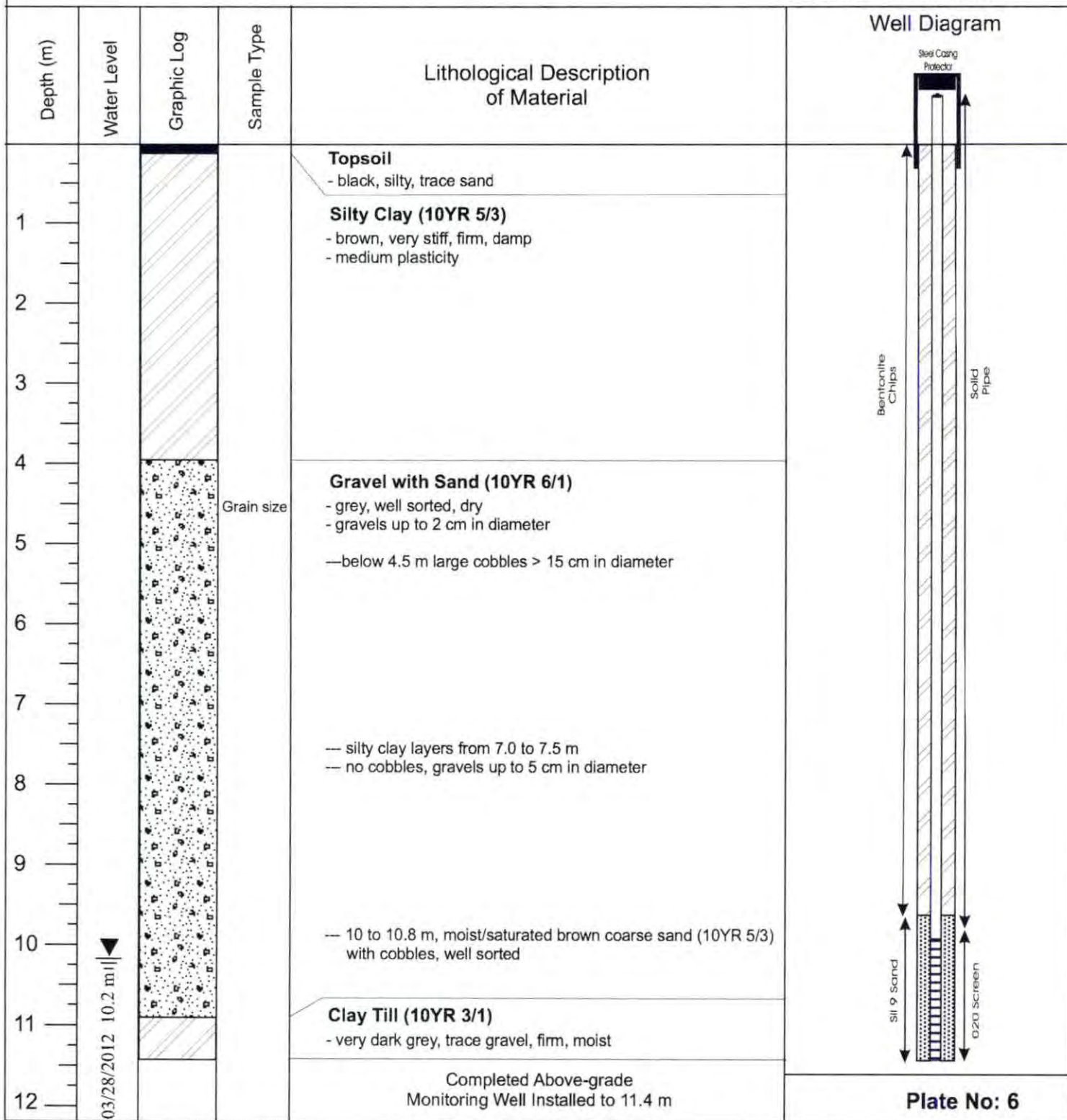
Project <u>McDougall Gravel Pit</u>	Project No. <u>AB12-0253-00</u>	Boring/Well <u>MW12-5</u>
Location <u>Southeast Portion of NE-14-26-5 W5M</u>	Logged By <u>AN</u>	Date Drilled <u>03/15/12</u>
Drill Method <u>Hammer</u>	Drill Co. <u>Beck Drilling</u>	Water Level read on <u>N/A</u>
Sample Method <u>N/A</u>	Rig Type <u>Becker Hammer</u>	Boring Depth <u>5.5 m</u>
Borehole Diameter <u>0.17 m</u>	Driller <u>Nathan Horvath</u>	Well Depth <u>5.5 m</u>
Casing Elevation <u>1173.08 m</u>	Ground Elevation <u>1172.19 m</u>	Water Table Depth: <u>Dry to 5.2 m</u>
		Water Table Elevation: <u>N/A</u>

Depth (m)	Water Level	Graphic Log	Sample Type	Lithological Description of Material	Well Diagram
1	03/28/2012 Dry to 5.2 m		Grain size	Topsoil - black, silty sand, dry Gravel with Sand (10YR 6/1) - grey, well sorted, trace silty - dry - up to 5 cm in diameter — cobbles up to 12 cm in diameter below 2.0 m — moist, silty clay, soft from 4.0 to 4.2 m Gravel and Sand (10YR 5/2) - greyish brown sandstone, very hard - refusal at 5.2 m Completed Above-grade Monitoring Well Installed to 5.2 m	
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					



Boring/Well Construction Log

Project McDougall Gravel Pit	Project No. AB12-0253-00	Boring/Well MW12-6
Location Northwest Portion of NW-13-26-5 W5M	Logged By AN	Date Drilled 03/14/12
Drill Method Hammer	Drill Co. Beck Drilling	Water Level read on 03/28/12
Sample Method N/A	Rig Type Becker Hammer	Boring Depth 11.4 m
Borehole Diameter 0.17 m	Driller Nathan Horvath	Well Depth 11.4 m
Casing Elevation 1186.34 m	Ground Elevation 1185.49 m	Water Table Depth: 10.2 m
		Water Table Elevation: 1175.29 m

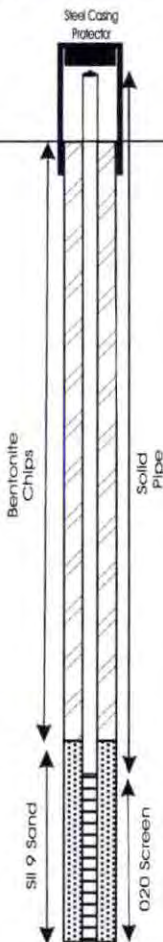




Levelton Consultants Ltd.

Boring/Well Construction Log

Project <u>McDougall Gravel Pit</u>	Project No. <u>AB12-0253-00</u>	Boring/Well <u>MW12-7</u>
Location <u>Northeast Portion of NW-14-26-5 W5M</u>	Logged By <u>AN</u>	Date Drilled <u>03/15/12</u>
Drill Method <u>Hammer</u>	Drill Co. <u>Beck Drilling</u>	Water Level read on <u>03/28/12</u>
Sample Method <u>N/A</u>	Rig Type <u>Becker Hammer</u>	Boring Depth <u>7.2 m</u>
Borehole Diameter <u>0.17 m</u>	Driller <u>Nathan Horvath</u>	Well Depth <u>7.2 m</u>
Casing Elevation <u>1180.26 m</u>	Ground Elevation <u>1179.34 m</u>	Water Table Depth: <u>6.82 m</u>
		Water Table Elevation: <u>1172.52 m</u>

Depth (m)	Water Level	Graphic Log	Sample Type	Lithological Description of Material	Well Diagram
1	03/28/2012 6.82 m			Topsoil - black, silty, trace sand	
2				Gravel with Sand (10YR 6/1) - grey, well sorted, trace silt - dry, gravels approximately 2 cm in diameter	
3				— cobbles > 10 cm in diameter	
4					
5					
6				— boulders below 5.5 m	
7				Bedrock (10YR 6/1) - grey sandstone, strong - refusal at 7.2 m	
8				Completed Above-grade Monitoring Well Installed to 7.2 m	
9					
10					
11					
12					
					Plate No: 7



Boring/Well Construction Log

Project <u>McDougall Gravel Pit</u>	Project No. <u>AB12-0253-00</u>	Boring/Well <u>MW12-8</u>
Location <u>Northeast Portion of NW-14-26-5 W5M</u>	Logged By <u>AN</u>	Date Drilled <u>03/15/12</u>
Drill Method <u>Hammer</u>	Drill Co. <u>Beck Drilling</u>	Water Level read on <u>04/02/12</u>
Sample Method <u>N/A</u>	Rig Type <u>Becker Hammer</u>	Boring Depth <u>8.5 m</u>
Borehole Diameter <u>0.17 m</u>	Driller <u>Nathan Horvath</u>	Well Depth <u>7.6 m</u>
Casing Elevation <u>1180.26 m</u>	Ground Elevation <u>1179.34 m</u>	Water Table Depth: <u>7.59 m</u>
		Water Table Elevation: <u>1172.52 m</u>

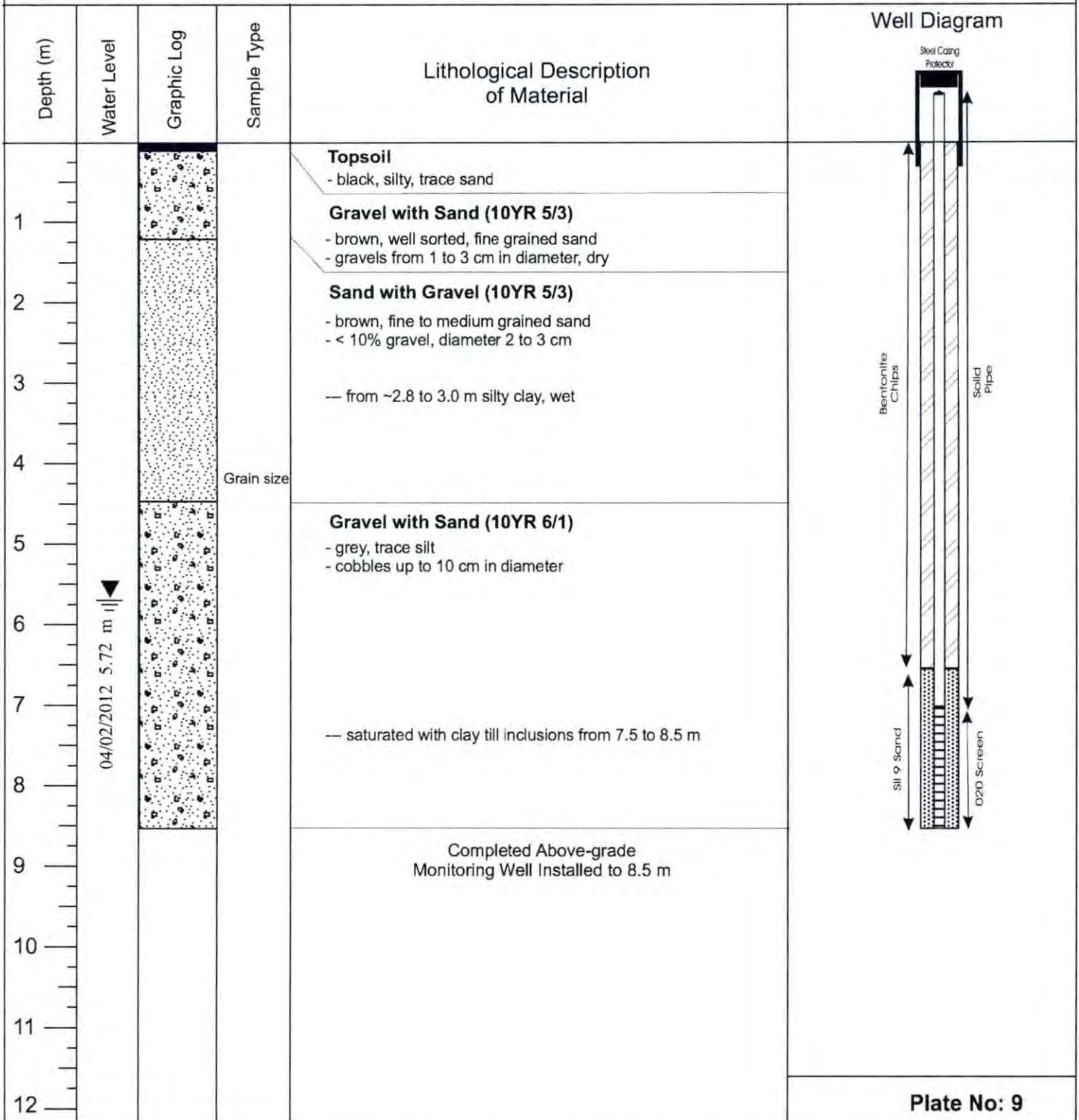
Depth (m)	Water Level	Graphic Log	Sample Type	Lithological Description of Material	Well Diagram
1	04/02/2012 7.59 m		Grain size	Topsoil - black, silty, trace sand Gravel with Sand (10YR 6/1) - grey, well sorted, trace silt - dry, gravels approximately 2 to 4 cm in diameter, <5% cobbles — layer of coarse sand at 2.0 m - increasing cobbles below 3.0 m — moist to wet 6.7 to 6.9 m Silty Clay(10YR 3/1) - very dark grey, trace fine grained sand - saturated, medium plasticity - clay till like at 8.0 m with gravel, iron, sulphate inclusions, moist	
2					
3					
4					
5					
6					
7					
8					
9				Completed Above-grade Monitoring Well Installed to 7.6 m	
10					
11					
12					



Levelton Consultants Ltd.

Boring/Well Construction Log

Project <u>McDougall Gravel Pit</u>	Project No. <u>AB12-0253-00</u>	Boring/Well <u>MW12-9</u>
Location <u>Northeast Portion of NW-14-26-5 W5M</u>	Logged By <u>AN</u>	Date Drilled <u>03/15/12</u>
Drill Method <u>Hammer</u>	Drill Co. <u>Beck Drilling</u>	Water Level read on <u>04/02/12</u>
Sample Method <u>N/A</u>	Rig Type <u>Becker Hammer</u>	Boring Depth <u>8.5 m</u>
Borehole Diameter <u>0.17 m</u>	Driller <u>Nathan Horvath</u>	Well Depth <u>8.5 m</u>
Casing Elevation <u>1185.24 m</u>	Ground Elevation <u>1184.46 m</u>	Water Table Depth: <u>5.72 m</u>
		Water Table Elevation: <u>1178.74 m</u>



GIC Well ID 1066247
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 2010/10/21

1. Well Identification and Location										Measurement in Imperial	
<i>Owner Name</i> DAVE H MCDOUGALL RANCH LTD			<i>Address</i> P.O. BOX 18			<i>Town</i> PINK MOUNTAIN		<i>Province</i> BRITISH COLUMBIA		<i>Postal Code</i> V0C 2B0	
<i>Location</i>	<i>1/4 or LSD</i>	<i>SEC</i>	<i>TWP</i>	<i>RGE</i>	<i>W of MER</i>	<i>Lot</i>	<i>Block</i>	<i>Plan</i>	<i>Additional Description</i>		
	NE	23	26	5	5						
<i>Measured from Boundary of</i>				<i>GPS Coordinates in Decimal Degrees (NAD 83)</i>				<i>Elevation</i>			
_____ ft from _____				Latitude <u>51.226460</u> Longitude <u>-114.611230</u>				_____ 3937.01 ft			
_____ ft from _____				<i>How Location Obtained</i> Differential corrected handheld GPS 5-10m				<i>How Elevation Obtained</i> Differential corrected handheld GPS 5-10m			

2. Drilling Information		
<i>Method of Drilling</i> Rotary - Air	<i>Type of Work</i> New Well	<i>Proposed Well Use</i> Domestic

3. Formation Log			Measurement in Imperial		
<i>Depth from ground level (ft)</i>	<i>Water Bearing</i>	<i>Lithology Description</i>			
18.00		Gray Sand			
23.00		Gray Clay & Rocks			
58.00		Gravel			
85.00		Gray Clay			
87.00		Gray Shale			
115.00	Yes	Gray Fractured Sandstone			
120.00		Gray Shale			

5. Yield Test Summary				Measurement in Imperial	
<i>Test Date</i>	<i>Water Removal Rate (igpm)</i>	<i>Static Water Level (ft)</i>			
2010/07/13	20.00	90.00			

4. Well Completion				Measurement in Imperial	
<i>Total Depth Drilled</i>	<i>Finished Well Depth</i>	<i>Start Date</i>	<i>End Date</i>		
120.00 ft	120.00 ft	2010/07/13	2010/07/17		
Borehole					
<i>Diameter (in)</i>	<i>From (ft)</i>	<i>To (ft)</i>			
6.75	0.00	87.00			
5.00	87.00	120.00			
Surface Casing (if applicable)			Well Casing/Liner		
Steel			Plastic		
<i>Size OD :</i>	<u>5.56 in</u>	<i>Size OD :</i>	<u>4.50 in</u>		
<i>Wall Thickness :</i>	<u>0.258 in</u>	<i>Wall Thickness :</i>	<u>0.237 in</u>		
<i>Bottom at :</i>	<u>87.00 ft</u>	<i>Top at :</i>	<u>60.00 ft</u>		
		<i>Bottom at :</i>	<u>120.00 ft</u>		
Perforations					
<i>From (ft)</i>	<i>To (ft)</i>	<i>Diameter (in) or Slot Length (in)</i>	<i>Interval (in)</i>		
90.00	110.00	0.375	12.00		
<i>Perforated by</i> Drill					
Annular Seal Bentonite Chips/Tablets					
<i>Placed from</i> <u>0.00 ft</u> <i>to</i> <u>87.00 ft</u>					
<i>Amount</i> _____					
<i>Other Seals</i>					
<i>Type</i>		<i>At (ft)</i>			
Drive Shoe		87.00			
Screen Type					
<i>Size OD :</i> _____ in					
<i>From (ft)</i>	<i>To (ft)</i>	<i>Slot Size (in)</i>			
<i>Attachment</i> _____					
<i>Top Fittings</i> _____		<i>Bottom Fittings</i> _____			
Pack					
<i>Type</i> _____		<i>Grain Size</i> _____			
<i>Amount</i> _____					

7. Contractor Certification	
<i>Name of Journeyman responsible for drilling/construction of well</i> RILEY PEARSON	<i>Certification No</i> 83061A
<i>Company Name</i> ALKEN BASIN DRILLING LTD.	<i>Copy of Well report provided to owner</i> Yes
	<i>Date approval holder signed</i> 2010/07/14

Water Well Drilling Report

[View in Metric](#) [Export to Excel](#)

GIC Well ID 1066247
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 2010/10/21

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

1. Well Identification and Location										Measurement in Imperial	
<i>Owner Name</i> DAVE H MCDOUGALL RANCH LTD			<i>Address</i> P.O. BOX 18			<i>Town</i> PINK MOUNTAIN		<i>Province</i> BRITISH COLUMBIA		<i>Postal Code</i> V0C 2B0	
<i>Location</i>	<i>1/4 or LSD</i>	<i>SEC</i>	<i>TWP</i>	<i>RGE</i>	<i>W of MER</i>	<i>Lot</i>	<i>Block</i>	<i>Plan</i>	<i>Additional Description</i>		
	NE	23	26	5	5						
<i>Measured from Boundary of</i>				<i>GPS Coordinates in Decimal Degrees (NAD 83)</i>				<i>Elevation</i>			
ft from				Latitude 51.226460 Longitude -114.611230				3937.01 ft			
ft from				How Location Obtained				How Elevation Obtained			
				Differential corrected handheld GPS 5-10m				Differential corrected handheld GPS 5-10m			
Additional Information										Measurement in Imperial	
<i>Distance From Top of Casing to Ground Level</i>										36.00 in	
<i>Is Artesian Flow</i>											
<i>Rate</i>										igpm	
<i>Describe</i>											
<i>Recommended Pump Rate</i>										10.00 igpm	
<i>Recommended Pump Intake Depth (From TOC)</i>										100.00 ft	
<i>Pump Installed</i>										ft	
<i>Type</i>										H.P.	
<i>Make</i>										Model (Output Rating)	
<i>Did you Encounter Saline Water (>4000 ppm TDS)</i>										Yes	
<i>Gas</i>										ft	
<i>Depth</i>										ft	
<i>Well Disinfected Upon Completion</i>										Yes	
<i>Geophysical Log Taken</i>											
<i>Submitted to GIC</i>											
<i>Sample Collected for Potability</i>										Result Attached	
<i>Additional Comments on Well</i>											

5. Yield Test			Measurement in Imperial		Taken From Top of Casing	
<i>Test Date</i>	<i>Start Time</i>	<i>Static Water Level</i>	<i>Depth to water level</i>			
2010/07/13	3:00 PM	90.00 ft				
<i>Method of Water Removal</i>			<i>Drawdown (ft)</i>		<i>Elapsed Time Minutes:Sec</i>	
<i>Type</i> AIR			90.00		0:00	
<i>Removal Rate</i> 20.00 igpm					1:00	
<i>Depth Withdrawn From</i> 120.00 ft					2:00	
			120.00		120:00	
					90.00	
					90.00	
<i>If water removal period was < 2 hours, explain why</i>						
AIR TEST 20+ IGPM @ 120', PUMP TEST 20 IGPM @ 100', 100% RECOVERY @ 2 MINUTES						

6. Water Diverted for Drilling		
<i>Water Source</i>	<i>Amount Taken</i>	<i>Diversion Date & Time</i>
LAST WELL	1200.00 ig	2010/07/13 4:00 PM

7. Contractor Certification		
<i>Name of Journeyman responsible for drilling/construction of well</i>		<i>Certification No</i>
RILEY PEARSON		83061A
<i>Company Name</i>		<i>Copy of Well report provided to owner</i>
ALKEN BASIN DRILLING LTD.		<i>Date approval holder signed</i>
		2010/07/14

Water Well Drilling Report

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

[View in Metric](#) [Export to Excel](#)

GIC Well ID 1066146
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 2010/08/11

1. Well Identification and Location					Measurement in Imperial				
Owner Name GERTNER, HAROLD		Address P.O. BOX 1319		Town CROSSFIELD		Province ALBERTA		Postal Code T0M 1S0	
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	13	14	26	5	5				
Measured from Boundary of				GPS Coordinates in Decimal Degrees (NAD 83)				Elevation	
ft from _____				Latitude <u>51.226520</u> Longitude <u>-114.601290</u>				3894.36 ft	
ft from _____				How Location Obtained				How Elevation Obtained	
				Not Verified				Differential corrected handheld GPS 5-10m	

2. Drilling Information		
Method of Drilling Rotary - Air	Type of Work New Well	Proposed Well Use Domestic

3. Formation Log			Measurement in Imperial		
Depth from ground level (ft)	Water Bearing	Lithology Description			
9.00		Sand			
21.00		Brown Clay			
52.00		Gravel			
55.00		Gray Shale			
70.00	Yes	Gray Sandstone			
120.00		Gray Shale			
136.00		Gray Sandstone			
144.00		Gray Shale			
159.00	Yes	Gray Sandstone			
217.00		Gray Shale			
228.00		Gray Sandstone			
318.00		Gray Shale			
335.00	Yes	Gray See Comments Sandstone			
360.00		Gray Shale			

5. Yield Test Summary				Measurement in Imperial	
Test Date	Water Removal Rate (igpm)	Static Water Level (ft)			
2010/06/08	3.50	58.00			

4. Well Completion				Measurement in Imperial	
Total Depth Drilled	Finished Well Depth	Start Date	End Date		
360.00 ft	280.00 ft	2010/06/07	2010/06/08		
Borehole					
Diameter (in)	From (ft)	To (ft)			
6.75	0.00	40.00			
5.00	40.00	360.00			
Surface Casing (if applicable)			Well Casing/Liner		
Steel			Plastic		
Size OD :	5.56 in	Size OD :	4.50 in		
Wall Thickness :	0.258 in	Wall Thickness :	0.237 in		
Bottom at :	54.00 ft	Top at :	40.00 ft		
		Bottom at :	280.00 ft		
Perforations					
From (ft)	To (ft)	Diameter (in) or Slot Length (in)	Interval (in)		
60.00	70.00	0.375	12.00		
140.00	160.00	0.375	12.00		

Perforated by Drill

Annular Seal Bentonite Chips/Tables

Placed from _____ ft to _____ ft

Amount _____

Other Seals

Type	At (ft)
Drive Shoe	54.00
Shale Trap	120.00

Screen Type

Size OD : _____ in

From (ft)	To (ft)	Slot Size (in)

Attachment _____

Top Fittings _____ Bottom Fittings _____

Pack

Type _____ Grain Size _____

Amount _____

7. Contractor Certification	
Name of Journeyman responsible for drilling/construction of well RILEY PEARSON	Certification No 83061A
Company Name ALKEN BASIN DRILLING LTD.	Copy of Well report provided to owner Yes
	Date approval holder signed 2010/07/10

1. Well Identification and Location										Measurement in Imperial
Owner Name GERTNER, HAROLD		Address P.O. BOX 1319			Town CROSSFIELD		Province ALBERTA		Postal Code T0M 1S0	
Location	1/4 or LSD 13	SEC 14	TWP 26	RGE 5	W of MER 5	Lot	Block	Plan	Additional Description	
Measured from Boundary of				GPS Coordinates in Decimal Degrees (NAD 83)				Elevation		
ft from				Latitude 51.226520 Longitude -114.601290				3894.36 ft		
ft from				How Location Obtained				How Elevation Obtained		
				Not Verified				Differential corrected handheld GPS 5-10m		

Additional Information		Measurement in Imperial
Distance From Top of Casing to Ground Level 24.00 in		
Is Artesian Flow	Rate	igpm
Is Flow Control Installed	Describe	
Recommended Pump Rate	3.00 igpm	Pump Installed
Recommended Pump Intake Depth (From TOC)	160.00 ft	Depth
		Type
		Make
		H.P.
		Model (Output Rating)
Did you Encounter Saline Water (>4000 ppm TDS)	Depth	ft
Gas	Depth	ft
Well Disinfected Upon Completion	Yes	
Geophysical Log Taken	Submitted to GIC	
Sample Collected for Potability	Result Attached	
Additional Comments on Well		
LITH: 318' - 335' ALSO BAD SMELL YELLOW TINGES. HIT HYDRO CARBONS @ 316' PLUGGED BACK TO 280'.		
DRILLER DID NOT PROVIDE LOCATION AND AMOUNT OF PLACED BENTONITE CHIP ANNULAR SEAL		

5. Yield Test		Measurement in Imperial	Taken From Ground Level
Test Date 2010/06/08	Start Time 5:00 PM	Static Water Level 58.00 ft	
Method of Water Removal		Drawdown (ft)	Elapsed Time Minutes:Sec
Type	Air	58.00	0:00
Removal Rate	3.50 igpm		1:00
Depth Withdrawn From	280.00 ft		2:00
			3:00
			4:00
			5:00
			6:00
			7:00
			8:00
			9:00
			10:00
			12:00
			14:00
			16:00
			18:00
			20:00
			25:00
			30:00
			35:00
			40:00
			50:00
			60:00
			75:00
			90:00
			105:00
			120:00
			Recovery (ft)
			280.00
			277.00
			274.00
			270.00
			267.00
			266.00
			262.00
			259.00
			256.00
			252.00
			249.00
			244.00
			239.00
			235.00
			230.00
			225.00
			220.00
			213.00
			208.00
			202.00
			195.00
			190.00
			185.00
			180.00
			178.00
			178.00

6. Water Diverted for Drilling		
Water Source BOW RIVER	Amount Taken 1200.00 ig	Diversion Date & Time 2010/06/07 9:00 AM

7. Contractor Certification		
Name of Journeyman responsible for drilling/construction of well RILEY PEARSON	Certification No 83061A	
Company Name ALKEN BASIN DRILLING LTD.	Copy of Well report provided to owner Yes	Date approval holder signed 2010/07/10

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 1066146
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 2010/08/11

1. Well Identification and Location										Measurement in Imperial
<i>Owner Name</i> GERTNER, HAROLD		<i>Address</i> P.O. BOX 1319			<i>Town</i> CROSSFIELD		<i>Province</i> ALBERTA		<i>Postal Code</i> T0M 1S0	
<i>Location</i>	<i>1/4 or LSD</i>	<i>SEC</i>	<i>TWP</i>	<i>RGE</i>	<i>W of MER</i>	<i>Lot</i>	<i>Block</i>	<i>Plan</i>	<i>Additional Description</i>	
	13	14	26	5	5					
<i>Measured from Boundary of</i>					<i>GPS Coordinates in Decimal Degrees (NAD 83)</i>					
_____ ft from _____					Latitude <u>51.226520</u> Longitude <u>-114.601290</u>			Elevation <u>3894.36</u> ft		
_____ ft from _____					<i>How Location Obtained</i>			<i>How Elevation Obtained</i>		
					Not Verified			Differential corrected handheld GPS 5-10m		

7. Contractor Certification	
<i>Name of Journeyman responsible for drilling/construction of well</i> RILEY PEARSON	<i>Certification No</i> 83061A
<i>Company Name</i> ALKEN BASIN DRILLING LTD.	<i>Copy of Well report provided to owner</i> <i>Date approval holder signed</i> Yes 2010/07/10

APPENDIX B
Sieve Analysis Reports

Sieve Analysis

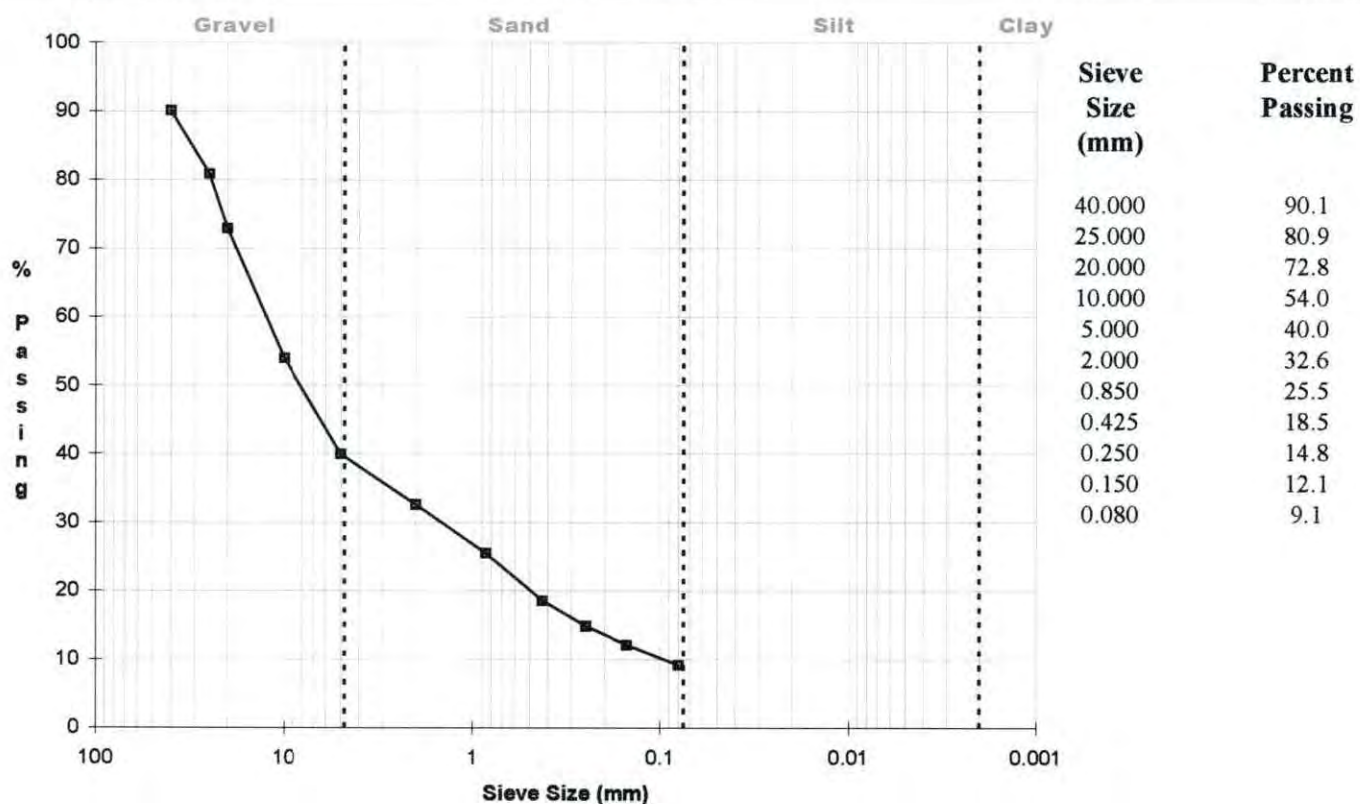
Report Date: Mar. 23, 2012
Project Number: AB12-0253-00
Report Number: 36A

To: Burnco Rock Products Ltd

Project: McDougall Gravel Pit

Copies To: Client
Sample Location: 1 @ 3m
Sample Type: Bulk
Sampled By: AN
Source: Jobsite
Tested By: FG

Sample Date: Mar 14, '12 **Date Tested:** Mar 20, '12 **Date Received:** Mar 14, '12



Sample Description: Sandy gravel
Remarks: Gravel = 60%; Sand = 30.8 %; Silt / Clay = 9.1%

Per: _____

Sieve Analysis

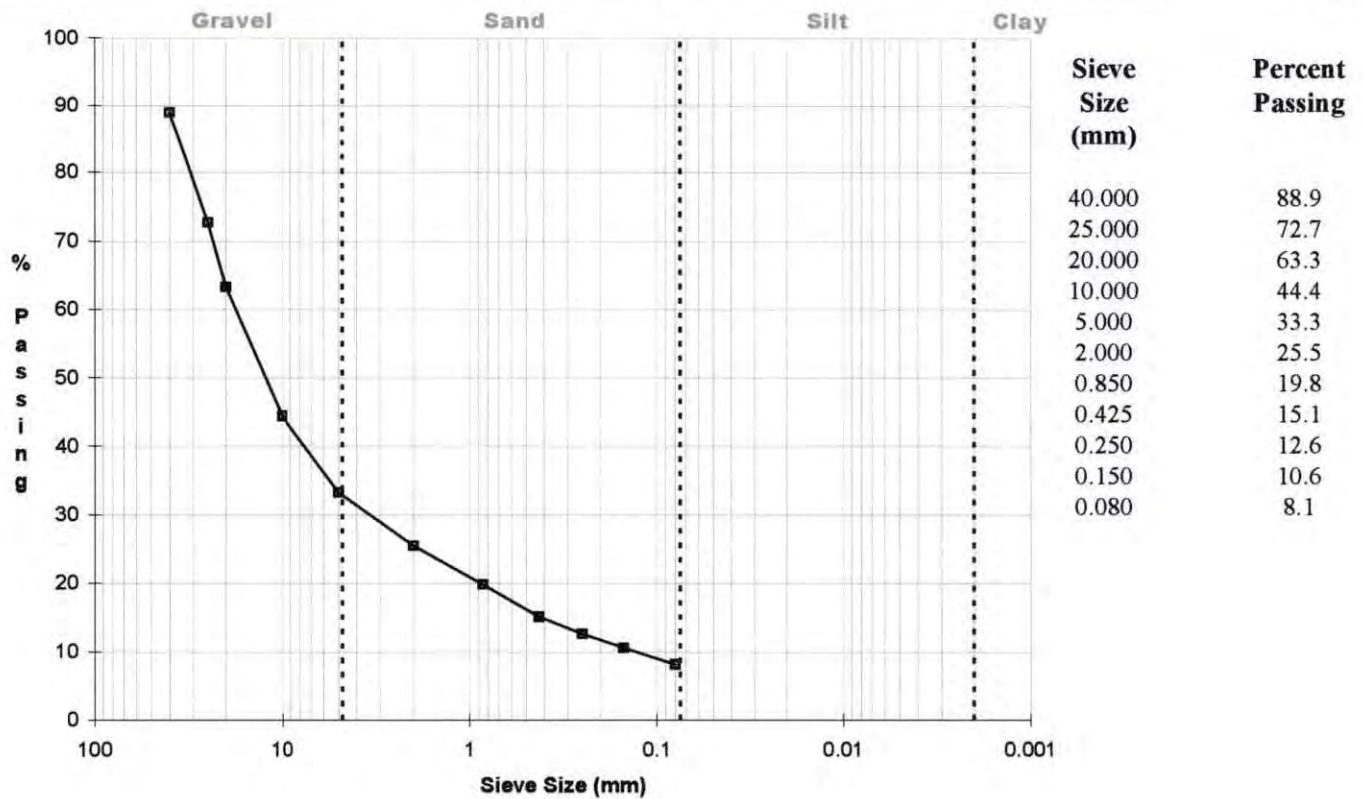
Report Date: Mar. 23, 2012
Project Number: AB12-0253-00
Report Number: 36B

To: Burnco Rock Products Ltd

Project: McDougall Gravel Pit

Copies To: Client
Sample Location: MW1 @ 3m
Sample Type: Bulk
Sampled By: AN
Source: Jobsite
Tested By: FG

Sample Date: Mar 14, '12 **Date Tested:** Mar 20, '12 **Date Received:** Mar 14, '12



Sample Description: Sandy gravel
Remarks: Gravel = 66.7%; Sand = 25.2 %; Silt / Clay = 8.1%

Per: _____

Sieve Analysis

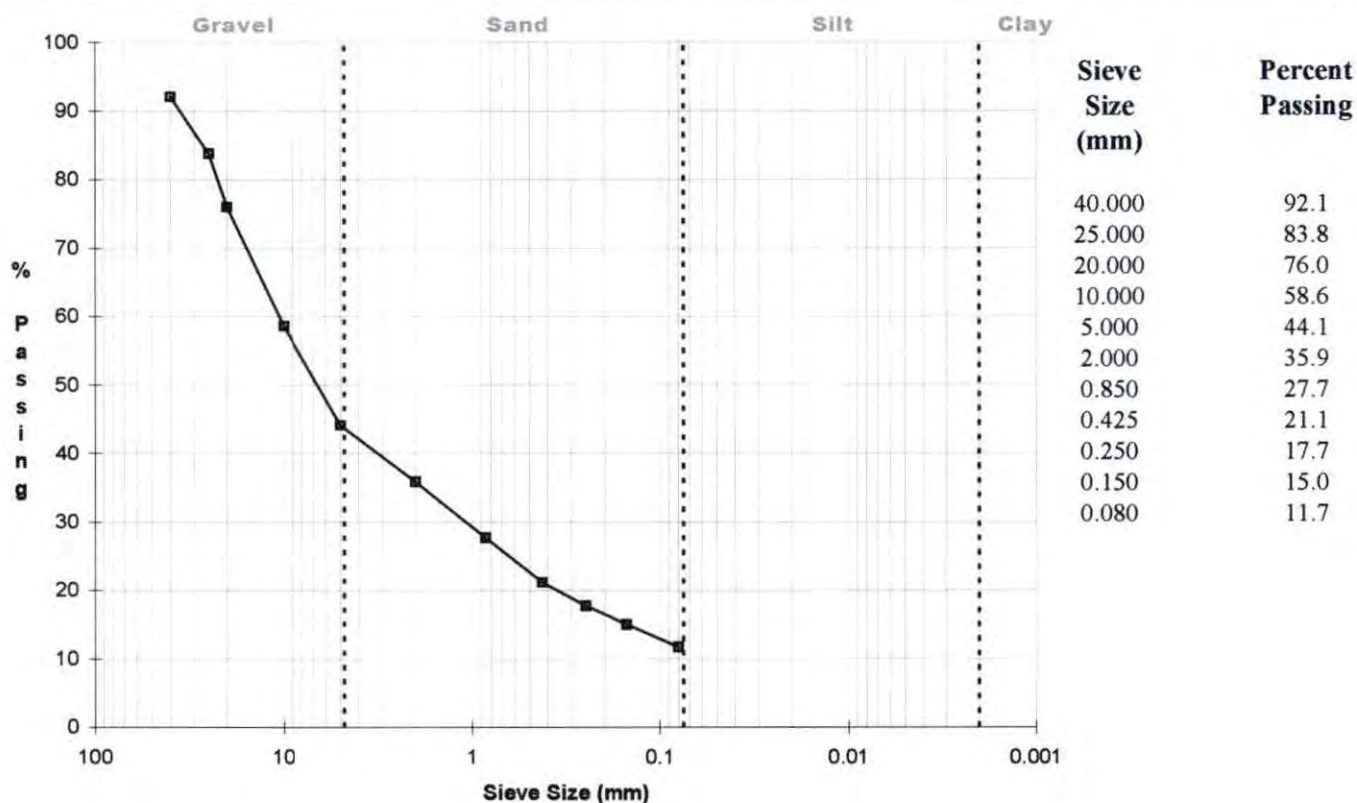
Report Date: Mar. 23, 2012
Project Number: AB12-0253-00
Report Number: 36C

To: Burnco Rock Products Ltd

Copies To: Client
Sample Location: MW2 @ 4.5m
Sample Type: Bulk
Sampled By: AN
Source: Jobsite
Tested By: FG

Project: McDougall Gravel Pit

Sample Date: Mar 14, '12 **Date Tested:** Mar 20, '12 **Date Received:** Mar 14, '12



Sample Description: Sandy gravel
Remarks: Gravel = 55.9%; Sand = 32.4 %; Silt / Clay = 11.7%

Per: _____

Sieve Analysis

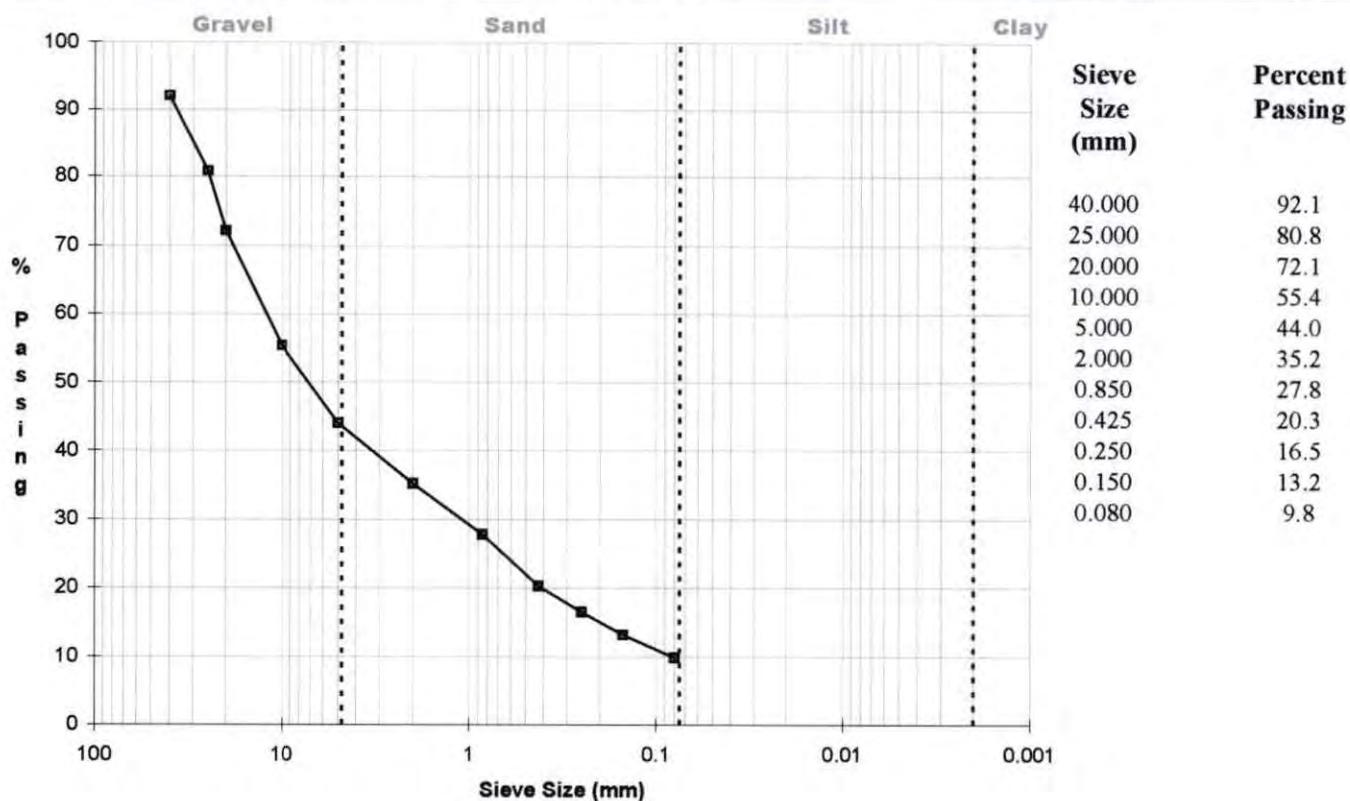
Report Date: Mar. 23, 2012
Project Number: AB12-0253-00
Report Number: 36D

To: Burnco Rock Products Ltd

Copies To: Client
Sample Location: MW3 @ 3-4.5m
Sample Type: Bulk
Sampled By: AN
Source: Jobsite
Tested By: FG

Project: McDougall Gravel Pit

Sample Date: Mar 14, '12 **Date Tested:** Mar 20, '12 **Date Received:** Mar 14, '12



Sample Description: Sandy gravel
Remarks: Gravel = 56%; Sand = 34.2 %; Silt / Clay = 9.8%

Per: _____



Levelton Consultants Ltd.
6919 32nd Avenue N.W., Calgary, AB
Tel. No. (403) 247-1813, FAX No. (403) 247-1814

Sieve Analysis

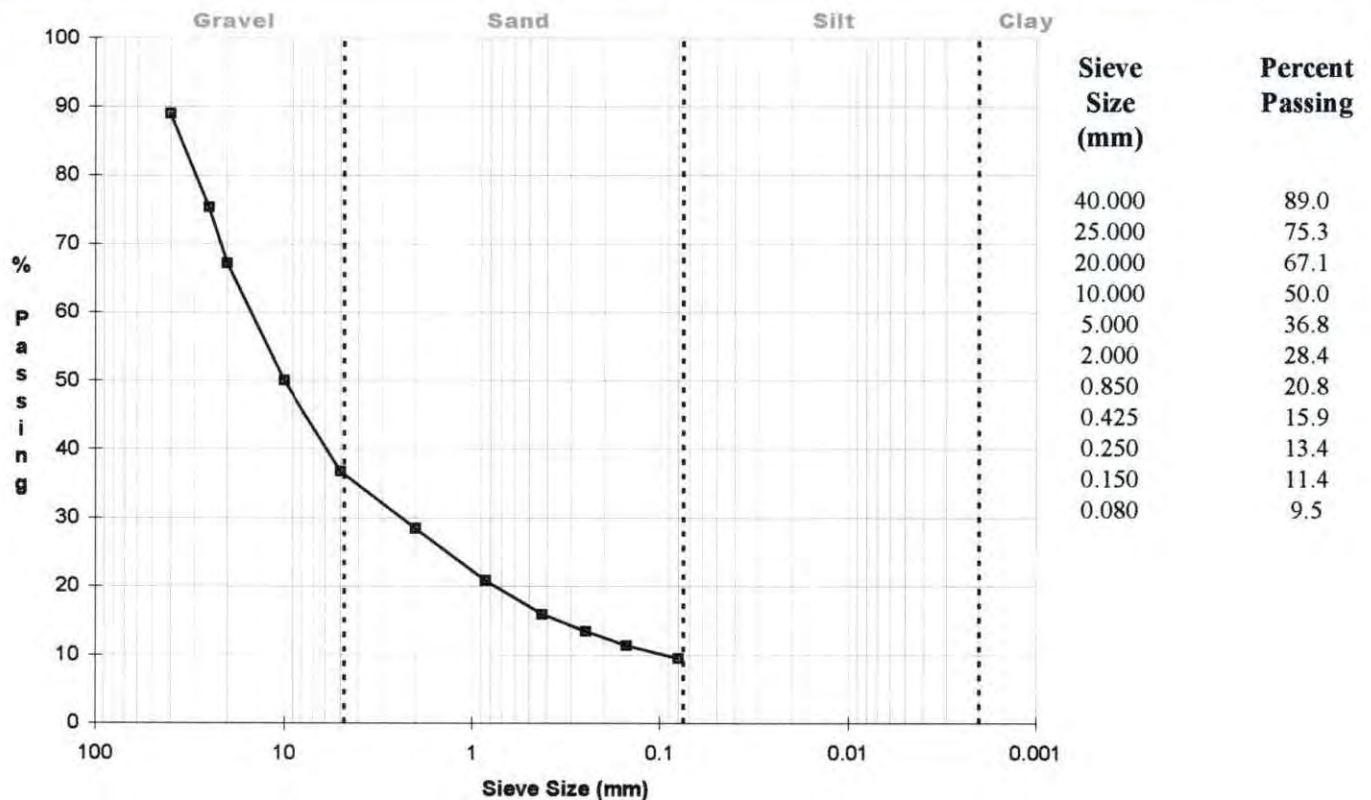
Report Date: Mar. 23, 2012
Project Number: AB12-0253-00
Report Number: 36E

To: Burnco Rock Products Ltd

Copies To: Client
Sample Location: MW4 @ 2.5m
Sample Type: Bulk
Sampled By: AN
Source: Jobsite
Tested By: FG

Project: McDougall Gravel Pit

Sample Date: Mar 14, '12 **Date Tested:** Mar 20, '12 **Date Received:** Mar 14, '12



Sample Description: Sandy gravel
Remarks: Gravel = 63.2%; Sand = 27.3 %; Silt / Clay = 9.5%

Per: _____



Levelton Consultants Ltd.
6919 32nd Avenue N.W., Calgary, AB
Tel. No. (403) 247-1813, FAX No. (403) 247-1814

Sieve Analysis

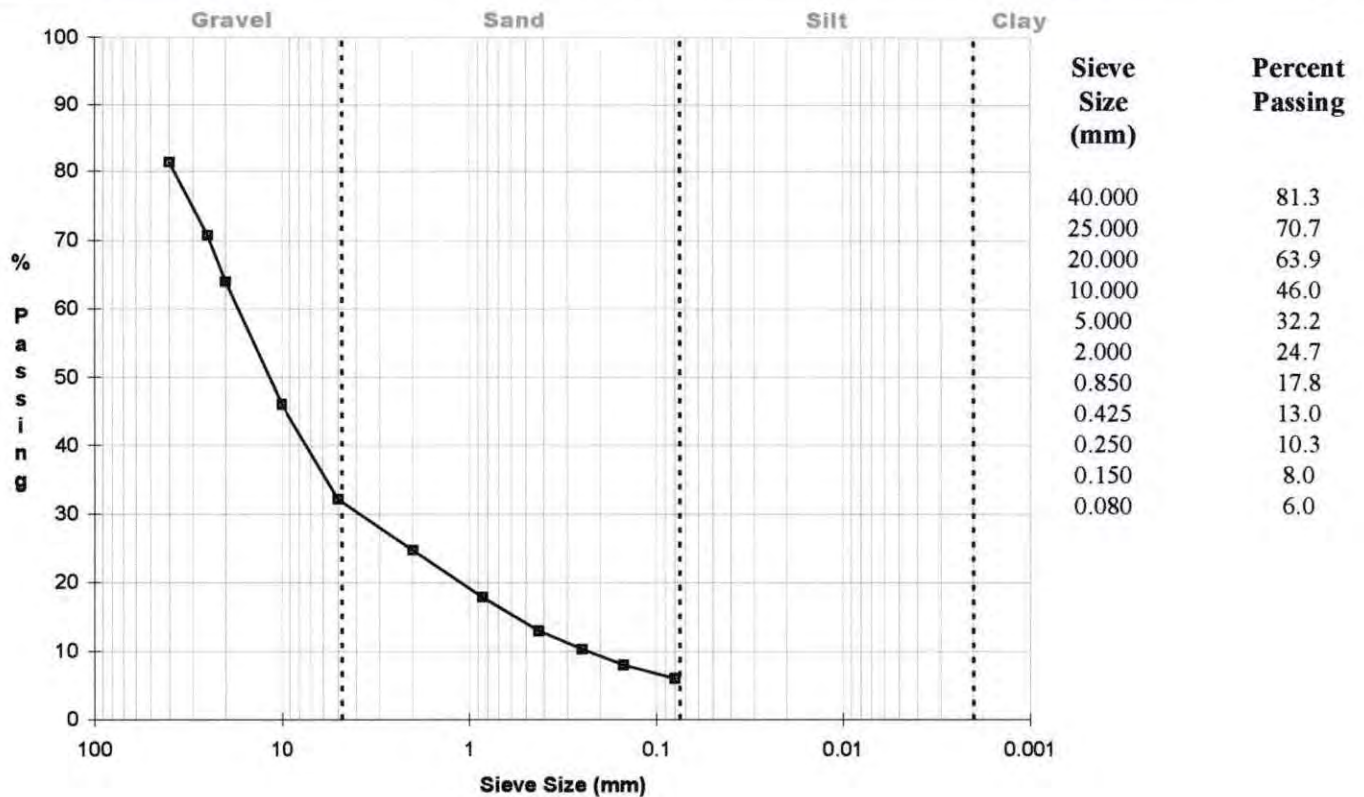
Report Date: Mar. 23, 2012
Project Number: AB12-0253-00
Report Number: 36F

To: Burnco Rock Products Ltd

Copies To: Client
Sample Location: MW5 @ 2m
Sample Type: Bulk
Sampled By: AN
Source: Jobsite
Tested By: FG

Project: McDougall Gravel Pit

Sample Date: Mar 14, '12 **Date Tested:** Mar 20, '12 **Date Received:** Mar 14, '12



Sample Description: Sandy gravel
Remarks: Gravel = 67.8%; Sand = 26.1 %; Silt / Clay = 6%

Per: _____

Reporting of these test results constitutes a testing service only. Engineering interpretation or evaluation of test results is provided only on written request.



6919 32nd Avenue N.W., Calgary, AB
Tel. No. (403) 247-1813, FAX No. (403) 247-1814

Sieve Analysis

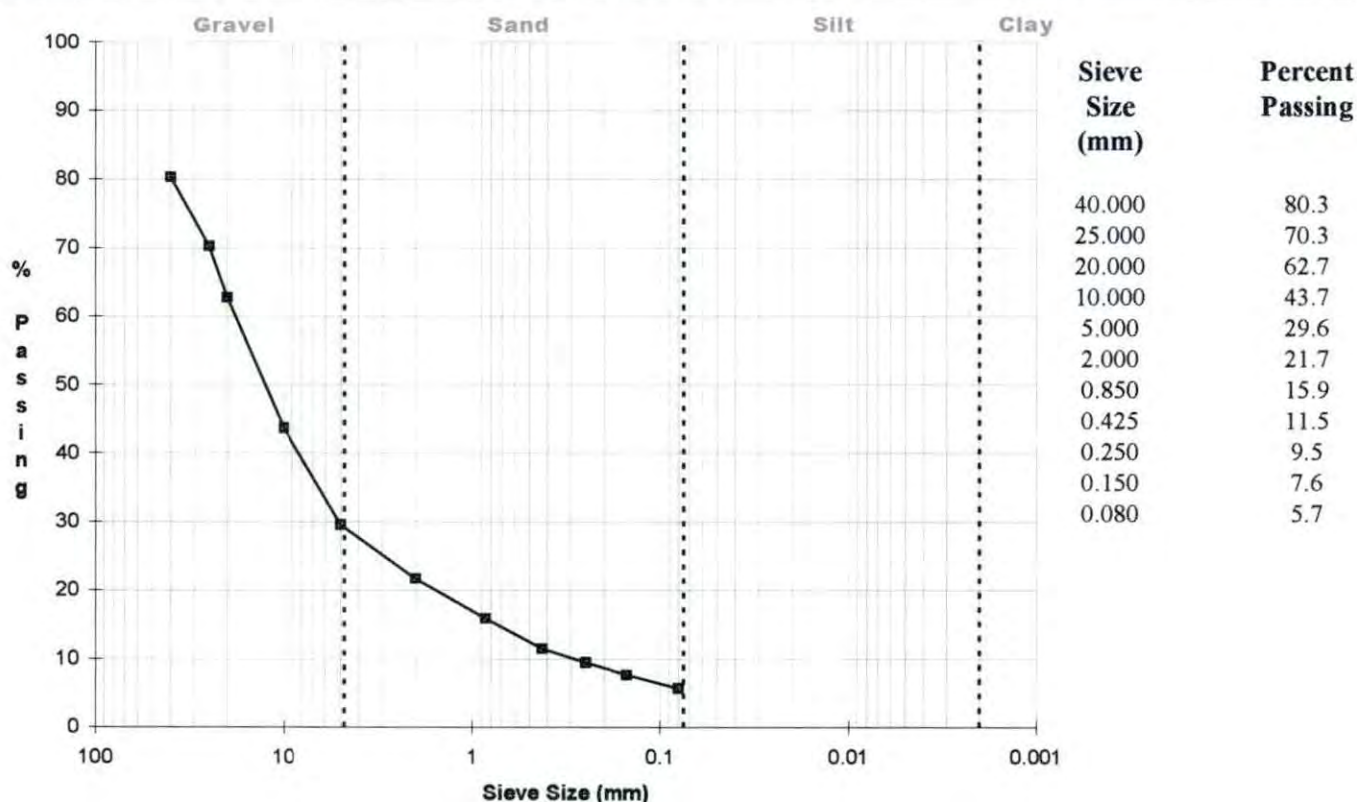
Report Date: Mar. 23, 2012
Project Number: AB12-0253-00
Report Number: 36G

To: Burnco Rock Products Ltd

Copies To: Client
Sample Location: MW6 @ 5.2m
Sample Type: Bulk
Sampled By: AN
Source: Jobsite
Tested By: FG

Project: McDougall Gravel Pit

Sample Date: Mar 14, '12 **Date Tested:** Mar 20, '12 **Date Received:** Mar 14, '12



Sample Description: Sandy gravel
Remarks: Gravel = 70.4%; Sand = 23.9 %; Silt / Clay = 5.7%

Per: _____

Sieve Analysis

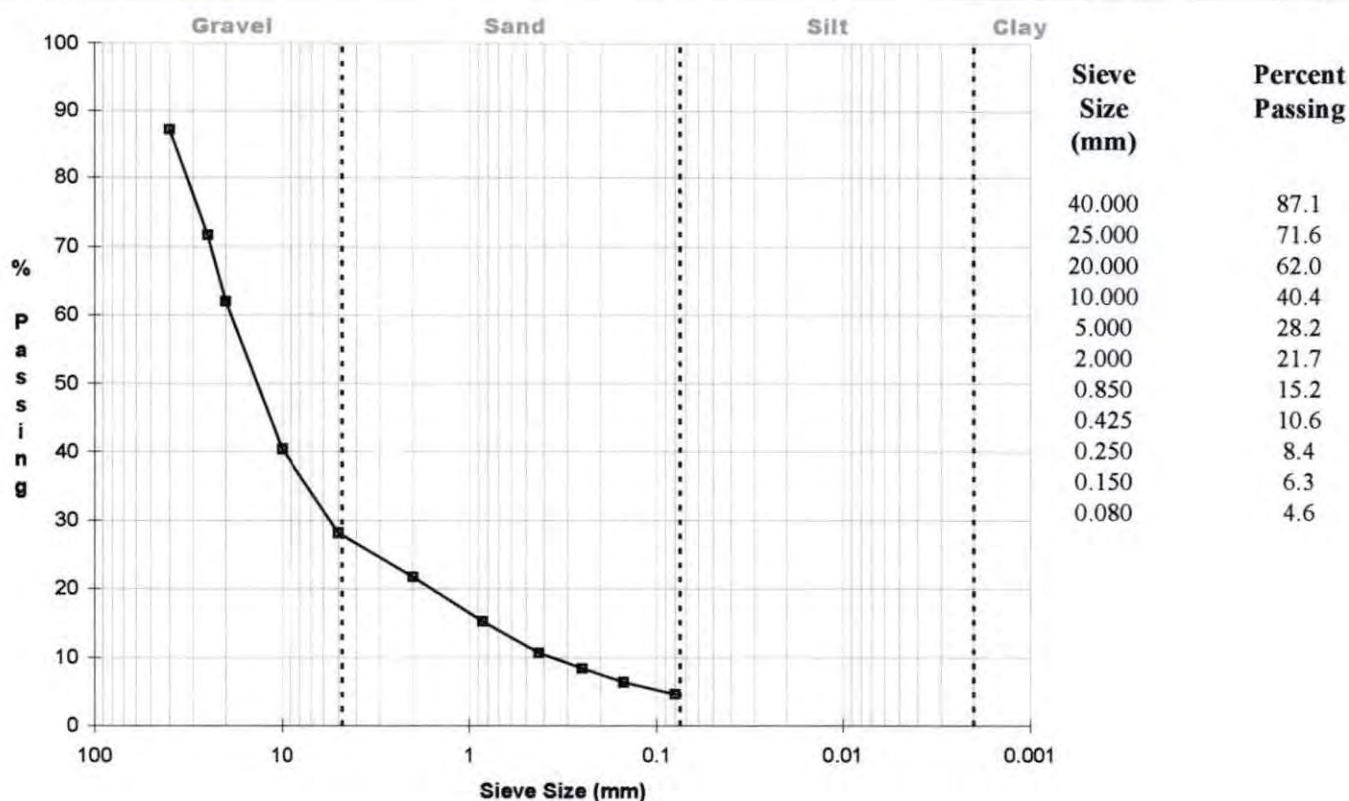
Report Date: Mar. 23, 2012
Project Number: AB12-0253-00
Report Number: 36H

To: Burnco Rock Products Ltd

Project: McDougall Gravel Pit

Copies To: Client
Sample Location: MW7 @ 3.6m
Sample Type: Bulk
Sampled By: AN
Source: Jobsite
Tested By: FG

Sample Date: Mar 14, '12 **Date Tested:** Mar 20, '12 **Date Received:** Mar 14, '12



Sample Description: Sandy gravel
Remarks: Gravel = 71.8%; Sand = 23.6 %; Silt / Clay = 4.6%

Per: _____

Sieve Analysis

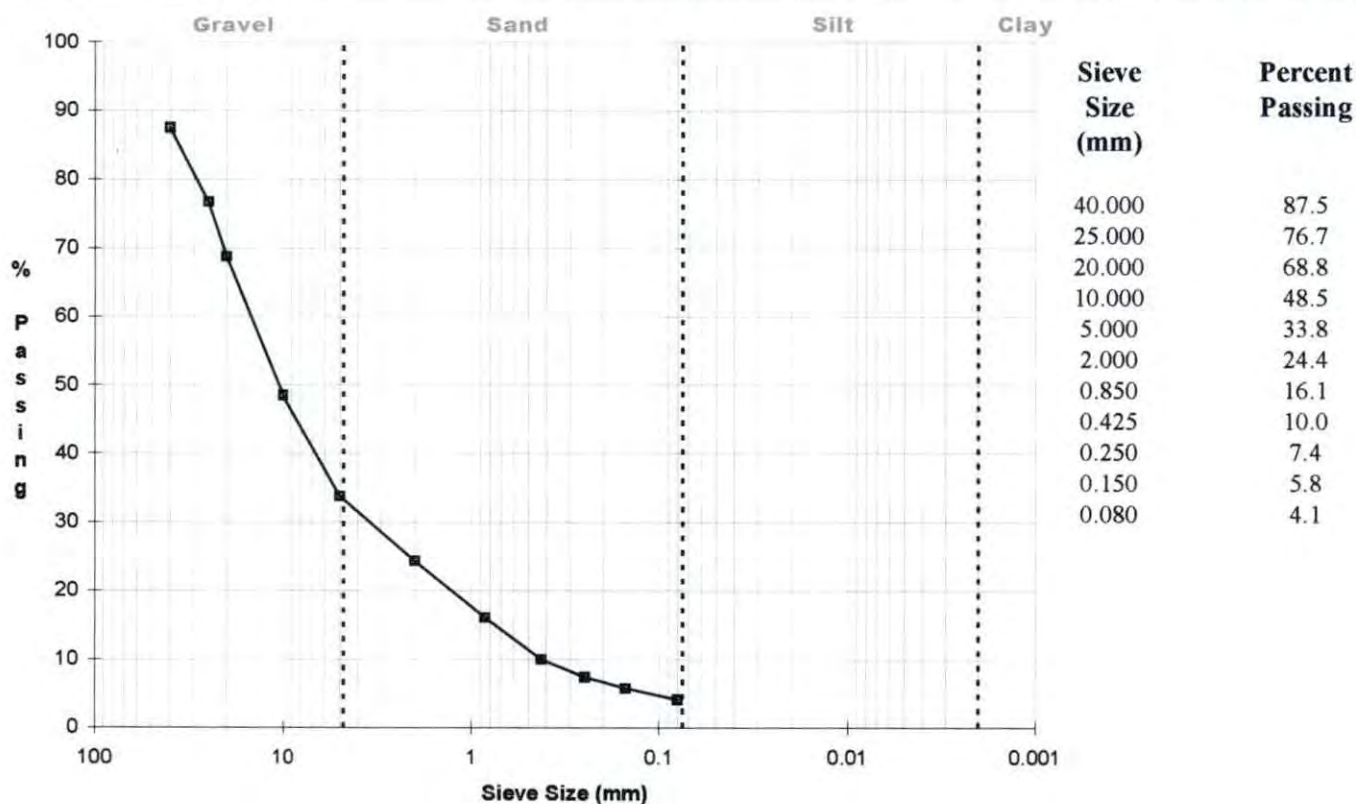
Report Date: Mar. 23, 2012
Project Number: AB12-0253-00
Report Number: 361

To: Burnco Rock Products Ltd

Project: McDougall Gravel Pit

Copies To: Client
Sample Location: MW8 @ 3m
Sample Type: Bulk
Sampled By: AN
Source: Jobsite
Tested By: FG

Sample Date: Mar 14, '12 **Date Tested:** Mar 20, '12 **Date Received:** Mar 14, '12



Sample Description: Sandy gravel
Remarks: Gravel = 66.2%; Sand = 29.7 %; Silt / Clay = 4.1%

Per: _____

Sieve Analysis

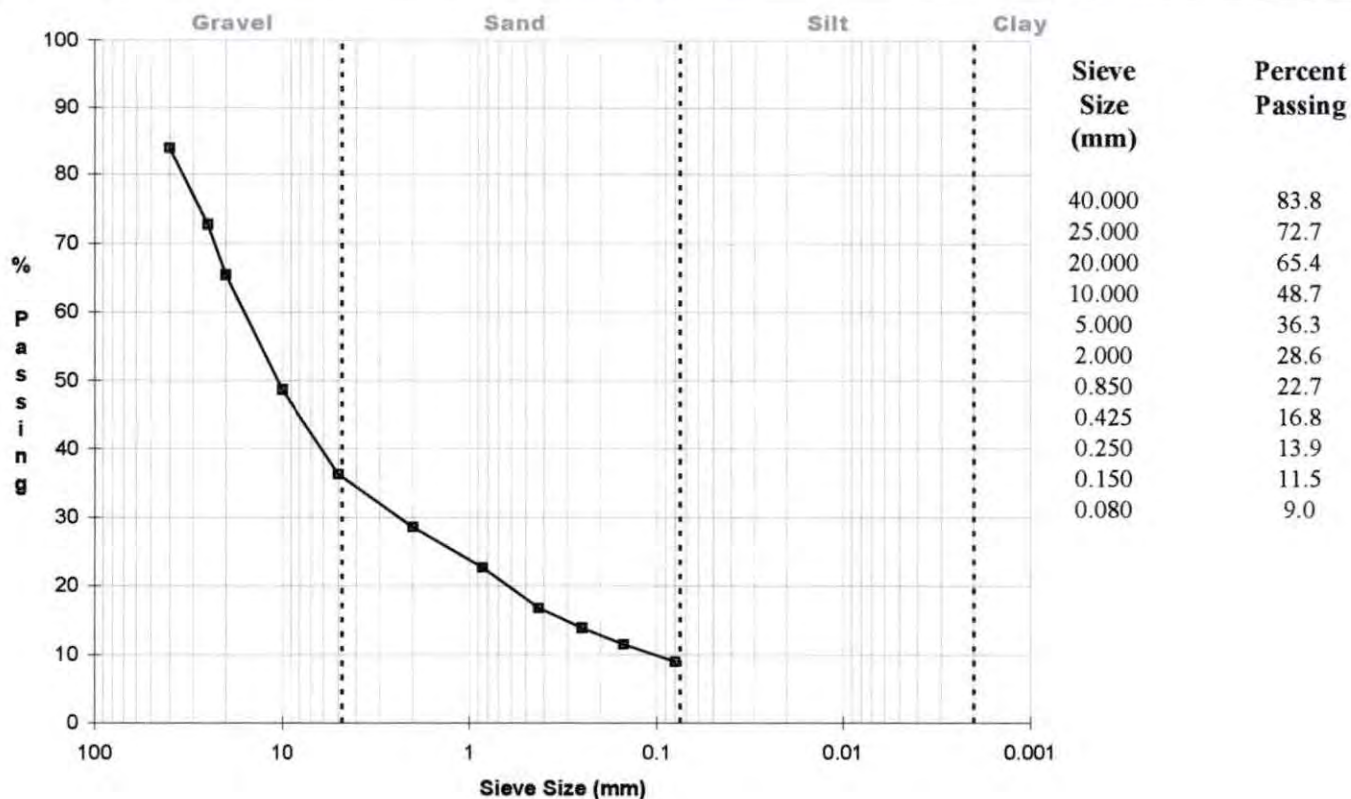
Report Date: Mar. 23, 2012
Project Number: AB12-0253-00
Report Number: 36J

To: Burnco Rock Products Ltd

Project: McDougall Gravel Pit

Copies To: Client
Sample Location: MW9 @ 4-4.5m
Sample Type: Bulk
Sampled By: AN
Source: Jobsite
Tested By: FG

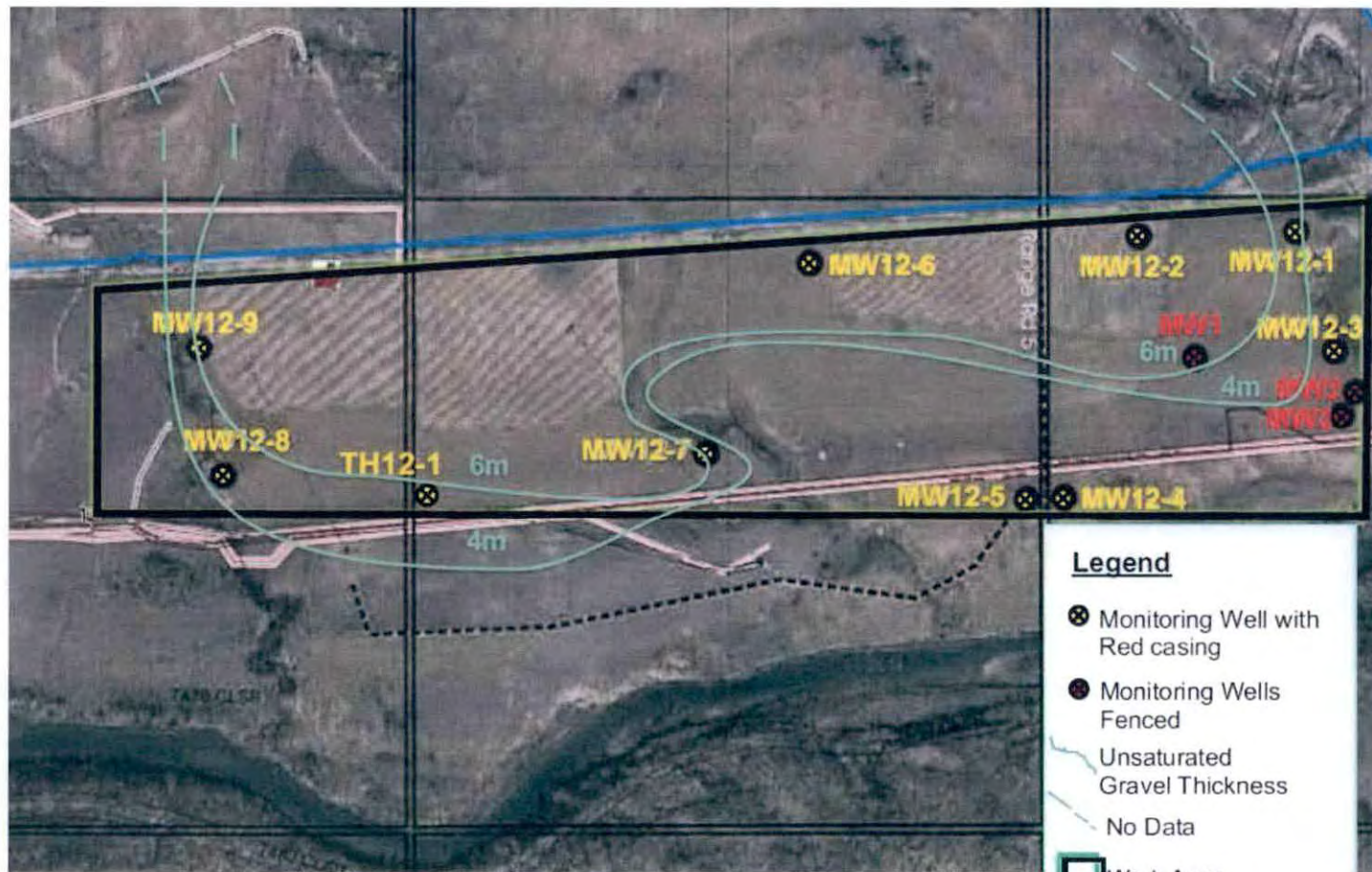
Sample Date: Mar 14, '12 **Date Tested:** Mar 20, '12 **Date Received:** Mar 14, '12



Sample Description: Sandy gravel
Remarks: Gravel = 63.7%; Sand = 27.3 %; Silt / Clay = 9%

Per: _____

APPENDIX C
ERCB and Gravel Thickness Maps



1 km = 7.8 cm

Legend

- ⊗ Monitoring Well with Red casing
- Monitoring Wells Fenced
- Unsaturated Gravel Thickness
- - - No Data
- Work Area



PROJECT: Groundwater Evaluation, Proposed BURNCO McDougall Gravel Pit
 TITLE: Unsaturated Gravel Thickness in NW-13, N-14 and NE-15-26-5 W5M
 CLIENT: BURNCO Rock Products Ltd

DRAWING NO.:

DATE:

June 2014

FILE NO.:

AB12-0253-00

SCALE:

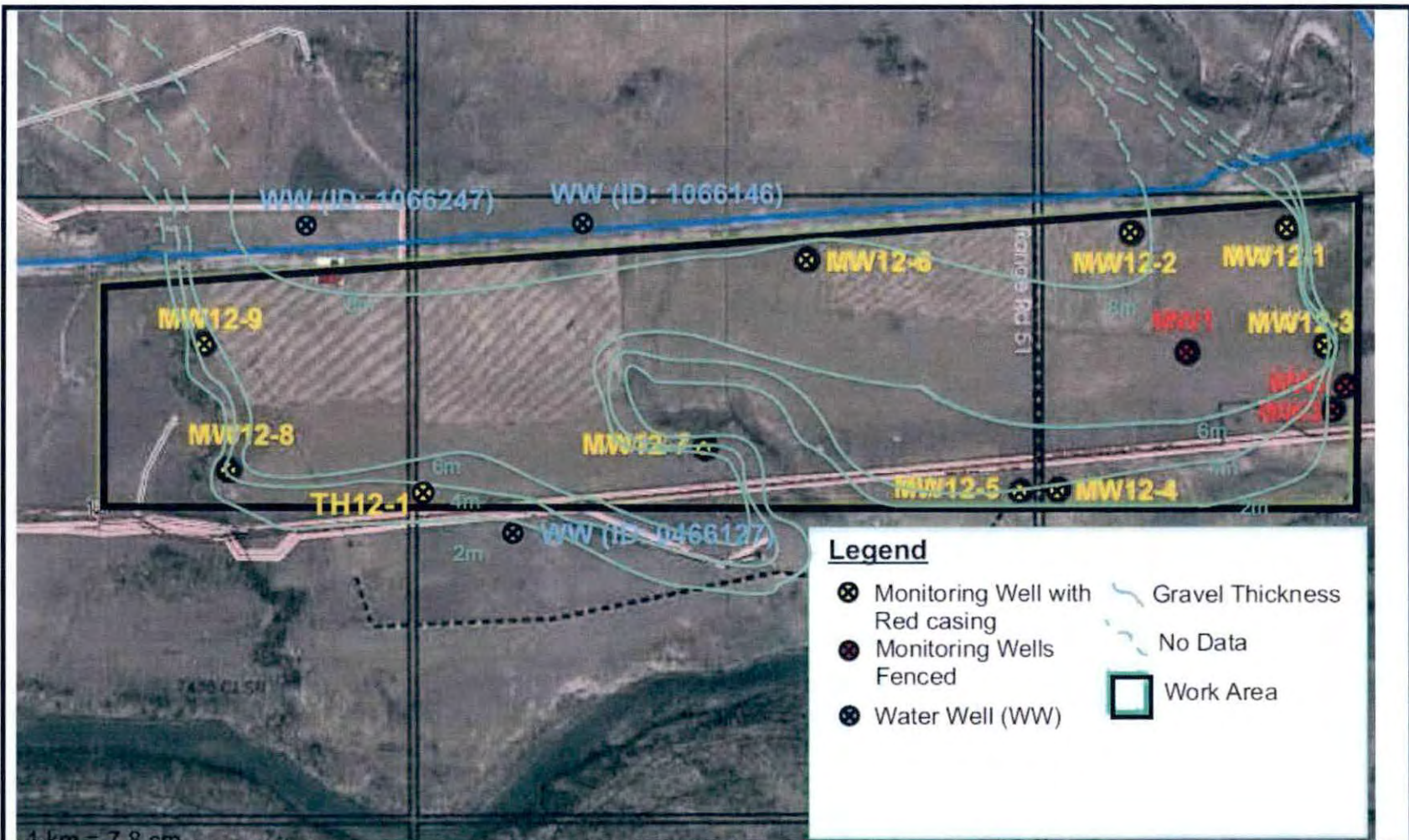
NTS

DRAWN BY:

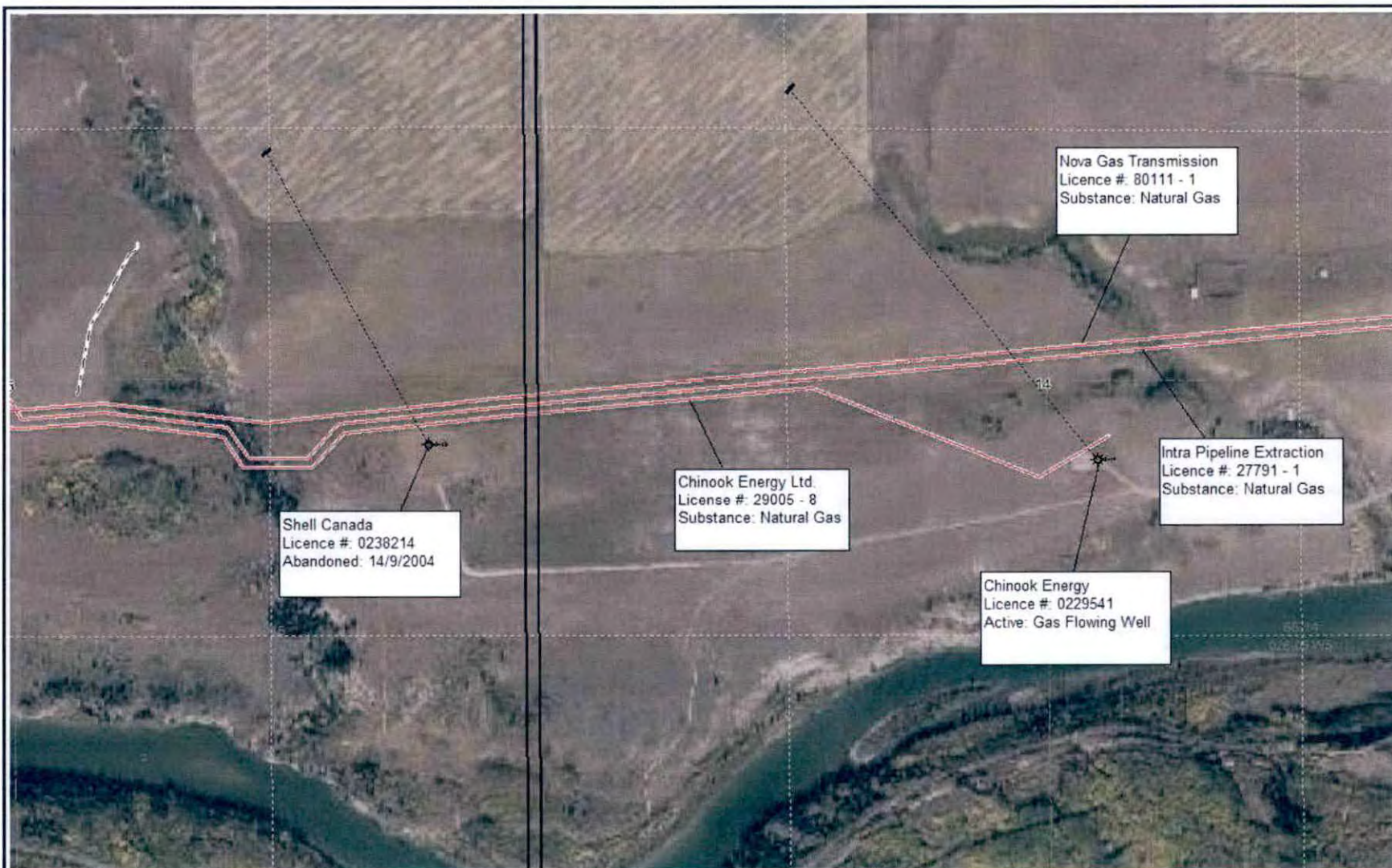
LR

REV NO.:

1



 LEVELTON	PROJECT: Groundwater Evaluation, Proposed BURNCO McDougall Gravel Pit					
	TITLE: Gravel Thickness in NW-13, N-14 and NE-15-26-5 W5M					
	CLIENT: BURNCO Rock Products Ltd					
DRAWING NO.:	DATE: June 2014	FILE NO.: AB12-0253-00	SCALE: NTS	DRAWN BY: LR	REV NO.: 1	



Levelton Consultants Ltd.
 #203, 6919 - 32 Avenue N.W.
 Calgary, AB T3B 0K6
 P: (403) 247-1813
 F: (403) 247-1814

Proposed BURNCO McDougall Gravel Pit

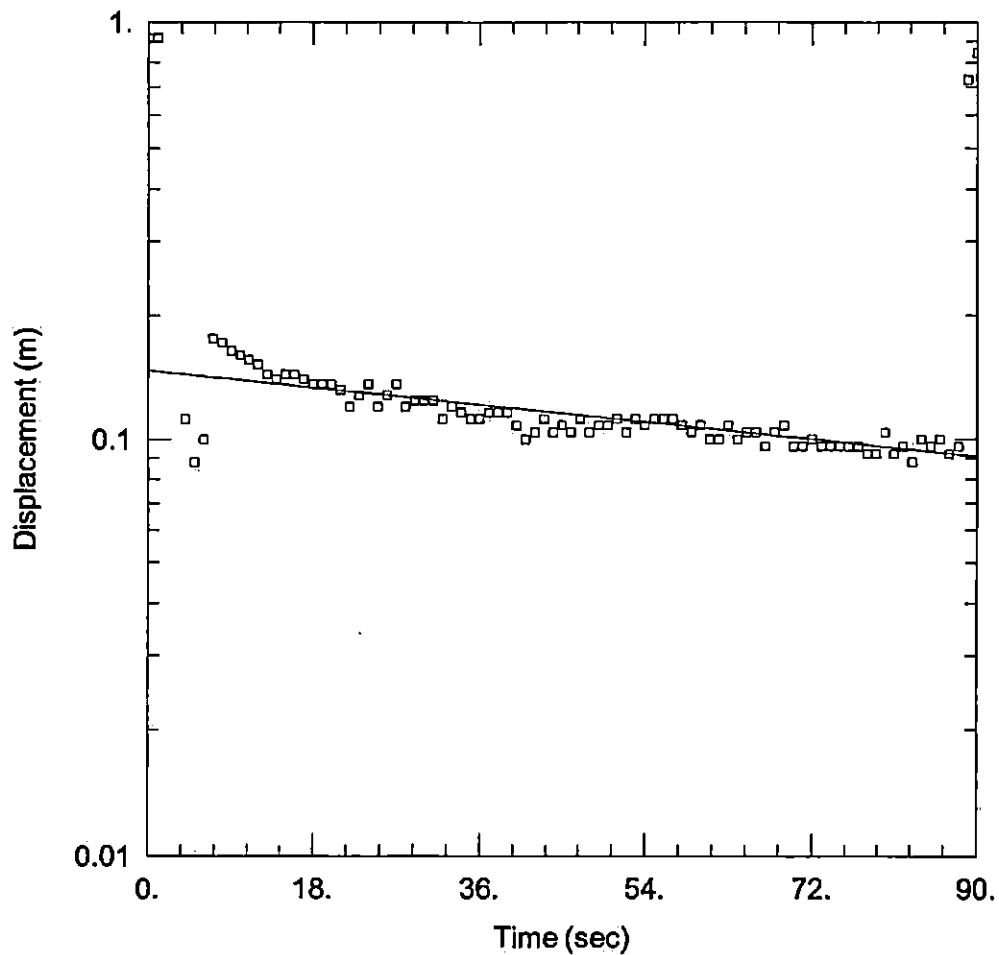
**AER Map, NE-15-26-5 W5M
 Calgary, AB**

Date: June 25, 2014

Job No. AB12-0253-00

APPENDIX D

Water Displacement with Time Graphs and Calculated Hydraulic Conductivity



WELL TEST ANALYSIS

PROJECT INFORMATION

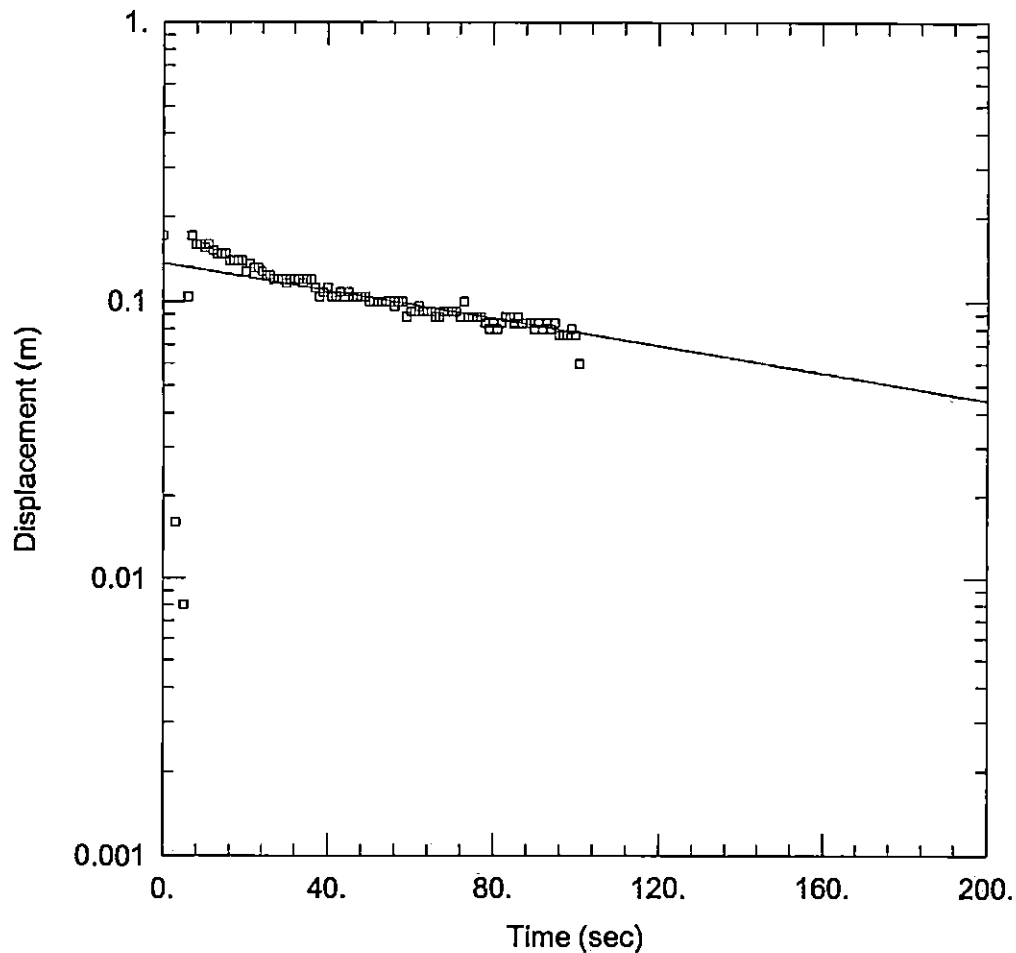
Company: Levelton Consultants Ltd.
 Client: Burnco McDougal Gravel Pit
 Project: AB12-0253-00
 Location: 15-26-5W5M
 Test Well: MW12-2
 Test Date: 3/28/12

AQUIFER DATA

Saturated Thickness: 2.14 m Anisotropy Ratio (K_z/K_r): 1.

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice
 $K = 4.787$ m/day $y_0 = 0.1471$ m



WELL TEST ANALYSIS

PROJECT INFORMATION

Company: Levelton Consultants Ltd.
 Client: Burnco McDougal Gravel Pit
 Project: AB12-0253-00
 Location: NW-14-26-5 W5M
 Test Well: MW12-9
 Test Date: 3/28/12

AQUIFER DATA

Saturated Thickness: 2.75 m

Anisotropy Ratio (K_z/K_r): 1.

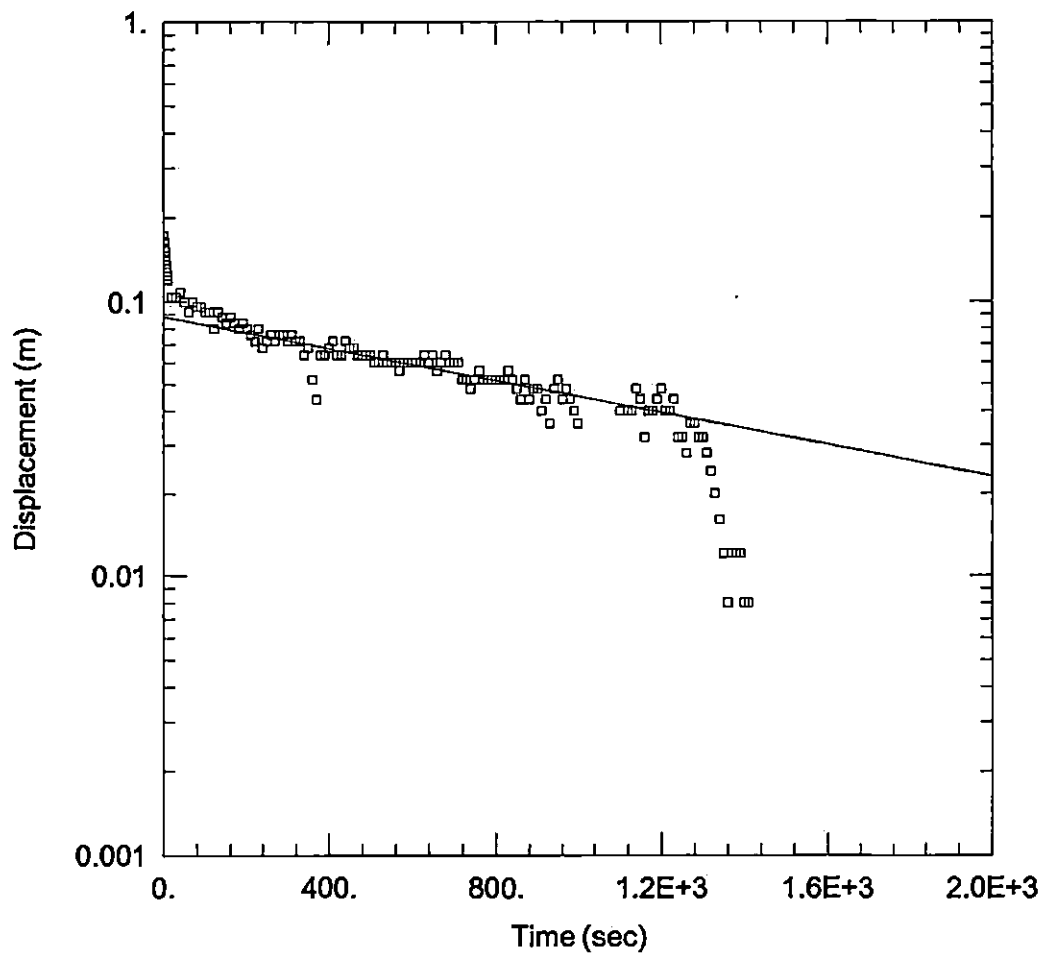
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 4.804$ m/day

$y_0 = 0.1372$ m



WELL TEST ANALYSIS

PROJECT INFORMATION

Company: Levelton Consultants Ltd.
 Client: McDougall Gravel Pit
 Project: AB12-0253-00
 Location: NW-13-26-5-W5M
 Test Well: MW12-1
 Test Date: 7/31/2012

AQUIFER DATA

Saturated Thickness: 2. m

Anisotropy Ratio (K_z/K_r): 1.

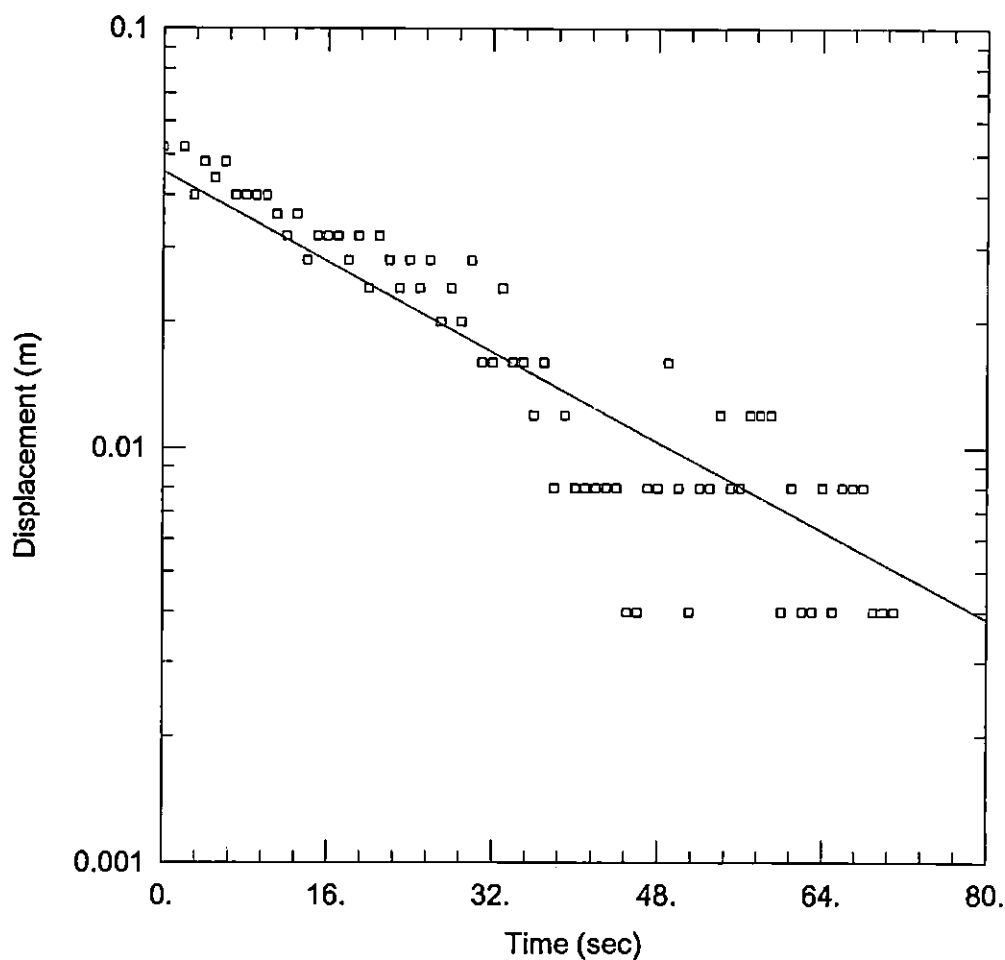
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 17.15$ m/day

$y_0 = 0.08842$ m



WELL TEST ANALYSIS

PROJECT INFORMATION

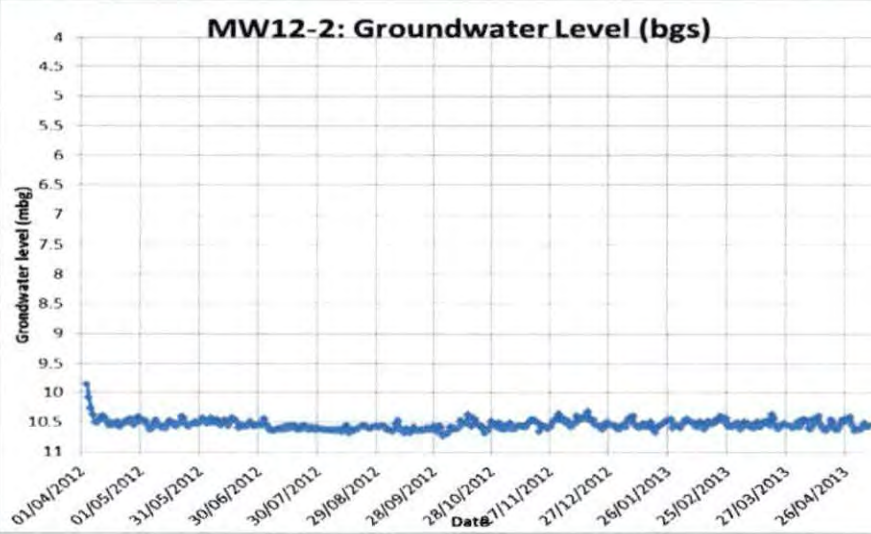
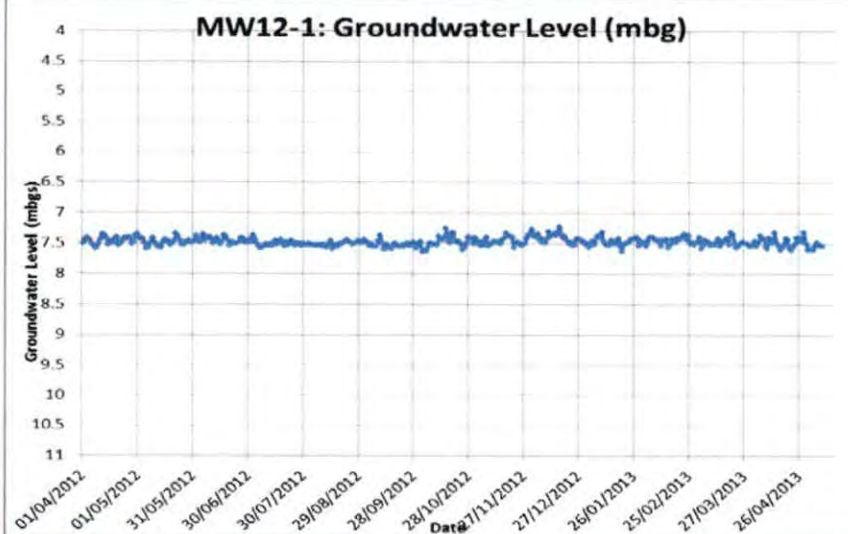
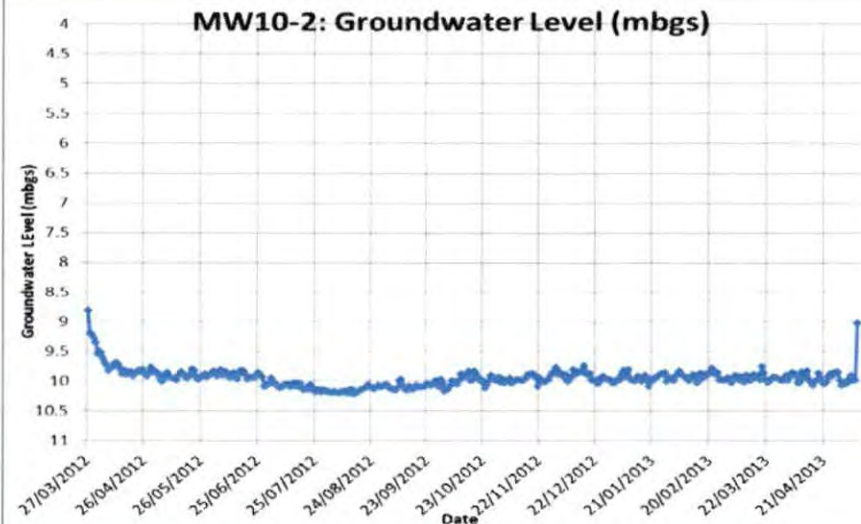
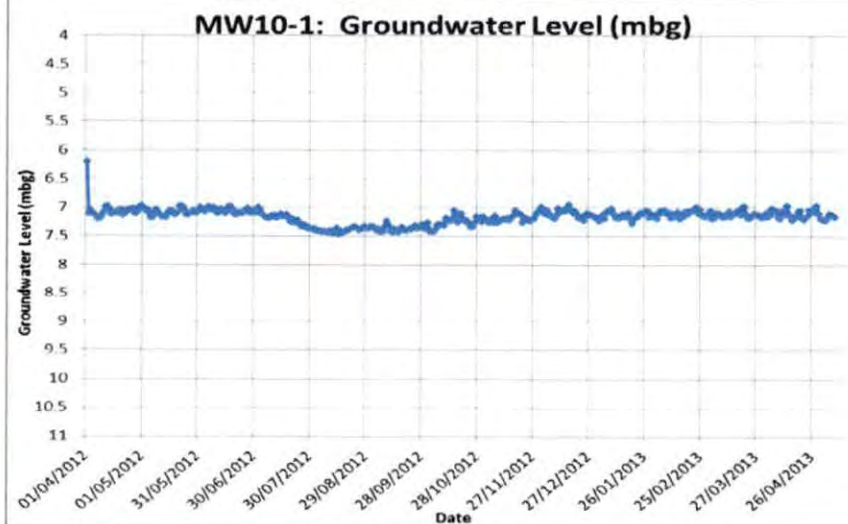
Company: Levelton Consultants Ltd.
 Client: Burnco McDougal Gravel Pit
 Project: AB12-0253-00
 Location: NW-14-26-5 W5M
 Test Well: MW12-7
 Test Date: 3/28/12

AQUIFER DATA

Saturated Thickness: 0.5 m Anisotropy Ratio (K_z/K_r): 1.

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice
 $K = 25.57$ m/day $y_0 = 0.04552$ m



PROJECT: Groundwater Evaluation, Proposed BURNCO McDougall Gravel Pit

TITLE: Groundwater levels in MW10-1, MW10-2, MW12-1 and MW12-2, April 2012 to May 2013

CLIENT: BURNCO Rock Products Ltd

DRAWING NO.:

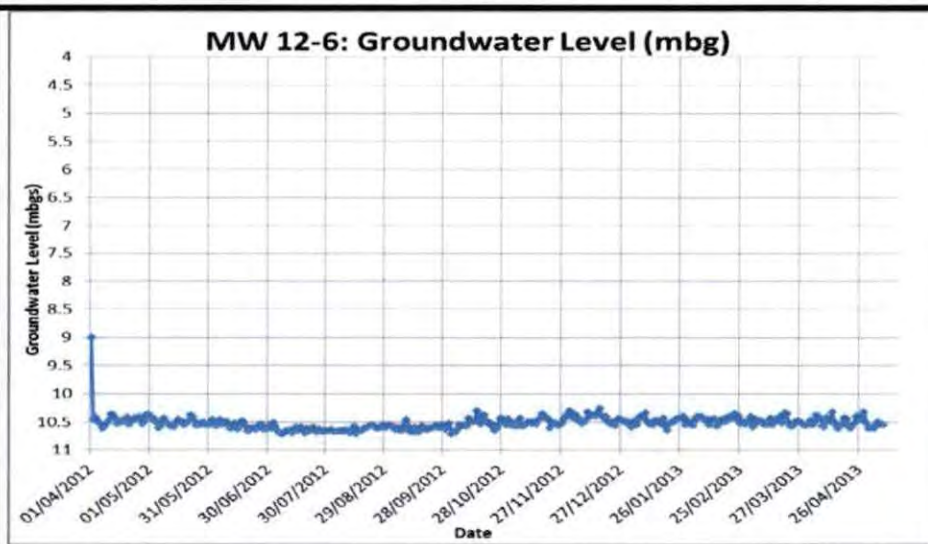
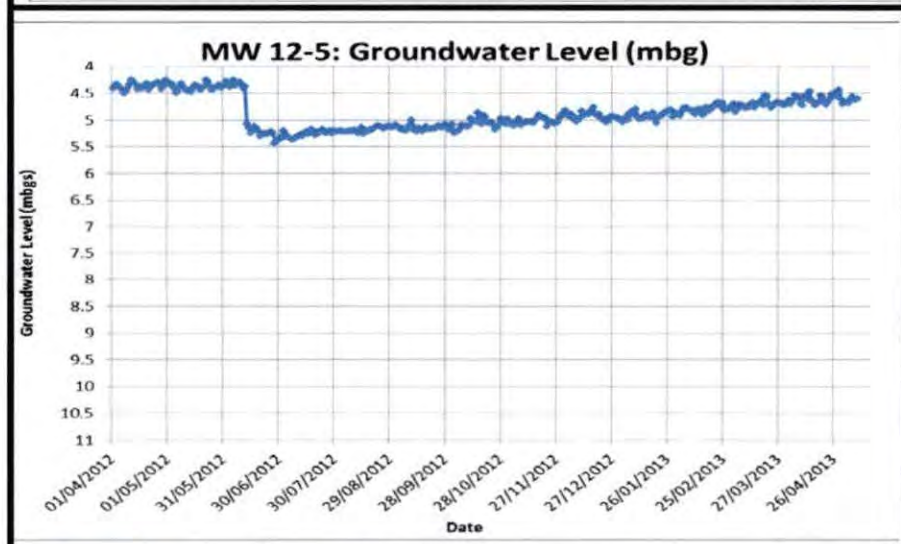
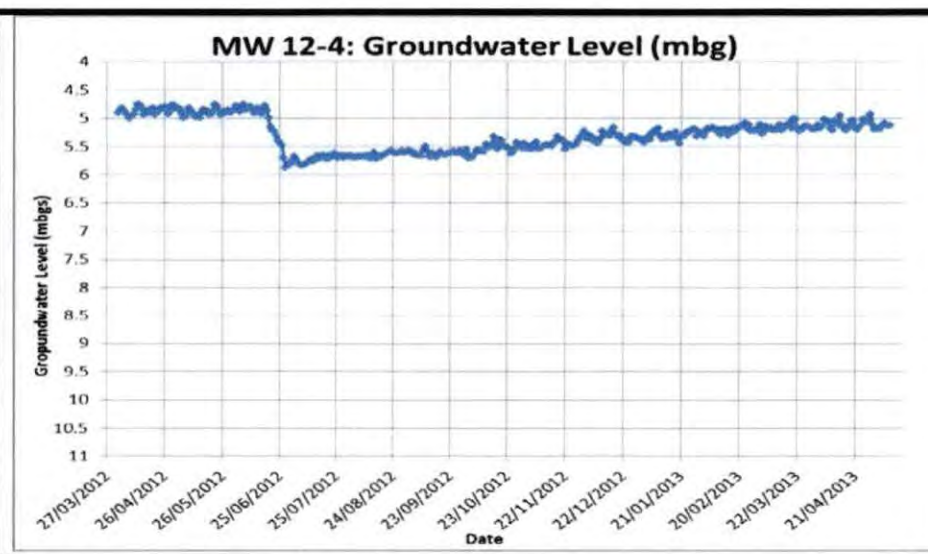
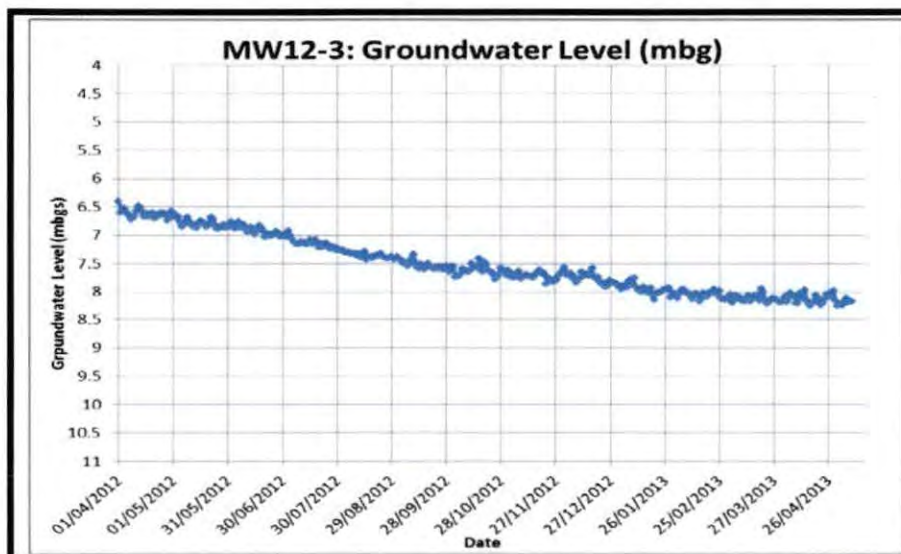
DATE: June 2013

FILE NO.: AB12-0253-00

SCALE: NTS

DRAWN BY: LR

REV NO.: 1



LEVELTON

PROJECT:

Groundwater Evaluation, Proposed BURNCO McDougall Gravel Pit

TITLE:

Groundwater levels in MW12-3, MW12-3, MW12-5 and MW12-6, April 2012 to May 2013

CLIENT:

BURNCO Rock Products Ltd

DRAWING NO.:

DATE:

June 2013

FILE NO.:

AB12-0253-00

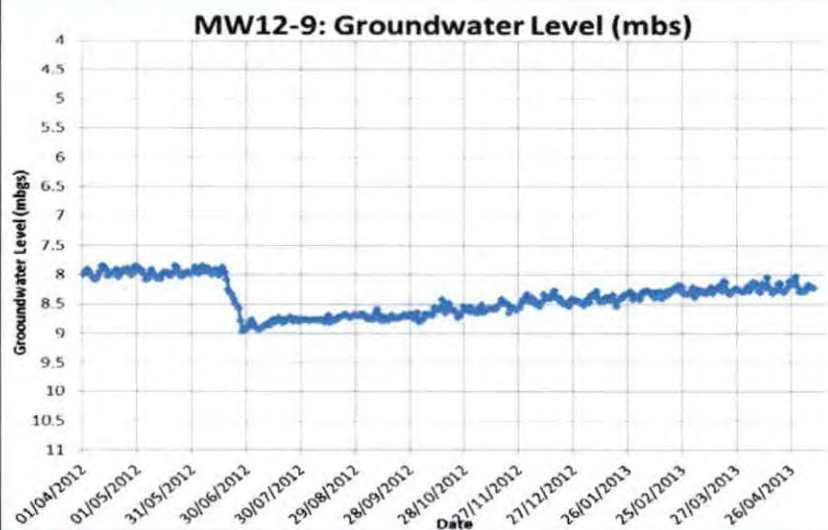
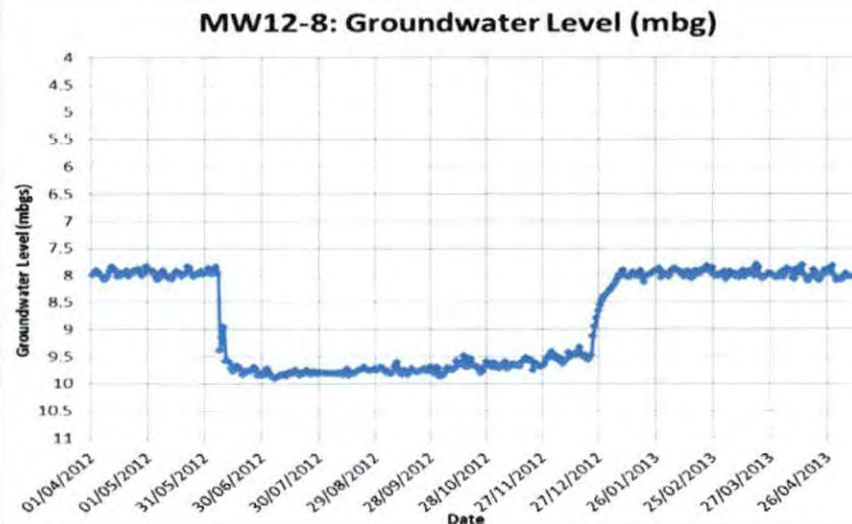
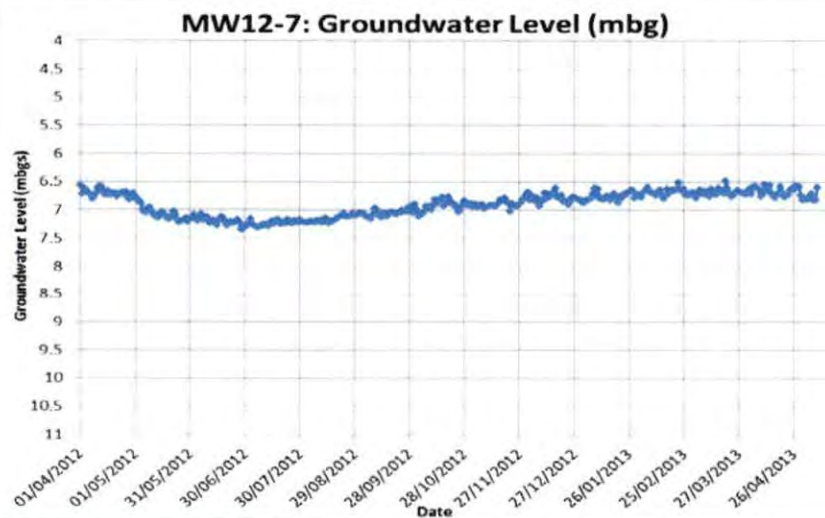
SCALE:

DRAWN BY:

LR

REV NO.:

1



PROJECT:

Groundwater Evaluation, Proposed BURNCO McDougall Gravel Pit

TITLE:

Groundwater levels in MW12-7, MW12-8 and MW12-9, April 2012 to May 2013

CLIENT:

BURNCO Rock Products Ltd

DRAWING NO.:

DATE:

June 2013

FILE NO.:

AB12-0253-00

SCALE:

DRAWN BY:

LR

REV NO.:

1

APPENDIX E
Water Chemistry Report and Piper Plot

Analytical Report

Bill To: Levelton Consultants Ltd
Report To: Levelton Consultants Ltd
6919 - 32 Avenue N. W.
Calgary, AB, Canada
T3B 0K6
Attn: Amelia Nechka
Sampled By: Amelia
Company: Levelton

Project:
ID:
Name: AB12-0253-00
Location:
LSD:
P.O.:
Acct code:

Lot ID: **862756**
Control Number: A214956
Date Received: Mar 29, 2012
Date Reported: Apr 4, 2012
Report Number: 1725574

		Reference Number	862756-1	862756-2	862756-3	
		Sample Date	Mar 28, 2012	Mar 28, 2012	Mar 28, 2012	
		Sample Time	NA	NA	NA	
		Sample Location				
		Sample Description	MW1 / 3.3°C	MW12-7 / 3.3°C	MW12-2 / 3.3°C	
		Matrix	Water	Water	Water	
Analyte		Units	Results	Results	Results	Nominal Detection Limit
Routine Water						
pH			8.08	7.88	8.08	
Temperature of observed		°C	19.6	19.4	19.3	
pH						
Electrical Conductivity		µS/cm at 25 C	679	643	764	1
Calcium	Dissolved	mg/L	46.8	61.2	39.8	0.2
Magnesium	Dissolved	mg/L	41.1	14.9	9.0	0.2
Sodium	Dissolved	mg/L	40.9	56.7	126	0.4
Potassium	Dissolved	mg/L	3.9	5.0	3.2	0.4
Iron	Dissolved	mg/L	<0.01	<0.01	<0.01	0.01
Manganese	Dissolved	mg/L	0.066	0.159	0.033	0.005
Chloride	Dissolved	mg/L	12.8	23.7	10.4	0.4
Nitrate - N		mg/L	1.22	0.81	0.33	0.01
Nitrite - N		mg/L	<0.005	<0.005	0.045	0.005
Nitrate and Nitrite - N		mg/L	1.22	0.81	0.37	0.01
Sulfate (SO4)	Dissolved	mg/L	59.5	85.6	89.4	0.9
Hydroxide		mg/L	<5	<5	<5	5
Carbonate		mg/L	<6	<6	<6	6
Bicarbonate		mg/L	372	271	393	5
P-Alkalinity	as CaCO3	mg/L	<5	<5	<5	5
T-Alkalinity	as CaCO3	mg/L	305	222	322	5
Total Dissolved Solids	Calculated	mg/L	388	380	471	1
Hardness	Dissolved as CaCO3	mg/L	286	214	140	
Ionic Balance	Dissolved	%	98	99	96	

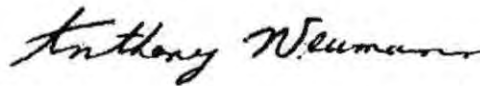
Analytical Report

Bill To: Levelton Consultants Ltd
Report To: Levelton Consultants Ltd
6919 - 32 Avenue N. W.
Calgary, AB, Canada
T3B 0K6
Attn: Amelia Nechka
Sampled By: Amelia
Company: Levelton

Project:
ID:
Name: AB12-0253-00
Location:
LSD:
P.O.:
Acct code:

Lot ID: **862756**
Control Number: A214956
Date Received: Mar 29, 2012
Date Reported: Apr 4, 2012
Report Number: 1725574

		Reference Number	862756-4	862756-5	
		Sample Date	Mar 28, 2012	Mar 28, 2012	
		Sample Time	NA	NA	
		Sample Location			
		Sample Description	MW12-3 / 3.3°C	MW2 / 3.3°C	
		Matrix	Water	Water	
Analyte		Units	Results	Results	Nominal Detection Limit
Routine Water					
pH			7.95	7.96	
Temperature of observed pH		°C	19.2	19.2	
Electrical Conductivity		µS/cm at 25 C	926	922	1
Calcium	Dissolved	mg/L	91.2	92.5	0.2
Magnesium	Dissolved	mg/L	49.1	49.4	0.2
Sodium	Dissolved	mg/L	30.3	31.2	0.4
Potassium	Dissolved	mg/L	4.0	4.1	0.4
Iron	Dissolved	mg/L	<0.01	<0.01	0.01
Manganese	Dissolved	mg/L	0.219	0.319	0.005
Chloride	Dissolved	mg/L	59.4	60.6	0.4
Nitrate - N		mg/L	0.02	0.01	0.01
Nitrite - N		mg/L	<0.005	<0.005	0.005
Nitrate and Nitrite - N		mg/L	0.02	0.01	0.01
Sulfate (SO4)	Dissolved	mg/L	196	193	0.9
Hydroxide		mg/L	<5	<5	5
Carbonate		mg/L	<6	<6	6
Bicarbonate		mg/L	281	280	5
P-Alkalinity	as CaCO3	mg/L	<5	<5	5
T-Alkalinity	as CaCO3	mg/L	230	230	5
Total Dissolved Solids	Calculated	mg/L	568	568	1
Hardness	Dissolved as CaCO3	mg/L	430	434	
Ionic Balance	Dissolved	%	97	98	

Approved by: 
Anthony Neumann, MSc
Laboratory Operations Manager



Methodology and Notes

Bill To: Levelton Consultants Ltd	Project:	Lot ID: 862756
Report To: Levelton Consultants Ltd	ID:	Control Number: A214956
6919 - 32 Avenue N. W.	Name: AB12-0253-00	Date Received: Mar 29, 2012
Calgary, AB, Canada	Location:	Date Reported: Apr 4, 2012
T3B 0K6	LSD:	Report Number: 1725574
Attn: Amelia Nechka	P.O.:	
Sampled By: Amelia	Acct code:	
Company: Levelton		

Method of Analysis

Method Name	Reference	Method	Date Analysis Started	Location
Alkalinity, pH, and EC in water	APHA	* Alkalinity - Titration Method, 2320 B	02-Apr-12	Exova Edmonton
Alkalinity, pH, and EC in water	APHA	* Conductivity, 2510 B	02-Apr-12	Exova Edmonton
Alkalinity, pH, and EC in water	APHA	* pH - Electrometric Method, 4500-H+ B	02-Apr-12	Exova Edmonton
Anions (Routine) by Ion Chromatography	APHA	* Ion Chromatography with Chemical Suppression of Eluent Cond., 4110 B	02-Apr-12	Exova Edmonton
Approval-Edmonton	APHA	Checking Correctness of Analyses, 1030 E	02-Apr-12	Exova Edmonton
Chloride in Water	APHA	* Automated Ferricyanide Method, 4500-Cl- E	02-Apr-12	Exova Edmonton
Metals Trace (Dissolved) in water	APHA	Hardness by Calculation, 2340 B	02-Apr-12	Exova Edmonton
Metals Trace (Dissolved) in water	APHA	* Inductively Coupled Plasma (ICP) Method, 3120 B	02-Apr-12	Exova Edmonton

* Reference Method Modified

References

APHA Standard Methods for the Examination of Water and Wastewater

Comments:

Please direct any inquiries regarding this report to our Client Services group.

Results relate only to samples as submitted.

The test report shall not be reproduced except in full, without the written approval of the laboratory.

[illegible]

COC



Environmental Sample Information Sheet

Note: Proper completion of this form is required in order to proceed with analysis.
See reverse for your nearest Exova location and proper sampling protocol.

Billing Address:		Copy of Report:		Copy of Report To:		Copy of Invoice:	
Company: Levelton Consultants Ltd. Address: 203.6919-32 Ave NW Calgary, AB T3B0K6 Attention: Amelia Nechka Phone: 403-247-1813 Fax: Cell: e-mail: anechka@levelton.com		QA/QC Report ☐ Report Result: e-mail ☒ Results Online ☐ Fax ☐ Mail ☐		Company: Address: Attention: Phone: Fax: Cell: e-mail:		Send invoice to this address for approval ☐ Report Result: e-mail ☐ Results Online ☐ Fax ☐ Mail ☐	

Sampled by: <i>Ameli</i>	
Company: <i>Lev Elton</i>	Signature: <i>AN</i>
I authorize Exova to proceed with the work indicated on this form:	
Date: <i>Mar 29, 12</i>	Initial: <i>AN</i>
Received by: <i>RM</i>	Sample Temp. <i>33C</i>
Waybill #:	Date
Company	Time

Please indicate which regulations you are required to meet:

☐	Health Canada Drinking Water Quality
☐	Alberta Tier 1
☐	Other: _____

Number of Containers

Routine

[illegible]

NOTE: All hazardous samples must be labeled according to WHMIS guidelines.

Page 1 of 1

ED 077-09

Analytical Report

Bill To: Levelton Consultants Ltd
Report To: Levelton Consultants Ltd
6919 - 32 Avenue N. W.
Calgary, AB, Canada
T3B 0K6
Attn: Amelia Nechka
Sampled By: Amelia
Company: Levelton

Project:
ID: AB12-0253-00
Name:
Location:
LSD:
P.O.:
Acct code:

Lot ID: **863229**
Control Number: A215266
Date Received: Apr 3, 2012
Date Reported: Apr 10, 2012
Report Number: 1726525

		Reference Number	863229-1	863229-2	Nominal Detection Limit
		Sample Date	Apr 02, 2012	Apr 02, 2012	
		Sample Time	NA	NA	
		Sample Location			
		Sample Description	MW12-6 / -0.1°C	MW12-9 / -0.1°C	
		Matrix	Water	Water	
Analyte	Units	Results	Results	Results	
Physical and Aggregate Properties					
Colour	Apparent, Potable	Colour units	>60	>60	5
Turbidity		NTU	9740	545	0.1
Routine Water					
pH			7.82	7.97	
Temperature of observed pH		°C	19.7	19.6	
Electrical Conductivity		µS/cm at 25 C	714	573	1
Calcium	Extractable	mg/L	280	86.0	0.2
Magnesium	Extractable	mg/L	53.0	20.9	0.2
Sodium	Extractable	mg/L	31.0	25.4	0.4
Potassium	Extractable	mg/L	4.4	3.4	0.4
Iron	Extractable	mg/L	0.79	0.50	0.01
Manganese	Extractable	mg/L	0.349	0.361	0.005
Chloride	Dissolved	mg/L	27.0	8.3	0.4
Fluoride		mg/L	0.16	0.22	0.05
Nitrate - N		mg/L	0.66	0.17	0.01
Nitrite - N		mg/L	<0.005	0.024	0.005
Nitrate and Nitrite - N		mg/L	0.66	0.19	0.01
Sulfate (SO ₄)		mg/L	44.0	57.8	0.9
Hydroxide		mg/L	<5	<5	5
Carbonate		mg/L	<6	<6	6
Bicarbonate		mg/L	410	310	5
P-Alkalinity	as CaCO ₃	mg/L	<5	<5	5
T-Alkalinity	as CaCO ₃	mg/L	336	255	5
Total Dissolved Solids		mg/L	641	355	1
Hardness	as CaCO ₃	mg/L	917	301	
Ionic Balance		%	235	110	

Approved by: 
Randy Neumann, BSc
General Manager

Methodology and Notes

Bill To: Levelton Consultants Ltd	Project:	Lot ID: 863229
Report To: Levelton Consultants Ltd	ID: AB12-0253-00	Control Number: A215266
6919 - 32 Avenue N. W.	Name:	Date Received: Apr 3, 2012
Calgary, AB, Canada	Location:	Date Reported: Apr 10, 2012
T3B 0K6	LSD:	Report Number: 1726525
Attn: Amelia Nechka	P.O.:	
Sampled By: Amelia	Acct code:	
Company: Levelton		

Method of Analysis

Method Name	Reference	Method	Date Analysis Started	Location
Alkalinity, pH, and EC in water	APHA	* Alkalinity - Titration Method, 2320 B	04-Apr-12	Exova Edmonton
Alkalinity, pH, and EC in water	APHA	* Conductivity, 2510 B	04-Apr-12	Exova Edmonton
Alkalinity, pH, and EC in water	APHA	* pH - Electrometric Method, 4500-H+ B	04-Apr-12	Exova Edmonton
Anions (Routine) by Ion Chromatography	APHA	* Ion Chromatography with Chemical Suppression of Eluent Cond., 4110 B	04-Apr-12	Exova Edmonton
Approval-Edmonton	APHA	Checking Correctness of Analyses, 1030 E	04-Apr-12	Exova Edmonton
Chloride in Water	APHA	* Automated Ferricyanide Method, 4500-Cl- E	04-Apr-12	Exova Edmonton
Colour (Apparent) in water	APHA	* Visual Comparison Method, 2120 B	04-Apr-12	Exova Edmonton
Metals Trace (Extractable) in water	APHA	Hardness by Calculation, 2340 B	04-Apr-12	Exova Edmonton
Metals Trace (Extractable) in water	APHA	* Inductively Coupled Plasma (ICP) Method, 3120 B	04-Apr-12	Exova Edmonton
Turbidity in Water	APHA	* Turbidity - Nephelometric Method, 2130 B	04-Apr-12	Exova Edmonton

* Reference Method Modified

References

APHA Standard Methods for the Examination of Water and Wastewater

Comments:

- The ion balance was outside the range 90 - 110% for sample 863229-1. This may be due to calcium and magnesium extracted from sediment present in the sample.

Please direct any inquiries regarding this report to our Client Services group.

Results relate only to samples as submitted.

The test report shall not be reproduced except in full, without the written approval of the laboratory.

(b) (7)(C),
(b) (7)(D),
(b) (7)(F),
(b) (7)(G)

COC



37

NOTE: Proper completion of this form is required in order to proceed with analysis
See reverse for your nearest Exova location and proper sampling protocol

www.exova.com

Billing Address:		Copy of Report:		Copy of Report To:		Copy of Invoice:	
Company: Levelton Consultants		QA/QC Report ☐		Company:		Send Invoice to this	
Address: 20316919-32 Ave NW				Address:		address for approval ☐	
Calgary, AB T3B0K6							
Attention: Amelia Nechka		Report Result:		Attention:		Report Result:	
Phone: 403 247-1813		e-mail ☒		Phone:		e-mail ☐	
Fax: 403 247-1813		Results Online ☐		Fax:		Results Online ☐	
Cell:		Fax ☐		Cell:		Fax ☐	
e-mail: a.nechka@levelton.com		Mail ☐		e-mail:		Mail ☐	

Information to be included on Report and Invoice	PRIORITY Please contact laboratory prior to submitting any RUSH samples. Upon filling out this section, client accepts that surcharges will be applied to this analysis. If not all samples require RUSH, please indicate in special instructions.	Sample Custody (Please Print) Sampled by: <u>Amelia</u> Company <u>hewlett</u> Signature <u>Amelia</u>
Project ID: <u>V-1316-0253-00</u> Project Name: Project Location: Legal Location: PO#: Proj. Acct. Code: Agreement ID:	Date Required: _____ Signature: _____	I authorize Exova to proceed with the work indicated on this form: Date: <u>Apr 2.12</u> Initial: <u>Am</u> Received by: <u>[Signature]</u> Sample Temp. <u>0.1K</u> Waybill #: _____ Date <u>APR 3'12 8:16</u> Company _____ Time _____

[illegible]

NOTE: All hazardous samples must be labeled according to WHMIS guidelines.

Page. 1 of 1

Analytical Report

Bill To: Levelton Consultants Ltd
Report To: Levelton Consultants Ltd
203, 6919 - 32 Avenue N. W.
Calgary, AB, Canada
T3B 0K6
Attn: Kent Reed
Sampled By:
Company: Levelton

Project:
ID: AB12-0253-02
Name: McDougal Gravel Pit
Location:
LSD:
P.O.:
Acct code:

Lot ID: **935496**
Control Number: A216054
Date Received: May 15, 2013
Date Reported: May 22, 2013
Report Number: 1826801

		Reference Number	935496-1	935496-2	935496-3	
		Sample Date				
		Sample Time				
		Sample Location				
		Sample Description	Bo Spree #1 / 5.4C	BO Spree #2 / 5.4C	Bedrock Spring #2 / 5.4C	
		Matrix	Water	Water	Water	
Analyte		Units	Results	Results	Results	Nominal Detection Limit
Routine Water						
pH			8.19	8.18	8.08	
Temperature of observed		°C	22.3	22.5	22.5	
pH						
Electrical Conductivity		µS/cm at 25 C	843	784	739	1
Calcium	Dissolved	mg/L	71.6	71.7	79.7	0.2
Magnesium	Dissolved	mg/L	54.3	46.1	36.7	0.2
Sodium	Dissolved	mg/L	37.5	32.3	31.8	0.4
Potassium	Dissolved	mg/L	2.3	2.3	3.5	0.4
Iron	Dissolved	mg/L	<0.01	<0.01	<0.01	0.01
Manganese	Dissolved	mg/L	<0.005	<0.005	<0.005	0.005
Chloride	Dissolved	mg/L	38.8	28.6	21.5	0.4
Nitrate - N		mg/L	2.94	2.09	1.11	0.01
Nitrite - N		mg/L	<0.005	<0.005	<0.005	0.005
Nitrate and Nitrite - N		mg/L	2.94	2.09	1.11	0.01
Sulfate (SO ₄)	Dissolved	mg/L	63.1	60.2	57.2	0.9
Hydroxide		mg/L	<5	<5	<5	5
Carbonate		mg/L	<6	<6	<6	6
Bicarbonate		mg/L	475	459	445	5
P-Alkalinity	as CaCO ₃	mg/L	<5	<5	<5	5
T-Alkalinity	as CaCO ₃	mg/L	390	376	365	5
Total Dissolved Solids	Calculated	mg/L	501	467	449	1
Hardness	Dissolved as CaCO ₃	mg/L	402	369	350	
Ionic Balance	Dissolved	%	94	91	92	

Analytical Report

Bill To: Levelton Consultants Ltd
Report To: Levelton Consultants Ltd
203, 6919 - 32 Avenue N. W.
Calgary, AB, Canada
T3B 0K6
Attn: Kent Reed
Sampled By:
Company: Levelton

Project:
ID: AB12-0253-02
Name: McDougal Gravel Pit
Location:
LSD:
P.O.:
Acct code:

Lot ID: **935496**
Control Number: A216054
Date Received: May 15, 2013
Date Reported: May 22, 2013
Report Number: 1826801

		Reference Number	935496-4	935496-5	935496-6	
		Sample Date				
		Sample Time				
		Sample Location				
		Sample Description	Mud Spring #1 (1) / 5.4C Water	Mud Spring #1 (2) / 5.4C Water	East Spring / 5.4C Water	
		Matrix				
Analyte		Units	Results	Results	Results	Nominal Detection Limit
Routine Water						
pH			8.13	8.14	8.23	
Temperature of observed		°C	22.5	22.5	22.6	
pH						
Electrical Conductivity		µS/cm at 25 C	718	715	909	1
Calcium	Dissolved	mg/L	74.9	76.3	66.5	0.2
Magnesium	Dissolved	mg/L	35.6	36.2	58.8	0.2
Sodium	Dissolved	mg/L	30.6	30.9	49.5	0.4
Potassium	Dissolved	mg/L	3.3	3.4	2.7	0.4
Iron	Dissolved	mg/L	<0.01	<0.01	<0.01	0.01
Manganese	Dissolved	mg/L	<0.005	<0.005	<0.005	0.005
Chloride	Dissolved	mg/L	21.2	21.1	34.7	0.4
Nitrate - N		mg/L	2.92	2.90	7.20	0.01
Nitrite - N		mg/L	<0.005	<0.005	<0.005	0.005
Nitrate and Nitrite - N		mg/L	2.92	2.90	7.20	0.01
Sulfate (SO4)	Dissolved	mg/L	54.2	53.2	77.7	0.9
Hydroxide		mg/L	<5	<5	<5	5
Carbonate		mg/L	<6	<6	<6	6
Bicarbonate		mg/L	425	422	496	5
P-Alkalinity	as CaCO3	mg/L	<5	<5	<5	5
T-Alkalinity	as CaCO3	mg/L	348	346	407	5
Total Dissolved Solids	Calculated	mg/L	429	429	534	1
Hardness	Dissolved as CaCO3	mg/L	333	340	408	
Ionic Balance	Dissolved	%	91	93	92	

Analytical Report

Bill To: Levelton Consultants Ltd
Report To: Levelton Consultants Ltd
203, 6919 - 32 Avenue N. W.
Calgary, AB, Canada
T3B 0K6
Attn: Kent Reed
Sampled By:
Company: Levelton

Project:
ID: AB12-0253-02
Name: McDougal Gravel Pit
Location:
LSD:
P.O.:
Acct code:

Lot ID: **935496**
Control Number: A216054
Date Received: May 15, 2013
Date Reported: May 22, 2013
Report Number: 1826801

		Reference Number	935496-7	935496-8	935496-9	
		Sample Date				
		Sample Time				
		Sample Location				
		Sample Description	MW12-6 #1 / 5.4C	MW12-6 #2 / 5.4C	Bedrock Spring #1 / 5.4C	
		Matrix	Water	Water	Water	
Analyte		Units	Results	Results	Results	Nominal Detection Limit
Routine Water						
pH			8.10	8.08	8.10	
Temperature of observed pH		°C	22.7	22.9	22.9	
Electrical Conductivity		µS/cm at 25 C	691	703	753	1
Calcium	Dissolved	mg/L	60.3	59.7	82.8	0.2
Magnesium	Dissolved	mg/L	41.0	42.3	36.5	0.2
Sodium	Dissolved	mg/L	33.3	32.9	31.4	0.4
Potassium	Dissolved	mg/L	2.6	2.5	3.8	0.4
Iron	Dissolved	mg/L	<0.01	<0.01	<0.01	0.01
Manganese	Dissolved	mg/L	0.035	0.013	<0.005	0.005
Chloride	Dissolved	mg/L	17.5	17.7	21.4	0.4
Nitrate - N		mg/L	0.68	0.72	1.12	0.01
Nitrite - N		mg/L	<0.005	<0.005	<0.005	0.005
Nitrate and Nitrite - N		mg/L	0.68	0.72	1.12	0.01
Sulfate (SO4)	Dissolved	mg/L	36.8	36.8	56.9	0.9
Hydroxide		mg/L	<5	<5	<5	5
Carbonate		mg/L	<6	<6	<6	6
Bicarbonate		mg/L	457	435	438	5
P-Alkalinity	as CaCO3	mg/L	<5	<5	<5	5
T-Alkalinity	as CaCO3	mg/L	375	356	359	5
Total Dissolved Solids	Calculated	mg/L	416	406	448	1
Hardness	Dissolved as CaCO3	mg/L	319	323	357	
Ionic Balance	Dissolved	%	90	94	95	

Analytical Report

Bill To: Levelton Consultants Ltd
Report To: Levelton Consultants Ltd
203, 6919 - 32 Avenue N. W.
Calgary, AB, Canada
T3B 0K6
Attn: Kent Reed
Sampled By:
Company: Levelton

Project:
ID: AB12-0253-02
Name: McDougal Gravel Pit
Location:
LSD:
P.O.:
Acct code:

Lot ID: **935496**
Control Number: A216054
Date Received: May 15, 2013
Date Reported: May 22, 2013
Report Number: 1826801

		Reference Number	935496-10	935496-11	935496-12	
		Sample Date				
		Sample Time				
		Sample Location				
		Sample Description	MW 12-9 #1 / 5.4C	MW 12-9 #2 / 5.4C	MW 12-2 #1 / 5.4C	
		Matrix	Water	Water	Water	
Analyte		Units	Results	Results	Results	Nominal Detection Limit
Routine Water						
pH			8.16	8.18	8.29	
Temperature of observed		°C	22.8	22.8	22.8	
pH						
Electrical Conductivity		µS/cm at 25 C	543	544	757	1
Calcium	Dissolved	mg/L	60.7	59.8	28.7	0.2
Magnesium	Dissolved	mg/L	24.0	23.6	11.8	0.2
Sodium	Dissolved	mg/L	25.3	25.7	138	0.4
Potassium	Dissolved	mg/L	3.1	3.2	2.9	0.4
Iron	Dissolved	mg/L	<0.01	<0.01	<0.01	0.01
Manganese	Dissolved	mg/L	0.194	0.096	0.077	0.005
Chloride	Dissolved	mg/L	6.1	6.7	5.6	0.4
Nitrate - N		mg/L	0.02	0.03	0.02	0.01
Nitrite - N		mg/L	<0.005	<0.005	0.005	0.005
Nitrate and Nitrite - N		mg/L	0.02	0.03	0.03	0.01
Sulfate (SO ₄)	Dissolved	mg/L	39.2	40.5	61.6	0.9
Hydroxide		mg/L	<5	<5	<5	5
Carbonate		mg/L	<6	<6	<6	6
Bicarbonate		mg/L	337	344	471	5
P-Alkalinity	as CaCO ₃	mg/L	<5	<5	<5	5
T-Alkalinity	as CaCO ₃	mg/L	277	282	386	5
Total Dissolved Solids	Calculated	mg/L	324	329	480	1
Hardness	Dissolved as CaCO ₃	mg/L	250	246	120	
Ionic Balance	Dissolved	%	95	92	92	

Analytical Report

Bill To: Levelton Consultants Ltd
Report To: Levelton Consultants Ltd
203, 6919 - 32 Avenue N. W.
Calgary, AB, Canada
T3B 0K6
Attn: Kent Reed
Sampled By:
Company: Levelton

Project:
ID: AB12-0253-02
Name: McDougal Gravel Pit
Location:
LSD:
P.O.:
Acct code:

Lot ID: **935496**
Control Number: A216054
Date Received: May 15, 2013
Date Reported: May 22, 2013
Report Number: 1826801

		Reference Number	935496-13	935496-14	
		Sample Date			
		Sample Time			
		Sample Location			
		Sample Description	MW 12-2 #2 / 5.4C	MW 12-2 #3 / 5.4C	
		Matrix	Water	Water	
Analyte		Units	Results	Results	Nominal Defection Limit
Routine Water					
pH			8.29	8.31	
Temperature of observed pH		°C	22.8	22.8	
Electrical Conductivity		µS/cm at 25 C	753	756	1
Calcium	Dissolved	mg/L	27.8	27.6	0.2
Magnesium	Dissolved	mg/L	11.6	11.4	0.2
Sodium	Dissolved	mg/L	134	140	0.4
Potassium	Dissolved	mg/L	2.8	2.8	0.4
Iron	Dissolved	mg/L	<0.01	<0.01	0.01
Manganese	Dissolved	mg/L	0.083	0.069	0.005
Chloride	Dissolved	mg/L	5.3	5.2	0.4
Nitrate - N		mg/L	0.02	0.05	0.01
Nitrite - N		mg/L	<0.005	<0.005	0.005
Nitrate and Nitrite - N		mg/L	0.02	0.05	0.01
Sulfate (SO4)	Dissolved	mg/L	64.3	61.8	0.9
Hydroxide		mg/L	<5	<5	5
Carbonate		mg/L	<6	<6	6
Bicarbonate		mg/L	470	470	5
P-Alkalinity	as CaCO3	mg/L	<5	<5	5
T-Alkalinity	as CaCO3	mg/L	385	386	5
Total Dissolved Solids	Calculated	mg/L	477	480	1
Hardness	Dissolved as CaCO3	mg/L	117	116	
Ionic Balance	Dissolved	%	90	93	

Approved by: 
Randy Neumann, BSc
General Manager

Methodology and Notes

Bill To:	Levelton Consultants Ltd	Project:		Lot ID:	935496
Report To:	Levelton Consultants Ltd	ID:	AB12-0253-02	Control Number:	A216054
	203, 6919 - 32 Avenue N. W.	Name:	McDougal Gravel Pit	Date Received:	May 15, 2013
	Calgary, AB, Canada	Location:		Date Reported:	May 22, 2013
	T3B 0K6	LSD:		Report Number:	1826801
Attn:	Kent Reed	P.O.:			
Sampled By:		Acct code:			
Company:	Levelton				

Method of Analysis

Method Name	Reference	Method	Date Analysis Started	Location
Alkalinity, pH, and EC in water	APHA	* Alkalinity - Titration Method, 2320 B	17-May-13	Exova Edmonton
Alkalinity, pH, and EC in water	APHA	* Conductivity, 2510 B	17-May-13	Exova Edmonton
Alkalinity, pH, and EC in water	APHA	* pH - Electrometric Method, 4500-H+ B	17-May-13	Exova Edmonton
Anions (Routine) by Ion Chromatography	APHA	* Ion Chromatography with Chemical Suppression of Eluent Cond., 4110 B	17-May-13	Exova Edmonton
Approval-Edmonton	APHA	Checking Correctness of Analyses, 1030 E	16-May-13	Exova Edmonton
Chloride in Water	APHA	* Automated Ferricyanide Method, 4500-Cl- E	17-May-13	Exova Edmonton
Metals Trace (Dissolved) in water	APHA	Hardness by Calculation, 2340 B	17-May-13	Exova Edmonton
Metals Trace (Dissolved) in water	APHA	* Inductively Coupled Plasma (ICP) Method, 3120 B	17-May-13	Exova Edmonton

* Reference Method Modified

References

APHA Standard Methods for the Examination of Water and Wastewater

Comments:

Please direct any inquiries regarding this report to our Client Services group.

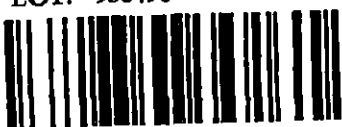
Results relate only to samples as submitted.

The test report shall not be reproduced except in full, without the written approval of the laboratory.



LOT: 935496

COC



Control Number A216054

Environmental Sample Information Sheet

Note: Proper completion of this form is required in order to proceed with analysis.
See reverse for your nearest Exova location and proper sampling protocol

WWW.EXOVA.COM

Billing Address:		Copy of Report:	Copy of Report To:		Copy of Invoice:
Company: Levelton		QA/QC Report ☐	Company:		Send invoice to this
Address: 203-6919-32nd Ave.			Address:		address for approval ☐
Calgary, AB.					
Attention: Kent Reed		Report Result:	Attention:		Report Result:
Phone: (403) 247-1813		e-mail ☐	Phone:		e-mail ☐
Fax: (403) 247-1814		Results Online ☐	Fax:		Results Online ☐
Cell:		Fax ☐	Cell:		Fax ☐
e-mail: kreed@levelton.com		Mail ☐	e-mail:		Mail ☐

Information to be included on Report and Invoice

Project ID: AB12-0253-02
Project Name: McDougall Gash P/A
Project Location:
Legal Location:
PO#:
Proj. Acct. Code:
Agreement ID:

PRIORITY

Please contact laboratory prior to submitting any RUSH samples.

Upon filling out this section, client accepts that surcharges will be applied to this analysis.
If not all samples require RUSH, please indicate in special instructions.

Date Required: _____
Signature: _____

Sample Custody (Please Print)

Sampled by: Levelton Signature: [Signature]
Company: Levelton
I authorize Exova to proceed with the work indicated on this form:
Date: May 10/13 Initial: LR
Received by: [Signature] Sample Temp. 5.4°C
Waybill #: _____ Date: _____
Company: MAY 15 '13 11:25 Filed: _____

Special Instructions / Comments

Please filter, then run Routine analysis on all samples. Not dissolved metals.

Please indicate which regulations you are required to meet:

☐ Health Canada Drinking Water Quality
☐ Alberta Tier 1
☐ Other: _____

Sample Identification	Location	Depth			Date/Time Sampled	Matrix	Sampling Method	Number of Containers	Enter tests above (✓ relevant samples below)											
		IN	CM	M																
Bo. Spec #1									✓											
Bo. Spec #2									✓											
Bedrock Springs #2									✓											
Mud Spring #1 (1)									✓											
Mud Spring #1 (2)									✓											
East Spring									✓											
MW12-6 #1									✓											
MW12-6 #2									✓											
Bedrock Springs #1									✓											
MW12-9 #1									✓											
MW12-9 #2									✓											
MW12-2 #1									✓											
MW12-2 #2									✓											
MW12-2 #3									✓											

NOTE: All hazardous samples must be labeled according to WHMIS guidelines.

Page 1 of 1



Environmental Division

Certificate of Analysis

SABATINI EARTH TECHNOLOGIES

ATTN: KEN HUGO

#203, 6919 - 32ND AVENUE NW

CALGARY AB T3B 0K6

Report Date: 26-MAY-10 09:30 (MT)

Version: FINAL

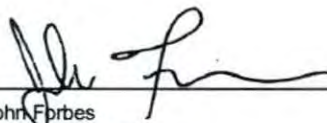
Lab Work Order #: **L888165**

Date Received: **19-MAY-10**

Project P.O. #: NOT PROVIDED
Job Reference: 1005-7802
Legal Site Desc: DUTCHIK GRAVEL PIT
CofC Numbers: 09-044692

Other Information:

Comments:



John Forbes
Account Manager

THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN AUTHORITY OF THE LABORATORY.
ALL SAMPLES WILL BE DISPOSED OF AFTER 30 DAYS FOLLOWING ANALYSIS. PLEASE CONTACT THE LAB IF YOU
REQUIRE ADDITIONAL SAMPLE STORAGE TIME.

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample/Details/Parameters	Result	Qualifier	D.L.	Units	Extracted	Analyzed	Batch
L888165-1 NE SPRING							
Sampled By: NOT PROVIDED on 19-MAY-10 @ 11:00							
Matrix: WATER							
Routine Water Analysis							
Chloride (Cl)							
Chloride (Cl)	41.2		0.10	mg/L		22-MAY-10	R1260035
Dissolved Metals by ICPOES							
Calcium (Ca)-Dissolved	69.5		0.050	mg/L		22-MAY-10	R1260120
Magnesium (Mg)-Dissolved	60.2		0.10	mg/L		22-MAY-10	R1260120
Potassium (K)-Dissolved	2.73		0.50	mg/L		22-MAY-10	R1260120
Sodium (Na)-Dissolved	52.6		1.0	mg/L		22-MAY-10	R1260120
Ion Balance Calculation							
Ion Balance	94.9			%		25-MAY-10	
TDS (Calculated)	571			mg/L		25-MAY-10	
Hardness (as CaCO3)	421			mg/L		25-MAY-10	
Nitrate+Nitrite							
Nitrate and Nitrite as N	2.81		0.071	mg/L		26-MAY-10	
Nitrate-N							
Nitrate-N	2.81		0.050	mg/L		22-MAY-10	R1260035
Nitrite-N							
Nitrite-N	<0.050		0.050	mg/L		22-MAY-10	R1260035
Sulfate (SO4)							
Sulphate (SO4)	86.8		0.50	mg/L		22-MAY-10	R1260035
pH, Conductivity and Total Alkalinity							
pH	8.10		0.10	pH		20-MAY-10	R1259461
Conductivity (EC)	947		3.0	uS/cm		20-MAY-10	R1259461
Bicarbonate (HCO3)	500		5.0	mg/L		20-MAY-10	R1259461
Carbonate (CO3)	<5.0		5.0	mg/L		20-MAY-10	R1259461
Hydroxide (OH)	<5.0		5.0	mg/L		20-MAY-10	R1259461
Alkalinity, Total (as CaCO3)	410		5.0	mg/L		20-MAY-10	R1259461

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CL-CL	Water	Chloride (Cl)	APHA 4110 B-Ion Chromatography
Inorganic Anions by ion chromatography (IC) in water and aqueous extracts of soils.			
IONBALANCE-CL	Water	Ion Balance Calculation	APHA 1030E
MET-DIS-ICP-CL	Water	Dissolved Metals by ICPOES	EPA SW-846 3005A/6010B
his analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves filtration (EPA Method 3005A) and analysis by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).			
N2N3-CALC-CL	Water	Nitrate+Nitrite	CALCULATION
NO2-CL	Water	Nitrite-N	APHA 4110 B-Ion Chromatography
NO3-IC-CL	Water	Nitrate-N	APHA 4110 B-Ion Chromatography
PH/EC/ALK-CL	Water	pH, Conductivity and Total Alkalinity	APHA 4500H,2510,2320
pH measurement is determined from the activity of the hydrogen ions using a hydrogen electrode and a reference electrode Alkalinity measurement is based on the sample's capacity to neutralize acid Conductivity measurement is based on the sample's capacity to convey an electric current			
SO4-CL	Water	Sulfate (SO4)	APHA 4110 B-Ion Chromatography

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
CL	ALS LABORATORY GROUP - CALGARY, ALBERTA, CANADA

Chain of Custody Numbers:

09-044692

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample
mk/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Environmental Division

ALS Laboratory Group Quality Control Report

Workorder: L888165

Report Date: 26-MAY-10

Page 1 of 3

Client: SABATINI EARTH TECHNOLOGIES
#203, 6919 - 32ND AVENUE NW
CALGARY AB T3B 0K6

Contact: KEN HUGO

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CL-CL	Water							
Batch	R1260035							
WG1108194-2	LCS							
Chloride (Cl)			97		%		85-115	21-MAY-10
WG1108194-1	MB							
Chloride (Cl)			<0.10		mg/L		0.1	22-MAY-10
MET-DIS-ICP-CL	Water							
Batch	R1260120							
WG1108238-4	CRM	QCS-A						
Calcium (Ca)-Dissolved			102		%		85-115	22-MAY-10
Magnesium (Mg)-Dissolved			99		%		85-115	22-MAY-10
Potassium (K)-Dissolved			99		%		85-115	22-MAY-10
Sodium (Na)-Dissolved			98		%		85-115	22-MAY-10
WG1108238-1	MB							
Calcium (Ca)-Dissolved			<0.10		mg/L		0.1	22-MAY-10
Magnesium (Mg)-Dissolved			<0.10		mg/L		0.1	22-MAY-10
Potassium (K)-Dissolved			<0.50		mg/L		0.5	22-MAY-10
Sodium (Na)-Dissolved			<1.0		mg/L		1	22-MAY-10
NO2-CL	Water							
Batch	R1260035							
WG1108194-2	LCS							
Nitrite-N			95		%		85-115	21-MAY-10
WG1108194-1	MB							
Nitrite-N			<0.050		mg/L		0.05	22-MAY-10
NO3-IC-CL	Water							
Batch	R1260035							
WG1108194-2	LCS							
Nitrate-N			101		%		85-115	21-MAY-10
WG1108194-1	MB							
Nitrate-N			<0.050		mg/L		0.05	22-MAY-10
PH/EC/ALK-CL	Water							
Batch	R1259461							
WG1107720-1	LCS							
pH			6.99		pH		6.9-7.1	20-MAY-10
Conductivity (EC)			98		%		90-110	20-MAY-10
Alkalinity, Total (as CaCO3)			99		%		85-115	20-MAY-10
SO4-CL	Water							

ALS Laboratory Group Quality Control Report

Workorder: L888165

Report Date: 26-MAY-10

Page 2 of 3

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SO4-CL	Water							
Batch	R1260035							
WG1108194-2	LCS							
Sulphate (SO4)			98		%		85-115	21-MAY-10
WG1108194-1	MB							
Sulphate (SO4)			<0.50		mg/L		0.5	22-MAY-10

ALS Laboratory Group Quality Control Report

Workorder: L888165

Report Date: 26-MAY-10

Page 3 of 3

Legend:

Limit	99% Confidence Interval (Laboratory Control Limits)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

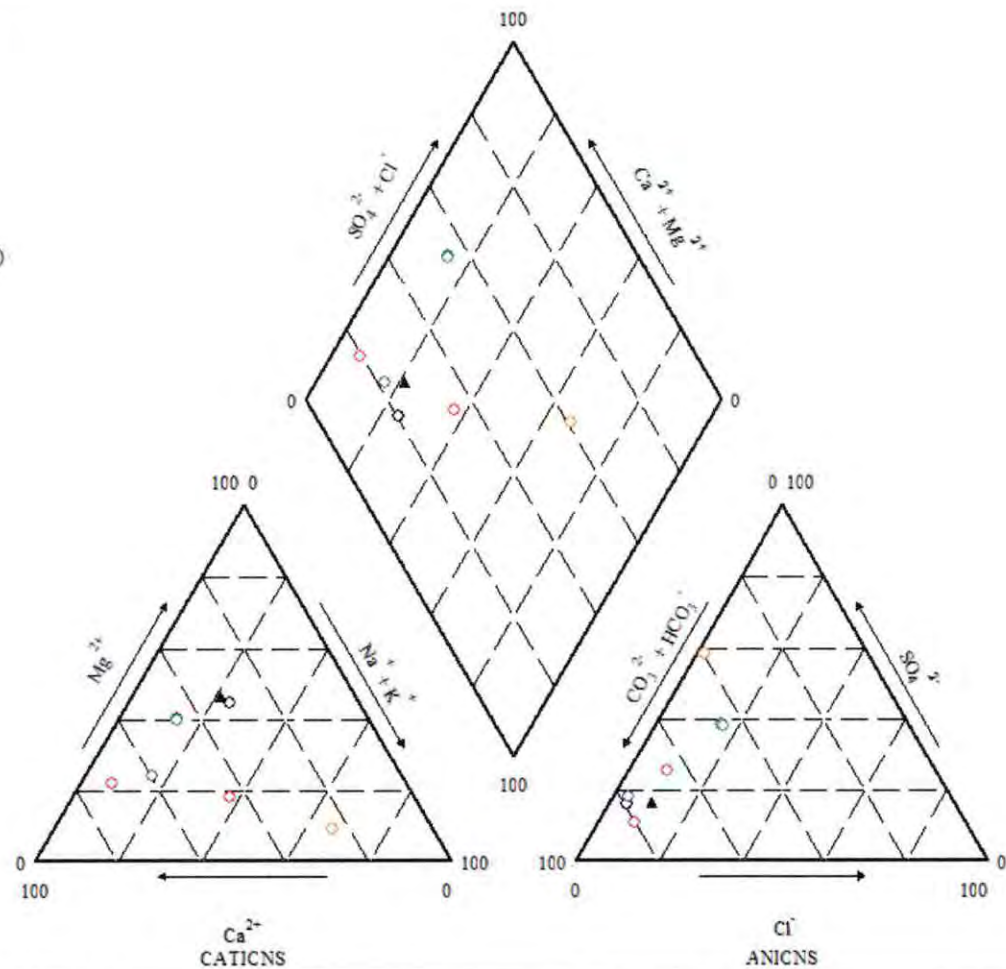
Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Report To			Report Format / Distribution			Service Requested: (Rush subject to availability)								
Company:			Standard: _____ Other (specify): _____			☒ Regular (Standard Turnaround Times))								
Contact: SETI Ken Hugo			Select: PDF ☒ Excel Digital Fax			Priority, Date Req'd: _____ (Surcharges apply)								
Address: # 203, 6919-32 Ave NW			Email 1: _____			Emergency (1 Business Day) - 100% Surcharge								
			Email 2: _____			For Emergency < 1 Day, ASAP or Weekend - Contact ALS								
Phone: _____ Fax: _____						Analysis Request								
Invoice To Same as Report? (circle) Yes or No (if No, provide details)			Client / Project Information			(Indicate Filtered or Preserved, F/P)								
Copy of Invoice with Report? (circle) Yes or No			Job #: 1005-7802											
Company:			PO / AFE:											
Contact:			LSD: Dutchik Gravel Pit											
Address:														
Phone: _____ Fax: _____			Quote #:											
Lab Work Order # (lab use only) U888165			ALS Contact:		Sampler:									
Sample #	Sample Identification (This description will appear on the report)	Date (dd-mm-yy)	Time (hh:mm)	Sample Type										Number of Containers
01	N.E Spring	19-05-10	11:00	water										
Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.														
By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.														
SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)			SHIPMENT RETURNED TO SENDER (verify contents on receipt)								
Released by: Ken Hugo	Date: 19/May	Time: 13:42	Received by: 	Date: 19-MAY-10	Time: 1342	Temperature: 15°C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF				

GENF 18.01 Front

EXPLANATION

- MW10-1
- MW12-2
- MW12-3
- MW12-3
- MW12-6
- MW12-7
- MW12-9
- ▲ NE Spring (2010)



PROJECT:

Groundwater Evaluation Proposed BURNCO McDougal Gravel Pit

TITLE:

Piper Plot of Groundwater and Spring Sample Data, March and April 2012

CLIENT:

BURNCO Rock Products Ltd

DRAWING NO.:

DATE:

March 2014

FILE NO.:

AB12-0253-00

SCALE:

NTS

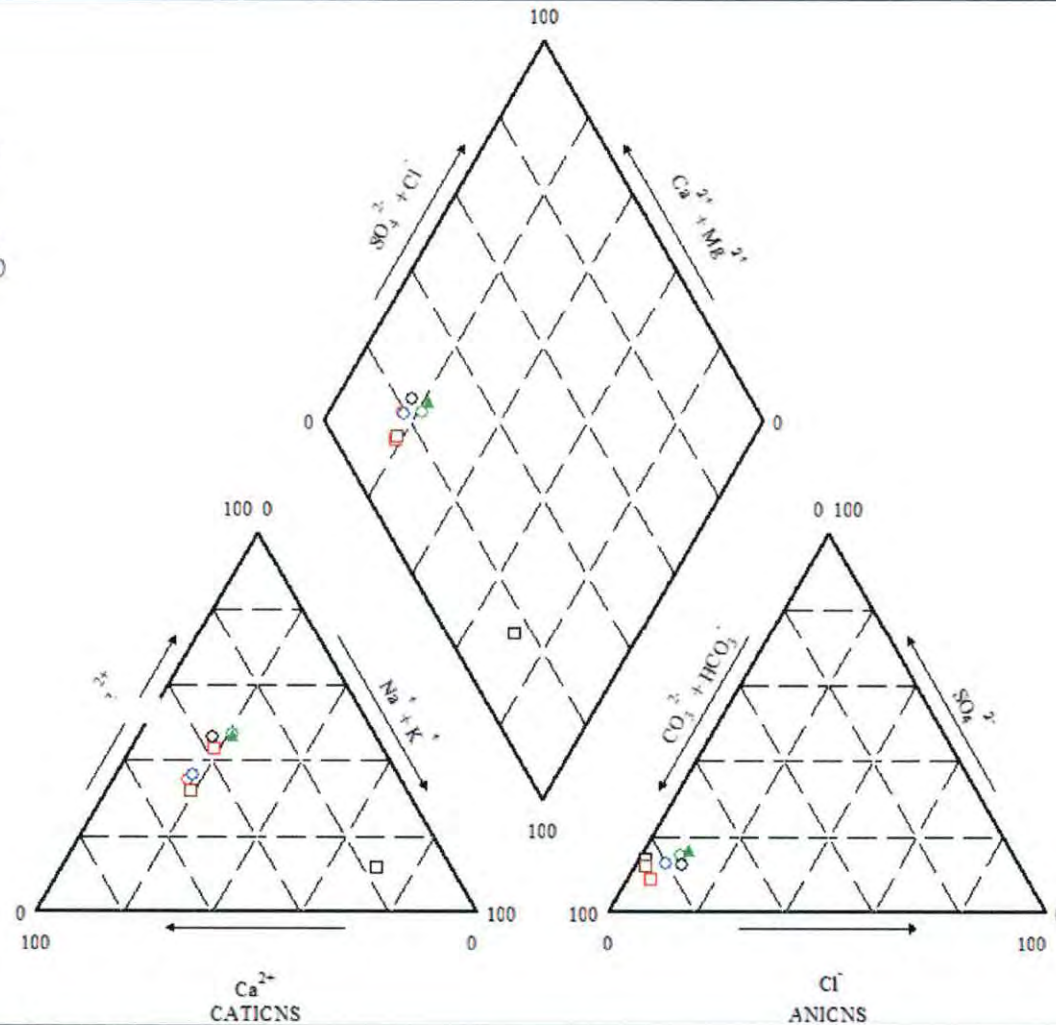
DRAWN BY:

LR

REV NO.:

EXPLANATION

- MW12-2
- MW12-6
- MW12-9
- Bedrock Spring
- NE Spring
- Mud Spring
- Beaupre Spring
- ▲ NE Spring (2010)



PROJECT:

Groundwater Evaluation Proposed BURNCO McDougal Gravel Pit

TITLE:

Piper Plot of Groundwater and Spring Sample Data, May 2013.

CLIENT:

BURNCO Rock Products Ltd

DRAWING NO.:

DATE:

March 2014

FILE NO.:

AB12-0253-00

SCALE:

NTS

DRAWN BY:

LR

REV NO.:

APPENDIX F
Water Well Reconnaissance Report

You have selected more than one water well.
Please click the water well ID to generate Water Well Drilling Report.

Well ID	LSD	SEC	TWP	RGE	M	DRILLING COMPANY	DATE COMPLETED	DEPTH (ft)	TYPE OF WORK	USE	CHM	LT	PT	WELL OWNER	STATIC LEVEL (ft)	TEST RATE (igpm)
341525	NW	15	026	05	5	AARON DRILLING INC.	2000-01-23	340.00	New Well-Abandoned	Domestic		15		RENO, ED #TH 1	200.00	0.25
349487	SE	22	026	05	5	AARON DRILLING INC.	1985-09-18	120.00	Test Hole-Abandoned	Domestic		10		MC NAB GRANT,ANN	60.00	5.00
349488	SE	22	026	05	5	AARON DRILLING INC.	1985-10-02	127.00	Test Hole-Abandoned	Domestic		5		MC NAB,GRANT,ANN	60.00	2.00
349489	SE	22	026	05	5	AARON DRILLING INC.	1985-10-09	105.00	Test Hole-Abandoned	Domestic		6		MC NAB,GRANT,ANN	75.00	3.00
356406	SW	22	026	05	5	UNKNOWN DRILLER		0.00	Chemistry	Domestic				SCHAPANSKY, CHARLENE/KYLE		
386452	NW	15	026	05	5	UNKNOWN DRILLER		150.00	Chemistry	Domestic				MARTIN, SHANNON		
386453	SE	16	026	05	5	ELGIN EXPLORATION COMPANY LIMITED	1976-07-24	150.00	New Well	Domestic & Stock		4		STONE BAND RANCH #HOLE 2	37.00	6.00
386455	SE	14	026	05	5	INTERPROVINCIAL DRILLING CONTRACTORS	1981-09-11	80.00	New Well	Stock		7		KING, HARRY	10.00	10.00
386459	NE	16	026	05	5	ELGIN EXPLORATION COMPANY LIMITED	1976-07-22	90.00	New Well	Domestic & Stock		5		STONE BAND RANCH #1	20.00	12.00
386516	SE	22	026	05	5	UNKNOWN DRILLER		140.00	Chemistry	Domestic				CHAPMAN, D.V.		
386517	SE	22	026	05	5	INTERPROVINCIAL DRILLING CONTRACTORS	1983-11-01	225.00	New Well	Stock		11		MCNABB, GRANT/ANN	100.00	1.00
386518	08	22	026	05	5	INTERPROVINCIAL DRILLING CONTRACTORS	1983-11-09	85.00	New Well	Stock		8		MCNABB, GRANT/ANN #2	65.00	3.00
386519	SE	22	026	05	5	KRIEGER DRILLING LTD.	1989-11-08	180.00	New Well	Domestic & Stock		9		MCNABB, GRANT/ANN	105.00	8.00
386520	SW	22	026	05	5	UNKNOWN DRILLER		120.00	Chemistry	Domestic				DUTCHIK, C.	8.00	
386521	SW	22	026	05	5	PARSONS DRLG	1968-05-10	102.00	New Well	Stock		5		MCDUGALL, D.M. #2	35.00	4.50
386522	SW	22	026	05	5	PARSONS DRLG	1968-04-24	68.00	New Well	Domestic		5		MCDUGALL, D.H. #1	35.00	4.00
386523	SW	22	026	05	5	DEN-ALTA DRILLING LTD.	1989-11-07	60.00	New Well	Domestic & Stock		3		DUTCHIK, GEORGE	45.00	8.00
386524	NW	22	026	05	5	UNKNOWN DRILLER		85.00	Chemistry	Domestic				DUTCHIK, DAVID	6.00	
386525	12	22	026	05	5	INTERPROVINCIAL DRILLING CONTRACTORS	1977-05-10	220.00	New Well	Unknown		11		RACIEOT, BRUCE	90.00	0.50
386526	NW	22	026	05	5	INTERPROVINCIAL DRILLING CONTRACTORS	1977-04-27	140.00	Dry Hole	Domestic & Stock		6		RACIEOT, BRUCE		
386530	NW	22	026	05	5	UNKNOWN DRILLER		160.00	Chemistry	Domestic				DUTCHIK, DAVID		
386531	SW	24	026	05	5	DEL'S DRILLING	1977-02-19	110.00	New Well	Stock		7		BALDWIN, C.	76.00	20.00
416458	SE	14	026	05	5	INTERPROVINCIAL DRILLING CONTRACTORS	1981-09-04	100.00	New Well	Domestic		8		KING, HARVEY#WELL 1	30.00	10.00
466127	05	14	026	05	5	M&M DRILLING CO. LTD.	1996-04-26	60.00	New Well	Domestic		5	24	BEDRY, MERVIN	22.70	10.00

You have selected more than one water well.
Please click the water well ID to generate Water Well Drilling Report.

Well ID	LSD	SEC	TWP	RGE	M	DRILLING COMPANY	DATE COMPLETED	DEPTH (ft)	TYPE OF WORK	USE	CHM	LT	PT	WELL OWNER	STATIC LEVEL (ft)	TEST RATE (igpm)
492955	01	27	026	05	5	ALKEN BASIN DRILLING LTD.	1999-08-02	140.00	New Well	Industrial		5	6	OLYMPIA ENERGY	81.20	40.00
492956	01	27	026	05	5	ALKEN BASIN DRILLING LTD.	1999-08-02	140.00	New Well	Industrial		4	10	OLYMPIA ENERGY#SHACK	80.30	18.00
495543	02	27	026	05	5	ALKEN BASIN DRILLING LTD.	2000-02-06	360.00	Test Hole-Abandoned	Industrial		7		OLYMPIA	0.00	2.00
495544	02	27	026	05	5	ALKEN BASIN DRILLING LTD.	2000-02-08	125.00	Test Hole-Abandoned	Industrial		11	5	OLYMPIA #RIG	85.00	17.00
497720	01	28	026	05	5	ALKEN BASIN DRILLING LTD.	2001-03-17	100.00	New Well	Industrial		9	5	OLYMPIA/EDGE, NORMAN #RIG	12.00	60.00
1060818	NE	24	026	05	5	ALKEN BASIN DRILLING LTD.	2005-10-17	200.00	New Well	Stock		9	11	G.A. MCKENDRICK RANCH LTD.	76.00	20.00
1066120	NE	15	26	5	5	ALKEN BASIN DRILLING LTD.	2010-06-04	320.00	New Well	Domestic		18	26	DUTCHIK, DAVE	50.00	2.00
1066121	NE	15	26	5	5	ALKEN BASIN DRILLING LTD.	2010-06-05	60.00	New Well	Domestic		7	19	DUTCHIK, DAVE	12.00	4.00
1066146	13	14	26	5	5	ALKEN BASIN DRILLING LTD.	2010-06-08	360.00	New Well	Domestic		14	26	GERTNER, HAROLD	58.00	3.50
1066247	NE	23	26	5	5	ALKEN BASIN DRILLING LTD.	2010-07-17	120.00	New Well	Domestic		7	4	DAVE H MCDOUGALL RANCH LTD	90.00	20.00
1066628	15	22	26	5	5	ALKEN BASIN DRILLING LTD.	2012-06-12	260.00	New Well	Domestic		11		MCNABB ANNE		
1260005	NW	15	026	05	5	DRIFT EXPLORATION DRILLING	2003-06-10	360.00	New Well	Domestic		8	25	K-COUNTRY EXCAVATING	30.84	3.00
1465008	NW	15	026	05	5	LOU'S WATER WELL DRILLING	2004-07-17	220.00	New Well	Domestic		12		LEWIS, DWAYNE		2.50
1465008	NW	15	026	05	5	LOU'S WATER WELL DRILLING	2004-07-17	220.00	New Well	Domestic		12		LEWIS, DWAYNE		2.50
1465008	NW	15	026	05	5	LOU'S WATER WELL DRILLING	2004-07-17	220.00	New Well	Domestic		12	25	LEWIS, DWAYNE	76.51	2.50
1465037	NE	16	026	05	5	LOU'S WATER WELL DRILLING	2007-07-21	80.00	New Well	Domestic		9	25	YOUNG, WENDELL	30.38	20.00
1465045	9	20	26	4	5	LOU'S WATER WELL DRILLING	2011-11-29	92.00	New Well	Domestic		7	26	SCHMUNK, DAVID	68.24	11.00

APPENDIX B

Geologic Logs and Well Completion Details

Matrix Solutions Inc.

Datum/Zone: **NAD83 / Zone11N**

NOTE: ODEX casing 5.5 ODEX hammer bit to 13.72 m Tricone at 13.72 m (4.5) stick up 0.95 m. Ground elevation = 1181 masl

Borehole Log - USC



Project/Site: **26388**

Well/borehole #: **MW21-1a**

Client: **Burnco Rock Products Ltd.**

Logged By: **R. Killam**

Compiled By: **B. Dang**

Driller: **Earth Drilling Co Ltd.**

Drill Equipment: **ODEX**

Start Time: **Nov 22 2021 09:32**

Finish Time: **Nov 22 2021 15:00**

Top of Casing: **--**

Ground Elev: **--**

Top / Base of Sand Pack: **12.8/18.28 m**

Screened Interval: **13.28-18.28 m**

Slot Size: **0.01 "**

Total Depth: **18.59 m**

Boring Diameter: **0.11 m**

Casing Diameter: **0.05 m**

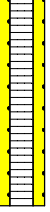
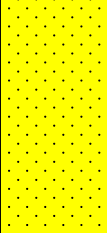
Legal Location: **NW-13-026-05 W5M**

Relative Location: **North of pit**

Northing: **5677740**

Easting: **669058**

Datum/Zone: **NAD83 / Zone11N**

Well / Borehole Completion Data	Depth (m) Elevation (m)	Soil / Bedrock	Soil Description	Sample Depth <i>B = Bag</i> <i>J = Jar</i> <i>V = Vial</i> Sample No. Prefix: --
	Screen -16 -17 -18 -19 -20 -21 -22 -23 -24 -25 -26 -27 -28 -29 -30 -31 -32		Bottom of Hole	

NOTE: ODEX casing 5.5 ODEX hammer bit to 13.72 m Tricone at 13.72 m (4.5) stick up 0.95 m. Ground elevation = 1181 masl

Borehole Log - USC



Project/Site: **26388**

Well/borehole #: **MW21-1b**

Client: **Burnco Rock Products Ltd.**

Logged By: **R. Killam**

Compiled By: **B. Dang**

Driller: **Earth Drilling Co Ltd.**

Drill Equipment: **ODEX**

Start Time: **Nov 26 2021 09:29**

Finish Time: **Nov 26 2021 16:00**

Top of Casing: **--**

Ground Elev: **--**

Top / Base of Sand Pack: **23.0/30.49 m**

Screened Interval: **24.49-30.49 m**

Slot Size: **0.01 "**

Total Depth: **30.49 m**

Boring Diameter: **0.11 m**

Casing Diameter: **0.05 m**

Legal Location: **NW-13-026-05 W5M**

Relative Location: **North of pit**

Northing: **5677744**

Easting: **668994**

Datum/Zone: **NAD83 / Zone11N**

Well / Borehole Completion Data	Depth (m) Elevation (m)	Soil / Bedrock	Soil Description	Sample Depth B = Bag J = Jar V = Vial Sample No. Prefix: --
	0 0		CLAY: (0-2.74 m) some sand (fine to coarse grained), some silt, brown, moist, firm, low plasticity.	
	-1 -1			
	-2 -2			
	-3 -3		GRAVEL (FINE TO COARSE GRAINED): (2.74-8.54 m) grey, dry, loose, subrounded, well graded.	
	-4 -4			
	-5 -5			
	-6 -6			
	-7 -7			
	-8 -8			
	-9 -9		CLAY AND SILT: (8.54-9.76 m) grey, moist, firm, medium plasticity.	
	-10 -10		GRAVEL (COARSE GRAINED): (9.76-10.21 m) light gray, wet, loose, subrounded, well graded.	
	-11 -11		SANDSTONE (FINE TO MEDIUM GRAINED): (10.21-10.95 m) well graded, subrounded, grey, moist, poorly cemented, weathered.	
	-12 -12		SANDSTONE (FINE TO MEDIUM GRAINED): (10.95-12.2 m) poorly graded, subrounded, grey, dry, moderately cemented.	
	-13 -13		SANDSTONE (FINE TO MEDIUM GRAINED): (12.2-14.94 m) trace siltstone, well graded, subangular, brown and grey, dry, moderately cemented.	
	-14 -14			
	-15 -15		SANDSTONE (FINE TO MEDIUM GRAINED): (14.94-16.16 m) well graded, subrounded, grey, dry, well cemented.	
	-16 -16			

← Bentonite
Chips

NOTE: ODEX casing 5.5 ODEX hammer bit to 10.67 m casing set at 10.67 m Down hole hammer bit to 30.49 m stick up m. Ground elevation = 1181 masl. 2 m NE of MW21-1a

Borehole Log - USC



Project/Site: **26388**

Well/borehole #: **MW21-1b**

Client: **Burnco Rock Products Ltd.**

Logged By: **R. Killam**

Compiled By: **B. Dang**

Driller: **Earth Drilling Co Ltd.**

Drill Equipment: **ODEX**

Start Time: **Nov 26 2021 09:29**

Finish Time: **Nov 26 2021 16:00**

Top of Casing: **--**

Ground Elev: **--**

Top / Base of Sand Pack: **23.0/30.49 m**

Screened Interval: **24.49-30.49 m**

Slot Size: **0.01 "**

Total Depth: **30.49 m**

Boring Diameter: **0.11 m**

Casing Diameter: **0.05 m**

Legal Location: **NW-13-026-05 W5M**

Relative Location: **North of pit**

Northing: **5677744**

Easting: **668994**

Datum/Zone: **NAD83 / Zone11N**

Well / Borehole Completion Data	Depth (m) Elevation (m)	Soil / Bedrock	Soil Description	Sample Depth <i>B = Bag</i> <i>J = Jar</i> <i>V = Vial</i> Sample No. Prefix: --
	-16 -16		SANDSTONE (FINE TO MEDIUM GRAINED): (16.16-17.07 m) some siltstone, well graded, subrounded, brown and grey, dry, moderately cemented.	
	-17 -17		SANDSTONE (FINE TO MEDIUM GRAINED): (17.07-17.68 m) well graded, subrounded, grey, wet, moderately cemented.	
	-18 -18		SANDSTONE (FINE TO MEDIUM GRAINED): (17.68-20.43 m) well graded, subrounded, grey, dry, moderately cemented.	
	-19 -19			
	-20 -20			
	-21 -21		SANDSTONE (FINE TO MEDIUM GRAINED) AND SILTSTONE: (20.43-30.49 m) well graded, subrounded, grey and reddish brown, moist, poorly cemented.	
	-22 -22			
	-23 -23			
	-24 -24			
	-25 -25		@ 24.7-24.71 m moist returns, possible from upper wet section.	
	-26 -26			
	-27 -27			
	-28 -28			
	-29 -29			
	-30 -30			
	-31 -31		Bottom of Hole	
	-32 -32			

NOTE: ODEX casing 5.5 ODEX hammer bit to 10.67 m casing set at 10.67 m Down hole hammer bit to 30.49 m stick up m. Ground elevation = 1181 masl. 2 m NE of MW21-1a

Borehole Log - USC



Project/Site: **26388**

Well/borehole #: **MW21-2a**

Client: **Burnco Rock Products Ltd.**

Logged By: **R. Killam**

Compiled By: **B. Dang**

Driller: **Earth Drilling Co Ltd.**

Drill Equipment: **ODEX**

Start Time: **Nov 22 2021 15:28**

Finish Time: **Nov 23 2021 11:30**

Top of Casing: **--**

Ground Elev: **--**

Top / Base of Sand Pack: **4.87/9.4 m**

Screened Interval: **6.1-9.1 m**

Slot Size: **0.01 "**

Total Depth: **9.94 m**

Boring Diameter: **0.11 m**

Casing Diameter: **0.05 m**

Legal Location: **NW-13-026-05 W5M**

Relative Location: **Adjacent pit**

Northing: **5677465**

Easting: **669058**

Datum/Zone: **NAD83 / Zone11N**

Well / Borehole Completion Data	Depth (m) Elevation (m)	Soil / Bedrock	Soil Description	Sample Depth <i>B = Bag</i> <i>J = Jar</i> <i>V = Vial</i> Sample No. Prefix: --
	0 0	SILT	SILT: (0-2.54 m) some sand (fine grained), brown, dry, soft, non-plastic.	
	-1 -1			
	-2 -2	GRAVEL (FINE TO COARSE GRAINED)		
	-3 -3		GRAVEL (FINE TO COARSE GRAINED): (2.54-3.35 m) some silt, grey, dry, loose, subrounded, well graded.	
	-4 -4		GRAVEL (FINE TO COARSE GRAINED): (3.35-7.62 m) trace silt, grey, dry, loose, subrounded, poorly graded.	
	-5 -5			
	-6 -6		@ 6.4-6.71 m boulder.	
	-7 -7			
	-8 -8		GRAVEL (FINE TO COARSE GRAINED): (7.62-7.93 m) trace silt, grey, wet, loose, subrounded, well graded.	
	-9 -9		GRAVEL (FINE TO COARSE GRAINED): (7.93-9.45 m) grey, moist, loose, subrounded, well graded.	
	-10 -10	SANDSTONE (FINE GRAINED)	SANDSTONE (FINE GRAINED): (9.45-9.94 m) well graded, subrounded, grey, moist, moderately cemented.	
	-11 -11		Bottom of Hole	
	-12 -12			
	-13 -13			
	-14 -14			
	-15 -15			

NOTE: ODEX casing 5.5 ODEX hammer bit 9.94m stick up 0.93 m ground elevation = 1177 masl.

Borehole Log - USC



Project/Site: **26388**

Well/borehole #: **MW21-2b**

Client: **Burnco Rock Products Ltd.**

Logged By: **R. Killam**

Compiled By: **B. Dang**

Driller: **Earth Drilling Co Ltd.**

Drill Equipment: **ODEX**

Start Time: **Nov 24 2021 10:22**

Finish Time: **Nov 24 2021 16:30**

Top of Casing: **--**

Ground Elev: **--**

Top / Base of Sand Pack: **12.45/18.18 m**

Screened Interval: **13.18-18.18 m**

Slot Size: **0.01 "**

Total Depth: **18.29 m**

Boring Diameter: **0.11 m**

Casing Diameter: **0.05 m**

Legal Location: **NW-13-026-05 W5M**

Relative Location: **Nested with MW21-2a**

Northing: **5677470**

Easting: **669059**

Datum/Zone: **NAD83 / Zone11N**

Well / Borehole Completion Data	Depth (m) Elevation (m)	Soil / Bedrock	Soil Description	Sample Depth <i>B = Bag</i> <i>J = Jar</i> <i>V = Vial</i> Sample No. Prefix: --
	0 0		SILT: (0-2.44 m) some sand (fine grained), brown, dry, soft, non-plastic.	
	-1 -1			
	-2 -2			
	-3 -3		GRAVEL (FINE TO COARSE GRAINED): (2.44-3.35 m) some silt, grey, dry, loose, subrounded, well graded.	
	-4 -4		GRAVEL (FINE TO COARSE GRAINED): (3.35-7.62 m) trace silt, grey, dry, loose, subrounded, well graded.	
	-5 -5			
	-6 -6			
	-7 -7			
	-8 -8		@ 7.32-7.6 m sand lense.	
	-9 -9		GRAVEL (FINE TO COARSE GRAINED): (7.62-7.93 m) trace silt, grey, wet, loose, subrounded, well graded.	
	-10 -10		GRAVEL (FINE TO COARSE GRAINED): (7.93-9.45 m) grey, moist, loose, subrounded, well graded.	
	-11 -11		SANDSTONE (FINE GRAINED): (9.45-10.37 m) well graded, subrounded, grey, moist, poorly cemented, heavily weathered.	
	-12 -12		SANDSTONE (FINE TO MEDIUM GRAINED): (10.37-10.98 m) well graded, subrounded, grey, moist, poorly cemented.	
	-13 -13		SANDSTONE (FINE TO MEDIUM GRAINED): (10.98-16.77 m) well graded, subrounded, grey, dry, poorly cemented.	
	-14 -14			
	-15 -15			

NOTE: ODEX casing 5.5 casing set at 10.37 m ODEX hammer bit 10.37 m down hole hammer bit from 10.37 m to 18.29 stick up 0.94 m. Ground elevation = 1177 masl. MW21-2b is 1.8m NE of MW21-2a.

Borehole Log - USC



Project/Site: **26388**

Well/borehole #: **MW21-2b**

Client: **Burnco Rock Products Ltd.**

Logged By: **R. Killam**

Compiled By: **B. Dang**

Driller: **Earth Drilling Co Ltd.**

Drill Equipment: **ODEX**

Start Time: **Nov 24 2021 10:22**

Finish Time: **Nov 24 2021 16:30**

Top of Casing: **--**

Ground Elev: **--**

Top / Base of Sand Pack: **12.45/18.18 m**

Screened Interval: **13.18-18.18 m**

Slot Size: **0.01 "**

Total Depth: **18.29 m**

Boring Diameter: **0.11 m**

Casing Diameter: **0.05 m**

Legal Location: **NW-13-026-05 W5M**

Relative Location: **Nested with MW21-2a**

Northing: **5677470**

Easting: **669059**

Datum/Zone: **NAD83 / Zone11N**

Well / Borehole Completion Data	Depth (m) Elevation (m)	Soil / Bedrock	Soil Description	Sample Depth <i>B = Bag</i> <i>J = Jar</i> <i>V = Vial</i> Sample No. Prefix: --
	-15 -15			
	-16 -16		@ 16.16-16.2 m trace silt, moist.	
	-17 -17		SANDSTONE (FINE TO MEDIUM GRAINED): (16.77-18.29 m) poorly graded, subrounded, grey, wet, moderately cemented.	
	-18 -18		@ 17.68-17.7 m hard very fine grained sandstone.	
	-19 -19		Bottom of Hole	
	-20 -20			
	-21 -21			
	-22 -22			
	-23 -23			
	-24 -24			
	-25 -25			
	-26 -26			
	-27 -27			
	-28 -28			
	-29 -29			
	-30 -30			

NOTE: ODEX casing 5.5 casing set at 10.37 m ODEX hammer bit 10.37 m down hole hammer bit from 10.37 m to 18.29 stick up 0.94 m. Ground elevation = 1177 masl. MW21-2b is 1.8m NE of MW21-2a.

Borehole Log - USC



Project/Site: **26388**

Well/borehole #: **MW21-3**

Client: **Burnco Rock Products Ltd.**

Logged By: **R. Killam**

Compiled By: **B. Dang**

Driller: **Earth Drilling Co Ltd.**

Drill Equipment: **ODEX**

Start Time: **Nov 23 2021 12:00**

Finish Time: **Nov 24 2021 10:00**

Top of Casing: **--**

Ground Elev: **--**

Top / Base of Sand Pack: **8.99/12.8 m**

Screened Interval: **9.6-12.6 m**

Slot Size: **0.01 "**

Total Depth: **15.24 m**

Boring Diameter: **0.11 m**

Casing Diameter: **0.05 m**

Legal Location: **NW-13-026-05 W5M**

Relative Location: **South of pit**

Northing: **5677240**

Easting: **669173**

Datum/Zone: **NAD83 / Zone11N**

Well / Borehole Completion Data	Depth (m) Elevation (m)	Soil / Bedrock	Soil Description	Sample Depth B = Bag J = Jar V = Vial Sample No. Prefix: --
	0 0		SAND (FINE GRAINED) AND SILT: (0-2.74 m) brown, dry, compact, subrounded, gap graded.	
	-1 -1			
	-2 -2			
	-3 -3		SAND (FINE TO MEDIUM GRAINED) AND GRAVEL (FINE TO COARSE GRAINED): (2.74-3.35 m) brown, dry, loose, subrounded, well graded.	
	-4 -4		SANDSTONE (FINE TO MEDIUM GRAINED): (3.35-4.57 m) trace shale, poorly graded, subrounded, dark grey, dry, poorly cemented, weathered.	
	-5 -5		SANDSTONE (FINE TO MEDIUM GRAINED): (4.57-6.1 m) poorly graded, subangular, grey, moist, moderately cemented, moderately weathered, potentially water bearing.	
	-6 -6		SANDSTONE (FINE TO MEDIUM GRAINED): (6.1-7.32 m) poorly graded, subrounded, grey, moist.	
	-7 -7		@ 7.01-7.02 m siltstone.	
	-8 -8		SANDSTONE (FINE GRAINED): (7.32-7.93 m) poorly graded, subrounded, grey, dry, moderately cemented.	
	-9 -9		SANDSTONE (FINE TO MEDIUM GRAINED): (7.93-12.8 m) poorly graded, subrounded, grey, moist, poorly cemented.	
	-10 -10		@ 9.15-12.8 m drilling open hole, water producing below casing set at 9.1 m.	
	-11 -11		@ 9.76-9.77 m shale lense.	
	-12 -12		@ 11.89-12.2 m dry/moist cuttings.	
	-13 -13		SILTSTONE: (12.8-15.24 m) dark grey, dry, well cemented.	
	-14 -14			
	-15 -15			
	-16 -16		Bottom of Hole	

NOTE: ODEX casing 5.5 ODEX hammer bit to 9.15 casing set at 9.15 m tricone bit from 9.15 to 15.24m TD stick up 0.93 m bolt dropped down at 11.2 m and unable to retrieve. Ground elevation = 1168 masl

Borehole Log - USC



Project/Site: **26388**

Well/borehole #: **MW21-4**

Client: **Burnco Rock Products Ltd.**

Logged By: **R. Killam**

Compiled By: **B. Dang**

Driller: **Earth Drilling Co Ltd.**

Drill Equipment: **ODEX**

Start Time: **Nov 25 2021 08:58**

Finish Time: **Nov 26 2021 09:00**

Top of Casing: **--**

Ground Elev: **--**

Top / Base of Sand Pack: **24.4/41.15 m**

Screened Interval: **29.15-41.15 m**

Slot Size: **0.01 "**

Total Depth: **41.16 m**

Boring Diameter: **0.11 m**

Casing Diameter: **0.05 m**

Legal Location: **NW-13-026-05 W5M**

Relative Location: **NE of pit**

Northing: **5677603**

Easting: **669415**

Datum/Zone: **NAD83 / Zone11N**

Well / Borehole Completion Data	Depth (m) Elevation (m)	Soil / Bedrock	Soil Description	Sample Depth <i>B = Bag</i> <i>J = Jar</i> <i>V = Vial</i> Sample No. Prefix: --
	0 0			
	-1 -1			
	-2 -2			
	-3 -3			
	-4 -4			
	-5 -5			
	-6 -6		GRAVEL (FINE TO COARSE GRAINED): (0-5.79 m) some sand, trace silt, grey, dry, loose, subrounded, well graded.	
	-7 -7			
	-8 -8			
	-9 -9		GRAVEL (FINE TO COARSE GRAINED) AND SAND (FINE TO COARSE GRAINED): (5.79-8.54 m) brown, moist, loose, subrounded, well graded.	
	-10 -10			
	-11 -11			
	-12 -12		SANDSTONE (FINE TO MEDIUM GRAINED): (8.54-9.15 m) well graded, subrounded, grey, dry, poorly cemented, weathered.	
	-13 -13		SANDSTONE (FINE TO MEDIUM GRAINED): (9.15-13.72 m) poorly graded, subrounded, grey, dry, poorly cemented.	
	-14 -14			
	-15 -15		SANDSTONE (FINE GRAINED): (13.72-20.73 m) trace siltstone, poorly graded, subrounded, dark grey, dry, moderately cemented.	

NOTE: ODEX casing 5.5 casing set at 9.15 m ODEX hammer bit 9.15 m down hole hammer bit from 9.15 m to 41.16m stick up 0.95 m. Ground elevation = 1172 masl

Borehole Log - USC



Project/Site: **26388**

Well/borehole #: **MW21-4**

Client: **Burnco Rock Products Ltd.**

Logged By: **R. Killam**

Compiled By: **B. Dang**

Driller: **Earth Drilling Co Ltd.**

Drill Equipment: **ODEX**

Start Time: **Nov 25 2021 08:58**

Finish Time: **Nov 26 2021 09:00**

Top of Casing: **--**

Ground Elev: **--**

Top / Base of Sand Pack: **24.4/41.15 m**

Screened Interval: **29.15-41.15 m**

Slot Size: **0.01 "**

Total Depth: **41.16 m**

Boring Diameter: **0.11 m**

Casing Diameter: **0.05 m**

Legal Location: **NW-13-026-05 W5M**

Relative Location: **NE of pit**

Northing: **5677603**

Easting: **669415**

Datum/Zone: **NAD83 / Zone11N**

Well / Borehole Completion Data	Depth (m) Elevation (m)	Soil / Bedrock	Soil Description	Sample Depth <i>B = Bag</i> <i>J = Jar</i> <i>V = Vial</i> Sample No. Prefix: --
	-15 -16 -17 -18 -19 -20 -21 -22 -23 -24 -25 -26 -27 -28 -29 -30			
			SANDSTONE (FINE TO MEDIUM GRAINED): (20.73-36.59 m) trace siltstone, poorly graded, subrounded, light brown and dark grey, dry, moderately cemented.	

NOTE: ODEX casing 5.5 casing set at 9.15 m ODEX hammer bit 9.15 m down hole hammer bit from 9.15 m to 41.16m stick up 0.95 m. Ground elevation = 1172 masl

Borehole Log - USC



Project/Site: **26388**

Well/borehole #: **MW21-4**

Client: **Burnco Rock Products Ltd.**

Logged By: **R. Killam**

Compiled By: **B. Dang**

Driller: **Earth Drilling Co Ltd.**

Drill Equipment: **ODEX**

Start Time: **Nov 25 2021 08:58**

Finish Time: **Nov 26 2021 09:00**

Top of Casing: **--**

Ground Elev: **--**

Top / Base of Sand Pack: **24.4/41.15 m**

Screened Interval: **29.15-41.15 m**

Slot Size: **0.01 "**

Total Depth: **41.16 m**

Boring Diameter: **0.11 m**

Casing Diameter: **0.05 m**

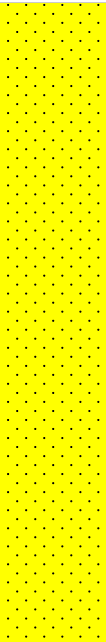
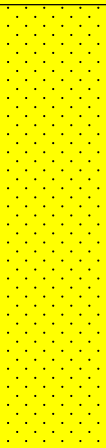
Legal Location: **NW-13-026-05 W5M**

Relative Location: **NE of pit**

Northing: **5677603**

Easting: **669415**

Datum/Zone: **NAD83 / Zone11N**

Well / Borehole Completion Data	Depth (m) Elevation (m)	Soil / Bedrock	Soil Description	Sample Depth <i>B = Bag</i> <i>J = Jar</i> <i>V = Vial</i> Sample No. Prefix: --
 10x20 Sand Screen	-30			
	-31			
	-32			
	-33			
	-34			
	-35			
	-36			
	-37			
	-38			
	-39			
	-40			
	-41		SANDSTONE (FINE TO MEDIUM GRAINED): (36.59-41.16 m) poorly graded, subrounded, light grey, dry, poorly cemented.	
	-42			
	-43			
	-44			
-45				
		Bottom of Hole		

NOTE: ODEX casing 5.5 casing set at 9.15 m ODEX hammer bit 9.15 m down hole hammer bit from 9.15 m to 41.16m stick up 0.95 m. Ground elevation = 1172 masl

APPENDIX C

Hydraulic Conductivity Tests

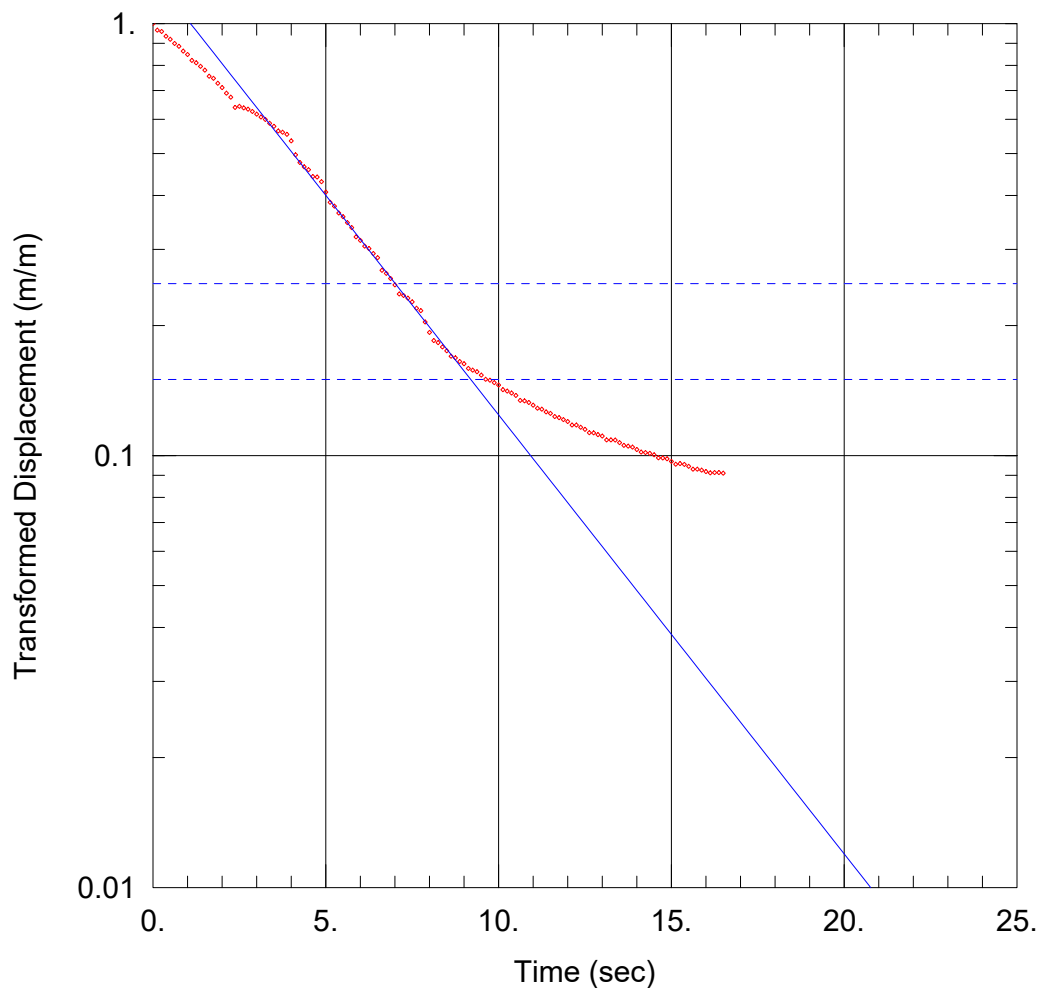
21-2a Hydraulic Conductivity Test Analysis - Slug Out (May 11, 2022)

Prepared By:
M.Rutten/D.Murfitt

Prepared For:
Burnco Rock Products Ltd.

Project:
26388

Location:
NW-13-026-05 W5M



SOLUTION

Aquifer Model: Unconfined

Solution Method: Dagan

$K = 0.0001461$ m/sec $y_0 = 0.8131$ m

AQUIFER DATA

Saturated Thickness: 2.045 m Anisotropy Ratio (K_z/K_r): 0.1

WELL DATA (21-2a)

Initial Displacement: 0.66 m

Static Water Column Height: 2.045 m

Total Well Penetration Depth: 2.045 m

Screen Length: 2.045 m

Casing Radius: 0.025 m

Well Radius: 0.055 m

Gravel Pack Porosity: 0.25

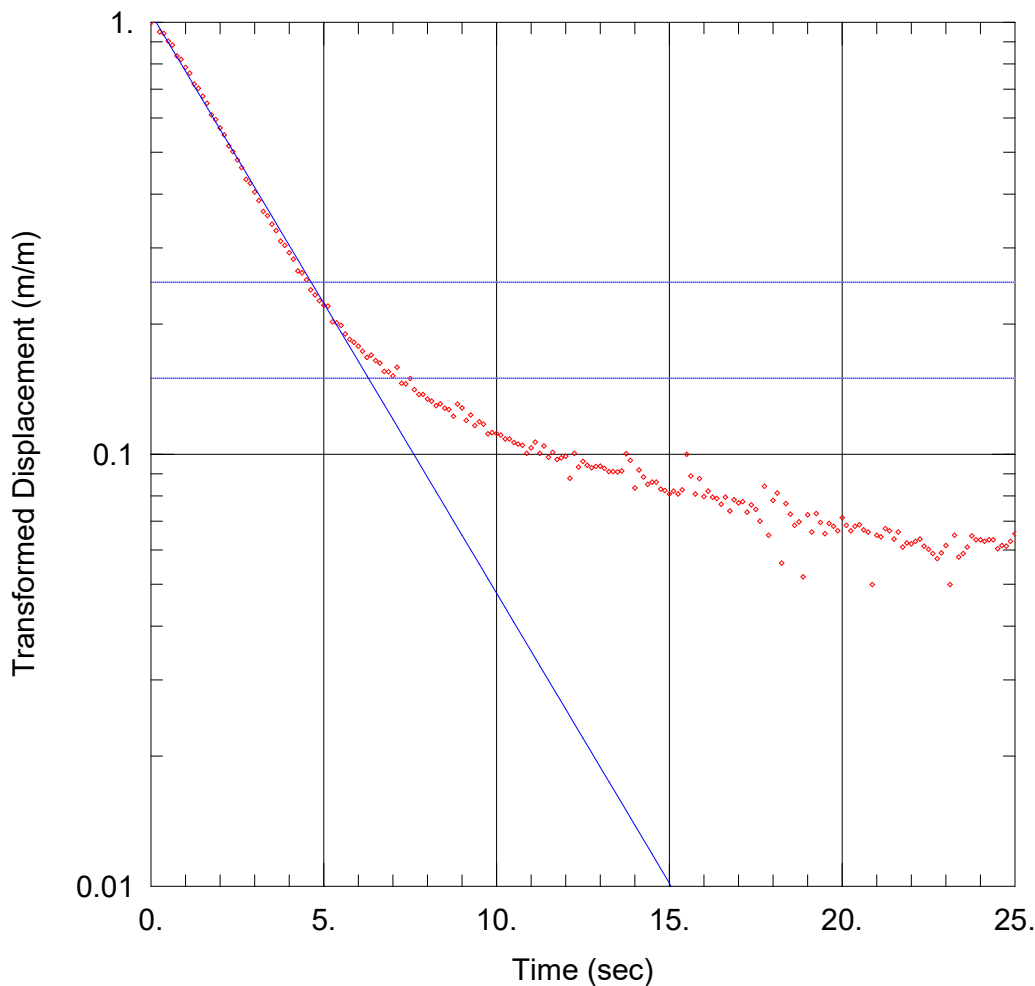
21-2a Hydraulic Conductivity Test Analysis - Slug Out (May 11, 2022)

Prepared By:
M.Rutten/D.Murfitt

Prepared For:
Burnco Rock Products Ltd.

Project:
26388

Location:
NW-13-026-05 W5M



SOLUTION

Aquifer Model: Unconfined

Solution Method: Dagan

$K = 0.0002468$ m/sec $y_0 = 0.3652$ m

AQUIFER DATA

Saturated Thickness: 2.046 m Anisotropy Ratio (K_z/K_r): 0.1

WELL DATA (21-2a)

Initial Displacement: 0.35 m

Static Water Column Height: 2.046 m

Total Well Penetration Depth: 2.046 m

Screen Length: 2.046 m

Casing Radius: 0.025 m

Well Radius: 0.055 m

Gravel Pack Porosity: 0.25

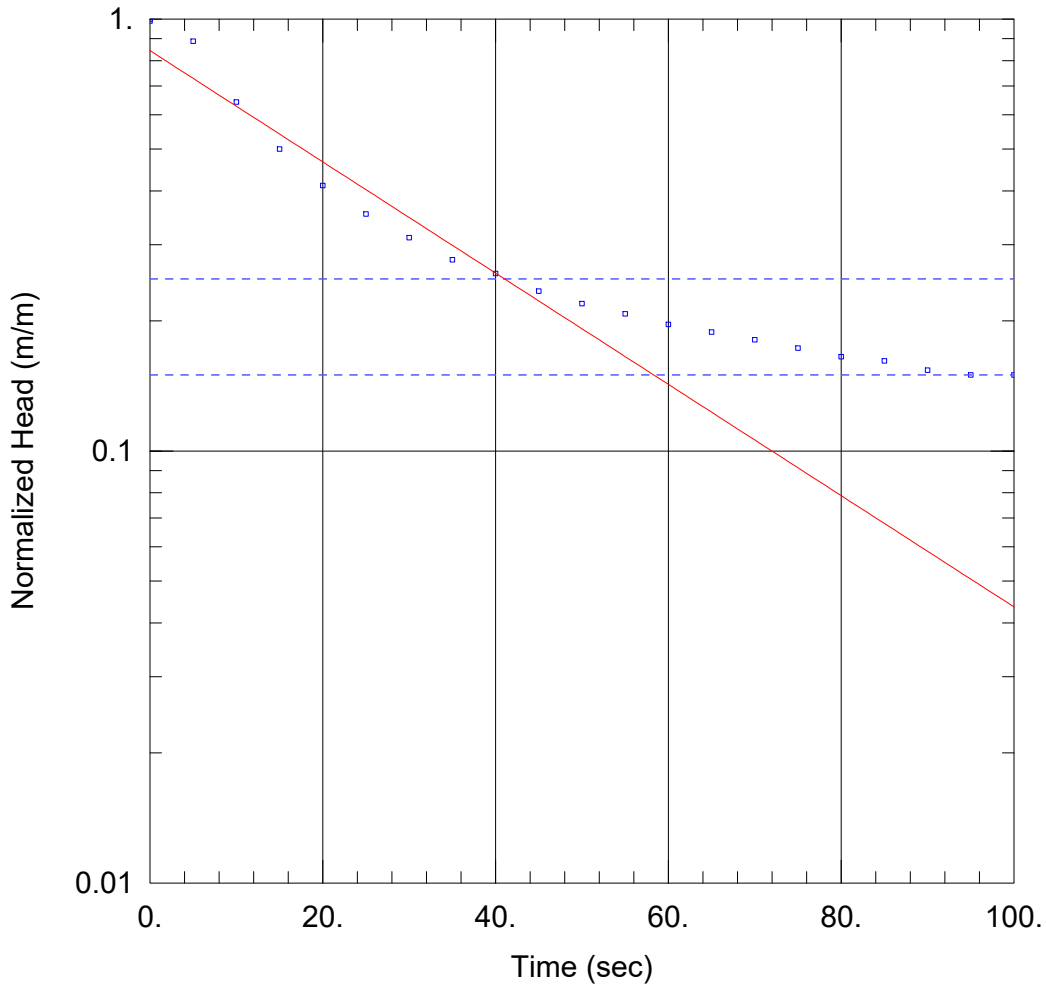
Well MW21-2b: Hydraulic Conductivity Test Analysis (Slug in)

Prepared By:
Matrix Solutions

Prepared For:
BURNCO

Project:
26388-512

Location:



SOLUTION

Aquifer Model: Confined
Solution Method: Hvorslev

$K = 9.818E-6$ m/sec $y_0 = 0.2196$ m

AQUIFER DATA

Saturated Thickness: 5 m Anisotropy Ratio (K_z/K_r): 1

WELL DATA (MW21-2b)

Initial Displacement: 0.26 m
Static Water Column Height: 10.32 m
Total Well Penetration Depth: 5 m
Screen Length: 5 m
Casing Radius: 0.025 m
Well Radius: 0.055 m
Gravel Pack Porosity: 0.3

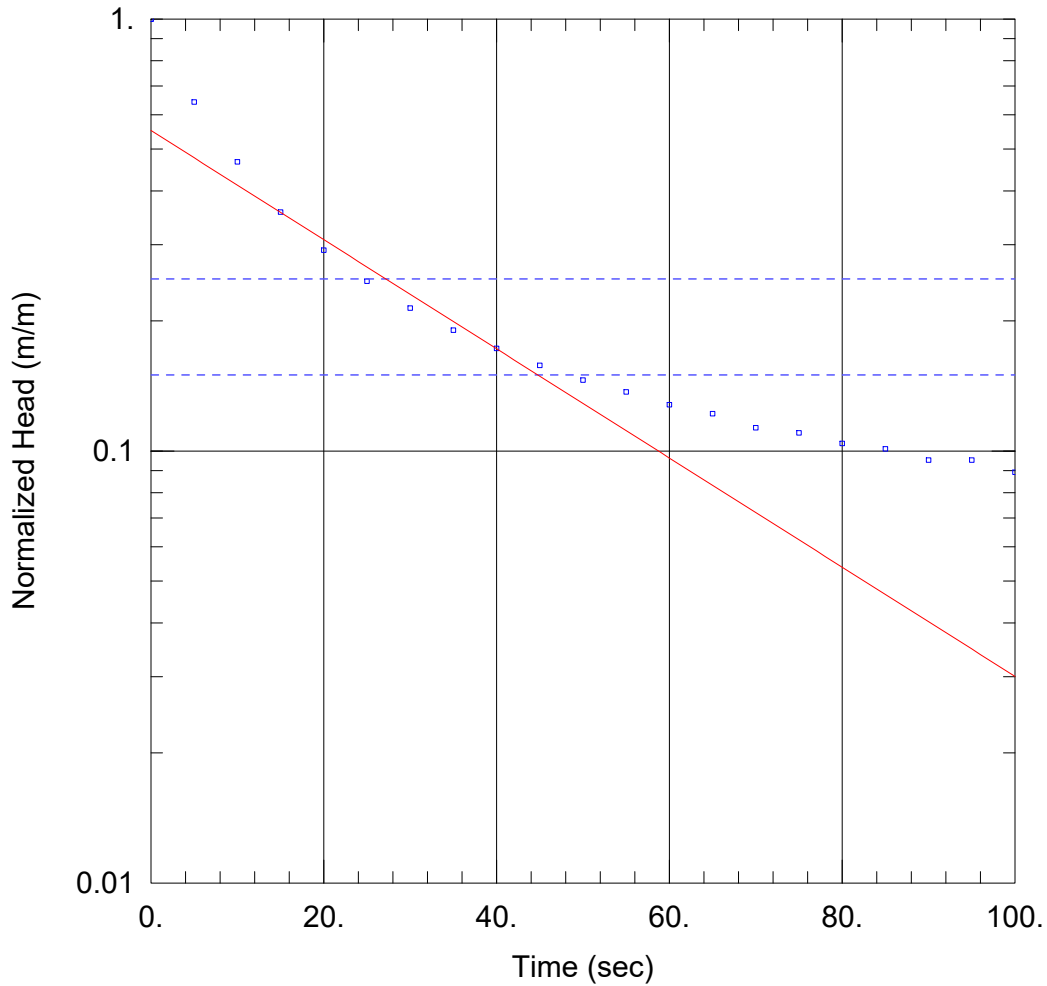
Well MW21-2b: Hydraulic Conductivity Test Analysis (Slug out)

Prepared By:
Matrix Solutions

Prepared For:
BURNCO

Project:
26388-512

Location:



SOLUTION

Aquifer Model: Confined
Solution Method: Hvorslev

$K = 9.633E-6$ m/sec $y_0 = 0.1854$ m

AQUIFER DATA

Saturated Thickness: 5 m Anisotropy Ratio (K_z/K_r): 1

WELL DATA (MW21-2b)

Initial Displacement: 0.336 m
Static Water Column Height: 10.32 m
Total Well Penetration Depth: 5 m
Screen Length: 5 m
Casing Radius: 0.025 m
Well Radius: 0.055 m
Gravel Pack Porosity: 0.3

APPENDIX D

Soil Aggregate Sampling and Testing Memorandum

MEMORANDUM

TO: Travis Butler, BURNCO Rock Products Ltd.

FROM: Ryley Killam and Goetz Aust, Matrix Solutions Inc.

SUBJECT: Soil Aggregate Sampling and Testing

DATE: February 20, 2022

VERSION: 1.0

1 OBJECTIVE

The objective of this memorandum is to summarize the results of the soil aggregate sample collection and laboratory testing conducted by BURNCO Rock Products Ltd. at the West Cochrane Gravel Pit in 2021.

2 METHODOLOGY

Eight samples were collected within the operating gravel pit and the Bow River bank south of the project on October 25, 2021 by BURNCO personnel. Location of the samples is presented on Figure D1 and photographs of the sample locations is presented on Figures D2a through D2h. Samples were collected from a depth of approximately 0.15 m.

The samples were collected and transported to AGAT Laboratories by BURNCO personnel and submitted for the following analyses: salinity, leachate metals, hydrocarbons, polycyclic aromatic hydrocarbons (PAH), and waste characterization.

For the waste characterization (leachate analyses), composite samples were prepared based upon their geographic location.

3 RESULTS

Results of the soil aggregate testing are summarized below and included in Tables D1 to 5. Laboratory reports are attached.

3.1 Detailed Salinity

Detailed salinity results for gravel samples are provided in Table D1. All parameters analyzed were below *Alberta Tier 1 Soil and Groundwater Remediation Guidelines* (Tier 1; AEP 2019). Comparison of riverbank sediments and operating pit area sediments indicated average parameter concentrations of the chloride (Cl) and potassium (K) ions were significantly higher (150%) in the near operating pit samples and whereas

the riverbank samples had significantly higher (1.50%) calcium (Ca), sodium (Na), and sulphate (SO₄) concentrations.

3.2 Leachate Metals

Leachate metals results are provided in Table D2. All parameters analyzed were below Tier 1 guidelines. Comparison of riverbank sediments and operating pit area sediments indicated that the ratio of the average parameter concentration of most of the leachate metals in the operating pit were significantly lower (ratio of 43 to 63% pit to riverbank) than the river bank deposits. Similar concentrations for molybdenum (Mo) and selenium (Se) were identified for pit and riverbank sediments.

3.3 Hydrocarbons

Hydrocarbon results are provided in Table D3. All parameters analyzed were below Tier 1 guidelines. Hydrocarbon parameter fraction 3 (F3; C_{>16}-C₃₄) were only measured above the detection in the Bow River riverbank sediment samples.

3.4 Polycyclic Aromatic Hydrocarbons

Polycyclic aromatic hydrocarbons (PAH) results are provided in Table D4. Generally, most parameters analyzed were below Tier 1 guidelines. Samples exceeding Tier 1 guidelines were only identified in the riverbank samples and are summarized below:

- Anthracene: Anthracene exceeded Tier 1 guidelines at River Sample 2 (0.008 mg/kg) and River Sample 4 (0.015 mg/kg).
- Fluoranthene: Fluoranthene exceeded Tier 1 guidelines at River Sample 1 (0.07 mg/kg).
- Naphthalene: Naphthalene exceeded Tier 1 guidelines at River Sample 1 (0.017 mg/kg), River Sample 2 (0.019 mg/kg), and River Sample 4 (0.08 mg/kg).
- Phenanthrene: Phenanthrene exceeded Tier 1 guidelines at River Sample 4 (0.08 mg/kg).

3.5 Waste Characterization

Waste characterization results are provided in Table D5 and compared to the *Alberta User Guide for Waste Managers* (Alberta Environmental Protection 1996). All parameters analyzed were below *Alberta User Guide for Waste Managers* guidelines.

4 SUMMARY AND CONCLUSIONS

Based upon the analyses conducted on the shallow sand and gravel samples, the results suggest that the samples exhibit very similar chemical characteristics with the following exceptions:

- Comparison of riverbank sediments and operating pit area sediments salinity analyses indicated average parameter concentrations of the chloride and potassium ions were significantly higher (150%) in the near operating pit samples and whereas the riverbank samples had significantly higher (1.50%) calcium, sodium, and sulphate concentrations

- Riverbank sediments exhibited detectable F3 concentrations whereas the gravels in the vicinity of the pit had no detectable hydrocarbons
- Riverbank sediments exhibited PAHs which exceeded the Tier 1 guidelines for the protection of freshwater aquatic life.
- Pit area samples exhibited leachate metal concentrations were significantly lower (ratio of 43 to 63%) than the riverbank deposits. Similar concentrations for molybdenum and selenium were identified for pit and river bank sediments.

Figure D2a



Figure D2b



Figure D2c



Figure D2d



Figure D2e



Figure D2f



Figure D2g



Figure D2h



Figure D2h



TABLE D1

Soil Quality Results - Detailed Salinity

BURNCO Rock Products Ltd.

West Cochrane Gravel Pit

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Lab pH	Lab EC dS/m	SAR	Saturation %	Soluble Ions						Salt Remediation Guidelines ⁺		
									Na mg/kg	Ca mg/kg	Mg mg/kg	K mg/kg	Cl mg/kg	SO ₄ mg/kg	Soil Horizon	Salinity Rating	Sodicity Rating
Gravel Pit Location 1	0.15	0.15	25-Oct-21	3132324	7.23	0.4	0.39	39	4	13	7	4	10	14	Subsoil	Good	Good
Gravel Pit Location 2	0.15	0.15	25-Oct-21	3132365	7.6	0.47	0.25	44	4	25	5	10	9	15	Subsoil	Good	Good
Gravel Pit Location 3	0.15	0.15	25-Oct-21	3132366	7.64	0.42	0.4	29	3	8	7	3	8	10	Subsoil	Good	Good
Gravel Pit Location 4	0.15	0.15	25-Oct-21	3132367	7.61	0.6	1.18	66	25	22	18	10	43	41	Subsoil	Good	Good
River Sample 1	0.15	0.15	25-Oct-21	3132370	7.55	0.53	0.35	29	3	18	5	3	6	14	Subsoil	Good	Good
River Sample 2	0.15	0.15	25-Oct-21	3132371	7.53	0.75	0.28	56	7	62	16	5	10	64	Subsoil	Good	Good
River Sample 3	0.15	0.15	25-Oct-21	3132372	7.41	0.61	0.28	48	5	40	10	3	7	41	Subsoil	Good	Good
River Sample 4	0.15	0.15	25-Oct-21	3132373	7.41	0.68	2.79	58	48	26	8	3	13	56	Subsoil	Good	Good
Alberta Tier 1 - Natural Area ⁺					6-8.5 ^{ES}	+	+	NS	NS	NS	NS	NS	NS	NS	-	-	-
Salt Guideline for Subsoil (Good) ⁺					NS	3	4	NS	NS	NS	NS	NS	NS	NS	-	-	-

Notes:

--- - not analyzed

NS - not specified

^{ES} - indicates guideline for Direct Soil Contact (ecological) exposure pathway⁺ - Alberta Tier 1 Soil and Groundwater Remediation Guidelines (AEP 2019)**Italics** - indicates values do not meet applicable guidelines**Bold** - EC and/or SAR values do not meet the "good" subsoil rating category (AEP 2019)**Good subsoil** - EC <3 dS/m; SAR <4**Fair subsoil** - EC 3 to 5 dS/m; SAR 4 to 8**Poor subsoil** - EC 5 to 10 dS/m; SAR 8 to 12**Unsuitable subsoil** - EC >10 dS/m; SAR >12

TABLE D2

Soil Quality Results - Metals

BURNCO Rock Products Ltd.

West Cochrane Gravel Pit

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Sb mg/kg	As mg/kg	Ba mg/kg	Be mg/kg	B ^{SAT} mg/L	Cd mg/kg	Cr mg/kg	Cr ⁶⁺ mg/kg	Co mg/kg	Cu mg/kg	Pb mg/kg	Hg mg/kg	Mo mg/kg	Ni mg/kg	Se mg/kg	Ag mg/kg	Tl mg/kg	Sn mg/kg	U mg/kg	V mg/kg	Zn mg/kg
Gravel Pit Location 1	0.15	0.15	25-Oct-21	3132324	<0.5	4	156	<0.5	<0.5	<0.5	11.3	<0.3	4.9	9.7	5.9	<0.5	0.6	14.3	0.9	<0.5	<0.5	<0.5	<1	18.9	37
Gravel Pit Location 2	0.15	0.15	25-Oct-21	3132365	<0.5	3	70	<0.5	<0.5	<0.5	5.4	<0.3	2	3.5	2.7	<0.5	<0.5	6.7	0.6	<0.5	<0.5	<0.5	<1	9	17
Gravel Pit Location 3	0.15	0.15	25-Oct-21	3132366	<0.5	3	88.5	<0.5	<0.5	<0.5	7.2	<0.3	2.6	5.4	3.3	<0.5	0.5	8.9	1	<0.5	<0.5	<0.5	<1	12.5	24
Gravel Pit Location 4	0.15	0.15	25-Oct-21	3132367	<0.5	2	72.2	<0.5	<0.5	<0.5	5.6	<0.3	2.1	3.9	2.6	<0.5	0.5	7	0.7	<0.5	<0.5	<0.5	<1	8.8	21
River Sample 1	0.15	0.15	25-Oct-21	3132370	<0.5	6	180	0.6	<0.5	<0.5	11.7	<0.3	7.1	17.4	11.8	<0.5	0.7	22.6	0.6	<0.5	<0.5	<0.5	<1	17.2	58
River Sample 2	0.15	0.15	25-Oct-21	3132371	<0.5	7	143	<0.5	<0.5	<0.5	9.8	<0.3	5.4	8.3	7.4	<0.5	0.7	15.5	1	<0.5	<0.5	<0.5	<1	18	48
River Sample 3	0.15	0.15	25-Oct-21	3132372	<0.5	8	200	<0.5	<0.5	<0.5	16.6	<0.3	7.7	12.9	7.8	<0.5	0.6	22.2	0.8	<0.5	<0.5	<0.5	<1	24.6	54
River Sample 4	0.15	0.15	25-Oct-21	3132373	<0.5	5	129	<0.5	<0.5	<0.5	11.8	<0.3	5.4	8.2	6.4	<0.5	0.6	15.5	0.9	<0.5	<0.5	<0.5	<1	18.6	42
Pit to River Average Concentration Ratio						46%	59%				59%		45%	48%	43%		82%	49%	97%					63%	49%
Alberta Tier 1 - Natural Area ⁺					20 ^{ES}	17 ^{ES}	750 ^{ES}	5 ^{ES}	3.3 ^{ES}	3.8 ^{EL}	64 ^{ES}	0.4 ^{ES}	20 ^{ES}	63 ^{ES}	70 ^{EL}	12 ^{ES}	4 ^{ES}	45 ^{ES}	1 ^{ES}	20 ^{ES}	1 ^{EL}	5 ^{ES}	33 ^{EL}	130 ^{ES}	250 ^{ES}

Notes:

--- - not analyzed

EL - indicates guideline for Livestock Soil and Food Ingestion exposure pathway

ES - indicates guideline for Direct Soil Contact (ecological) exposure pathway

SAT - saturated paste

⁺ - Alberta Tier 1 Soil and Groundwater Remediation Guidelines (AEP 2019)**Italics** - indicates values do not meet applicable guidelines

TABLE D3**Soil Quality Results - Hydrocarbons**

BURNCO Rock Products Ltd.

West Cochrane Gravel Pit

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Benzene mg/kg	Toluene mg/kg	Ethylbenzene mg/kg	Xylenes mg/kg	F1 C ₆ -C ₁₀ - BTEX mg/kg	F2 C ₁₀ -C ₁₆ mg/kg	F3 C ₁₆ -C ₃₄ mg/kg	F4 C ₃₄ mg/kg
Gravel Pit Location 1	0.15	0.15	25-Oct-21	3132324	<0.005	<0.05	<0.01	<0.05	<10	<10	<10	<10
Gravel Pit Location 2	0.15	0.15	25-Oct-21	3132365	<0.005	<0.05	<0.01	<0.05	<10	<10	<10	<10
Gravel Pit Location 3	0.15	0.15	25-Oct-21	3132366	<0.005	<0.05	<0.01	<0.05	<10	<10	<10	<10
Gravel Pit Location 4	0.15	0.15	25-Oct-21	3132367	<0.005	<0.05	<0.01	<0.05	<10	<10	<10	<10
River Sample 1	0.15	0.15	25-Oct-21	3132370	<0.005	<0.05	<0.01	<0.05	<10	<10	18	<10
River Sample 2	0.15	0.15	25-Oct-21	3132371	<0.005	<0.05	<0.01	<0.05	<10	<10	25	<10
River Sample 3	0.15	0.15	25-Oct-21	3132372	<0.005	<0.05	<0.01	<0.05	<10	<10	12	<10
River Sample 4	0.15	0.15	25-Oct-21	3132373	<0.005	<0.05	<0.01	<0.05	<10	<10	17	<10
Alberta Tier 1 - Coarse-grained Surface Soils - Natural Areas+					0.078^{HD}	0.12^{EA}	0.14^{HD}	1.9^{HD}	210^{ES}	150^{ES}	300^{ES}	2800^{ES}
Alberta Tier 1 - Fine-grained Surface Soils - Natural Areas+					0.046^{HD}	0.52^{HD}	0.073^{HD}	0.99^{HD}	210^{ES}	150^{ES}	1300^{ES}	5600^{ES}

Notes:

--- - not analyzed

EA - indicates guideline for Protection of Freshwater Aquatic Life exposure pathway

ES - indicates guideline for Direct Soil Contact (ecological) exposure pathway

HD - indicates guideline for Protection of Domestic Use Aquifer exposure pathway

+ - *Alberta Tier 1 Soil and Groundwater Remediation Guidelines* (AEP 2019)

F4 - F4 fraction shown represents either extractable, gravimetric or post-silica gel gravimetric petroleum hydrocarbons (PHC)

Italics - indicates values do not meet applicable guidelines

TABLE D4
Soil Quality Results - Polycyclic Aromatic Hydrocarbons
BURNCO Rock Products Ltd.
West Cochrane Gravel Pit

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Acenaphthene mg/kg	Acenaphthylene mg/kg	Anthracene mg/kg	Acridine mg/kg	Benz[a]anthracene++ mg/kg	Benzo[a]pyrene++ mg/kg	Benzo[b&j]fluoranthene++ mg/kg	Benzo[g,h,i]perylene++ mg/kg	Benzo[k]fluoranthene++ mg/kg	Chrysene ++ mg/kg	Dibenz[a,h]anthracene++ mg/kg	Indeno[1,2,3-cd]pyrene++ mg/kg	Fluoranthene mg/kg	Fluorene mg/kg	Naphthalene mg/kg	Phenanthrene mg/kg	Pyrene mg/kg	Quinoline mg/kg	2-Methylnaphthalene mg/kg	IACR - Coarse-grained soils	IACR -Fine-grained soils	B[a]P TPE mg/kg
Gravel Pit Location 1	0.15	0.15	25-Oct-21	3132324	<0.005	<0.005	<0.004	<0.05	<0.02	<0.03	<0.03	<0.05	<0.02	<0.05	<0.005	<0.02	<0.01	<0.02	<0.005	<0.02	<0.01	<0.05	<0.005	ND	ND	ND
Gravel Pit Location 2	0.15	0.15	25-Oct-21	3132365	<0.005	<0.005	<0.004	<0.05	<0.02	<0.03	<0.03	<0.05	<0.02	<0.05	<0.005	<0.02	<0.01	<0.02	<0.005	<0.02	<0.01	<0.05	<0.005	ND	ND	ND
Gravel Pit Location 3	0.15	0.15	25-Oct-21	3132366	<0.005	<0.005	<0.004	<0.05	<0.02	<0.03	<0.03	<0.05	<0.02	<0.05	<0.005	<0.02	<0.01	<0.02	<0.005	<0.02	<0.01	<0.05	<0.005	ND	ND	ND
Gravel Pit Location 4	0.15	0.15	25-Oct-21	3132367	<0.005	<0.005	<0.004	<0.05	<0.02	<0.03	<0.03	<0.05	<0.02	<0.05	<0.005	<0.02	<0.01	<0.02	<0.005	<0.02	<0.01	<0.05	<0.005	ND	ND	ND
River Sample 1	0.15	0.15	25-Oct-21	3132370	<0.005	<0.005	0.004	<0.05	0.04	0.04	0.07	<0.05	0.02	<0.05	<0.005	0.03	0.07	<0.02	0.017	0.04	0.06	<0.05	0.036	0.04	0.07	0.06
River Sample 2	0.15	0.15	25-Oct-21	3132371	<0.005	<0.005	0.008	<0.05	0.02	<0.03	<0.03	<0.05	<0.02	<0.05	<0.005	<0.02	0.04	<0.02	0.019	0.06	0.03	<0.05	0.034	0.00	0.00	0.00
River Sample 3	0.15	0.15	25-Oct-21	3132372	<0.005	<0.005	<0.004	<0.05	<0.02	<0.03	<0.03	<0.05	<0.02	<0.05	<0.005	<0.02	<0.01	<0.02	0.011	<0.02	<0.01	<0.05	0.018	ND	ND	ND
River Sample 4	0.15	0.15	25-Oct-21	3132373	0.009	<0.005	0.015	<0.05	0.02	<0.03	<0.03	<0.05	<0.02	<0.05	<0.005	<0.02	0.05	<0.02	0.04	0.08	0.05	<0.05	0.04	0.00	0.00	0.00
Alberta Tier 1 - Coarse-grained Soils - Natural Areas ⁺					0.38 ^{EA}	NS	0.0056 ^{EA}	NS	6.2 ^{EL,EW}	0.60 ^{EL,EW}	6.2 ^{EL,EW}	NS	6.2 ^{EL,EW}	6.2 ^{EL,EW}	NS	NS	0.055 ^{EA}	0.34 ^{EA}	0.017 ^{EA}	0.061 ^{EA}	0.15 ^{EA}	NS	NS	1.0 ^{HD}	NA	NA
Alberta Tier 1 - Fine-grained Soils - Natural Areas ⁺					0.33 ^{EA}	NS	1.3 ^{EA}	NS	6.2 ^{EL,EW}	0.60 ^{EL,EW}	6.2 ^{EL,EW}	NS	6.2 ^{EL,EW}	6.2 ^{EL,EW}	NS	NS	15.4 ^{EL,EW}	0.40 ^{EA}	0.014 ^{EA}	0.11 ^{EA}	7.7 ^{EL,EW}	NS	NS	NA	1.0 ^{HD}	NA

Notes:

- - not analyzed
- NA - not applicable
- NS - not specified
- ND - not detected
- ^{EA} - indicates guideline for Protection of Freshwater Aquatic Life exposure pathway
- ^{EL} - indicates guideline for Livestock Soil and Food Ingestion exposure pathway
- ^{EW} - indicates guideline for Wildlife Soil and Food Ingestion exposure pathway
- ^{HD} - indicates guideline for Protection of Domestic Use Aquifer exposure pathway
- ++ - carcinogenic PAH compounds
- IACR - Index of Additive Cancer Risk for Human Health calculated by Matrix Solutions
- B[a]P TPE - Benzo[a]pyrene Total Potency Equivalents calculated by Matrix Solutions
- ⁺ - Alberta Tier 1 Soil and Groundwater Remediation Guidelines (AEP 2019)
- Italics* - indicates values do not meet applicable guidelines

TABLE D5**Soil Quality Results - Waste Characterization**

BURNCO Rock Products Ltd.

West Cochrane Gravel Pit

Sample Point Sample Depth Sample Date MSI Sample Number		Gravel Pit North Composite 0.15 25-Oct-21 3132368	Gravel Pit South Composite 0.15 25-Oct-21 3132369	River West Composite 0.15 25-Oct-21 3132374	River East Composite 0.15 25-Oct-21 3132375	Alberta User Guide for Waste Managers Criteria*
Leachable Metals						
Antimony	mg/L	<0.5	<0.5	<0.5	<0.5	500
Arsenic	mg/L	<0.5	<0.5	<0.5	<0.5	5
Barium	mg/L	0.9	<0.5	1	0.8	100
Beryllium	mg/L	<0.5	<0.5	<0.5	<0.5	5
Boron	mg/L	<0.5	<0.5	<0.5	<0.5	500
Cadmium	mg/L	<0.1	<0.1	<0.1	<0.1	1
Chromium	mg/L	<0.5	<0.5	<0.5	<0.5	5
Cobalt	mg/L	<0.5	<0.5	<0.5	<0.5	100
Copper	mg/L	<0.5	<0.5	<0.5	<0.5	100
Iron	mg/L	<0.5	<0.5	<0.5	<0.5	1000
Lead	mg/L	<0.5	<0.5	<0.5	<0.5	5
Mercury	mg/L	<0.1	<0.1	<0.1	<0.1	0.2
Nickel	mg/L	<0.5	<0.5	<0.5	<0.5	5
Selenium	mg/L	<0.5	<0.5	<0.5	<0.5	1
Silver	mg/L	<0.5	<0.5	<0.5	<0.5	5
Thallium	mg/L	<0.5	<0.5	<0.5	<0.5	5
Uranium	mg/L	<0.5	<0.5	<0.5	<0.5	2
Vanadium	mg/L	<0.5	<0.5	<0.5	<0.5	100
Zinc	mg/L	<0.5	<0.5	<0.5	<0.5	500
Zirconium	mg/L	<0.5	<0.5	<0.5	<0.5	500

Notes:

NS - not specified

* - *Alberta User Guide for Waste Managers* (Alberta Environmental Protection 1996)**Italics** - indicates values do not meet applicable guidelines

APPENDIX E

Field-verified Survey

TABLE E-1

Field Verified Survey Summary

Burnco Rock Products Ltd.

Burnco West Cochrane Gravel Pit

Water Source Number	Legal Land Location	Landowner	GIC Well ID	Well Name*	Depth m	Water Level (m bgs)	Completion Unit	Water Source Status*	Use*
1	NW-15-026-5 W5M	Bert Levesque	-	House Well	36.33*	25.02*	-	Operational	Domestic, Livestock, Garden
-	NE-16-026-5 W5M	Dianne and Wendal Young	-	House Well	-	-	-	Operational	Domestic, Livestock, Garden
2	NW-15-026-5 W5M	Darrel Cornish	-	North Well	24.4*	7.6*	Gravel*	Operational	Domestic, Livestock, Garden
3	NW-15-026-5 W5M	Darrel Cornish	-	South Well	70.1*	-	-	Seasonal Operation	Domestic, Livestock, Garden
4	SW-22-026-5 W5M	Dave Dutchik	-	North Well	51.8*	-	-	Operational	Domestic, Livestock, Garden
5	SW-22-026-5 W5M	Dave Dutchik	-	Barn Well	42.7*	-	-	Operational	Livestock
6	SW-22-026-5 W5M	Dave Dutchik	-	South Well	-	-	-	Operational	Livestock
7	SW-22-026-5 W5M	Dave Dutchik	-	Abandoned Well	-	-	-	Not in use	-
8	SW-22-026-5 W5M	Dave Dutchik	-	Spring 1	-	-	-	Operational	Livestock
9	NW-23-026-5 W5M	Dave Dutchik	-	East Well	14.0*	-	-	Operational	Livestock
10	NW-23-026-5 W5M	Dave Dutchik	-	West Well	85.3*	-	-	Operational	Domestic
11	NW-23-026-5 W5M	Dave Dutchik	-	Spring 2	-	-	-	Operational	Livestock
12	NW-15-026-5 W5M	Dave Felthua	-	Well 1	-	-	-	Operational	Domestic, Livestock, Garden
13	NW-15-026-5 W5M	Dave Felthua	-	Well 2	-	-	-	Operational	Domestic, Livestock, Garden
14	NW-15-026-5 W5M	Dave Felthua	-	Well 3	-	-	-	Operational	Domestic, Livestock, Garden
-	-	Georgena Decagny	-	Primary Well	-	91.4*	-	-	Domestic and Livestock
-	-	Georgena Decagny	-	Secondary Well	-	-	-	Not in use	Domestic
-	-	Georgena Decagny	-	Dugout Well	-	-	-	Dry	-
15	SE-22-026-5 W5M	Ann McKendrick McNabb	386518	Stock Water Well 1	25.91**	19.81*	Sand and Gravel**	Operational	Livestock
16	SE-22-026-5 W5M	Ann McKendrick McNabb	386519	Stock Water Well 2	54.86**	32*	Sandstone**	Operational	Livestock
17	SW-23-026-5 W5M	Ann McKendrick McNabb	9826181	Domestic Water Well	30.48**	14.33*	Sandstone**	Operational	Domestic
18	SE-23-026-5 W5M	Mckendrick Ranches Ltd.	9826378	Stock Water Well 1	33.53**	8*	Sandstone**	Operational	Livestock
19	SW-24-026-5 W5M	Mckendrick Ranches Ltd.	386531	Stock Water Well 2	33.53**	23.16*	Sandstone and Shale**	Operational	Livestock
20	NE-24-26-5 W5M	Mckendrick Ranches Ltd.	1060818	Stock Water Well 3	60.96**	23.16*	Sandstone and Shale**	Operational	Livestock
21	NE-22-026-5 W5M	Mckendrick Ranches Ltd.	-	Dugout 1	-	-	-	Seasonal Operation	Livestock
22	NE-22-026-5 W5M	Mckendrick Ranches Ltd.	-	Dugout 2	-	-	-	Seasonal Operation	Livestock
23	NE-22-026-5 W5M	Mckendrick Ranches Ltd.	-	Dugout 3	-	-	-	Seasonal Operation	Livestock
24	NE-22-026-5 W5M	Mckendrick Ranches Ltd.	-	Spring 1	-	-	-	Seasonal Operation	Livestock
25	NE-22-026-5 W5M	Mckendrick Ranches Ltd.	-	Spring 2	-	-	-	Seasonal Operation	Livestock
26	NE-22-026-5 W5M	Mckendrick Ranches Ltd.	-	Spring 3	-	-	-	Seasonal Operation	Livestock
27	SE-8-026-4 W5M	Mckendrick Ranches Ltd.	-	Spring 4	-	-	Gravel and Sandstone**	Seasonal Operation	Livestock
28	SE-8-026-4 W5M	Mckendrick Ranches Ltd.	-	Spring 5	-	-	Gravel and Sandstone**	Seasonal Operation	Livestock
29	SE-8-026-4 W5M	Mckendrick Ranches Ltd.	-	Spring 6	-	-	Gravel and Sandstone**	Seasonal Operation	Livestock
30	NE-18-026-4 W5M	BURNCO	349481	Water Well 1	27.43**	16.38	Sandstone**	Operational	Domestic and Livestock
31	SE-18-026-4 W5M	BURNCO	386379	Water Well 2	93.88*	53.95**	Sandstone and Shale**	Operational	Domestic
32	SE-18-026-4 W5M	BURNCO	386380	Water Well 3	18.92**	16.72	Shale and Sandy Stringers**	Operational	Domestic
33	SE-18-026-4 W5M	BURNCO	-	Non-registered Water Well	1.16	-	-	Abandoned	-

Notes:

* Verbal communication from landowner

** Based on drilling report records

SE 22-26-5 W5M - Stock Water Well (1)	
Owner/Lessee Name	Ann McKendrick McNabb
Legal Land Location/GPS of Source	8-22-26-5 W5M 51.232369, -114.609389
Surface Elevation	1223m
Type of Water Source	Unconsolidated
Water Source/Well Status	In Use
Original Non-Pumping Water Level and Date Recorded	19.81m - 1983/11/09
Well Completion Details	Well ID - 386518 - 1983/11/09
Pumping Rate	Pumping Rates (Report) - 3.00g/min (Max)
Current Estimated Water Requirements	N/A
Purpose of Well Use	Stock
Historical Chemical Results	N/A

SE 22-26-5 W5M - Stock Water Well (2)	
Owner/Lessee Name	Ann McKendrick McNabb
Legal Land Location/GPS of Source	SE 22-26-5 W5M 51.230561, -114.612269
Surface Elevation	1129m
Type of Water Source	Unconsolidated/Consolidated
Water Source/Well Status	In Use
Original Non-Pumping Water Level and Date Recorded	32.00m - 1983/11/07
Well Completion Details	Well ID - 386519 - 1983/11/07
Pumping Rate	Pumping Rates (Report) - 5.00g/min (Recommended) 8.00g/min (Max)
Current Estimated Water Requirements	N/A
Purpose of Well Use	Stock
Historical Chemical Results	N/A

SW 23-26-5 W5M - Domestic Water Well	
Owner/Lessee Name	McKendrick Ranches Ltd.
Legal Land Location/GPS of Source	SW 23-26-5 W5M 51.233440, -114.599480
Surface Elevation	1234m
Type of Water Source	Consolidated
Water Source/Well Status	In Use
Original Non-Pumping Water Level and Date Recorded	14.33m - 2017/12/05
Well Completion Details	Well ID - 9826181 - 2017/12/05
Pumping Rate	Pumping Rates (Report) - 10.00g/min (Recommended) 38.00g/min (Max)
Current Estimated Water Requirements	N/A
Purpose of Well Use	Domestic
Historical Chemical Results	N/A

SE 23-26-5 W5M - Stock Water Well

Owner/Lessee Name	McKendrick Ranches Ltd.
Legal Land Location/GPS of Source	1-23-26-5 W5M 51.229016, -114.585798
Surface Elevation	1193m
Type of Water Source	Consolidated
Water Source/Well Status	In Use
Original Non-Pumping Water Level and Date Recorded	8.00m - 2019/06/06
Well Completion Details	Well ID - 9826378 - 2019/06/06
Pumping Rate	Pumping Rates (Report) - 6.50g/min (Recommended) 7.50g/min (Max)
Current Estimated Water Requirements	N/A
Purpose of Well Use	Stock
Historical Chemical Results	N/A

SW 24-26-5 W5M - Stock Water Well

Owner/Lessee Name	McKendrick Ranches Ltd.
Legal Land Location/GPS of Source	SW 24-26-5 W5M 51.227897, -114.582396
Surface Elevation	1192m
Type of Water Source	Consolidated
Water Source/Well Status	In Use
Original Non-Pumping Water Level and Date Recorded	23.16m - 1977/02/19
Well Completion Details	Well ID - 386531 - 1977/02/19
Pumping Rate	Pumping Rates (Report) - 20.00g/min (Max)
Current Estimated Water Requirements	N/A
Purpose of Well Use	Stock
Historical Chemical Results	N/A



Water Well Drilling Report

[View in Metric](#) [Export to Excel](#)

GIC Well ID 386518
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 1983/11/18

GOWN ID

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

Well Identification and Location										Measurement in Imperial	
Owner Name		Address		Town		Province		Country		Postal Code	
MCNABB, GRANT/ANN #2		P.O. BOX 264 COCHRANE						CANADA		T0L 0W0	
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description		
	8	22	26	5	5						
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ ft from _____					Latitude <u>51.232369</u> Longitude <u>-114.609389</u>					Elevation _____ ft	
_____ ft from _____					How Location Obtained					How Elevation Obtained	
					Map					Not Obtained	

Drilling Information	
Method of Drilling	Type of Work
Cable Tool	New Well
Proposed Well Use	
Stock	

Formation Log			Measurement in Imperial	
Depth from ground level (ft)	Water Bearing	Lithology Description		
2.00		Topsoil		
14.00		Brown Clay		
30.00		Gray Clay & Rocks		
54.00		Silty Sand		
67.00		Silty Sand & Gravel		
76.00		Silty Sand		
79.00	Yes	Water Bearing Sand & Gravel		
85.00		Silty Clay		

Yield Test Summary			Measurement in Imperial	
Recommended Pump Rate _____ igpm				
Test Date	Water Removal Rate (igpm)	Static Water Level (ft)		
1983/11/09	3.00	65.00		

Well Completion			Measurement in Imperial	
Total Depth Drilled	Finished Well Depth	Start Date	End Date	
85.00 ft			1983/11/09	
Borehole				
Diameter (in)	From (ft)	To (ft)		
0.00	0.00	85.00		
Surface Casing (if applicable)		Well Casing/Liner		
Steel		Steel		
Size OD :	6.00 in	Size OD :	5.00 in	
Wall Thickness :	0.188 in	Wall Thickness :	0.156 in	
Bottom at :	74.00 ft	Top at :	0.00 ft	
		Bottom at :	85.00 ft	
Perforations				
From (ft)	To (ft)	Diameter or Slot Width(in)	Slot Length (in)	Hole or Slot Interval(in)
74.00	82.00	0.125		12.00
Perforated by Torch				
Annular Seal Driven				
Placed from _____ 0.00 ft to _____ 0.00 ft				
Amount _____				
Other Seals				
Type		At (ft)		
Screen Type				
Size OD : _____ 0.00 in				
From (ft)	To (ft)	Slot Size (in)		
Attachment _____				
Top Fittings _____		Bottom Fittings _____		
Pack				
Type _____		Grain Size _____		
Amount _____				

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well	Certification No
UNKNOWN NA DRILLER	1
Company Name	Copy of Well report provided to owner
INTERPROVINCIAL DRILLING CONTRACTORS	Date approval holder signed



Water Well Drilling Report

[View in Metric](#) [Export to Excel](#)

GIC Well ID 386518
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 1983/11/18

GOWN ID

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

Well Identification and Location										Measurement in Imperial
Owner Name		Address		Town		Province		Country	Postal Code	
MCNABB, GRANT/ANN #2		P.O. BOX 264 COCHRANE						CANADA	T0L 0W0	
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description	
	8	22	26	5	5					
Measured from Boundary of				GPS Coordinates in Decimal Degrees (NAD 83)						
ft from				Latitude 51.232369 Longitude -114.609389				Elevation ft		
ft from				How Location Obtained				How Elevation Obtained		
				Map				Not Obtained		

Additional Information										Measurement in Imperial
Distance From Top of Casing to Ground Level in										
Is Artesian Flow										
Rate igpm										
Is Flow Control Installed										
Describe										
Recommended Pump Rate										ft
Recommended Pump Intake Depth (From TOC)										82.00 ft
Pump Installed										
Type										
Make										
Model (Output Rating)										
Did you Encounter Saline Water (>4000 ppm TDS)										
Depth ft										
Well Disinfected Upon Completion										
Gas										
Depth ft										
Geophysical Log Taken										
Submitted to ESRD										
Sample Collected for Potability										
Submitted to ESRD										
Additional Comments on Well										
WATER IS MEDIUM HARD. WATER COMES IN @ 3 GPM FROM GRAVEL & SAND LAYER. INFORMATION TAKEN FROM DROUGHT EMERGENCY WATER SUPPLY APPLICATION OF 1985/12/11. OWNER REPORTS WELL YIELD OF 3 GPM BUT STARTING TO DROP OFF.										

Yield Test			Taken From Ground Level	Measurement in Imperial
			Depth to water level	
Test Date	Start Time	Static Water Level		
1983/11/09	12:00 AM	65.00 ft		
			Pumping (ft)	Elapsed Time
				Minutes:Sec
				Recovery (ft)
Method of Water Removal				
Type Bailer				
Removal Rate 3.00 igpm				
Depth Withdrawn From 75.00 ft				
If water removal period was < 2 hours, explain why				

Water Diverted for Drilling		
Water Source	Amount Taken	Diversion Date & Time
	ig	

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well	Certification No
UNKNOWN NA DRILLER	1
Company Name	Copy of Well report provided to owner
INTERPROVINCIAL DRILLING CONTRACTORS	Date approval holder signed



Water Well Drilling Report

[View in Metric](#) [Export to Excel](#)

GIC Well ID 386519
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 1989/12/12

GOWN ID

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

Well Identification and Location										Measurement in Imperial
Owner Name		Address		Town		Province		Country	Postal Code	
MCNABB, GRANT/ANN		P.O. BOX 264 COCHRANE							TOL OW0	
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description	
	SE	22	26	5	5					
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)					
ft from					Latitude 51.230561 Longitude -114.612269					Elevation ft
ft from					How Location Obtained					How Elevation Obtained
					Map					Not Obtained

Drilling Information	
Method of Drilling	Type of Work
Rotary	New Well
Proposed Well Use	
Domestic & Stock	

Formation Log			Measurement in Imperial
Depth from ground level (ft)	Water Bearing	Lithology Description	
2.00		Topsoil	
38.00		Sandy Clay	
131.00		Silty Sand & Gravel	
136.00	Yes	Water Bearing Sand & Gravel	
140.00		Gravelly Clay & Boulders	
141.00		Gravelly Clay & Boulders	
152.00		Brown Fine Grained Sandstone	
174.00	Yes	Water Bearing Sandstone	
180.00		Fine Grained Sandstone	

Yield Test Summary			Measurement in Imperial
Recommended Pump Rate			5.00 igpm
Test Date	Water Removal Rate (igpm)	Static Water Level (ft)	
1989/11/07	8.00	105.00	

Well Completion			Measurement in Imperial
Total Depth Drilled	Finished Well Depth	Start Date	End Date
180.00 ft			1989/11/08
Borehole			
Diameter (in)	From (ft)	To (ft)	
0.00	0.00	180.00	
Surface Casing (if applicable)		Well Casing/Liner	
Steel			
Size OD :	6.63 in	Size OD :	0.00 in
Wall Thickness :	0.188 in	Wall Thickness :	0.000 in
Bottom at :	141.00 ft	Top at :	0.00 ft
		Bottom at :	0.00 ft
Perforations			
From (ft)	To (ft)	Diameter or Slot Width(in)	Slot Length (in)
			Hole or Slot Interval(in)
Perforated by			
Annular Seal Driven			
Placed from 0.00 ft to 141.00 ft			
Amount			
Other Seals			
Type		At (ft)	
Screen Type			
Size OD : 0.00 in			
From (ft)	To (ft)	Slot Size (in)	
Attachment			
Top Fittings		Bottom Fittings	
Pack			
Type		Grain Size	
Amount			

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well	Certification No
UNKNOWN NA DRILLER	1
Company Name	Copy of Well report provided to owner
KRIEGER DRILLING LTD.	Date approval holder signed



Water Well Drilling Report

[View in Metric](#) [Export to Excel](#)

GIC Well ID 386519
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 1989/12/12

GOWN ID

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

Well Identification and Location										Measurement in Imperial	
Owner Name		Address			Town		Province		Country	Postal Code	
MCNABB, GRANT/ANN		P.O. BOX 264 COCHRANE								TOL OW0	
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description		
	SE	22	26	5	5						
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
ft from					Latitude 51.230561 Longitude -114.612269					Elevation ft	
ft from					How Location Obtained					How Elevation Obtained	
					Map					Not Obtained	

Additional Information										Measurement in Imperial
Distance From Top of Casing to Ground Level in										
Is Artesian Flow										
Rate igpm										
Is Flow Control Installed										
Describe										
Recommended Pump Rate 5.00 igpm										
Pump Installed										
Depth ft										
Recommended Pump Intake Depth (From TOC) 170.00 ft										
Type										
Make										
H.P.										
Model (Output Rating)										
Did you Encounter Saline Water (>4000 ppm TDS)										
Depth ft										
Well Disinfected Upon Completion										
Gas										
Depth ft										
Geophysical Log Taken										
Submitted to ESRD										
Sample Collected for Potability										
Submitted to ESRD										
Additional Comments on Well										
WATER COMES IN 131'-136' @ 3 GPM, 152'-174' @ 8 GPM.										

Yield Test			Taken From Ground Level	Measurement in Imperial
			Depth to water level	
Test Date	Start Time	Static Water Level		
1989/11/07	12:00 AM	105.00 ft		
			Pumping (ft)	Elapsed Time
				Minutes:Sec
				Recovery (ft)
Method of Water Removal				
Type Bailer				
Removal Rate 8.00 igpm				
Depth Withdrawn From 160.00 ft				
If water removal period was < 2 hours, explain why				

Water Diverted for Drilling		
Water Source	Amount Taken	Diversion Date & Time
	ig	

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well	Certification No
UNKNOWN NA DRILLER	1
Company Name	Copy of Well report provided to owner
KRIEGER DRILLING LTD.	Date approval holder signed



Water Well Drilling Report

[View in Metric](#) [Export to Excel](#)

GIC Well ID 9826378
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 2019/06/19

GOWN ID

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

Well Identification and Location										Measurement in Imperial	
Owner Name MCKENDRICK RANCHES LTD		Address P.O. BOX 264		Town COCHRANE		Province ALBERTA		Country CANADA	Postal Code T4C 1A5		
Location	1/4 or LSD 1	SEC 23	TWP 26	RGE 5	W of MER 5	Lot	Block	Plan	Additional Description WELL#2		
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
ft from _____					Latitude <u>51.229016</u> Longitude <u>-114.585798</u>					Elevation <u>3973.10</u> ft	
ft from _____					How Location Obtained					How Elevation Obtained	
					Differential corrected handheld GPS 5-10m					Differential corrected handheld GPS 5-10m	

Drilling Information	
Method of Drilling Rotary - Air	Type of Work New Well
Proposed Well Use Domestic	

Formation Log			Measurement in Imperial	
Depth from ground level (ft)	Water Bearing	Lithology Description		
30.00		Clay		
42.00		Sand		
72.00		Clay & Gravel		
77.00		Gray Shale		
81.00		Blue Shale		
95.00	Yes	Gray Fractured Sandstone		
110.00		Gray Shale		

Yield Test Summary			Measurement in Imperial	
Recommended Pump Rate <u>6.50</u> igpm				
Test Date	Water Removal Rate (igpm)	Static Water Level (ft)		
2019/06/06	7.50	26.24		

Well Completion				Measurement in Imperial	
Total Depth Drilled	Finished Well Depth	Start Date	End Date		
110.00 ft	110.00 ft	2019/06/05	2019/06/06		
Borehole					
Diameter (in)	From (ft)	To (ft)			
6.75	0.00	80.00			
5.00	80.00	110.00			
Surface Casing (if applicable)			Well Casing/Liner		
Steel			Plastic		
Size OD : <u>5.56</u> in			Size OD : <u>4.50</u> in		
Wall Thickness : <u>0.258</u> in			Wall Thickness : <u>0.237</u> in		
Bottom at : <u>80.00</u> ft			Top at : <u>30.00</u> ft		
			Bottom at : <u>110.00</u> ft		
Perforations					
From (ft)	To (ft)	Diameter or Slot Width(in)	Slot Length (in)	Hole or Slot Interval(in)	
80.00	95.00	0.500		12.00	
Perforated by Drill					
Annular Seal Bentonite Slurry					
Placed from <u>0.00</u> ft to <u>80.00</u> ft					
Amount <u>200.00</u> Gallons					
Other Seals					
Type				At (ft)	
Drive Shoe				80.00	
K-Packer				79.00	
Screen Type					
Size OD : _____ in					
From (ft)		To (ft)		Slot Size (in)	
Attachment _____					
Top Fittings _____			Bottom Fittings _____		
Pack					
Type _____				Grain Size _____	
Amount _____					

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well LYNDON STINSON	Certification No 57644A
Company Name ALTAIR WATER AND DRILLING SERVICES INC.	Copy of Well report provided to owner Date approval holder signed Yes 2019/06/06



Water Well Drilling Report

[View in Metric](#) [Export to Excel](#)

GIC Well ID 9826378
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 2019/06/19

GOWN ID

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

Well Identification and Location										Measurement in Imperial	
Owner Name		Address			Town		Province		Country	Postal Code	
MCKENDRICK RANCHES LTD		P.O. BOX 264			COCHRANE		ALBERTA		CANADA	T4C 1A5	
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description		
1		23	26	5	5				WELL#2		
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
ft from					Latitude 51.229016 Longitude -114.585798					Elevation 3973.10 ft	
ft from					How Location Obtained					How Elevation Obtained	
					Differential corrected handheld GPS 5-10m					Differential corrected handheld GPS 5-10m	

Additional Information										Measurement in Imperial	
Distance From Top of Casing to Ground Level 24.00 in											
Is Artesian Flow										Is Flow Control Installed	
Rate igpm										Describe	
Recommended Pump Rate 6.50 igpm										Pump Installed	
Recommended Pump Intake Depth (From TOC) 80.00 ft										Depth ft	
										Type Make H.P.	
										Model (Output Rating)	
Did you Encounter Saline Water (>4000 ppm TDS)										Well Disinfected Upon Completion Yes	
Gas										Geophysical Log Taken	
										Submitted to ESRD	
Additional Comments on Well										Sample Collected for Potability	
1 GRAIN HARD, 0 PPM IRON										Submitted to ESRD	

Yield Test			Taken From Top of Casing		Measurement in Imperial	
			Depth to water level			
Test Date	Start Time	Static Water Level				
2019/06/06	7:45 AM	26.24 ft				
Method of Water Removal						
Type Pump						
Removal Rate 7.50 igpm						
Depth Withdrawn From 84.00 ft						
If water removal period was < 2 hours, explain why						
			Pumping (ft)	Elapsed Time	Recovery (ft)	
				Minutes:Sec		
			26.25	0:00	84.02	
			48.33	1:00	77.76	
			57.28	2:00	73.16	
			63.42	3:00	69.23	
			67.95	4:00	66.04	
			69.59	5:00	63.32	
			70.31	6:00	61.55	
			70.24	7:00	59.61	
			70.54	8:00	57.41	
			71.16	9:00	56.43	
			71.52	10:00		
			72.60	12:00	55.02	
			74.15	14:00	53.81	
			75.33	16:00	52.66	
			75.13	18:00	52.03	
			74.90	20:00	51.25	
			74.97	25:00	49.87	
			75.85	30:00	48.72	
			76.71	35:00	47.57	
			77.49	40:00	46.82	
			78.87	50:00	45.34	
			79.79	60:00	44.26	
			81.43	75:00	42.55	
			81.46	90:00	41.63	
			83.20	105:00	40.72	
			84.02	120:00	39.86	

Water Diverted for Drilling		
Water Source	Amount Taken	Diversion Date & Time
BOW RIVER	1000.00 ig	2019/06/05 8:00 AM

Contractor Certification		
Name of Journeyman responsible for drilling/construction of well	Certification No	
LYNDON STINSON	57644A	
Company Name	Copy of Well report provided to owner	Date approval holder signed
ALTAIR WATER AND DRILLING SERVICES INC.	Yes	2019/06/06



Water Well Drilling Report

[View in Imperial](#) [Export to Excel](#)

GIC Well ID 9826181
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 2017/12/07

GOWN ID

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

Well Identification and Location										Measurement in Metric	
Owner Name MCKENDRICK RANCHES LTD		Address P.O. BOX 264		Town COCHRANE		Province ALBERTA		Country CANADA	Postal Code T4C 1A5		
Location	1/4 or LSD 6	SEC 23	TWP 26	RGE 5	W of MER 5	Lot	Block	Plan	Additional Description		
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ m from _____					Latitude <u>51.233440</u> Longitude <u>-114.599480</u>					Elevation <u>1234.44</u> m	
_____ m from _____					How Location Obtained					How Elevation Obtained	
					Differential corrected handheld GPS 5-10m					Differential corrected handheld GPS 5-10m	

Drilling Information	
Method of Drilling Rotary - Air	Type of Work New Well
Proposed Well Use Stock	

Formation Log			Measurement in Metric	
Depth from ground level (m)	Water Bearing	Lithology Description		
4.27		Clay		
16.46		Sand		
22.56		Gray Shale		
28.35	Yes	Gray Sandstone		
30.48		Gray Shale		

Yield Test Summary			Measurement in Metric	
Recommended Pump Rate		<u>45.46</u> L/min		
Test Date	Water Removal Rate (L/min)	Static Water Level (m)		
2017/12/05	172.75	14.33		

Well Completion				Measurement in Metric	
Total Depth Drilled	Finished Well Depth	Start Date	End Date		
30.48 m	30.48 m	2017/12/05	2017/12/05		
Borehole					
Diameter (cm)	From (m)	To (m)			
17.15	0.00	18.29			
12.70	18.29	30.48			
Surface Casing (if applicable)			Well Casing/Liner		
Steel			Plastic		
Size OD : <u>14.13</u> cm			Size OD : <u>11.43</u> cm		
Wall Thickness : <u>0.655</u> cm			Wall Thickness : <u>0.602</u> cm		
Bottom at : <u>18.29</u> m			Top at : <u>12.19</u> m		
			Bottom at : <u>30.48</u> m		
Perforations					
From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval (cm)	
22.56	27.43	1.168		30.48	
Perforated by Drill					
Annular Seal Bentonite Slurry					
Placed from <u>0.00</u> m to <u>18.29</u> m					
Amount <u>150.00</u> Gallons					
Other Seals					
Type				At (m)	
Drive Shoe				18.29	
Screen Type					
Size OD : _____ cm					
From (m)		To (m)		Slot Size (cm)	
Attachment _____					
Top Fittings _____			Bottom Fittings _____		
Pack					
Type _____			Grain Size _____		
Amount _____					

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well RILEY PEARSON	Certification No 83061A
Company Name ALTAIR WATER AND DRILLING SERVICES INC.	Copy of Well report provided to owner Yes
	Date approval holder signed 2017/12/06



Water Well Drilling Report

[View in Imperial](#) [Export to Excel](#)

GIC Well ID 9826181
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 2017/12/07

GOWN ID

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

Well Identification and Location										Measurement in Metric	
Owner Name		Address		Town		Province		Country		Postal Code	
MCKENDRICK RANCHES LTD		P.O. BOX 264		COCHRANE		ALBERTA		CANADA		T4C 1A5	
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description		
	6	23	26	5	5						
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ m from					Latitude 51.233440 Longitude -114.599480					Elevation 1234.44 m	
_____ m from					How Location Obtained					How Elevation Obtained	
					Differential corrected handheld GPS 5-10m					Differential corrected handheld GPS 5-10m	

Additional Information										Measurement in Metric	
Distance From Top of Casing to Ground Level										91.44 cm	
Is Artesian Flow											
Rate										L/min	
Is Flow Control Installed											
Describe											
Recommended Pump Rate										45.46 L/min	
Recommended Pump Intake Depth (From TOC)										22.56 m	
Pump Installed										Depth m	
Type										Make H.P.	
										Model (Output Rating)	
Did you Encounter Saline Water (>4000 ppm TDS)										Depth m	
Gas										Depth m	
Well Disinfected Upon Completion										Yes	
Geophysical Log Taken											
Submitted to ESRD											
Sample Collected for Potability										Submitted to ESRD	
Additional Comments on Well											

Yield Test			Taken From Top of Casing		Measurement in Metric	
			Depth to water level			
Test Date	Start Time	Static Water Level				
2017/12/05	3:30 PM	14.33 m				
Method of Water Removal						
Type AIR						
Removal Rate			172.75 L/min			
Depth Withdrawn From			30.48 m			
If water removal period was < 2 hours, explain why						
AIRLIFT WITH STEM IN HOLE FROM 100'						
			Pumping (m)	Elapsed Time	Recovery (m)	
				Minutes:Sec		
			30.48	0:00	30.48	
				1:00	18.29	
				2:00	16.46	
				3:00	15.54	
				4:00	15.24	
				5:00	14.94	
				6:00	14.63	
				7:00	14.63	
				8:00	14.33	
				9:00	14.33	

Water Diverted for Drilling		
Water Source	Amount Taken	Diversion Date & Time
SHOP	5455.31 L	2017/12/05 7:00 AM

Contractor Certification		
Name of Journeyman responsible for drilling/construction of well		Certification No
RILEY PEARSON		83061A
Company Name	Copy of Well report provided to owner	Date approval holder signed
ALTAIR WATER AND DRILLING SERVICES INC.	Yes	2017/12/06



Water Well Drilling Report

[View in Metric](#) [Export to Excel](#)

GIC Well ID 386531
GoA Well Tag No.
Drilling Company Well ID
Date Report Received

GOWN ID

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

Well Identification and Location										Measurement in Imperial	
Owner Name		Address		Town		Province		Country		Postal Code	
BALDWIN, C.		COCHRANE									
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description		
	SW	24	26	5	5						
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
ft from					Latitude 51.230505 Longitude -114.577291					Elevation ft	
ft from					How Location Obtained					How Elevation Obtained	
					Not Verified					Not Obtained	

Drilling Information	
Method of Drilling	Type of Work
Cable Tool	New Well
Proposed Well Use	
Stock	

Formation Log			Measurement in Imperial
Depth from ground level (ft)	Water Bearing	Lithology Description	
24.00		Brown Clay & Sandstone	
27.00		Gray Shale	
41.00		Brown Shale & Sandstone	
89.00		Gray Shale	
92.00		Brown Sandstone	
94.00		Brown Shale	
110.00		Gray Shale	

Yield Test Summary			Measurement in Imperial
Recommended Pump Rate			0.00 igpm
Test Date	Water Removal Rate (igpm)	Static Water Level (ft)	
1977/02/19	20.00	76.00	

Well Completion			Measurement in Imperial
Total Depth Drilled	Finished Well Depth	Start Date	End Date
110.00 ft		1977/02/18	1977/02/19
Borehole			
Diameter (in)	From (ft)	To (ft)	
0.00	0.00	110.00	
Surface Casing (if applicable)		Well Casing/Liner	
Steel		Steel	
Size OD :	7.00 in	Size OD :	5.00 in
Wall Thickness :	0.251 in	Wall Thickness :	0.438 in
Bottom at :	27.00 ft	Top at :	0.00 ft
		Bottom at :	110.00 ft
Perforations			
From (ft)	To (ft)	Diameter or Slot Width(in)	Slot Length (in)
85.00	106.00	0.000	
Hole or Slot Interval(in)			
0.00			
Perforated by Torch			
Annular Seal Driven			
Placed from 0.00 ft to 27.00 ft			
Amount			
Other Seals			
Type		At (ft)	
Screen Type			
Size OD : 0.00 in			
From (ft)	To (ft)	Slot Size (in)	
Attachment			
Top Fittings		Bottom Fittings	
Pack			
Type		Grain Size	
Amount			

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well	Certification No
UNKNOWN NA DRILLER	1
Company Name	Copy of Well report provided to owner
DEL'S DRILLING	Date approval holder signed



Water Well Drilling Report

[View in Metric](#) [Export to Excel](#)

GIC Well ID 386531
GoA Well Tag No.
Drilling Company Well ID
Date Report Received

GOWN ID

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

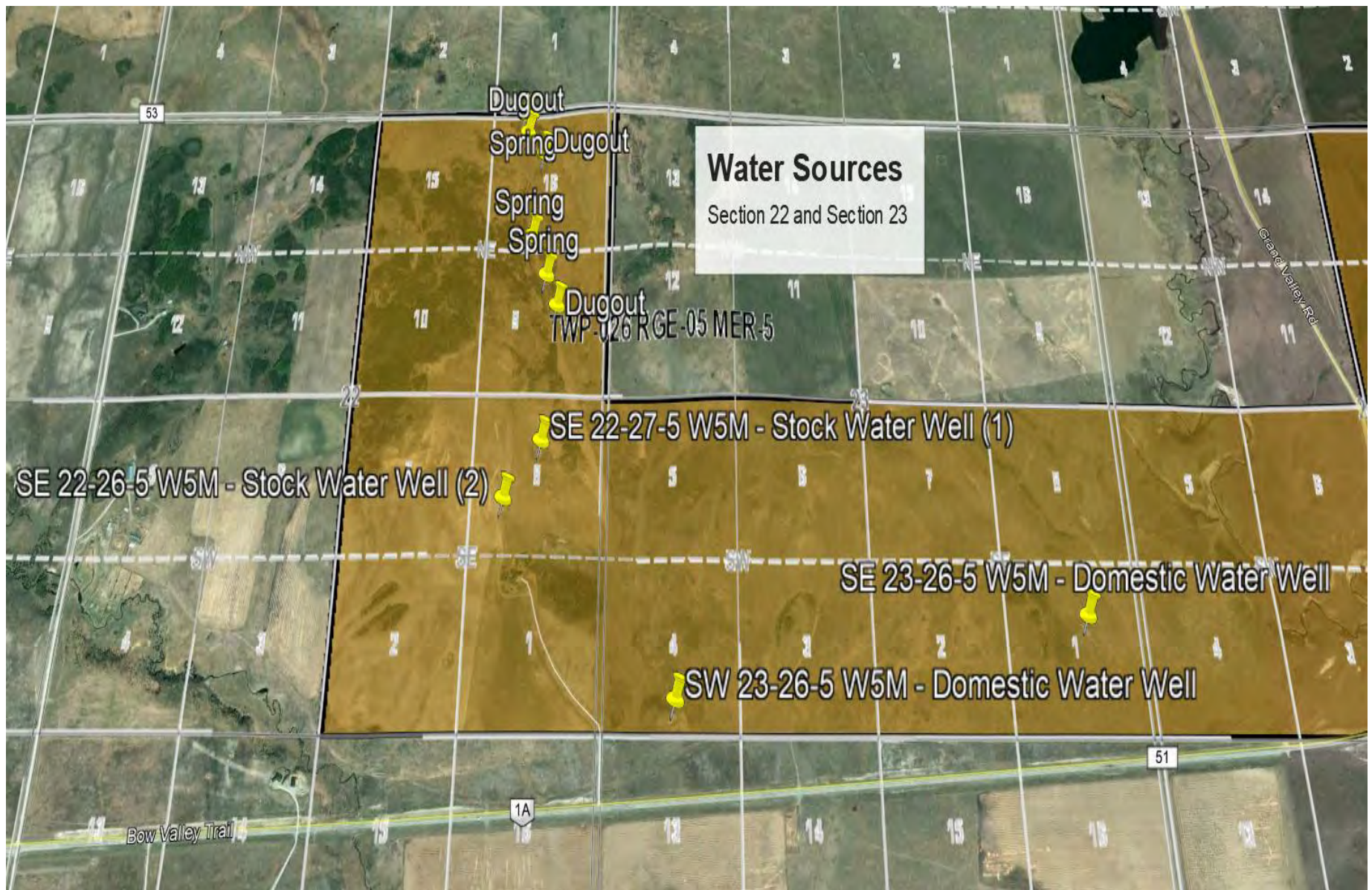
Well Identification and Location										Measurement in Imperial
Owner Name BALDWIN, C.		Address COCHRANE			Town		Province		Country	Postal Code
Location	1/4 or LSD SW	SEC 24	TWP 26	RGE 5	W of MER 5	Lot	Block	Plan	Additional Description	
Measured from Boundary of _____ ft from _____ ft from					GPS Coordinates in Decimal Degrees (NAD 83) Latitude 51.230505 Longitude -114.577291 How Location Obtained Not Verified				Elevation _____ ft How Elevation Obtained Not Obtained	

Additional Information										Measurement in Imperial
Distance From Top of Casing to Ground Level _____ in										
Is Artesian Flow _____ Rate _____ igpm					Is Flow Control Installed _____ Describe _____					
Recommended Pump Rate _____ 0.00 igpm					Pump Installed _____		Depth _____ ft			
Recommended Pump Intake Depth (From TOC) _____ 0.00 ft					Type _____		Make _____		H.P. _____ Model (Output Rating) _____	
Did you Encounter Saline Water (>4000 ppm TDS) _____ Gas _____					Depth _____ ft		Well Disinfected Upon Completion _____ Geophysical Log Taken _____ Submitted to ESRD _____			
Additional Comments on Well _____					Sample Collected for Potability _____		Submitted to ESRD _____			

Yield Test			Taken From Ground Level Depth to water level	Measurement in Imperial
Test Date 1977/02/19	Start Time 12:00 AM	Static Water Level 76.00 ft		
Method of Water Removal Type Bailer			Pumping (ft)	Recovery (ft)
Removal Rate _____ 20.00 igpm			Elapsed Time Minutes:Sec	
Depth Withdrawn From _____ 0.00 ft				
If water removal period was < 2 hours, explain why _____				

Water Diverted for Drilling		
Water Source	Amount Taken _____ ig	Diversion Date & Time

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well UNKNOWN NA DRILLER	Certification No 1
Company Name DEL'S DRILLING	Copy of Well report provided to owner Date approval holder signed



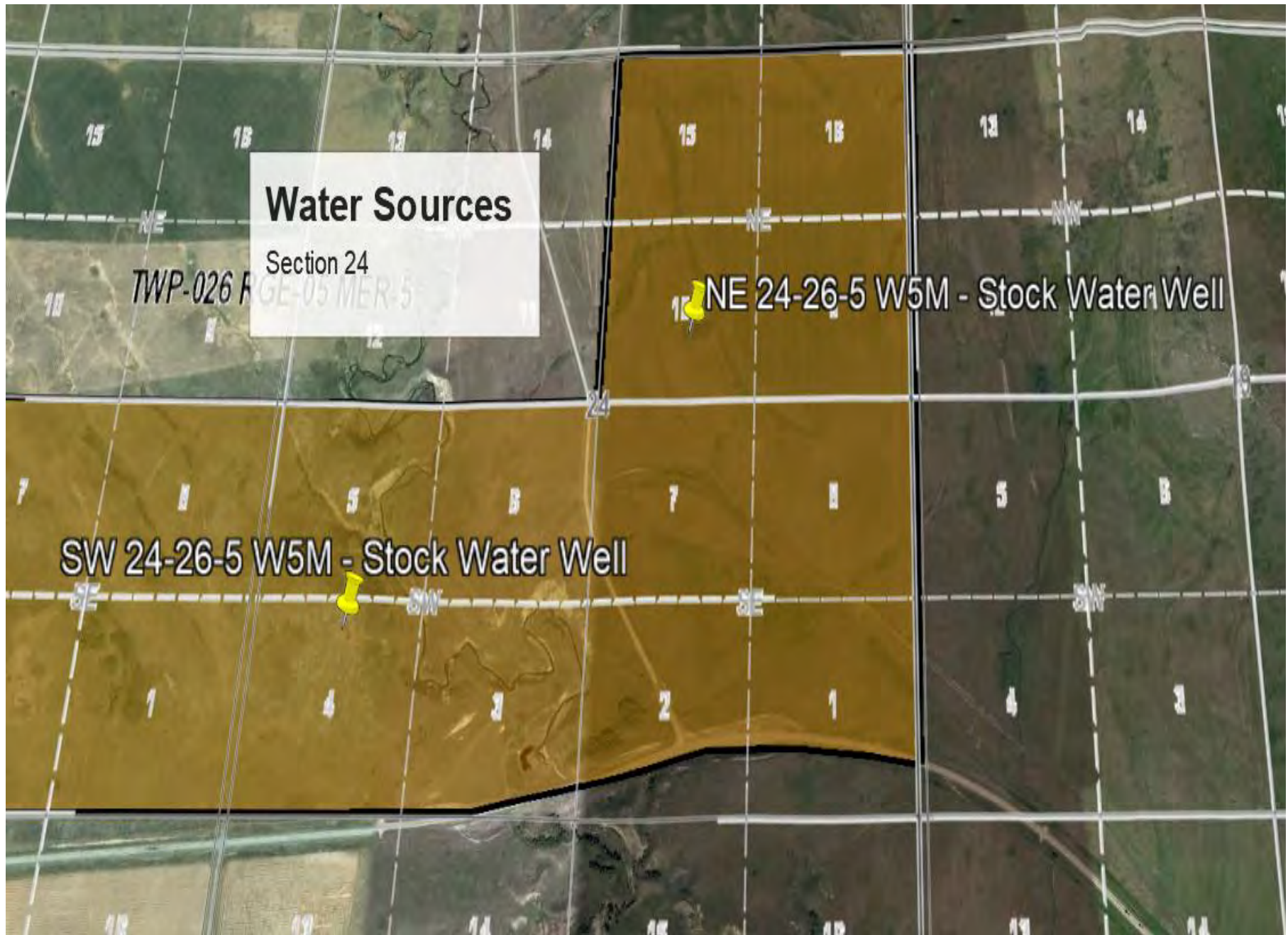
Water Sources

Section 24

TWP-026 RGE-05 MER-5

NE 24-26-5 W5M - Stock Water Well

SW 24-26-5 W5M - Stock Water Well



Water Sources

Section 8

TWP-026 RGE-04 MER-5

Spring

Spring

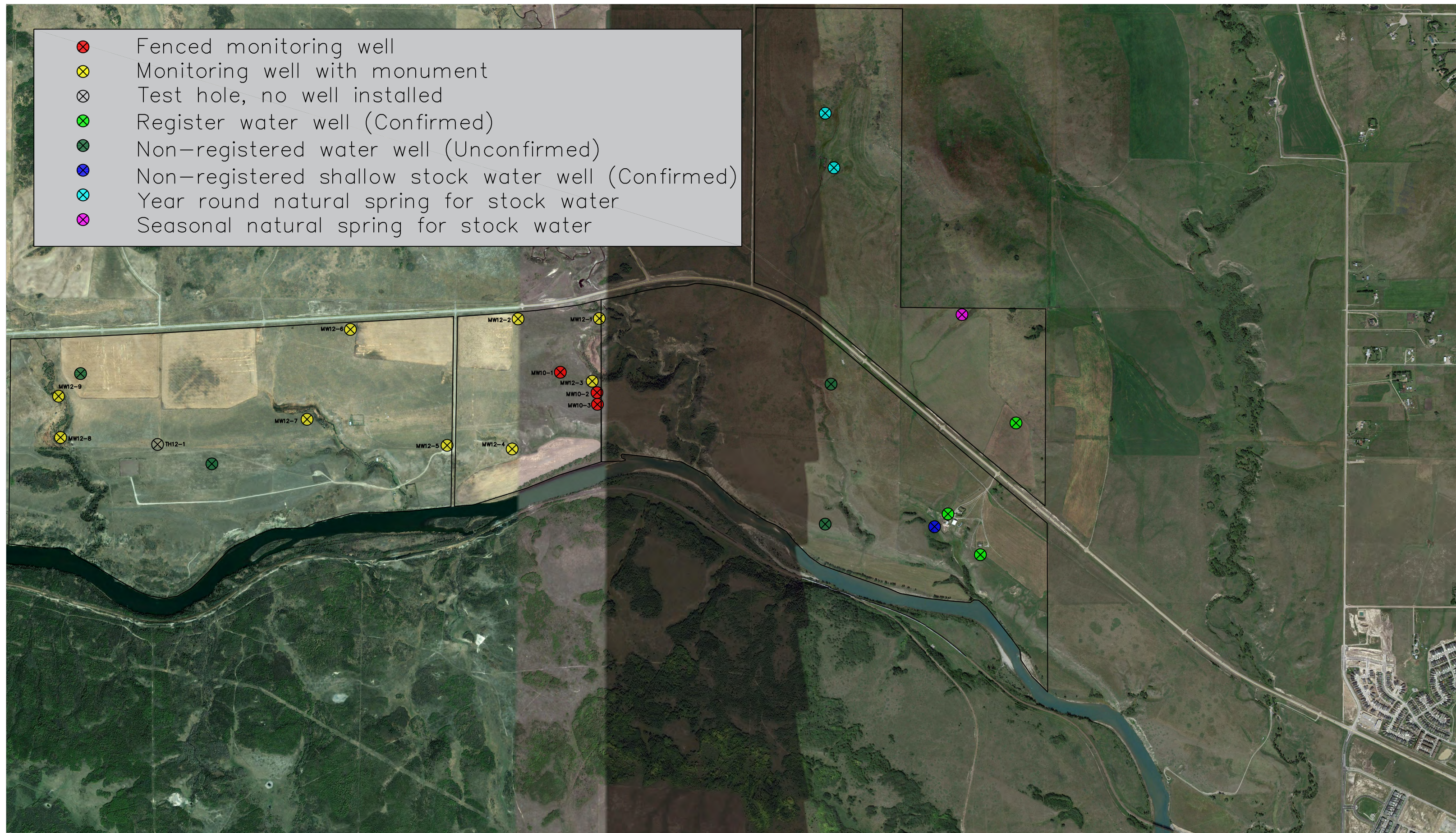
Spring

Google Earth

600 m



- ⊗ Fenced monitoring well
- ⊗ Monitoring well with monument
- ⊗ Test hole, no well installed
- ⊗ Register water well (Confirmed)
- ⊗ Non-registered water well (Unconfirmed)
- ⊗ Non-registered shallow stock water well (Confirmed)
- ⊗ Year round natural spring for stock water
- ⊗ Seasonal natural spring for stock water



Field Verification Survey Form

Surveyor's Name Ryley Killam Date May 28, 2019 MSI # —
 Owner/lessee name Bert Levesque Telephone number 403-921-7630
 Mailing address 52138 Highway 2A Alternative number —
 Email —

Well ID number (if available) — Legal land location: W 15 T 26 S 5 S/LS —
 Type of water source: ☒ Well ☐ Dug-out ☐ Spring ☐ Cistern ☐ Other: —
 Water source status: ☒ Producing ☐ Abandoned ☐ Standby ☐ Observation ☐ Other: —
 Historical chemical analysis ☒ Yes ☐ No Can a copy be made available ☒ Yes ☐ No

To be completed during site visit

Date May 28, 2019

Specify information source: DR- Drilling report, V-Verbal, M-measured, O-other(specify)

Well completion details (open hole / perforated / slotted / screened / other unknown)
 Purpose - identify all uses: ☒ household ☒ potable ☒ livestock ☒ garden ☐ other: —
 Well water level 82.1 (ft / m) Pump intake depth: — (ft / m) Well depth 120 (ft / m)
 Top of aquifer depth — (ft / m) Max pumping rate: 7 (gpm / Lpm)
 Estimated daily use — (gal/day / m3/day) Available head or water column above pump: — (ft / m)
 Casing diameter 6.58 (in / cm) Casing material ☒ Steel ☐ PVC Casing Height 0.50 (ft / m)
 Well and Location description: ~ 300m NW of residence

Well GPS location (NAD 83) Northing: 51.22601 Easting: 114.6198 Elev: 1200m

Distance from proposed water diversion — m km From pumping test report
↳ After we plot LD UTM 11

— Let Bert know what AIC well ID is if we find.

Field Verification Survey Form

Surveyor's Name Ryley Killian Date May 29, 2019 MSI # _____
 Owner/lessee name Dianne + Wendal Young Telephone number 403-604-1899
 Mailing address _____ Alternative number _____
 _____ Email NE-16-026-5-W5
 Well ID number (if available) _____ Legal land location: W ___ M ___ Tp ___ R ___ S ___ S/LSD ___
 Type of water source: (Well) Dug-out Spring Cistern Other : _____
 Water source status: (Producing) Producing / Abandoned / Standby / Observation / Other : _____
 Historical chemical analysis Yes / No Can a copy be made available Yes / No

To be completed during site visit Date May 29, 2019, conducted via phone
 Specify information source: DR- Drilling report, V-Verbal, M-measured, O-other(specify) _____
 Well completion details (open hole / perforated / slotted / screened / other _____)
 Purpose - identify all uses: (household) household / (potable) potable / livestock / garden / other : _____
 Well water level _____ (ft / m) Pump intake depth: _____ (ft / m) Well depth 80 (ft / m)
 Top of aquifer depth _____ (ft / m) Max pumping rate: 30 (gpm) Lpm)
 Estimated daily use 300 (gal/day / m3/day) Available head or water column above pump: _____ (ft / m)
 Casing diameter 4 (in / cm) Casing material (Steel / PVC) Casing Height _____ (ft / m)
 Well and Location description: 70m west residence
 Well GPS location (NAD 83) Northing: _____ Easting: _____ Elev: _____
 Distance from proposed water diversion _____ m km

Drilled in 2007

✓

Field Verification Survey Form

Surveyor's Name Riley Killam Date May 28, 2019 MSI # _____
Owner/lessee name Darrel Cornish Telephone number —
Mailing address — Alternative number —
Email _____
Well ID number (if available) — Legal land location: W ___ M Tp ___ R ___ S ___ S/LSD ___
Type of water source: Well Dug-out Spring Cistern Other: _____
Water source status: Producing / Abandoned / Standby / Observation / Other : _____
Historical chemical analysis Yes / No Can a copy be made available Yes No
To be completed during site visit Date May 28, 2019
Specify information source: DR- Drilling report, V-Verbal, M-measured, O-other(specify)
Well completion details (open hole / perforated / plotted / screened / other _____)
Purpose - identify all uses: household / potable / livestock / garden / other : _____
Well water level 25 (ft / m) Pump intake depth: 45 (ft / m) Well depth 80 (ft / m)
Top of aquifer depth _____ (ft / m) Max pumping rate: 20 (gpm / Lpm)
Estimated daily use _____ (gal/day / m3/day) Available head or water column above pump: _____ (ft / m)
Casing diameter _____ (in / cm) Casing material (Steel / PVC) Casing Height _____ (ft / m)
Well and Location description: South well ~ 150 m from Residence, North well ~
Well GPS location (NAD 83) Northing: 0665561 Easting: 5677400 Elev: 1189
Distance from proposed water diversion _____ m km

North well - All year
~ 20' , Gravel well
South well - Summer Use Only
~ 230' deep
~ 0.5 gpm
UDTM 11 0665644
5677010
Elev. 1187m

Field Verification Survey Form

Surveyor's Name Ryley Killam Date May 28, 2011 MSI # _____
 Owner/lessee name Dave Ritchie Telephone number _____
 Mailing address _____ Alternative number _____
 Email SW-22-06-05WS
 Well ID number (if available) _____ Legal land location W M To R S S/LSD
 Type of water source (Well) Bug-out Spring Cistern Other : _____
 Water source status (Producing) / Abandoned / Standby / Observation / Other : _____
 Historical chemical analysis Yes / No Can a copy be made available Yes / No

To be completed during site visit

Specify information source: DR- Drilling report, V-Verbal, M-measured, O-other(specify)

Date _____

Well completion details (open hole / perforated / slotted / screened / other) _____

Purpose - identify all uses: (household / potable / livestock / garden / other) _____

Well water level _____ (ft / m) Pump intake depth: _____ (ft / m) Jet Well depth 120' (ft / m)

Top of aquifer depth _____ (ft / m) Max pumping rate: _____ (gpm / Lpm)

Estimated daily use 500 (gal/day / m3/day) Available head or water column above pump: _____ (ft / m)

Casing diameter _____ (in / cm) Casing material (Steel / PVC) Casing Height _____ (ft / m)

Well and Location description: _____

Well GPS location (NAD 83) Northing: _____ Easting: _____ Elev: _____

Distance from proposed water diversion _____ m km

Copy of Field verification survey

Page 1 of 2

Matrix Solutions Inc.

South well
 0665534
 5678347
 1214m elev.

House wells

- 7 gpm

North well

UTM 11 0665531 1218 elev. m.
 5678377

2 wells not being used
 1st could not locate 2nd abandoned well

Barn Well

3-5 gpm

- 140' deep
 - livestock use

UTM 11
 0665654
 5678042
 1203m

Spring XR

15 gpm

Spring 1 UTM 11 0665541
 5678179
 elev = 1201m

Abandoned well (Don't use, not actually abandoned)
 0665625
 5678271
 1213m

Field Verification Survey Form

Surveyor's Name Kyley Date May 28, 2019 MSI # _____
 Owner/lessee name Dave Dutschak Telephone number _____
 Mailing address _____ Alternative number _____
 Well ID number (if available) _____ Legal land location: W__M__Tp__R__S__S/LSD__
 Type of water source: (Well) 3 Dug-out Spring Cistern Other : _____
 Water source status: (Producing) 3 Abandoned / Standby / Observation / Other : _____
 Historical chemical analysis Yes / No Can a copy be made available Yes / No

To be completed during site visit

Date _____

Specify information source: DR- Drilling report, V-Verbal, M-measured, O-other(specify)

Well completion details (open hole / perforated / slotted / screened / other _____)
 Purpose - identify all uses: (household / potable / livestock / garden / other : Unknown)
 Well water level _____ (ft / m) Pump intake depth: _____ (ft / m) Well depth _____ (ft / m)
 Top of aquifer depth _____ (ft / m) Max pumping rate: _____ (gpm / Lpm)
 Estimated daily use _____ (gal/day / m3/day) Available head or water column above pump: _____ (ft / m)
 Casing diameter _____ (in / cm) Casing material (Steel / PVC) Casing Height _____ (ft / m)
 Well and Location description: _____
 Well GPS location (NAD 83) Northing: _____ Easting: _____ Elev: _____
 Distance from proposed water diversion _____ m km

2 well
East Santa well
 46' 26gpm
 - Livestock
 UTM 11 0667826
 5679324
 1221m
 - Artesian

Drilled ~10 years ago
 West
North well
 6-7 gpm 280'
 - household
 UTM 11 0667244
 5679015
 elev. = 1263m

Spring
 Fills dug out
 UTM 11 0667838
 5677320
 1220m

Field Verification Survey Form

Surveyor's Name Ryly Hillman Date May 28, 2019 MSI # _____
 Owner/lessee name Dave Feltham Telephone number _____
 Mailing address _____ Alternative number _____
 _____ Email _____
 Well ID number (if available) _____ Legal land location: W__M__Tp__R__S__S/LSD_____
 Type of water source: Well Dug-out Spring Cistern Other: _____
 Water source status: Producing / Abandoned / Standby / Observation / Other : _____
 Historical chemical analysis Yes / No Can a copy be made available Yes No / Yes
To be completed during site visit Date May 28, 2019
 Specify information source: DR- Drilling report, V-Verbal, M-measured, O-other(specify) _____
 Well completion details (open hole / perforated / slotted screeped / other _____)
 Purpose - identify all uses household / potable livestock / garden / other: _____
 Well water level 70 (ft / m) Pump intake depth: _____ (ft / m) Well depth 100 (ft / m)
 Top of aquifer depth _____ (ft / m) Max pumping rate: 28-45 (gpm / Lpm)
 Estimated daily use _____ (gal/day / m3/day) Available head or water column above pump: _____ (ft / m)
 Casing diameter 6 (in / cm) Casing material (Steel / PVC) Casing Height 0.25 (ft / m)
 Well and Location description: _____
 Well GPS location (NAD 83) Northing: _____ Easting: _____ Elev: _____
 Distance from proposed water diversion _____ m km

Copy of Field verification survey

HWW 1A

Page 1 of 2

Matrix Solutions Inc.

3 wells
100'

① 28 gpm
 ② 15 gpm
 ③ 15 gpm
 ① -15' -
 ②
 ③
 residence
 Garage

① 0665874
 5677159
 1189 m
 ② 0665881
 5677140
 elev. 1189 m
 ③ 0665719
 5677168
 1187 m

Field Verification Survey Form

Surveyor's Name TRP Date May 30, 2019 MSI # _____

Owner/lessee name Georgina Decagny Telephone number 403-690-4302

Mailing address _____ Alternative number _____

_____ Email _____

Well ID number (if available) _____ Legal land location: W__M Tp__R__S__S/LSD__

Type of water source: ☒ Well ☐ Dug-out ☐ Spring ☐ Cistern ☐ Other: _____

Water source status: ☒ Producing ☐ Abandoned ☐ Standby ☐ Observation ☐ Other: _____

Historical chemical analysis ☒ Yes ☐ No Can a copy be made available Yes / No _____

To be completed during site visit Date _____

Specify information source: DR- Drilling report, V-Verbal, M-measured, O-other(specify) _____

Well completion details (open hole / perforated / slotted / screened / other _____)

Purpose - identify all uses: (household / potable / livestock / garden / other: _____)

Well water level _____ (ft / m) Pump intake depth: _____ (ft / m) Well depth _____ (ft / m)

Top of aquifer depth _____ (ft / m) Max pumping rate: _____ (gpm Lpm)

Estimated daily use _____ (gal/day / m3/day) Available head or water column above pump: _____ (ft / m)

Casing diameter _____ (in / cm) Casing material (Steel / PVC) Casing Height _____ (ft / m)

Well and Location description: Primary ~ 20' S, Secondary NW corner of property

Well GPS location (NAD 83) Northing: _____ Easting: _____ Elev: _____

Distance from proposed water diversion _____ m km

2 wells

Primary Well

- household
- livestock
- 300' deep

Secondary

- Drilled in 2018
- household only
- Not in use
-

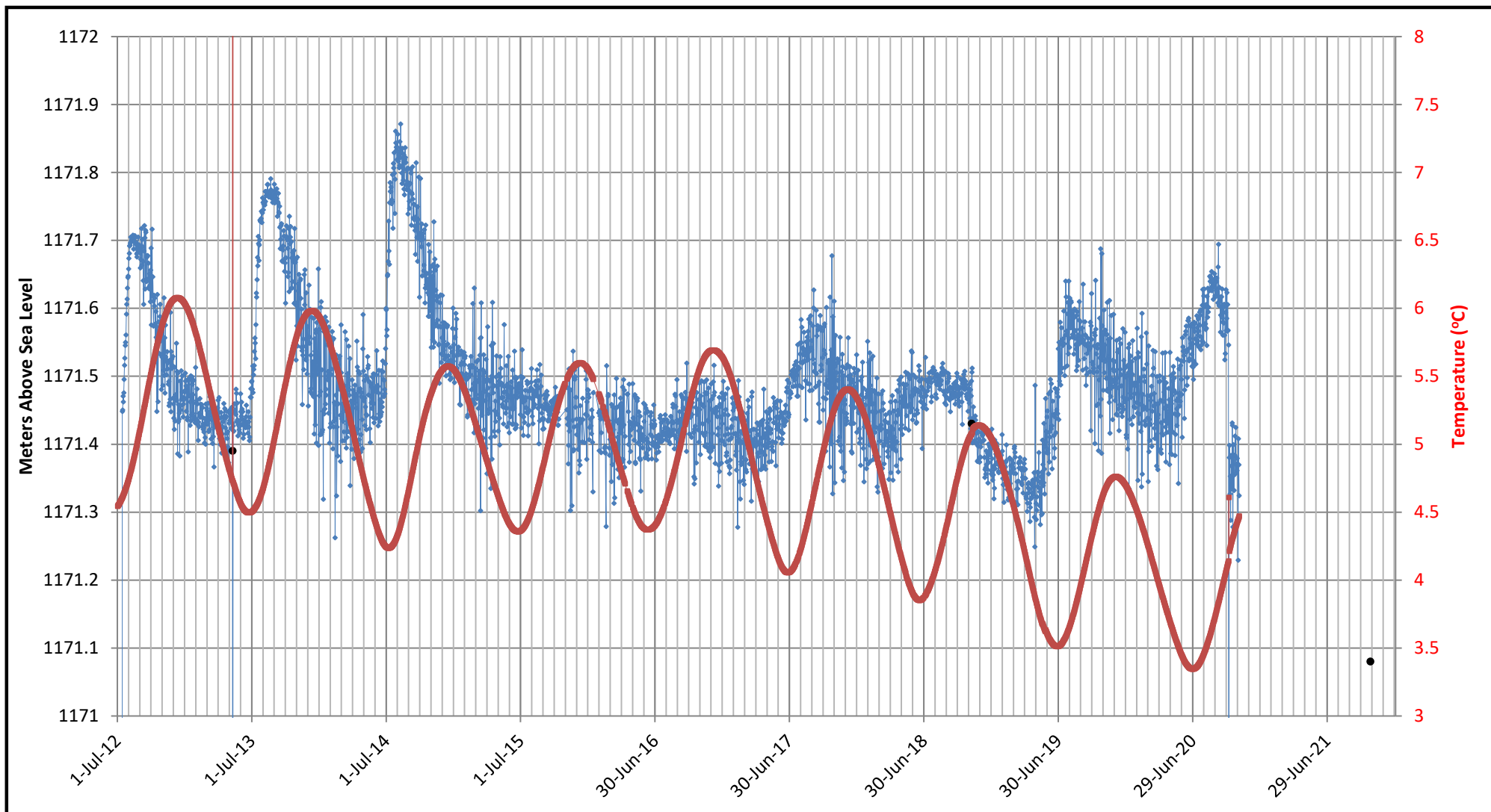
- Plan to drill 3rd well

Dugout well

Dry most of the time
South of Residence
~ 400'

APPENDIX F

Hydrographs



—•— Water Level • Manual Water Level — Temperature



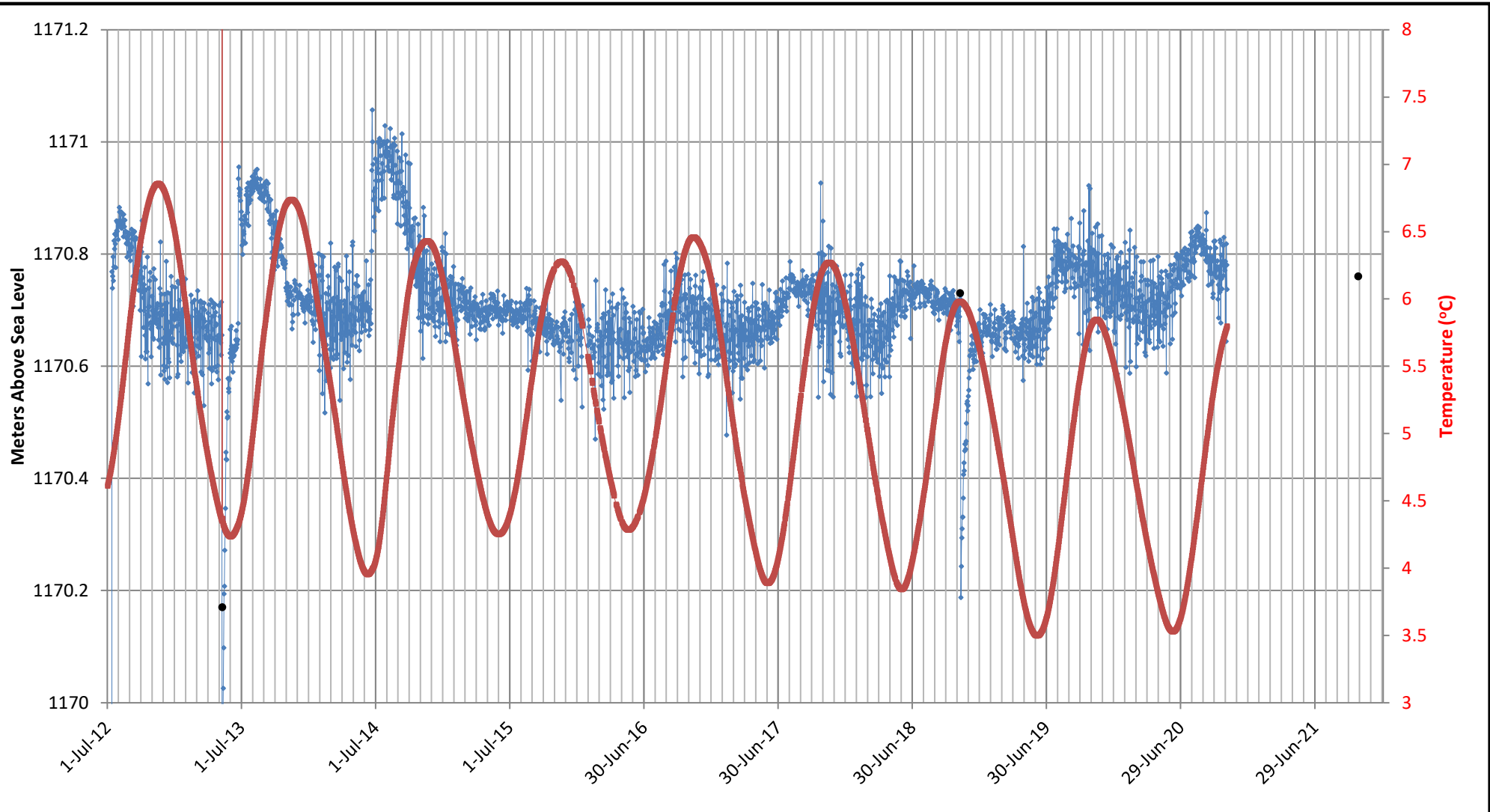
BURNCO Rock Products Ltd.
West Cochrane Gravel Pit

MW10-1 Hydrograph

Date:	Project:	Submitter:	Reviewer:
January 2022	26388-512	R.Killam	G.Aust

Disclaimer: The information contained herein may be compiled from numerous third party materials that are subject to periodic change without prior notification. While every effort has been made by Matrix Solutions Inc. to ensure the accuracy of the information presented at the time of publication, Matrix Solutions Inc. assumes no liability for any errors, omissions, or inaccuracies in the third party material.

Figure
F1



—•— Water Level • Manual Water Level — Temperature



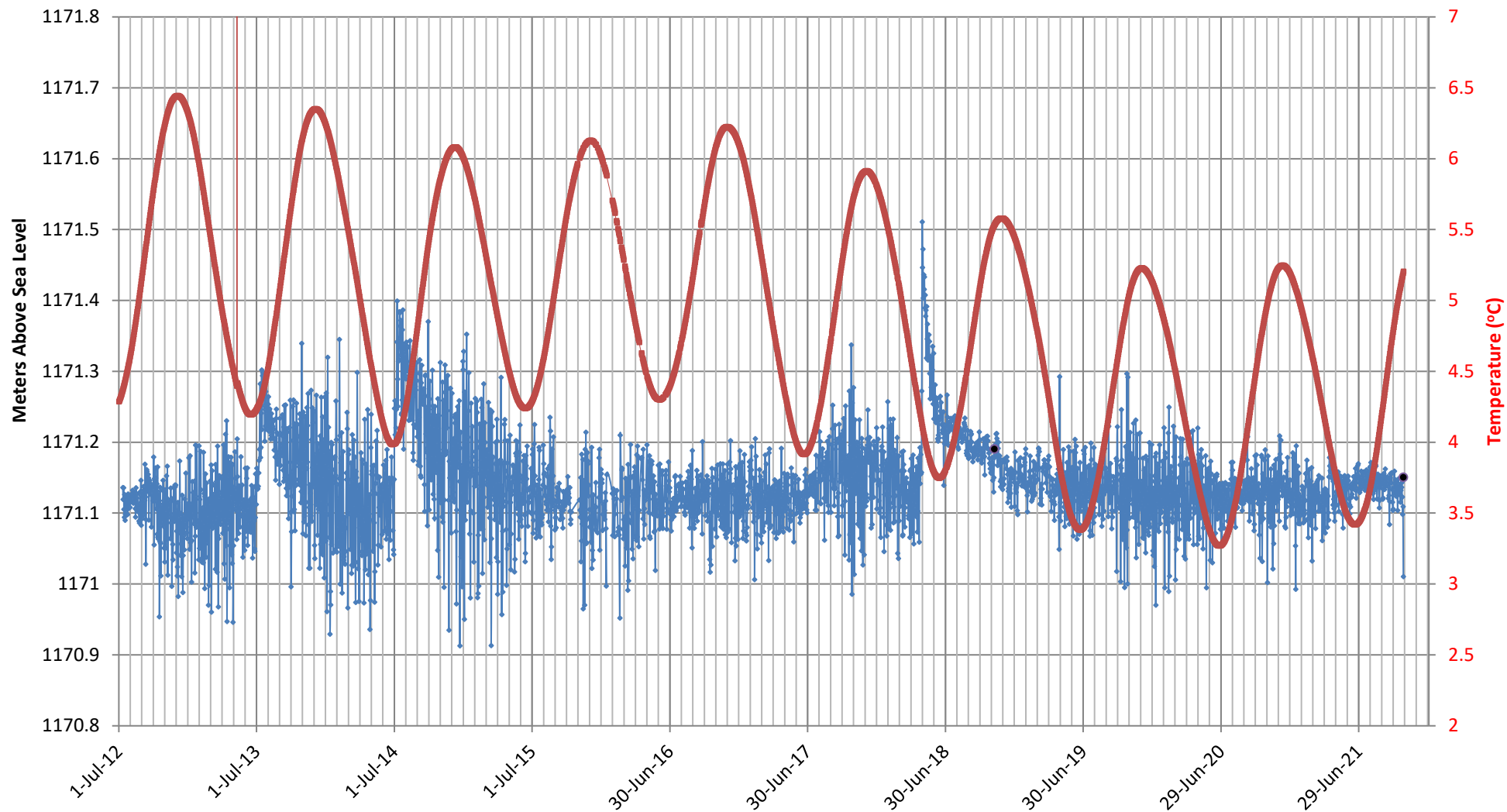
BURNCO Rock Products Ltd.
West Cochrane Gravel Pit

MW10-2 Hydrograph

Date:	January 2022	Project:	26388-512	Submitter:	R.Killam	Reviewer:	G.Aust
-------	--------------	----------	-----------	------------	----------	-----------	--------

Disclaimer: The information contained herein may be compiled from numerous third party materials that are subject to periodic change without prior notification. While every effort has been made by Matrix Solutions Inc. to ensure the accuracy of the information presented at the time of publication, Matrix Solutions Inc. assumes no liability for any errors, omissions, or inaccuracies in the third party material.

Figure
F2



—●— Water Level
 ● Manual Water Level
 —■— Temperature



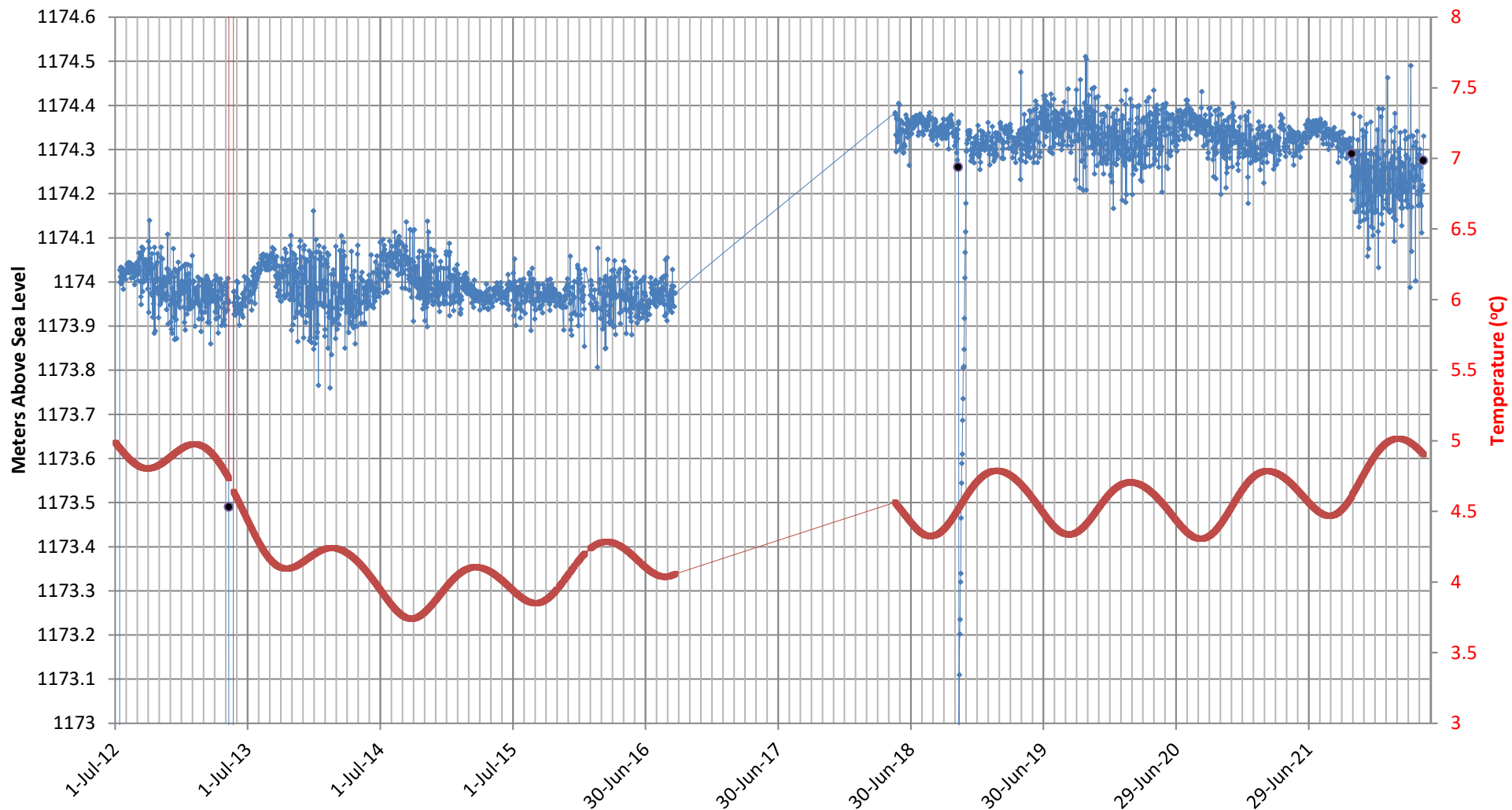
BURNCO Rock Products Ltd.
West Cochrane Gravel Pit

MW12-1 Hydrograph

Date: January 2022	Project: 26388-512	Submitter: R.Killam	Reviewer: G.Aust
--------------------	--------------------	---------------------	------------------

Disclaimer: The information contained herein may be compiled from numerous third party materials that are subject to periodic change without prior notification. While every effort has been made by Matrix Solutions Inc. to ensure the accuracy of the information presented at the time of publication, Matrix Solutions Inc. assumes no liability for any errors, omissions, or inaccuracies in the third party material.

Figure
F3



—●— Water Level ● Manual Water Level — Temperature



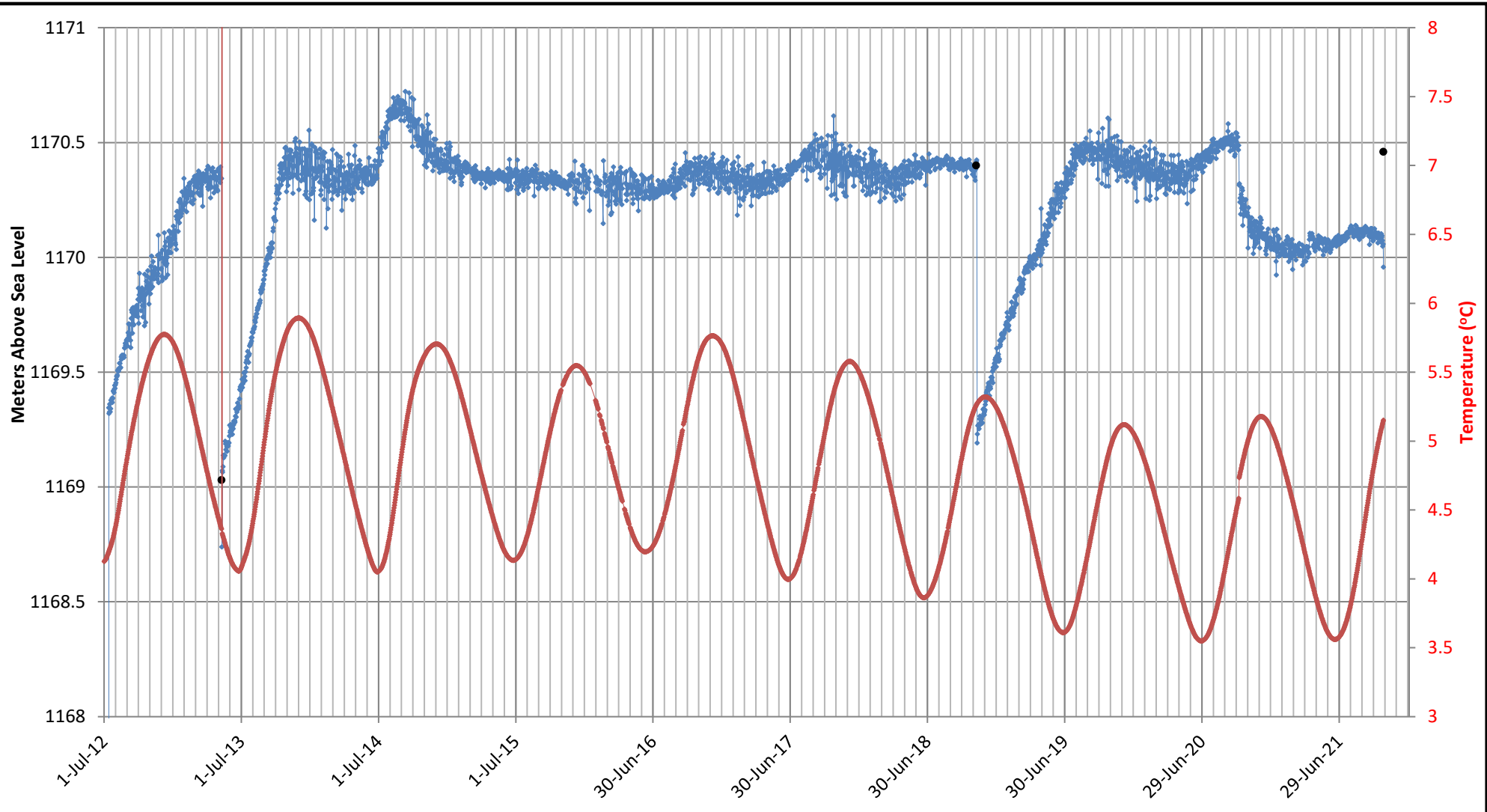
BURNCO Rock Products Ltd.
West Cochrane Gravel Pit

MW12-2 Hydrograph

Date:	January 2022	Project:	26388-512	Submitter:	R.Killam	Reviewer:	G.Aust
-------	--------------	----------	-----------	------------	----------	-----------	--------

Disclaimer: The information contained herein may be compiled from numerous third party materials that are subject to periodic change without prior notification. While every effort has been made by Matrix Solutions Inc. to ensure the accuracy of the information presented at the time of publication, Matrix Solutions Inc. assumes no liability for any errors, omissions, or inaccuracies in the third party material.

Figure
F4



—●— Water Level
 ● Manual Water Level
 —■— Temperature



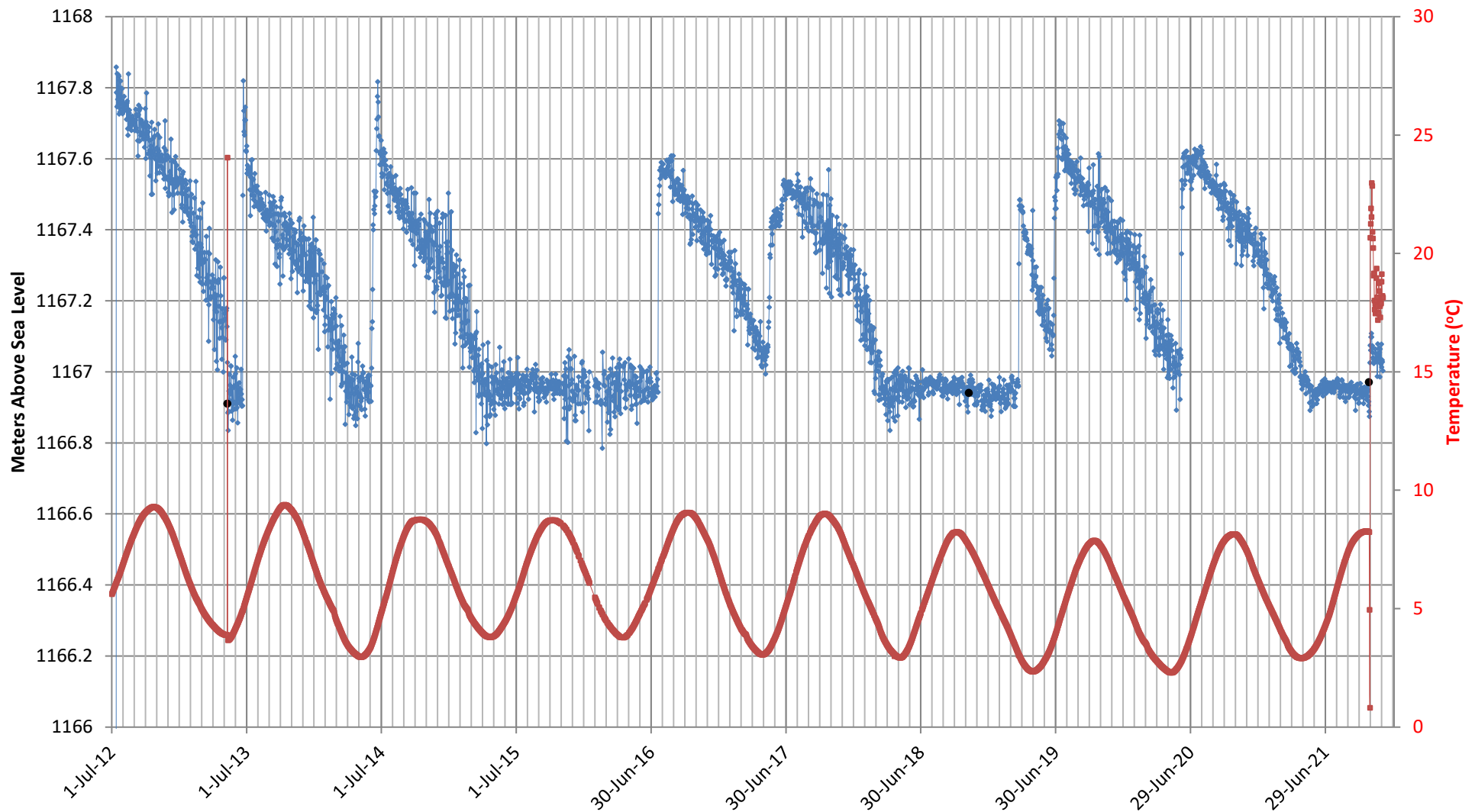
BURNCO Rock Products Ltd.
West Cochrane Gravel Pit

MW12-3 Hydrograph

Date:	January 2022	Project:	26388-512	Submitter:	R.Killam	Reviewer:	G.Aust
-------	--------------	----------	-----------	------------	----------	-----------	--------

Disclaimer: The information contained herein may be compiled from numerous third party materials that are subject to periodic change without prior notification. While every effort has been made by Matrix Solutions Inc. to ensure the accuracy of the information presented at the time of publication, Matrix Solutions Inc. assumes no liability for any errors, omissions, or inaccuracies in the third party material.

Figure
F5



—●— Water Level ● Manual Water Level —■— Temperature



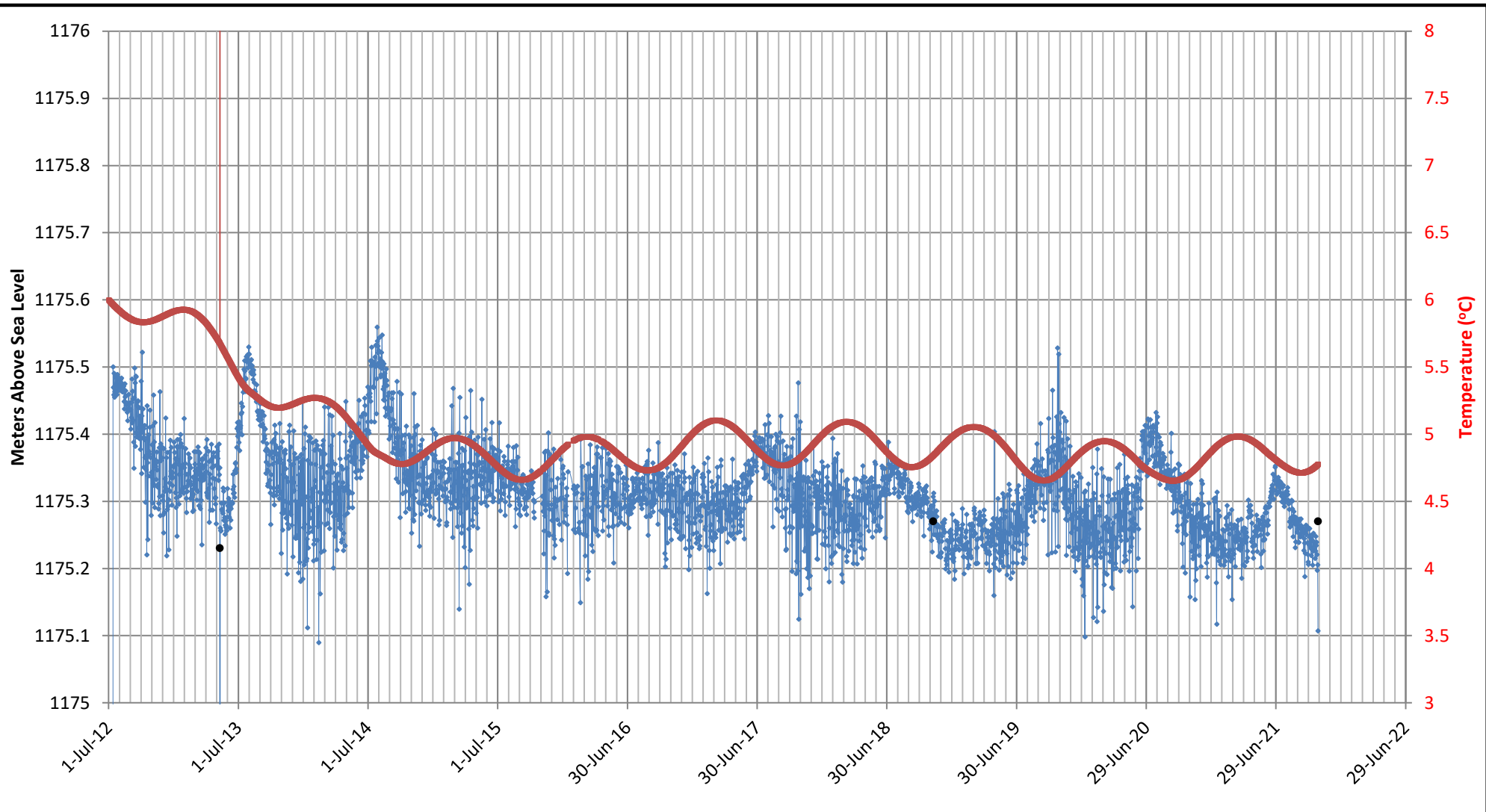
BURNCO Rock Products Ltd.
West Cochrane Gravel Pit

MW12-5 Hydrograph

Date:	January 2022	Project:	26388-512	Submitter:	R.Killam	Reviewer:	G.Aust
-------	--------------	----------	-----------	------------	----------	-----------	--------

Disclaimer: The information contained herein may be compiled from numerous third party materials that are subject to periodic change without prior notification. While every effort has been made by Matrix Solutions Inc. to ensure the accuracy of the information presented at the time of publication, Matrix Solutions Inc. assumes no liability for any errors, omissions, or inaccuracies in the third party material.

Figure
F6



—◆— Water Level
 ● Manual Water Level
 —■— Temperature



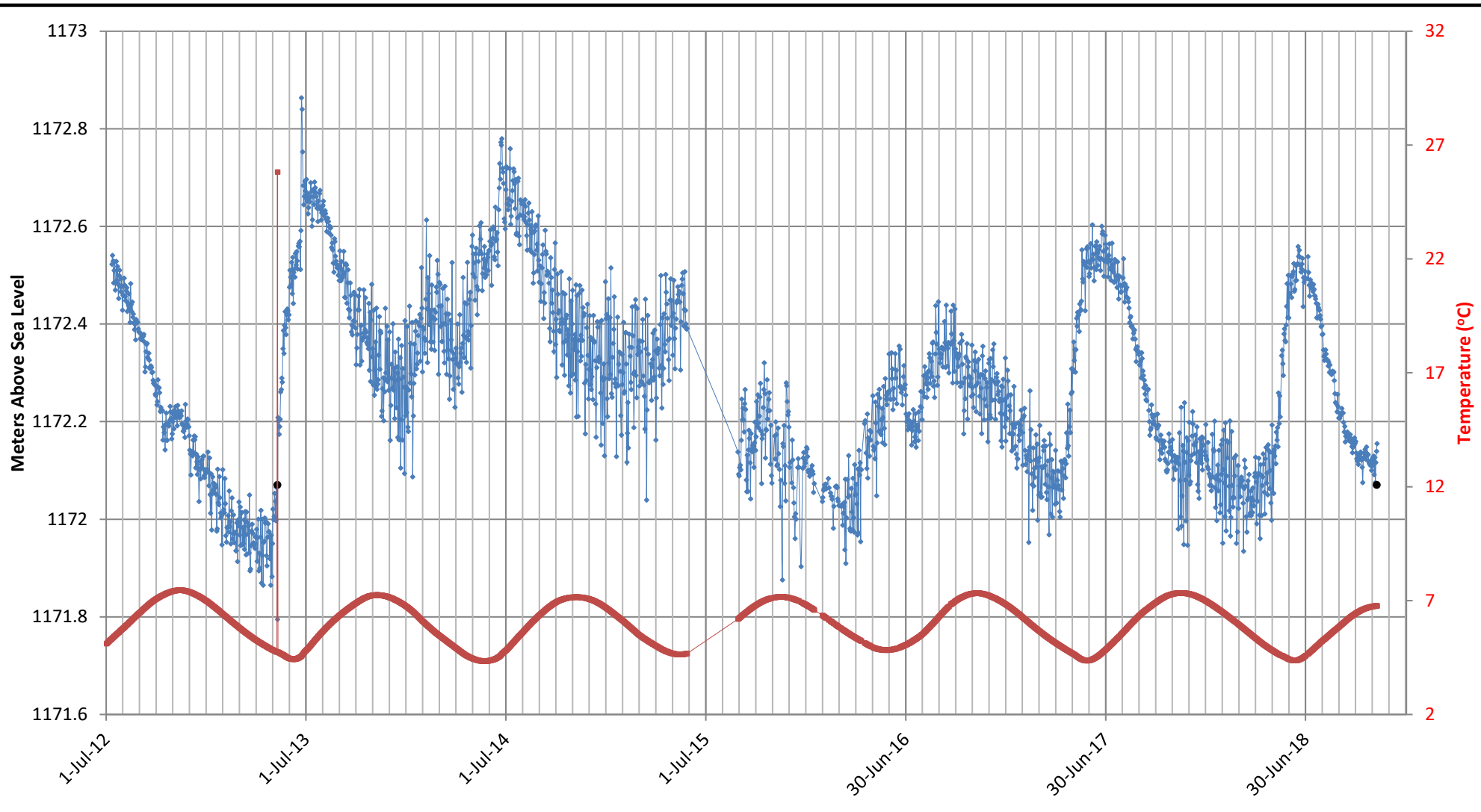
BURNCO Rock Products Ltd.
West Cochrane Gravel Pit

MW12-6 Hydrograph

Date:	January 2022	Project:	26388-512	Submitter:	R.Killam	Reviewer:	G.Aust
-------	--------------	----------	-----------	------------	----------	-----------	--------

Disclaimer: The information contained herein may be compiled from numerous third party materials that are subject to periodic change without prior notification. While every effort has been made by Matrix Solutions Inc. to ensure the accuracy of the information presented at the time of publication, Matrix Solutions Inc. assumes no liability for any errors, omissions, or inaccuracies in the third party material.

Figure
F7



—●— Water Level ● Manual Water Level — Temperature



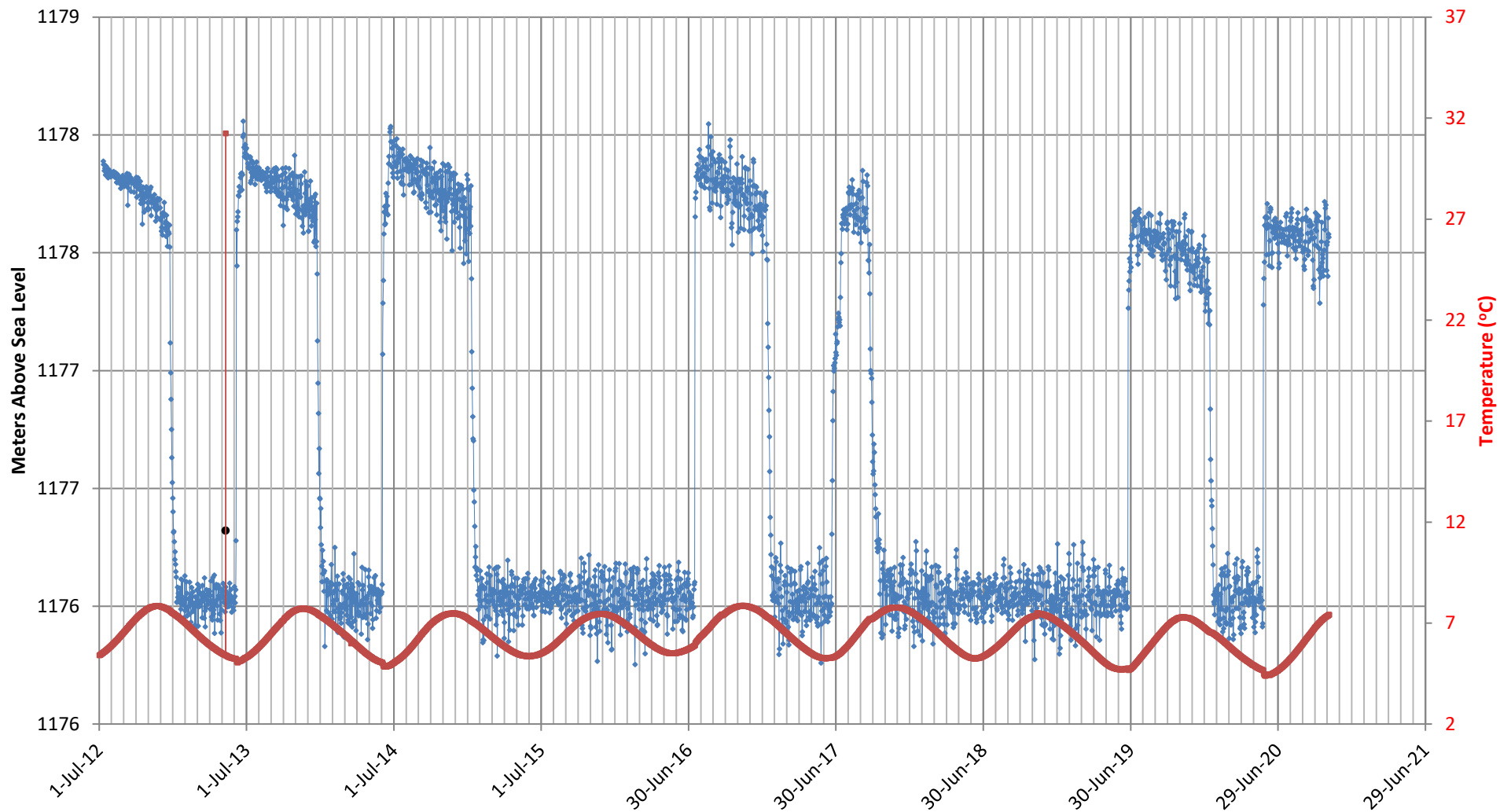
BURNCO Rock Products Ltd.
West Cochrane Gravel Pit

MW12-7 Hydrograph

Date: January 2022	Project: 26388-512	Submitter: R.Killam	Reviewer: G.Aust
--------------------	--------------------	---------------------	------------------

Disclaimer: The information contained herein may be compiled from numerous third party materials that are subject to periodic change without prior notification. While every effort has been made by Matrix Solutions Inc. to ensure the accuracy of the information presented at the time of publication, Matrix Solutions Inc. assumes no liability for any errors, omissions, or inaccuracies in the third party material.

Figure
F8



—•— Water Level • Manual Water Level — Temperature



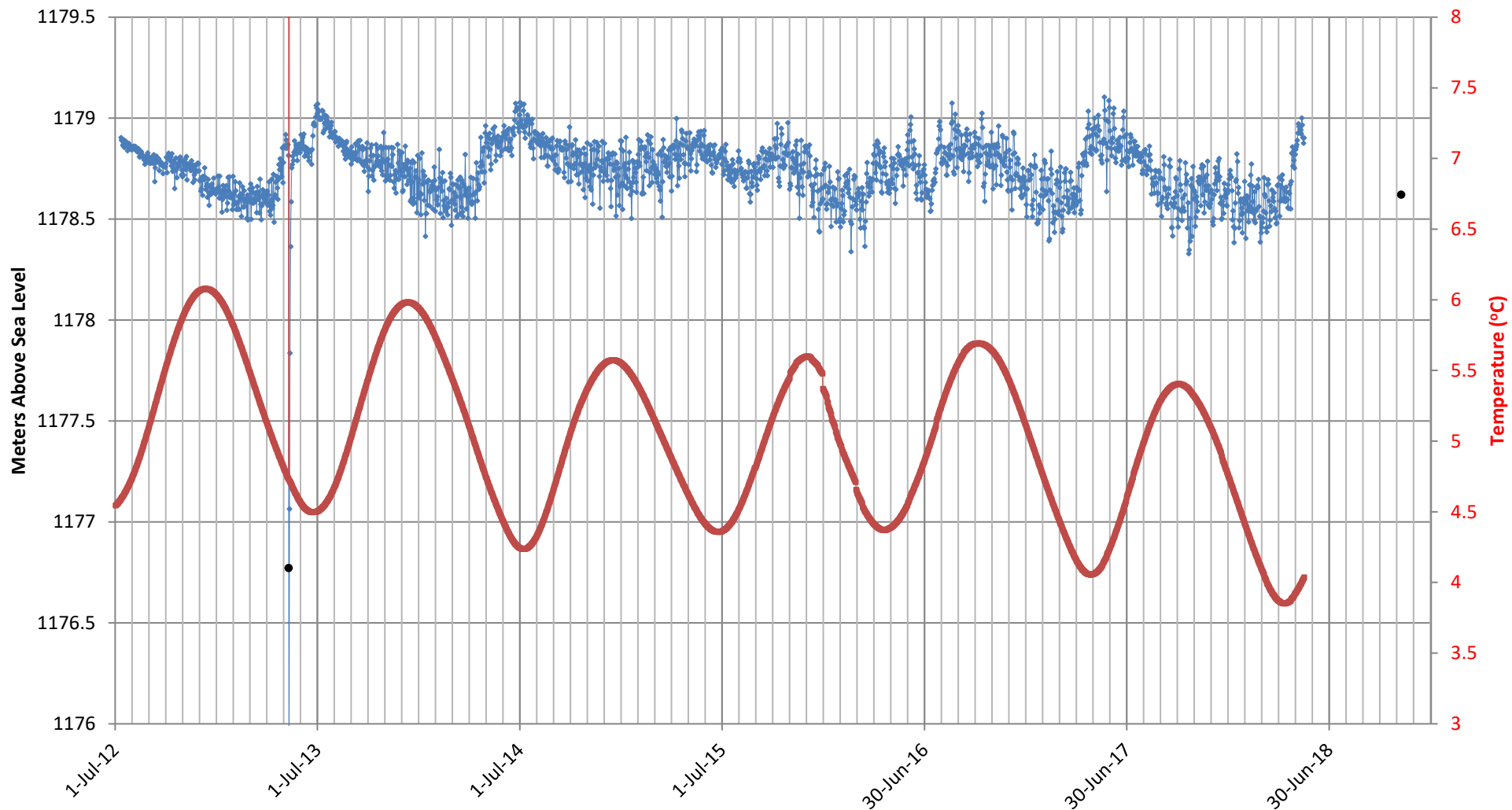
BURNCO Rock Products Ltd.
West Cochrane Gravel Pit

MW12-8 Hydrograph

Date:	January 2022	Project:	26388-512	Submitter:	R.Killam	Reviewer:	G.Aust
-------	--------------	----------	-----------	------------	----------	-----------	--------

Disclaimer: The information contained herein may be compiled from numerous third party materials that are subject to periodic change without prior notification. While every effort has been made by Matrix Solutions Inc. to ensure the accuracy of the information presented at the time of publication, Matrix Solutions Inc. assumes no liability for any errors, omissions, or inaccuracies in the third party material.

Figure
F9



—●— Water Level
 ● Manual Water Level
 —■— Temperature



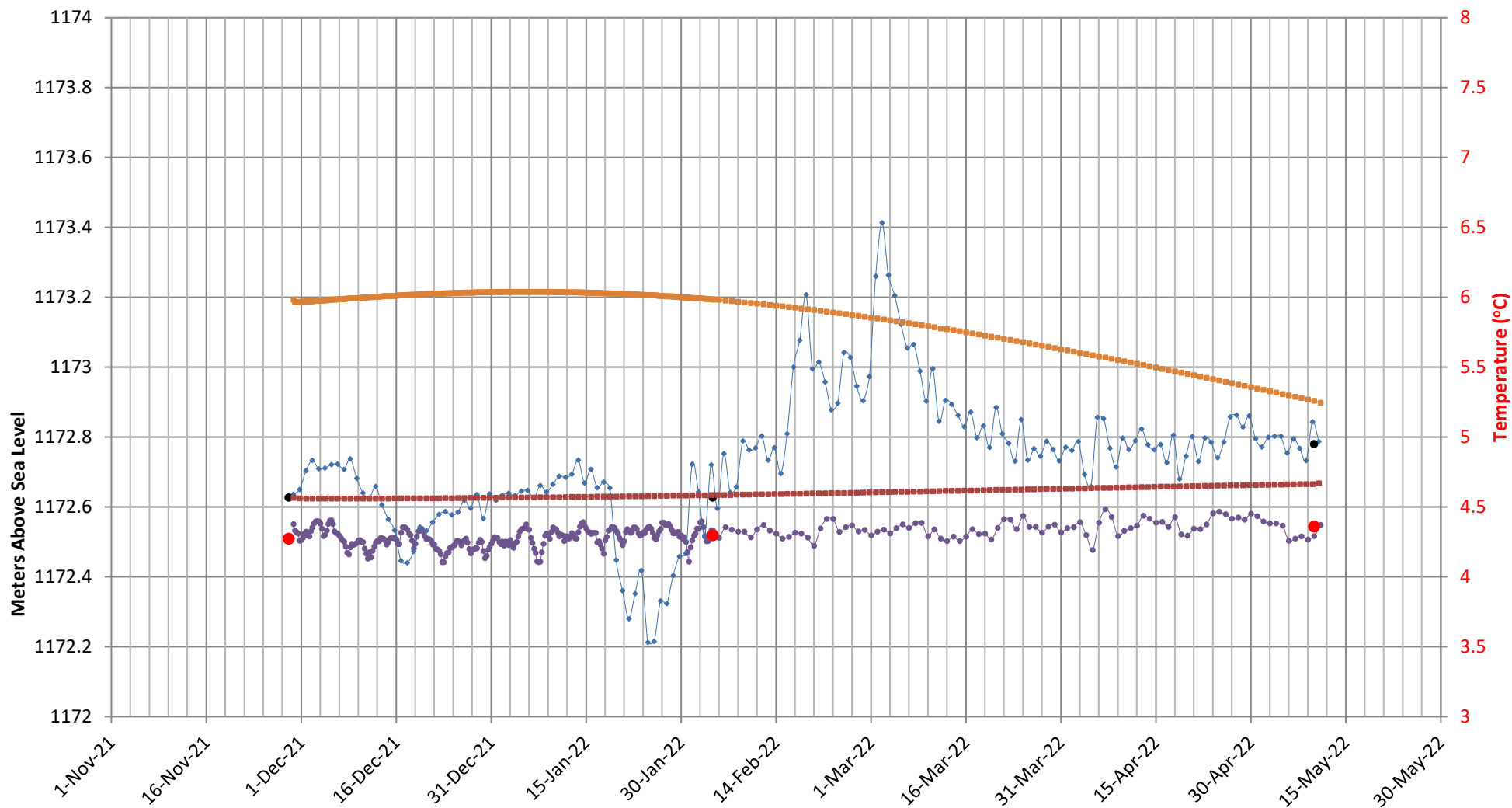
BURNCO Rock Products Ltd.
West Cochrane Gravel Pit

MW12-9 Hydrograph

Date:	January 2022	Project:	26388-512	Submitter:	R.Killam	Reviewer:	G.Aust
-------	--------------	----------	-----------	------------	----------	-----------	--------

Disclaimer: The information contained herein may be compiled from numerous third party materials that are subject to periodic change without prior notification. While every effort has been made by Matrix Solutions Inc. to ensure the accuracy of the information presented at the time of publication, Matrix Solutions Inc. assumes no liability for any errors, omissions, or inaccuracies in the third party material.

Figure
F10



- MW21-2a Water Level
- MW21-2b Water Level
- MW21-2a Manual Water Level
- MW21-2b Manual Water Level
- MW21-2a Temperature
- MW21-2b Temperature



BURNCO Rock Products Ltd.
West Cochrane Gravel Pit

MW21-2a and MW21-2b Hydrograph

Date: January 2022	Project: 26388-512	Submitter: R.Killam	Reviewer: G.Aust
--------------------	--------------------	---------------------	------------------

Disclaimer: The information contained herein may be compiled from numerous third party materials that are subject to periodic change without prior notification. While every effort has been made by Matrix Solutions Inc. to ensure the accuracy of the information presented at the time of publication, Matrix Solutions Inc. assumes no liability for any errors, omissions, or inaccuracies in the third party material.

Figure
F11

APPENDIX G

Preliminary Hydrogeology Inputs

MEMORANDUM

TO: Duncan Gordon, BURNCO Rock Products Ltd.

FROM: Ryley Killam and Goetz Aust, Matrix Solutions Inc.

SUBJECT: Estimated Dewatering Flow Rates from Gravel Pits for the Purpose of Sizing Storage Ponds

DATE: Original January 18, 2019: revised February 23, 2022

VERSION: 1.0

1 OBJECTIVE

The objective of this memorandum is to determine estimated groundwater flow rates for gravel pit dewatering. Information was collected to aid in the sizing of storage ponds. The analyses were conducted to provide conservative estimates of dewatering requirements to ensure adequate sizing of the storage ponds.

2 METHODOLOGY

2.1 Saturated Thickness

A saturated thickness map was generated using water elevation data and the base of sand and gravel supplied by BURNCO Rock Products Ltd.

Groundwater depths were converted to groundwater elevations. Water elevations and bedrock elevation data was imported into Surfer to create grids of the groundwater and bedrock structure. elevations. The difference of both grids was used to generate a saturated thickness map (see main report Figure 8).

A preliminary mine plan was imported into surfer as a base map and the saturated thickness contours (m) were overlaid to assess the saturated thickness of the gravel deposits.

2.2 Hydraulic Conductivity

No K-testing was conducted on the new groundwater monitoring wells installed in Area 4 in 2018. Slug tests were completed on four wells in the west project area by Levelton Consultants in 2014. The highest K-value (25 m/day) was used in the flow rate calculations in order to be conservative.

2.3 Dewatering Formulas

2.3.1 Radial Flow in a Water Table Aquifer

The radial flow in a water table aquifer equation was used for the hydrogeological analysis for dewatering. This equation is used when the dewatering system assumes a rectangular shape (pit). The equation (Powers 1992) is as follows:

$$Q = \frac{\pi K (H^2 - h_w^2)}{\ln \frac{R_o}{r_w}}$$

Q = flow rate (m³/day)

K = hydraulic conductivity (m/day)

H = hydraulic head of original water table (m) or saturated thickness

h_w = hydraulic head at maximum dewatering (m)

R_o = radius of influence of well or point source (m) beyond the radius of the well

r_w = equivalent radius of well (m)

h_w was assumed to be 0.5 m.

r_w was approximated using:

$$r_w = \sqrt{\frac{ab}{\pi}}$$

Where a and b are the length and width of the pit and assumed to act as a circular system of the same enclosed area.

R_o (calculated) was approximated using the Sichart and Kryieleis method (Sichart and Kyrieleis 1930) and gives R_o as a function of drawdown:

$$R_o = 3000(H - h_w)\sqrt{K}$$

Where K = hydraulic conductivity (m/sec)

A value of 100 m, R_o (r_w+100 m), was selected as a conservative constant as recharge to the aquifer is expected to occur at more than 100 m from the gravel pit boundaries, and recharge from surface water bodies will be beyond 100 m due to buffer zones.

2.3.2 Water Table Flow From a Line Source to a Drainage Trench

The flow to a drainage trench from a line source equation was used for the hydrogeological analysis for dewatering and yields flow from one side per unit length. The equation is used when a trench is the system for dewatering. The equation is as follows:

$$\frac{Q}{X} = \frac{K(H^2 - h^2)}{2L}$$

Q/X = flow rate (m³/day) per unit length of trench

K = hydraulic conductivity (m/day)

H = hydraulic head of original water table (m) or saturated thickness

H = hydraulic head at maximum dewatering (m) assumed to be 0.5 m

L = radius of influence (recharge) length (m)

Based on site conditions, value of 100 m for L was used as a constant and is considered a conservative value. The flow rate values are double to represent flow from both sides of the trench.

3 RESULTS

Conservative flow rates in m³/day for pit dewatering are presented in Tables G1 and G2 depending upon the style of dewatering.

TABLE G1 Pit Flow Rates (m³/day)

Saturated Thickness (H) in Metres	100 × 100 m Pit Using R _o Calculated	100 × 100 m Using R _o 100 m	150 × 150 m Pit Using R _o Calculated	150 × 150 m Using R _o 100 m	250 × 250 m Pit Using R _o Calculated	250 × 250 m Using R _o 100 m
1	158	58	224	76	354	110
2	344	289	457	378	679	550
3	581	674	748	881	1,067	1,282
4	867	1,213	1,090	1,586	1,512	2,308
5	1,197	1,906	1,482	2,492	2,012	3,627
6	1,571	2,753	1,920	3,599	2,564	5,239
7	1,985	3,755	2,403	4,908	3,166	7,145
8	2,440	4,910	2,930	6,418	3,816	9,343

TABLE G2 Trench Flow Rates From Both Sides of Trench (m³/day)

Saturated Thickness (H) in Metres	50 m Trench Length	100 m Trench Length	150 m Trench Length	200 m Trench Length
1	9	19	28	38
2	47	94	141	188
3	109	219	328	438
4	197	394	591	788
5	309	619	928	1,238
6	447	894	1,341	1,788
7	609	1,219	1,828	2,438
8	797	1,594	2,391	3,188

4 REFERENCES

Powers J.P. 1992. *Construction Dewatering: New Methods and Applications*. Second Edition. John Wiley & Sons, Inc. 1992.

Sichart W. and W. Kyrieleis. 1930. *Grunwasser Abeskungen bei Fundierungs Arbeiten*. Berlin. 1930.

APPENDIX H

Laboratory Reports

Report Transmission Cover Page

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1	Project ID: 26388 Project Name: Burnco/West Cochrane Gravel Pit Project Location: LSD: West Cochrane Gravel Pit P.O.: Proj. Acct. code:	Lot ID: 1531395 Control Number: 067005 Date Received: Oct 27, 2021 Date Reported: Nov 3, 2021 Report Number: 2682987
Attn: Accounts Payable Sampled By: Colin McKenzie Company: Matrix Solutions Inc.		

Contact	Company	Address
Accounts Payable	Matrix Solutions Inc.	Suite 600, 214 11 Ave SW Calgary, AB T2R 0K1 Phone: (403) 237-0606 Fax: (403) 263-2493 Email: ap@matrix-solutions.com

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / Invoice

EDS	Matrix Solutions Inc.	Suite 600 214-11th Ave SW Calgary, AB T2R 0K1 Phone: (403) 700-2058 Fax: Email: eds@matrix-solutions.com
-----	-----------------------	---

Delivery	Format	Deliverables
Email - Single Report	Equis Matrix Batch File (with QC)	Test Report
Email - Single Report	Equis Matrix Sample File (with QC)	Test Report
Email - Single Report	Equis Matrix Test Result File (with QC)	Test Report
Email - Single Report	PDF	COC / COA
Email - Single Report	PDF	COC / Test Report
Email - Single Report	PDF	Invoice

Ryley Killam	Matrix Solutions Inc.	Suite 600 214-11th Ave SW Calgary, AB T2R 0K1 Phone: (403) 237-0606 Fax: (403) 263-2493 Email: rkillam@matrix-solutions.com
--------------	-----------------------	--

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / COA
Email - Merge Reports	PDF	COC / Test Report

Notes To Clients:

- Nov 02, 2021 - Some trace total metal results were less than dissolved metal results for sample 1531395-6,-14. The results were verified and are within expected measurement uncertainty.
- Nov 02, 2021 - Some ICP-MS total metal results were less than dissolved metal results for sample 1531349-1 to 14. The results were verified and are within expected measurement uncertainty.

The information contained on this and all other pages transmitted, is intended for the addressee only and is considered confidential. If the reader is not the intended recipient, you are hereby notified that any use, dissemination, distribution or copy of this transmission is strictly prohibited. If you receive this transmission by error, or if this transmission is not satisfactory, please notify us by telephone.

Analytical Report

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1	Project ID: 26388 Project Name: Burnco/West Cochrane Gravel Pit Project Location: LSD: West Cochrane Gravel Pit P.O.: Proj. Acct. code:	Lot ID: 1531395 Control Number: 067005 Date Received: Oct 27, 2021 Date Reported: Nov 3, 2021 Report Number: 2682987
Attn: Accounts Payable Sampled By: Colin McKenzie Company: Matrix Solutions Inc.		

Reference Number	1531395-1	1531395-2
Sample Date	Oct 25, 2021	Oct 25, 2021
Sample Time	NA	NA
Sample Location		
Sample Description	26388211025001 / 8.1°C Water	26388211025002 / 8.1°C Water
Matrix		

Analyte		Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Metals Dissolved							
Silicon	Dissolved	mg/L	3.67	±0.33	3.43	±0.31	0.05
Sulfur	Dissolved	mg/L	10.4	±1.0	36.9	±3.5	0.3
Mercury	Dissolved	mg/L	<0.000005		<0.000005		0.000005
Aluminum	Dissolved	mg/L	0.019	±0.0016	0.005	±0.00059	0.002
Antimony	Dissolved	mg/L	<0.0002		<0.0002		0.0002
Arsenic	Dissolved	mg/L	0.0005	±0.00007	0.0004	±0.00007	0.0002
Barium	Dissolved	mg/L	0.090	±0.005	0.044	±0.003	0.001
Beryllium	Dissolved	mg/L	<0.0001		<0.0001		0.0001
Bismuth	Dissolved	mg/L	<0.0005		<0.0005		0.0005
Boron	Dissolved	mg/L	0.016	±0.001	0.037	±0.003	0.002
Cadmium	Dissolved	mg/L	<0.00001		0.00002	±0.000002	0.00001
Chromium	Dissolved	mg/L	<0.0005		<0.0005		0.0005
Cobalt	Dissolved	mg/L	0.0004	±0.00002	0.0002	±0.00001	0.0001
Copper	Dissolved	mg/L	0.006	±0.0005	<0.001		0.001
Lead	Dissolved	mg/L	<0.0001		<0.0001		0.0001
Lithium	Dissolved	mg/L	0.009	±0.0008	0.016	±0.001	0.001
Molybdenum	Dissolved	mg/L	0.002	±0.0001	0.006	±0.0003	0.001
Nickel	Dissolved	mg/L	0.0008	±0.00005	0.0060	±0.0002	0.0005
Selenium	Dissolved	mg/L	0.0005	±0.0003	<0.0002		0.0002
Silver	Dissolved	mg/L	<0.00001		<0.00001		0.00001
Strontium	Dissolved	mg/L	0.362	±0.027	1.01	±0.08	0.001
Thallium	Dissolved	mg/L	<0.00005		<0.00005		0.00005
Tin	Dissolved	mg/L	<0.001		<0.001		0.001
Titanium	Dissolved	mg/L	0.0007	±0.00006	<0.0005		0.0005
Uranium	Dissolved	mg/L	0.0020	±0.0001	0.0033	±0.0002	0.0005
Vanadium	Dissolved	mg/L	<0.0001		0.0002	±0.00003	0.0001
Zinc	Dissolved	mg/L	0.001	±0.00023	0.002	±0.00024	0.001
Zirconium	Dissolved	mg/L	<0.001		<0.001		0.001
Subsample			Field Filtered		Field Filtered		
Metals Total							
Aluminum	Total	mg/L	32.0		25.2		0.02
Calcium	Total	mg/L	325	±2	231	±1	0.2
Iron	Total	mg/L	67.2	±0.4	52.4	±0.3	0.05
Magnesium	Total	mg/L	92.9	±1.2	78.2	±1.0	0.2
Manganese	Total	mg/L	1.91	±0.05	2.19	±0.05	0.005
Potassium	Total	mg/L	6.5	±0.6	7.2	±0.7	0.4
Silicon	Total	mg/L	46.3	±0.4	37.7	±0.4	0.05

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1 Attn: Accounts Payable Sampled By: Colin McKenzie Company: Matrix Solutions Inc.	Project ID: 26388 Project Name: Burnco/West Cochrane Gravel Pit Project Location: LSD: West Cochrane Gravel Pit P.O.: Proj. Acct. code:	Lot ID: 1531395 Control Number: 067005 Date Received: Oct 27, 2021 Date Reported: Nov 3, 2021 Report Number: 2682987
--	--	---

Reference Number	1531395-1	1531395-2
Sample Date	Oct 25, 2021	Oct 25, 2021
Sample Time	NA	NA
Sample Location		
Sample Description	26388211025001 / 8.1°C Water	26388211025002 / 8.1°C Water
Matrix		

Analyte	Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Metals Total - Continued						
Sodium	Total	mg/L	20.1 ±0.6	24.7 ±0.7	0.4	
Sulfur	Total	mg/L	12.1 ±0.1	38.7 ±0.3	0.3	
Mercury	Total	mg/L	0.000043 ±0.0002	0.000057 ±0.0002	0.000005	
Antimony	Total	mg/L	0.0003 ±0.00003	0.0005 ±0.00004	0.0002	
Arsenic	Total	mg/L	0.0227 ±0.0023	0.0185 ±0.0019	0.0002	
Barium	Total	mg/L	1.18 ±0.11	0.751 ±0.068	0.001	
Beryllium	Total	mg/L	0.0016 ±0.0002	0.0010 ±0.0001	0.0001	
Bismuth	Total	mg/L	<0.0005	<0.0005	0.0005	
Boron	Total	mg/L	0.031 ±0.003	0.045 ±0.004	0.002	
Cadmium	Total	mg/L	0.00090 ±0.00008	0.00086 ±0.00008	0.00001	
Chromium	Total	mg/L	0.0579 ±0.0059	0.0535 ±0.0055	0.0005	
Cobalt	Total	mg/L	0.0405 ±0.0039	0.0311 ±0.0030	0.0001	
Copper	Total	mg/L	0.072 ±0.007	0.052 ±0.005	0.001	
Lead	Total	mg/L	0.0352 ±0.0025	0.0222 ±0.0016	0.0001	
Lithium	Total	mg/L	0.051 ±0.006	0.046 ±0.005	0.001	
Molybdenum	Total	mg/L	0.002 ±0.0002	0.007 ±0.0008	0.001	
Nickel	Total	mg/L	0.0896 ±0.0100	0.0738 ±0.0083	0.0005	
Selenium	Total	mg/L	0.0014 ±0.0002	0.0021 ±0.0003	0.0002	
Silver	Total	mg/L	0.00043 ±0.00006	0.00024 ±0.00003	0.00001	
Strontium	Total	mg/L	0.689 ±0.074	1.33 ±0.14	0.001	
Thallium	Total	mg/L	0.00058 ±0.00004	0.00042 ±0.00003	0.00005	
Tin	Total	mg/L	<0.001	<0.001	0.001	
Titanium	Total	mg/L	0.148 ±0.018	0.192 ±0.024	0.0005	
Uranium	Total	mg/L	0.0045 ±0.0003	0.0051 ±0.0004	0.0005	
Vanadium	Total	mg/L	0.0818 ±0.0071	0.0700 ±0.0061	0.0001	
Zinc	Total	mg/L	0.238 ±0.018	0.159 ±0.012	0.004	
Zirconium	Total	mg/L	0.002 ±0.0002	0.002 ±0.0002	0.001	

Physical and Aggregate Properties

Turbidity		NTU	3990	±110	7740	±220	0.1
Solids	Total Suspended	mg/L	3110	±330	4220	±450	2

Routine Water

pH			7.80	±0.10	7.84	±0.10	1
Temperature of observed		°C	18.2		18.1		
pH							
Electrical Conductivity	at 25 °C	µS/cm	520	±17	742	±24	1
Calcium	Dissolved	mg/L	55.2	±1.9	73.5	±2.5	0.2
Magnesium	Dissolved	mg/L	24.7	±1.8	42.2	±3.0	0.2

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To:	Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1	Project ID:	26388	Lot ID:	1531395		
		Project Name:	Burnco/West Cochrane Gravel Pit	Control Number:	067005		
		Project Location:		Date Received:	Oct 27, 2021		
Attn:	Accounts Payable	LSD:	West Cochrane Gravel Pit	Date Reported:	Nov 3, 2021		
Sampled By:	Colin McKenzie	P.O.:		Report Number:	2682987		
Company:	Matrix Solutions Inc.	Proj. Acct. code:					
Reference Number				1531395-1	1531395-2		
Sample Date				Oct 25, 2021	Oct 25, 2021		
Sample Time				NA	NA		
Sample Location							
Sample Description				26388211025001 /	26388211025002 /		
				8.1°C	8.1°C		
Matrix				Water	Water		
Analyte		Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Routine Water - Continued							
Sodium	Dissolved	mg/L	18.3	±0.9	23.3	±1.2	0.4
Potassium	Dissolved	mg/L	1.5	±0.1	3.4	±0.2	0.4
Iron	Dissolved	mg/L	0.03	±0.002	<0.01		0.01
Manganese	Dissolved	mg/L	0.055	±0.004	0.050	±0.003	0.005
Chloride	Dissolved	mg/L	5.1	±0.3	28.5	±1.7	0.4
Nitrate - N		mg/L	0.91	±0.07	0.01	±0.01	0.01
Nitrite - N		mg/L	<0.005		<0.005		0.005
Nitrate and Nitrite - N		mg/L	0.91		0.01		0.01
Sulfate (SO4)	Dissolved	mg/L	31.2	±2.9	111	±10	0.9
Hydroxide		mg/L	<5		<5		
Carbonate		mg/L	<6		<6		
Bicarbonate		mg/L	305		306		
P-Alkalinity	as CaCO3	mg/L	<5		<5		5
T-Alkalinity	as CaCO3	mg/L	250	±10	251	±10	5
Total Dissolved Solids	Calculated	mg/L	286		432		1
Hardness	Dissolved as CaCO3	mg/L	240		357		
Ionic Balance	Dissolved	%	96		102		

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1 Attn: Accounts Payable Sampled By: Colin McKenzie Company: Matrix Solutions Inc.	Project ID: 26388 Project Name: Burnco/West Cochrane Gravel Pit Project Location: LSD: West Cochrane Gravel Pit P.O.: Proj. Acct. code:	Lot ID: 1531395 Control Number: 067005 Date Received: Oct 27, 2021 Date Reported: Nov 3, 2021 Report Number: 2682987
--	--	---

Reference Number	1531395-3	1531395-4
Sample Date	Oct 25, 2021	Oct 25, 2021
Sample Time	NA	NA
Sample Location		
Sample Description	26388211025003 / 8.1°C Water	26388211025004 / 8.1°C Water
Matrix		

Analyte		Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Metals Dissolved							
Silicon	Dissolved	mg/L	3.71	±0.33	4.53	±0.41	0.05
Sulfur	Dissolved	mg/L	36.5	±3.4	18.3	±1.7	0.3
Mercury	Dissolved	mg/L	<0.000005		<0.000005		0.000005
Aluminum	Dissolved	mg/L	0.006	±0.00064	0.131	±0.010	0.002
Antimony	Dissolved	mg/L	<0.0002		<0.0002		0.0002
Arsenic	Dissolved	mg/L	0.0005	±0.00007	0.0004	±0.00006	0.0002
Barium	Dissolved	mg/L	0.030	±0.002	0.094	±0.005	0.001
Beryllium	Dissolved	mg/L	<0.0001		<0.0001		0.0001
Bismuth	Dissolved	mg/L	<0.0005		<0.0005		0.0005
Boron	Dissolved	mg/L	0.036	±0.003	0.042	±0.004	0.002
Cadmium	Dissolved	mg/L	0.00001	±0.	0.00002	±0.000002	0.00001
Chromium	Dissolved	mg/L	<0.0005		0.0006	±0.00006	0.0005
Cobalt	Dissolved	mg/L	0.0002	±0.00001	0.0003	±0.00002	0.0001
Copper	Dissolved	mg/L	0.002	±0.0002	0.003	±0.0002	0.001
Lead	Dissolved	mg/L	<0.0001		0.0002	±0.00002	0.0001
Lithium	Dissolved	mg/L	0.024	±0.002	0.017	±0.001	0.001
Molybdenum	Dissolved	mg/L	0.003	±0.0002	0.003	±0.0002	0.001
Nickel	Dissolved	mg/L	0.0017	±0.00008	0.0016	±0.00007	0.0005
Selenium	Dissolved	mg/L	<0.0002		0.0010	±0.0003	0.0002
Silver	Dissolved	mg/L	<0.00001		<0.00001		0.00001
Strontium	Dissolved	mg/L	0.646	±0.049	0.820	±0.062	0.001
Thallium	Dissolved	mg/L	<0.00005		<0.00005		0.00005
Tin	Dissolved	mg/L	<0.001		<0.001		0.001
Titanium	Dissolved	mg/L	<0.0005		0.0017	±0.0001	0.0005
Uranium	Dissolved	mg/L	0.0059	±0.0004	0.0033	±0.0002	0.0005
Vanadium	Dissolved	mg/L	0.0002	±0.00003	0.0004	±0.00005	0.0001
Zinc	Dissolved	mg/L	0.002	±0.00024	0.005	±0.00047	0.001
Zirconium	Dissolved	mg/L	<0.001		<0.001		0.001
Subsample			Field Filtered		Field Filtered		
Metals Total							
Aluminum	Total	mg/L	22.7		5.75		0.02
Calcium	Total	mg/L	163	±0.8	157	±0.8	0.2
Iron	Total	mg/L	56.9	±0.4	9.70	±0.16	0.05
Magnesium	Total	mg/L	57.1	±0.7	70.9	±0.9	0.2
Manganese	Total	mg/L	1.99	±0.05	0.300	±0.047	0.005
Potassium	Total	mg/L	6.6	±0.6	4.5	±0.4	0.4
Silicon	Total	mg/L	38.9	±0.4	14.4	±0.2	0.05

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1 Attn: Accounts Payable Sampled By: Colin McKenzie Company: Matrix Solutions Inc.	Project ID: 26388 Project Name: Burnco/West Cochrane Gravel Pit Project Location: LSD: West Cochrane Gravel Pit P.O.: Proj. Acct. code:	Lot ID: 1531395 Control Number: 067005 Date Received: Oct 27, 2021 Date Reported: Nov 3, 2021 Report Number: 2682987
--	--	---

Reference Number	1531395-3	1531395-4
Sample Date	Oct 25, 2021	Oct 25, 2021
Sample Time	NA	NA
Sample Location		
Sample Description	26388211025003 / 8.1°C Water	26388211025004 / 8.1°C Water
Matrix		

Analyte	Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Metals Total - Continued						
Sodium	Total	mg/L	97.5 ±2.8	48.8 ±1.4	0.4	
Sulfur	Total	mg/L	37.7 ±0.3	20.1 ±0.2	0.3	
Mercury	Total	mg/L	0.000068 ±0.0002	0.00019 ±0.00020	0.000005	
Antimony	Total	mg/L	0.0006 ±0.00006	0.0002 ±0.00002	0.0002	
Arsenic	Total	mg/L	0.0219 ±0.0023	0.0037 ±0.0004	0.0002	
Barium	Total	mg/L	0.741 ±0.067	0.243 ±0.022	0.001	
Beryllium	Total	mg/L	0.0012 ±0.0002	0.0003 ±0.00005	0.0001	
Bismuth	Total	mg/L	<0.0005	<0.0005	0.0005	
Boron	Total	mg/L	0.044 ±0.004	0.047 ±0.004	0.002	
Cadmium	Total	mg/L	0.00088 ±0.00008	0.00020 ±0.00002	0.00001	
Chromium	Total	mg/L	0.0484 ±0.0049	0.0098 ±0.0010	0.0005	
Cobalt	Total	mg/L	0.0398 ±0.0039	0.0043 ±0.0004	0.0001	
Copper	Total	mg/L	0.060 ±0.006	0.012 ±0.001	0.001	
Lead	Total	mg/L	0.0258 ±0.0018	0.0049 ±0.0003	0.0001	
Lithium	Total	mg/L	0.047 ±0.005	0.025 ±0.003	0.001	
Molybdenum	Total	mg/L	0.004 ±0.0004	0.004 ±0.0005	0.001	
Nickel	Total	mg/L	0.0772 ±0.0087	0.0139 ±0.0016	0.0005	
Selenium	Total	mg/L	0.0013 ±0.0002	0.0010 ±0.0002	0.0002	
Silver	Total	mg/L	0.00037 ±0.00005	0.00007 ±0.00001	0.00001	
Strontium	Total	mg/L	0.912 ±0.098	0.921 ±0.098	0.001	
Thallium	Total	mg/L	0.00053 ±0.00003	0.00012 ±0.000007	0.00005	
Tin	Total	mg/L	0.001 ±0.0003	<0.001	0.001	
Titanium	Total	mg/L	0.199 ±0.025	0.0435 ±0.0054	0.0005	
Uranium	Total	mg/L	0.0089 ±0.0007	0.0040 ±0.0003	0.0005	
Vanadium	Total	mg/L	0.0692 ±0.0060	0.0142 ±0.0012	0.0001	
Zinc	Total	mg/L	0.178 ±0.013	0.065 ±0.005	0.004	
Zirconium	Total	mg/L	0.001 ±0.0001	0.001 ±0.0001	0.001	

Physical and Aggregate Properties

Turbidity		NTU	4090	±110	697	±20	0.1
Solids	Total Suspended	mg/L	4430	±470	563	±60	2

Routine Water

pH			7.98	±0.10	7.91	±0.10	1
Temperature of observed		°C	18.3		18.2		
pH							
Electrical Conductivity	at 25 °C	µS/cm	791	±26	777	±26	1
Calcium	Dissolved	mg/L	46.9	±1.6	60.6	±2.1	0.2
Magnesium	Dissolved	mg/L	27.4	±2.0	45.3	±3.3	0.2

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To:	Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1	Project ID:	26388	Lot ID:	1531395		
		Project Name:	Burnco/West Cochrane Gravel Pit	Control Number:	067005		
		Project Location:		Date Received:	Oct 27, 2021		
Attn:	Accounts Payable	LSD:	West Cochrane Gravel Pit	Date Reported:	Nov 3, 2021		
Sampled By:	Colin McKenzie	P.O.:		Report Number:	2682987		
Company:	Matrix Solutions Inc.	Proj. Acct. code:					
Reference Number				1531395-3	1531395-4		
Sample Date				Oct 25, 2021	Oct 25, 2021		
Sample Time				NA	NA		
Sample Location							
Sample Description				26388211025003 /	26388211025004 /		
				8.1°C	8.1°C		
Matrix				Water	Water		
Analyte		Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Routine Water - Continued							
Sodium	Dissolved	mg/L	92.2	±4.8	46.2	±2.4	0.4
Potassium	Dissolved	mg/L	2.9	±0.2	3.0	±0.2	0.4
Iron	Dissolved	mg/L	<0.01		0.27	±0.01	0.01
Manganese	Dissolved	mg/L	0.033	±0.002	0.016	±0.001	0.005
Chloride	Dissolved	mg/L	12.8	±0.8	21.0	±1.3	0.4
Nitrate - N		mg/L	0.05	±0.01	11.5	±0.8	0.01
Nitrite - N		mg/L	<0.005		<0.005		0.005
Nitrate and Nitrite - N		mg/L	0.05		11.5		0.01
Sulfate (SO4)	Dissolved	mg/L	109	±10	54.9	±5.2	0.9
Hydroxide		mg/L	<5		<5		
Carbonate		mg/L	<6		<6		
Bicarbonate		mg/L	371		358		
P-Alkalinity	as CaCO3	mg/L	<5		<5		5
T-Alkalinity	as CaCO3	mg/L	304	±12	294	±12	5
Total Dissolved Solids	Calculated	mg/L	474		407		1
Hardness	Dissolved as CaCO3	mg/L	230		338		
Ionic Balance	Dissolved	%	100		105		

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1		Project ID: 26388	Lot ID: 1531395			
Attn: Accounts Payable		Project Name: Burnco/West Cochrane Gravel Pit	Control Number: 067005		Date Received: Oct 27, 2021	
Sampled By: Colin McKenzie		Project Location: West Cochrane Gravel Pit	Date Reported: Nov 3, 2021		Report Number: 2682987	
Company: Matrix Solutions Inc.		P.O.:				
		Proj. Acct. code:				
		Reference Number	1531395-5	1531395-6		
		Sample Date	Oct 25, 2021	Oct 25, 2021		
		Sample Time	NA	NA		
		Sample Location				
		Sample Description	26388211025005 /	26388211025006 /		
		Matrix	8.1°C Water	8.1°C Water		
Analyte	Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Metals Dissolved						
Silicon	Dissolved	mg/L		3.72	±0.34	0.05
Sulfur	Dissolved	mg/L		19.8	±1.9	0.3
Mercury	Dissolved	mg/L		<0.000005		0.000005
Aluminum	Dissolved	mg/L		0.003	±0.00050	0.002
Antimony	Dissolved	mg/L		0.0004	±0.00003	0.0002
Arsenic	Dissolved	mg/L		0.0008	±0.00010	0.0002
Barium	Dissolved	mg/L		0.029	±0.002	0.001
Beryllium	Dissolved	mg/L		<0.0001		0.0001
Bismuth	Dissolved	mg/L		<0.0005		0.0005
Boron	Dissolved	mg/L		0.069	±0.007	0.002
Cadmium	Dissolved	mg/L		0.00003	±0.000002	0.00001
Chromium	Dissolved	mg/L		<0.0005		0.0005
Cobalt	Dissolved	mg/L		<0.0001		0.0001
Copper	Dissolved	mg/L		0.002	±0.0002	0.001
Lead	Dissolved	mg/L		<0.0001		0.0001
Lithium	Dissolved	mg/L		0.021	±0.002	0.001
Molybdenum	Dissolved	mg/L		0.013	±0.0007	0.001
Nickel	Dissolved	mg/L		0.0014	±0.00006	0.0005
Selenium	Dissolved	mg/L		<0.0002		0.0002
Silver	Dissolved	mg/L		<0.00001		0.00001
Strontium	Dissolved	mg/L		0.581	±0.044	0.001
Thallium	Dissolved	mg/L		<0.00005		0.00005
Tin	Dissolved	mg/L		<0.001		0.001
Titanium	Dissolved	mg/L		<0.0005		0.0005
Uranium	Dissolved	mg/L		0.0057	±0.0004	0.0005
Vanadium	Dissolved	mg/L		0.0002	±0.00003	0.0001
Zinc	Dissolved	mg/L		0.004	±0.00039	0.001
Zirconium	Dissolved	mg/L		<0.001		0.001
Subsample			Lab Filtered		Field Filtered	
Physical and Aggregate Properties						
Turbidity		NTU	2050	±60	6.0	±0.2
Solids	Total Suspended	mg/L	1020	±110	16	±2
Routine Water						
pH			7.97	±0.10	7.97	±0.10
Temperature of observed		°C	18.2		18.3	
pH						
Electrical Conductivity	at 25 °C	µS/cm	550	±18	711	±23

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To:	Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1	Project ID:	26388	Lot ID:	1531395		
		Project Name:	Burnco/West Cochrane Gravel Pit	Control Number:	067005		
		Project Location:		Date Received:	Oct 27, 2021		
Attn:	Accounts Payable	LSD:	West Cochrane Gravel Pit	Date Reported:	Nov 3, 2021		
Sampled By:	Colin McKenzie	P.O.:		Report Number:	2682987		
Company:	Matrix Solutions Inc.	Proj. Acct. code:					
		Reference Number	1531395-5	1531395-6			
		Sample Date	Oct 25, 2021	Oct 25, 2021			
		Sample Time	NA	NA			
		Sample Location					
		Sample Description	26388211025005 /	26388211025006 /			
			8.1°C	8.1°C			
		Matrix	Water	Water			
Analyte		Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Routine Water - Continued							
Electrical Conductivity	at 25 °C	dS/m	0.550	±0.018			0.001
Calcium	Dissolved	mg/L	26.0	±0.9	34.6	±1.2	0.2
Magnesium	Dissolved	mg/L	10.6	±0.8	20.1	±1.4	0.2
Sodium	Dissolved	mg/L	81.9	±4.3	101	±5	0.4
Potassium	Dissolved	mg/L	2.8	±0.2	2.7	±0.2	0.4
Iron	Dissolved	mg/L	<0.01		<0.01		0.01
Manganese	Dissolved	mg/L	<0.005		0.030	±0.002	0.005
Chloride	Dissolved	mg/L	4.8	±0.3	12.1	±0.8	0.4
Nitrate - N		mg/L	3.77	±0.27	0.15	±0.02	0.01
Nitrite - N		mg/L	<0.005		<0.005		0.005
Nitrate and Nitrite - N		mg/L	3.77		0.15		0.01
Sulfate (SO4)	Dissolved	mg/L	62.9	±5.9	59.3	±5.6	0.9
Hydroxide		mg/L	<5		<5		
Carbonate		mg/L	<6		<6		
Bicarbonate		mg/L	245		383		
P-Alkalinity	as CaCO3	mg/L	<5		<5		5
T-Alkalinity	as CaCO3	mg/L	201	±9	314	±13	5
Total Dissolved Solids	Calculated	mg/L	310		418		1
Hardness	Dissolved as CaCO3	mg/L	109.0		169.0		
Ionic Balance	Dissolved	%	101		100		

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To:	Matrix Solutions Inc.	Project ID:	26388	Lot ID:	1531395		
	Suite 600, 214 11 Ave SW	Project Name:	Burnco/West Cochrane	Control Number:	067005		
	Calgary, AB, Canada	Project Location:	Gravel Pit	Date Received:	Oct 27, 2021		
	T2R 0K1	LSD:	West Cochrane Gravel	Date Reported:	Nov 3, 2021		
Attn:	Accounts Payable		Pit	Report Number:	2682987		
Sampled By:	Colin McKenzie	P.O.:					
Company:	Matrix Solutions Inc.	Proj. Acct. code:					
		Reference Number	1531395-6			1531395-7	
		Sample Date	Oct 25, 2021			Oct 25, 2021	
		Sample Time	NA			NA	
		Sample Location					
		Sample Description	26388211025006 /			26388211025007 /	
			8.1°C			8.1°C	
		Matrix	Water			Water	
Analyte		Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Metals Total							
Aluminum	Total	mg/L	0.10		8.24		0.02
Calcium	Total	mg/L	33.9	±0.2	96.2	±0.5	0.2
Iron	Total	mg/L	0.36	±0.15	26.4	±0.2	0.05
Magnesium	Total	mg/L	20.2	±0.3	38.1	±0.5	0.2
Manganese	Total	mg/L	0.092	±0.047	1.18	±0.05	0.005
Potassium	Total	mg/L	2.8	±0.3	4.4	±0.4	0.4
Silicon	Total	mg/L	3.85	±0.10	17.0	±0.2	0.05
Sodium	Total	mg/L	101	±3	27.0	±0.8	0.4
Sulfur	Total	mg/L	19.8	±0.2	15.8	±0.2	0.3
Mercury	Total	mg/L	<0.000005		0.000033	±0.0002	0.000005
Antimony	Total	mg/L	0.0004	±0.00004	0.0006	±0.00005	0.0002
Arsenic	Total	mg/L	0.0009	±0.00010	0.0101	±0.0010	0.0002
Barium	Total	mg/L	0.033	±0.003	0.352	±0.032	0.001
Beryllium	Total	mg/L	<0.0001		0.0006	±0.00008	0.0001
Bismuth	Total	mg/L	<0.0005		<0.0005		0.0005
Boron	Total	mg/L	0.069	±0.006	0.040	±0.004	0.002
Cadmium	Total	mg/L	0.00008	±0.000008	0.00079	±0.00007	0.00001
Chromium	Total	mg/L	0.0078	±0.0008	0.0188	±0.0019	0.0005
Cobalt	Total	mg/L	0.0004	±0.00004	0.0124	±0.0012	0.0001
Copper	Total	mg/L	0.003	±0.0003	0.021	±0.002	0.001
Lead	Total	mg/L	0.0002	±0.00002	0.0086	±0.0006	0.0001
Lithium	Total	mg/L	0.020	±0.002	0.016	±0.002	0.001
Molybdenum	Total	mg/L	0.014	±0.002	0.002	±0.0003	0.001
Nickel	Total	mg/L	0.0063	±0.0007	0.0260	±0.0029	0.0005
Selenium	Total	mg/L	<0.0002		0.0004	±0.0001	0.0002
Silver	Total	mg/L	<0.00001		0.00007	±0.00001	0.00001
Strontium	Total	mg/L	0.568	±0.061	0.823	±0.088	0.001
Thallium	Total	mg/L	<0.00005		0.00025	±0.00002	0.00005
Tin	Total	mg/L	<0.001		0.001	±0.0002	0.001
Titanium	Total	mg/L	0.0045	±0.0006	0.224	±0.028	0.0005
Uranium	Total	mg/L	0.0057	±0.0004	0.0031	±0.0002	0.0005
Vanadium	Total	mg/L	0.0005	±0.00005	0.0268	±0.0023	0.0001
Zinc	Total	mg/L	0.008	±0.0006	0.071	±0.005	0.004
Zirconium	Total	mg/L	<0.001		0.002	±0.0002	0.001

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1		Project ID: 26388	Lot ID: 1531395		Control Number: 067005	
Attn: Accounts Payable		Project Name: Burnco/West Cochrane Gravel Pit	Date Received: Oct 27, 2021		Date Reported: Nov 3, 2021	
Sampled By: Colin McKenzie		Project Location: West Cochrane Gravel Pit	Report Number: 2682987			
Company: Matrix Solutions Inc.		P.O.:				
		Proj. Acct. code:				
		Reference Number	1531395-7	1531395-8		
		Sample Date	Oct 25, 2021	Oct 25, 2021		
		Sample Time	NA	NA		
		Sample Location				
		Sample Description	26388211025007 /	26388211025008 /		
			8.1°C	8.1°C		
		Matrix	Water	Water		
Analyte	Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Metals Dissolved						
Silicon	Dissolved	mg/L	4.48 ±0.40	4.48	±0.40	0.05
Sulfur	Dissolved	mg/L	15.5 ±1.5	11.7	±1.1	0.3
Mercury	Dissolved	mg/L	<0.000005	<0.000005		0.000005
Aluminum	Dissolved	mg/L	<0.002	<0.002		0.002
Antimony	Dissolved	mg/L	<0.0002	<0.0002		0.0002
Arsenic	Dissolved	mg/L	0.0004 ±0.00006	0.0002	±0.00005	0.0002
Barium	Dissolved	mg/L	0.082 ±0.005	0.147	±0.009	0.001
Beryllium	Dissolved	mg/L	<0.0001	<0.0001		0.0001
Bismuth	Dissolved	mg/L	<0.0005	<0.0005		0.0005
Boron	Dissolved	mg/L	0.037 ±0.004	0.044	±0.004	0.002
Cadmium	Dissolved	mg/L	0.00004 ±0.000003	<0.00001		0.00001
Chromium	Dissolved	mg/L	<0.0005	<0.0005		0.0005
Cobalt	Dissolved	mg/L	0.0004 ±0.00002	<0.0001		0.0001
Copper	Dissolved	mg/L	<0.001	<0.001		0.001
Lead	Dissolved	mg/L	<0.0001	<0.0001		0.0001
Lithium	Dissolved	mg/L	0.007 ±0.0006	0.014	±0.001	0.001
Molybdenum	Dissolved	mg/L	0.002 ±0.0001	0.001	±0.00007	0.001
Nickel	Dissolved	mg/L	0.0014 ±0.00006	<0.0005		0.0005
Selenium	Dissolved	mg/L	<0.0002	0.0007	±0.0003	0.0002
Silver	Dissolved	mg/L	<0.00001	<0.00001		0.00001
Strontium	Dissolved	mg/L	0.770 ±0.058	0.818	±0.062	0.001
Thallium	Dissolved	mg/L	<0.00005	<0.00005		0.00005
Tin	Dissolved	mg/L	<0.001	<0.001		0.001
Titanium	Dissolved	mg/L	<0.0005	<0.0005		0.0005
Uranium	Dissolved	mg/L	0.0022 ±0.0002	0.0026	±0.0002	0.0005
Vanadium	Dissolved	mg/L	0.0002 ±0.00003	<0.0001		0.0001
Zinc	Dissolved	mg/L	0.001 ±0.00023	<0.001		0.001
Zirconium	Dissolved	mg/L	<0.001	<0.001		0.001
Subsample			Field Filtered	Field Filtered		
Physical and Aggregate Properties						
Turbidity		NTU	416 ±12	5870	±160	0.1
Solids	Total Suspended	mg/L	437 ±46	3220	±340	2
Routine Water						
pH			7.86 ±0.10	7.80	±0.10	1
Temperature of observed		°C	18.4	18.6		
pH						
Electrical Conductivity	at 25 °C	µS/cm	581 ±19	692	±23	1

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To:	Matrix Solutions Inc.	Project ID:	26388	Lot ID:	1531395		
	Suite 600, 214 11 Ave SW	Project Name:	Burnco/West Cochrane	Control Number:	067005		
	Calgary, AB, Canada		Gravel Pit	Date Received:	Oct 27, 2021		
	T2R 0K1	Project Location:		Date Reported:	Nov 3, 2021		
Attn:	Accounts Payable	LSD:	West Cochrane Gravel Pit	Report Number:	2682987		
Sampled By:	Colin McKenzie	P.O.:					
Company:	Matrix Solutions Inc.	Proj. Acct. code:					
Reference Number				1531395-7	1531395-8		
Sample Date				Oct 25, 2021	Oct 25, 2021		
Sample Time				NA	NA		
Sample Location							
Sample Description				26388211025007 /	26388211025008 /		
				8.1°C	8.1°C		
Matrix				Water	Water		
Analyte		Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Routine Water - Continued							
Calcium	Dissolved	mg/L	60.6	±2.1	60.1	±2.0	0.2
Magnesium	Dissolved	mg/L	26.2	±1.9	39.4	±2.8	0.2
Sodium	Dissolved	mg/L	25.6	±1.3	38.7	±2.0	0.4
Potassium	Dissolved	mg/L	2.7	±0.2	2.5	±0.2	0.4
Iron	Dissolved	mg/L	0.01	±0.001	<0.01		0.01
Manganese	Dissolved	mg/L	0.187	±0.013	<0.005		0.005
Chloride	Dissolved	mg/L	5.5	±0.4	12.0	±0.7	0.4
Nitrate - N		mg/L	0.06	±0.01	0.33	±0.03	0.01
Nitrite - N		mg/L	<0.005		<0.005		0.005
Nitrate and Nitrite - N		mg/L	0.06		0.33		0.01
Sulfate (SO4)	Dissolved	mg/L	46.6	±4.4	35.2	±3.3	0.9
Hydroxide		mg/L	<5		<5		
Carbonate		mg/L	<6		<6		
Bicarbonate		mg/L	326		422		
P-Alkalinity	as CaCO3	mg/L	<5		<5		5
T-Alkalinity	as CaCO3	mg/L	267	±11	346	±14	5
Total Dissolved Solids	Calculated	mg/L	328		396		1
Hardness	Dissolved as CaCO3	mg/L	259		312		
Ionic Balance	Dissolved	%	99		100		

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1	Project ID: 26388 Project Name: Burnco/West Cochrane Gravel Pit Project Location: LSD: West Cochrane Gravel Pit P.O.: Proj. Acct. code:	Lot ID: 1531395 Control Number: 067005 Date Received: Oct 27, 2021 Date Reported: Nov 3, 2021 Report Number: 2682987
Attn: Accounts Payable Sampled By: Colin McKenzie Company: Matrix Solutions Inc.		

Reference Number	1531395-8	1531395-9
Sample Date	Oct 25, 2021	Oct 26, 2021
Sample Time	NA	NA
Sample Location		
Sample Description	26388211025008 / 8.1°C Water	26388211026009 / 8.1°C Water
Matrix		

Analyte		Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Metals Total							
Aluminum	Total	mg/L	14.5		14.8		0.02
Calcium	Total	mg/L	795	±4	205	±1	0.2
Iron	Total	mg/L	33.9	±0.3	25.2	±0.2	0.05
Magnesium	Total	mg/L	151	±2	164	±2	0.2
Manganese	Total	mg/L	1.58	±0.05	0.681	±0.047	0.005
Potassium	Total	mg/L	6.9	±0.7	6.7	±0.7	0.4
Silicon	Total	mg/L	32.8	±0.3	29.5	±0.3	0.05
Sodium	Total	mg/L	40.9	±1.2	112	±3	0.4
Sulfur	Total	mg/L	13	±0.1	75.1	±0.5	0.3
Mercury	Total	mg/L	0.000035	±0.0002	0.000044	±0.0002	0.000005
Antimony	Total	mg/L	0.0007	±0.00007	<0.0004		0.0002
Arsenic	Total	mg/L	0.013	±0.001	0.0089	±0.0009	0.0002
Barium	Total	mg/L	0.590	±0.053	0.455	±0.041	0.001
Beryllium	Total	mg/L	0.0007	±0.00009	0.0006	±0.00008	0.0001
Bismuth	Total	mg/L	<0.001		<0.001		0.0005
Boron	Total	mg/L	0.065	±0.006	0.11	±0.01	0.002
Cadmium	Total	mg/L	0.0012	±0.0001	0.00045	±0.00004	0.00001
Chromium	Total	mg/L	0.0415	±0.0042	0.0359	±0.0037	0.0005
Cobalt	Total	mg/L	0.019	±0.002	0.011	±0.001	0.0001
Copper	Total	mg/L	0.029	±0.003	0.038	±0.004	0.001
Lead	Total	mg/L	0.016	±0.001	0.010	±0.0007	0.0001
Lithium	Total	mg/L	0.042	±0.005	0.099	±0.011	0.001
Molybdenum	Total	mg/L	0.003	±0.0003	0.002	±0.0002	0.001
Nickel	Total	mg/L	0.0375	±0.0042	0.0309	±0.0035	0.0005
Selenium	Total	mg/L	0.0010	±0.0002	0.0005	±0.0002	0.0002
Silver	Total	mg/L	0.00023	±0.00003	0.0002	±0.00002	0.00001
Strontium	Total	mg/L	1.70	±0.18	1.22	±0.13	0.001
Thallium	Total	mg/L	0.00047	±0.00003	0.00029	±0.00002	0.00005
Tin	Total	mg/L	<0.002		<0.002		0.001
Titanium	Total	mg/L	0.0904	±0.0112	0.247	±0.031	0.0005
Uranium	Total	mg/L	0.0047	±0.0004	0.017	±0.001	0.0005
Vanadium	Total	mg/L	0.0472	±0.0041	0.0383	±0.0033	0.0001
Zinc	Total	mg/L	0.15	±0.01	0.084	±0.006	0.004
Zirconium	Total	mg/L	0.002	±0.0002	0.003	±0.0003	0.001

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To:	Matrix Solutions Inc.	Project ID:	26388	Lot ID:	1531395		
	Suite 600, 214 11 Ave SW	Project Name:	Burnco/West Cochrane	Control Number:	067005		
	Calgary, AB, Canada	Project Location:	Gravel Pit	Date Received:	Oct 27, 2021		
	T2R 0K1	LSD:	West Cochrane Gravel	Date Reported:	Nov 3, 2021		
Attn:	Accounts Payable		Pit	Report Number:	2682987		
Sampled By:	Colin McKenzie	P.O.:					
Company:	Matrix Solutions Inc.	Proj. Acct. code:					
		Reference Number	1531395-9		1531395-10		
		Sample Date	Oct 26, 2021		Oct 26, 2021		
		Sample Time	NA		NA		
		Sample Location					
		Sample Description	26388211026009 /		26388211026010 /		
			8.1°C		8.1°C		
		Matrix	Water		Water		
Analyte		Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Metals Dissolved							
Silicon	Dissolved	mg/L	6.01	±0.54	5.74	±0.52	0.05
Sulfur	Dissolved	mg/L	71.9	±6.8	71.1	±6.7	0.3
Mercury	Dissolved	mg/L	<0.000005		<0.000005		0.000005
Aluminum	Dissolved	mg/L	0.669	±0.054	0.539	±0.043	0.002
Antimony	Dissolved	mg/L	<0.001		<0.001		0.0002
Arsenic	Dissolved	mg/L	<0.001		<0.001		0.0002
Barium	Dissolved	mg/L	0.053	±0.003	0.053	±0.003	0.001
Beryllium	Dissolved	mg/L	<0.0005		<0.0005		0.0001
Bismuth	Dissolved	mg/L	<0.002		<0.002		0.0005
Boron	Dissolved	mg/L	0.10	±0.009	0.097	±0.009	0.002
Cadmium	Dissolved	mg/L	<0.00005		<0.00005		0.00001
Chromium	Dissolved	mg/L	<0.002		<0.002		0.0005
Cobalt	Dissolved	mg/L	0.002	±0.00009	0.002	±0.00009	0.0001
Copper	Dissolved	mg/L	<0.005		<0.005		0.001
Lead	Dissolved	mg/L	0.0006	±0.00003	0.0007	±0.00003	0.0001
Lithium	Dissolved	mg/L	0.087	±0.007	0.088	±0.007	0.001
Molybdenum	Dissolved	mg/L	<0.005		<0.005		0.001
Nickel	Dissolved	mg/L	0.004	±0.0002	0.004	±0.0002	0.0005
Selenium	Dissolved	mg/L	<0.001		<0.001		0.0002
Silver	Dissolved	mg/L	<0.00005		<0.00005		0.00001
Strontium	Dissolved	mg/L	1.11	±0.08	1.09	±0.08	0.001
Thallium	Dissolved	mg/L	<0.0003		<0.0003		0.00005
Tin	Dissolved	mg/L	<0.005		<0.005		0.001
Titanium	Dissolved	mg/L	0.014	±0.001	0.0098	±0.0008	0.0005
Uranium	Dissolved	mg/L	0.015	±0.001	0.015	±0.001	0.0005
Vanadium	Dissolved	mg/L	0.002	±0.0002	0.002	±0.0002	0.0001
Zinc	Dissolved	mg/L	0.006	±0.00048	0.005	±0.00046	0.001
Zirconium	Dissolved	mg/L	<0.005		<0.005		0.001
Subsample			Field Filtered		Field Filtered		
Physical and Aggregate Properties							
Turbidity		NTU	2910	±80	1980	±60	0.1
Solids	Total Suspended	mg/L	1180	±130	1210	±130	2
Routine Water							
pH			7.37	±0.10	7.42	±0.10	1
Temperature of observed		°C	18.6		18.5		
pH							
Electrical Conductivity	at 25 °C	µS/cm	2020	±70	2010	±70	1

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To:	Matrix Solutions Inc.	Project ID:	26388	Lot ID:	1531395		
	Suite 600, 214 11 Ave SW	Project Name:	Burnco/West Cochrane Gravel Pit	Control Number:	067005		
	Calgary, AB, Canada	Project Location:		Date Received:	Oct 27, 2021		
	T2R 0K1	LSD:	West Cochrane Gravel Pit	Date Reported:	Nov 3, 2021		
Attn:	Accounts Payable	P.O.:		Report Number:	2682987		
Sampled By:	Colin McKenzie	Proj. Acct. code:					
Company:	Matrix Solutions Inc.						
				Reference Number	1531395-9	1531395-10	
				Sample Date	Oct 26, 2021	Oct 26, 2021	
				Sample Time	NA	NA	
				Sample Location			
				Sample Description	26388211026009 /	26388211026010 /	
					8.1°C	8.1°C	
				Matrix	Water	Water	
Analyte		Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Routine Water - Continued							
Calcium	Dissolved	mg/L	142	±5	141	±5	0.2
Magnesium	Dissolved	mg/L	143	±10	143	±10	0.2
Sodium	Dissolved	mg/L	105	±5	102	±5	0.4
Potassium	Dissolved	mg/L	4	±0.3	4	±0.3	0.4
Iron	Dissolved	mg/L	1.1	±0.05	1.1	±0.05	0.01
Manganese	Dissolved	mg/L	0.12	±0.008	0.12	±0.008	0.005
Chloride	Dissolved	mg/L	194	±12	193	±12	0.4
Nitrate - N		mg/L	0.3	±0.02	<0.05		0.01
Nitrite - N		mg/L	<0.02		<0.02		0.005
Nitrate and Nitrite - N		mg/L	0.3		<0.07		0.01
Sulfate (SO4)	Dissolved	mg/L	216	±20	213	±20	0.9
Hydroxide		mg/L	<5		<5		
Carbonate		mg/L	<6		<6		
Bicarbonate		mg/L	848		830		
P-Alkalinity	as CaCO3	mg/L	<5		<5		5
T-Alkalinity	as CaCO3	mg/L	696	±27	681	±27	5
Total Dissolved Solids	Calculated	mg/L	1220		1210		1
Hardness	Dissolved as CaCO3	mg/L	946		940		
Ionic Balance	Dissolved	%	99		100		

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1	Project ID: 26388 Project Name: Burnco/West Cochrane Gravel Pit Project Location: LSD: West Cochrane Gravel Pit P.O.: Proj. Acct. code:	Lot ID: 1531395 Control Number: 067005 Date Received: Oct 27, 2021 Date Reported: Nov 3, 2021 Report Number: 2682987
Attn: Accounts Payable Sampled By: Colin McKenzie Company: Matrix Solutions Inc.		

Reference Number	1531395-10	1531395-11
Sample Date	Oct 26, 2021	Oct 26, 2021
Sample Time	NA	NA
Sample Location		
Sample Description	26388211026010 / 8.1°C Water	26388211026011 / 8.1°C Water
Matrix		

Analyte		Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Metals Total							
Aluminum	Total	mg/L	15.2		9.74		0.02
Calcium	Total	mg/L	202	±1	66.7	±0.3	0.2
Iron	Total	mg/L	25.4	±0.2	20.6	±0.2	0.05
Magnesium	Total	mg/L	168	±2	26.6	±0.4	0.2
Manganese	Total	mg/L	0.683	±0.047	0.504	±0.047	0.005
Potassium	Total	mg/L	6.9	±0.7	4.2	±0.4	0.4
Silicon	Total	mg/L	29.8	±0.3	20.4	±0.2	0.05
Sodium	Total	mg/L	112	±3	148	±4	0.4
Sulfur	Total	mg/L	76.6	±0.5	34.6	±0.3	0.3
Mercury	Total	mg/L	0.000044	±0.0002	0.00013	±0.00020	0.000005
Antimony	Total	mg/L	0.0004	±0.00004	0.0005	±0.00005	0.0002
Arsenic	Total	mg/L	0.0091	±0.0009	0.0146	±0.0015	0.0002
Barium	Total	mg/L	0.463	±0.042	0.329	±0.030	0.001
Beryllium	Total	mg/L	0.0007	±0.00010	0.0007	±0.00010	0.0001
Bismuth	Total	mg/L	<0.001		<0.0005		0.0005
Boron	Total	mg/L	0.11	±0.01	0.106	±0.010	0.002
Cadmium	Total	mg/L	0.00046	±0.00004	0.00044	±0.00004	0.00001
Chromium	Total	mg/L	0.0359	±0.0037	0.0199	±0.0020	0.0005
Cobalt	Total	mg/L	0.011	±0.001	0.0095	±0.0009	0.0001
Copper	Total	mg/L	0.040	±0.004	0.032	±0.003	0.001
Lead	Total	mg/L	0.010	±0.0007	0.0078	±0.0005	0.0001
Lithium	Total	mg/L	0.097	±0.011	0.027	±0.003	0.001
Molybdenum	Total	mg/L	<0.002		0.004	±0.0004	0.001
Nickel	Total	mg/L	0.0308	±0.0034	0.0348	±0.0039	0.0005
Selenium	Total	mg/L	0.0005	±0.0001	0.0022	±0.0003	0.0002
Silver	Total	mg/L	0.0002	±0.00002	0.00009	±0.00001	0.00001
Strontium	Total	mg/L	1.25	±0.13	0.796	±0.085	0.001
Thallium	Total	mg/L	0.00029	±0.00002	0.00057	±0.00003	0.00005
Tin	Total	mg/L	<0.002		<0.001		0.001
Titanium	Total	mg/L	0.227	±0.028	0.165	±0.020	0.0005
Uranium	Total	mg/L	0.017	±0.001	0.0044	±0.0003	0.0005
Vanadium	Total	mg/L	0.0385	±0.0033	0.0293	±0.0026	0.0001
Zinc	Total	mg/L	0.096	±0.007	0.075	±0.006	0.004
Zirconium	Total	mg/L	0.003	±0.0002	0.001	±0.00010	0.001

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1		Project ID: 26388	Lot ID: 1531395		Control Number: 067005	
Attn: Accounts Payable		Project Name: Burnco/West Cochrane Gravel Pit	Date Received: Oct 27, 2021		Date Reported: Nov 3, 2021	
Sampled By: Colin McKenzie		Project Location: West Cochrane Gravel Pit	Report Number: 2682987			
Company: Matrix Solutions Inc.		P.O.:				
		Proj. Acct. code:				
		Reference Number	1531395-11	1531395-12		
		Sample Date	Oct 26, 2021	Oct 26, 2021		
		Sample Time	NA	NA		
		Sample Location				
		Sample Description	26388211026011 /	26388211026012 /		
		Matrix	8.1°C Water	8.1°C Water		
Analyte	Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Metals Dissolved						
Silicon	Dissolved	mg/L	3.78 ±0.34	4.86 ±0.44	0.05	
Sulfur	Dissolved	mg/L	31.1 ±2.9	9.2 ±0.9	0.3	
Mercury	Dissolved	mg/L	<0.000005	<0.000005	0.000005	
Aluminum	Dissolved	mg/L	0.007 ±0.00072	0.002 ±0.00048	0.002	
Antimony	Dissolved	mg/L	<0.0002	<0.0002	0.0002	
Arsenic	Dissolved	mg/L	0.0024 ±0.0003	0.0006 ±0.00008	0.0002	
Barium	Dissolved	mg/L	0.037 ±0.002	0.070 ±0.004	0.001	
Beryllium	Dissolved	mg/L	<0.0001	<0.0001	0.0001	
Bismuth	Dissolved	mg/L	<0.0005	<0.0005	0.0005	
Boron	Dissolved	mg/L	0.107 ±0.010	0.033 ±0.003	0.002	
Cadmium	Dissolved	mg/L	0.00001 ±0.	<0.00001	0.00001	
Chromium	Dissolved	mg/L	<0.0005	<0.0005	0.0005	
Cobalt	Dissolved	mg/L	0.0003 ±0.00002	0.0001 ±0.000009	0.0001	
Copper	Dissolved	mg/L	<0.001	0.002 ±0.0001	0.001	
Lead	Dissolved	mg/L	<0.0001	<0.0001	0.0001	
Lithium	Dissolved	mg/L	0.019 ±0.002	0.022 ±0.002	0.001	
Molybdenum	Dissolved	mg/L	0.003 ±0.0001	0.003 ±0.0002	0.001	
Nickel	Dissolved	mg/L	0.0014 ±0.00006	0.0010 ±0.00005	0.0005	
Selenium	Dissolved	mg/L	<0.0002	0.0017 ±0.0003	0.0002	
Silver	Dissolved	mg/L	<0.00001	<0.00001	0.00001	
Strontium	Dissolved	mg/L	0.694 ±0.053	0.494 ±0.038	0.001	
Thallium	Dissolved	mg/L	<0.00005	<0.00005	0.00005	
Tin	Dissolved	mg/L	<0.001	<0.001	0.001	
Titanium	Dissolved	mg/L	<0.0005	<0.0005	0.0005	
Uranium	Dissolved	mg/L	0.0033 ±0.0002	0.0101 ±0.0007	0.0005	
Vanadium	Dissolved	mg/L	0.0002 ±0.00003	0.0002 ±0.00003	0.0001	
Zinc	Dissolved	mg/L	0.004 ±0.00036	0.001 ±0.00022	0.001	
Zirconium	Dissolved	mg/L	<0.001	<0.001	0.001	
Subsample			Field Filtered	Field Filtered		
Physical and Aggregate Properties						
Turbidity	NTU	703	±20	4800	±130	0.1
Solids	Total Suspended	mg/L	690	±70	3400	±360
Routine Water						
pH		7.96	±0.10	7.89	±0.10	1
Temperature of observed	°C	18.5		18.5		
pH						
Electrical Conductivity	at 25 °C	µS/cm	902	±30	586	±19

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To:	Matrix Solutions Inc.	Project ID:	26388	Lot ID:	1531395		
	Suite 600, 214 11 Ave SW	Project Name:	Burnco/West Cochrane	Control Number:	067005		
	Calgary, AB, Canada	Project Location:	Gravel Pit	Date Received:	Oct 27, 2021		
	T2R 0K1	LSD:	West Cochrane Gravel	Date Reported:	Nov 3, 2021		
Attn:	Accounts Payable		Pit	Report Number:	2682987		
Sampled By:	Colin McKenzie	P.O.:					
Company:	Matrix Solutions Inc.	Proj. Acct. code:					
		Reference Number	1531395-11	1531395-12			
		Sample Date	Oct 26, 2021	Oct 26, 2021			
		Sample Time	NA	NA			
		Sample Location					
		Sample Description	26388211026011 /	26388211026012 /			
			8.1°C	8.1°C			
		Matrix	Water	Water			
Analyte		Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Routine Water - Continued							
Calcium	Dissolved	mg/L	47.6	±1.6	60.2	±2.0	0.2
Magnesium	Dissolved	mg/L	19.2	±1.4	34.1	±2.5	0.2
Sodium	Dissolved	mg/L	130	±7	9.2	±0.5	0.4
Potassium	Dissolved	mg/L	2.4	±0.2	5.0	±0.3	0.4
Iron	Dissolved	mg/L	0.03	±0.002	<0.01		0.01
Manganese	Dissolved	mg/L	0.151	±0.010	0.032	±0.002	0.005
Chloride	Dissolved	mg/L	25.4	±1.6	12.4	±0.8	0.4
Nitrate - N		mg/L	0.11	±0.02	4.63	±0.33	0.01
Nitrite - N		mg/L	<0.005		<0.005		0.005
Nitrate and Nitrite - N		mg/L	0.11		4.63		0.01
Sulfate (SO4)	Dissolved	mg/L	93.4	±8.8	27	±3	0.9
Hydroxide		mg/L	<5		<5		
Carbonate		mg/L	<6		<6		
Bicarbonate		mg/L	438		317		
P-Alkalinity	as CaCO3	mg/L	<5		<5		5
T-Alkalinity	as CaCO3	mg/L	360	±14	260	±11	5
Total Dissolved Solids	Calculated	mg/L	534		305		1
Hardness	Dissolved as CaCO3	mg/L	198		291		
Ionic Balance	Dissolved	%	98		98		

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1	Project ID: 26388 Project Name: Burnco/West Cochrane Gravel Pit Project Location: LSD: West Cochrane Gravel Pit P.O.: Proj. Acct. code:	Lot ID: 1531395 Control Number: 067005 Date Received: Oct 27, 2021 Date Reported: Nov 3, 2021 Report Number: 2682987
Attn: Accounts Payable Sampled By: Colin McKenzie Company: Matrix Solutions Inc.		

Reference Number	1531395-12	1531395-13
Sample Date	Oct 26, 2021	Oct 26, 2021
Sample Time	NA	NA
Sample Location		
Sample Description	26388211026012 / 8.1°C Water	26388211026013 / 8.1°C Water
Matrix		

Analyte		Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Metals Total							
Aluminum	Total	mg/L	52.4		<0.02		0.02
Calcium	Total	mg/L	642	±3	89.3	±0.5	0.2
Iron	Total	mg/L	109	±0.7	0.21	±0.15	0.05
Magnesium	Total	mg/L	172	±2	54.9	±0.7	0.2
Manganese	Total	mg/L	3.63	±0.05	<0.005		0.005
Potassium	Total	mg/L	14	±1	3.0	±0.3	0.4
Silicon	Total	mg/L	80.4	±0.7	3.68	±0.10	0.05
Sodium	Total	mg/L	12	±0.4	139	±4	0.4
Sulfur	Total	mg/L	11	±0.1	101	±0.7	0.3
Mercury	Total	mg/L	0.00015	±0.00020	<0.000005		0.000005
Antimony	Total	mg/L	0.001	±0.0001	<0.0002		0.0002
Arsenic	Total	mg/L	0.0416	±0.0043	<0.0002		0.0002
Barium	Total	mg/L	1.19	±0.11	0.033	±0.003	0.001
Beryllium	Total	mg/L	0.0032	±0.0004	<0.0001		0.0001
Bismuth	Total	mg/L	<0.001		<0.0005		0.0005
Boron	Total	mg/L	0.054	±0.005	0.097	±0.009	0.002
Cadmium	Total	mg/L	0.00241	±0.00022	0.00001	±0.	0.00001
Chromium	Total	mg/L	0.139	±0.014	<0.0005		0.0005
Cobalt	Total	mg/L	0.0519	±0.0050	<0.0001		0.0001
Copper	Total	mg/L	0.11	±0.01	0.010	±0.0010	0.001
Lead	Total	mg/L	0.0543	±0.0038	0.0004	±0.00003	0.0001
Lithium	Total	mg/L	0.079	±0.009	0.017	±0.002	0.001
Molybdenum	Total	mg/L	0.005	±0.0005	0.002	±0.0002	0.001
Nickel	Total	mg/L	0.155	±0.017	<0.0005		0.0005
Selenium	Total	mg/L	0.0031	±0.0003	0.0023	±0.0003	0.0002
Silver	Total	mg/L	0.00061	±0.00009	<0.00001		0.00001
Strontium	Total	mg/L	1.27	±0.14	1.44	±0.15	0.001
Thallium	Total	mg/L	0.0012	±0.00008	<0.00005		0.00005
Tin	Total	mg/L	<0.002		<0.001		0.001
Titanium	Total	mg/L	0.320	±0.040	<0.0005		0.0005
Uranium	Total	mg/L	0.019	±0.001	0.0043	±0.0003	0.0005
Vanadium	Total	mg/L	0.155	±0.013	0.0002	±0.00003	0.0001
Zinc	Total	mg/L	0.408	±0.031	0.018	±0.001	0.004
Zirconium	Total	mg/L	0.002	±0.0002	<0.001		0.001

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1		Project ID: 26388	Lot ID: 1531395		Control Number: 067005	
Attn: Accounts Payable		Project Name: Burnco/West Cochrane Gravel Pit	Date Received: Oct 27, 2021		Date Reported: Nov 3, 2021	
Sampled By: Colin McKenzie		Project Location: West Cochrane Gravel Pit	Report Number: 2682987			
Company: Matrix Solutions Inc.		P.O.:				
		Proj. Acct. code:				
		Reference Number	1531395-13	1531395-14		
		Sample Date	Oct 26, 2021	Oct 26, 2021		
		Sample Time	NA	NA		
		Sample Location				
		Sample Description	26388211026013 /	26388211026014 /		
		Matrix	8.1°C Water	8.1°C Water		
Analyte	Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Metals Dissolved						
Silicon	Dissolved	mg/L	3.58 ±0.32	3.58	±0.32	0.05
Sulfur	Dissolved	mg/L	94.9 ±8.9	95.9	±9.0	0.3
Mercury	Dissolved	mg/L	<0.000005	<0.000005		0.000005
Aluminum	Dissolved	mg/L	<0.002	<0.002		0.002
Antimony	Dissolved	mg/L	<0.0002	<0.0002		0.0002
Arsenic	Dissolved	mg/L	<0.0002	<0.0002		0.0002
Barium	Dissolved	mg/L	0.031 ±0.002	0.033	±0.002	0.001
Beryllium	Dissolved	mg/L	<0.0001	<0.0001		0.0001
Bismuth	Dissolved	mg/L	<0.0005	<0.0005		0.0005
Boron	Dissolved	mg/L	0.104 ±0.010	0.104	±0.010	0.002
Cadmium	Dissolved	mg/L	<0.00001	0.00001	±0.	0.00001
Chromium	Dissolved	mg/L	<0.0005	<0.0005		0.0005
Cobalt	Dissolved	mg/L	<0.0001	<0.0001		0.0001
Copper	Dissolved	mg/L	0.005 ±0.0004	0.018	±0.001	0.001
Lead	Dissolved	mg/L	<0.0001	0.0005	±0.00002	0.0001
Lithium	Dissolved	mg/L	0.018 ±0.001	0.018	±0.001	0.001
Molybdenum	Dissolved	mg/L	0.002 ±0.00008	0.002	±0.00008	0.001
Nickel	Dissolved	mg/L	<0.0005	<0.0005		0.0005
Selenium	Dissolved	mg/L	0.0026 ±0.0004	0.0033	±0.0005	0.0002
Silver	Dissolved	mg/L	<0.00001	<0.00001		0.00001
Strontium	Dissolved	mg/L	1.45 ±0.11	1.40	±0.11	0.001
Thallium	Dissolved	mg/L	<0.00005	<0.00005		0.00005
Tin	Dissolved	mg/L	<0.001	<0.001		0.001
Titanium	Dissolved	mg/L	<0.0005	<0.0005		0.0005
Uranium	Dissolved	mg/L	0.0042 ±0.0003	0.0046	±0.0003	0.0005
Vanadium	Dissolved	mg/L	<0.0001	0.0001	±0.00003	0.0001
Zinc	Dissolved	mg/L	0.012 ±0.0010	0.025	±0.0020	0.001
Zirconium	Dissolved	mg/L	<0.001	<0.001		0.001
Subsample			Field Filtered	Field Filtered		
Physical and Aggregate Properties						
Turbidity		NTU	2.4 ±0.07	0.8	±0.02	0.1
Solids	Total Suspended	mg/L	4 ±0.9	<2		2
Routine Water						
pH			7.65 ±0.10	7.62	±0.10	1
Temperature of observed		°C	18.5	18.5		
pH						
Electrical Conductivity	at 25 °C	µS/cm	1240 ±40	1260	±40	1

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To:	Matrix Solutions Inc.	Project ID:	26388	Lot ID:	1531395		
	Suite 600, 214 11 Ave SW	Project Name:	Burnco/West Cochrane	Control Number:	067005		
	Calgary, AB, Canada		Gravel Pit	Date Received:	Oct 27, 2021		
	T2R 0K1	Project Location:		Date Reported:	Nov 3, 2021		
Attn:	Accounts Payable	LSD:	West Cochrane Gravel Pit	Report Number:	2682987		
Sampled By:	Colin McKenzie	P.O.:					
Company:	Matrix Solutions Inc.	Proj. Acct. code:					
		Reference Number	1531395-13	1531395-14			
		Sample Date	Oct 26, 2021	Oct 26, 2021			
		Sample Time	NA	NA			
		Sample Location					
		Sample Description	26388211026013 /	26388211026014 /			
			8.1°C	8.1°C			
		Matrix	Water	Water			
Analyte		Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Routine Water - Continued							
Calcium	Dissolved	mg/L	88.0	±3.0	90.3	±3.1	0.2
Magnesium	Dissolved	mg/L	52.0	±3.7	54.2	±3.9	0.2
Sodium	Dissolved	mg/L	129	±7	126	±7	0.4
Potassium	Dissolved	mg/L	2.8	±0.2	2.8	±0.2	0.4
Iron	Dissolved	mg/L	0.02	±0.001	<0.01		0.01
Manganese	Dissolved	mg/L	<0.005		<0.005		0.005
Chloride	Dissolved	mg/L	4.0	±0.3	6.7	±0.4	0.4
Nitrate - N		mg/L	0.33	±0.03	0.61	±0.05	0.01
Nitrite - N		mg/L	<0.005		<0.005		0.005
Nitrate and Nitrite - N		mg/L	0.33		0.61		0.01
Sulfate (SO4)	Dissolved	mg/L	285	±27	288	±27	0.9
Hydroxide		mg/L	<5		<5		
Carbonate		mg/L	<6		<6		
Bicarbonate		mg/L	503		515		
P-Alkalinity	as CaCO3	mg/L	<5		<5		5
T-Alkalinity	as CaCO3	mg/L	412	±16	423	±17	5
Total Dissolved Solids	Calculated	mg/L	808		821		1
Hardness	Dissolved as CaCO3	mg/L	434		449		
Ionic Balance	Dissolved	%	100		99		

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1	Project ID: 26388 Project Name: Burnco/West Cochrane Gravel Pit Project Location: LSD: West Cochrane Gravel Pit P.O.: Proj. Acct. code:	Lot ID: 1531395 Control Number: 067005 Date Received: Oct 27, 2021 Date Reported: Nov 3, 2021 Report Number: 2682987
Attn: Accounts Payable Sampled By: Colin McKenzie Company: Matrix Solutions Inc.		

Reference Number 1531395-14
Sample Date Oct 26, 2021
Sample Time NA
Sample Location
Sample Description 26388211026014 /
8.1°C
Matrix Water

Analyte	Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Metals Total						
Aluminum	Total	mg/L	<0.02			0.02
Calcium	Total	mg/L	88.5	±0.4		0.2
Iron	Total	mg/L	0.09	±0.2		0.05
Magnesium	Total	mg/L	52.7	±0.7		0.2
Manganese	Total	mg/L	<0.005			0.005
Potassium	Total	mg/L	2.9	±0.3		0.4
Silicon	Total	mg/L	3.58	±0.10		0.05
Sodium	Total	mg/L	129	±4		0.4
Sulfur	Total	mg/L	96.8	±0.7		0.3
Mercury	Total	mg/L	<0.00005			0.000005
Antimony	Total	mg/L	<0.0002			0.0002
Arsenic	Total	mg/L	0.0002	±0.00003		0.0002
Barium	Total	mg/L	0.034	±0.003		0.001
Beryllium	Total	mg/L	<0.0001			0.0001
Bismuth	Total	mg/L	<0.0005			0.0005
Boron	Total	mg/L	0.098	±0.009		0.002
Cadmium	Total	mg/L	0.00001	±0.000002		0.00001
Chromium	Total	mg/L	<0.0005			0.0005
Cobalt	Total	mg/L	<0.0001			0.0001
Copper	Total	mg/L	0.062	±0.006		0.001
Lead	Total	mg/L	0.0019	±0.0001		0.0001
Lithium	Total	mg/L	0.018	±0.002		0.001
Molybdenum	Total	mg/L	0.002	±0.0002		0.001
Nickel	Total	mg/L	0.0006	±0.00007		0.0005
Selenium	Total	mg/L	0.0028	±0.0003		0.0002
Silver	Total	mg/L	0.00001	±0.000003		0.00001
Strontium	Total	mg/L	1.43	±0.15		0.001
Thallium	Total	mg/L	<0.00005			0.00005
Tin	Total	mg/L	<0.001			0.001
Titanium	Total	mg/L	<0.0005			0.0005
Uranium	Total	mg/L	0.0045	±0.0003		0.0005
Vanadium	Total	mg/L	0.0003	±0.00003		0.0001
Zinc	Total	mg/L	0.042	±0.003		0.004
Zirconium	Total	mg/L	<0.001			0.001

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To:	Matrix Solutions Inc.	Project ID:	26388	Lot ID:	1531395
	Suite 600, 214 11 Ave SW	Project Name:	Burnco/West Cochrane	Control Number:	067005
	Calgary, AB, Canada		Gravel Pit	Date Received:	Oct 27, 2021
	T2R 0K1	Project Location:		Date Reported:	Nov 3, 2021
Attn:	Accounts Payable	LSD:	West Cochrane Gravel	Report Number:	2682987
			Pit		
Sampled By:	Colin McKenzie	P.O.:			
Company:	Matrix Solutions Inc.	Proj. Acct. code:			

Approved by:

Anthony Neumann, MSc
General Manager

Data have been validated by Analytical Quality Control and Element's Integrated Data Validation System (IDVS).
Generation and distribution of the report, and approval by the digitized signature above, are performed through a secure and controlled automatic process.
* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Quality Control

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1	Project ID: 26388 Project Name: Burnco/West Cochrane Gravel Pit Project Location: LSD: West Cochrane Gravel Pit P.O.: Proj. Acct. code:	Lot ID: 1531395 Control Number: 067005 Date Received: Oct 27, 2021 Date Reported: Nov 3, 2021 Report Number: 2682987
Attn: Accounts Payable Sampled By: Colin McKenzie Company: Matrix Solutions Inc.		

Metals Dissolved

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Silicon	mg/L	-0.00832649	-0.04	0.05	yes
Sulfur	mg/L	0.0583361	-0.3	0.2	yes
Mercury	µg/L	0.0002727	-0.038000	0.064000	yes
Aluminum	µg/L	0.461909	-2	2	yes
Antimony	µg/L	0.00177085	-0.2	0.2	yes
Arsenic	µg/L	0.0099763	-0.2	0.2	yes
Barium	µg/L	0.0467822	-1	1	yes
Beryllium	µg/L	-0.00634302	-0.0	0.1	yes
Boron	µg/L	0.388582	-2	2	yes
Cadmium	µg/L	0.000460051	-0.01	0.01	yes
Chromium	µg/L	-0.0341985	-0.3	0.3	yes
Cobalt	µg/L	-0.0016232	-0.1	0.1	yes
Copper	µg/L	0.924617	-1	1	yes
Lead	µg/L	0.00872553	-0.1	0.1	yes
Lithium	µg/L	-0.0728218	-1	1	yes
Molybdenum	µg/L	0.0432188	-1	1	yes
Nickel	µg/L	0.0273347	-0.5	0.5	yes
Selenium	µg/L	0.00314733	-0.2	0.2	yes
Silver	µg/L	0.000358658	-0.10	0.10	yes
Strontium	µg/L	0.056833	-1	1	yes
Thallium	µg/L	-0.0211705	-0.05	0.05	yes
Tin	µg/L	-0.0476843	-1	1	yes
Titanium	µg/L	-0.0327995	-0.5	0.5	yes
Uranium	µg/L	0.00230364	-0.5	0.5	yes
Vanadium	µg/L	-0.0343879	-0.1	0.1	yes
Zinc	µg/L	0.237326	-0	2	yes
Zirconium	µg/L	0.00945587	-1	1	yes

Date Acquired: November 02, 2021

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Silicon	mg/L	4.16	4.06	10	0.01	yes
Sulfur	mg/L	28.9	28.4	10	0.1	yes
Mercury	mg/L	<0.000005	0.000005	10	0.000030	yes
Aluminum	µg/L	5	5	10	11	yes
Antimony	µg/L	<0.2	0.2	10	0.4	yes
Arsenic	µg/L	1.0	0.9	10	0.4	yes
Barium	µg/L	51	49	10	2	yes
Beryllium	µg/L	<0.1	<0.1	10	0.2	yes
Bismuth	µg/L	<0.5	<0.5	10	1.1	yes
Boron	µg/L	208	211	10	4	yes
Cadmium	µg/L	0.03	0.03	10	0.02	yes
Chromium	µg/L	<0.5	<0.5	10	1.1	yes
Cobalt	µg/L	0.1	0.1	10	0.2	yes
Copper	µg/L	6	6	10	2	yes
Lead	µg/L	<0.1	<0.1	10	0.2	yes

Quality Control

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1	Project ID: 26388 Project Name: Burnco/West Cochrane Gravel Pit Project Location: LSD: West Cochrane Gravel Pit P.O.: Proj. Acct. code:	Lot ID: 1531395 Control Number: 067005 Date Received: Oct 27, 2021 Date Reported: Nov 3, 2021 Report Number: 2682987
Attn: Accounts Payable Sampled By: Colin McKenzie Company: Matrix Solutions Inc.		

Metals Dissolved - Continued

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Lithium	µg/L	29	29	10	2	yes
Molybdenum	µg/L	14	14	10	2	yes
Nickel	µg/L	2.7	2.7	10	1.1	yes
Selenium	µg/L	1.8	1.8	10	0.4	yes
Silver	µg/L	<0.01	<0.01	10	0.22	yes
Strontium	µg/L	1470	1470	10	2	yes
Thallium	µg/L	0.07	0.07	10	0.11	yes
Tin	µg/L	<1	<1	10	2	yes
Titanium	µg/L	<0.5	<0.5	10	1.1	yes
Uranium	µg/L	81.5	80.2	10	1.1	yes
Vanadium	µg/L	0.1	0.1	10	0.2	yes
Zinc	µg/L	3	4	10	2	yes
Zirconium	µg/L	<1	<1	10	2	yes

Date Acquired: November 02, 2021

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Aluminum	µg/L	952	917	1067	yes
Antimony	µg/L	38.5	36.4	44.2	yes
Arsenic	µg/L	40.1	36.7	43.3	yes
Barium	µg/L	191	182	211	yes
Beryllium	µg/L	18.9	17.3	22.1	yes
Bismuth	µg/L	95.4	89.1	108.3	yes
Boron	µg/L	369	344	434	yes
Cadmium	µg/L	1.98	1.86	2.25	yes
Chromium	µg/L	99.4	92.2	110.2	yes
Cobalt	µg/L	20.1	18.4	21.2	yes
Copper	µg/L	201	187	214	yes
Lead	µg/L	19.8	18.4	22.0	yes
Lithium	µg/L	181	175	223	yes
Molybdenum	µg/L	196	182	218	yes
Nickel	µg/L	97.5	93.3	105.9	yes
Selenium	µg/L	39.5	35.8	43.0	yes
Silver	µg/L	19.5	18.40	22.00	yes
Strontium	µg/L	199	180	216	yes
Thallium	µg/L	9.06	8.80	10.60	yes
Tin	µg/L	194	180	220	yes
Titanium	µg/L	100	92.4	110.4	yes
Uranium	µg/L	95.2	90.9	106.5	yes
Vanadium	µg/L	19.4	18.0	22.0	yes
Zinc	µg/L	201	183	219	yes
Zirconium	µg/L	206	180	220	yes

Date Acquired: November 02, 2021

Mercury	mg/L	0.000092	0.000070	0.000130	yes
---------	------	----------	----------	----------	-----

Date Acquired: November 01, 2021

Mercury	mg/L	0.000020	0.000006	0.000036	yes
---------	------	----------	----------	----------	-----

Quality Control

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1	Project ID: 26388 Project Name: Burnco/West Cochrane Gravel Pit Project Location: LSD: West Cochrane Gravel Pit P.O.: Proj. Acct. code:	Lot ID: 1531395 Control Number: 067005 Date Received: Oct 27, 2021 Date Reported: Nov 3, 2021 Report Number: 2682987
Attn: Accounts Payable Sampled By: Colin McKenzie Company: Matrix Solutions Inc.		

Metals Dissolved - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Aluminum	µg/L	49	45	55	yes
Antimony	µg/L	2.0	1.8	2.3	yes
Arsenic	µg/L	2.0	1.8	2.2	yes
Barium	µg/L	10	9	11	yes
Beryllium	µg/L	1.0	0.9	1.1	yes
Bismuth	µg/L	5.2	4.1	5.5	yes
Boron	µg/L	21	18	22	yes
Cadmium	µg/L	0.10	0.09	0.11	yes
Chromium	µg/L	4.9	4.5	5.5	yes
Cobalt	µg/L	1.0	0.9	1.1	yes
Copper	µg/L	11	9	11	yes
Lead	µg/L	1.0	0.9	1.1	yes
Lithium	µg/L	10	9	11	yes
Molybdenum	µg/L	10	9	10	yes
Nickel	µg/L	5.1	4.4	5.5	yes
Selenium	µg/L	1.9	1.7	2.2	yes
Silver	µg/L	0.98	0.84	1.08	yes
Strontium	µg/L	10	9	11	yes
Thallium	µg/L	0.49	0.45	0.55	yes
Tin	µg/L	10	9	11	yes
Titanium	µg/L	5.0	4.5	5.5	yes
Uranium	µg/L	5.2	4.5	5.5	yes
Vanadium	µg/L	0.9	0.9	1.1	yes
Zinc	µg/L	10	9	11	yes
Zirconium	µg/L	11	9	11	yes
Date Acquired: November 02, 2021					
Silicon	mg/L	10.4	8.98	10.78	yes
Sulfur	mg/L	150	138.5	155.3	yes
Date Acquired: November 02, 2021					
Silicon	mg/L	2.12	1.88	2.24	yes
Sulfur	mg/L	10.1	9.2	11.0	yes
Date Acquired: November 02, 2021					
Silicon	mg/L	0.21	0.19	0.23	yes
Sulfur	mg/L	2.9	2.8	3.3	yes
Date Acquired: November 02, 2021					

Metals Total

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Aluminum	mg/L	-0.00164281	-0.02	0.02	yes
Calcium	mg/L	0.0263675	-0.1	0.1	yes
Iron	mg/L	0.00329525	-0.01	0.02	yes
Magnesium	mg/L	0.000162553	-0.04	0.04	yes
Manganese	mg/L	-4.83821e-005	-0.005	0.005	yes
Potassium	mg/L	0.062733	-0.1	0.2	yes

Quality Control

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1	Project ID: 26388 Project Name: Burnco/West Cochrane Gravel Pit Project Location: LSD: West Cochrane Gravel Pit P.O.: Proj. Acct. code:	Lot ID: 1531395 Control Number: 067005 Date Received: Oct 27, 2021 Date Reported: Nov 3, 2021 Report Number: 2682987
Attn: Accounts Payable Sampled By: Colin McKenzie Company: Matrix Solutions Inc.		

Metals Total - Continued

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Silicon	mg/L	0.00187523	-0.03	0.04	yes
Sodium	mg/L	0.0408696	-0.4	0.4	yes
Sulfur	mg/L	0.0101596	-0.1	0.2	yes
Mercury	µg/L	-0.0002194	-0.038000	0.070000	yes
Antimony	µg/L	0.000701553	-0.2	0.2	yes
Arsenic	µg/L	0.00298564	-0.2	0.2	yes
Barium	µg/L	0.0417091	-1	1	yes
Beryllium	µg/L	0.0017705	-0.1	0.1	yes
Bismuth	µg/L	-0.0305326	-0.5	0.5	yes
Boron	µg/L	0.258097	-1	3	yes
Cadmium	µg/L	0.00021429	-0.007	0.012	yes
Chromium	µg/L	0.0921468	-0.7	0.3	yes
Cobalt	µg/L	0.00134838	-0.1	0.1	yes
Copper	µg/L	0.769122	-1	1	yes
Lead	µg/L	0.00427539	-0.1	0.1	yes
Lithium	µg/L	-0.0418876	-1	1	yes
Molybdenum	µg/L	0.00363971	-1	1	yes
Nickel	µg/L	0.0698262	-0.5	0.5	yes
Selenium	µg/L	0.00295725	-0.2	0.2	yes
Silver	µg/L	0.00129824	-0.02	0.10	yes
Strontium	µg/L	0.0375804	-1	1	yes
Thallium	µg/L	-0.000359115	-0.05	0.05	yes
Tin	µg/L	-0.0200809	-1	1	yes
Titanium	µg/L	-0.00478552	-0.5	0.5	yes
Uranium	µg/L	-0.000493019	-0.5	0.5	yes
Vanadium	µg/L	-0.0189829	-0.1	0.1	yes
Zinc	µg/L	0.3416	-4	4	yes
Zirconium	µg/L	0.0124532	-1	1	yes

Date Acquired: November 01, 2021

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Aluminum	mg/L	0.2	0.2	15	0.03	yes
Calcium	mg/L	399	393	15	0.6	yes
Iron	mg/L	20.2	19.8	15	0.20	yes
Magnesium	mg/L	56.0	54.6	15	0.40	yes
Manganese	mg/L	8.12	7.92	15	0.010	yes
Potassium	mg/L	7.7	7.5	15	1.2	yes
Silicon	mg/L	13.9	13.6	15	0.10	yes
Sodium	mg/L	135	133	15	1.2	yes
Sulfur	mg/L	25.6	24.7	15	0.1	yes
Mercury	mg/L	0.000007	0.000007	10	0.000030	yes
Antimony	µg/L	1	1	15	0.4	yes
Arsenic	µg/L	41.6	39.7	15	0.4	yes
Barium	µg/L	1190	1210	15	2	yes
Beryllium	µg/L	3.2	3.2	15	0.2	yes

Quality Control

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1	Project ID: 26388 Project Name: Burnco/West Cochrane Gravel Pit Project Location: LSD: West Cochrane Gravel Pit P.O.: Proj. Acct. code:	Lot ID: 1531395 Control Number: 067005 Date Received: Oct 27, 2021 Date Reported: Nov 3, 2021 Report Number: 2682987
Attn: Accounts Payable Sampled By: Colin McKenzie Company: Matrix Solutions Inc.		

Metals Total - Continued

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Bismuth	µg/L	<1	<1	15	1.1	yes
Boron	µg/L	54	51	15	4	yes
Cadmium	µg/L	2.41	2.40	15	0.022	yes
Chromium	µg/L	139	137	15	1.1	yes
Cobalt	µg/L	51.9	50.5	15	0.2	yes
Copper	µg/L	110	110	15	2	yes
Lead	µg/L	54.3	54.6	15	0.2	yes
Lithium	µg/L	79	78	15	2	yes
Molybdenum	µg/L	5	5	15	2	yes
Nickel	µg/L	155	151	15	1.1	yes
Selenium	µg/L	3.1	3.1	15	0.4	yes
Silver	µg/L	0.61	0.59	15	0.22	yes
Strontium	µg/L	1270	1200	15	2	yes
Thallium	µg/L	1.2	1.3	15	0.11	yes
Tin	µg/L	<2	<2	15	2	yes
Titanium	µg/L	320	314	15	1.1	yes
Uranium	µg/L	19	19	15	1.1	yes
Vanadium	µg/L	155	149	15	0.2	yes
Zinc	µg/L	408	400	15	2	yes
Zirconium	µg/L	2	2	15	2	yes

Date Acquired: November 01, 2021

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Aluminum	mg/L	4.01	3.61	4.45	yes
Calcium	mg/L	50.9	47.6	54.2	yes
Iron	mg/L	2.03	1.91	2.21	yes
Magnesium	mg/L	20.5	17.88	21.86	yes
Manganese	mg/L	0.509	0.472	0.568	yes
Potassium	mg/L	52.1	46.9	55.9	yes
Silicon	mg/L	2.12	1.96	2.26	yes
Sodium	mg/L	53.3	47.0	57.2	yes
Sulfur	mg/L	10.0	9.2	11.2	yes
Antimony	µg/L	12.0	10.8	13.2	yes
Arsenic	µg/L	12.4	10.8	12.9	yes
Barium	µg/L	63	54	68	yes
Beryllium	µg/L	5.7	4.9	6.8	yes
Bismuth	µg/L	32.4	26.2	35.8	yes
Boron	µg/L	129	102	139	yes
Cadmium	µg/L	0.61	0.543	0.675	yes
Chromium	µg/L	31.5	26.5	33.7	yes
Cobalt	µg/L	6.4	5.2	6.8	yes
Copper	µg/L	63	53	67	yes
Lead	µg/L	6.3	5.2	7.1	yes
Lithium	µg/L	64	53	77	yes
Molybdenum	µg/L	63	56	66	yes

Quality Control

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1	Project ID: 26388 Project Name: Burnco/West Cochrane Gravel Pit Project Location: LSD: West Cochrane Gravel Pit P.O.: Proj. Acct. code:	Lot ID: 1531395 Control Number: 067005 Date Received: Oct 27, 2021 Date Reported: Nov 3, 2021 Report Number: 2682987
Attn: Accounts Payable Sampled By: Colin McKenzie Company: Matrix Solutions Inc.		

Metals Total - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Nickel	µg/L	31.5	27.6	32.8	yes
Selenium	µg/L	11.5	9.9	13.5	yes
Silver	µg/L	6.13	5.39	7.13	yes
Strontium	µg/L	62	55	65	yes
Thallium	µg/L	3.53	2.70	3.60	yes
Tin	µg/L	62	56	66	yes
Titanium	µg/L	32.0	26.6	35.7	yes
Uranium	µg/L	32.8	25.7	36.3	yes
Vanadium	µg/L	6.2	5.1	7.2	yes
Zinc	µg/L	64	53	65	yes
Zirconium	µg/L	66	53	67	yes
Date Acquired: November 01, 2021					
Antimony	µg/L	38.1	37.5	43.1	yes
Arsenic	µg/L	40.0	36.5	43.5	yes
Barium	µg/L	197	183	212	yes
Beryllium	µg/L	19.1	17.1	21.9	yes
Bismuth	µg/L	98.7	88.2	106.2	yes
Boron	µg/L	394	343	436	yes
Cadmium	µg/L	2.00	1.910	2.210	yes
Chromium	µg/L	99.9	90.0	110.0	yes
Cobalt	µg/L	20.2	18.1	21.7	yes
Copper	µg/L	201	188	212	yes
Lead	µg/L	19.7	18.0	24.0	yes
Lithium	µg/L	198	173	222	yes
Molybdenum	µg/L	198	182	218	yes
Nickel	µg/L	98.7	90.0	110.0	yes
Selenium	µg/L	39.4	36.7	43.3	yes
Silver	µg/L	19.4	18.00	22.00	yes
Strontium	µg/L	194	171	231	yes
Thallium	µg/L	9.92	9.01	10.99	yes
Tin	µg/L	193	190	218	yes
Titanium	µg/L	98.1	93.2	107.0	yes
Uranium	µg/L	98.9	90.2	109.0	yes
Vanadium	µg/L	19.4	16.9	22.1	yes
Zinc	µg/L	200	183	218	yes
Zirconium	µg/L	209	188	218	yes
Date Acquired: November 01, 2021					
Mercury	mg/L	0.000099	0.000070	0.000130	yes
Antimony	µg/L	11.7	10.8	13.2	yes
Arsenic	µg/L	11.9	10.8	13.2	yes
Barium	µg/L	60	55	67	yes
Beryllium	µg/L	6.0	5.2	6.5	yes
Bismuth	µg/L	31.0	27.3	31.9	yes
Boron	µg/L	125	108	132	yes

Quality Control

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1	Project ID: 26388 Project Name: Burnco/West Cochrane Gravel Pit Project Location: LSD: West Cochrane Gravel Pit P.O.: Proj. Acct. code:	Lot ID: 1531395 Control Number: 067005 Date Received: Oct 27, 2021 Date Reported: Nov 3, 2021 Report Number: 2682987
Attn: Accounts Payable Sampled By: Colin McKenzie Company: Matrix Solutions Inc.		

Metals Total - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Cadmium	µg/L	0.60	0.540	0.660	yes
Chromium	µg/L	29.9	27.0	33.0	yes
Cobalt	µg/L	6.1	5.4	6.6	yes
Copper	µg/L	60	54	66	yes
Lead	µg/L	6.1	5.4	6.6	yes
Lithium	µg/L	61	53	66	yes
Molybdenum	µg/L	59	53	64	yes
Nickel	µg/L	29.7	27.1	33.1	yes
Selenium	µg/L	11.9	10.3	13.4	yes
Silver	µg/L	5.95	5.40	6.60	yes
Strontium	µg/L	58	54	66	yes
Thallium	µg/L	3.08	0.00	6.00	yes
Tin	µg/L	60	54	66	yes
Titanium	µg/L	29.3	27.0	33.0	yes
Uranium	µg/L	31.3	27.0	33.0	yes
Vanadium	µg/L	5.9	5.4	6.6	yes
Zinc	µg/L	60	56	64	yes
Zirconium	µg/L	61	54	66	yes
Date Acquired: November 01, 2021					
Mercury	mg/L	0.000021	0.000006	0.000036	yes
Antimony	µg/L	2.0	1.8	2.2	yes
Arsenic	µg/L	2.0	1.7	2.2	yes
Barium	µg/L	10	9	10	yes
Beryllium	µg/L	1.0	0.8	1.1	yes
Bismuth	µg/L	5.2	4.6	5.3	yes
Boron	µg/L	21	17	23	yes
Cadmium	µg/L	0.10	0.089	0.113	yes
Chromium	µg/L	5.0	4.6	5.3	yes
Cobalt	µg/L	1.0	0.9	1.1	yes
Copper	µg/L	10	9	11	yes
Lead	µg/L	1.0	0.9	1.1	yes
Lithium	µg/L	10	9	11	yes
Molybdenum	µg/L	10	9	10	yes
Nickel	µg/L	5.0	4.5	5.5	yes
Selenium	µg/L	2.0	1.6	2.2	yes
Silver	µg/L	1.00	0.89	1.13	yes
Strontium	µg/L	10	9	10	yes
Thallium	µg/L	0.51	0.44	0.56	yes
Tin	µg/L	10	9	11	yes
Titanium	µg/L	5.2	4.2	5.7	yes
Uranium	µg/L	5.2	4.7	5.3	yes
Vanadium	µg/L	1.0	0.9	1.2	yes
Zinc	µg/L	10	9	11	yes
Zirconium	µg/L	11	9	11	yes
Date Acquired: November 01, 2021					

Quality Control

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1	Project ID: 26388 Project Name: Burnco/West Cochrane Gravel Pit Project Location: LSD: West Cochrane Gravel Pit P.O.: Proj. Acct. code:	Lot ID: 1531395 Control Number: 067005 Date Received: Oct 27, 2021 Date Reported: Nov 3, 2021 Report Number: 2682987
Attn: Accounts Payable Sampled By: Colin McKenzie Company: Matrix Solutions Inc.		

Metals Total - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Aluminum	mg/L	19.5	18.80	20.60	yes
Calcium	mg/L	242	231.3	258.9	yes
Iron	mg/L	9.56	9.06	10.14	yes
Magnesium	mg/L	99.1	92.78	104.72	yes
Manganese	mg/L	2.39	2.290	2.590	yes
Potassium	mg/L	249	234.2	261.8	yes
Silicon	mg/L	10.2	9.13	10.93	yes
Sodium	mg/L	244	228.8	269.4	yes
Sulfur	mg/L	149	135.5	165.3	yes
Date Acquired: November 01, 2021					
Aluminum	mg/L	3.96	3.60	4.40	yes
Calcium	mg/L	50.5	46.5	56.5	yes
Iron	mg/L	2.03	1.87	2.27	yes
Magnesium	mg/L	20.3	18.05	22.07	yes
Manganese	mg/L	0.506	0.466	0.568	yes
Potassium	mg/L	51.2	45.4	55.5	yes
Silicon	mg/L	2.12	1.93	2.24	yes
Sodium	mg/L	52.3	45.9	55.9	yes
Sulfur	mg/L	10.0	9.3	11.3	yes
Date Acquired: November 01, 2021					
Aluminum	mg/L	0.40	0.36	0.44	yes
Calcium	mg/L	5.1	4.8	5.8	yes
Iron	mg/L	0.21	0.19	0.25	yes
Magnesium	mg/L	2.0	1.84	2.20	yes
Manganese	mg/L	0.051	0.047	0.059	yes
Potassium	mg/L	5.2	4.8	5.8	yes
Silicon	mg/L	0.22	0.17	0.23	yes
Sodium	mg/L	5.3	4.8	5.6	yes
Sulfur	mg/L	3.0	2.8	3.3	yes
Date Acquired: November 01, 2021					

Physical and Aggregate Properties

Blanks		Units	Measured	Lower Limit	Upper Limit	Passed QC	
Turbidity		NTU	0.068	-0.1	0.1	yes	
Date Acquired:		November 01, 2021					
Turbidity		NTU	0.094	0.0	0.1	yes	
Date Acquired:		November 01, 2021					
Client Sample Replicates		Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Turbidity		NTU	0.3	0.3	10	0.2	yes
Solids		mg/L	450	450	10	2	yes
Date Acquired:		November 01, 2021					
Control Sample		Units	Measured	Lower Limit	Upper Limit	Passed QC	
Turbidity		NTU	1920	1856.7	2054.7	yes	
Date Acquired:		November 01, 2021					

Quality Control

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1	Project ID: 26388 Project Name: Burnco/West Cochrane Gravel Pit Project Location: LSD: West Cochrane Gravel Pit P.O.: Proj. Acct. code:	Lot ID: 1531395 Control Number: 067005 Date Received: Oct 27, 2021 Date Reported: Nov 3, 2021 Report Number: 2682987
Attn: Accounts Payable Sampled By: Colin McKenzie Company: Matrix Solutions Inc.		

Physical and Aggregate Properties -

Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Turbidity	NTU	5690	4441.7	6661.7	yes
Date Acquired:	November 01, 2021				
Turbidity	NTU	151	132.1	162.1	yes
Solids	mg/L	192	174	209	yes
Date Acquired:	November 01, 2021				
Turbidity	NTU	13.7	12.6	15.6	yes
Solids	mg/L	17	10	22	yes
Date Acquired:	November 01, 2021				
Turbidity	NTU	1.6	1.0	2.2	yes
Date Acquired:	November 01, 2021				

Routine Water

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Calcium	mg/L	-0.00244185	-0.2	0.2	yes
Magnesium	mg/L	0.00294114	-0.1	0.1	yes
Sodium	mg/L	0.0779748	-0.4	0.4	yes
Potassium	mg/L	0.00258424	-0.4	0.4	yes
Iron	mg/L	0.00104742	-0.01	0.01	yes
Manganese	mg/L	0.000108455	-0.004	0.004	yes
Chloride	mg/L	0.3	-0.4	0.4	yes
Nitrate - N	mg/L	0.00086675	-0.01	0.01	yes
Nitrite - N	mg/L	0.00245678	-0.005	0.005	yes

Date Acquired: November 02, 2021

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
pH		7.62	7.63	0	0.10	yes
Electrical Conductivity	dS/m	2.34	2.32	10	0.002	yes
Calcium	mg/L	49.2	48.0	10	0.6	yes
Magnesium	mg/L	47.8	46.6	10	0.7	yes
Sodium	mg/L	84.1	83.4	10	1.2	yes
Potassium	mg/L	3.2	3.2	10	1.2	yes
Iron	mg/L	<0.01	<0.01	10	0.05	yes
Manganese	mg/L	<0.005	<0.005	10	0.010	yes
Chloride	mg/L	76.7	76.2	10	0.5	yes
Nitrate - N	mg/L	0.01	0.01	10	0.01	yes
Nitrite - N	mg/L	<0.005	<0.005	10	0.010	yes
Hydroxide	mg/L	<5	<5	10		yes
Carbonate	mg/L	<6	<6	10	6	yes
Bicarbonate	mg/L	745	743	10	6	yes
P-Alkalinity	mg/L	<5	<5	10	5	yes
T-Alkalinity	mg/L	611	609	10	5	yes

Date Acquired: November 01, 2021

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
----------------	-------	----------	-------------	-------------	-----------

Quality Control

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1 Attn: Accounts Payable Sampled By: Colin McKenzie Company: Matrix Solutions Inc.	Project ID: 26388 Project Name: Burnco/West Cochrane Gravel Pit Project Location: West Cochrane Gravel Pit LSD: Pit P.O.: Proj. Acct. code:	Lot ID: 1531395 Control Number: 067005 Date Received: Oct 27, 2021 Date Reported: Nov 3, 2021 Report Number: 2682987
--	--	---

Routine Water - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Chloride	mg/L	2120	1847.4	2256.0	yes
Date Acquired: November 02, 2021					
Electrical Conductivity	dS/m	33.1	27.200	36.800	yes
Date Acquired: November 01, 2021					
pH		9.14	8.90	9.44	yes
Temperature of observed	°C	18.8	15.5	24.5	yes
Electrical Conductivity	dS/m	2.75	2.631	2.829	yes
Calcium	mg/L	248	230.0	260.0	yes
Magnesium	mg/L	100	91.3	103.3	yes
Sodium	mg/L	252	233.3	257.3	yes
Potassium	mg/L	249	229.0	259.0	yes
Iron	mg/L	9.74	8.91	10.20	yes
Manganese	mg/L	2.43	2.240	2.540	yes
Nitrate - N	mg/L	9.95	9.03	11.13	yes
Nitrite - N	mg/L	9.98	9.010	10.990	yes
Nitrate and Nitrite - N	mg/L	19.90	19.10	20.90	yes
P-Alkalinity	mg/L	522	442	584	yes
T-Alkalinity	mg/L	1000	926	1106	yes
Date Acquired: November 01, 2021					
pH		6.87	6.79	6.97	yes
Temperature of observed	°C	18.9	15.5	24.5	yes
Electrical Conductivity	dS/m	0.077	0.069	0.085	yes
Calcium	mg/L	51.8	44.9	56.9	yes
Magnesium	mg/L	20.9	17.9	22.0	yes
Sodium	mg/L	51.0	47.7	55.5	yes
Potassium	mg/L	51.0	45.8	55.8	yes
Iron	mg/L	2.06	1.89	2.25	yes
Manganese	mg/L	0.517	0.468	0.552	yes
Chloride	mg/L	81.7	74.9	86.9	yes
Nitrate - N	mg/L	4.70	4.37	5.33	yes
Nitrite - N	mg/L	4.84	4.370	5.330	yes
Nitrate and Nitrite - N	mg/L	9.54	8.80	10.60	yes
P-Alkalinity	mg/L	53	28	72	yes
T-Alkalinity	mg/L	121	114	140	yes
Date Acquired: November 01, 2021					
Calcium	mg/L	5.1	4.7	5.8	yes
Magnesium	mg/L	2.1	1.8	2.2	yes
Sodium	mg/L	5.1	4.7	5.7	yes
Potassium	mg/L	5.0	4.7	5.7	yes
Iron	mg/L	0.21	0.19	0.24	yes
Manganese	mg/L	0.051	0.048	0.058	yes
Chloride	mg/L	15.0	13.3	16.5	yes
Nitrate - N	mg/L	0.49	0.42	0.57	yes
Nitrite - N	mg/L	0.507	0.424	0.564	yes

Quality Control

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1 Attn: Accounts Payable Sampled By: Colin McKenzie Company: Matrix Solutions Inc.	Project ID: 26388 Project Name: Burnco/West Cochrane Gravel Pit Project Location: LSD: West Cochrane Gravel Pit P.O.: Proj. Acct. code:	Lot ID: 1531395 Control Number: 067005 Date Received: Oct 27, 2021 Date Reported: Nov 3, 2021 Report Number: 2682987
--	--	---

Routine Water - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Nitrate and Nitrite - N	mg/L	1.00	0.85	1.15	yes
Date Acquired: November 02, 2021					

Methodology and Notes

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1	Project ID: 26388	Lot ID: 1531395
Attn: Accounts Payable	Project Name: Burnco/West Cochrane Gravel Pit	Control Number: 067005
Sampled By: Colin McKenzie	Project Location: West Cochrane Gravel Pit	Date Received: Oct 27, 2021
Company: Matrix Solutions Inc.	LSD: P.O.:	Date Reported: Nov 3, 2021
	Proj. Acct. code:	Report Number: 2682987

Method of Analysis

Method Name	Reference	Method	Date Analysis Started	Location
Alkalinity, pH, and EC in water	APHA	* Alkalinity - Titration Method, 2320 B	Nov 1, 2021	Element Edmonton - Roper Road
Alkalinity, pH, and EC in water	APHA	* Conductivity, 2510 B	Nov 1, 2021	Element Edmonton - Roper Road
Alkalinity, pH, and EC in water	APHA	* pH - Electrometric Method, 4500-H+ B	Nov 1, 2021	Element Edmonton - Roper Road
Anions (Routine) by Ion Chromatography	APHA	* Ion Chromatography with Chemical Suppression of Eluent Cond., 4110 B	Nov 2, 2021	Element Edmonton - Roper Road
Approval-Edmonton	APHA	Checking Correctness of Analyses, 1030 E	Nov 2, 2021	Element Edmonton - Roper Road
Chloride in Water	APHA	* Automated Ferricyanide Method, 4500-Cl- E	Nov 2, 2021	Element Edmonton - Roper Road
Mercury (Dissolved) in water	APHA	* Cold Vapour Atomic Absorption Spectrometric Method, 3112 B	Nov 1, 2021	Element Edmonton - Roper Road
Mercury (Dissolved) in water	EPA	* Mercury in Water by Cold Vapor Atomic Fluorescence Spectrometry, 245.7	Nov 1, 2021	Element Edmonton - Roper Road
Mercury (Total) in water	EPA	* Mercury in Water by Cold Vapor Atomic Fluorescence Spectrometry, 245.7	Nov 1, 2021	Element Edmonton - Roper Road
Metals ICP-MS (Dissolved) in water	APHA/USEPA	* Metals By Inductively Coupled Plasma/Mass Spectrometry, APHA 3125 B / USEPA 200.2, 200.8	Nov 2, 2021	Element Edmonton - Roper Road
Metals ICP-MS (Dissolved) in water	US EPA	* Determination of Trace Elements in Waters and Wastes by ICP-MS, 200.8	Nov 2, 2021	Element Edmonton - Roper Road
Metals ICP-MS (Total) in water	APHA/USEPA	* Metals By Inductively Coupled Plasma/Mass Spectrometry, APHA 3125 B / USEPA 200.2, 200.8	Nov 1, 2021	Element Edmonton - Roper Road
Metals ICP-MS (Total) in water	US EPA	* Determination of Trace Elements in Waters and Wastes by ICP-MS, 200.8	Nov 1, 2021	Element Edmonton - Roper Road
Metals Trace (Dissolved) in water	APHA	Hardness by Calculation, 2340 B	Nov 2, 2021	Element Edmonton - Roper Road
Metals Trace (Dissolved) in water	APHA	* Inductively Coupled Plasma (ICP) Method, 3120 B	Nov 2, 2021	Element Edmonton - Roper Road
Metals Trace (Total) in water	APHA	* Inductively Coupled Plasma (ICP) Method, 3120 B	Nov 1, 2021	Element Edmonton - Roper Road
Solids Suspended (Total, Fixed and Volatile)	APHA	* Total Suspended Solids Dried at 103-105°C, 2540 D	Nov 1, 2021	Element Edmonton - Roper Road
Turbidity in Water	APHA	* Turbidity - Nephelometric Method, 2130 B	Nov 1, 2021	Element Edmonton - Roper Road

* Reference Method Modified

References

APHA	Standard Methods for the Examination of Water and Wastewater
APHA/USEPA	Standard Methods For Water/ Environmental Protection Agency
EPA	Environmental Protection Agency Test Methods - US
US EPA	US Environmental Protection Agency Test Methods

Methodology and Notes

Bill To: Matrix Solutions Inc.	Project ID: 26388	Lot ID: 1531395
Suite 600, 214 11 Ave SW	Project Name: Burnco/West Cochrane	Control Number: 067005
Calgary, AB, Canada	Gravel Pit	Date Received: Oct 27, 2021
T2R 0K1	Project Location:	Date Reported: Nov 3, 2021
Attn: Accounts Payable	LSD: West Cochrane Gravel	Report Number: 2682987
Sampled By: Colin McKenzie	Pit	
Company: Matrix Solutions Inc.	P.O.:	
	Proj. Acct. code:	

Comments:

- Nov 02, 2021 - Some trace total metal results were less than dissolved metal results for sample 1531395-6,-14. The results were verified and are within expected measurement uncertainty.
- Nov 02, 2021 - Some ICP-MS total metal results were less than dissolved metal results for sample 1531349-1 to 14. The results were verified and are within expected measurement uncertainty.

Please direct any inquiries regarding this report to our Client Services group.

Results relate only to samples as submitted.

The test report shall not be reproduced except in full, without the written approval of the laboratory.

COC # M 067005

Page: 1 of 1

Lab Submitted to: Planned Laboratory
Lab Agreement no: _____
Lab Job ID: _____

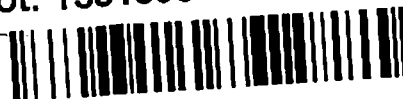
Invoice to: _____ Requir Report: Y N

Company Name: Matrix Solutions Inc
Contact Name: _____
Address: _____
Phone / Fax#: _____ Ph: _____ Fax: _____

Copy of Report to:

Matrix _____
Suite: _____
Calgar: _____
T2R 0: _____
Ph: 40: _____
Fax dr: _____

Lot: 1531395 COC



Matrix Project #: 26388
Matrix Proj. Name: Burnham West Lakeview Ground Pit
Location: West Lakeview Ground Pit
Sampler's Name(s): Colin McKenzie

AFE #:

REGULATORY REQUIREMENTS: (check)

- ☒ Alberta Tier 1
☐ SPIGEC
☐ Freshwater Aquatic Life (Low Level Metals)
☐ Canadian Drinking Water
☐ BC Regs
☐ Other: _____

SERVICE REQUESTED:

- ☐ RUSH (Please ensure you contact the lab) Due Date: _____
☒ REGULAR Turnaround
REPORT DISTRIBUTION: always send to data_management@matrix-solutions.com
☒ Additional Y Killam @ Matrix Solutions Inc
Emails

Analysis Required

	Sample Number (14 digits only) yr-mth-day	Sample Point Name	Depth (cm)	Sample Type	Date/Time Sampled	Quantity # of		Routine	Diss metals - Diss	Total metals - Metals	TSS + Turbidity	Analysis Required										Lab Sample Number
						Jars	Bags															
1	26388211025001			M20	Oct 25, 2021		5	✓	✓	✓	✓											
2		002					5	✓	✓	✓	✓											
3		003					5	✓	✓	✓	✓											
4		004					5	✓	✓	✓	✓											
5		005					1	✓			✓											
6		006					5	✓	✓	✓	✓											
7		007					5	✓	✓	✓	✓											
8		008					5	✓	✓	✓	✓											
9	26388211026009				Oct 26, 2021		5	✓	✓	✓	✓											
10		010					5	✓	✓	✓	✓											
11		011					5	✓	✓	✓	✓											
12		012					5	✓	✓	✓	✓											
13		013					5	✓	✓	✓	✓											
14		014					5	✓	✓	✓	✓											
15																						

*For metals in water samples indicate if you want Total (T), Dissolved (D) or Extractable (E) as part of "Analysis Required"

Preserved/Filtered

Relinquished by: Colin McKenzie Date/Time: 13:30 Received by: [Signature] 8.1°C Date/Time: OCT 27 '21 PM 1:29
Signature: [Signature] Signature: _____
COMMENTS/SPECIAL INSTRUCTIONS: Questions/Concerns please call Colin M. @ 403-703-9155

**CLIENT NAME: MATRIX SOLUTIONS INC.
SUITE 600, 214 11 AVE SW
CALGARY, AB T2R0K1
(403) 237-0606**

ATTENTION TO: Isabelle Fillion

PROJECT: 26388-512 / West Cochrane

AGAT WORK ORDER: 18C408063

WATER ANALYSIS REVIEWED BY: Jennifer Liu, Analyst, Qualified Person

DATE REPORTED: Nov 14, 2018

PAGES (INCLUDING COVER): 17

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (403) 735-2005

***NOTES**

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

Certificate of Analysis

CLIENT NAME: MATRIX SOLUTIONS INC.

PROJECT: 26388-512 / West Cochrane

SAMPLING SITE:

AGAT WORK ORDER: 18C408063

ATTENTION TO: Isabelle Fillion

SAMPLED BY:RK/RS

Matrix Solutions Routine Chemistry Water Analysis							
SAMPLE TYPE: Water		SAMPLE ID: 9692912			DATE RECEIVED: Nov 09, 2018		
DATE SAMPLED: Nov 07, 2018				DATE REPORTED: Nov 14, 2018			
SAMPLE DESCRIPTION: 26388181107001							
PARAMETER	UNIT	RESULT	G / S	RDL	DATE ANALYZED	INITIAL	DATE PREPARED
pH	pH Units	8.03		N/A	Nov 13, 2018	KT	Nov 13, 2018
p - Alkalinity (as CaCO3)	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
T - Alkalinity (as CaCO3)	mg/L	359		5	Nov 13, 2018	KT	Nov 13, 2018
Bicarbonate	mg/L	438		5	Nov 13, 2018	KT	Nov 13, 2018
Carbonate	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
Hydroxide	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
Electrical Conductivity	uS/cm	965		5	Nov 13, 2018	KT	Nov 13, 2018
Chloride	mg/L	32.9		0.6	Nov 10, 2018	CO	Nov 10, 2018
Fluoride	mg/L	0.28		0.01	Nov 10, 2018	CO	Nov 10, 2018
Nitrate	mg/L	0.12		0.08	Nov 10, 2018	CO	Nov 10, 2018
Nitrate-N	mg/L	0.03		0.02	Nov 10, 2018	SYS	Nov 10, 2018
Nitrite	mg/L	<0.03		0.03	Nov 10, 2018	CO	Nov 10, 2018
Nitrite-N	mg/L	<0.01		0.01	Nov 10, 2018	SYS	Nov 10, 2018
Sulfate	mg/L	110		0.6	Nov 10, 2018	CO	Nov 10, 2018
Dissolved Calcium	mg/L	49.7		0.3	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Magnesium	mg/L	17.6		0.2	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Sodium	mg/L	149		0.6	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Potassium	mg/L	3.2		0.6	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Iron	mg/L	<0.1		0.1	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Manganese	mg/L	0.106		0.005	Nov 10, 2018	IP	Nov 10, 2018
Ion Balance	%	101		1	Nov 13, 2018	SYS	Nov 13, 2018
Hardness	mg CaCO3/L	197		0.5		SYS	
Nitrate + Nitrite - Nitrogen	mg/L	0.03		0.02		SYS	
Calculated TDS	mg/L	578		1		SYS	

COMMENTS:

RDL - Reported Detection Limit; G / S - Guideline / Standard
< - Values refer to Report Detection Limits.

Certified By:



Certificate of Analysis

CLIENT NAME: MATRIX SOLUTIONS INC.

PROJECT: 26388-512 / West Cochrane

SAMPLING SITE:

AGAT WORK ORDER: 18C408063

ATTENTION TO: Isabelle Fillion

SAMPLED BY: RK/RS

Matrix Solutions Routine Chemistry Water Analysis							
SAMPLE TYPE: Water		SAMPLE ID: 9692916			DATE RECEIVED: Nov 09, 2018		
DATE SAMPLED: Nov 07, 2018				DATE REPORTED: Nov 14, 2018			
SAMPLE DESCRIPTION: 26388181107002							
PARAMETER	UNIT	RESULT	G / S	RDL	DATE ANALYZED	INITIAL	DATE PREPARED
pH	pH Units	7.96		N/A	Nov 13, 2018	KT	Nov 13, 2018
p - Alkalinity (as CaCO3)	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
T - Alkalinity (as CaCO3)	mg/L	337		5	Nov 13, 2018	KT	Nov 13, 2018
Bicarbonate	mg/L	411		5	Nov 13, 2018	KT	Nov 13, 2018
Carbonate	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
Hydroxide	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
Electrical Conductivity	uS/cm	780		5	Nov 13, 2018	KT	Nov 13, 2018
Chloride	mg/L	22.9		0.6	Nov 10, 2018	CO	Nov 10, 2018
Fluoride	mg/L	0.13		0.01	Nov 10, 2018	CO	Nov 10, 2018
Nitrate	mg/L	1.20		0.08	Nov 10, 2018	CO	Nov 10, 2018
Nitrate-N	mg/L	0.27		0.02	Nov 10, 2018	SYS	Nov 10, 2018
Nitrite	mg/L	<0.03		0.03	Nov 10, 2018	CO	Nov 10, 2018
Nitrite-N	mg/L	<0.01		0.01	Nov 10, 2018	SYS	Nov 10, 2018
Sulfate	mg/L	55.9		0.6	Nov 10, 2018	CO	Nov 10, 2018
Dissolved Calcium	mg/L	68.7		0.3	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Magnesium	mg/L	30.3		0.2	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Sodium	mg/L	59.2		0.6	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Potassium	mg/L	3.3		0.6	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Iron	mg/L	<0.1		0.1	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Manganese	mg/L	0.005		0.005	Nov 10, 2018	IP	Nov 10, 2018
Ion Balance	%	100		1	Nov 13, 2018	SYS	Nov 13, 2018
Hardness	mg CaCO3/L	296		0.5		SYS	
Nitrate + Nitrite - Nitrogen	mg/L	0.27		0.02		SYS	
Calculated TDS	mg/L	444		1		SYS	

COMMENTS:

RDL - Reported Detection Limit; G / S - Guideline / Standard
< - Values refer to Report Detection Limits.

Certified By:



Certificate of Analysis

CLIENT NAME: MATRIX SOLUTIONS INC.

PROJECT: 26388-512 / West Cochrane

SAMPLING SITE:

AGAT WORK ORDER: 18C408063

ATTENTION TO: Isabelle Fillion

SAMPLED BY:RK/RS

Matrix Solutions Routine Chemistry Water Analysis							
SAMPLE TYPE: Water		SAMPLE ID: 9692917			DATE RECEIVED: Nov 09, 2018		
DATE SAMPLED: Nov 07, 2018				DATE REPORTED: Nov 14, 2018			
SAMPLE DESCRIPTION: 26388181107003							
PARAMETER	UNIT	RESULT	G / S	RDL	DATE ANALYZED	INITIAL	DATE PREPARED
pH	pH Units	7.98		N/A	Nov 13, 2018	KT	Nov 13, 2018
p - Alkalinity (as CaCO3)	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
T - Alkalinity (as CaCO3)	mg/L	271		5	Nov 13, 2018	KT	Nov 13, 2018
Bicarbonate	mg/L	330		5	Nov 13, 2018	KT	Nov 13, 2018
Carbonate	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
Hydroxide	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
Electrical Conductivity	uS/cm	578		5	Nov 13, 2018	KT	Nov 13, 2018
Chloride	mg/L	6.4		0.6	Nov 10, 2018	CO	Nov 10, 2018
Fluoride	mg/L	0.18		0.01	Nov 10, 2018	CO	Nov 10, 2018
Nitrate	mg/L	<0.08		0.08	Nov 10, 2018	CO	Nov 10, 2018
Nitrate-N	mg/L	<0.02		0.02	Nov 10, 2018	SYS	Nov 10, 2018
Nitrite	mg/L	<0.03		0.03	Nov 10, 2018	CO	Nov 10, 2018
Nitrite-N	mg/L	<0.01		0.01	Nov 10, 2018	SYS	Nov 10, 2018
Sulfate	mg/L	37.8		0.6	Nov 10, 2018	CO	Nov 10, 2018
Dissolved Calcium	mg/L	59.2		0.3	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Magnesium	mg/L	26.8		0.2	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Sodium	mg/L	25.5		0.6	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Potassium	mg/L	2.8		0.6	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Iron	mg/L	<0.1		0.1	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Manganese	mg/L	0.303		0.005	Nov 10, 2018	IP	Nov 10, 2018
Ion Balance	%	99		1	Nov 13, 2018	SYS	Nov 13, 2018
Hardness	mg CaCO3/L	258		0.5		SYS	
Nitrate + Nitrite - Nitrogen	mg/L	<0.02		0.02		SYS	
Calculated TDS	mg/L	321		1		SYS	

COMMENTS:

RDL - Reported Detection Limit; G / S - Guideline / Standard
< - Values refer to Report Detection Limits.

Certified By:



Certificate of Analysis

CLIENT NAME: MATRIX SOLUTIONS INC.

PROJECT: 26388-512 / West Cochrane

SAMPLING SITE:

AGAT WORK ORDER: 18C408063

ATTENTION TO: Isabelle Fillion

SAMPLED BY: RK/RS

Matrix Solutions Routine Chemistry Water Analysis							
SAMPLE TYPE: Water		SAMPLE ID: 9692918			DATE RECEIVED: Nov 09, 2018		
DATE SAMPLED: Nov 07, 2018				DATE REPORTED: Nov 14, 2018			
SAMPLE DESCRIPTION: 26388181107004							
PARAMETER	UNIT	RESULT	G / S	RDL	DATE ANALYZED	INITIAL	DATE PREPARED
pH	pH Units	7.99		N/A	Nov 13, 2018	KT	Nov 13, 2018
p - Alkalinity (as CaCO3)	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
T - Alkalinity (as CaCO3)	mg/L	270		5	Nov 13, 2018	KT	Nov 13, 2018
Bicarbonate	mg/L	330		5	Nov 13, 2018	KT	Nov 13, 2018
Carbonate	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
Hydroxide	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
Electrical Conductivity	uS/cm	577		5	Nov 13, 2018	KT	Nov 13, 2018
Chloride	mg/L	6.2		0.6	Nov 10, 2018	CO	Nov 10, 2018
Fluoride	mg/L	0.18		0.01	Nov 10, 2018	CO	Nov 10, 2018
Nitrate	mg/L	<0.08		0.08	Nov 10, 2018	CO	Nov 10, 2018
Nitrate-N	mg/L	<0.02		0.02	Nov 10, 2018	SYS	Nov 10, 2018
Nitrite	mg/L	<0.03		0.03	Nov 10, 2018	CO	Nov 10, 2018
Nitrite-N	mg/L	<0.01		0.01	Nov 10, 2018	SYS	Nov 10, 2018
Sulfate	mg/L	37.7		0.6	Nov 10, 2018	CO	Nov 10, 2018
Dissolved Calcium	mg/L	60.9		0.3	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Magnesium	mg/L	26.7		0.2	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Sodium	mg/L	26.0		0.6	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Potassium	mg/L	2.9		0.6	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Iron	mg/L	<0.1		0.1	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Manganese	mg/L	0.367		0.005	Nov 10, 2018	IP	Nov 10, 2018
Ion Balance	%	101		1	Nov 13, 2018	SYS	Nov 13, 2018
Hardness	mg CaCO3/L	262		0.5		SYS	
Nitrate + Nitrite - Nitrogen	mg/L	<0.02		0.02		SYS	
Calculated TDS	mg/L	323		1		SYS	

COMMENTS:

RDL - Reported Detection Limit; G / S - Guideline / Standard
< - Values refer to Report Detection Limits.

Certified By:



Certificate of Analysis

CLIENT NAME: MATRIX SOLUTIONS INC.

PROJECT: 26388-512 / West Cochrane

SAMPLING SITE:

AGAT WORK ORDER: 18C408063

ATTENTION TO: Isabelle Fillion

SAMPLED BY:RK/RS

Matrix Solutions Routine Chemistry Water Analysis							
SAMPLE TYPE: Water		SAMPLE ID: 9692919			DATE RECEIVED: Nov 09, 2018		
DATE SAMPLED: Nov 07, 2018				DATE REPORTED: Nov 14, 2018			
SAMPLE DESCRIPTION: 26388181107005							
PARAMETER	UNIT	RESULT	G / S	RDL	DATE ANALYZED	INITIAL	DATE PREPARED
pH	pH Units	8.03		N/A	Nov 13, 2018	KT	Nov 13, 2018
p - Alkalinity (as CaCO3)	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
T - Alkalinity (as CaCO3)	mg/L	314		5	Nov 13, 2018	KT	Nov 13, 2018
Bicarbonate	mg/L	383		5	Nov 13, 2018	KT	Nov 13, 2018
Carbonate	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
Hydroxide	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
Electrical Conductivity	uS/cm	752		5	Nov 13, 2018	KT	Nov 13, 2018
Chloride	mg/L	16.7		0.6	Nov 10, 2018	CO	Nov 10, 2018
Fluoride	mg/L	0.34		0.01	Nov 10, 2018	CO	Nov 10, 2018
Nitrate	mg/L	21.2		0.08	Nov 10, 2018	CO	Nov 10, 2018
Nitrate-N	mg/L	4.79		0.02	Nov 10, 2018	SYS	Nov 10, 2018
Nitrite	mg/L	<0.03		0.03	Nov 10, 2018	CO	Nov 10, 2018
Nitrite-N	mg/L	<0.01		0.01	Nov 10, 2018	SYS	Nov 10, 2018
Sulfate	mg/L	54.8		0.6	Nov 10, 2018	CO	Nov 10, 2018
Dissolved Calcium	mg/L	51.8		0.3	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Magnesium	mg/L	39.8		0.2	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Sodium	mg/L	43.7		0.6	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Potassium	mg/L	3.5		0.6	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Iron	mg/L	<0.1		0.1	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Manganese	mg/L	0.006		0.005	Nov 10, 2018	IP	Nov 10, 2018
Ion Balance	%	95		1	Nov 13, 2018	SYS	Nov 13, 2018
Hardness	mg CaCO3/L	293		0.5		SYS	
Nitrate + Nitrite - Nitrogen	mg/L	4.79		0.02		SYS	
Calculated TDS	mg/L	420		1		SYS	

COMMENTS:

RDL - Reported Detection Limit; G / S - Guideline / Standard
< - Values refer to Report Detection Limits.

Certified By:



Certificate of Analysis

CLIENT NAME: MATRIX SOLUTIONS INC.

PROJECT: 26388-512 / West Cochrane

SAMPLING SITE:

AGAT WORK ORDER: 18C408063

ATTENTION TO: Isabelle Fillion

SAMPLED BY: RK/RS

Matrix Solutions Routine Chemistry Water Analysis							
SAMPLE TYPE: Water		SAMPLE ID: 9692920			DATE RECEIVED: Nov 09, 2018		
DATE SAMPLED: Nov 07, 2018				DATE REPORTED: Nov 14, 2018			
SAMPLE DESCRIPTION: 26388181107006							
PARAMETER	UNIT	RESULT	G / S	RDL	DATE ANALYZED	INITIAL	DATE PREPARED
pH	pH Units	8.09		N/A	Nov 13, 2018	KT	Nov 13, 2018
p - Alkalinity (as CaCO3)	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
T - Alkalinity (as CaCO3)	mg/L	325		5	Nov 13, 2018	KT	Nov 13, 2018
Bicarbonate	mg/L	397		5	Nov 13, 2018	KT	Nov 13, 2018
Carbonate	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
Hydroxide	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
Electrical Conductivity	uS/cm	877		5	Nov 13, 2018	KT	Nov 13, 2018
Chloride	mg/L	14.2		0.6	Nov 10, 2018	CO	Nov 10, 2018
Fluoride	mg/L	0.30		0.01	Nov 10, 2018	CO	Nov 10, 2018
Nitrate	mg/L	0.12		0.08	Nov 10, 2018	CO	Nov 10, 2018
Nitrate-N	mg/L	0.03		0.02	Nov 10, 2018	SYS	Nov 10, 2018
Nitrite	mg/L	<0.03		0.03	Nov 10, 2018	CO	Nov 10, 2018
Nitrite-N	mg/L	<0.01		0.01	Nov 10, 2018	SYS	Nov 10, 2018
Sulfate	mg/L	135		0.6	Nov 10, 2018	CO	Nov 10, 2018
Dissolved Calcium	mg/L	53.5		0.3	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Magnesium	mg/L	32.0		0.2	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Sodium	mg/L	99.9		0.6	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Potassium	mg/L	3.0		0.6	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Iron	mg/L	<0.1		0.1	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Manganese	mg/L	0.068		0.005	Nov 10, 2018	IP	Nov 10, 2018
Ion Balance	%	100		1	Nov 13, 2018	SYS	Nov 13, 2018
Hardness	mg CaCO3/L	265		0.5		SYS	
Nitrate + Nitrite - Nitrogen	mg/L	0.03		0.02		SYS	
Calculated TDS	mg/L	533		1		SYS	

COMMENTS:

RDL - Reported Detection Limit; G / S - Guideline / Standard
< - Values refer to Report Detection Limits.

Certified By:



Certificate of Analysis

CLIENT NAME: MATRIX SOLUTIONS INC.

PROJECT: 26388-512 / West Cochrane

SAMPLING SITE:
AGAT WORK ORDER: 18C408063

ATTENTION TO: Isabelle Fillion

SAMPLED BY: RK/RS

Matrix Solutions Routine Chemistry Water Analysis							
SAMPLE TYPE: Water		SAMPLE ID: 9692921			DATE RECEIVED: Nov 09, 2018		
DATE SAMPLED: Nov 07, 2018				DATE REPORTED: Nov 14, 2018			
SAMPLE DESCRIPTION: 26388181107007							
PARAMETER	UNIT	RESULT	G / S	RDL	DATE ANALYZED	INITIAL	DATE PREPARED
pH	pH Units	7.97		N/A	Nov 13, 2018	KT	Nov 13, 2018
p - Alkalinity (as CaCO3)	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
T - Alkalinity (as CaCO3)	mg/L	256		5	Nov 13, 2018	KT	Nov 13, 2018
Bicarbonate	mg/L	312		5	Nov 13, 2018	KT	Nov 13, 2018
Carbonate	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
Hydroxide	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
Electrical Conductivity	uS/cm	796		5	Nov 13, 2018	KT	Nov 13, 2018
Chloride	mg/L	40.4		0.6	Nov 10, 2018	CO	Nov 10, 2018
Fluoride	mg/L	0.21		0.01	Nov 10, 2018	CO	Nov 10, 2018
Nitrate	mg/L	<0.08		0.08	Nov 10, 2018	CO	Nov 10, 2018
Nitrate-N	mg/L	<0.02		0.02	Nov 10, 2018	SYS	Nov 10, 2018
Nitrite	mg/L	<0.03		0.03	Nov 10, 2018	CO	Nov 10, 2018
Nitrite-N	mg/L	<0.01		0.01	Nov 10, 2018	SYS	Nov 10, 2018
Sulfate	mg/L	119		0.6	Nov 10, 2018	CO	Nov 10, 2018
Dissolved Calcium	mg/L	75.9		0.3	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Magnesium	mg/L	40.9		0.2	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Sodium	mg/L	23.2		0.6	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Potassium	mg/L	3.1		0.6	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Iron	mg/L	<0.1		0.1	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Manganese	mg/L	0.040		0.005	Nov 10, 2018	IP	Nov 10, 2018
Ion Balance	%	94		1	Nov 13, 2018	SYS	Nov 13, 2018
Hardness	mg CaCO3/L	358		0.5		SYS	
Nitrate + Nitrite - Nitrogen	mg/L	<0.02		0.02		SYS	
Calculated TDS	mg/L	456		1		SYS	

COMMENTS:

RDL - Reported Detection Limit; G / S - Guideline / Standard
< - Values refer to Report Detection Limits.

Certified By:


Certificate of Analysis

CLIENT NAME: MATRIX SOLUTIONS INC.

PROJECT: 26388-512 / West Cochrane

SAMPLING SITE:

AGAT WORK ORDER: 18C408063

ATTENTION TO: Isabelle Fillion

SAMPLED BY: RK/RS

Matrix Solutions Routine Chemistry Water Analysis							
SAMPLE TYPE: Water		SAMPLE ID: 9692922			DATE RECEIVED: Nov 09, 2018		
DATE SAMPLED: Nov 07, 2018				DATE REPORTED: Nov 14, 2018			
SAMPLE DESCRIPTION: 26388181107008							
PARAMETER	UNIT	RESULT	G / S	RDL	DATE ANALYZED	INITIAL	DATE PREPARED
pH	pH Units	8.07		N/A	Nov 13, 2018	KT	Nov 13, 2018
p - Alkalinity (as CaCO3)	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
T - Alkalinity (as CaCO3)	mg/L	253		5	Nov 13, 2018	KT	Nov 13, 2018
Bicarbonate	mg/L	309		5	Nov 13, 2018	KT	Nov 13, 2018
Carbonate	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
Hydroxide	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
Electrical Conductivity	uS/cm	545		5	Nov 13, 2018	KT	Nov 13, 2018
Chloride	mg/L	6.2		0.6	Nov 10, 2018	CO	Nov 10, 2018
Fluoride	mg/L	0.12		0.01	Nov 10, 2018	CO	Nov 10, 2018
Nitrate	mg/L	1.86		0.08	Nov 10, 2018	CO	Nov 10, 2018
Nitrate-N	mg/L	0.42		0.02	Nov 10, 2018	SYS	Nov 10, 2018
Nitrite	mg/L	<0.03		0.03	Nov 10, 2018	CO	Nov 10, 2018
Nitrite-N	mg/L	<0.01		0.01	Nov 10, 2018	SYS	Nov 10, 2018
Sulfate	mg/L	35.6		0.6	Nov 10, 2018	CO	Nov 10, 2018
Dissolved Calcium	mg/L	61.9		0.3	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Magnesium	mg/L	28.4		0.2	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Sodium	mg/L	18.0		0.6	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Potassium	mg/L	1.5		0.6	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Iron	mg/L	<0.1		0.1	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Manganese	mg/L	0.146		0.005	Nov 10, 2018	IP	Nov 10, 2018
Ion Balance	%	104		1	Nov 13, 2018	SYS	Nov 13, 2018
Hardness	mg CaCO3/L	272		0.5		SYS	
Nitrate + Nitrite - Nitrogen	mg/L	0.42		0.02		SYS	
Calculated TDS	mg/L	305		1		SYS	

COMMENTS:

RDL - Reported Detection Limit; G / S - Guideline / Standard
< - Values refer to Report Detection Limits.

Certified By:



Certificate of Analysis

CLIENT NAME: MATRIX SOLUTIONS INC.

PROJECT: 26388-512 / West Cochrane

SAMPLING SITE:

AGAT WORK ORDER: 18C408063

ATTENTION TO: Isabelle Fillion

SAMPLED BY: RK/RS

Matrix Solutions Routine Chemistry Water Analysis							
SAMPLE TYPE: Water		SAMPLE ID: 9692923			DATE RECEIVED: Nov 09, 2018		
DATE SAMPLED: Nov 07, 2018				DATE REPORTED: Nov 14, 2018			
SAMPLE DESCRIPTION: 26388181107009							
PARAMETER	UNIT	RESULT	G / S	RDL	DATE ANALYZED	INITIAL	DATE PREPARED
pH	pH Units	7.95		N/A	Nov 13, 2018	KT	Nov 13, 2018
p - Alkalinity (as CaCO3)	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
T - Alkalinity (as CaCO3)	mg/L	355		5	Nov 13, 2018	KT	Nov 13, 2018
Bicarbonate	mg/L	433		5	Nov 13, 2018	KT	Nov 13, 2018
Carbonate	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
Hydroxide	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
Electrical Conductivity	uS/cm	688		5	Nov 13, 2018	KT	Nov 13, 2018
Chloride	mg/L	10.9		0.6	Nov 10, 2018	CO	Nov 10, 2018
Fluoride	mg/L	0.14		0.01	Nov 10, 2018	CO	Nov 10, 2018
Nitrate	mg/L	1.46		0.08	Nov 10, 2018	CO	Nov 10, 2018
Nitrate-N	mg/L	0.33		0.02	Nov 10, 2018	SYS	Nov 10, 2018
Nitrite	mg/L	<0.03		0.03	Nov 10, 2018	CO	Nov 10, 2018
Nitrite-N	mg/L	<0.01		0.01	Nov 10, 2018	SYS	Nov 10, 2018
Sulfate	mg/L	31.9		0.6	Nov 10, 2018	CO	Nov 10, 2018
Dissolved Calcium	mg/L	61.2		0.3	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Magnesium	mg/L	38.0		0.2	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Sodium	mg/L	36.8		0.6	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Potassium	mg/L	2.4		0.6	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Iron	mg/L	<0.1		0.1	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Manganese	mg/L	<0.005		0.005	Nov 10, 2018	IP	Nov 10, 2018
Ion Balance	%	97		1	Nov 13, 2018	SYS	Nov 13, 2018
Hardness	mg CaCO3/L	309		0.5		SYS	
Nitrate + Nitrite - Nitrogen	mg/L	0.33		0.02		SYS	
Calculated TDS	mg/L	396		1		SYS	

COMMENTS:

RDL - Reported Detection Limit; G / S - Guideline / Standard
< - Values refer to Report Detection Limits.

Certified By:



Certificate of Analysis

CLIENT NAME: MATRIX SOLUTIONS INC.

PROJECT: 26388-512 / West Cochrane

SAMPLING SITE:
AGAT WORK ORDER: 18C408063

ATTENTION TO: Isabelle Fillion

SAMPLED BY: RK/RS

Matrix Solutions Routine Chemistry Water Analysis							
SAMPLE TYPE: Water		SAMPLE ID: 9692924			DATE RECEIVED: Nov 09, 2018		
DATE SAMPLED: Nov 07, 2018				DATE REPORTED: Nov 14, 2018			
SAMPLE DESCRIPTION: 26388181107010							
PARAMETER	UNIT	RESULT	G / S	RDL	DATE ANALYZED	INITIAL	DATE PREPARED
pH	pH Units	8.14		N/A	Nov 13, 2018	KT	Nov 13, 2018
p - Alkalinity (as CaCO3)	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
T - Alkalinity (as CaCO3)	mg/L	313		5	Nov 13, 2018	KT	Nov 13, 2018
Bicarbonate	mg/L	381		5	Nov 13, 2018	KT	Nov 13, 2018
Carbonate	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
Hydroxide	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
Electrical Conductivity	uS/cm	783		5	Nov 13, 2018	KT	Nov 13, 2018
Chloride	mg/L	17.7		0.6	Nov 10, 2018	CO	Nov 10, 2018
Fluoride	mg/L	0.32		0.01	Nov 10, 2018	CO	Nov 10, 2018
Nitrate	mg/L	4.54		0.08	Nov 10, 2018	CO	Nov 10, 2018
Nitrate-N	mg/L	1.03		0.02	Nov 10, 2018	SYS	Nov 10, 2018
Nitrite	mg/L	0.75		0.03	Nov 10, 2018	CO	Nov 10, 2018
Nitrite-N	mg/L	0.23		0.01	Nov 10, 2018	SYS	Nov 10, 2018
Sulfate	mg/L	79.6		0.6	Nov 10, 2018	CO	Nov 10, 2018
Dissolved Calcium	mg/L	42.7		0.3	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Magnesium	mg/L	23.9		0.2	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Sodium	mg/L	98.3		0.6	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Potassium	mg/L	2.8		0.6	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Iron	mg/L	<0.1		0.1	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Manganese	mg/L	0.081		0.005	Nov 10, 2018	IP	Nov 10, 2018
Ion Balance	%	99		1	Nov 13, 2018	SYS	Nov 13, 2018
Hardness	mg CaCO3/L	205		0.5		SYS	
Nitrate + Nitrite - Nitrogen	mg/L	1.25		0.02		SYS	
Calculated TDS	mg/L	458		1		SYS	

COMMENTS:

RDL - Reported Detection Limit; G / S - Guideline / Standard
< - Values refer to Report Detection Limits.

Certified By:


Certificate of Analysis

CLIENT NAME: MATRIX SOLUTIONS INC.

PROJECT: 26388-512 / West Cochrane

SAMPLING SITE:

AGAT WORK ORDER: 18C408063

ATTENTION TO: Isabelle Fillion

SAMPLED BY: RK/RS

Matrix Solutions Routine Chemistry Water Analysis							
SAMPLE TYPE: Water		SAMPLE ID: 9692925			DATE RECEIVED: Nov 09, 2018		
DATE SAMPLED: Nov 07, 2018				DATE REPORTED: Nov 14, 2018			
SAMPLE DESCRIPTION: 26388181107012							
PARAMETER	UNIT	RESULT	G / S	RDL	DATE ANALYZED	INITIAL	DATE PREPARED
pH	pH Units	8.01		N/A	Nov 13, 2018	KT	Nov 13, 2018
p - Alkalinity (as CaCO3)	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
T - Alkalinity (as CaCO3)	mg/L	297		5	Nov 13, 2018	KT	Nov 13, 2018
Bicarbonate	mg/L	362		5	Nov 13, 2018	KT	Nov 13, 2018
Carbonate	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
Hydroxide	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
Electrical Conductivity	uS/cm	680		5	Nov 13, 2018	KT	Nov 13, 2018
Chloride	mg/L	11.1		0.6	Nov 10, 2018	CO	Nov 10, 2018
Fluoride	mg/L	0.46		0.01	Nov 10, 2018	CO	Nov 10, 2018
Nitrate	mg/L	14.5		0.08	Nov 10, 2018	CO	Nov 10, 2018
Nitrate-N	mg/L	3.28		0.02	Nov 10, 2018	SYS	Nov 10, 2018
Nitrite	mg/L	0.29		0.03	Nov 10, 2018	CO	Nov 10, 2018
Nitrite-N	mg/L	0.09		0.01	Nov 10, 2018	SYS	Nov 10, 2018
Sulfate	mg/L	56.7		0.6	Nov 10, 2018	CO	Nov 10, 2018
Dissolved Calcium	mg/L	79.1		0.3	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Magnesium	mg/L	37.0		0.2	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Sodium	mg/L	12.1		0.6	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Potassium	mg/L	6.8		0.6	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Iron	mg/L	0.3		0.1	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Manganese	mg/L	0.101		0.005	Nov 10, 2018	IP	Nov 10, 2018
Ion Balance	%	100		1	Nov 13, 2018	SYS	Nov 13, 2018
Hardness	mg CaCO3/L	350		0.5		SYS	
Nitrate + Nitrite - Nitrogen	mg/L	3.36		0.02		SYS	
Calculated TDS	mg/L	396		1		SYS	

COMMENTS:

RDL - Reported Detection Limit; G / S - Guideline / Standard
< - Values refer to Report Detection Limits.

Certified By:



Certificate of Analysis

CLIENT NAME: MATRIX SOLUTIONS INC.

PROJECT: 26388-512 / West Cochrane

SAMPLING SITE:

AGAT WORK ORDER: 18C408063

ATTENTION TO: Isabelle Fillion

SAMPLED BY:RK/RS

Matrix Solutions Routine Chemistry Water Analysis							
SAMPLE TYPE: Water		SAMPLE ID: 9692926			DATE RECEIVED: Nov 09, 2018		
DATE SAMPLED: Nov 07, 2018				DATE REPORTED: Nov 14, 2018			
SAMPLE DESCRIPTION: 26388181107011							
PARAMETER	UNIT	RESULT	G / S	RDL	DATE ANALYZED	INITIAL	DATE PREPARED
pH	pH Units	7.71		N/A	Nov 13, 2018	KT	Nov 13, 2018
p - Alkalinity (as CaCO3)	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
T - Alkalinity (as CaCO3)	mg/L	665		5	Nov 13, 2018	KT	Nov 13, 2018
Bicarbonate	mg/L	811		5	Nov 13, 2018	KT	Nov 13, 2018
Carbonate	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
Hydroxide	mg/L	<5		5	Nov 13, 2018	KT	Nov 13, 2018
Electrical Conductivity	uS/cm	2010		5	Nov 13, 2018	KT	Nov 13, 2018
Chloride	mg/L	195		0.6	Nov 10, 2018	CO	Nov 10, 2018
Fluoride	mg/L	0.08		0.01	Nov 10, 2018	CO	Nov 10, 2018
Nitrate	mg/L	<0.08		0.08	Nov 10, 2018	CO	Nov 10, 2018
Nitrate-N	mg/L	<0.02		0.02	Nov 10, 2018	SYS	Nov 10, 2018
Nitrite	mg/L	<0.03		0.03	Nov 10, 2018	CO	Nov 10, 2018
Nitrite-N	mg/L	<0.01		0.01	Nov 10, 2018	SYS	Nov 10, 2018
Sulfate	mg/L	228		0.6	Nov 10, 2018	CO	Nov 10, 2018
Dissolved Calcium	mg/L	140		0.3	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Magnesium	mg/L	128		0.2	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Sodium	mg/L	101		0.6	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Potassium	mg/L	3.8		0.6	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Iron	mg/L	<0.1		0.1	Nov 10, 2018	IP	Nov 10, 2018
Dissolved Manganese	mg/L	0.134		0.005	Nov 10, 2018	IP	Nov 10, 2018
Ion Balance	%	94		1	Nov 13, 2018	SYS	Nov 13, 2018
Hardness	mg CaCO3/L	877		0.5		SYS	
Nitrate + Nitrite - Nitrogen	mg/L	<0.02		0.02		SYS	
Calculated TDS	mg/L	1190		1		SYS	

COMMENTS:

RDL - Reported Detection Limit; G / S - Guideline / Standard
< - Values refer to Report Detection Limits.

Certified By:



Quality Assurance

CLIENT NAME: MATRIX SOLUTIONS INC.

PROJECT: 26388-512 / West Cochrane

SAMPLING SITE:

AGAT WORK ORDER: 18C408063

ATTENTION TO: Isabelle Fillion

SAMPLED BY:RK/RS

Water Analysis															
RPT Date: Nov 14, 2018			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Matrix Solutions Routine Chemistry Water Analysis															
pH	9692953		7.54	7.64	1.3%	N/A	100%	90%	110%						
T - Alkalinity (as CaCO3)	9692953		468	466	0.3%	< 5	105%	80%	120%						
Electrical Conductivity	9692953		3060	3150	2.8%	< 5	104%	80%	120%						
Chloride	9692920	9692920	13.8	13.8	0.4%	< 0.6	111%	80%	120%	110%	80%	120%	107%	80%	120%
Fluoride	9692920	9692920	0.18	0.25	NA	< 0.01	98%	80%	120%	89%	80%	120%	86%	80%	120%
Nitrate	9692920	9692920	<0.40	<0.40	NA	< 0.08	109%	80%	120%	97%	80%	120%	86%	80%	120%
Nitrite	9692920	9692920	<0.20	<0.20	NA	< 0.03	100%	80%	120%	96%	80%	120%	95%	80%	120%
Sulfate	9692920	9692920	135	137	1.4%	< 0.6	102%	80%	120%	102%	80%	120%	NA	80%	120%
Dissolved Calcium	9692840		6.6	6.5	2.3%	< 0.3	105%	80%	120%	107%	80%	120%	NA	80%	120%
Dissolved Magnesium	9692840		2.5	2.4	6.3%	< 0.2	103%	80%	120%	99%	80%	120%	NA	80%	120%
Dissolved Sodium	9692840		191	180	6.0%	< 0.6	95%	80%	120%	96%	80%	120%	NA	80%	120%
Dissolved Potassium	9692840		1.0	0.9	NA	< 0.6	89%	80%	120%	96%	80%	120%	91%	80%	120%
Dissolved Iron	9692840		<0.1	<0.1	NA	< 0.1	101%	80%	120%	97%	80%	120%	98%	80%	120%
Dissolved Manganese	9692840		<0.005	<0.005	NA	< 0.005	99%	80%	120%	94%	80%	120%	95%	80%	120%

Comments: If Matrix spike value is NA, the spiked analyte concentration was lower than that of the matrix contribution.
If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

pH has been analyzed past the recommended holding time of 15 minutes from sampling (field measurement ideal if more accurate data required)

Nitrate and Nitrite: The regulatory hold time for the analysis of nitrate and/or nitrite in water is 72 hours.

Certified By:



Method Summary

CLIENT NAME: MATRIX SOLUTIONS INC.

AGAT WORK ORDER: 18C408063

PROJECT: 26388-512 / West Cochrane

ATTENTION TO: Isabelle Fillion

SAMPLING SITE:

SAMPLED BY:RK/RS

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
pH	INST 0101, INST 0104	SM 4500 H+	pH METER
p - Alkalinity (as CaCO ₃)	INST 0101	SM 2320 B	TITRATION
T - Alkalinity (as CaCO ₃)	INST 0101	SM 2320 B	TITRATION
Bicarbonate	INST 0101	SM 2320 B	PC TITRATE
Carbonate	INST 0101	SM 2320 B	PC TITRATE
Hydroxide	INST 0101	SM 2320 B	TITRATION
Electrical Conductivity	INST 0101, INST 0120	SM 2510 B	CONDUCTIVITY METER
Chloride	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Fluoride	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrate	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrate-N	INST 0150	SM 4110 B	CALCULATION
Nitrite	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrite-N	INST 0150	SM 4110 B	CALCULATION
Sulfate	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Dissolved Calcium	INST 0140	SM 3120 B	ICP/OES
Dissolved Magnesium	INST 0140	SM 3120 B	ICP/OES
Dissolved Sodium	INST 0140	SM 3120 B	ICP/OES
Dissolved Potassium	INST 0140	SM 3120 B	ICP/OES
Dissolved Iron	INST 0140	SM 3120 B	ICP/OES
Dissolved Manganese	INST 0140	SM 3120 B	ICP/OES
Ion Balance		SM 1030E	



Matrix Solutions Inc.

ENVIRONMENT & ENGINEERING

COC # 100413

20C

Page: 1 of 1

Lab Submitted to: AGAT Calgary
Lab Agreement no: 18C408063
Lab Job ID:

Invoice to: Require Report: Y N

Company Name: Matrix Solutions
Contact Name: Isabelle Fillion
Address:
Phone / Fax#: Ph: PC Fax:

Copy of Report to:

Matrix Solutions - EDS
Suite 600, 214 - 11th Avenue SW
Calgary, Alberta, Canada
T2R 0K1
Ph: 403-237-0606 Fax: 403-263-2493
email invoices to ap@matrix-solutions.com

Matrix Project #: 26388-512
Matrix Proj. Name: Burnco GW
Location: West Cochrane
Sampler's Name(s): RK/RS

AFE #:

REGULATORY REQUIREMENTS: (check)

- ☒ Alberta Tier 1 ☐ BC CSR
☐ Alberta SW FAL
☒ Canadian Drinking Water
☐ CCME FAL
☐ SPIGEC
☐ SEQG Other:

SERVICE REQUESTED:

☐ RUSH (Please ensure you contact the lab) Due Date:

☒ REGULAR Turnaround

REPORT DISTRIBUTION: always send to eds@matrix-solutions.com

☒ Additional

Emails

rkillam@matrix-solutions.com

ifillion@matrix-solutions.com

Analysis Required

	Sample Number (14 digits only) yr-mth-day	Sample Point Name	Depth (m)	Sample Type	Date/Time Sampled	Quantity # of Containers			Ratire	HOLD
						J/V	Bags	Bottles		
1	26388181107001	-	-	H2O	Nov. 7/18 @ 0840	/		1	X	9692912 916 917 918 919 920 921 922 923 924 925 926
2	002				1020	/		1	X	
3	003				1100	/		1	X	
4	004				1105	/		1	X	
5	005				1250	/		1	X	
6	006				1340	/		1	X	
7	007				1400	/		1	X	
8	008				1410	/		1	X	
9	009				1440	/		1	X	
10	010				1520	/		1	X	
11	012				1655	/		1	X	
12	011				1600	/		1	X	
13						/				
14						/				
15						/				

*For metals in water samples indicate if you want Total (T) or Dissolved (D) as part of "Analysis Required"

Preserved/Filtered

Relinquished by:

Ryley Killam

Date/Time:

Nov. 8/18 @ 1020

Received by:

C. Farn

Date/Time:

Nov. 9/18

10:26

Signature:

COMMENTS/SPECIAL INSTRUCTIONS

C 34428

J = jars V = vials



RECEIVING BASICS - Shipping

Company/Consultant: Matrix
Courier: D/D Prepaid Collect
Waybill# _____
Branch: EDM GP FN FM RD VAN LYD FSJ EST Other: C
If multiple sites were submitted at once: Yes No
Custody Seal Intact: Yes No NA
TAT: <24hr 24-48hr 48-72hr Reg Other _____
Cooler Quantity: 1

TIME SENSITIVE ISSUES - Shipping

ALREADY EXCEEDED HOLD TIME? Yes No
Inorganic Tests (Please Circle): Mibi , BOD , Nitrate/Nitrite , Turbidity , Microtox , Ortho PO4 , Tedlar Bag , Residual Chlorine , Chlorophyll* , Chloroamines*
Earliest Expiry: Nov . 10, 2018
Hydrocarbons: Earliest Expiry NA

SAMPLE INTEGRITY - Shipping

Hazardous Samples: YES NO Precaution Taken: _____
Legal Samples: Yes No
International Samples: Yes No
Tape Sealed: Yes No
Coolant Used: Icepack Bagged Ice Free Ice Free Water None

Temperature (Bottles/Jars only) N/A if only Soil Bags Received

FROZEN (Please Circle if samples received Frozen)

1 (Bottle/Jar) 2 + 3 + 2 = 7 °C 2 (Bottle/Jar) _____ + _____ + _____ = _____ °C
3 (Bottle/Jar) _____ + _____ + _____ = _____ °C 4 (Bottle/Jar) _____ + _____ + _____ = _____ °C
5 (Bottle/Jar) _____ + _____ + _____ = _____ °C 6 (Bottle/Jar) _____ + _____ + _____ = _____ °C
7 (Bottle/Jar) _____ + _____ + _____ = _____ °C 8 (Bottle/Jar) _____ + _____ + _____ = _____ °C
9 (Bottle/Jar) _____ + _____ + _____ = _____ °C 10 (Bottle/Jar) _____ + _____ + _____ = _____ °C

(If more than 10 coolers are received use another sheet of paper and attach)

LOGISTICS USE ONLY

Workorder No: 18c408063

Samples Damaged: Yes No If YES why?

No Bubble Wrap Frozen Courier

Other: _____

Account Project Manager: _____ have they been notified of the above issues: Yes No

Whom spoken to: _____ Date/Time: _____

CPM Initial _____

General Comments: _____

* Subcontracted Analysis (See CPM)

Report Transmission Cover Page

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1	Project ID: 26388-512 Project Name: Project Location: LSD: P.O.:	Lot ID: 1539091 Control Number: 110046 Date Received: Nov 26, 2021 Date Reported: Dec 2, 2021 Report Number: 2697801
Attn: Accounts Payable Sampled By: Ryley K. Company: Matrix Solutions Inc.	Proj. Acct. code:	

Contact	Company	Address
Accounts Payable	Matrix Solutions Inc.	Suite 600, 214 11 Ave SW Calgary, AB T2R 0K1 Phone: (403) 237-0606 Fax: (403) 263-2493 Email: ap@matrix-solutions.com

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / Invoice

EDS	Matrix Solutions Inc.	Suite 600 214-11th Ave SW Calgary, AB T2R 0K1 Phone: (403) 700-2058 Fax: Email: eds@matrix-solutions.com
-----	-----------------------	---

Delivery	Format	Deliverables
Email - Single Report	Equis Matrix Batch File (with QC)	Test Report
Email - Single Report	Equis Matrix Sample File (with QC)	Test Report
Email - Single Report	Equis Matrix Test Result File (with QC)	Test Report
Email - Single Report	PDF	COC / COA
Email - Single Report	PDF	COC / Test Report
Email - Single Report	PDF	Invoice

Ryley Killam	Matrix Solutions Inc.	Suite 600 214-11th Ave SW Calgary, AB T2R 0K1 Phone: (403) 237-0606 Fax: (403) 263-2493 Email: rkillam@matrix-solutions.com
--------------	-----------------------	--

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / COA
Email - Merge Reports	PDF	COC / Test Report

Notes To Clients:

- Dec 01, 2021 - Sample 1539091-1; 7796414: Sediment was present in the field filtered bottle for Sample 1539091-1 which may affect dissolved metals results.
- Dec 01, 2021 - Sample 1539091-3; 7796416: Some trace total metal results were less than dissolved metal results for sample 1539091-3. The results were verified and are within expected measurement uncertainty.
- Dec 01, 2021 - Sample 1539091-1; 7796414: Some trace total metal results were less than dissolved metal results for sample 1539091-1. The results were verified and are within expected measurement uncertainty.
- Dec 02, 2021 - Some ICP-MS total metal results were less than dissolved metal results for sample(s) 1539091-1 and 3. Total metals were analyzed from the metals bottle and dissolved from the field filtered bottle. Results were verified.

The information contained on this and all other pages transmitted, is intended for the addressee only and is considered confidential. If the reader is not the intended recipient, you are hereby notified that any use, dissemination, distribution or copy of this transmission is strictly prohibited. If you receive this transmission by error, or if this transmission is not satisfactory, please notify us by telephone.

Analytical Report

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1	Project ID: 26388-512 Project Name: Project Location: LSD: P.O.:	Lot ID: 1539091 Control Number: 110046 Date Received: Nov 26, 2021 Date Reported: Dec 2, 2021 Report Number: 2697801
Attn: Accounts Payable Sampled By: Ryley K. Company: Matrix Solutions Inc.	Proj. Acct. code:	

Reference Number	1539091-1	1539091-2
Sample Date	Nov 26, 2021	Nov 26, 2021
Sample Time	14:40	14:40
Sample Location		
Sample Description	MW21-2a / 26388211126001 / 10.1C	MW21-2a / 26388211126002 / 10.1C
Matrix	Water	Water

Analyte	Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Physical and Aggregate Properties						
Turbidity	NTU	26800	±800	44400	±1200	0.1
Solids	Total Suspended mg/L	4340	±460			2

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To: Matrix Solutions Inc.
Suite 600, 214 11 Ave SW
Calgary, AB, Canada
T2R 0K1
Attn: Accounts Payable
Sampled By: Ryley K.
Company: Matrix Solutions Inc.

Project ID: 26388-512
Project Name:
Project Location:
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1539091**
Control Number: 110046
Date Received: Nov 26, 2021
Date Reported: Dec 2, 2021
Report Number: 2697801

Reference Number	1539091-1	1539091-3
Sample Date	Nov 26, 2021	Nov 26, 2021
Sample Time	14:40	15:30
Sample Location		
Sample Description	MW21-2a / 26388211126001 / 10.1C Water	MW21-2b / 26388211126003 / 10.1C Water
Matrix	Water	Water

Analyte		Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Metals Dissolved							
Silicon	Dissolved	mg/L	5.24	±0.47	2.63	±0.24	0.05
Sulfur	Dissolved	mg/L	17.4	±1.6	11.4	±1.1	0.3
Mercury	Dissolved	mg/L	<0.000005		<0.000005		0.000005
Aluminum	Dissolved	mg/L	0.558	±0.045	0.190	±0.015	0.002
Antimony	Dissolved	mg/L	0.0004	±0.00003	0.0742	±0.0051	0.0002
Arsenic	Dissolved	mg/L	0.0013	±0.0002	0.666	±0.073	0.0002
Barium	Dissolved	mg/L	0.141	±0.008	0.055	±0.003	0.001
Beryllium	Dissolved	mg/L	<0.0001		<0.0001		0.0001
Bismuth	Dissolved	mg/L	<0.0005		<0.0005		0.0005
Boron	Dissolved	mg/L	0.060	±0.006	0.112	±0.011	0.002
Cadmium	Dissolved	mg/L	0.00006	±0.000005	0.00004	±0.000003	0.00001
Chromium	Dissolved	mg/L	0.0014	±0.0001	<0.0005		0.0005
Cobalt	Dissolved	mg/L	0.0015	±0.00008	0.0002	±0.000010	0.0001
Copper	Dissolved	mg/L	0.005	±0.0003	0.001	±0.0001	0.001
Lead	Dissolved	mg/L	0.0012	±0.00003	0.0001	±0.00002	0.0001
Lithium	Dissolved	mg/L	0.020	±0.002	0.034	±0.003	0.001
Molybdenum	Dissolved	mg/L	0.007	±0.0003	0.159	±0.008	0.001
Nickel	Dissolved	mg/L	0.0050	±0.0002	0.0041	±0.0002	0.0005
Selenium	Dissolved	mg/L	0.0014	±0.0003	0.0853	±0.0103	0.0002
Silver	Dissolved	mg/L	<0.00001		<0.00001		0.00001
Strontium	Dissolved	mg/L	0.574	±0.044	0.038	±0.0029	0.001
Thallium	Dissolved	mg/L	<0.00005		<0.00005		0.00005
Tin	Dissolved	mg/L	<0.001		<0.001		0.001
Titanium	Dissolved	mg/L	0.0076	±0.0006	0.0032	±0.0003	0.0005
Uranium	Dissolved	mg/L	0.0031	±0.0002	0.0130	±0.0010	0.0005
Vanadium	Dissolved	mg/L	0.0017	±0.0002	0.0090	±0.0008	0.0001
Zinc	Dissolved	mg/L	0.008	±0.00064	0.001	±0.00023	0.001
Zirconium	Dissolved	mg/L	<0.001		<0.001		0.001
Subsample			Field Filtered		Field Filtered		
Metals Total							
Aluminum	Total	mg/L	62.6		69.7		0.02
Calcium	Total	mg/L	1040	±5	74.1	±0.4	0.2
Iron	Total	mg/L	140	±0.9	87.6	±0.5	0.05
Magnesium	Total	mg/L	204	±3	31.9	±0.4	0.2
Manganese	Total	mg/L	3.62	±0.05	1.70	±0.05	0.005
Potassium	Total	mg/L	10.8	±1.0	11.4	±1.1	0.4

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To: Matrix Solutions Inc.
Suite 600, 214 11 Ave SW
Calgary, AB, Canada
T2R 0K1
Attn: Accounts Payable
Sampled By: Ryley K.
Company: Matrix Solutions Inc.

Project ID: 26388-512
Project Name:
Project Location:
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1539091**
Control Number: 110046
Date Received: Nov 26, 2021
Date Reported: Dec 2, 2021
Report Number: 2697801

Reference Number	1539091-1	1539091-3
Sample Date	Nov 26, 2021	Nov 26, 2021
Sample Time	14:40	15:30
Sample Location		
Sample Description	MW21-2a / 26388211126001 / 10.1C Water	MW21-2b / 26388211126003 / 10.1C Water
Matrix	Water	Water

Analyte		Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Metals Total - Continued							
Silicon	Total	mg/L	66.5	±0.6	91.8	±0.8	0.05
Sodium	Total	mg/L	67.5	±2.0	223	±6	0.4
Sulfur	Total	mg/L	24.9	±0.2	10.7	±0.1	0.3
Mercury	Total	mg/L	0.000023	±0.0002	0.000017	±0.0002	0.000005
Antimony	Total	mg/L	0.0006	±0.00006	0.0063	±0.0006	0.0002
Arsenic	Total	mg/L	0.0482	±0.0050	0.675	±0.070	0.0002
Barium	Total	mg/L	2.36	±0.21	2.35	±0.21	0.001
Beryllium	Total	mg/L	0.0028	±0.0004	0.0059	±0.0007	0.0001
Bismuth	Total	mg/L	0.0011	±0.00008	0.0014	±0.0001	0.0005
Boron	Total	mg/L	0.069	±0.006	0.124	±0.011	0.002
Cadmium	Total	mg/L	0.00306	±0.00028	0.00103	±0.00010	0.00001
Chromium	Total	mg/L	0.156	±0.016	0.0953	±0.0097	0.0005
Cobalt	Total	mg/L	0.0868	±0.0084	0.0500	±0.0049	0.0001
Copper	Total	mg/L	0.175	±0.016	0.123	±0.011	0.001
Lead	Total	mg/L	0.0816	±0.0057	0.0708	±0.0050	0.0001
Lithium	Total	mg/L	0.105	±0.012	0.125	±0.014	0.001
Molybdenum	Total	mg/L	0.007	±0.0008	0.106	±0.012	0.001
Nickel	Total	mg/L	0.223	±0.025	0.156	±0.017	0.0005
Selenium	Total	mg/L	0.0020	±0.0002	0.0811	±0.0083	0.0002
Silver	Total	mg/L	0.00087	±0.00012	0.00051	±0.00007	0.00001
Strontium	Total	mg/L	2.05	±0.22	0.880	±0.094	0.001
Thallium	Total	mg/L	0.00158	±0.00010	0.00092	±0.00006	0.00005
Tin	Total	mg/L	0.001	±0.0002	<0.001		0.001
Titanium	Total	mg/L	0.206	±0.025	0.0832	±0.0103	0.0005
Uranium	Total	mg/L	0.0088	±0.0007	0.0191	±0.0015	0.0005
Vanadium	Total	mg/L	0.150	±0.013	0.130	±0.011	0.0001
Zinc	Total	mg/L	0.605	±0.045	0.292	±0.022	0.004
Zirconium	Total	mg/L	0.003	±0.0003	0.002	±0.0001	0.001
Routine Water							
pH			8.12	±0.10	9.31	±0.10	1
Temperature of observed		°C	20.5		21.0		
pH							
Electrical Conductivity	at 25 °C	µS/cm	826	±27	857	±28	1
Calcium	Dissolved	mg/L	71.7	±2.4	1.5	±0.05	0.2
Magnesium	Dissolved	mg/L	39.3	±2.8	0.3	±0.03	0.2
Sodium	Dissolved	mg/L	68.3	±3.6	202	±11	0.4
Potassium	Dissolved	mg/L	3.8	±0.3	0.7	±0.1	0.4

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1 Attn: Accounts Payable Sampled By: Ryley K. Company: Matrix Solutions Inc.	Project ID: 26388-512 Project Name: Project Location: LSD: P.O.: Proj. Acct. code:	Lot ID: 1539091 Control Number: 110046 Date Received: Nov 26, 2021 Date Reported: Dec 2, 2021 Report Number: 2697801
--	---	---

		Reference Number	1539091-1	1539091-3
		Sample Date	Nov 26, 2021	Nov 26, 2021
		Sample Time	14:40	15:30
		Sample Location		
		Sample Description	MW21-2a / 26388211126001 / 10.1C Water	MW21-2b / 26388211126003 / 10.1C Water
		Matrix	Water	Water

Analyte	Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Routine Water - Continued						
Iron	Dissolved	mg/L	1.30 ±0.07	0.10	±0.005	0.01
Manganese	Dissolved	mg/L	0.094 ±0.006	<0.005		0.005
Chloride	Dissolved	mg/L	24.0 ±1.5	12.3	±0.8	0.4
Nitrate - N		mg/L	2.31 ±0.16	0.05	±0.01	0.01
Nitrite - N		mg/L	0.005 ±0.009	0.155	±0.011	0.005
Nitrate and Nitrite - N		mg/L	2.32	0.21		0.01
Sulfate (SO4)	Dissolved	mg/L	52.2 ±4.9	34.3	±3.2	0.9
Hydroxide		mg/L	<5	<5		
Carbonate		mg/L	<6	66		
Bicarbonate		mg/L	437	404		
P-Alkalinity	as CaCO3	mg/L	<5	55	±5.5	5
T-Alkalinity	as CaCO3	mg/L	358 ±14	442	±18	5
Total Dissolved Solids	Calculated	mg/L	474	516		1
Hardness	Dissolved as CaCO3	mg/L	341	5		
Ionic Balance	Dissolved	%	109	90		
Mono-Aromatic Hydrocarbons - Water						
Benzene		mg/L	<0.001	<0.001		0.001
Toluene		mg/L	<0.0004	<0.0004		0.0004
Ethylbenzene		mg/L	<0.0010	<0.0010		0.0010
Total Xylenes (m,p,o)		mg/L	<0.001	<0.001		0.001
Volatile Petroleum Hydrocarbons - Water						
F1 -BTEX		mg/L	<0.1	<0.1		0.1
F1 C6-C10		mg/L	<0.1	<0.1		0.1
Extractable Petroleum Hydrocarbons - Water						
F2 C10-C16		mg/L	<0.1	<0.1		0.1
F3 C16-C34		mg/L	7.2 ±0.9	<0.1		0.1
F3+ C34+		mg/L	1.3 ±0.2	<0.1		0.1

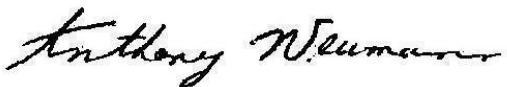
* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1 Attn: Accounts Payable Sampled By: Ryley K. Company: Matrix Solutions Inc.	Project ID: 26388-512 Project Name: Project Location: LSD: P.O.: Proj. Acct. code:	Lot ID: 1539091 Control Number: 110046 Date Received: Nov 26, 2021 Date Reported: Dec 2, 2021 Report Number: 2697801
--	---	---

Reference Number	1539091-3
Sample Date	Nov 26, 2021
Sample Time	15:30
Sample Location	
Sample Description	MW21-2b / 26388211126003 / 10.1C Water
Matrix	

Analyte	Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Physical and Aggregate Properties						
Turbidity	NTU	5210	±150			0.1
Solids	Total Suspended mg/L	2230	±240			2

Approved by: 
Anthony Neumann, MSc
General Manager

Data have been validated by Analytical Quality Control and Element's Integrated Data Validation System (IDVS).
Generation and distribution of the report, and approval by the digitized signature above, are performed through a secure and controlled automatic process.
* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Chromatograms Results

Bill To: Matrix Solutions Inc.
Suite 600, 214 11 Ave SW
Calgary, AB, Canada
T2R 0K1
Attn: Accounts Payable
Sampled By: Ryley K.
Company: Matrix Solutions Inc.

Project ID: 26388-512
Project Name:
Project Location:
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1539091**
Control Number: 110046
Date Received: Nov 26, 2021
Date Reported: Dec 2, 2021
Report Number: 2697801

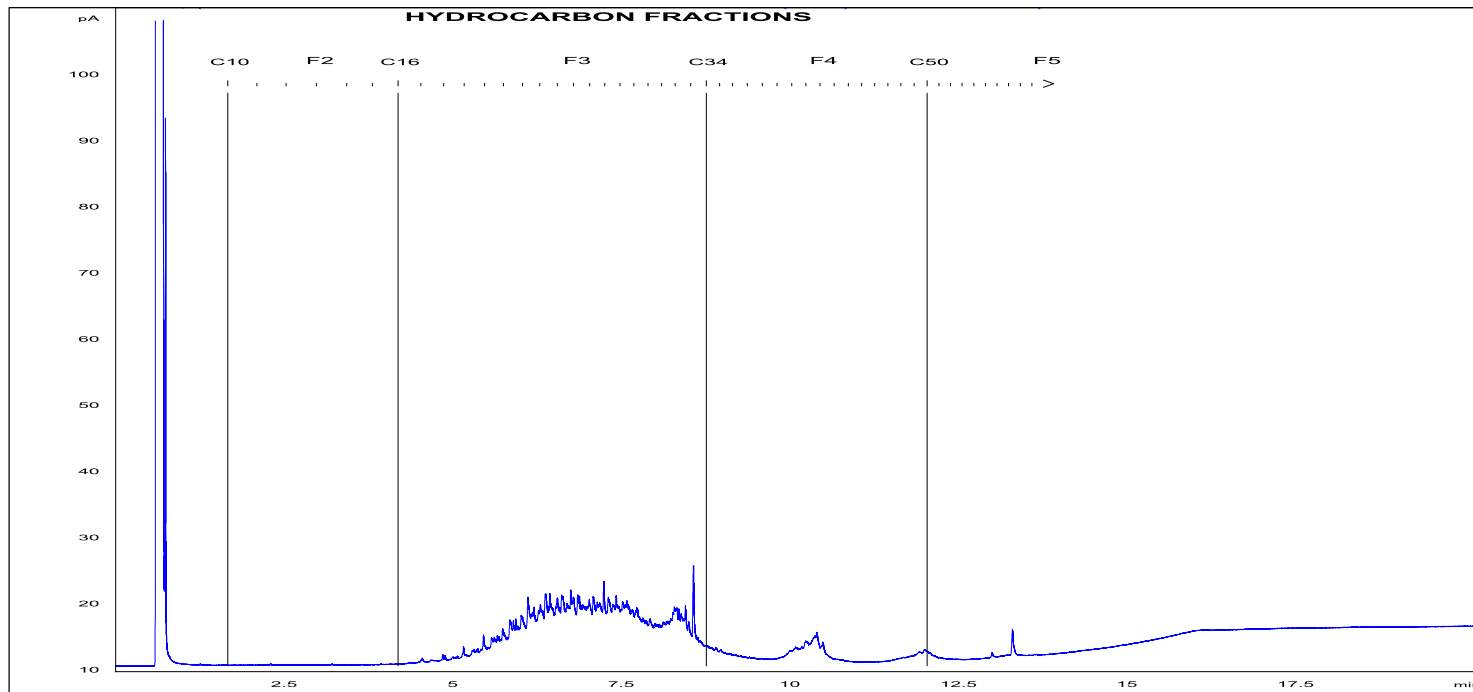
Reference Number: 1539091-1

Sample Description: MW21-2a / 26388211126001 / 10.1C

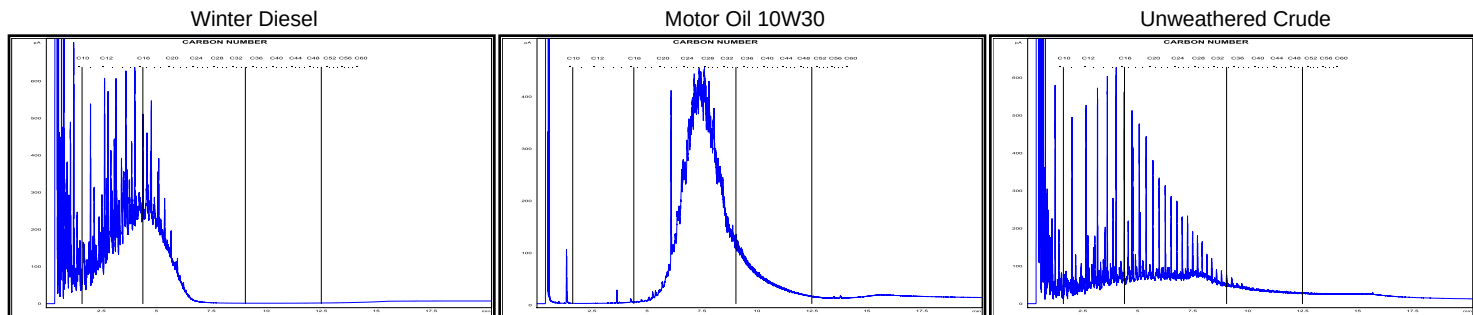
Sample Date: November 26, 2021

Location:

Matrix: Water



TYPICAL PRODUCT CHROMATOGRAMS



Product Carbon Number Ranges

Gasoline
Varsol

C4-C12
C8-C12

Kerosene
Diesel

C7-C16
C8-C22

Lubricating Oils
Crude Oils

C20-C40
C3-C60+

Chromatograms Results

Bill To: Matrix Solutions Inc.
Suite 600, 214 11 Ave SW
Calgary, AB, Canada
T2R 0K1
Attn: Accounts Payable
Sampled By: Ryley K.
Company: Matrix Solutions Inc.

Project ID: 26388-512
Project Name:
Project Location:
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1539091**
Control Number: 110046
Date Received: Nov 26, 2021
Date Reported: Dec 2, 2021
Report Number: 2697801

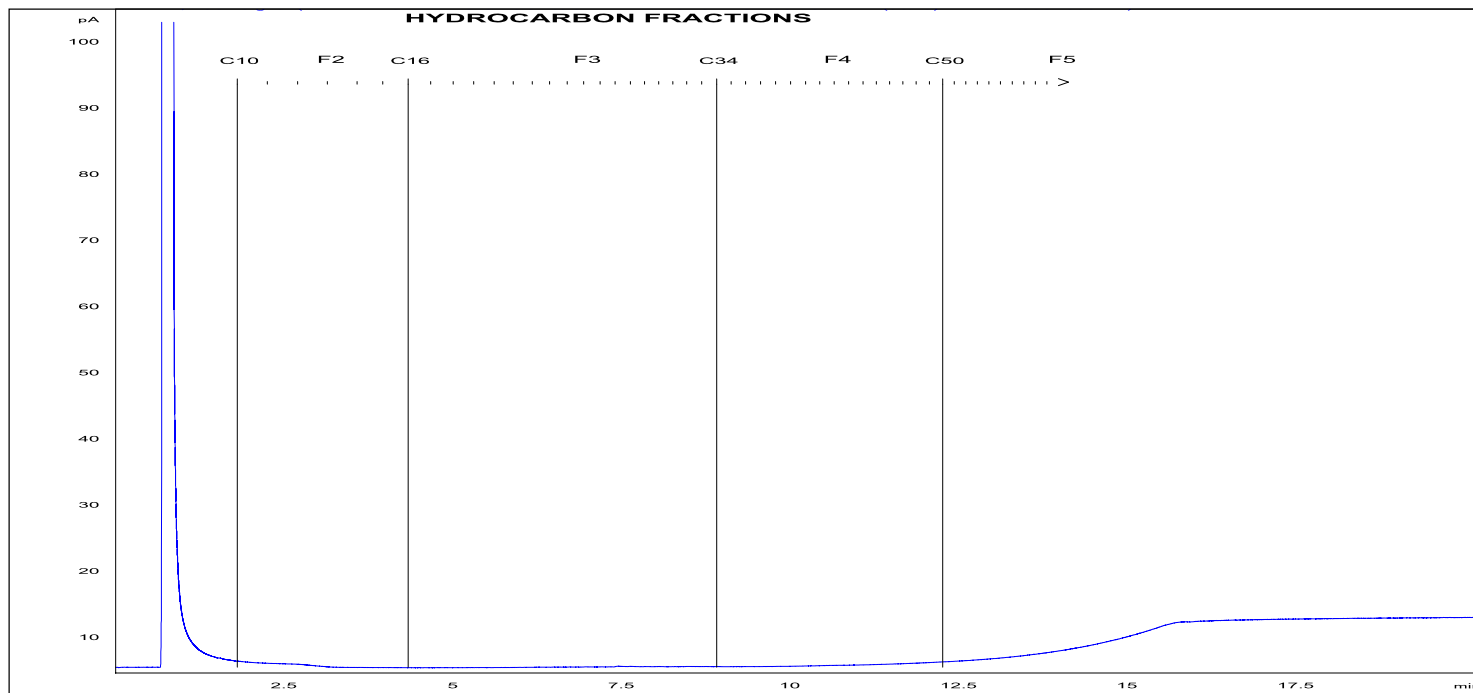
Reference Number: 1539091-3

Sample Description: MW21-2b / 26388211126003 / 10.1C

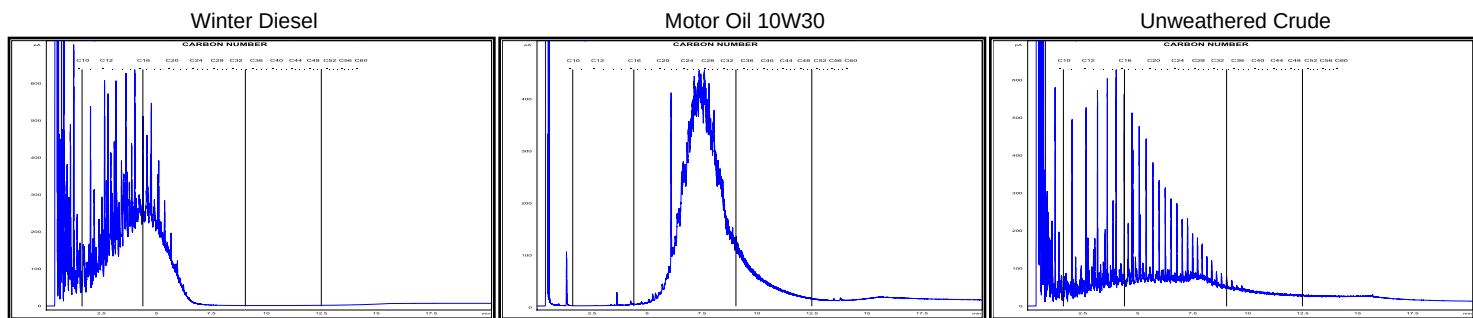
Sample Date: November 26, 2021

Location:

Matrix: Water



TYPICAL PRODUCT CHROMATOGRAMS



Product Carbon Number Ranges

Gasoline
Varsol

C4-C12
C8-C12

Kerosene
Diesel

C7-C16
C8-C22

Lubricating Oils
Crude Oils

C20-C40
C3-C60+

Quality Control

Bill To: Matrix Solutions Inc.	Project ID: 26388-512	Lot ID: 1539091
Suite 600, 214 11 Ave SW	Project Name:	Control Number: 110046
Calgary, AB, Canada	Project Location:	Date Received: Nov 26, 2021
T2R 0K1	LSD:	Date Reported: Dec 2, 2021
Attn: Accounts Payable	P.O.:	Report Number: 2697801
Sampled By: Ryley K.	Proj. Acct. code:	
Company: Matrix Solutions Inc.		

Extractable Petroleum Hydrocarbons -

Water

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
F2 C10-C16	µg/mL	0	-0.2	0.2	yes
F3 C16-C34	µg/mL	0	-0.2	0.2	yes
F3+ C34+	µg/mL	0	-0.2	0.2	yes

Date Acquired: November 30, 2021

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
F2 C10-C16	µg/mL	107.33	80	120	yes
F3 C16-C34	µg/mL	112.65	80	120	yes
F3+ C34+	µg/mL	99.17	80	120	yes

Date Acquired: November 30, 2021

Metals Dissolved

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Silicon	mg/L	-0.00770658	-0.04	0.05	yes
Sulfur	mg/L	0.00885702	-0.3	0.2	yes
Mercury	µg/L	-0.0002767	-0.038000	0.064000	yes
Aluminum	µg/L	1.04474	-2	2	yes
Antimony	µg/L	0.00233873	-0.2	0.2	yes
Arsenic	µg/L	-0.00282333	-0.2	0.2	yes
Barium	µg/L	0.0541659	-1	1	yes
Beryllium	µg/L	-6.49526e-005	-0.0	0.1	yes
Boron	µg/L	-0.50208	-2	2	yes
Cadmium	µg/L	0.000182909	-0.01	0.01	yes
Chromium	µg/L	-0.0336708	-0.3	0.3	yes
Cobalt	µg/L	0.00106365	-0.1	0.1	yes
Copper	µg/L	0.339132	-1	1	yes
Lead	µg/L	0.0799189	-0.1	0.1	yes
Lithium	µg/L	-0.0247754	-1	1	yes
Molybdenum	µg/L	-0.0601371	-1	1	yes
Nickel	µg/L	0.0940793	-0.5	0.5	yes
Selenium	µg/L	-6.63147e-005	-0.2	0.2	yes
Silver	µg/L	0.000797171	-0.10	0.10	yes
Strontium	µg/L	0.0123971	-1	1	yes
Thallium	µg/L	-0.00227099	-0.05	0.05	yes
Tin	µg/L	-0.0127381	-1	1	yes
Titanium	µg/L	-0.106928	-0.5	0.5	yes
Uranium	µg/L	-0.00108717	-0.5	0.5	yes
Vanadium	µg/L	-0.00272462	-0.1	0.1	yes
Zinc	µg/L	0.155548	-0	2	yes
Zirconium	µg/L	-0.00206831	-1	1	yes

Date Acquired: November 30, 2021

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Sulfur	mg/L	12.4	12.3	10	0.1	yes
Mercury	mg/L	<0.000005	<0.000005	10	0.000030	yes

Quality Control

Bill To: Matrix Solutions Inc.	Project ID: 26388-512	Lot ID: 1539091
Suite 600, 214 11 Ave SW	Project Name:	Control Number: 110046
Calgary, AB, Canada	Project Location:	Date Received: Nov 26, 2021
T2R 0K1	LSD:	Date Reported: Dec 2, 2021
Attn: Accounts Payable	P.O.:	Report Number: 2697801
Sampled By: Ryley K.	Proj. Acct. code:	
Company: Matrix Solutions Inc.		

Metals Dissolved - Continued

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Aluminum	µg/L	<2	<2	10	11	yes
Antimony	µg/L	<0.2	<0.2	10	0.4	yes
Arsenic	µg/L	2.7	2.6	10	0.4	yes
Barium	µg/L	13	13	10	2	yes
Beryllium	µg/L	<0.1	<0.1	10	0.2	yes
Bismuth	µg/L	<0.5	<0.5	10	1.1	yes
Boron	µg/L	339	335	10	4	yes
Cadmium	µg/L	0.02	0.02	10	0.02	yes
Chromium	µg/L	<0.5	<0.5	10	1.1	yes
Cobalt	µg/L	3.6	3.6	10	0.2	yes
Copper	µg/L	<1	<1	10	2	yes
Lead	µg/L	<0.1	<0.1	10	0.2	yes
Lithium	µg/L	180	176	10	2	yes
Molybdenum	µg/L	1	1	10	2	yes
Nickel	µg/L	6.7	6.6	10	1.1	yes
Selenium	µg/L	<0.2	<0.2	10	0.4	yes
Silver	µg/L	<0.01	<0.01	10	0.22	yes
Strontium	µg/L	820	808	10	2	yes
Thallium	µg/L	<0.05	<0.05	10	0.11	yes
Tin	µg/L	<1	<1	10	2	yes
Titanium	µg/L	<0.5	<0.5	10	1.1	yes
Uranium	µg/L	7.2	7.1	10	1.1	yes
Vanadium	µg/L	<0.1	<0.1	10	0.2	yes
Zinc	µg/L	10	9	10	2	yes
Zirconium	µg/L	<1	<1	10	2	yes

Date Acquired: November 30, 2021

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Aluminum	µg/L	992	917	1067	yes
Antimony	µg/L	40.8	36.4	44.2	yes
Arsenic	µg/L	41.1	36.7	43.3	yes
Barium	µg/L	199	182	211	yes
Beryllium	µg/L	19.6	17.3	22.1	yes
Bismuth	µg/L	99.1	89.1	108.3	yes
Boron	µg/L	398	344	434	yes
Cadmium	µg/L	2.00	1.86	2.25	yes
Chromium	µg/L	103	92.2	110.2	yes
Cobalt	µg/L	20.7	18.4	21.2	yes
Copper	µg/L	212	187	214	yes
Lead	µg/L	20.0	18.4	22.0	yes
Lithium	µg/L	199	175	223	yes
Molybdenum	µg/L	208	182	218	yes
Nickel	µg/L	103	93.3	105.9	yes
Selenium	µg/L	40.3	35.8	43.0	yes
Silver	µg/L	20.5	18.40	22.00	yes
Strontium	µg/L	205	180	216	yes

Quality Control

Bill To: Matrix Solutions Inc.	Project ID: 26388-512	Lot ID: 1539091
Suite 600, 214 11 Ave SW	Project Name:	Control Number: 110046
Calgary, AB, Canada	Project Location:	Date Received: Nov 26, 2021
T2R 0K1	LSD:	Date Reported: Dec 2, 2021
Attn: Accounts Payable	P.O.:	Report Number: 2697801
Sampled By: Ryley K.	Proj. Acct. code:	
Company: Matrix Solutions Inc.		

Metals Dissolved - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Thallium	µg/L	9.93	8.80	10.60	yes
Tin	µg/L	204	180	220	yes
Titanium	µg/L	103	92.4	110.4	yes
Uranium	µg/L	99.7	90.9	106.5	yes
Vanadium	µg/L	20.4	18.0	22.0	yes
Zinc	µg/L	206	183	219	yes
Zirconium	µg/L	220	180	220	yes
Date Acquired: November 30, 2021					
Mercury	mg/L	0.000098	0.000070	0.000130	yes
Date Acquired: November 30, 2021					
Mercury	mg/L	0.000020	0.000006	0.000036	yes
Aluminum	µg/L	52	45	55	yes
Antimony	µg/L	2.0	1.8	2.3	yes
Arsenic	µg/L	2.0	1.8	2.2	yes
Barium	µg/L	10	9	11	yes
Beryllium	µg/L	1.0	0.9	1.1	yes
Bismuth	µg/L	5.1	4.1	5.5	yes
Boron	µg/L	19	18	22	yes
Cadmium	µg/L	0.10	0.09	0.11	yes
Chromium	µg/L	5.0	4.5	5.5	yes
Cobalt	µg/L	1.0	0.9	1.1	yes
Copper	µg/L	10	9	11	yes
Lead	µg/L	1.0	0.9	1.1	yes
Lithium	µg/L	10	9	11	yes
Molybdenum	µg/L	10	9	10	yes
Nickel	µg/L	5.0	4.4	5.5	yes
Selenium	µg/L	1.9	1.7	2.2	yes
Silver	µg/L	0.99	0.84	1.08	yes
Strontium	µg/L	10	9	11	yes
Thallium	µg/L	0.51	0.45	0.55	yes
Tin	µg/L	10	9	11	yes
Titanium	µg/L	5.3	4.5	5.5	yes
Uranium	µg/L	5.2	4.5	5.5	yes
Vanadium	µg/L	1.0	0.9	1.1	yes
Zinc	µg/L	10	9	11	yes
Zirconium	µg/L	11	9	11	yes
Date Acquired: November 30, 2021					
Silicon	mg/L	9.94	8.98	10.78	yes
Sulfur	mg/L	146	138.5	155.3	yes
Date Acquired: November 30, 2021					
Silicon	mg/L	2.04	1.88	2.24	yes
Sulfur	mg/L	10.0	9.2	11.0	yes
Date Acquired: November 30, 2021					
Silicon	mg/L	0.20	0.19	0.23	yes

Quality Control

Bill To: Matrix Solutions Inc.	Project ID: 26388-512	Lot ID: 1539091
Suite 600, 214 11 Ave SW	Project Name:	Control Number: 110046
Calgary, AB, Canada	Project Location:	Date Received: Nov 26, 2021
T2R 0K1	LSD:	Date Reported: Dec 2, 2021
Attn: Accounts Payable	P.O.:	Report Number: 2697801
Sampled By: Ryley K.	Proj. Acct. code:	
Company: Matrix Solutions Inc.		

Metals Dissolved - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Sulfur	mg/L	3.0	2.8	3.3	yes
Date Acquired: November 30, 2021					

Metals Total

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Aluminum	mg/L	0.00998765	-0.02	0.02	yes
Calcium	mg/L	0.0362543	-0.1	0.1	yes
Iron	mg/L	0.0023466	-0.01	0.02	yes
Magnesium	mg/L	-0.000561947	-0.04	0.04	yes
Manganese	mg/L	-0.000405647	-0.005	0.005	yes
Potassium	mg/L	-0.0135493	-0.1	0.2	yes
Silicon	mg/L	0.00391114	-0.03	0.04	yes
Sodium	mg/L	0.0103842	-0.4	0.4	yes
Sulfur	mg/L	0.0064375	-0.1	0.2	yes
Mercury	µg/L	0.0004028	-0.038000	0.070000	yes
Antimony	µg/L	-5.45725e-005	-0.2	0.2	yes
Arsenic	µg/L	0.00992117	-0.2	0.2	yes
Barium	µg/L	0.0180811	-1	1	yes
Beryllium	µg/L	-0.000119197	-0.1	0.1	yes
Bismuth	µg/L	-0.00356887	-0.5	0.5	yes
Boron	µg/L	-0.440541	-1	3	yes
Cadmium	µg/L	0.000389387	-0.007	0.012	yes
Chromium	µg/L	0.00742111	-0.7	0.3	yes
Cobalt	µg/L	0.000613618	-0.1	0.1	yes
Copper	µg/L	0.0639742	-1	1	yes
Lead	µg/L	0.00347248	-0.1	0.1	yes
Lithium	µg/L	-0.0202771	-1	1	yes
Molybdenum	µg/L	-0.0159891	-1	1	yes
Nickel	µg/L	0.00768093	-0.5	0.5	yes
Selenium	µg/L	-0.00320152	-0.2	0.2	yes
Silver	µg/L	0.00109811	-0.02	0.10	yes
Strontium	µg/L	0.00826247	-1	1	yes
Thallium	µg/L	9.48945e-005	-0.05	0.05	yes
Tin	µg/L	0.00609389	-1	1	yes
Titanium	µg/L	-0.0472122	-0.5	0.5	yes
Uranium	µg/L	-0.00147696	-0.5	0.5	yes
Vanadium	µg/L	-0.0143134	-0.1	0.1	yes
Zinc	µg/L	0.245199	-4	4	yes
Zirconium	µg/L	0.00491217	-1	1	yes

Date Acquired: November 30, 2021

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Iron	mg/L	2.6	2	15	0.20	yes
Manganese	mg/L	0.35	0.35	15	0.010	yes
Mercury	mg/L	0.00005	<0.00005	10	0.000030	yes
Antimony	µg/L	3	3	15	0.4	yes

Quality Control

Bill To: Matrix Solutions Inc.	Project ID: 26388-512	Lot ID: 1539091
Suite 600, 214 11 Ave SW	Project Name:	Control Number: 110046
Calgary, AB, Canada	Project Location:	Date Received: Nov 26, 2021
T2R 0K1	LSD:	Date Reported: Dec 2, 2021
Attn: Accounts Payable	P.O.:	Report Number: 2697801
Sampled By: Ryley K.	Proj. Acct. code:	
Company: Matrix Solutions Inc.		

Metals Total - Continued

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Arsenic	µg/L	3	3	15	0.4	yes
Barium	µg/L	4390	4190	15	2	yes
Beryllium	µg/L	<1	<1	15	0.2	yes
Bismuth	µg/L	<5	<5	15	1.1	yes
Boron	µg/L	3280	3390	15	4	yes
Cadmium	µg/L	1.3	1.5	15	0.022	yes
Chromium	µg/L	49	50	15	1.1	yes
Cobalt	µg/L	5	5	15	0.2	yes
Copper	µg/L	20	20	15	2	yes
Lead	µg/L	5	5	15	0.2	yes
Lithium	µg/L	90	90	15	2	yes
Molybdenum	µg/L	<10	<10	15	2	yes
Nickel	µg/L	36	38	15	1.1	yes
Selenium	µg/L	<1	<1	15	0.4	yes
Silver	µg/L	<0.1	<0.1	15	0.22	yes
Strontium	µg/L	6270	6360	15	2	yes
Thallium	µg/L	<0.5	<0.5	15	0.11	yes
Tin	µg/L	<10	<10	15	2	yes
Titanium	µg/L	<5	<5	15	1.1	yes
Uranium	µg/L	<5	<5	15	1.1	yes
Vanadium	µg/L	1	1	15	0.2	yes
Zinc	µg/L	140	140	15	2	yes
Zirconium	µg/L	<10	<10	15	2	yes

Date Acquired: November 30, 2021

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Aluminum	mg/L	4.03	3.61	4.45	yes
Calcium	mg/L	51.4	47.6	54.2	yes
Iron	mg/L	2.07	1.91	2.21	yes
Magnesium	mg/L	20.1	17.88	21.86	yes
Manganese	mg/L	0.519	0.472	0.568	yes
Potassium	mg/L	51.7	46.9	55.9	yes
Silicon	mg/L	2.18	1.96	2.26	yes
Sodium	mg/L	51.9	47.0	57.2	yes
Sulfur	mg/L	10.3	9.2	11.2	yes
Antimony	µg/L	12.0	10.8	13.2	yes
Arsenic	µg/L	12.1	10.8	12.9	yes
Barium	µg/L	64	54	68	yes
Beryllium	µg/L	5.8	4.9	6.8	yes
Bismuth	µg/L	31.7	26.2	35.8	yes
Boron	µg/L	125	102	139	yes
Cadmium	µg/L	0.62	0.543	0.675	yes
Chromium	µg/L	31.3	26.5	33.7	yes
Cobalt	µg/L	6.3	5.2	6.8	yes
Copper	µg/L	63	53	67	yes
Lead	µg/L	6.4	5.2	7.1	yes

Quality Control

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1 Attn: Accounts Payable Sampled By: Ryley K. Company: Matrix Solutions Inc.	Project ID: 26388-512 Project Name: Project Location: LSD: P.O.: Proj. Acct. code:	Lot ID: 1539091 Control Number: 110046 Date Received: Nov 26, 2021 Date Reported: Dec 2, 2021 Report Number: 2697801
--	---	---

Metals Total - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Lithium	µg/L	62	53	77	yes
Molybdenum	µg/L	62	56	66	yes
Nickel	µg/L	31.3	27.6	32.8	yes
Selenium	µg/L	11.2	9.9	13.5	yes
Silver	µg/L	6.18	5.39	7.13	yes
Strontium	µg/L	63	55	65	yes
Thallium	µg/L	3.24	2.70	3.60	yes
Tin	µg/L	63	56	66	yes
Titanium	µg/L	32.0	26.6	35.7	yes
Uranium	µg/L	31.8	25.7	36.3	yes
Vanadium	µg/L	6.1	5.1	7.2	yes
Zinc	µg/L	60	53	65	yes
Zirconium	µg/L	62	53	67	yes
Date Acquired: November 30, 2021					
Antimony	µg/L	40.9	37.5	43.1	yes
Arsenic	µg/L	41.5	36.5	43.5	yes
Barium	µg/L	199	183	212	yes
Beryllium	µg/L	19.0	17.1	21.9	yes
Bismuth	µg/L	101	88.2	106.2	yes
Boron	µg/L	395	343	436	yes
Cadmium	µg/L	2.05	1.910	2.210	yes
Chromium	µg/L	102	90.0	110.0	yes
Cobalt	µg/L	20.4	18.1	21.7	yes
Copper	µg/L	208	188	212	yes
Lead	µg/L	20.3	18.0	24.0	yes
Lithium	µg/L	194	173	222	yes
Molybdenum	µg/L	209	182	218	yes
Nickel	µg/L	102	90.0	110.0	yes
Selenium	µg/L	39.6	36.7	43.3	yes
Silver	µg/L	20.0	18.00	22.00	yes
Strontium	µg/L	203	171	231	yes
Thallium	µg/L	10.0	9.01	10.99	yes
Tin	µg/L	202	190	218	yes
Titanium	µg/L	102	93.2	107.0	yes
Uranium	µg/L	98.4	90.2	109.0	yes
Vanadium	µg/L	20.3	16.9	22.1	yes
Zinc	µg/L	206	183	218	yes
Zirconium	µg/L	207	188	218	yes
Date Acquired: November 30, 2021					
Mercury	mg/L	0.000093	0.000070	0.000130	yes
Antimony	µg/L	12.0	10.8	13.2	yes
Arsenic	µg/L	12.4	10.8	13.2	yes
Barium	µg/L	61	55	67	yes
Beryllium	µg/L	6.0	5.2	6.5	yes

Quality Control

Bill To: Matrix Solutions Inc.	Project ID: 26388-512	Lot ID: 1539091
Suite 600, 214 11 Ave SW	Project Name:	Control Number: 110046
Calgary, AB, Canada	Project Location:	Date Received: Nov 26, 2021
T2R 0K1	LSD:	Date Reported: Dec 2, 2021
Attn: Accounts Payable	P.O.:	Report Number: 2697801
Sampled By: Ryley K.	Proj. Acct. code:	
Company: Matrix Solutions Inc.		

Metals Total - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Bismuth	µg/L	31.0	27.3	31.9	yes
Boron	µg/L	122	108	132	yes
Cadmium	µg/L	0.59	0.540	0.660	yes
Chromium	µg/L	30.9	27.0	33.0	yes
Cobalt	µg/L	6.2	5.4	6.6	yes
Copper	µg/L	62	54	66	yes
Lead	µg/L	6.2	5.4	6.6	yes
Lithium	µg/L	61	53	66	yes
Molybdenum	µg/L	60	53	64	yes
Nickel	µg/L	30.7	27.1	33.1	yes
Selenium	µg/L	12.3	10.3	13.4	yes
Silver	µg/L	6.14	5.40	6.60	yes
Strontium	µg/L	61	54	66	yes
Thallium	µg/L	3.17	0.00	6.00	yes
Tin	µg/L	60	54	66	yes
Titanium	µg/L	29.8	27.0	33.0	yes
Uranium	µg/L	31.1	27.0	33.0	yes
Vanadium	µg/L	6.1	5.4	6.6	yes
Zinc	µg/L	62	56	64	yes
Zirconium	µg/L	59	54	66	yes
Date Acquired: November 30, 2021					
Mercury	mg/L	0.000019	0.000006	0.000036	yes
Antimony	µg/L	2.0	1.8	2.2	yes
Arsenic	µg/L	2.0	1.7	2.2	yes
Barium	µg/L	10	9	10	yes
Beryllium	µg/L	0.9	0.8	1.1	yes
Bismuth	µg/L	5.3	4.6	5.3	yes
Boron	µg/L	20	17	23	yes
Cadmium	µg/L	0.10	0.089	0.113	yes
Chromium	µg/L	4.9	4.6	5.3	yes
Cobalt	µg/L	1.0	0.9	1.1	yes
Copper	µg/L	10	9	11	yes
Lead	µg/L	1.0	0.9	1.1	yes
Lithium	µg/L	10	9	11	yes
Molybdenum	µg/L	10	9	10	yes
Nickel	µg/L	5.2	4.5	5.5	yes
Selenium	µg/L	1.9	1.6	2.2	yes
Silver	µg/L	0.99	0.89	1.13	yes
Strontium	µg/L	10	9	10	yes
Thallium	µg/L	0.53	0.44	0.56	yes
Tin	µg/L	10	9	11	yes
Titanium	µg/L	4.9	4.2	5.7	yes
Uranium	µg/L	5.3	4.7	5.3	yes
Vanadium	µg/L	1.0	0.9	1.2	yes
Zinc	µg/L	10	9	11	yes

Quality Control

Bill To: Matrix Solutions Inc.	Project ID: 26388-512	Lot ID: 1539091
Suite 600, 214 11 Ave SW	Project Name:	Control Number: 110046
Calgary, AB, Canada	Project Location:	Date Received: Nov 26, 2021
T2R 0K1	LSD:	Date Reported: Dec 2, 2021
Attn: Accounts Payable	P.O.:	Report Number: 2697801
Sampled By: Ryley K.	Proj. Acct. code:	
Company: Matrix Solutions Inc.		

Metals Total - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Zirconium	µg/L	10	9	11	yes
Date Acquired: November 30, 2021					
Aluminum	mg/L	19.8	18.80	20.60	yes
Calcium	mg/L	249	231.3	258.9	yes
Iron	mg/L	9.68	9.06	10.14	yes
Magnesium	mg/L	99.3	92.78	104.72	yes
Manganese	mg/L	2.44	2.290	2.590	yes
Potassium	mg/L	252	234.2	261.8	yes
Silicon	mg/L	10.3	9.13	10.93	yes
Sodium	mg/L	248	228.8	269.4	yes
Sulfur	mg/L	151	135.5	165.3	yes
Date Acquired: November 30, 2021					
Aluminum	mg/L	4.02	3.60	4.40	yes
Calcium	mg/L	51.5	46.5	56.5	yes
Iron	mg/L	2.08	1.87	2.27	yes
Magnesium	mg/L	20.3	18.05	22.07	yes
Manganese	mg/L	0.522	0.466	0.568	yes
Potassium	mg/L	51.4	45.4	55.5	yes
Silicon	mg/L	2.14	1.93	2.24	yes
Sodium	mg/L	51.9	45.9	55.9	yes
Sulfur	mg/L	10.5	9.3	11.3	yes
Date Acquired: November 30, 2021					
Aluminum	mg/L	0.41	0.36	0.44	yes
Calcium	mg/L	5.2	4.8	5.8	yes
Iron	mg/L	0.22	0.19	0.25	yes
Magnesium	mg/L	2.0	1.84	2.20	yes
Manganese	mg/L	0.053	0.047	0.059	yes
Potassium	mg/L	5.1	4.8	5.8	yes
Silicon	mg/L	0.22	0.17	0.23	yes
Sodium	mg/L	5.2	4.8	5.6	yes
Sulfur	mg/L	3.0	2.8	3.3	yes
Date Acquired: November 30, 2021					

Mono-Aromatic Hydrocarbons - Water

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Benzene	ng	0	-0.002	0.002	yes
Toluene	ng	0	-0.0015	0.0015	yes
Ethylbenzene	ng	0	-0.0015	0.0015	yes
Total Xylenes (m,p,o)	ng	0	-0.002	0.002	yes
Styrene	ng	0	-0.002	0.002	yes
Date Acquired: November 30, 2021					
Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Benzene	ng	88.50	80	120	yes
Toluene	ng	83.15	80	120	yes

Quality Control

Bill To: Matrix Solutions Inc.	Project ID: 26388-512	Lot ID: 1539091
Suite 600, 214 11 Ave SW	Project Name:	Control Number: 110046
Calgary, AB, Canada	Project Location:	Date Received: Nov 26, 2021
T2R 0K1	LSD:	Date Reported: Dec 2, 2021
Attn: Accounts Payable	P.O.:	Report Number: 2697801
Sampled By: Ryley K.	Proj. Acct. code:	
Company: Matrix Solutions Inc.		

Mono-Aromatic Hydrocarbons - Water - Continued

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Ethylbenzene	ng	85.03	80	120	yes
m,p-Xylene	ng	89.39	80	120	yes
Total Xylenes (m,p,o)	ng	89.71	80	120	yes
Styrene	ng	83.21	80	120	yes

Date Acquired: November 30, 2021

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Benzene	mg/L	0.001	0.001	30	0.002	yes
Toluene	mg/L	0.0030	0.0029	30	0.0020	yes
Ethylbenzene	mg/L	<0.0010	<0.0010	30	0.0020	yes
Total Xylenes (m,p,o)	mg/L	0.001	<0.001	30	0.002	yes
Styrene	mg/L	<0.001	<0.001	30	0.002	yes

Date Acquired: November 30, 2021

Physical and Aggregate Properties

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Turbidity	NTU	0.077	-0.1	0.1	yes

Date Acquired: December 02, 2021

Turbidity	NTU	0.095	0.0	0.1	yes
-----------	-----	-------	-----	-----	-----

Date Acquired: December 02, 2021

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Turbidity	NTU	4.8	4.8	10	0.2	yes
Solids	mg/L	7	8	10	2	yes

Date Acquired: November 30, 2021

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Turbidity	NTU	1920	1856.7	2054.7	yes

Date Acquired: December 02, 2021

Turbidity	NTU	5700	4441.7	6661.7	yes
-----------	-----	------	--------	--------	-----

Date Acquired: December 02, 2021

Turbidity	NTU	151	132.1	162.1	yes
Solids	mg/L	191	174	209	yes

Date Acquired: November 30, 2021

Turbidity	NTU	13.8	12.6	15.6	yes
Solids	mg/L	18	10	22	yes

Date Acquired: November 30, 2021

Turbidity	NTU	1.6	1.0	2.2	yes
-----------	-----	-----	-----	-----	-----

Date Acquired: December 02, 2021

Routine Water

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Calcium	mg/L	0.0592286	-0.2	0.2	yes
Magnesium	mg/L	0.0138367	-0.1	0.1	yes
Sodium	mg/L	0.00802744	-0.4	0.4	yes

Quality Control

Bill To: Matrix Solutions Inc.	Project ID: 26388-512	Lot ID: 1539091
Suite 600, 214 11 Ave SW	Project Name:	Control Number: 110046
Calgary, AB, Canada	Project Location:	Date Received: Nov 26, 2021
T2R 0K1	LSD:	Date Reported: Dec 2, 2021
Attn: Accounts Payable	P.O.:	Report Number: 2697801
Sampled By: Ryley K.	Proj. Acct. code:	
Company: Matrix Solutions Inc.		

Routine Water - Continued

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Potassium	mg/L	-0.0112017	-0.4	0.4	yes
Iron	mg/L	0.00112603	-0.01	0.01	yes
Manganese	mg/L	0.000759298	-0.004	0.004	yes
Chloride	mg/L	0.27	-0.4	0.4	yes
Nitrate - N	mg/L	0.00216322	-0.01	0.01	yes
Nitrite - N	mg/L	0	-0.005	0.005	yes

Date Acquired: November 30, 2021

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
pH		7.40	7.41	0	0.10	yes
Electrical Conductivity	dS/m	10.4	10.5	10	0.002	yes
Calcium	mg/L	140	140	10	0.6	yes
Magnesium	mg/L	38.8	38.7	10	0.7	yes
Sodium	mg/L	13.1	13.2	10	1.2	yes
Potassium	mg/L	5.9	5.9	10	1.2	yes
Iron	mg/L	<0.01	<0.01	10	0.05	yes
Manganese	mg/L	0.295	0.295	10	0.010	yes
Chloride	mg/L	183	182	10	0.5	yes
Nitrate - N	mg/L	<0.05	<0.05	10	0.01	yes
Nitrite - N	mg/L	<0.02	<0.02	10	0.010	yes
Hydroxide	mg/L	<5	<5	10		yes
Carbonate	mg/L	<6	<6	10	6	yes
Bicarbonate	mg/L	350	347	10	6	yes
P-Alkalinity	mg/L	<5	<5	10	5	yes
T-Alkalinity	mg/L	287	285	10	5	yes

Date Acquired: November 29, 2021

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Chloride	mg/L	2070	1847.4	2256.0	yes
Date Acquired: November 30, 2021					
Electrical Conductivity	dS/m	32.9	27.200	36.800	yes
Date Acquired: November 29, 2021					
pH		9.21	8.90	9.44	yes
Temperature of observed	°C	20.9	15.5	24.5	yes
Electrical Conductivity	dS/m	2.75	2.631	2.829	yes
Calcium	mg/L	245	230.0	260.0	yes
Magnesium	mg/L	97.6	91.3	103.3	yes
Sodium	mg/L	246	233.3	257.3	yes
Potassium	mg/L	246	229.0	259.0	yes
Iron	mg/L	9.52	8.91	10.20	yes
Manganese	mg/L	2.37	2.240	2.540	yes
Nitrate - N	mg/L	9.88	9.03	11.13	yes
Nitrite - N	mg/L	9.84	9.010	10.990	yes
Nitrate and Nitrite - N	mg/L	19.70	19.10	20.90	yes
P-Alkalinity	mg/L	494	442	584	yes
T-Alkalinity	mg/L	1010	926	1106	yes

Quality Control

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1 Attn: Accounts Payable Sampled By: Ryley K. Company: Matrix Solutions Inc.	Project ID: 26388-512 Project Name: Project Location: LSD: P.O.: Proj. Acct. code:	Lot ID: 1539091 Control Number: 110046 Date Received: Nov 26, 2021 Date Reported: Dec 2, 2021 Report Number: 2697801
--	---	---

Routine Water - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Date Acquired: November 29, 2021					
pH		6.91	6.79	6.97	yes
Temperature of observed	°C	20.7	15.5	24.5	yes
Electrical Conductivity	dS/m	0.076	0.069	0.085	yes
Calcium	mg/L	50.8	44.9	56.9	yes
Magnesium	mg/L	19.7	17.9	22.0	yes
Sodium	mg/L	50.8	47.7	55.5	yes
Potassium	mg/L	50.3	45.8	55.8	yes
Iron	mg/L	2.01	1.89	2.25	yes
Manganese	mg/L	0.507	0.468	0.552	yes
Chloride	mg/L	80.6	74.9	86.9	yes
Nitrate - N	mg/L	4.70	4.37	5.33	yes
Nitrite - N	mg/L	4.76	4.370	5.330	yes
Nitrate and Nitrite - N	mg/L	9.46	8.80	10.60	yes
P-Alkalinity	mg/L	39	28	72	yes
T-Alkalinity	mg/L	130	114	140	yes
Date Acquired: November 29, 2021					
Calcium	mg/L	5.2	4.7	5.8	yes
Magnesium	mg/L	2.0	1.9	2.2	yes
Sodium	mg/L	5.2	4.7	5.7	yes
Potassium	mg/L	5.1	4.7	5.7	yes
Iron	mg/L	0.21	0.19	0.24	yes
Manganese	mg/L	0.053	0.048	0.058	yes
Chloride	mg/L	14.3	13.3	16.5	yes
Nitrate - N	mg/L	0.49	0.42	0.57	yes
Nitrite - N	mg/L	0.508	0.424	0.564	yes
Nitrate and Nitrite - N	mg/L	0.99	0.85	1.15	yes
Date Acquired: November 30, 2021					

Volatile Petroleum Hydrocarbons - Water

Blanks		Units	Measured	Lower Limit	Upper Limit	Passed QC	
F1 -BTEX		ng	0	-0.3	0.3	yes	
F1 C6-C10		ng	0	-0.300	0.300	yes	
F2 C10-C16		ng	0	-0.3	0.3	yes	
Date Acquired:		November 30, 2021					
Calibration Check		Units	% Recovery	Lower Limit	Upper Limit	Passed QC	
F2 C10-C16		ng	103.84	80	120	yes	
Date Acquired:		November 30, 2021					
Client Sample Replicates		Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
F1 C6-C10		mg/L	<0.1	<0.1	30		yes
F2 C10-C16		mg/L	<0.1	<0.1	30		yes
Date Acquired:		November 30, 2021					

Methodology and Notes

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1 Attn: Accounts Payable Sampled By: Ryley K. Company: Matrix Solutions Inc.	Project ID: 26388-512 Project Name: Project Location: LSD: P.O.: Proj. Acct. code:	Lot ID: 1539091 Control Number: 110046 Date Received: Nov 26, 2021 Date Reported: Dec 2, 2021 Report Number: 2697801
--	---	---

Method of Analysis

Method Name	Reference	Method	Date Analysis Started	Location
Alkalinity, pH, and EC in water	APHA	* Alkalinity - Titration Method, 2320 B	Nov 29, 2021	Element Edmonton - Roper Road
Alkalinity, pH, and EC in water	APHA	* Conductivity, 2510 B	Nov 29, 2021	Element Edmonton - Roper Road
Alkalinity, pH, and EC in water	APHA	* pH - Electrometric Method, 4500-H+ B	Nov 29, 2021	Element Edmonton - Roper Road
Anions (Routine) by Ion Chromatography	APHA	* Ion Chromatography with Chemical Suppression of Eluent Cond., 4110 B	Nov 30, 2021	Element Edmonton - Roper Road
Approval-Edmonton	APHA	Checking Correctness of Analyses, 1030 E	Dec 1, 2021	Element Edmonton - Roper Road
Approval-Edmonton	APHA	Checking Correctness of Analyses, 1030 E	Dec 2, 2021	Element Edmonton - Roper Road
BTEX-CCME - Water	US EPA	* Volatile Organic Compounds in Various Sample Matrices Using Equilibrium Headspace Analysis/Gas Chromatography Mass Spectrometry, 5021/8260	Nov 30, 2021	Element Calgary
Chloride in Water	APHA	* Automated Ferricyanide Method, 4500-Cl-E	Nov 30, 2021	Element Edmonton - Roper Road
Mercury (Dissolved) in water	APHA	* Cold Vapour Atomic Absorption Spectrometric Method, 3112 B	Nov 30, 2021	Element Edmonton - Roper Road
Mercury (Dissolved) in water	EPA	* Mercury in Water by Cold Vapor Atomic Fluorescence Spectrometry, 245.7	Nov 30, 2021	Element Edmonton - Roper Road
Mercury (Total) in water	EPA	* Mercury in Water by Cold Vapor Atomic Fluorescence Spectrometry, 245.7	Nov 30, 2021	Element Edmonton - Roper Road
Metals ICP-MS (Dissolved) in water	APHA/USEPA	* Metals By Inductively Coupled Plasma/Mass Spectrometry, APHA 3125 B / USEPA 200.2, 200.8	Nov 30, 2021	Element Edmonton - Roper Road
Metals ICP-MS (Dissolved) in water	US EPA	* Determination of Trace Elements in Waters and Wastes by ICP-MS, 200.8	Nov 30, 2021	Element Edmonton - Roper Road
Metals ICP-MS (Total) in water	APHA/USEPA	* Metals By Inductively Coupled Plasma/Mass Spectrometry, APHA 3125 B / USEPA 200.2, 200.8	Nov 29, 2021	Element Edmonton - Roper Road
Metals ICP-MS (Total) in water	US EPA	* Determination of Trace Elements in Waters and Wastes by ICP-MS, 200.8	Nov 29, 2021	Element Edmonton - Roper Road
Metals Trace (Dissolved) in water	APHA	Hardness by Calculation, 2340 B	Nov 30, 2021	Element Edmonton - Roper Road
Metals Trace (Dissolved) in water	APHA	* Inductively Coupled Plasma (ICP) Method, 3120 B	Nov 30, 2021	Element Edmonton - Roper Road
Metals Trace (Total) in water	APHA	* Inductively Coupled Plasma (ICP) Method, 3120 B	Nov 29, 2021	Element Edmonton - Roper Road
Solids Suspended (Total, Fixed and Volatile)	APHA	* Total Suspended Solids Dried at 103-105°C, 2540 D	Nov 30, 2021	Element Edmonton - Roper Road
TEH-CCME - Water	EPA/CCME	* Separatory Funnel Liquid-liquid Extraction/CCME, EPA 3510/CCME	Nov 30, 2021	Element Calgary
Turbidity in Water	APHA	* Turbidity - Nephelometric Method, 2130 B	Dec 2, 2021	Element Edmonton - Roper Road

Methodology and Notes

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1 Attn: Accounts Payable Sampled By: Ryley K. Company: Matrix Solutions Inc.	Project ID: 26388-512 Project Name: Project Location: LSD: P.O.: Proj. Acct. code:	Lot ID: 1539091 Control Number: 110046 Date Received: Nov 26, 2021 Date Reported: Dec 2, 2021 Report Number: 2697801
--	---	---

** Reference Method Modified*

References

APHA	Standard Methods for the Examination of Water and Wastewater
APHA/USEPA	Standard Methods For Water/ Environmental Protection Agency
EPA	Environmental Protection Agency Test Methods - US
EPA/CCME	Environmental Protection Agency Test Methods - US/CCME
US EPA	US Environmental Protection Agency Test Methods

Comments:

- Dec 01, 2021 - Sample 1539091-1; 7796414: Sediment was present in the field filtered bottle for Sample 1539091-1 which may affect dissolved metals results.
- Dec 01, 2021 - Sample 1539091-3; 7796416: Some trace total metal results were less than dissolved metal results for sample 1539091-3. The results were verified and are within expected measurement uncertainty.
- Dec 01, 2021 - Sample 1539091-1; 7796414: Some trace total metal results were less than dissolved metal results for sample 1539091-1. The results were verified and are within expected measurement uncertainty.
- Dec 02, 2021 - Some ICP-MS total metal results were less than dissolved metal results for sample(s) 1539091-1 and 3. Total metals were analyzed from the metals bottle and dissolved from the field filtered bottle. Results were verified.

Please direct any inquiries regarding this report to our Client Services group.

Results relate only to samples as submitted.

The test report shall not be reproduced except in full, without the written approval of the laboratory.

COC # 110046

 Lab Submitted to: Elbow Valley Page: 1 of 1
 Lab Agreement no: _____
 Lab Job ID: _____

 Invoice to: Matrix Require Report: Y ☐ N ☐
 Company Name: _____
 Contact Name: _____
 Address: _____
 Phone / Fax#: _____ Ph: _____ PC: _____ Fax: _____

 Copy of Report to:
 Matrix Solutions - EDS
 Suite 600, 214 - 11th Avenue SW
 Calgary, Alberta, Canada
 T2R 0K1
 Ph: 403-237-0606 Fax: 403-263-2493
 email invoices to ap@matrix-solutions.com

 Matrix Project #: 76388-512
 Matrix Proj. Name: _____
 Location: _____
 Sampler's Name(s): Ryley K.

AFE #: _____

REGULATORY REQUIREMENTS: (check)

- ☒ Alberta Tier 1 ☐ BC CSR
- ☐ Alberta SW FAL
- ☐ Canadian Drinking Water
- ☐ CCME FAL
- ☐ SPIGEC
- ☐ SEQG Other: _____

SERVICE REQUESTED:

- ☐ RUSH (Please ensure you contact the lab) Due Date: _____
- ☒ REGULAR Turnaround
- REPORT DISTRIBUTION: always send to eds@matrix-solutions.com
- ☐ Additional Emails rkilham

Analysis Required

	Sample Number (14 digits only) yr-mth-day	Sample Point Name	Depth (m)	Sample Type	Date/Time Sampled	Quantity # of Containers			Rg	Tb	Dis	Tb	Tb	B	F		HOL
						J/V	Bags	Bottles									
1	2638821126001	MW21-2a			Nov 26 @ 1440	/		11	X	X	X	X	X	X	X		
2	002	MW21-2a			1440	/		1			X						
3	003	MW21-2b			1530	/		11	X	X	X	X	X	X	X		
4	004					/											
5						/											
6						/											
7						/											
8						/											
9						/											
10						/											
11						/											
12						/											
13						/											
14						/											
15						/											

Lot: 1539091

COC



Lot: 1539091 COC



*For metals in water samples indicate if you want Total (T) or Dissolved (D) as part of "Analysis Required"

Preserved/Filtered

 Relinquished by: Ryley Kilham Date/Time: Nov 26, 2021 @ 1700
 Signature: _____

 Received by: LR 10.1°C Date/Time: NOV 26 '21 @ 5:12
 Signature: _____

COMMENTS/SPECIAL INSTRUCTIONS

J = jars V = vials

Report Transmission Cover Page

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1	Project ID: 26388-512 Project Name: Project Location: LSD: P.O.:	Lot ID: 1540181 Control Number: COC110048 Date Received: Nov 29, 2021 Date Reported: Dec 7, 2021 Report Number: 2699622
Attn: Accounts Payable Sampled By: Ryley K. Company: Matrix	Proj. Acct. code:	

Contact	Company	Address
Accounts Payable	Matrix Solutions Inc.	Suite 600, 214 11 Ave SW Calgary, AB T2R 0K1 Phone: (403) 237-0606 Fax: (403) 263-2493 Email: ap@matrix-solutions.com

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / Invoice

EDS	Matrix Solutions Inc.	Suite 600 214-11th Ave SW Calgary, AB T2R 0K1 Phone: (403) 700-2058 Fax: Email: eds@matrix-solutions.com
-----	-----------------------	---

Delivery	Format	Deliverables
Email - Single Report	Equis Matrix Batch File (with QC)	Test Report
Email - Single Report	Equis Matrix Sample File (with QC)	Test Report
Email - Single Report	Equis Matrix Test Result File (with QC)	Test Report
Email - Single Report	PDF	COC / COA
Email - Single Report	PDF	COC / Test Report
Email - Single Report	PDF	Invoice

Ryley Killam	Matrix Solutions Inc.	Suite 600 214-11th Ave SW Calgary, AB T2R 0K1 Phone: (403) 237-0606 Fax: (403) 263-2493 Email: rkillam@matrix-solutions.com
--------------	-----------------------	--

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / COA
Email - Merge Reports	PDF	COC / Test Report

Notes To Clients:

The information contained on this and all other pages transmitted, is intended for the addressee only and is considered confidential. If the reader is not the intended recipient, you are hereby notified that any use, dissemination, distribution or copy of this transmission is strictly prohibited. If you receive this transmission by error, or if this transmission is not satisfactory, please notify us by telephone.

Analytical Report

Bill To: Matrix Solutions Inc.
Suite 600, 214 11 Ave SW
Calgary, AB, Canada
T2R 0K1
Attn: Accounts Payable
Sampled By: Ryley K.
Company: Matrix

Project ID: 26388-512
Project Name:
Project Location:
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1540181**
Control Number: COC110048
Date Received: Nov 29, 2021
Date Reported: Dec 7, 2021
Report Number: 2699622

Reference Number	1540181-1	1540181-2
Sample Date	Nov 29, 2021	Nov 29, 2021
Sample Time	09:30	10:00
Sample Location		
Sample Description	MW21-1a / 26388211129004 / 6.4°C Water	MW21-1b / 26388211129005 / 6.4°C Water
Matrix		

Analyte		Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Metals Dissolved							
Silicon	Dissolved	mg/L	2.61	±0.24	2.16	±0.19	0.05
Sulfur	Dissolved	mg/L	15.8	±1.5	12.4	±1.2	0.3
Mercury	Dissolved	mg/L	<0.000005		<0.000005		0.000005
Aluminum	Dissolved	mg/L	0.085	±0.0068	0.079	±0.0063	0.002
Antimony	Dissolved	mg/L	0.0018	±0.0001	0.0166	±0.0011	0.0002
Arsenic	Dissolved	mg/L	0.0049	±0.0005	0.0991	±0.0108	0.0002
Barium	Dissolved	mg/L	0.081	±0.005	0.098	±0.006	0.001
Beryllium	Dissolved	mg/L	<0.0001		<0.0001		0.0001
Bismuth	Dissolved	mg/L	<0.0005		<0.0005		0.0005
Boron	Dissolved	mg/L	0.318	±0.030	0.276	±0.026	0.002
Cadmium	Dissolved	mg/L	0.00004	±0.000003	0.00002	±0.000002	0.00001
Chromium	Dissolved	mg/L	0.0006	±0.00006	<0.0005		0.0005
Cobalt	Dissolved	mg/L	0.0004	±0.00002	<0.0001		0.0001
Copper	Dissolved	mg/L	0.003	±0.0002	0.030	±0.002	0.001
Lead	Dissolved	mg/L	0.0001	±0.00002	0.0001	±0.00002	0.0001
Lithium	Dissolved	mg/L	0.049	±0.004	0.039	±0.003	0.001
Molybdenum	Dissolved	mg/L	0.018	±0.0009	0.068	±0.003	0.001
Nickel	Dissolved	mg/L	0.0040	±0.0002	0.0013	±0.00006	0.0005
Selenium	Dissolved	mg/L	0.0054	±0.0007	0.0102	±0.0013	0.0002
Silver	Dissolved	mg/L	<0.00001		<0.00001		0.00001
Strontium	Dissolved	mg/L	0.103	±0.008	0.087	±0.0066	0.001
Thallium	Dissolved	mg/L	<0.00005		<0.00005		0.00005
Tin	Dissolved	mg/L	0.002	±0.00028	<0.001		0.001
Titanium	Dissolved	mg/L	0.0025	±0.0002	<0.0005		0.0005
Uranium	Dissolved	mg/L	0.0078	±0.0006	0.0095	±0.0007	0.0005
Vanadium	Dissolved	mg/L	0.0010	±0.00009	0.0098	±0.0009	0.0001
Zinc	Dissolved	mg/L	0.002	±0.00025	0.003	±0.00030	0.001
Zirconium	Dissolved	mg/L	0.002	±0.00020	<0.001		0.001
Subsample			Field Filtered		Lab Filtered		
Metals Total							
Aluminum	Total	mg/L	30.1		592		0.02
Calcium	Total	mg/L	48.0	±0.2	353	±2	0.2
Iron	Total	mg/L	56.8	±0.4	884	±5	0.05
Magnesium	Total	mg/L	14.1	±0.2	148	±2	0.2
Manganese	Total	mg/L	0.926	±0.047	18.7	±0.05	0.005
Potassium	Total	mg/L	8.7	±0.8	77.0	±7.5	0.4

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To: Matrix Solutions Inc.
Suite 600, 214 11 Ave SW
Calgary, AB, Canada
T2R 0K1
Attn: Accounts Payable
Sampled By: Ryley K.
Company: Matrix

Project ID: 26388-512
Project Name:
Project Location:
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1540181**
Control Number: COC110048
Date Received: Nov 29, 2021
Date Reported: Dec 7, 2021
Report Number: 2699622

Reference Number	1540181-1	1540181-2
Sample Date	Nov 29, 2021	Nov 29, 2021
Sample Time	09:30	10:00
Sample Location		
Sample Description	MW21-1a / 26388211129004 / 6.4°C	MW21-1b / 26388211129005 / 6.4°C
Matrix	Water	Water

Analyte	Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Metals Total - Continued						
Silicon	Total	mg/L	45.3 ±0.4	632 ±6		0.05
Sodium	Total	mg/L	387 ±11	626 ±18		0.4
Sulfur	Total	mg/L	22.9 ±0.2	18 ±0.2		0.3
Antimony	Total	mg/L	0.0012 ±0.0001	<0.004		0.0002
Arsenic	Total	mg/L	0.0214 ±0.0022	0.243 ±0.025		0.0002
Barium	Total	mg/L	0.687 ±0.062	23.3 ±2.1		0.001
Beryllium	Total	mg/L	0.0013 ±0.0002	0.036 ±0.004		0.0001
Bismuth	Total	mg/L	0.0011 ±0.00008	<0.01		0.0005
Boron	Total	mg/L	0.261 ±0.024	0.48 ±0.04		0.002
Cadmium	Total	mg/L	0.00088 ±0.00008	0.0091 ±0.0008		0.00001
Chromium	Total	mg/L	0.0496 ±0.0051	0.677 ±0.069		0.0005
Cobalt	Total	mg/L	0.0188 ±0.0018	0.357 ±0.035		0.0001
Copper	Total	mg/L	0.066 ±0.006	0.93 ±0.09		0.001
Lead	Total	mg/L	0.0403 ±0.0028	0.412 ±0.029		0.0001
Lithium	Total	mg/L	0.071 ±0.008	0.85 ±0.09		0.001
Molybdenum	Total	mg/L	0.012 ±0.001	<0.02		0.001
Nickel	Total	mg/L	0.0533 ±0.0060	0.986 ±0.110		0.0005
Selenium	Total	mg/L	0.0030 ±0.0003	0.010 ±0.0010		0.0002
Silver	Total	mg/L	0.00026 ±0.00004	0.0041 ±0.0006		0.00001
Strontium	Total	mg/L	0.258 ±0.028	6.71 ±0.72		0.001
Thallium	Total	mg/L	0.00077 ±0.00005	0.0087 ±0.0005		0.00005
Tin	Total	mg/L	0.005 ±0.0010	<0.02		0.001
Titanium	Total	mg/L	0.122 ±0.015	0.083 ±0.010		0.0005
Uranium	Total	mg/L	0.0086 ±0.0007	0.042 ±0.003		0.0005
Vanadium	Total	mg/L	0.0541 ±0.0047	0.674 ±0.059		0.0001
Zinc	Total	mg/L	0.151 ±0.011	2.06 ±0.15		0.004
Zirconium	Total	mg/L	0.003 ±0.0003	<0.02		0.001

Physical and Aggregate Properties

Turbidity		NTU	609 ±17	59300 ±1700		0.1
Solids	Total Suspended	mg/L	595 ±63	25700 ±2700		2

Routine Water

pH			8.69 ±0.10	9.38 ±0.10		1
Temperature of observed		°C	20.1	20.7		
pH						
Electrical Conductivity	at 25 °C	µS/cm	1580 ±50	1610 ±50		1
Calcium	Dissolved	mg/L	12.6 ±0.4	1.7 ±0.06		0.2
Magnesium	Dissolved	mg/L	1.9 ±0.1	<0.2		0.2

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1 Attn: Accounts Payable Sampled By: Ryley K. Company: Matrix	Project ID: 26388-512 Project Name: Project Location: LSD: P.O.: Proj. Acct. code:	Lot ID: 1540181 Control Number: COC110048 Date Received: Nov 29, 2021 Date Reported: Dec 7, 2021 Report Number: 2699622
---	---	--

		Reference Number	1540181-1		1540181-2		
		Sample Date	Nov 29, 2021		Nov 29, 2021		
		Sample Time	09:30		10:00		
		Sample Location					
		Sample Description	MW21-1a / 26388211129004 / 6.4°C		MW21-1b / 26388211129005 / 6.4°C		
		Matrix	Water		Water		
Analyte		Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Routine Water - Continued							
Sodium	Dissolved	mg/L	388	±20	354	±18	0.4
Potassium	Dissolved	mg/L	3.3	±0.2	2.4	±0.2	0.4
Iron	Dissolved	mg/L	0.11	±0.006	0.01	±0.001	0.01
Manganese	Dissolved	mg/L	0.013	±0.0009	<0.005		0.005
Chloride	Dissolved	mg/L	125	±8	34.7	±2.1	0.4
Nitrate - N		mg/L	<0.01		0.19	±0.02	0.01
Nitrite - N		mg/L	<0.005		0.067	±0.009	0.005
Nitrate and Nitrite - N		mg/L	<0.01		0.26		0.01
Sulfate (SO4)	Dissolved	mg/L	47.3	±4.5	37.3	±3.5	0.9
Hydroxide		mg/L	<5		<5		
Carbonate		mg/L	35		110		
Bicarbonate		mg/L	667		680		
P-Alkalinity	as CaCO3	mg/L	29	±3	89	±9	5
T-Alkalinity	as CaCO3	mg/L	606	±24	737	±29	5
Total Dissolved Solids	Calculated	mg/L	942		872		1
Hardness	Dissolved as CaCO3	mg/L	39.3		4.2		
Ionic Balance	Dissolved	%	107		94		

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1 Attn: Accounts Payable Sampled By: Ryley K. Company: Matrix	Project ID: 26388-512 Project Name: Project Location: LSD: P.O.: Proj. Acct. code:	Lot ID: 1540181 Control Number: COC110048 Date Received: Nov 29, 2021 Date Reported: Dec 7, 2021 Report Number: 2699622
---	---	--

		Reference Number	1540181-3		1540181-4		
		Sample Date	Nov 29, 2021		Nov 29, 2021		
		Sample Time	11:20		12:30		
		Sample Location					
		Sample Description	MW21-3 / 26388211129006 / 6.4°C		MW21-4 / 26388211129007 / 6.4°C		
		Matrix	Water		Water		
Analyte		Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Metals Dissolved							
Silicon	Dissolved	mg/L	2.68	±0.24	3.04	±0.27	0.05
Sulfur	Dissolved	mg/L	11.1	±1.0	92.1	±8.7	0.3
Mercury	Dissolved	mg/L	<0.000005		<0.000005		0.000005
Aluminum	Dissolved	mg/L	0.089	±0.0071	0.023	±0.0019	0.002
Antimony	Dissolved	mg/L	0.0053	±0.0004	0.0091	±0.0006	0.0002
Arsenic	Dissolved	mg/L	0.0837	±0.0091	0.0524	±0.0057	0.0002
Barium	Dissolved	mg/L	0.047	±0.003	0.095	±0.006	0.001
Beryllium	Dissolved	mg/L	<0.0001		<0.0001		0.0001
Bismuth	Dissolved	mg/L	<0.0005		<0.0005		0.0005
Boron	Dissolved	mg/L	0.188	±0.018	0.159	±0.015	0.002
Cadmium	Dissolved	mg/L	<0.00001		0.00002	±0.000002	0.00001
Chromium	Dissolved	mg/L	<0.0005		<0.0005		0.0005
Cobalt	Dissolved	mg/L	0.0002	±0.00001	0.0004	±0.00002	0.0001
Copper	Dissolved	mg/L	0.007	±0.0005	0.004	±0.0003	0.001
Lead	Dissolved	mg/L	0.0001	±0.00002	<0.0001		0.0001
Lithium	Dissolved	mg/L	0.031	±0.002	0.034	±0.003	0.001
Molybdenum	Dissolved	mg/L	0.027	±0.001	0.080	±0.004	0.001
Nickel	Dissolved	mg/L	0.0033	±0.0001	0.0092	±0.0004	0.0005
Selenium	Dissolved	mg/L	0.0039	±0.0005	0.0079	±0.0010	0.0002
Silver	Dissolved	mg/L	<0.00001		<0.00001		0.00001
Strontium	Dissolved	mg/L	0.045	±0.0034	0.258	±0.020	0.001
Thallium	Dissolved	mg/L	<0.00005		<0.00005		0.00005
Tin	Dissolved	mg/L	<0.001		0.004	±0.00066	0.001
Titanium	Dissolved	mg/L	0.0024	±0.0002	<0.0005		0.0005
Uranium	Dissolved	mg/L	0.0042	±0.0003	0.0149	±0.0011	0.0005
Vanadium	Dissolved	mg/L	0.0016	±0.0002	0.0008	±0.00008	0.0001
Zinc	Dissolved	mg/L	0.002	±0.00025	0.002	±0.00025	0.001
Zirconium	Dissolved	mg/L	<0.001		0.001	±0.00019	0.001
Subsample			Field Filtered		Field Filtered		
Metals Total							
Aluminum	Total	mg/L	61.8		1.83		0.02
Calcium	Total	mg/L	36.8	±0.2	43.5	±0.2	0.2
Iron	Total	mg/L	105	±0.7	3.07	±0.15	0.05
Magnesium	Total	mg/L	20.1	±0.3	7.2	±0.1	0.2
Manganese	Total	mg/L	1.36	±0.05	0.075	±0.047	0.005
Potassium	Total	mg/L	11.9	±1.2	5.8	±0.6	0.4

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To: Matrix Solutions Inc.
Suite 600, 214 11 Ave SW
Calgary, AB, Canada
T2R 0K1
Attn: Accounts Payable
Sampled By: Ryley K.
Company: Matrix

Project ID: 26388-512
Project Name:
Project Location:
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1540181**
Control Number: COC110048
Date Received: Nov 29, 2021
Date Reported: Dec 7, 2021
Report Number: 2699622

		Reference Number		1540181-3		1540181-4	
		Sample Date		Nov 29, 2021		Nov 29, 2021	
		Sample Time		11:20		12:30	
		Sample Location					
		Sample Description		MW21-3 / 26388211129006 / 6.4°C		MW21-4 / 26388211129007 / 6.4°C	
		Matrix		Water		Water	
Analyte		Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Metals Total - Continued							
Silicon	Total	mg/L	68.7	±0.6	6.09	±0.11	0.05
Sodium	Total	mg/L	219	±6	360	±10	0.4
Sulfur	Total	mg/L	14.3	±0.2	119	±0.8	0.3
Antimony	Total	mg/L	<0.002		0.0084	±0.0008	0.0002
Arsenic	Total	mg/L	0.120	±0.012	0.0392	±0.0040	0.0002
Barium	Total	mg/L	2.16	±0.19	0.122	±0.011	0.001
Beryllium	Total	mg/L	0.004	±0.0006	<0.0001		0.0001
Bismuth	Total	mg/L	<0.005		<0.0005		0.0005
Boron	Total	mg/L	0.19	±0.02	0.155	±0.014	0.002
Cadmium	Total	mg/L	0.0028	±0.0003	0.00006	±0.000005	0.00001
Chromium	Total	mg/L	0.097	±0.010	0.0032	±0.0003	0.0005
Cobalt	Total	mg/L	0.058	±0.006	0.0014	±0.0001	0.0001
Copper	Total	mg/L	0.26	±0.02	0.007	±0.0006	0.001
Lead	Total	mg/L	0.085	±0.006	0.0012	±0.00009	0.0001
Lithium	Total	mg/L	0.12	±0.01	0.038	±0.004	0.001
Molybdenum	Total	mg/L	0.01	±0.001	0.087	±0.010	0.001
Nickel	Total	mg/L	0.153	±0.017	0.0125	±0.0014	0.0005
Selenium	Total	mg/L	0.005	±0.0005	0.0073	±0.0008	0.0002
Silver	Total	mg/L	0.0008	±0.0001	0.00002	±0.000004	0.00001
Strontium	Total	mg/L	0.57	±0.06	0.337	±0.036	0.001
Thallium	Total	mg/L	0.0014	±0.00009	<0.00005		0.00005
Tin	Total	mg/L	<0.01		0.005	±0.0010	0.001
Titanium	Total	mg/L	0.091	±0.011	0.0296	±0.0037	0.0005
Uranium	Total	mg/L	0.010	±0.0008	0.0146	±0.0011	0.0005
Vanadium	Total	mg/L	0.099	±0.009	0.0050	±0.0004	0.0001
Zinc	Total	mg/L	0.52	±0.04	0.009	±0.0007	0.004
Zirconium	Total	mg/L	<0.01		0.002	±0.0002	0.001
Physical and Aggregate Properties							
Turbidity		NTU	7530	±210	157	±4	0.1
Solids	Total Suspended	mg/L	4720	±500	266	±28	2
Routine Water							
pH			8.97	±0.10	8.33	±0.10	1
Temperature of observed		°C	20.2		20.8		
pH							
Electrical Conductivity	at 25 °C	µS/cm	837	±28	1720	±60	1
Calcium	Dissolved	mg/L	1.9	±0.07	33.0	±1.1	0.2
Magnesium	Dissolved	mg/L	0.3	±0.02	5.1	±0.4	0.2

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1 Attn: Accounts Payable Sampled By: Ryley K. Company: Matrix	Project ID: 26388-512 Project Name: Project Location: LSD: P.O.: Proj. Acct. code:	Lot ID: 1540181 Control Number: COC110048 Date Received: Nov 29, 2021 Date Reported: Dec 7, 2021 Report Number: 2699622
---	---	--

		Reference Number	1540181-3		1540181-4		
		Sample Date	Nov 29, 2021		Nov 29, 2021		
		Sample Time	11:20		12:30		
		Sample Location					
		Sample Description	MW21-3 / 26388211129006 / 6.4°C		MW21-4 / 26388211129007 / 6.4°C		
		Matrix	Water		Water		
Analyte		Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Routine Water - Continued							
Sodium	Dissolved	mg/L	202	±11	346	±18	0.4
Potassium	Dissolved	mg/L	1.2	±0.1	4.8	±0.3	0.4
Iron	Dissolved	mg/L	0.07	±0.004	0.02	±0.002	0.01
Manganese	Dissolved	mg/L	<0.005		0.012	±0.0009	0.005
Chloride	Dissolved	mg/L	4.3	±0.3	52.3	±3.2	0.4
Nitrate - N		mg/L	0.07	±0.02	0.78	±0.06	0.01
Nitrite - N		mg/L	0.009	±0.009	0.085	±0.009	0.005
Nitrate and Nitrite - N		mg/L	0.08		0.87		0.01
Sulfate (SO4)	Dissolved	mg/L	33.2	±3.1	276	±26	0.9
Hydroxide		mg/L	<5		<5		
Carbonate		mg/L	44		<6		
Bicarbonate		mg/L	424		594		
P-Alkalinity	as CaCO3	mg/L	37	±4	<5		5
T-Alkalinity	as CaCO3	mg/L	421	±17	487	±19	5
Total Dissolved Solids	Calculated	mg/L	495		1010		1
Hardness	Dissolved as CaCO3	mg/L	6		103		
Ionic Balance	Dissolved	%	97		101		

Approved by:



Benjamin Morris, B.Sc
Operations Manager

Data have been validated by Analytical Quality Control and Element's Integrated Data Validation System (IDVS).
Generation and distribution of the report, and approval by the digitized signature above, are performed through a secure and controlled automatic process.
* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Quality Control

Bill To: Matrix Solutions Inc.	Project ID: 26388-512	Lot ID: 1540181
Suite 600, 214 11 Ave SW	Project Name:	Control Number: COC110048
Calgary, AB, Canada	Project Location:	Date Received: Nov 29, 2021
T2R 0K1	LSD:	Date Reported: Dec 7, 2021
Attn: Accounts Payable	P.O.:	Report Number: 2699622
Sampled By: Ryley K.	Proj. Acct. code:	
Company: Matrix		

Metals Dissolved

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Silicon	mg/L	-0.0057	-0.04	0.05	yes
Sulfur	mg/L	0.0009	-0.3	0.2	yes
Mercury	µg/L	0.001766	-0.038000	0.064000	yes
Aluminum	µg/L	-0.0107826	-2	2	yes
Antimony	µg/L	-0.000410163	-0.2	0.2	yes
Arsenic	µg/L	-0.00413518	-0.2	0.2	yes
Barium	µg/L	0.143305	-1	1	yes
Beryllium	µg/L	0.00902773	-0.0	0.1	yes
Boron	µg/L	-0.467139	-2	2	yes
Cadmium	µg/L	-3.78245e-005	-0.01	0.01	yes
Chromium	µg/L	-0.0276564	-0.3	0.3	yes
Cobalt	µg/L	0.00139271	-0.1	0.1	yes
Copper	µg/L	0.0125295	-1	1	yes
Lead	µg/L	0.000618187	-0.1	0.1	yes
Lithium	µg/L	-0.142287	-1	1	yes
Molybdenum	µg/L	-0.0541289	-1	1	yes
Nickel	µg/L	-0.0257503	-0.5	0.5	yes
Selenium	µg/L	0.00326495	-0.2	0.2	yes
Silver	µg/L	0.000501202	-0.10	0.10	yes
Strontium	µg/L	-0.00661882	-1	1	yes
Thallium	µg/L	0.000180163	-0.05	0.05	yes
Tin	µg/L	-0.0326372	-1	1	yes
Titanium	µg/L	-0.0163453	-0.5	0.5	yes
Uranium	µg/L	-0.000680117	-0.5	0.5	yes
Vanadium	µg/L	-0.0644748	-0.1	0.1	yes
Zinc	µg/L	0.724536	-0	2	yes
Zirconium	µg/L	0.00119116	-1	1	yes

Date Acquired: December 03, 2021

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Silicon	mg/L	4.66	4.64	10	0.01	yes
Sulfur	mg/L	7.1	7.0	10	0.1	yes
Mercury	mg/L	<0.000005	<0.000005	10	0.000030	yes
Aluminum	µg/L	<10	<10	10	11	yes
Antimony	µg/L	<1	<1	10	0.4	yes
Arsenic	µg/L	2	2	10	0.4	yes
Barium	µg/L	200	200	10	2	yes
Beryllium	µg/L	<0.5	<0.5	10	0.2	yes
Bismuth	µg/L	<2	<2	10	1.1	yes
Boron	µg/L	6320	6210	10	4	yes
Cadmium	µg/L	<0.05	<0.05	10	0.02	yes
Chromium	µg/L	<2	<2	10	1.1	yes
Cobalt	µg/L	0.9	1.0	10	0.2	yes
Copper	µg/L	<5	<5	10	2	yes
Lead	µg/L	<0.5	<0.5	10	0.2	yes
Lithium	µg/L	230	230	10	2	yes

Quality Control

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1	Project ID: 26388-512 Project Name: Project Location: LSD: P.O.:	Lot ID: 1540181 Control Number: COC110048 Date Received: Nov 29, 2021 Date Reported: Dec 7, 2021 Report Number: 2699622
Attn: Accounts Payable Sampled By: Ryley K. Company: Matrix	Proj. Acct. code:	

Metals Dissolved - Continued

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Molybdenum	µg/L	20	20	10	2	yes
Nickel	µg/L	4	4	10	1.1	yes
Selenium	µg/L	<1	<1	10	0.4	yes
Silver	µg/L	<0.05	<0.05	10	0.22	yes
Strontium	µg/L	333	333	10	2	yes
Thallium	µg/L	<0.3	<0.3	10	0.11	yes
Tin	µg/L	<5	<5	10	2	yes
Titanium	µg/L	<2	<2	10	1.1	yes
Uranium	µg/L	<2	<2	10	1.1	yes
Vanadium	µg/L	<0.5	<0.5	10	0.2	yes
Zinc	µg/L	<5	<5	10	2	yes
Zirconium	µg/L	<5	<5	10	2	yes

Date Acquired: December 03, 2021

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Aluminum	µg/L	992	917	1067	yes
Antimony	µg/L	40.6	36.4	44.2	yes
Arsenic	µg/L	39.5	36.7	43.3	yes
Barium	µg/L	200	182	211	yes
Beryllium	µg/L	19.5	17.3	22.1	yes
Bismuth	µg/L	102	89.1	108.3	yes
Boron	µg/L	389	344	434	yes
Cadmium	µg/L	2.06	1.86	2.25	yes
Chromium	µg/L	99.4	92.2	110.2	yes
Cobalt	µg/L	20.2	18.4	21.2	yes
Copper	µg/L	204	187	214	yes
Lead	µg/L	20.6	18.4	22.0	yes
Lithium	µg/L	196	175	223	yes
Molybdenum	µg/L	203	182	218	yes
Nickel	µg/L	101	93.3	105.9	yes
Selenium	µg/L	39.7	35.8	43.0	yes
Silver	µg/L	19.9	18.40	22.00	yes
Strontium	µg/L	194	180	216	yes
Thallium	µg/L	10.6	8.80	10.60	yes
Tin	µg/L	203	180	220	yes
Titanium	µg/L	99.2	92.4	110.4	yes
Uranium	µg/L	102	90.9	106.5	yes
Vanadium	µg/L	19.8	18.0	22.0	yes
Zinc	µg/L	199	183	219	yes
Zirconium	µg/L	194	180	220	yes

Date Acquired: December 03, 2021

Mercury	mg/L	0.000095	0.000070	0.000130	yes
---------	------	----------	----------	----------	-----

Date Acquired: December 07, 2021

Mercury	mg/L	0.000023	0.000006	0.000036	yes
Aluminum	µg/L	54	45	55	yes

Quality Control

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1 Attn: Accounts Payable Sampled By: Ryley K. Company: Matrix	Project ID: 26388-512 Project Name: Project Location: LSD: P.O.: Proj. Acct. code:	Lot ID: 1540181 Control Number: COC110048 Date Received: Nov 29, 2021 Date Reported: Dec 7, 2021 Report Number: 2699622
---	---	--

Metals Dissolved - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Antimony	µg/L	2.1	1.8	2.3	yes
Arsenic	µg/L	2.1	1.8	2.2	yes
Barium	µg/L	10	9	11	yes
Beryllium	µg/L	1.0	0.9	1.1	yes
Bismuth	µg/L	5.3	4.1	5.5	yes
Boron	µg/L	22	18	22	yes
Cadmium	µg/L	0.11	0.09	0.11	yes
Chromium	µg/L	5.2	4.5	5.5	yes
Cobalt	µg/L	1.1	0.9	1.1	yes
Copper	µg/L	11	9	11	yes
Lead	µg/L	1.1	0.9	1.1	yes
Lithium	µg/L	11	9	11	yes
Molybdenum	µg/L	10	9	10	yes
Nickel	µg/L	5.2	4.4	5.5	yes
Selenium	µg/L	2.1	1.7	2.2	yes
Silver	µg/L	1.06	0.84	1.08	yes
Strontium	µg/L	10	9	11	yes
Thallium	µg/L	0.52	0.45	0.55	yes
Tin	µg/L	10	9	11	yes
Titanium	µg/L	5.2	4.5	5.5	yes
Uranium	µg/L	5.2	4.5	5.5	yes
Vanadium	µg/L	1.0	0.9	1.1	yes
Zinc	µg/L	11	9	11	yes
Zirconium	µg/L	11	9	11	yes
Date Acquired: December 03, 2021					
Silicon	mg/L	9.75	8.98	10.78	yes
Sulfur	mg/L	142	138.5	155.3	yes
Date Acquired: December 03, 2021					
Silicon	mg/L	2.00	1.88	2.24	yes
Sulfur	mg/L	10.2	9.2	11.0	yes
Date Acquired: December 03, 2021					
Silicon	mg/L	0.20	0.19	0.23	yes
Sulfur	mg/L	3.0	2.8	3.3	yes
Date Acquired: December 03, 2021					

Metals Total

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Aluminum	mg/L	0.00436309	-0.02	0.02	yes
Calcium	mg/L	-0.000530293	-0.1	0.1	yes
Iron	mg/L	0.00257685	-0.01	0.02	yes
Magnesium	mg/L	-0.00321027	-0.04	0.04	yes
Manganese	mg/L	-8.47587e-005	-0.005	0.005	yes
Potassium	mg/L	0.0224259	-0.1	0.2	yes
Silicon	mg/L	0.000738502	-0.03	0.04	yes

Quality Control

Bill To: Matrix Solutions Inc.	Project ID: 26388-512	Lot ID: 1540181
Suite 600, 214 11 Ave SW	Project Name:	Control Number: COC110048
Calgary, AB, Canada	Project Location:	Date Received: Nov 29, 2021
T2R 0K1	LSD:	Date Reported: Dec 7, 2021
Attn: Accounts Payable	P.O.:	Report Number: 2699622
Sampled By: Ryley K.	Proj. Acct. code:	
Company: Matrix		

Metals Total - Continued

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Sodium	mg/L	0.0135987	-0.4	0.4	yes
Sulfur	mg/L	0.0463628	-0.1	0.2	yes
Antimony	µg/L	0.00259031	-0.2	0.2	yes
Arsenic	µg/L	0.0155654	-0.2	0.2	yes
Barium	µg/L	0.0700798	-1	1	yes
Beryllium	µg/L	0.000119241	-0.1	0.1	yes
Bismuth	µg/L	0.0026158	-0.5	0.5	yes
Boron	µg/L	1.32171	-1	3	yes
Cadmium	µg/L	6.19818e-005	-0.007	0.012	yes
Chromium	µg/L	0.0950587	-0.7	0.3	yes
Cobalt	µg/L	-0.00474148	-0.1	0.1	yes
Copper	µg/L	0.112155	-1	1	yes
Lead	µg/L	0.00245519	-0.1	0.1	yes
Lithium	µg/L	0.0655515	-1	1	yes
Molybdenum	µg/L	0.0349893	-1	1	yes
Nickel	µg/L	0.0431006	-0.5	0.5	yes
Selenium	µg/L	0.00601894	-0.2	0.2	yes
Silver	µg/L	0.000154607	-0.02	0.10	yes
Strontium	µg/L	0.107256	-1	1	yes
Thallium	µg/L	-0.0372517	-0.05	0.05	yes
Tin	µg/L	0.0132095	-1	1	yes
Titanium	µg/L	-0.00656745	-0.5	0.5	yes
Uranium	µg/L	0.00306826	-0.5	0.5	yes
Vanadium	µg/L	0.00871547	-0.1	0.1	yes
Zinc	µg/L	0.0563278	-4	4	yes
Zirconium	µg/L	0.0254487	-1	1	yes

Date Acquired: December 02, 2021

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Aluminum	mg/L	<0.04	0.04	15	0.03	yes
Calcium	mg/L	98.3	97.9	15	0.6	yes
Iron	mg/L	0.2	0.2	15	0.20	yes
Magnesium	mg/L	33.3	33.0	15	0.40	yes
Manganese	mg/L	0.725	0.723	15	0.010	yes
Potassium	mg/L	3.7	3.7	15	1.2	yes
Silicon	mg/L	3.89	3.87	15	0.10	yes
Sodium	mg/L	424	421	15	1.2	yes
Sulfur	mg/L	289	286	15	0.1	yes
Antimony	µg/L	<0.4	<0.4	15	0.4	yes
Arsenic	µg/L	1	1	15	0.4	yes
Barium	µg/L	75	76	15	2	yes
Beryllium	µg/L	<0.2	<0.2	15	0.2	yes
Bismuth	µg/L	<1	<1	15	1.1	yes
Boron	µg/L	170	180	15	4	yes
Cadmium	µg/L	0.1	0.1	15	0.022	yes
Chromium	µg/L	<1	1	15	1.1	yes

Quality Control

Bill To: Matrix Solutions Inc.	Project ID: 26388-512	Lot ID: 1540181
Suite 600, 214 11 Ave SW	Project Name:	Control Number: COC110048
Calgary, AB, Canada	Project Location:	Date Received: Nov 29, 2021
T2R 0K1	LSD:	Date Reported: Dec 7, 2021
Attn: Accounts Payable	P.O.:	Report Number: 2699622
Sampled By: Ryley K.	Proj. Acct. code:	
Company: Matrix		

Metals Total - Continued

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Cobalt	µg/L	2.7	2.9	15	0.2	yes
Copper	µg/L	4	6	15	2	yes
Lead	µg/L	0.3	0.3	15	0.2	yes
Lithium	µg/L	338	350	15	2	yes
Molybdenum	µg/L	<2	<2	15	2	yes
Nickel	µg/L	9.4	9.8	15	1.1	yes
Selenium	µg/L	2.2	2.2	15	0.4	yes
Silver	µg/L	0.09	0.02	15	0.22	yes
Strontium	µg/L	3150	3340	15	2	yes
Thallium	µg/L	<0.1	<0.1	15	0.11	yes
Tin	µg/L	4	4	15	2	yes
Titanium	µg/L	15	16	15	1.1	yes
Uranium	µg/L	44.8	45.2	15	1.1	yes
Vanadium	µg/L	2	2	15	0.2	yes
Zinc	µg/L	<8	<8	15	2	yes
Zirconium	µg/L	<2	<2	15	2	yes

Date Acquired: December 02, 2021

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Aluminum	mg/L	3.96	3.61	4.45	yes
Calcium	mg/L	50.4	47.6	54.2	yes
Iron	mg/L	2.03	1.91	2.21	yes
Magnesium	mg/L	19.6	17.88	21.86	yes
Manganese	mg/L	0.507	0.472	0.568	yes
Potassium	mg/L	50.2	46.9	55.9	yes
Silicon	mg/L	2.06	1.96	2.26	yes
Sodium	mg/L	51.1	47.0	57.2	yes
Sulfur	mg/L	10.0	9.2	11.2	yes
Antimony	µg/L	11.4	10.8	13.2	yes
Arsenic	µg/L	11.1	10.8	12.9	yes
Barium	µg/L	58	54	68	yes
Beryllium	µg/L	5.8	4.9	6.8	yes
Bismuth	µg/L	28.0	26.2	35.8	yes
Boron	µg/L	119	102	139	yes
Cadmium	µg/L	0.60	0.543	0.675	yes
Chromium	µg/L	29.2	26.5	33.7	yes
Cobalt	µg/L	5.7	5.2	6.8	yes
Copper	µg/L	59	53	67	yes
Lead	µg/L	6.0	5.2	7.1	yes
Lithium	µg/L	58	53	77	yes
Molybdenum	µg/L	60	56	66	yes
Nickel	µg/L	32.5	27.6	32.8	yes
Selenium	µg/L	11.7	9.9	13.5	yes
Silver	µg/L	5.87	5.39	7.13	yes
Strontium	µg/L	57	55	65	yes
Thallium	µg/L	3.34	2.70	3.60	yes

Quality Control

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1 Attn: Accounts Payable Sampled By: Ryley K. Company: Matrix	Project ID: 26388-512 Project Name: Project Location: LSD: P.O.: Proj. Acct. code:	Lot ID: 1540181 Control Number: COC110048 Date Received: Nov 29, 2021 Date Reported: Dec 7, 2021 Report Number: 2699622
---	---	--

Metals Total - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Tin	µg/L	60	56	66	yes
Titanium	µg/L	28.6	26.6	35.7	yes
Uranium	µg/L	29.3	25.7	36.3	yes
Vanadium	µg/L	5.8	5.1	7.2	yes
Zinc	µg/L	57	53	65	yes
Zirconium	µg/L	63	53	67	yes
Date Acquired: December 02, 2021					
Antimony	µg/L	40.7	37.5	43.1	yes
Arsenic	µg/L	39.8	36.5	43.5	yes
Barium	µg/L	185	183	212	yes
Beryllium	µg/L	19.6	17.1	21.9	yes
Bismuth	µg/L	93.0	88.2	106.2	yes
Boron	µg/L	369	343	436	yes
Cadmium	µg/L	2.00	1.910	2.210	yes
Chromium	µg/L	101	90.0	110.0	yes
Cobalt	µg/L	19.9	18.1	21.7	yes
Copper	µg/L	208	188	212	yes
Lead	µg/L	19.4	18.0	24.0	yes
Lithium	µg/L	185	173	222	yes
Molybdenum	µg/L	206	182	218	yes
Nickel	µg/L	101	90.0	110.0	yes
Selenium	µg/L	41.3	36.7	43.3	yes
Silver	µg/L	20.5	18.00	22.00	yes
Strontium	µg/L	198	171	231	yes
Thallium	µg/L	10.1	9.01	10.99	yes
Tin	µg/L	204	190	218	yes
Titanium	µg/L	98.8	93.2	107.0	yes
Uranium	µg/L	95.1	90.2	109.0	yes
Vanadium	µg/L	19.9	16.9	22.1	yes
Zinc	µg/L	200	183	218	yes
Zirconium	µg/L	208	188	218	yes
Date Acquired: December 02, 2021					
Antimony	µg/L	12.4	10.8	13.2	yes
Arsenic	µg/L	12.1	10.8	13.2	yes
Barium	µg/L	59	55	67	yes
Beryllium	µg/L	5.9	5.2	6.5	yes
Bismuth	µg/L	30.1	27.3	31.9	yes
Boron	µg/L	120	108	132	yes
Cadmium	µg/L	0.62	0.540	0.660	yes
Chromium	µg/L	30.7	27.0	33.0	yes
Cobalt	µg/L	6.1	5.4	6.6	yes
Copper	µg/L	62	54	66	yes
Lead	µg/L	6.1	5.4	6.6	yes
Lithium	µg/L	59	53	66	yes

Quality Control

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1 Attn: Accounts Payable Sampled By: Ryley K. Company: Matrix	Project ID: 26388-512 Project Name: Project Location: LSD: P.O.: Proj. Acct. code:	Lot ID: 1540181 Control Number: COC110048 Date Received: Nov 29, 2021 Date Reported: Dec 7, 2021 Report Number: 2699622
---	---	--

Metals Total - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Molybdenum	µg/L	61	53	64	yes
Nickel	µg/L	30.4	27.1	33.1	yes
Selenium	µg/L	13.0	10.3	13.4	yes
Silver	µg/L	6.24	5.40	6.60	yes
Strontium	µg/L	60	54	66	yes
Thallium	µg/L	3.12	0.00	6.00	yes
Tin	µg/L	62	54	66	yes
Titanium	µg/L	30.2	27.0	33.0	yes
Uranium	µg/L	29.7	27.0	33.0	yes
Vanadium	µg/L	6.0	5.4	6.6	yes
Zinc	µg/L	60	56	64	yes
Zirconium	µg/L	62	54	66	yes
Date Acquired: December 02, 2021					
Antimony	µg/L	2.0	1.8	2.2	yes
Arsenic	µg/L	2.1	1.7	2.2	yes
Barium	µg/L	10	9	10	yes
Beryllium	µg/L	1.0	0.8	1.1	yes
Bismuth	µg/L	5.1	4.6	5.3	yes
Boron	µg/L	22	17	23	yes
Cadmium	µg/L	0.09	0.089	0.113	yes
Chromium	µg/L	4.9	4.6	5.3	yes
Cobalt	µg/L	1.0	0.9	1.1	yes
Copper	µg/L	10	9	11	yes
Lead	µg/L	1.0	0.9	1.1	yes
Lithium	µg/L	10	9	11	yes
Molybdenum	µg/L	10	9	10	yes
Nickel	µg/L	5.2	4.5	5.5	yes
Selenium	µg/L	1.9	1.6	2.2	yes
Silver	µg/L	1.01	0.89	1.13	yes
Strontium	µg/L	10	9	10	yes
Thallium	µg/L	0.49	0.44	0.56	yes
Tin	µg/L	10	9	11	yes
Titanium	µg/L	5.0	4.2	5.7	yes
Uranium	µg/L	4.8	4.7	5.3	yes
Vanadium	µg/L	1.1	0.9	1.2	yes
Zinc	µg/L	10	9	11	yes
Zirconium	µg/L	11	9	11	yes
Date Acquired: December 02, 2021					
Aluminum	mg/L	19.2	18.80	20.60	yes
Calcium	mg/L	242	231.3	258.9	yes
Iron	mg/L	9.57	9.06	10.14	yes
Magnesium	mg/L	97.4	92.78	104.72	yes
Manganese	mg/L	2.40	2.290	2.590	yes
Potassium	mg/L	246	234.2	261.8	yes

Quality Control

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1 Attn: Accounts Payable Sampled By: Ryley K. Company: Matrix	Project ID: 26388-512 Project Name: Project Location: LSD: P.O.: Proj. Acct. code:	Lot ID: 1540181 Control Number: COC110048 Date Received: Nov 29, 2021 Date Reported: Dec 7, 2021 Report Number: 2699622
---	---	--

Metals Total - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Silicon	mg/L	10.0	9.13	10.93	yes
Sodium	mg/L	242	228.8	269.4	yes
Sulfur	mg/L	149	135.5	165.3	yes
Date Acquired: December 02, 2021					
Aluminum	mg/L	4.02	3.60	4.40	yes
Calcium	mg/L	51.0	46.5	56.5	yes
Iron	mg/L	2.07	1.87	2.27	yes
Magnesium	mg/L	20.0	18.05	22.07	yes
Manganese	mg/L	0.515	0.466	0.568	yes
Potassium	mg/L	50.8	45.4	55.5	yes
Silicon	mg/L	2.09	1.93	2.24	yes
Sodium	mg/L	51.4	45.9	55.9	yes
Sulfur	mg/L	10.3	9.3	11.3	yes
Date Acquired: December 02, 2021					
Aluminum	mg/L	0.40	0.36	0.44	yes
Calcium	mg/L	5.2	4.8	5.8	yes
Iron	mg/L	0.21	0.19	0.25	yes
Magnesium	mg/L	2.0	1.84	2.20	yes
Manganese	mg/L	0.052	0.047	0.059	yes
Potassium	mg/L	5.1	4.8	5.8	yes
Silicon	mg/L	0.21	0.17	0.23	yes
Sodium	mg/L	5.0	4.8	5.6	yes
Sulfur	mg/L	3.0	2.8	3.3	yes
Date Acquired: December 02, 2021					

Physical and Aggregate Properties

Blanks		Units	Measured	Lower Limit	Upper Limit	Passed QC	
Turbidity		NTU	0.077	-0.1	0.1	yes	
Date Acquired:		December 02, 2021					
Turbidity		NTU	0.095	0.0	0.1	yes	
Date Acquired:		December 02, 2021					
Client Sample Replicates		Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Turbidity		NTU	609	610	10	0.2	yes
Solids		mg/L	640	630	10	2	yes
Date Acquired:		December 06, 2021					
Control Sample		Units	Measured	Lower Limit	Upper Limit		Passed QC
Turbidity		NTU	1920	1856.7	2054.7		yes
Date Acquired:		December 02, 2021					
Turbidity		NTU	5700	4441.7	6661.7		yes
Date Acquired:		December 02, 2021					
Turbidity		NTU	151	132.1	162.1		yes
Solids		mg/L	201	174	209		yes
Date Acquired:		December 06, 2021					

Quality Control

Bill To: Matrix Solutions Inc.	Project ID: 26388-512	Lot ID: 1540181
Suite 600, 214 11 Ave SW	Project Name:	Control Number: COC110048
Calgary, AB, Canada	Project Location:	Date Received: Nov 29, 2021
T2R 0K1	LSD:	Date Reported: Dec 7, 2021
Attn: Accounts Payable	P.O.:	Report Number: 2699622
Sampled By: Ryley K.	Proj. Acct. code:	
Company: Matrix		

Physical and Aggregate Properties - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Turbidity	NTU	13.8	12.6	15.6	yes
Solids	mg/L	14	10	22	yes
Date Acquired:	December 06, 2021				
Turbidity	NTU	1.6	1.0	2.2	yes
Date Acquired:	December 02, 2021				

Routine Water

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Calcium	mg/L	-0.0113	-0.2	0.2	yes
Magnesium	mg/L	-0.0013	-0.1	0.1	yes
Sodium	mg/L	0.0181	-0.4	0.4	yes
Potassium	mg/L	0.014	-0.4	0.4	yes
Iron	mg/L	-0.0015	-0.01	0.01	yes
Manganese	mg/L	-0.0004	-0.004	0.004	yes
Chloride	mg/L	0.25	-0.4	0.4	yes
Nitrate - N	mg/L	0.00167028	-0.01	0.01	yes
Nitrite - N	mg/L	0	-0.005	0.005	yes
Date Acquired:	December 03, 2021				

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
pH		7.03	7.05	0	0.10	yes
Electrical Conductivity	dS/m	10.4	10.4	10	0.002	yes
Calcium	mg/L	88.6	90.1	10	0.6	yes
Magnesium	mg/L	33.8	34.2	10	0.7	yes
Sodium	mg/L	57.5	58.5	10	1.2	yes
Potassium	mg/L	3.5	3.5	10	1.2	yes
Iron	mg/L	<0.01	<0.01	10	0.05	yes
Manganese	mg/L	0.182	0.185	10	0.010	yes
Chloride	mg/L	49.0	46.6	10	0.5	yes
Nitrate - N	mg/L	<0.01	<0.01	10	0.01	yes
Nitrite - N	mg/L	<0.005	<0.005	10	0.010	yes
Hydroxide	mg/L	<5	<5	10		yes
Carbonate	mg/L	<6	<6	10	6	yes
Bicarbonate	mg/L	690	701	10	6	yes
P-Alkalinity	mg/L	<5	<5	10	5	yes
T-Alkalinity	mg/L	566	575	10	5	yes
Date Acquired:	December 03, 2021					

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Chloride	mg/L	2070	1847.4	2256.0	yes
Date Acquired:	December 03, 2021				
Electrical Conductivity	dS/m	32.9	27.200	36.800	yes
Date Acquired:	December 03, 2021				
pH		9.16	8.90	9.44	yes
Temperature of observed	°C	20.4	15.5	24.5	yes

Quality Control

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1 Attn: Accounts Payable Sampled By: Ryley K. Company: Matrix	Project ID: 26388-512 Project Name: Project Location: LSD: P.O.: Proj. Acct. code:	Lot ID: 1540181 Control Number: COC110048 Date Received: Nov 29, 2021 Date Reported: Dec 7, 2021 Report Number: 2699622
---	---	--

Routine Water - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Electrical Conductivity	dS/m	2.73	2.631	2.829	yes
Calcium	mg/L	239	230.0	260.0	yes
Magnesium	mg/L	96.9	91.3	103.3	yes
Sodium	mg/L	239	233.3	257.3	yes
Potassium	mg/L	235	229.0	259.0	yes
Iron	mg/L	9.42	8.91	10.20	yes
Manganese	mg/L	2.38	2.240	2.540	yes
Nitrate - N	mg/L	9.97	9.03	11.13	yes
Nitrite - N	mg/L	9.91	9.010	10.990	yes
Nitrate and Nitrite - N	mg/L	19.90	19.10	20.90	yes
P-Alkalinity	mg/L	508	442	584	yes
T-Alkalinity	mg/L	996	926	1106	yes
Date Acquired: December 03, 2021					
pH		6.87	6.79	6.97	yes
Temperature of observed	°C	20.3	15.5	24.5	yes
Electrical Conductivity	dS/m	0.077	0.069	0.085	yes
Calcium	mg/L	51.9	44.9	56.9	yes
Magnesium	mg/L	19.9	17.9	22.0	yes
Sodium	mg/L	50.2	47.7	55.5	yes
Potassium	mg/L	49.1	45.8	55.8	yes
Iron	mg/L	2.00	1.89	2.25	yes
Manganese	mg/L	0.507	0.468	0.552	yes
Chloride	mg/L	81.0	74.9	86.9	yes
Nitrate - N	mg/L	4.72	4.37	5.33	yes
Nitrite - N	mg/L	4.80	4.370	5.330	yes
Nitrate and Nitrite - N	mg/L	9.52	8.80	10.60	yes
P-Alkalinity	mg/L	34	28	72	yes
T-Alkalinity	mg/L	128	114	140	yes
Date Acquired: December 03, 2021					
Calcium	mg/L	5.4	4.7	5.8	yes
Magnesium	mg/L	2.1	1.9	2.2	yes
Sodium	mg/L	5.2	4.7	5.7	yes
Potassium	mg/L	5.2	4.7	5.7	yes
Iron	mg/L	0.21	0.19	0.24	yes
Manganese	mg/L	0.053	0.048	0.058	yes
Chloride	mg/L	14.8	13.3	16.5	yes
Nitrate - N	mg/L	0.50	0.42	0.57	yes
Nitrite - N	mg/L	0.516	0.424	0.564	yes
Nitrate and Nitrite - N	mg/L	1.01	0.85	1.15	yes
Date Acquired: December 03, 2021					

Methodology and Notes

Bill To: Matrix Solutions Inc. Suite 600, 214 11 Ave SW Calgary, AB, Canada T2R 0K1 Attn: Accounts Payable Sampled By: Ryley K. Company: Matrix	Project ID: 26388-512 Project Name: Project Location: LSD: P.O.: Proj. Acct. code:	Lot ID: 1540181 Control Number: COC110048 Date Received: Nov 29, 2021 Date Reported: Dec 7, 2021 Report Number: 2699622
---	---	--

Method of Analysis

Method Name	Reference	Method	Date Analysis Started	Location
Alkalinity, pH, and EC in water	APHA	* Alkalinity - Titration Method, 2320 B	Dec 3, 2021	Element Edmonton - Roper Road
Alkalinity, pH, and EC in water	APHA	* Conductivity, 2510 B	Dec 3, 2021	Element Edmonton - Roper Road
Alkalinity, pH, and EC in water	APHA	* pH - Electrometric Method, 4500-H+ B	Dec 3, 2021	Element Edmonton - Roper Road
Anions (Routine) by Ion Chromatography	APHA	* Ion Chromatography with Chemical Suppression of Eluent Cond., 4110 B	Dec 3, 2021	Element Edmonton - Roper Road
Approval-Edmonton	APHA	Checking Correctness of Analyses, 1030 E	Dec 6, 2021	Element Edmonton - Roper Road
Chloride in Water	APHA	* Automated Ferricyanide Method, 4500-Cl-E	Dec 3, 2021	Element Edmonton - Roper Road
Mercury (Dissolved) in water	APHA	* Cold Vapour Atomic Absorption Spectrometric Method, 3112 B	Dec 7, 2021	Element Edmonton - Roper Road
Mercury (Dissolved) in water	EPA	* Mercury in Water by Cold Vapor Atomic Fluorescence Spectrometry, 245.7	Dec 7, 2021	Element Edmonton - Roper Road
Metals ICP-MS (Dissolved) in water	APHA/USEPA	* Metals By Inductively Coupled Plasma/Mass Spectrometry, APHA 3125 B / USEPA 200.2, 200.8	Dec 3, 2021	Element Edmonton - Roper Road
Metals ICP-MS (Dissolved) in water	US EPA	* Determination of Trace Elements in Waters and Wastes by ICP-MS, 200.8	Dec 3, 2021	Element Edmonton - Roper Road
Metals ICP-MS (Total) in water	APHA/USEPA	* Metals By Inductively Coupled Plasma/Mass Spectrometry, APHA 3125 B / USEPA 200.2, 200.8	Dec 2, 2021	Element Edmonton - Roper Road
Metals ICP-MS (Total) in water	US EPA	* Determination of Trace Elements in Waters and Wastes by ICP-MS, 200.8	Dec 2, 2021	Element Edmonton - Roper Road
Metals Trace (Dissolved) in water	APHA	Hardness by Calculation, 2340 B	Dec 3, 2021	Element Edmonton - Roper Road
Metals Trace (Dissolved) in water	APHA	* Inductively Coupled Plasma (ICP) Method, 3120 B	Dec 3, 2021	Element Edmonton - Roper Road
Metals Trace (Total) in water	APHA	* Inductively Coupled Plasma (ICP) Method, 3120 B	Dec 2, 2021	Element Edmonton - Roper Road
Solids Suspended (Total, Fixed and Volatile)	APHA	* Total Suspended Solids Dried at 103-105°C, 2540 D	Dec 6, 2021	Element Edmonton - Roper Road
Turbidity in Water	APHA	* Turbidity - Nephelometric Method, 2130 B	Dec 2, 2021	Element Edmonton - Roper Road

* Reference Method Modified

References

APHA	Standard Methods for the Examination of Water and Wastewater
APHA/USEPA	Standard Methods For Water/ Environmental Protection Agency
EPA	Environmental Protection Agency Test Methods - US
US EPA	US Environmental Protection Agency Test Methods

Methodology and Notes

Bill To: Matrix Solutions Inc.	Project ID: 26388-512	Lot ID: 1540181
Suite 600, 214 11 Ave SW	Project Name:	Control Number: COC110048
Calgary, AB, Canada	Project Location:	Date Received: Nov 29, 2021
T2R 0K1	LSD:	Date Reported: Dec 7, 2021
Attn: Accounts Payable	P.O.:	Report Number: 2699622
Sampled By: Ryley K.	Proj. Acct. code:	
Company: Matrix		

Please direct any inquiries regarding this report to our Client Services group.

Results relate only to samples as submitted.

The test report shall not be reproduced except in full, without the written approval of the laboratory.



Matrix Solutions Inc.

ENVIRONMENT & ENGINEERING

COC # **110048**

Page: _____ of _____

Lab Submitted to: Element Calgary
 Lab Agreement no: _____
 Lab Job ID: _____

Invoice to: _____ Require Report: Y ☒ N ☐

Company Name: Matrix Solution
 Contact Name: _____
 Address: _____
 Phone / Fax#: _____ Ph: _____ PC: _____
 Fax: _____

Copy of Report to:
 Matrix Solutions - EDS
 Suite 600, 214 - 11th Avenue SW
 Calgary, Alberta, Canada
 T2R 0K1
 Ph: 403-237-0606 Fax: 403-263-2493
 email invoices to ap@matrix-solutions.com

Matrix Project #: 26388-512
 Matrix Proj. Name: _____
 Location: _____
 Sampler's Name(s): Riley K.

AFE #:

REGULATORY REQUIREMENTS: (check)

- ☒ Alberta Tier 1 ☐ BC CSR
☐ Alberta SW FAL
☐ Canadian Drinking Water
☐ CCME FAL
☐ SPIGEC
☐ SEQG Other: _____

SERVICE REQUESTED:

- ☐ RUSH (Please ensure you contact the lab) Due Date: _____
☒ REGULAR Turnaround
REPORT DISTRIBUTION: always send to eds@matrix-solutions.com
☒ Additional Emails killam, asordi

	Sample Number (14 digits only) yr-mth-day	Sample Point Name	Depth (m)	Sample Type	Date/Time Sampled	Quantity # of Containers			Analysis Required					HOLD
						J/V	Bags	Bottles	Routine	Turbidity	TSS	Total Metals	Dissolved Metals	
1	<u>2638821129004</u>	<u>MW21-1a</u>		<u>H₂O</u>	<u>Nov. 29, @ 0930</u>			<u>5</u>	X	X	X	X	X	
2	<u>005</u>	<u>MW21-1b</u>			<u>@ 1000</u>			<u>5</u>	X	X	X	X	X	
3	<u>006</u>	<u>MW21-3</u>			<u>@ 1120</u>			<u>5</u>	X	X	X	X	X	
4	<u>007</u>	<u>MW21-4</u>			<u>@ 1230</u>			<u>5</u>	X	X	X	X	X	
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														

Lot: 1540181 COC



*For metals in water samples indicate if you want Total (T) or Dissolved (D) as part of "Analysis Required"

Preserved/Filtered

Relinquished by: Riley Killam Date/Time: Nov. 29, 2021 @ 1515 Received by: LR Date/Time: NOV 29 '21 @ 18:18
 Signature: _____ Signature: _____

COMMENTS/SPECIAL INSTRUCTIONS: Note Sample 2638821129005 -> Dissolved Metals was not filtered or preserved in the field - sample was too turbid to filter

J = jars V = vials

Report Transmission Cover Page

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512 Project Name: Project Location: LSD: P.O.:	Lot ID: 1551110 Control Number: Date Received: Feb 4, 2022 Date Reported: Feb 10, 2022 Report Number: 2716691
Attn: Allisha Sordi Sampled By: Ryley K. Company: Matrix Solutions Inc.	Proj. Acct. code:	

Contact	Company	Address
Accounts Payable	Matrix Solutions Inc.	Suite 600, 214 11 Ave SW Calgary, AB T2R 0K1 Phone: (403) 237-0606 Fax: (403) 263-2493 Email: ap@matrix-solutions.com

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / Invoice

Allisha Sordi	Matrix Solutions Inc.	11312 - 100 Avenue Fort St. John, BC V1J 1Z9 Phone: (250) 785-7833 Fax: (250) 785-7813 Email: asordi@matrix-solutions.com
---------------	-----------------------	--

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / COA
Email - Merge Reports	PDF	COC / Test Report
Email - Single Report	Equis Matrix Batch File (with QC)	Test Report
Email - Single Report	Equis Matrix Sample File (with QC)	Test Report
Email - Single Report	Equis Matrix Test Result File (with QC)	Test Report

EDS	Matrix Solutions Inc.	Suite 600 214-11th Ave SW Calgary, AB T2R 0K1 Phone: (403) 700-2058 Fax: Email: eds@matrix-solutions.com
-----	-----------------------	---

Delivery	Format	Deliverables
Email - Single Report	Equis Matrix Batch File (with QC)	Test Report
Email - Single Report	Equis Matrix Sample File (with QC)	Test Report
Email - Single Report	Equis Matrix Test Result File (with QC)	Test Report
Email - Single Report	PDF	COC / COA
Email - Single Report	PDF	COC / Test Report
Email - Single Report	PDF	Invoice

Notes To Clients:

- Feb 09, 2022 - Sample 1551110-1; 7894090: Some trace total metal results were less than dissolved metal results for sample 1551110-1. Total metals were analyzed from the metals bottle and dissolved from the routine bottle. Results were verified.
- Feb 10, 2022 - Sample 1551110-1; 7894090: Total silver results were less than dissolved metal results for sample(s) 1551110-1. Total metals were analyzed from the metals bottle and dissolved from the routine bottle. Results were verified.
- Feb 10, 2022 - Sample 1551110-1; 7894090: Some ICP-MS total metal results were less than dissolved metal results for sample 1551110-1. The results were verified and are within expected measurement uncertainty.

The information contained on this and all other pages transmitted, is intended for the addressee only and is considered confidential. If the reader is not the intended recipient, you are hereby notified that any use, dissemination, distribution or copy of this transmission is strictly prohibited. If you receive this transmission by error, or if this transmission is not satisfactory, please notify us by telephone.

Analytical Report

Bill To: Matrix Solutions Inc.
11312 - 100 Avenue
Fort St. John, BC, Canada
V1J 1Z9
Attn: Allisha Sordi
Sampled By: Ryley K.
Company: Matrix Solutions Inc.

Project ID: 26388-512
Project Name:
Project Location:
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1551110**
Control Number:
Date Received: Feb 4, 2022
Date Reported: Feb 10, 2022
Report Number: 2716691

Reference Number 1551110-1
Sample Date Feb 04, 2022
Sample Time 10:30
Sample Location
Sample Description Bedrock #5 /
26388220204001 /
5.0°C
Matrix Water

Analyte		Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Metals Dissolved							
Silicon	Dissolved	mg/L	4.74	±0.43			0.05
Sulfur	Dissolved	mg/L	30.7	±2.9			0.3
Mercury	Dissolved	mg/L	<0.000005				0.000005
Aluminum	Dissolved	mg/L	<0.002				0.002
Antimony	Dissolved	mg/L	<0.0002				0.0002
Arsenic	Dissolved	mg/L	0.0007	±0.00009			0.0002
Barium	Dissolved	mg/L	0.033	±0.002			0.001
Beryllium	Dissolved	mg/L	<0.0001				0.0001
Bismuth	Dissolved	mg/L	<0.0005				0.0005
Boron	Dissolved	mg/L	0.096	±0.009			0.002
Cadmium	Dissolved	mg/L	<0.00001				0.00001
Chromium	Dissolved	mg/L	<0.0005				0.0005
Cobalt	Dissolved	mg/L	0.0004	±0.00002			0.0001
Copper	Dissolved	mg/L	0.001	±0.0001			0.001
Lead	Dissolved	mg/L	<0.0001				0.0001
Lithium	Dissolved	mg/L	0.018	±0.001			0.001
Molybdenum	Dissolved	mg/L	0.002	±0.00010			0.001
Nickel	Dissolved	mg/L	<0.0005				0.0005
Selenium	Dissolved	mg/L	<0.0002				0.0002
Silver	Dissolved	mg/L	0.00018	±0.00002			0.00001
Strontium	Dissolved	mg/L	1.43	±0.11			0.001
Thallium	Dissolved	mg/L	<0.00005				0.00005
Tin	Dissolved	mg/L	<0.001				0.001
Titanium	Dissolved	mg/L	<0.0005				0.0005
Uranium	Dissolved	mg/L	<0.0005				0.0005
Vanadium	Dissolved	mg/L	<0.0001				0.0001
Zinc	Dissolved	mg/L	0.035	±0.0028			0.001
Zirconium	Dissolved	mg/L	<0.001				0.001
Subsample			Lab Filtered				
Metals Total							
Aluminum	Total	mg/L	<0.02				0.02
Calcium	Total	mg/L	66.5	±0.3			0.2
Iron	Total	mg/L	0.09	±0.2			0.05
Magnesium	Total	mg/L	38.9	±0.5			0.2
Manganese	Total	mg/L	0.218	±0.047			0.005
Potassium	Total	mg/L	2.6	±0.3			0.4

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To: Matrix Solutions Inc.
11312 - 100 Avenue
Fort St. John, BC, Canada
V1J 1Z9
Attn: Allisha Sordi
Sampled By: Ryley K.
Company: Matrix Solutions Inc.

Project ID: 26388-512
Project Name:
Project Location:
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1551110**
Control Number:
Date Received: Feb 4, 2022
Date Reported: Feb 10, 2022
Report Number: 2716691

Reference Number 1551110-1
Sample Date Feb 04, 2022
Sample Time 10:30
Sample Location
Sample Description Bedrock #5 /
26388220204001 /
5.0°C
Matrix Water

Analyte		Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Metals Total - Continued							
Silicon	Total	mg/L	4.81	±0.10			0.05
Sodium	Total	mg/L	67.9	±2.0			0.4
Sulfur	Total	mg/L	30.9	±0.2			0.3
Mercury	Total	mg/L	<0.000005				0.000005
Antimony	Total	mg/L	<0.0002				0.0002
Arsenic	Total	mg/L	0.0007	±0.00008			0.0002
Barium	Total	mg/L	0.031	±0.003			0.001
Beryllium	Total	mg/L	<0.0001				0.0001
Bismuth	Total	mg/L	<0.0005				0.0005
Boron	Total	mg/L	0.094	±0.009			0.002
Cadmium	Total	mg/L	<0.00001				0.00001
Chromium	Total	mg/L	<0.0005				0.0005
Cobalt	Total	mg/L	0.0004	±0.00004			0.0001
Copper	Total	mg/L	0.002	±0.0002			0.001
Lead	Total	mg/L	0.0002	±0.00002			0.0001
Lithium	Total	mg/L	0.018	±0.002			0.001
Molybdenum	Total	mg/L	0.002	±0.0002			0.001
Nickel	Total	mg/L	<0.0005				0.0005
Selenium	Total	mg/L	<0.0002				0.0002
Silver	Total	mg/L	<0.00001				0.00001
Strontium	Total	mg/L	1.31	±0.14			0.001
Thallium	Total	mg/L	<0.00005				0.00005
Tin	Total	mg/L	<0.001				0.001
Titanium	Total	mg/L	<0.0005				0.0005
Uranium	Total	mg/L	<0.0005				0.0005
Vanadium	Total	mg/L	<0.0001				0.0001
Zinc	Total	mg/L	0.032	±0.002			0.004
Zirconium	Total	mg/L	<0.001				0.001
Physical and Aggregate Properties							
Turbidity		NTU	0.6	±0.02			0.1
Solids	Total Suspended	mg/L	<2				2
Routine Water							
pH			7.92	±0.10			1
Temperature of observed		°C	20.9				
pH							
Electrical Conductivity	at 25 °C	µS/cm	868	±29			1
Calcium	Dissolved	mg/L	68.8	±2.3			0.2

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To: Matrix Solutions Inc.
11312 - 100 Avenue
Fort St. John, BC, Canada
V1J 1Z9
Attn: Allisha Sordi
Sampled By: Ryley K.
Company: Matrix Solutions Inc.

Project ID: 26388-512
Project Name:
Project Location:
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1551110**
Control Number:
Date Received: Feb 4, 2022
Date Reported: Feb 10, 2022
Report Number: 2716691

Reference Number 1551110-1
Sample Date Feb 04, 2022
Sample Time 10:30
Sample Location
Sample Description Bedrock #5 /
26388220204001 /
5.0°C
Matrix Water

Analyte		Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Routine Water - Continued							
Magnesium	Dissolved	mg/L	40.2	±2.9			0.2
Sodium	Dissolved	mg/L	68.9	±3.6			0.4
Potassium	Dissolved	mg/L	9.3	±0.6			0.4
Iron	Dissolved	mg/L	<0.01				0.01
Manganese	Dissolved	mg/L	0.220	±0.015			0.005
Chloride	Dissolved	mg/L	9.4	±0.6			0.4
Nitrate - N		mg/L	<0.01				0.01
Nitrite - N		mg/L	<0.005				0.005
Nitrate and Nitrite - N		mg/L	<0.01				0.01
Sulfate (SO ₄)	Dissolved	mg/L	92.2	±8.7			0.9
Hydroxide		mg/L	<5				
Carbonate		mg/L	<6				
Bicarbonate		mg/L	472				
P-Alkalinity	as CaCO ₃	mg/L	<5				5
T-Alkalinity	as CaCO ₃	mg/L	387	±15			5
Total Dissolved Solids	Calculated	mg/L	521				1
Hardness	Dissolved as CaCO ₃	mg/L	337				
Ionic Balance	Dissolved	%	101				

Approved by:



Anthony Neumann, MSc
General Manager

Data have been validated by Analytical Quality Control and Element's Integrated Data Validation System (IDVS).
Generation and distribution of the report, and approval by the digitized signature above, are performed through a secure and controlled automatic process.
* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Quality Control

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512	Lot ID: 1551110
Attn: Allisha Sordi	Project Name:	Control Number:
Sampled By: Ryley K.	Project Location:	Date Received: Feb 4, 2022
Company: Matrix Solutions Inc.	LSD:	Date Reported: Feb 10, 2022
	P.O.:	Report Number: 2716691
	Proj. Acct. code:	

Metals Dissolved

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Silicon	mg/L	-0.00170873	-0.04	0.05	yes
Sulfur	mg/L	0.0238982	-0.3	0.2	yes
Mercury	µg/L	-0.0004506	-0.038000	0.064000	yes
Aluminum	µg/L	-0.00757255	-2	2	yes
Antimony	µg/L	0.0060693	-0.2	0.2	yes
Arsenic	µg/L	0.00536604	-0.2	0.2	yes
Barium	µg/L	0.0369847	-1	1	yes
Beryllium	µg/L	0.0027293	-0.0	0.1	yes
Boron	µg/L	1.17848	-2	2	yes
Cadmium	µg/L	0.00135417	-0.01	0.01	yes
Chromium	µg/L	-0.026806	-0.3	0.3	yes
Cobalt	µg/L	-0.0395675	-0.1	0.1	yes
Copper	µg/L	0.0287491	-1	1	yes
Lead	µg/L	0.00380871	-0.1	0.1	yes
Lithium	µg/L	-0.0749186	-1	1	yes
Molybdenum	µg/L	0.0387697	-1	1	yes
Nickel	µg/L	0.00689652	-0.5	0.5	yes
Selenium	µg/L	0.00545393	-0.2	0.2	yes
Silver	µg/L	0.00194235	-0.10	0.10	yes
Strontium	µg/L	0.0602761	-1	1	yes
Thallium	µg/L	-0.0366589	-0.05	0.05	yes
Tin	µg/L	0.00606002	-1	1	yes
Titanium	µg/L	-0.0535952	-0.5	0.5	yes
Uranium	µg/L	0.00466491	-0.5	0.5	yes
Vanadium	µg/L	-0.00156854	-0.1	0.1	yes
Zinc	µg/L	0.024107	-0	2	yes
Zirconium	µg/L	0.0104355	-1	1	yes

Date Acquired: February 08, 2022

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Silicon	mg/L	0.33	0.31	10	0.01	yes
Sulfur	mg/L	6.2	6.2	10	0.1	yes
Mercury	mg/L	<0.000005	<0.000005	10	0.000030	yes
Aluminum	µg/L	12700	13700	10	11	yes
Antimony	µg/L	<0.2	<0.2	10	0.4	yes
Arsenic	µg/L	0.7	0.8	10	0.4	yes
Barium	µg/L	82	84	10	2	yes
Beryllium	µg/L	<0.1	<0.1	10	0.2	yes
Bismuth	µg/L	<0.5	<0.5	10	1.1	yes
Boron	µg/L	33	34	10	4	yes
Cadmium	µg/L	0.01	0.02	10	0.02	yes
Chromium	µg/L	<0.5	<0.5	10	1.1	yes
Cobalt	µg/L	<0.1	<0.1	10	0.2	yes
Copper	µg/L	1	1	10	2	yes
Lead	µg/L	<0.1	<0.1	10	0.2	yes
Lithium	µg/L	5	5	10	2	yes

Quality Control

Bill To: Matrix Solutions Inc.
11312 - 100 Avenue
Fort St. John, BC, Canada
V1J 1Z9
Attn: Allisha Sordi
Sampled By: Ryley K.
Company: Matrix Solutions Inc.

Project ID: 26388-512
Project Name:
Project Location:
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1551110**
Control Number:
Date Received: Feb 4, 2022
Date Reported: Feb 10, 2022
Report Number: 2716691

Metals Dissolved - Continued

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Molybdenum	µg/L	<1	<1	10	2	yes
Nickel	µg/L	1.2	1.2	10	1.1	yes
Selenium	µg/L	<0.2	<0.2	10	0.4	yes
Silver	µg/L	<0.01	<0.01	10	0.22	yes
Strontium	µg/L	173	177	10	2	yes
Thallium	µg/L	<0.05	<0.05	10	0.11	yes
Tin	µg/L	<1	<1	10	2	yes
Titanium	µg/L	0.5	0.6	10	1.1	yes
Uranium	µg/L	1.3	1.5	10	1.1	yes
Vanadium	µg/L	0.3	0.4	10	0.2	yes
Zinc	µg/L	7	7	10	2	yes

Date Acquired: February 08, 2022

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Aluminum	µg/L	945	917	1067	yes
Antimony	µg/L	39.3	36.4	44.2	yes
Arsenic	µg/L	39.8	36.7	43.3	yes
Barium	µg/L	200	182	211	yes
Beryllium	µg/L	19.4	17.3	22.1	yes
Bismuth	µg/L	96.2	89.1	108.3	yes
Boron	µg/L	382	344	434	yes
Cadmium	µg/L	1.96	1.86	2.25	yes
Chromium	µg/L	99.1	92.2	110.2	yes
Cobalt	µg/L	19.9	18.4	21.2	yes
Copper	µg/L	199	187	214	yes
Lead	µg/L	20.0	18.4	22.0	yes
Lithium	µg/L	187	175	223	yes
Molybdenum	µg/L	195	182	218	yes
Nickel	µg/L	98.5	93.3	105.9	yes
Selenium	µg/L	40.8	35.8	43.0	yes
Silver	µg/L	19.6	18.40	22.00	yes
Strontium	µg/L	196	180	216	yes
Thallium	µg/L	9.43	8.80	10.60	yes
Tin	µg/L	195	180	220	yes
Titanium	µg/L	97.9	92.4	110.4	yes
Uranium	µg/L	97.5	90.9	106.5	yes
Vanadium	µg/L	19.5	18.0	22.0	yes
Zinc	µg/L	199	183	219	yes
Zirconium	µg/L	207	180	220	yes

Date Acquired: February 08, 2022

Mercury	mg/L	0.000098	0.000070	0.000130	yes
---------	------	----------	----------	----------	-----

Date Acquired: February 07, 2022

Mercury	mg/L	0.000019	0.000006	0.000036	yes
Aluminum	µg/L	50	45	55	yes
Antimony	µg/L	1.9	1.8	2.3	yes

Quality Control

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512 Project Name: Project Location: LSD: P.O.:	Lot ID: 1551110 Control Number: Date Received: Feb 4, 2022 Date Reported: Feb 10, 2022 Report Number: 2716691
Attn: Allisha Sordi Sampled By: Ryley K. Company: Matrix Solutions Inc.	Proj. Acct. code:	

Metals Dissolved - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Arsenic	µg/L	1.9	1.8	2.2	yes
Barium	µg/L	10	9	11	yes
Beryllium	µg/L	0.9	0.9	1.1	yes
Bismuth	µg/L	5.0	4.1	5.5	yes
Boron	µg/L	20	18	22	yes
Cadmium	µg/L	0.10	0.09	0.11	yes
Chromium	µg/L	4.9	4.5	5.5	yes
Cobalt	µg/L	0.9	0.9	1.1	yes
Copper	µg/L	10	9	11	yes
Lead	µg/L	1.0	0.9	1.1	yes
Lithium	µg/L	10	9	11	yes
Molybdenum	µg/L	9	9	10	yes
Nickel	µg/L	4.9	4.4	5.5	yes
Selenium	µg/L	2.0	1.7	2.2	yes
Silver	µg/L	0.98	0.84	1.08	yes
Strontium	µg/L	10	9	11	yes
Thallium	µg/L	0.48	0.45	0.55	yes
Tin	µg/L	10	9	11	yes
Titanium	µg/L	4.7	4.5	5.5	yes
Uranium	µg/L	5.2	4.5	5.5	yes
Vanadium	µg/L	0.9	0.9	1.1	yes
Zinc	µg/L	10	9	11	yes
Zirconium	µg/L	11	9	11	yes
Date Acquired: February 08, 2022					
Silicon	mg/L	9.91	8.98	10.78	yes
Sulfur	mg/L	146	138.5	155.3	yes
Date Acquired: February 08, 2022					
Silicon	mg/L	2.05	1.88	2.24	yes
Sulfur	mg/L	10.1	9.2	11.0	yes
Date Acquired: February 08, 2022					
Silicon	mg/L	0.21	0.19	0.23	yes
Sulfur	mg/L	3.0	2.8	3.3	yes
Date Acquired: February 08, 2022					

Metals Total

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Aluminum	mg/L	0.0103552	-0.02	0.02	yes
Calcium	mg/L	-0.0213858	-0.1	0.1	yes
Iron	mg/L	0.0132963	-0.01	0.02	yes
Magnesium	mg/L	-0.00876405	-0.04	0.04	yes
Manganese	mg/L	0.000444092	-0.005	0.005	yes
Potassium	mg/L	0.000143232	-0.1	0.2	yes
Silicon	mg/L	0.0305047	-0.03	0.04	yes
Sodium	mg/L	0.000597309	-0.4	0.4	yes

Quality Control

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512	Lot ID: 1551110
Attn: Allisha Sordi	Project Name:	Control Number:
Sampled By: Ryley K.	Project Location:	Date Received: Feb 4, 2022
Company: Matrix Solutions Inc.	LSD:	Date Reported: Feb 10, 2022
	P.O.:	Report Number: 2716691
	Proj. Acct. code:	

Metals Total - Continued

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Sulfur	mg/L	0.00886641	-0.1	0.2	yes
Mercury	µg/L	-0.0002258	-0.038000	0.070000	yes
Antimony	µg/L	0.00941142	-0.2	0.2	yes
Arsenic	µg/L	0.00687434	-0.2	0.2	yes
Barium	µg/L	0.286963	-1	1	yes
Beryllium	µg/L	0.00643337	-0.1	0.1	yes
Bismuth	µg/L	0.00631247	-0.5	0.5	yes
Boron	µg/L	1.26083	-1	3	yes
Cadmium	µg/L	-0.00022146	-0.007	0.012	yes
Chromium	µg/L	0.1588	-0.7	0.3	yes
Cobalt	µg/L	0.0054771	-0.1	0.1	yes
Copper	µg/L	0.150406	-1	1	yes
Lead	µg/L	0.00912946	-0.1	0.1	yes
Lithium	µg/L	0.0410428	-1	1	yes
Molybdenum	µg/L	0.040102	-1	1	yes
Nickel	µg/L	0.00430546	-0.5	0.5	yes
Selenium	µg/L	0.00199371	-0.2	0.2	yes
Silver	µg/L	0.000975522	-0.02	0.10	yes
Strontium	µg/L	0.150522	-1	1	yes
Thallium	µg/L	0.000906476	-0.05	0.05	yes
Tin	µg/L	0.0139829	-1	1	yes
Titanium	µg/L	-0.00555297	-0.5	0.5	yes
Uranium	µg/L	0.00238988	-0.5	0.5	yes
Vanadium	µg/L	-0.0148131	-0.1	0.1	yes
Zinc	µg/L	0.480995	-4	4	yes
Zirconium	µg/L	0.0148302	-1	1	yes

Date Acquired: February 08, 2022

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Iron	mg/L	32.5	33.1	15	0.20	yes
Manganese	mg/L	5.44	5.58	15	0.010	yes
Mercury	mg/L	<0.000005	<0.000005	10	0.000030	yes
Antimony	µg/L	0.5	0.5	15	0.4	yes
Arsenic	µg/L	<0.2	<0.2	15	0.4	yes
Barium	µg/L	22	22	15	2	yes
Beryllium	µg/L	<0.1	<0.1	15	0.2	yes
Bismuth	µg/L	<0.5	<0.5	15	1.1	yes
Boron	µg/L	126	125	15	4	yes
Cadmium	µg/L	<0.01	<0.01	15	0.022	yes
Chromium	µg/L	<0.5	<0.5	15	1.1	yes
Cobalt	µg/L	<0.1	<0.1	15	0.2	yes
Copper	µg/L	<1	<1	15	2	yes
Lead	µg/L	<0.1	<0.1	15	0.2	yes
Lithium	µg/L	59	58	15	2	yes
Molybdenum	µg/L	2	2	15	2	yes
Nickel	µg/L	<0.5	<0.5	15	1.1	yes

Quality Control

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512	Lot ID: 1551110
Attn: Allisha Sordi	Project Name:	Control Number:
Sampled By: Ryley K.	Project Location:	Date Received: Feb 4, 2022
Company: Matrix Solutions Inc.	LSD:	Date Reported: Feb 10, 2022
	P.O.:	Report Number: 2716691
	Proj. Acct. code:	

Metals Total - Continued

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Selenium	µg/L	<0.1	<0.1	15	0.4	yes
Silver	µg/L	<0.01	<0.01	15	0.22	yes
Strontium	µg/L	378	377	15	2	yes
Thallium	µg/L	<0.05	<0.05	15	0.11	yes
Tin	µg/L	<1	<1	15	2	yes
Titanium	µg/L	<0.5	<0.5	15	1.1	yes
Uranium	µg/L	<0.5	<0.5	15	1.1	yes
Vanadium	µg/L	<0.1	<0.1	15	0.2	yes
Zinc	µg/L	<4	<4	15	2	yes
Zirconium	µg/L	<1	<1	15	2	yes

Date Acquired: February 08, 2022

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Aluminum	mg/L	4.04	3.61	4.45	yes
Calcium	mg/L	51.7	47.6	54.2	yes
Iron	mg/L	2.12	1.91	2.21	yes
Magnesium	mg/L	20.2	17.88	21.86	yes
Manganese	mg/L	0.532	0.472	0.568	yes
Potassium	mg/L	51.3	46.9	55.9	yes
Silicon	mg/L	2.18	1.96	2.26	yes
Sodium	mg/L	51.8	47.0	57.2	yes
Sulfur	mg/L	10.6	9.2	11.2	yes
Antimony	µg/L	12.1	10.8	13.2	yes
Arsenic	µg/L	11.3	10.8	12.9	yes
Barium	µg/L	59	54	68	yes
Beryllium	µg/L	6.3	4.9	6.8	yes
Bismuth	µg/L	30.0	26.2	35.8	yes
Boron	µg/L	127	102	139	yes
Cadmium	µg/L	0.56	0.543	0.675	yes
Chromium	µg/L	31.0	26.5	33.7	yes
Cobalt	µg/L	6.2	5.2	6.8	yes
Copper	µg/L	61	53	67	yes
Lead	µg/L	6.1	5.2	7.1	yes
Lithium	µg/L	60	53	77	yes
Molybdenum	µg/L	61	56	66	yes
Nickel	µg/L	31.8	27.6	32.8	yes
Selenium	µg/L	12.6	9.9	13.5	yes
Silver	µg/L	6.36	5.39	7.13	yes
Strontium	µg/L	61	55	65	yes
Thallium	µg/L	2.94	2.70	3.60	yes
Tin	µg/L	63	56	66	yes
Titanium	µg/L	30.8	26.6	35.7	yes
Uranium	µg/L	30.5	25.7	36.3	yes
Vanadium	µg/L	6.2	5.1	7.2	yes
Zinc	µg/L	58	53	65	yes
Zirconium	µg/L	64	53	67	yes

Quality Control

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512 Project Name: Project Location: LSD: P.O.:	Lot ID: 1551110 Control Number: Date Received: Feb 4, 2022 Date Reported: Feb 10, 2022 Report Number: 2716691
Attn: Allisha Sordi Sampled By: Ryley K. Company: Matrix Solutions Inc.	Proj. Acct. code:	

Metals Total - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Date Acquired: February 08, 2022					
Antimony	µg/L	41.2	37.5	43.1	yes
Arsenic	µg/L	38.8	36.5	43.5	yes
Barium	µg/L	190	183	212	yes
Beryllium	µg/L	19.5	17.1	21.9	yes
Bismuth	µg/L	93.5	88.2	106.2	yes
Boron	µg/L	402	343	436	yes
Cadmium	µg/L	2.11	1.910	2.210	yes
Chromium	µg/L	97.3	90.0	110.0	yes
Cobalt	µg/L	19.8	18.1	21.7	yes
Copper	µg/L	201	188	212	yes
Lead	µg/L	19.5	18.0	24.0	yes
Lithium	µg/L	202	173	222	yes
Molybdenum	µg/L	195	182	218	yes
Nickel	µg/L	97.2	90.0	110.0	yes
Selenium	µg/L	40.7	36.7	43.3	yes
Silver	µg/L	19.9	18.00	22.00	yes
Strontium	µg/L	204	171	231	yes
Thallium	µg/L	9.14	9.01	10.99	yes
Tin	µg/L	202	190	218	yes
Titanium	µg/L	97.0	93.2	107.0	yes
Uranium	µg/L	96.0	90.2	109.0	yes
Vanadium	µg/L	19.6	16.9	22.1	yes
Zinc	µg/L	198	183	218	yes
Zirconium	µg/L	200	188	218	yes
Date Acquired: February 08, 2022					
Mercury	mg/L	0.000096	0.000070	0.000130	yes
Antimony	µg/L	12.6	10.8	13.2	yes
Arsenic	µg/L	11.9	10.8	13.2	yes
Barium	µg/L	61	55	67	yes
Beryllium	µg/L	6.0	5.2	6.5	yes
Bismuth	µg/L	30.7	27.3	31.9	yes
Boron	µg/L	120	108	132	yes
Cadmium	µg/L	0.60	0.540	0.660	yes
Chromium	µg/L	29.8	27.0	33.0	yes
Cobalt	µg/L	6.0	5.4	6.6	yes
Copper	µg/L	60	54	66	yes
Lead	µg/L	6.4	5.4	6.6	yes
Lithium	µg/L	60	53	66	yes
Molybdenum	µg/L	58	53	64	yes
Nickel	µg/L	29.9	27.1	33.1	yes
Selenium	µg/L	12.5	10.3	13.4	yes
Silver	µg/L	6.05	5.40	6.60	yes
Strontium	µg/L	61	54	66	yes

Quality Control

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512 Project Name: Project Location: LSD: P.O.:	Lot ID: 1551110 Control Number: Date Received: Feb 4, 2022 Date Reported: Feb 10, 2022 Report Number: 2716691
Attn: Allisha Sordi	Proj. Acct. code:	
Sampled By: Ryley K.		
Company: Matrix Solutions Inc.		

Metals Total - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Thallium	µg/L	3.00	0.00	6.00	yes
Tin	µg/L	60	54	66	yes
Titanium	µg/L	29.7	27.0	33.0	yes
Uranium	µg/L	30.8	27.0	33.0	yes
Vanadium	µg/L	5.9	5.4	6.6	yes
Zinc	µg/L	59	56	64	yes
Zirconium	µg/L	60	54	66	yes

Date Acquired: February 08, 2022

Mercury	mg/L	0.000018	0.000006	0.000036	yes
Antimony	µg/L	2.1	1.8	2.2	yes
Arsenic	µg/L	2.0	1.7	2.2	yes
Barium	µg/L	10	9	10	yes
Beryllium	µg/L	0.9	0.8	1.1	yes
Bismuth	µg/L	5.0	4.6	5.3	yes
Boron	µg/L	22	17	23	yes
Cadmium	µg/L	0.11	0.089	0.113	yes
Chromium	µg/L	5.0	4.6	5.3	yes
Cobalt	µg/L	1.0	0.9	1.1	yes
Copper	µg/L	10	9	11	yes
Lead	µg/L	1.0	0.9	1.1	yes
Lithium	µg/L	10	9	11	yes
Molybdenum	µg/L	10	9	10	yes
Nickel	µg/L	4.9	4.5	5.5	yes
Selenium	µg/L	2.0	1.6	2.2	yes
Silver	µg/L	0.99	0.89	1.13	yes
Strontium	µg/L	10	9	11	yes
Thallium	µg/L	0.49	0.44	0.56	yes
Tin	µg/L	10	9	11	yes
Titanium	µg/L	5.0	4.2	5.7	yes
Uranium	µg/L	5.0	4.7	5.3	yes
Vanadium	µg/L	1.0	0.9	1.2	yes
Zinc	µg/L	10	9	11	yes
Zirconium	µg/L	11	9	11	yes

Date Acquired: February 08, 2022

Aluminum	mg/L	19.3	18.80	20.60	yes
Calcium	mg/L	243	231.3	258.9	yes
Iron	mg/L	9.62	9.06	10.14	yes
Magnesium	mg/L	96.6	92.78	104.72	yes
Manganese	mg/L	2.40	2.290	2.590	yes
Potassium	mg/L	249	234.2	261.8	yes
Silicon	mg/L	9.95	9.13	10.93	yes
Sodium	mg/L	248	228.8	269.4	yes
Sulfur	mg/L	152	135.5	165.3	yes

Date Acquired: February 08, 2022

Quality Control

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512	Lot ID: 1551110
Attn: Allisha Sordi	Project Name:	Control Number:
Sampled By: Ryley K.	Project Location:	Date Received: Feb 4, 2022
Company: Matrix Solutions Inc.	LSD:	Date Reported: Feb 10, 2022
	P.O.:	Report Number: 2716691
	Proj. Acct. code:	

Metals Total - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Aluminum	mg/L	4.04	3.60	4.40	yes
Calcium	mg/L	51.3	46.5	56.5	yes
Iron	mg/L	2.09	1.87	2.27	yes
Magnesium	mg/L	20.3	18.05	22.07	yes
Manganese	mg/L	0.521	0.466	0.568	yes
Potassium	mg/L	51.5	45.4	55.5	yes
Silicon	mg/L	2.10	1.93	2.24	yes
Sodium	mg/L	52.1	45.9	55.9	yes
Sulfur	mg/L	10.6	9.3	11.3	yes
Date Acquired: February 08, 2022					
Aluminum	mg/L	0.42	0.36	0.44	yes
Calcium	mg/L	5.3	4.8	5.8	yes
Iron	mg/L	0.22	0.19	0.25	yes
Magnesium	mg/L	2.1	1.84	2.20	yes
Manganese	mg/L	0.054	0.047	0.059	yes
Potassium	mg/L	5.3	4.8	5.8	yes
Silicon	mg/L	0.22	0.17	0.23	yes
Sodium	mg/L	5.3	4.8	5.6	yes
Sulfur	mg/L	3.1	2.8	3.3	yes
Date Acquired: February 08, 2022					

Physical and Aggregate Properties

Blanks		Units	Measured	Lower Limit	Upper Limit	Passed QC	
Turbidity		NTU	0.047	-0.1	0.1	yes	
Date Acquired:		February 09, 2022					
Turbidity		NTU	0.096	0.0	0.1	yes	
Date Acquired:		February 09, 2022					
Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC	
Turbidity		NTU	3.3	3.0	10	0.2	yes
Solids		mg/L	260	280	10	2	yes
Date Acquired:		February 08, 2022					
Control Sample	Units	Measured	Lower Limit	Upper Limit		Passed QC	
Turbidity		NTU	1920	1856.7	2054.7	yes	
Date Acquired:		February 09, 2022					
Turbidity		NTU	5830	4441.7	6661.7	yes	
Date Acquired:		February 09, 2022					
Turbidity		NTU	151	132.1	162.1	yes	
Solids		mg/L	190	174	209	yes	
Date Acquired:		February 08, 2022					
Turbidity		NTU	13.8	12.6	15.6	yes	
Solids		mg/L	14	10	22	yes	
Date Acquired:		February 08, 2022					
Turbidity		NTU	1.5	1.0	2.2	yes	

Quality Control

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512	Lot ID: 1551110
Attn: Allisha Sordi	Project Name:	Control Number:
Sampled By: Ryley K.	Project Location:	Date Received: Feb 4, 2022
Company: Matrix Solutions Inc.	LSD:	Date Reported: Feb 10, 2022
	P.O.:	Report Number: 2716691
	Proj. Acct. code:	

Physical and Aggregate Properties - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
----------------	-------	----------	-------------	-------------	-----------

Date Acquired: February 09, 2022

Routine Water

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Calcium	mg/L	0.0111932	-0.2	0.2	yes
Magnesium	mg/L	0.00349314	-0.1	0.1	yes
Sodium	mg/L	0.0187912	-0.4	0.4	yes
Potassium	mg/L	0.0421882	-0.4	0.4	yes
Iron	mg/L	0.00200587	-0.01	0.01	yes
Manganese	mg/L	0.000106004	-0.004	0.004	yes
Chloride	mg/L	0.19	-0.4	0.4	yes
Nitrate - N	mg/L	0	-0.01	0.01	yes
Nitrite - N	mg/L	0	-0.005	0.005	yes

Date Acquired: February 08, 2022

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
pH		7.57	7.58	0	0.10	yes
Electrical Conductivity	dS/m	1.13	1.12	10	0.002	yes
Calcium	mg/L	12.3	12.2	10	0.6	yes
Magnesium	mg/L	7.3	7.3	10	0.7	yes
Sodium	mg/L	53.7	54.1	10	1.2	yes
Potassium	mg/L	4.2	4.2	10	1.2	yes
Iron	mg/L	0.26	0.26	10	0.05	yes
Manganese	mg/L	0.490	0.492	10	0.010	yes
Chloride	mg/L	180	180	10	0.5	yes
Nitrate - N	mg/L	3.7	3.7	10	0.01	yes
Nitrite - N	mg/L	0.34	0.35	10	0.010	yes
Hydroxide	mg/L	<5	<5	10		yes
Carbonate	mg/L	<6	<6	10	6	yes
Bicarbonate	mg/L	463	457	10	6	yes
P-Alkalinity	mg/L	<5	<5	10	5	yes
T-Alkalinity	mg/L	379	375	10	5	yes

Date Acquired: February 07, 2022

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Chloride	mg/L	2060	1847.4	2256.0	yes
Electrical Conductivity	dS/m	32.2	27.200	36.800	yes
pH		9.18	8.90	9.44	yes
Temperature of observed	°C	20.6	15.5	24.5	yes
Electrical Conductivity	dS/m	2.74	2.631	2.829	yes
Calcium	mg/L	247	230.0	260.0	yes
Magnesium	mg/L	97.5	91.3	103.3	yes
Sodium	mg/L	247	233.3	257.3	yes

Quality Control

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512 Project Name: Project Location: LSD: P.O.: Proj. Acct. code:	Lot ID: 1551110 Control Number: Date Received: Feb 4, 2022 Date Reported: Feb 10, 2022 Report Number: 2716691
Attn: Allisha Sordi Sampled By: Ryley K. Company: Matrix Solutions Inc.		

Routine Water - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Potassium	mg/L	250	229.0	259.0	yes
Iron	mg/L	9.57	8.91	10.20	yes
Manganese	mg/L	2.39	2.240	2.540	yes
Nitrate - N	mg/L	10.1	9.03	11.13	yes
Nitrite - N	mg/L	9.85	9.010	10.990	yes
Nitrate and Nitrite - N	mg/L	19.9	19.10	20.90	yes
P-Alkalinity	mg/L	523	442	584	yes
T-Alkalinity	mg/L	1040	925	1063	yes

Date Acquired: February 07, 2022

pH		6.89	6.79	6.97	yes
Temperature of observed	°C	20.4	15.5	24.5	yes
Electrical Conductivity	dS/m	0.074	0.069	0.085	yes
Calcium	mg/L	51.8	44.9	56.9	yes
Magnesium	mg/L	20.3	17.9	22.0	yes
Sodium	mg/L	51.6	47.7	55.5	yes
Potassium	mg/L	51.2	45.8	55.8	yes
Iron	mg/L	2.03	1.89	2.25	yes
Manganese	mg/L	0.509	0.468	0.552	yes
Chloride	mg/L	81.4	74.9	86.9	yes
Nitrate - N	mg/L	4.77	4.37	5.33	yes
Nitrite - N	mg/L	4.78	4.370	5.330	yes
Nitrate and Nitrite - N	mg/L	9.56	8.80	10.60	yes
P-Alkalinity	mg/L	44	28	72	yes
T-Alkalinity	mg/L	120	114	140	yes

Date Acquired: February 07, 2022

Calcium	mg/L	5.3	4.7	5.8	yes
Magnesium	mg/L	2.1	1.9	2.2	yes
Sodium	mg/L	5.3	4.7	5.7	yes
Potassium	mg/L	5.2	4.7	5.7	yes
Iron	mg/L	0.21	0.19	0.24	yes
Manganese	mg/L	0.053	0.048	0.058	yes
Chloride	mg/L	13.9	13.3	16.5	yes
Nitrate - N	mg/L	0.52	0.42	0.57	yes
Nitrite - N	mg/L	0.509	0.424	0.564	yes
Nitrate and Nitrite - N	mg/L	1.03	0.85	1.15	yes

Date Acquired: February 08, 2022

Methodology and Notes

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512	Lot ID: 1551110
Attn: Allisha Sordi	Project Name:	Control Number:
Sampled By: Ryley K.	Project Location:	Date Received: Feb 4, 2022
Company: Matrix Solutions Inc.	LSD:	Date Reported: Feb 10, 2022
	P.O.:	Report Number: 2716691
	Proj. Acct. code:	

Method of Analysis

Method Name	Reference	Method	Date Analysis Started	Location
Alkalinity, pH, and EC in water	APHA	* Alkalinity - Titration Method, 2320 B	Feb 7, 2022	Element Edmonton - Roper Road
Alkalinity, pH, and EC in water	APHA	* Conductivity, 2510 B	Feb 7, 2022	Element Edmonton - Roper Road
Alkalinity, pH, and EC in water	APHA	* pH - Electrometric Method, 4500-H+ B	Feb 7, 2022	Element Edmonton - Roper Road
Anions (Routine) by Ion Chromatography	APHA	* Ion Chromatography with Chemical Suppression of Eluent Cond., 4110 B	Feb 8, 2022	Element Edmonton - Roper Road
Approval-Edmonton	APHA	Checking Correctness of Analyses, 1030 E	Feb 9, 2022	Element Edmonton - Roper Road
Chloride in Water	APHA	* Automated Ferricyanide Method, 4500-Cl- E	Feb 8, 2022	Element Edmonton - Roper Road
Mercury (Dissolved) in water	APHA	* Cold Vapour Atomic Absorption Spectrometric Method, 3112 B	Feb 7, 2022	Element Edmonton - Roper Road
Mercury (Dissolved) in water	EPA	* Mercury in Water by Cold Vapor Atomic Fluorescence Spectrometry, 245.7	Feb 7, 2022	Element Edmonton - Roper Road
Mercury (Total) in water	EPA	* Mercury in Water by Cold Vapor Atomic Fluorescence Spectrometry, 245.7	Feb 7, 2022	Element Edmonton - Roper Road
Metals ICP-MS (Dissolved) in water	APHA/USEPA	* Metals By Inductively Coupled Plasma/Mass Spectrometry, APHA 3125 B / USEPA 200.2, 200.8	Feb 8, 2022	Element Edmonton - Roper Road
Metals ICP-MS (Dissolved) in water	US EPA	* Determination of Trace Elements in Waters and Wastes by ICP-MS, 200.8	Feb 8, 2022	Element Edmonton - Roper Road
Metals ICP-MS (Total) in water	APHA/USEPA	* Metals By Inductively Coupled Plasma/Mass Spectrometry, APHA 3125 B / USEPA 200.2, 200.8	Feb 8, 2022	Element Edmonton - Roper Road
Metals ICP-MS (Total) in water	US EPA	* Determination of Trace Elements in Waters and Wastes by ICP-MS, 200.8	Feb 8, 2022	Element Edmonton - Roper Road
Metals Trace (Dissolved) in water	APHA	Hardness by Calculation, 2340 B	Feb 8, 2022	Element Edmonton - Roper Road
Metals Trace (Dissolved) in water	APHA	* Inductively Coupled Plasma (ICP) Method, 3120 B	Feb 8, 2022	Element Edmonton - Roper Road
Metals Trace (Total) in water	APHA	* Inductively Coupled Plasma (ICP) Method, 3120 B	Feb 8, 2022	Element Edmonton - Roper Road
Solids Suspended (Total, Fixed and Volatile)	APHA	* Total Suspended Solids Dried at 103-105°C, 2540 D	Feb 8, 2022	Element Edmonton - Roper Road
Turbidity in Water	APHA	* Turbidity - Nephelometric Method, 2130 B	Feb 9, 2022	Element Edmonton - Roper Road

* Reference Method Modified

References

APHA	Standard Methods for the Examination of Water and Wastewater
APHA/USEPA	Standard Methods For Water/ Environmental Protection Agency
EPA	Environmental Protection Agency Test Methods - US
US EPA	US Environmental Protection Agency Test Methods

Methodology and Notes

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512 Project Name: Project Location: LSD: P.O.:	Lot ID: 1551110 Control Number: Date Received: Feb 4, 2022 Date Reported: Feb 10, 2022 Report Number: 2716691
Attn: Allisha Sordi Sampled By: Ryley K. Company: Matrix Solutions Inc.	Proj. Acct. code:	

Comments:

- Feb 09, 2022 - Sample 1551110-1; 7894090: Some trace total metal results were less than dissolved metal results for sample 1551110-1. Total metals were analyzed from the metals bottle and dissolved from the routine bottle. Results were verified.
- Feb 10, 2022 - Sample 1551110-1; 7894090: Total silver results were less than dissolved metal results for sample(s) 1551110-1. Total metals were analyzed from the metals bottle and dissolved from the routine bottle. Results were verified.
- Feb 10, 2022 - Sample 1551110-1; 7894090: Some ICP-MS total metal results were less than dissolved metal results for sample 1551110-1. The results were verified and are within expected measurement uncertainty.

Please direct any inquiries regarding this report to our Client Services group.

Results relate only to samples as submitted.

The test report shall not be reproduced except in full, without the written approval of the laboratory.



Project Information

Project ID: 20388-512
Project Name: _____
Project Location: _____
Legal Location: _____
PO/AFE#: _____
Proj. Acct. Code: _____
Quote #: _____

Invoice To

Company: Matrix Solutions Inc
Address: _____
Attention: Allison Ford
Phone: _____
Cell: _____
E-mail: aford@matrix-solutions.com
Government Funded Work YES / NO
SRP # _____
Agreement ID: _____

Report To

Company: Matrix
Address: _____
Attention: _____
Phone: _____
Cell: _____
Fax: _____
E-mail 1: eds@matrix-solutions.com
E-mail 2: _____
Copy of Invoice: YES / NO

Additional Reports to

1) Name: _____
E-mail: _____
2) Name: _____
E-mail: _____
Sample Custody
Sampled by: Kyle
Company: _____
I authorize Element to proceed with the work indicated on this form:
Signature: _____
Date/Time: _____

RUSH Priority

- ☐ Same Day (200%)
☐ Next Day/Two Day (100%)
☐ Three or Four Days (50%)
☒ 5 to 7 Days (Regular TAT)

Date Required Feb 9, 2022

When "ASAP" is requested, turn around will default to a 100% RUSH priority, with pricing and turn around time to match. Please contact the lab prior to submitting RUSH samples. If not all samples require RUSH, please indicate in the special instructions.

Report Results

- ☐ Email ☐ QA/QC
☐ Online ☐ PDF
☐ Fax ☐ Excel

Requirements

- ☐ HCDWQ ☐ SPIGEC
☐ AB Tier 1 ☐ BCCSR
Other (list below)

Special Instructions/Comments (please include contact information including phone number if different from above).

Piss - Filtered & preserved infield, Total - preserved

	Site I.D.	Sample Description	Depth		Date/Time sampled	Matrix	Sampling method	#	MeOH Field Preserved?	Enter tests above (✓ relevant samples below)											
			start	end in cm																	
1	2038822024001	Bedrock #5			Feb 4, 2022	H ₂ O		5													
2					@ 1030																
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10																					
11																					
12																					
13																					
14																					
15																					

Please indicate any potentially hazardous samples

Submission of this form acknowledges acceptance of Element's Standard of terms and conditions (<https://www.element.com/terms/terms-and-conditions>)

Page _____ of _____ Control #
ED 120-06

Lot: 1551110^{COC}



Temp. received: 5.0 °C
Date/Time stamp: 2022 02 04 15:17
Delivery Method: _____
Waybill: _____
Received by: [Signature]

Report Transmission Cover Page

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512 Project Name: Burnco West Cochrane Gravel Project Location: West Cochrane Gravel Pit	Lot ID: 1571114 Control Number: 116931 Date Received: May 13, 2022 Date Reported: May 19, 2022 Report Number: 2747745
Attn: Allisha Sordi Sampled By: R. Veitch Company: Matrix Solutions Inc.	LSD: P.O.: Proj. Acct. code:	

Contact	Company	Address
Accounts Payable	Matrix Solutions Inc.	Suite 600, 214 11 Ave SW Calgary, AB T2R 0K1 Phone: (403) 237-0606 Fax: (403) 263-2493 Email: ap@matrix-solutions.com

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / Invoice
Allisha Sordi	Matrix Solutions Inc.	11312 - 100 Avenue Fort St. John, BC V1J 1Z9 Phone: (250) 785-7833 Fax: (250) 785-7813 Email: asordi@matrix-solutions.com

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / COA
Email - Merge Reports	PDF	COC / Test Report
Email - Single Report	Equis Matrix Batch File (with QC)	Test Report
Email - Single Report	Equis Matrix Sample File (with QC)	Test Report
Email - Single Report	Equis Matrix Test Result File (with QC)	Test Report

EDS	Matrix Solutions Inc.	Suite 600 214-11th Ave SW Calgary, AB T2R 0K1 Phone: (403) 700-2058 Fax: Email: eds@matrix-solutions.com
-----	-----------------------	---

Delivery	Format	Deliverables
Email - Single Report	Equis Matrix Batch File (with QC)	Test Report
Email - Single Report	Equis Matrix Sample File (with QC)	Test Report
Email - Single Report	Equis Matrix Test Result File (with QC)	Test Report
Email - Single Report	PDF	COA
Email - Single Report	PDF	COC / COA
Email - Single Report	PDF	COC / Test Report
Email - Single Report	PDF	Invoice

Ryley Killam	Matrix Solutions Inc.	Suite 600 214-11th Ave SW Calgary, AB T2R 0K1 Phone: (403) 237-0606 Fax: (403) 263-2493 Email: rkillam@matrix-solutions.com
--------------	-----------------------	--

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / COA
Email - Merge Reports	PDF	COC / Test Report

Notes To Clients:

- May 16, 2022 - Sample 1571114-9; 8047280: Sample 1571114-9 : There was insufficient sample volume to reach a detection limit of 2 mg/L for TSS analysis. The detection limit was adjusted accordingly.
- May 17, 2022 - Some trace total metal results were less than dissolved metal results for sample 157114-2. The results were verified and are within expected measurement uncertainty.
- May 18, 2022 - Some ICP-MS total metal results were less than dissolved metal results for samples 1571114-1 to 9. The results were verified and are within expected measurement uncertainty.

The information contained on this and all other pages transmitted, is intended for the addressee only and is considered confidential. If the reader is not the intended recipient, you are hereby notified that any use, dissemination, distribution or copy of this transmission is strictly prohibited. If you receive this transmission by error, or if this transmission is not satisfactory, please notify us by telephone.

Report Transmission Cover Page

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512	Lot ID: 1571114
Attn: Allisha Sordi	Project Name: Burnco West Cochrane Gravel	Control Number: 116931
Sampled By: R. Veitch	Project Location: West Cochrane Gravel Pit	Date Received: May 13, 2022
Company: Matrix Solutions Inc.	LSD:	Date Reported: May 19, 2022
	P.O.:	Report Number: 2747745
	Proj. Acct. code:	

Notes To Clients:

- May 18, 2022 - Total copper results were less than dissolved copper results for sample(s) 1571114-2, 7 and 9. Total metals were analyzed from the metals bottle and dissolved from the field filtered bottle. Results were verified.

Analytical Report

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512 Project Name: Burnco West Cochrane Gravel Project Location: West Cochrane Gravel Pit	Lot ID: 1571114 Control Number: 116931 Date Received: May 13, 2022 Date Reported: May 19, 2022 Report Number: 2747745
Attn: Allisha Sordi Sampled By: R. Veitch Company: Matrix Solutions Inc.	LSD: P.O.: Proj. Acct. code:	

Reference Number	1571114-1	1571114-2
Sample Date	May 10, 2022	May 10, 2022
Sample Time	NA	NA
Sample Location		
Sample Description	26388220510101 / 1.3°C Water	26388220510102 / 1.3°C Water
Matrix		

Analyte	Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Metals Dissolved						
Silicon	Dissolved	mg/L	4.37 ±0.39	4.52 ±0.41		0.05
Sulfur	Dissolved	mg/L	12.9 ±1.2	22.3 ±2.1		0.3
Mercury	Dissolved	mg/L	<0.000005	<0.000005		0.000005
Aluminum	Dissolved	mg/L	<0.002	0.004 ±0.00053		0.002
Antimony	Dissolved	mg/L	<0.0002	<0.0002		0.0002
Arsenic	Dissolved	mg/L	0.0002 ±0.00005	<0.0002		0.0002
Barium	Dissolved	mg/L	0.156 ±0.009	0.153 ±0.009		0.001
Beryllium	Dissolved	mg/L	<0.0001	<0.0001		0.0001
Bismuth	Dissolved	mg/L	<0.0005	<0.0005		0.0005
Boron	Dissolved	mg/L	0.041 ±0.004	0.044 ±0.004		0.002
Cadmium	Dissolved	mg/L	0.00001 ±0.	0.00001 ±0.		0.00001
Chromium	Dissolved	mg/L	<0.0005	<0.0005		0.0005
Cobalt	Dissolved	mg/L	<0.0001	<0.0001		0.0001
Copper	Dissolved	mg/L	0.002 ±0.0001	0.005 ±0.0004		0.001
Lead	Dissolved	mg/L	<0.0001	<0.0001		0.0001
Lithium	Dissolved	mg/L	0.018 ±0.001	0.020 ±0.002		0.001
Molybdenum	Dissolved	mg/L	0.002 ±0.00009	0.002 ±0.00009		0.001
Nickel	Dissolved	mg/L	0.0006 ±0.00004	<0.0005		0.0005
Selenium	Dissolved	mg/L	0.0008 ±0.0003	0.0011 ±0.0003		0.0002
Silver	Dissolved	mg/L	<0.00001	<0.00001		0.00001
Strontium	Dissolved	mg/L	0.777 ±0.059	0.767 ±0.058		0.001
Thallium	Dissolved	mg/L	<0.00005	<0.00005		0.00005
Tin	Dissolved	mg/L	<0.001	<0.001		0.001
Titanium	Dissolved	mg/L	<0.0005	<0.0005		0.0005
Uranium	Dissolved	mg/L	0.0032 ±0.0002	0.0049 ±0.0004		0.0005
Vanadium	Dissolved	mg/L	<0.0001	<0.0001		0.0001
Zinc	Dissolved	mg/L	0.001 ±0.00021	0.001 ±0.00022		0.001
Zirconium	Dissolved	mg/L	<0.001	<0.001		0.001
Subsample			Field Filtered	Field Filtered		
Metals Total						
Aluminum	Total	mg/L	<0.02	0.08		0.02
Calcium	Total	mg/L	64.7 ±0.3	67.0 ±0.3		0.2
Iron	Total	mg/L	<0.05	0.09 ±0.2		0.05
Magnesium	Total	mg/L	48.5 ±0.6	60.6 ±0.8		0.2
Manganese	Total	mg/L	<0.005	<0.005		0.005
Potassium	Total	mg/L	2.8 ±0.3	2.9 ±0.3		0.4
Silicon	Total	mg/L	4.52 ±0.10	4.70 ±0.10		0.05

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To:	Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID:	26388-512	Lot ID:	1571114		
		Project Name:	Burnco West Cochrane Gravel	Control Number:	116931		
		Project Location:	West Cochrane Gravel Pit	Date Received:	May 13, 2022		
Attn:	Allisha Sordi	LSD:		Date Reported:	May 19, 2022		
Sampled By:	R. Veitch	P.O.:		Report Number:	2747745		
Company:	Matrix Solutions Inc.	Proj. Acct. code:					
		Reference Number	1571114-1		1571114-2		
		Sample Date	May 10, 2022		May 10, 2022		
		Sample Time	NA		NA		
		Sample Location					
		Sample Description	26388220510101 / 1.3°C		26388220510102 / 1.3°C		
		Matrix	Water		Water		
Analyte		Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Metals Total - Continued							
Sodium	Total	mg/L	37.2	±1.1	51.7	±1.5	0.4
Sulfur	Total	mg/L	13.6	±0.1	23.7	±0.2	0.3
Mercury	Total	mg/L	<0.000005		<0.000005		0.000005
Antimony	Total	mg/L	<0.0002		<0.0002		0.0002
Arsenic	Total	mg/L	<0.0002		<0.0002		0.0002
Barium	Total	mg/L	0.157	±0.014	0.153	±0.014	0.001
Beryllium	Total	mg/L	<0.0001		<0.0001		0.0001
Bismuth	Total	mg/L	<0.0005		<0.0005		0.0005
Boron	Total	mg/L	0.039	±0.004	0.042	±0.004	0.002
Cadmium	Total	mg/L	<0.00001		<0.00001		0.00001
Chromium	Total	mg/L	0.0005	±0.00008	<0.0005		0.0005
Cobalt	Total	mg/L	<0.0001		<0.0001		0.0001
Copper	Total	mg/L	<0.001		<0.001		0.001
Lead	Total	mg/L	<0.0001		<0.0001		0.0001
Lithium	Total	mg/L	0.018	±0.002	0.020	±0.002	0.001
Molybdenum	Total	mg/L	0.002	±0.0002	0.002	±0.0002	0.001
Nickel	Total	mg/L	0.0008	±0.00010	0.0007	±0.00008	0.0005
Selenium	Total	mg/L	0.0008	±0.0002	0.0010	±0.0002	0.0002
Silver	Total	mg/L	<0.00001		<0.00001		0.00001
Strontium	Total	mg/L	0.843	±0.090	0.810	±0.087	0.001
Thallium	Total	mg/L	<0.00005		<0.00005		0.00005
Tin	Total	mg/L	<0.001		<0.001		0.001
Titanium	Total	mg/L	<0.0005		0.0012	±0.0001	0.0005
Uranium	Total	mg/L	0.0036	±0.0003	0.0051	±0.0004	0.0005
Vanadium	Total	mg/L	<0.0001		0.0002	±0.00003	0.0001
Zinc	Total	mg/L	<0.004		<0.004		0.004
Zirconium	Total	mg/L	<0.001		<0.001		0.001
Physical and Aggregate Properties							
Turbidity		NTU	0.4	±0.01	0.7	±0.02	0.1
Solids	Total Suspended	mg/L	6	±1.0	11	±1	2
Routine Water							
pH			8.43	±0.10	8.42	±0.10	1
Temperature of observed pH		°C	18.2		18.3		
Electrical Conductivity	at 25 °C	µS/cm	760	±25	877	±29	1
Calcium	Dissolved	mg/L	62.6	±2.1	66.4	±2.3	0.2
Magnesium	Dissolved	mg/L	47.2	±3.4	58.7	±4.2	0.2

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512	Lot ID: 1571114
Attn: Allisha Sordi	Project Name: Burnco West Cochrane Gravel	Control Number: 116931
Sampled By: R. Veitch	Project Location: West Cochrane Gravel Pit	Date Received: May 13, 2022
Company: Matrix Solutions Inc.	LSD:	Date Reported: May 19, 2022
	P.O.:	Report Number: 2747745
	Proj. Acct. code:	

Reference Number	1571114-1	1571114-2
Sample Date	May 10, 2022	May 10, 2022
Sample Time	NA	NA
Sample Location		
Sample Description	26388220510101 / 1.3°C Water	26388220510102 / 1.3°C Water
Matrix		

Analyte	Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Routine Water - Continued						
Sodium	Dissolved	mg/L	35.6 ±1.9	49.9 ±2.6		0.4
Potassium	Dissolved	mg/L	2.5 ±0.2	3.0 ±0.2		0.4
Iron	Dissolved	mg/L	0.01 ±0.001	<0.01		0.01
Manganese	Dissolved	mg/L	<0.005	<0.005		0.005
Chloride	Dissolved	mg/L	35.8 ±2.2	35.4 ±2.2		0.4
Nitrate - N		mg/L	4.16 ±0.30	2.35 ±0.17		0.01
Nitrite - N		mg/L	<0.005	<0.005		0.005
Nitrate and Nitrite - N		mg/L	4.16	2.35		0.01
Sulfate (SO ₄)	Dissolved	mg/L	38.8 ±3.6	67.0 ±6.3		0.9
Hydroxide		mg/L	<5	<5		
Carbonate		mg/L	7	8		
Bicarbonate		mg/L	387	459		
P-Alkalinity	as CaCO ₃	mg/L	6 ±1.3	7 ±1.4		5
T-Alkalinity	as CaCO ₃	mg/L	329 ±13	390 ±16		5
Total Dissolved Solids	Calculated	mg/L	420	514		1
Hardness	Dissolved as CaCO ₃	mg/L	351	408		
Ionic Balance	Dissolved	%	99	101		

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512 Project Name: Burnco West Cochrane Gravel Project Location: West Cochrane Gravel Pit	Lot ID: 1571114 Control Number: 116931 Date Received: May 13, 2022 Date Reported: May 19, 2022 Report Number: 2747745
Attn: Allisha Sordi Sampled By: R. Veitch Company: Matrix Solutions Inc.	LSD: P.O.: Proj. Acct. code:	

Reference Number	1571114-3	1571114-4
Sample Date	May 10, 2022	May 10, 2022
Sample Time	NA	NA
Sample Location		
Sample Description	26388220510103 / 1.3°C Water	26388220510104 / 1.3°C Water
Matrix		

Analyte		Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Metals Dissolved							
Silicon	Dissolved	mg/L	4.03	±0.36	4.64	±0.42	0.05
Sulfur	Dissolved	mg/L	12.1	±1.1	24.7	±2.3	0.3
Mercury	Dissolved	mg/L	<0.000005		<0.000005		0.000005
Aluminum	Dissolved	mg/L	<0.002		<0.002		0.002
Antimony	Dissolved	mg/L	<0.0002		<0.0002		0.0002
Arsenic	Dissolved	mg/L	<0.0002		0.0002	±0.00006	0.0002
Barium	Dissolved	mg/L	0.217	±0.013	0.135	±0.008	0.001
Beryllium	Dissolved	mg/L	<0.0001		<0.0001		0.0001
Bismuth	Dissolved	mg/L	<0.0005		<0.0005		0.0005
Boron	Dissolved	mg/L	0.022	±0.002	0.050	±0.005	0.002
Cadmium	Dissolved	mg/L	<0.00001		<0.00001		0.00001
Chromium	Dissolved	mg/L	<0.0005		<0.0005		0.0005
Cobalt	Dissolved	mg/L	<0.0001		<0.0001		0.0001
Copper	Dissolved	mg/L	<0.001		<0.001		0.001
Lead	Dissolved	mg/L	<0.0001		<0.0001		0.0001
Lithium	Dissolved	mg/L	0.012	±0.0010	0.021	±0.002	0.001
Molybdenum	Dissolved	mg/L	0.001	±0.00007	0.002	±0.00008	0.001
Nickel	Dissolved	mg/L	<0.0005		<0.0005		0.0005
Selenium	Dissolved	mg/L	0.0008	±0.0003	0.0009	±0.0003	0.0002
Silver	Dissolved	mg/L	<0.00001		<0.00001		0.00001
Strontium	Dissolved	mg/L	0.613	±0.047	0.860	±0.065	0.001
Thallium	Dissolved	mg/L	<0.00005		<0.00005		0.00005
Tin	Dissolved	mg/L	<0.001		<0.001		0.001
Titanium	Dissolved	mg/L	<0.0005		<0.0005		0.0005
Uranium	Dissolved	mg/L	0.0021	±0.0002	0.0036	±0.0003	0.0005
Vanadium	Dissolved	mg/L	<0.0001		<0.0001		0.0001
Zinc	Dissolved	mg/L	<0.001		<0.001		0.001
Zirconium	Dissolved	mg/L	<0.001		<0.001		0.001
Subsample			Field Filtered		Field Filtered		
Metals Total							
Aluminum	Total	mg/L	0.03		<0.02		0.02
Calcium	Total	mg/L	66.8	±0.3	82.5	±0.4	0.2
Iron	Total	mg/L	<0.05		<0.05		0.05
Magnesium	Total	mg/L	52.2	±0.7	60.7	±0.8	0.2
Manganese	Total	mg/L	<0.005		<0.005		0.005
Potassium	Total	mg/L	2.6	±0.3	2.9	±0.3	0.4
Silicon	Total	mg/L	4.22	±0.10	4.85	±0.10	0.05

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512 Project Name: Burnco West Cochrane Gravel Project Location: West Cochrane Gravel Pit	Lot ID: 1571114 Control Number: 116931 Date Received: May 13, 2022 Date Reported: May 19, 2022 Report Number: 2747745
Attn: Allisha Sordi Sampled By: R. Veitch Company: Matrix Solutions Inc.	LSD: P.O.: Proj. Acct. code:	

Reference Number	1571114-3	1571114-4
Sample Date	May 10, 2022	May 10, 2022
Sample Time	NA	NA
Sample Location		
Sample Description	26388220510103 / 1.3°C Water	26388220510104 / 1.3°C Water
Matrix		

Analyte	Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Metals Total - Continued						
Sodium	Total	mg/L	28.3 ±0.8	47.2 ±1.4	0.4	
Sulfur	Total	mg/L	12.8 ±0.1	26.4 ±0.2	0.3	
Mercury	Total	mg/L	<0.000005	<0.000005	0.000005	
Antimony	Total	mg/L	<0.0002	<0.0002	0.0002	
Arsenic	Total	mg/L	<0.0002	0.0002 ±0.00003	0.0002	
Barium	Total	mg/L	0.210 ±0.019	0.142 ±0.013	0.001	
Beryllium	Total	mg/L	<0.0001	<0.0001	0.0001	
Bismuth	Total	mg/L	<0.0005	<0.0005	0.0005	
Boron	Total	mg/L	0.021 ±0.002	0.048 ±0.004	0.002	
Cadmium	Total	mg/L	<0.00001	<0.00001	0.00001	
Chromium	Total	mg/L	<0.0005	<0.0005	0.0005	
Cobalt	Total	mg/L	<0.0001	<0.0001	0.0001	
Copper	Total	mg/L	<0.001	<0.001	0.001	
Lead	Total	mg/L	<0.0001	<0.0001	0.0001	
Lithium	Total	mg/L	0.012 ±0.001	0.022 ±0.002	0.001	
Molybdenum	Total	mg/L	0.001 ±0.0002	0.001 ±0.0002	0.001	
Nickel	Total	mg/L	<0.0005	<0.0005	0.0005	
Selenium	Total	mg/L	0.0007 ±0.0002	0.0008 ±0.0002	0.0002	
Silver	Total	mg/L	<0.00001	<0.00001	0.00001	
Strontium	Total	mg/L	0.631 ±0.067	0.920 ±0.098	0.001	
Thallium	Total	mg/L	<0.00005	<0.00005	0.00005	
Tin	Total	mg/L	<0.001	<0.001	0.001	
Titanium	Total	mg/L	<0.0005	<0.0005	0.0005	
Uranium	Total	mg/L	0.0021 ±0.0002	0.0037 ±0.0003	0.0005	
Vanadium	Total	mg/L	0.0002 ±0.00003	0.0001 ±0.00003	0.0001	
Zinc	Total	mg/L	<0.004	<0.004	0.004	
Zirconium	Total	mg/L	<0.001	<0.001	0.001	

Physical and Aggregate Properties

Turbidity	NTU	0.6 ±0.02	0.9 ±0.03	0.1
Solids	Total Suspended	mg/L	5 ±1.0	2

Routine Water

pH			8.52	±0.10	8.49	±0.10	1
Temperature of observed		°C	18.4		18.4		
pH							
Electrical Conductivity	at 25 °C	µS/cm	748	±25	910	±30	1
Calcium	Dissolved	mg/L	64.5	±2.2	78.8	±2.7	0.2
Magnesium	Dissolved	mg/L	50.6	±3.6	58.1	±4.2	0.2

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512	Lot ID: 1571114
Attn: Allisha Sordi	Project Name: Burnco West Cochrane Gravel	Control Number: 116931
Sampled By: R. Veitch	Project Location: West Cochrane Gravel Pit	Date Received: May 13, 2022
Company: Matrix Solutions Inc.	LSD:	Date Reported: May 19, 2022
	P.O.:	Report Number: 2747745
	Proj. Acct. code:	

Reference Number	1571114-3	1571114-4
Sample Date	May 10, 2022	May 10, 2022
Sample Time	NA	NA
Sample Location		
Sample Description	26388220510103 / 1.3°C Water	26388220510104 / 1.3°C Water
Matrix		

Analyte		Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Routine Water - Continued							
Sodium	Dissolved	mg/L	26.7	±1.4	45.0	±2.3	0.4
Potassium	Dissolved	mg/L	2.4	±0.2	2.6	±0.2	0.4
Iron	Dissolved	mg/L	<0.01		<0.01		0.01
Manganese	Dissolved	mg/L	<0.005		<0.005		0.005
Chloride	Dissolved	mg/L	42.2	±2.6	37.6	±2.3	0.4
Nitrate - N		mg/L	3.19	±0.23	2.19	±0.16	0.01
Nitrite - N		mg/L	<0.005		<0.005		0.005
Nitrate and Nitrite - N		mg/L	3.19		2.19		0.01
Sulfate (SO4)	Dissolved	mg/L	36.2	±3.4	74.0	±7.0	0.9
Hydroxide		mg/L	<5		<5		
Carbonate		mg/L	11		15		
Bicarbonate		mg/L	370		471		
P-Alkalinity	as CaCO3	mg/L	10	±1.5	12	±2	5
T-Alkalinity	as CaCO3	mg/L	323	±13	411	±16	5
Total Dissolved Solids	Calculated	mg/L	416		542		1
Hardness	Dissolved as CaCO3	mg/L	369		436		
Ionic Balance	Dissolved	%	100		98		

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512 Project Name: Burnco West Cochrane Gravel Project Location: West Cochrane Gravel Pit	Lot ID: 1571114 Control Number: 116931 Date Received: May 13, 2022 Date Reported: May 19, 2022 Report Number: 2747745
Attn: Allisha Sordi Sampled By: R. Veitch Company: Matrix Solutions Inc.	LSD: P.O.: Proj. Acct. code:	

Reference Number	1571114-5	1571114-6
Sample Date	May 10, 2022	May 10, 2022
Sample Time	NA	NA
Sample Location		
Sample Description	26388220510105 / 1.3°C Water	26388220510106 / 1.3°C Water
Matrix		

Analyte	Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Metals Dissolved						
Silicon	Dissolved	mg/L	4.61 ±0.42	4.66 ±0.42		0.05
Sulfur	Dissolved	mg/L	25.6 ±2.4	22.5 ±2.1		0.3
Mercury	Dissolved	mg/L	<0.000005	<0.000005		0.000005
Aluminum	Dissolved	mg/L	0.006 ±0.00063	<0.002		0.002
Antimony	Dissolved	mg/L	<0.0002	<0.0002		0.0002
Arsenic	Dissolved	mg/L	0.0002 ±0.00005	0.0002 ±0.00006		0.0002
Barium	Dissolved	mg/L	0.112 ±0.007	0.102 ±0.006		0.001
Beryllium	Dissolved	mg/L	<0.0001	<0.0001		0.0001
Bismuth	Dissolved	mg/L	<0.0005	<0.0005		0.0005
Boron	Dissolved	mg/L	0.055 ±0.005	0.049 ±0.005		0.002
Cadmium	Dissolved	mg/L	<0.00001	<0.00001		0.00001
Chromium	Dissolved	mg/L	<0.0005	<0.0005		0.0005
Cobalt	Dissolved	mg/L	<0.0001	<0.0001		0.0001
Copper	Dissolved	mg/L	0.001 ±0.0001	<0.001		0.001
Lead	Dissolved	mg/L	<0.0001	<0.0001		0.0001
Lithium	Dissolved	mg/L	0.024 ±0.002	0.022 ±0.002		0.001
Molybdenum	Dissolved	mg/L	0.002 ±0.00008	0.001 ±0.00007		0.001
Nickel	Dissolved	mg/L	<0.0005	<0.0005		0.0005
Selenium	Dissolved	mg/L	0.0009 ±0.0003	0.0009 ±0.0003		0.0002
Silver	Dissolved	mg/L	<0.00001	<0.00001		0.00001
Strontium	Dissolved	mg/L	0.901 ±0.068	0.808 ±0.061		0.001
Thallium	Dissolved	mg/L	<0.00005	<0.00005		0.00005
Tin	Dissolved	mg/L	<0.001	<0.001		0.001
Titanium	Dissolved	mg/L	<0.0005	<0.0005		0.0005
Uranium	Dissolved	mg/L	0.0040 ±0.0003	0.0034 ±0.0003		0.0005
Vanadium	Dissolved	mg/L	<0.0001	<0.0001		0.0001
Zinc	Dissolved	mg/L	<0.001	<0.001		0.001
Zirconium	Dissolved	mg/L	<0.001	<0.001		0.001
Subsample			Field Filtered	Field Filtered		
Metals Total						
Aluminum	Total	mg/L	0.15	<0.02		0.02
Calcium	Total	mg/L	75.5 ±0.4	73.2 ±0.4		0.2
Iron	Total	mg/L	0.14 ±0.15	<0.05		0.05
Magnesium	Total	mg/L	67.7 ±0.9	63.1 ±0.8		0.2
Manganese	Total	mg/L	0.006 ±0.05	<0.005		0.005
Potassium	Total	mg/L	2.7 ±0.3	2.6 ±0.3		0.4
Silicon	Total	mg/L	5.00 ±0.11	4.79 ±0.10		0.05

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To:	Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID:	26388-512	Lot ID:	1571114		
		Project Name:	Burnco West Cochrane Gravel	Control Number:	116931		
		Project Location:	West Cochrane Gravel Pit	Date Received:	May 13, 2022		
Attn:	Allisha Sordi	LSD:		Date Reported:	May 19, 2022		
Sampled By:	R. Veitch	P.O.:		Report Number:	2747745		
Company:	Matrix Solutions Inc.	Proj. Acct. code:					
		Reference Number	1571114-5		1571114-6		
		Sample Date	May 10, 2022		May 10, 2022		
		Sample Time	NA		NA		
		Sample Location					
		Sample Description	26388220510105 /		26388220510106 /		
			1.3°C		1.3°C		
		Matrix	Water		Water		
Analyte		Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Metals Total - Continued							
Sodium	Total	mg/L	49.8	±1.4	41.5	±1.2	0.4
Sulfur	Total	mg/L	26.8	±0.2	24.1	±0.2	0.3
Mercury	Total	mg/L	<0.000005		<0.000005		0.000005
Antimony	Total	mg/L	<0.0002		<0.0002		0.0002
Arsenic	Total	mg/L	0.0002	±0.00003	0.0002	±0.00003	0.0002
Barium	Total	mg/L	0.112	±0.010	0.104	±0.009	0.001
Beryllium	Total	mg/L	<0.0001		<0.0001		0.0001
Bismuth	Total	mg/L	<0.0005		<0.0005		0.0005
Boron	Total	mg/L	0.053	±0.005	0.048	±0.004	0.002
Cadmium	Total	mg/L	<0.00001		<0.00001		0.00001
Chromium	Total	mg/L	<0.0005		<0.0005		0.0005
Cobalt	Total	mg/L	0.0001	±0.00001	<0.0001		0.0001
Copper	Total	mg/L	<0.001		<0.001		0.001
Lead	Total	mg/L	0.0002	±0.00001	<0.0001		0.0001
Lithium	Total	mg/L	0.025	±0.003	0.023	±0.002	0.001
Molybdenum	Total	mg/L	0.001	±0.0002	0.001	±0.0002	0.001
Nickel	Total	mg/L	0.0006	±0.00007	<0.0005		0.0005
Selenium	Total	mg/L	0.0008	±0.0002	0.0008	±0.0002	0.0002
Silver	Total	mg/L	<0.00001		<0.00001		0.00001
Strontium	Total	mg/L	0.951	±0.102	0.908	±0.097	0.001
Thallium	Total	mg/L	<0.00005		<0.00005		0.00005
Tin	Total	mg/L	<0.001		<0.001		0.001
Titanium	Total	mg/L	0.0027	±0.0003	<0.0005		0.0005
Uranium	Total	mg/L	0.0040	±0.0003	0.0030	±0.0002	0.0005
Vanadium	Total	mg/L	0.0003	±0.00004	<0.0001		0.0001
Zinc	Total	mg/L	<0.004		<0.004		0.004
Zirconium	Total	mg/L	<0.001		<0.001		0.001
Physical and Aggregate Properties							
Turbidity		NTU	6.8	±0.2	1.1	±0.03	0.1
Solids	Total Suspended	mg/L	6	±1.0	3	±0.8	2
Routine Water							
pH			8.34	±0.10	8.39	±0.10	1
Temperature of observed		°C	20.3		20.1		
pH							
Electrical Conductivity	at 25 °C	µS/cm	960	±32	880	±29	1
Calcium	Dissolved	mg/L	73.7	±2.5	71.1	±2.4	0.2
Magnesium	Dissolved	mg/L	65.5	±4.7	60.2	±4.3	0.2

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512	Lot ID: 1571114
Attn: Allisha Sordi	Project Name: Burnco West Cochrane Gravel	Control Number: 116931
Sampled By: R. Veitch	Project Location: West Cochrane Gravel Pit	Date Received: May 13, 2022
Company: Matrix Solutions Inc.	LSD:	Date Reported: May 19, 2022
	P.O.:	Report Number: 2747745
	Proj. Acct. code:	

Reference Number	1571114-5	1571114-6
Sample Date	May 10, 2022	May 10, 2022
Sample Time	NA	NA
Sample Location		
Sample Description	26388220510105 / 1.3°C Water	26388220510106 / 1.3°C Water
Matrix		

Analyte		Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Routine Water - Continued							
Sodium	Dissolved	mg/L	48.6	±2.5	40.1	±2.1	0.4
Potassium	Dissolved	mg/L	2.4	±0.2	2.4	±0.2	0.4
Iron	Dissolved	mg/L	<0.01		<0.01		0.01
Manganese	Dissolved	mg/L	<0.005		<0.005		0.005
Chloride	Dissolved	mg/L	39.7	±2.4	35.0	±2.1	0.4
Nitrate - N		mg/L	2.61	±0.19	2.04	±0.15	0.01
Nitrite - N		mg/L	<0.005		<0.005		0.005
Nitrate and Nitrite - N		mg/L	2.61		2.04		0.01
Sulfate (SO4)	Dissolved	mg/L	76.8	±7.2	67.5	±6.3	0.9
Hydroxide		mg/L	<5		<5		
Carbonate		mg/L	<6		7		
Bicarbonate		mg/L	521		468		
P-Alkalinity	as CaCO3	mg/L	<5		5	±1.3	5
T-Alkalinity	as CaCO3	mg/L	428	±17	395	±16	5
Total Dissolved Solids	Calculated	mg/L	563		513		1
Hardness	Dissolved as CaCO3	mg/L	453		426		
Ionic Balance	Dissolved	%	98		99		

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To:	Matrix Solutions Inc.	Project ID:	26388-512	Lot ID:	1571114		
	11312 - 100 Avenue	Project Name:	Burnco West Cochrane Gravel	Control Number:	116931		
	Fort St. John, BC, Canada	Project Location:	West Cochrane Gravel Pit	Date Received:	May 13, 2022		
	V1J 1Z9			Date Reported:	May 19, 2022		
Attn:	Allisha Sordi	LSD:		Report Number:	2747745		
Sampled By:	R. Veitch	P.O.:					
Company:	Matrix Solutions Inc.	Proj. Acct. code:					
		Reference Number	1571114-7	1571114-8			
		Sample Date	May 12, 2022	May 12, 2022			
		Sample Time	NA	NA			
		Sample Location					
		Sample Description	26388220512001 /	26388220512107 /			
			1.3°C	1.3°C			
		Matrix	Water	Water			
Analyte		Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Metals Dissolved							
Silicon	Dissolved	mg/L	3.11	±0.28	5.41	±0.49	0.05
Sulfur	Dissolved	mg/L	26.9	±2.5	24.6	±2.3	0.3
Mercury	Dissolved	mg/L	<0.000005		<0.000005		0.000005
Aluminum	Dissolved	mg/L	<0.002		<0.002		0.002
Antimony	Dissolved	mg/L	<0.0002		<0.0002		0.0002
Arsenic	Dissolved	mg/L	<0.0002		<0.0002		0.0002
Barium	Dissolved	mg/L	0.029	±0.002	0.173	±0.010	0.001
Beryllium	Dissolved	mg/L	<0.0001		<0.0001		0.0001
Bismuth	Dissolved	mg/L	<0.0005		<0.0005		0.0005
Boron	Dissolved	mg/L	0.054	±0.005	0.036	±0.003	0.002
Cadmium	Dissolved	mg/L	<0.00001		<0.00001		0.00001
Chromium	Dissolved	mg/L	<0.0005		<0.0005		0.0005
Cobalt	Dissolved	mg/L	0.0001	±0.000009	<0.0001		0.0001
Copper	Dissolved	mg/L	0.006	±0.0005	<0.001		0.001
Lead	Dissolved	mg/L	<0.0001		<0.0001		0.0001
Lithium	Dissolved	mg/L	0.016	±0.001	0.013	±0.001	0.001
Molybdenum	Dissolved	mg/L	0.002	±0.0001	0.001	±0.00006	0.001
Nickel	Dissolved	mg/L	0.0007	±0.00004	<0.0005		0.0005
Selenium	Dissolved	mg/L	0.0066	±0.0008	0.0017	±0.0003	0.0002
Silver	Dissolved	mg/L	<0.00001		<0.00001		0.00001
Strontium	Dissolved	mg/L	0.894	±0.068	0.880	±0.067	0.001
Thallium	Dissolved	mg/L	<0.00005		<0.00005		0.00005
Tin	Dissolved	mg/L	<0.001		<0.001		0.001
Titanium	Dissolved	mg/L	<0.0005		<0.0005		0.0005
Uranium	Dissolved	mg/L	0.0030	±0.0002	0.0019	±0.0001	0.0005
Vanadium	Dissolved	mg/L	<0.0001		<0.0001		0.0001
Zinc	Dissolved	mg/L	0.001	±0.00023	<0.001		0.001
Zirconium	Dissolved	mg/L	<0.001		<0.001		0.001
Subsample			Field Filtered		Field Filtered		
Metals Total							
Aluminum	Total	mg/L	0.09		0.03		0.02
Calcium	Total	mg/L	70.5	±0.4	87.1	±0.4	0.2
Iron	Total	mg/L	3.65	±0.15	<0.05		0.05
Magnesium	Total	mg/L	29.9	±0.4	40.4	±0.5	0.2
Manganese	Total	mg/L	0.050	±0.047	<0.005		0.005
Potassium	Total	mg/L	5.0	±0.5	4.2	±0.4	0.4
Silicon	Total	mg/L	3.40	±0.10	5.45	±0.11	0.05

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To:	Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512	Lot ID: 1571114				
		Project Name: Burnco West Cochrane Gravel	Control Number: 116931				
		Project Location: West Cochrane Gravel Pit	Date Received: May 13, 2022				
Attn:	Allisha Sordi	LSD:	Date Reported: May 19, 2022				
Sampled By:	R. Veitch	P.O.:	Report Number: 2747745				
Company:	Matrix Solutions Inc.	Proj. Acct. code:					
		Reference Number	1571114-7	1571114-8			
		Sample Date	May 12, 2022	May 12, 2022			
		Sample Time	NA	NA			
		Sample Location					
		Sample Description	26388220512001 / 1.3°C	26388220512107 / 1.3°C			
		Matrix	Water	Water			
Analyte		Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Metals Total - Continued							
Sodium	Total	mg/L	63.9	±1.9	36.0	±1.0	0.4
Sulfur	Total	mg/L	27.7	±0.2	25.8	±0.2	0.3
Mercury	Total	mg/L	<0.000005		<0.000005		0.000005
Antimony	Total	mg/L	<0.0002		<0.0002		0.0002
Arsenic	Total	mg/L	0.0004	±0.00005	0.0002	±0.00003	0.0002
Barium	Total	mg/L	0.030	±0.003	0.176	±0.016	0.001
Beryllium	Total	mg/L	<0.0001		<0.0001		0.0001
Bismuth	Total	mg/L	<0.0005		<0.0005		0.0005
Boron	Total	mg/L	0.054	±0.005	0.034	±0.003	0.002
Cadmium	Total	mg/L	0.00002	±0.000002	<0.00001		0.00001
Chromium	Total	mg/L	0.0015	±0.0002	<0.0005		0.0005
Cobalt	Total	mg/L	0.0007	±0.00007	<0.0001		0.0001
Copper	Total	mg/L	0.002	±0.0002	<0.001		0.001
Lead	Total	mg/L	0.0002	±0.00002	<0.0001		0.0001
Lithium	Total	mg/L	0.017	±0.002	0.013	±0.001	0.001
Molybdenum	Total	mg/L	0.002	±0.0002	<0.001		0.001
Nickel	Total	mg/L	0.0012	±0.0001	<0.0005		0.0005
Selenium	Total	mg/L	0.0058	±0.0006	0.0014	±0.0002	0.0002
Silver	Total	mg/L	0.00002	±0.000004	<0.00001		0.00001
Strontium	Total	mg/L	1.02	±0.11	0.918	±0.098	0.001
Thallium	Total	mg/L	<0.00005		<0.00005		0.00005
Tin	Total	mg/L	<0.001		<0.001		0.001
Titanium	Total	mg/L	0.0013	±0.0002	<0.0005		0.0005
Uranium	Total	mg/L	0.0031	±0.0002	0.0019	±0.0001	0.0005
Vanadium	Total	mg/L	0.0004	±0.00004	0.0001	±0.00003	0.0001
Zinc	Total	mg/L	<0.004		<0.004		0.004
Zirconium	Total	mg/L	<0.001		<0.001		0.001
Physical and Aggregate Properties							
Turbidity		NTU	9.9	±0.3	1.7	±0.05	0.1
Solids	Total Suspended	mg/L	12	±2	4	±0.9	2
Routine Water							
pH			8.07	±0.10	8.09	±0.10	1
Temperature of observed pH		°C	20.2		20.2		
Electrical Conductivity	at 25 °C	µS/cm	754	±25	800	±26	1
Calcium	Dissolved	mg/L	70.1	±2.4	85.8	±2.9	0.2
Magnesium	Dissolved	mg/L	29.8	±2.1	40.2	±2.9	0.2

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To:	Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID:	26388-512	Lot ID:	1571114		
		Project Name:	Burnco West Cochrane Gravel	Control Number:	116931		
		Project Location:	West Cochrane Gravel Pit	Date Received:	May 13, 2022		
Attn:	Allisha Sordi	LSD:		Date Reported:	May 19, 2022		
Sampled By:	R. Veitch	P.O.:		Report Number:	2747745		
Company:	Matrix Solutions Inc.	Proj. Acct. code:					
				Reference Number	1571114-7	1571114-8	
				Sample Date	May 12, 2022	May 12, 2022	
				Sample Time	NA	NA	
				Sample Location			
				Sample Description	26388220512001 /	26388220512107 /	
					1.3°C	1.3°C	
				Matrix	Water	Water	
Analyte		Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Routine Water - Continued							
Sodium	Dissolved	mg/L	62.1	±3.2	35.8	±1.9	0.4
Potassium	Dissolved	mg/L	4.6	±0.3	3.8	±0.3	0.4
Iron	Dissolved	mg/L	0.09	±0.004	<0.01		0.01
Manganese	Dissolved	mg/L	0.009	±0.0007	<0.005		0.005
Chloride	Dissolved	mg/L	1.4	±0.2	20.3	±1.2	0.4
Nitrate - N		mg/L	0.20	±0.02	1.04	±0.08	0.01
Nitrite - N		mg/L	<0.005		<0.005		0.005
Nitrate and Nitrite - N		mg/L	0.20		1.04		0.01
Sulfate (SO4)	Dissolved	mg/L	80.8	±7.6	73.8	±6.9	0.9
Hydroxide		mg/L	<5		<5		
Carbonate		mg/L	<6		<6		
Bicarbonate		mg/L	437		435		
P-Alkalinity	as CaCO3	mg/L	<5		<5		5
T-Alkalinity	as CaCO3	mg/L	359	±14	357	±14	5
Total Dissolved Solids	Calculated	mg/L	464		474		1
Hardness	Dissolved as CaCO3	mg/L	298		380		
Ionic Balance	Dissolved	%	99		100		

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512 Project Name: Burnco West Cochrane Gravel Project Location: West Cochrane Gravel Pit	Lot ID: 1571114 Control Number: 116931 Date Received: May 13, 2022 Date Reported: May 19, 2022 Report Number: 2747745
Attn: Allisha Sordi Sampled By: R. Veitch Company: Matrix Solutions Inc.	LSD: P.O.: Proj. Acct. code:	

Reference Number 1571114-9
Sample Date May 12, 2022
Sample Time NA
Sample Location
Sample Description 26388220512108 /
1.3°C
Matrix Water

Analyte		Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Metals Dissolved							
Silicon	Dissolved	mg/L	5.25	±0.47			0.05
Sulfur	Dissolved	mg/L	23.7	±2.2			0.3
Mercury	Dissolved	mg/L	<0.000005				0.000005
Aluminum	Dissolved	mg/L	<0.002				0.002
Antimony	Dissolved	mg/L	<0.0002				0.0002
Arsenic	Dissolved	mg/L	0.0002	±0.00006			0.0002
Barium	Dissolved	mg/L	0.175	±0.010			0.001
Beryllium	Dissolved	mg/L	<0.0001				0.0001
Bismuth	Dissolved	mg/L	<0.0005				0.0005
Boron	Dissolved	mg/L	0.038	±0.004			0.002
Cadmium	Dissolved	mg/L	<0.00001				0.00001
Chromium	Dissolved	mg/L	<0.0005				0.0005
Cobalt	Dissolved	mg/L	<0.0001				0.0001
Copper	Dissolved	mg/L	0.005	±0.0004			0.001
Lead	Dissolved	mg/L	<0.0001				0.0001
Lithium	Dissolved	mg/L	0.013	±0.001			0.001
Molybdenum	Dissolved	mg/L	0.001	±0.00005			0.001
Nickel	Dissolved	mg/L	<0.0005				0.0005
Selenium	Dissolved	mg/L	0.0016	±0.0003			0.0002
Silver	Dissolved	mg/L	<0.00001				0.00001
Strontium	Dissolved	mg/L	0.848	±0.064			0.001
Thallium	Dissolved	mg/L	<0.00005				0.00005
Tin	Dissolved	mg/L	<0.001				0.001
Titanium	Dissolved	mg/L	<0.0005				0.0005
Uranium	Dissolved	mg/L	0.0019	±0.0001			0.0005
Vanadium	Dissolved	mg/L	<0.0001				0.0001
Zinc	Dissolved	mg/L	0.002	±0.00024			0.001
Zirconium	Dissolved	mg/L	<0.001				0.001
Subsample			Field Filtered				
Metals Total							
Aluminum	Total	mg/L	<0.02				0.02
Calcium	Total	mg/L	86.2	±0.4			0.2
Iron	Total	mg/L	<0.05				0.05
Magnesium	Total	mg/L	40.2	±0.5			0.2
Manganese	Total	mg/L	<0.005				0.005
Potassium	Total	mg/L	4.2	±0.4			0.4
Silicon	Total	mg/L	5.42	±0.11			0.05

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512 Project Name: Burnco West Cochrane Gravel Project Location: West Cochrane Gravel Pit	Lot ID: 1571114 Control Number: 116931 Date Received: May 13, 2022 Date Reported: May 19, 2022 Report Number: 2747745
Attn: Allisha Sordi Sampled By: R. Veitch Company: Matrix Solutions Inc.	LSD: P.O.: Proj. Acct. code:	

Reference Number 1571114-9
Sample Date May 12, 2022
Sample Time NA
Sample Location
Sample Description 26388220512108 /
1.3°C
Matrix Water

Analyte		Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Metals Total - Continued							
Sodium	Total	mg/L	35.9	±1.0			0.4
Sulfur	Total	mg/L	25.1	±0.2			0.3
Mercury	Total	mg/L	<0.000005				0.000005
Antimony	Total	mg/L	<0.0002				0.0002
Arsenic	Total	mg/L	<0.0002				0.0002
Barium	Total	mg/L	0.173	±0.016			0.001
Beryllium	Total	mg/L	<0.0001				0.0001
Bismuth	Total	mg/L	<0.0005				0.0005
Boron	Total	mg/L	0.034	±0.003			0.002
Cadmium	Total	mg/L	<0.00001				0.00001
Chromium	Total	mg/L	<0.0005				0.0005
Cobalt	Total	mg/L	<0.0001				0.0001
Copper	Total	mg/L	<0.001				0.001
Lead	Total	mg/L	<0.0001				0.0001
Lithium	Total	mg/L	0.013	±0.001			0.001
Molybdenum	Total	mg/L	<0.001				0.001
Nickel	Total	mg/L	0.0005	±0.00007			0.0005
Selenium	Total	mg/L	0.0015	±0.0002			0.0002
Silver	Total	mg/L	<0.00001				0.00001
Strontium	Total	mg/L	0.931	±0.100			0.001
Thallium	Total	mg/L	<0.00005				0.00005
Tin	Total	mg/L	<0.001				0.001
Titanium	Total	mg/L	<0.0005				0.0005
Uranium	Total	mg/L	0.0019	±0.0001			0.0005
Vanadium	Total	mg/L	<0.0001				0.0001
Zinc	Total	mg/L	<0.004				0.004
Zirconium	Total	mg/L	<0.001				0.001
Physical and Aggregate Properties							
Turbidity		NTU	0.2	±0.008			0.1
Solids	Total Suspended	mg/L	<3				2
Routine Water							
pH			8.20	±0.10			1
Temperature of observed pH		°C	20.1				
Electrical Conductivity	at 25 °C	µS/cm	788	±26			1
Calcium	Dissolved	mg/L	83.3	±2.8			0.2
Magnesium	Dissolved	mg/L	39.6	±2.9			0.2

* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Analytical Report

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512 Project Name: Burnco West Cochrane Gravel Project Location: West Cochrane Gravel Pit	Lot ID: 1571114 Control Number: 116931 Date Received: May 13, 2022 Date Reported: May 19, 2022 Report Number: 2747745
Attn: Allisha Sordi Sampled By: R. Veitch Company: Matrix Solutions Inc.	LSD: P.O.: Proj. Acct. code:	

Reference Number 1571114-9
Sample Date May 12, 2022
Sample Time NA
Sample Location
Sample Description 26388220512108 /
1.3°C
Matrix Water

Analyte	Units	Results	Uc *	Results	Uc *	Nominal Detection Limit
Routine Water - Continued						
Sodium	Dissolved	mg/L	34.6	±1.8		0.4
Potassium	Dissolved	mg/L	3.8	±0.3		0.4
Iron	Dissolved	mg/L	<0.01			0.01
Manganese	Dissolved	mg/L	<0.005			0.005
Chloride	Dissolved	mg/L	21.1	±1.3		0.4
Nitrate - N		mg/L	1.17	±0.08		0.01
Nitrite - N		mg/L	<0.005			0.005
Nitrate and Nitrite - N		mg/L	1.17			0.01
Sulfate (SO ₄)	Dissolved	mg/L	71.2	±6.7		0.9
Hydroxide		mg/L	<5			
Carbonate		mg/L	<6			
Bicarbonate		mg/L	426			
P-Alkalinity	as CaCO ₃	mg/L	<5			5
T-Alkalinity	as CaCO ₃	mg/L	350	±14		5
Total Dissolved Solids	Calculated	mg/L	463			1
Hardness	Dissolved as CaCO ₃	mg/L	371			
Ionic Balance	Dissolved	%	99			

Approved by:



Benjamin Morris, B.Sc
Operations Manager

Data have been validated by Analytical Quality Control and Element's Integrated Data Validation System (IDVS).
Generation and distribution of the report, and approval by the digitized signature above, are performed through a secure and controlled automatic process.
* The reported uncertainty is calculated using a coverage factor of 2 which gives a confidence of approximately 95%.

Quality Control

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512	Lot ID: 1571114
Attn: Allisha Sordi	Project Name: Burnco West Cochrane Gravel	Control Number: 116931
Sampled By: R. Veitch	Project Location: West Cochrane Gravel Pit	Date Received: May 13, 2022
Company: Matrix Solutions Inc.	LSD:	Date Reported: May 19, 2022
	P.O.:	Report Number: 2747745
	Proj. Acct. code:	

Metals Dissolved

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Silicon	mg/L	-0.0186885	-0.04	0.05	yes
Sulfur	mg/L	-0.0479279	-0.3	0.2	yes
Mercury	µg/L	-0.001365	-0.038000	0.064000	yes
Aluminum	µg/L	-0.0929714	-2	2	yes
Antimony	µg/L	-0.0021691	-0.2	0.2	yes
Arsenic	µg/L	0.00558088	-0.2	0.2	yes
Barium	µg/L	0.0108845	-1	1	yes
Beryllium	µg/L	0.00113216	-0.0	0.1	yes
Boron	µg/L	-0.159503	-2	2	yes
Cadmium	µg/L	-1.05256e-005	-0.01	0.01	yes
Chromium	µg/L	-0.00175481	-0.3	0.3	yes
Cobalt	µg/L	0.000858373	-0.1	0.1	yes
Copper	µg/L	0.179405	-1	1	yes
Lead	µg/L	0.00598495	-0.1	0.1	yes
Lithium	µg/L	-0.0157471	-1	1	yes
Molybdenum	µg/L	-0.00537819	-1	1	yes
Nickel	µg/L	0.000324497	-0.5	0.5	yes
Selenium	µg/L	-0.00248927	-0.2	0.2	yes
Silver	µg/L	0.000475075	-0.10	0.10	yes
Strontium	µg/L	-0.00816617	-1	1	yes
Thallium	µg/L	-2.9912e-005	-0.05	0.05	yes
Tin	µg/L	-0.031631	-1	1	yes
Titanium	µg/L	-0.224546	-0.5	0.5	yes
Uranium	µg/L	-0.00124161	-0.5	0.5	yes
Vanadium	µg/L	-0.00925736	-0.1	0.1	yes
Zinc	µg/L	-0.0495107	-0	2	yes
Zirconium	µg/L	-0.0122736	-1	1	yes

Date Acquired: May 16, 2022

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Silicon	mg/L	3.11	3.10	10	0.01	yes
Sulfur	mg/L	6.8	6.9	10	0.1	yes
Mercury	mg/L	<0.000005	<0.000005	10	0.000030	yes
Aluminum	µg/L	3	2	10	11	yes
Antimony	µg/L	0.3	0.3	10	0.4	yes
Arsenic	µg/L	0.7	0.7	10	0.4	yes
Barium	µg/L	92	95	10	2	yes
Beryllium	µg/L	<0.1	<0.1	10	0.2	yes
Bismuth	µg/L	<0.5	<0.5	10	1.1	yes
Boron	µg/L	147	147	10	4	yes
Cadmium	µg/L	<0.01	<0.01	10	0.02	yes
Chromium	µg/L	<0.5	<0.5	10	1.1	yes
Cobalt	µg/L	0.3	0.3	10	0.2	yes
Copper	µg/L	1	1	10	2	yes
Lead	µg/L	<0.1	<0.1	10	0.2	yes

Quality Control

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512	Lot ID: 1571114
Attn: Allisha Sordi	Project Name: Burnco West Cochrane Gravel	Control Number: 116931
Sampled By: R. Veitch	Project Location: West Cochrane Gravel Pit	Date Received: May 13, 2022
Company: Matrix Solutions Inc.	LSD:	Date Reported: May 19, 2022
	P.O.:	Report Number: 2747745
	Proj. Acct. code:	

Metals Dissolved - Continued

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Lithium	µg/L	33	34	10	2	yes
Molybdenum	µg/L	2	2	10	2	yes
Nickel	µg/L	3.1	3.0	10	1.1	yes
Selenium	µg/L	<0.2	<0.2	10	0.4	yes
Silver	µg/L	<0.01	<0.01	10	0.22	yes
Strontium	µg/L	607	596	10	2	yes
Thallium	µg/L	<0.05	<0.05	10	0.11	yes
Tin	µg/L	<1	<1	10	2	yes
Titanium	µg/L	<0.5	<0.5	10	1.1	yes
Uranium	µg/L	6.3	6.6	10	1.1	yes
Vanadium	µg/L	<0.1	<0.1	10	0.2	yes
Zinc	µg/L	<1	<1	10	2	yes
Zirconium	µg/L	<1	<1	10	2	yes

Date Acquired: May 16, 2022

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Aluminum	µg/L	978	917	1067	yes
Antimony	µg/L	42.0	36.4	44.2	yes
Arsenic	µg/L	39.9	36.7	43.3	yes
Barium	µg/L	208	182	211	yes
Beryllium	µg/L	20.4	17.3	22.1	yes
Bismuth	µg/L	102	89.1	108.3	yes
Boron	µg/L	422	344	434	yes
Cadmium	µg/L	1.94	1.86	2.25	yes
Chromium	µg/L	99.2	92.2	110.2	yes
Cobalt	µg/L	20.1	18.4	21.2	yes
Copper	µg/L	196	187	214	yes
Lead	µg/L	20.5	18.4	22.0	yes
Lithium	µg/L	209	175	223	yes
Molybdenum	µg/L	199	182	218	yes
Nickel	µg/L	99.9	93.3	105.9	yes
Selenium	µg/L	39.6	35.8	43.0	yes
Silver	µg/L	19.7	18.40	22.00	yes
Strontium	µg/L	205	180	216	yes
Thallium	µg/L	9.76	8.80	10.60	yes
Tin	µg/L	206	180	220	yes
Titanium	µg/L	102	92.4	110.4	yes
Uranium	µg/L	99.7	90.9	106.5	yes
Vanadium	µg/L	19.8	18.0	22.0	yes
Zinc	µg/L	198	183	219	yes

Date Acquired: May 16, 2022

Mercury	mg/L	0.000092	0.000070	0.000130	yes
---------	------	----------	----------	----------	-----

Date Acquired: May 16, 2022

Mercury	mg/L	0.000019	0.000006	0.000036	yes
Aluminum	µg/L	51	45	55	yes

Quality Control

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512	Lot ID: 1571114
Attn: Allisha Sordi	Project Name: Burnco West Cochrane Gravel	Control Number: 116931
Sampled By: R. Veitch	Project Location: West Cochrane Gravel Pit	Date Received: May 13, 2022
Company: Matrix Solutions Inc.	LSD:	Date Reported: May 19, 2022
	P.O.:	Report Number: 2747745
	Proj. Acct. code:	

Metals Dissolved - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Antimony	µg/L	2.0	1.8	2.3	yes
Arsenic	µg/L	2.0	1.8	2.2	yes
Barium	µg/L	10	9	11	yes
Beryllium	µg/L	1.0	0.9	1.1	yes
Bismuth	µg/L	5.1	4.1	5.5	yes
Boron	µg/L	21	18	22	yes
Cadmium	µg/L	0.10	0.09	0.11	yes
Chromium	µg/L	5.1	4.5	5.5	yes
Cobalt	µg/L	1.0	0.9	1.1	yes
Copper	µg/L	10	9	11	yes
Lead	µg/L	1.0	0.9	1.1	yes
Lithium	µg/L	11	9	11	yes
Molybdenum	µg/L	10	9	10	yes
Nickel	µg/L	5.0	4.4	5.5	yes
Selenium	µg/L	2.0	1.7	2.2	yes
Silver	µg/L	1.00	0.84	1.08	yes
Strontium	µg/L	10	9	11	yes
Thallium	µg/L	0.48	0.45	0.55	yes
Tin	µg/L	10	9	11	yes
Titanium	µg/L	5.1	4.5	5.5	yes
Uranium	µg/L	4.8	4.5	5.5	yes
Vanadium	µg/L	1.1	0.9	1.1	yes
Zinc	µg/L	10	9	11	yes
Zirconium	µg/L	11	9	11	yes
Date Acquired: May 16, 2022					
Silicon	mg/L	10.1	8.98	10.78	yes
Sulfur	mg/L	147	138.5	155.3	yes
Date Acquired: May 16, 2022					
Silicon	mg/L	2.05	1.88	2.24	yes
Sulfur	mg/L	9.7	9.2	11.0	yes
Date Acquired: May 16, 2022					
Silicon	mg/L	0.20	0.19	0.23	yes
Sulfur	mg/L	2.9	2.8	3.3	yes
Date Acquired: May 16, 2022					

Metals Total

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Aluminum	mg/L	-0.0011721	-0.02	0.02	yes
Calcium	mg/L	-0.00089653	-0.1	0.1	yes
Iron	mg/L	-0.000257179	-0.01	0.02	yes
Magnesium	mg/L	-0.0123935	-0.04	0.04	yes
Manganese	mg/L	-0.000128016	-0.005	0.005	yes
Potassium	mg/L	0.0674368	-0.1	0.2	yes
Silicon	mg/L	0.00191086	-0.03	0.04	yes

Quality Control

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512 Project Name: Burnco West Cochrane Gravel Project Location: West Cochrane Gravel Pit	Lot ID: 1571114 Control Number: 116931 Date Received: May 13, 2022 Date Reported: May 19, 2022 Report Number: 2747745
Attn: Allisha Sordi Sampled By: R. Veitch Company: Matrix Solutions Inc.	LSD: P.O.: Proj. Acct. code:	

Metals Total - Continued

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Sodium	mg/L	0.011941	-0.4	0.4	yes
Sulfur	mg/L	0.0252614	-0.1	0.2	yes
Mercury	µg/L	0.0003587	-0.038000	0.070000	yes
Antimony	µg/L	-0.00129766	-0.2	0.2	yes
Arsenic	µg/L	0.00466139	-0.2	0.2	yes
Barium	µg/L	0.0289497	-1	1	yes
Beryllium	µg/L	0.00125209	-0.1	0.1	yes
Bismuth	µg/L	-0.000614358	-0.5	0.5	yes
Boron	µg/L	-0.615218	-1	3	yes
Cadmium	µg/L	0.00197447	-0.007	0.012	yes
Chromium	µg/L	0.0661429	-0.5	0.5	yes
Cobalt	µg/L	0.000508071	-0.1	0.1	yes
Copper	µg/L	0.0463882	-1	1	yes
Lead	µg/L	0.0028032	-0.1	0.1	yes
Lithium	µg/L	0.00374695	-1	1	yes
Molybdenum	µg/L	-0.0162059	-1	1	yes
Nickel	µg/L	0.0042267	-0.5	0.5	yes
Selenium	µg/L	-0.000719124	-0.2	0.2	yes
Silver	µg/L	-0.000867525	-0.02	0.10	yes
Strontium	µg/L	0.0405049	-1	1	yes
Thallium	µg/L	0.000569923	-0.05	0.05	yes
Tin	µg/L	-0.0390384	-1	1	yes
Titanium	µg/L	0.0248433	-0.5	0.5	yes
Uranium	µg/L	-0.00293328	-0.5	0.5	yes
Vanadium	µg/L	0.0474216	-0.1	0.1	yes
Zinc	µg/L	-0.137667	-4	4	yes
Zirconium	µg/L	-0.00316891	-1	1	yes

Date Acquired: May 16, 2022

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Aluminum	mg/L	<0.02	<0.02	15	0.03	yes
Calcium	mg/L	82.5	83.0	15	0.6	yes
Iron	mg/L	<0.05	<0.05	15	0.20	yes
Magnesium	mg/L	60.7	61.0	15	0.40	yes
Manganese	mg/L	<0.005	<0.005	15	0.010	yes
Potassium	mg/L	2.9	2.9	15	1.2	yes
Silicon	mg/L	4.85	4.86	15	0.10	yes
Sodium	mg/L	47.2	47.2	15	1.2	yes
Sulfur	mg/L	0.8	0.8	15	0.1	yes
Mercury	mg/L	<0.000005	<0.000005	10	0.000030	yes
Antimony	µg/L	<0.2	<0.2	15	0.4	yes
Arsenic	µg/L	<0.2	<0.2	15	0.4	yes
Barium	µg/L	157	156	15	2	yes
Beryllium	µg/L	<0.1	<0.1	15	0.2	yes
Bismuth	µg/L	<0.5	<0.5	15	1.1	yes

Quality Control

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512	Lot ID: 1571114
Attn: Allisha Sordi	Project Name: Burnco West Cochrane Gravel	Control Number: 116931
Sampled By: R. Veitch	Project Location: West Cochrane Gravel Pit	Date Received: May 13, 2022
Company: Matrix Solutions Inc.	LSD:	Date Reported: May 19, 2022
	P.O.:	Report Number: 2747745
	Proj. Acct. code:	

Metals Total - Continued

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Boron	µg/L	39	38	15	4	yes
Cadmium	µg/L	<0.01	0.01	15	0.022	yes
Chromium	µg/L	0.5	<0.5	15	1.1	yes
Cobalt	µg/L	<0.1	<0.1	15	0.2	yes
Copper	µg/L	<1	2	15	2	yes
Lead	µg/L	<0.1	<0.1	15	0.2	yes
Lithium	µg/L	18	18	15	2	yes
Molybdenum	µg/L	2	2	15	2	yes
Nickel	µg/L	0.8	0.6	15	1.1	yes
Selenium	µg/L	0.8	0.7	15	0.4	yes
Silver	µg/L	<0.01	<0.01	15	0.22	yes
Strontium	µg/L	843	869	15	2	yes
Thallium	µg/L	<0.05	<0.05	15	0.11	yes
Tin	µg/L	<1	<1	15	2	yes
Titanium	µg/L	<0.5	<0.5	15	1.1	yes
Uranium	µg/L	3.6	3.5	15	1.1	yes
Vanadium	µg/L	<0.1	<0.1	15	0.2	yes
Zinc	µg/L	<4	<4	15	2	yes
Zirconium	µg/L	<1	<1	15	2	yes

Date Acquired: May 16, 2022

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Aluminum	mg/L	4.07	3.61	4.45	yes
Calcium	mg/L	52.0	47.6	54.2	yes
Iron	mg/L	2.06	1.91	2.21	yes
Magnesium	mg/L	20.1	17.88	21.86	yes
Manganese	mg/L	0.514	0.472	0.568	yes
Potassium	mg/L	54.4	46.9	55.9	yes
Silicon	mg/L	2.08	1.93	2.19	yes
Sodium	mg/L	53.2	47.0	57.2	yes
Sulfur	mg/L	10.1	9.2	11.2	yes
Antimony	µg/L	11.6	10.8	13.2	yes
Arsenic	µg/L	11.5	10.4	12.8	yes
Barium	µg/L	56	54	68	yes
Beryllium	µg/L	5.6	5.1	6.4	yes
Bismuth	µg/L	31.0	26.2	35.8	yes
Boron	µg/L	119	102	139	yes
Cadmium	µg/L	0.56	0.543	0.675	yes
Chromium	µg/L	30.1	26.5	33.7	yes
Cobalt	µg/L	6.1	5.2	6.8	yes
Copper	µg/L	60	53	67	yes
Lead	µg/L	6.5	5.2	7.1	yes
Lithium	µg/L	60	53	77	yes
Molybdenum	µg/L	58	56	66	yes
Nickel	µg/L	29.9	27.6	32.8	yes

Quality Control

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512	Lot ID: 1571114
Attn: Allisha Sordi	Project Name: Burnco West Cochrane Gravel	Control Number: 116931
Sampled By: R. Veitch	Project Location: West Cochrane Gravel Pit	Date Received: May 13, 2022
Company: Matrix Solutions Inc.	LSD:	Date Reported: May 19, 2022
	P.O.:	Report Number: 2747745
	Proj. Acct. code:	

Metals Total - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Selenium	µg/L	10.8	9.9	13.5	yes
Silver	µg/L	5.92	5.39	7.13	yes
Strontium	µg/L	63	55	65	yes
Thallium	µg/L	3.13	2.70	3.60	yes
Tin	µg/L	58	56	66	yes
Titanium	µg/L	31.0	26.6	35.7	yes
Uranium	µg/L	30.0	25.7	36.3	yes
Vanadium	µg/L	6.0	5.1	7.2	yes
Zinc	µg/L	56	53	65	yes
Zirconium	µg/L	61	53	67	yes
Date Acquired: May 16, 2022					
Antimony	µg/L	39.6	37.5	43.1	yes
Arsenic	µg/L	39.3	36.5	43.5	yes
Barium	µg/L	203	183	212	yes
Beryllium	µg/L	18.8	17.1	21.9	yes
Bismuth	µg/L	101	88.2	106.2	yes
Boron	µg/L	385	343	436	yes
Cadmium	µg/L	2.07	1.910	2.210	yes
Chromium	µg/L	100	90.0	110.0	yes
Cobalt	µg/L	20.7	18.1	21.7	yes
Copper	µg/L	205	188	212	yes
Lead	µg/L	20.7	18.0	24.0	yes
Lithium	µg/L	194	173	222	yes
Molybdenum	µg/L	211	182	218	yes
Nickel	µg/L	98.3	90.0	110.0	yes
Selenium	µg/L	39.0	36.7	43.3	yes
Silver	µg/L	21.5	18.00	22.00	yes
Strontium	µg/L	211	171	231	yes
Thallium	µg/L	10.5	9.01	10.99	yes
Tin	µg/L	194	190	218	yes
Titanium	µg/L	95.1	93.2	107.0	yes
Uranium	µg/L	106	90.2	109.0	yes
Vanadium	µg/L	19.8	16.9	22.1	yes
Zinc	µg/L	207	183	218	yes
Zirconium	µg/L	196	188	218	yes
Date Acquired: May 16, 2022					
Mercury	mg/L	0.000088	0.000070	0.000130	yes
Antimony	µg/L	11.6	10.8	13.2	yes
Arsenic	µg/L	12.0	10.8	13.2	yes
Barium	µg/L	57	55	67	yes
Beryllium	µg/L	5.7	5.2	6.5	yes
Bismuth	µg/L	29.9	27.3	31.9	yes
Boron	µg/L	117	108	132	yes
Cadmium	µg/L	0.61	0.540	0.660	yes

Quality Control

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512 Project Name: Burnco West Cochrane Gravel Project Location: West Cochrane Gravel Pit	Lot ID: 1571114 Control Number: 116931 Date Received: May 13, 2022 Date Reported: May 19, 2022 Report Number: 2747745
Attn: Allisha Sordi Sampled By: R. Veitch Company: Matrix Solutions Inc.	LSD: P.O.: Proj. Acct. code:	

Metals Total - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Chromium	µg/L	30.2	27.0	33.0	yes
Cobalt	µg/L	6.2	5.4	6.6	yes
Copper	µg/L	60	54	66	yes
Lead	µg/L	6.2	5.4	6.6	yes
Lithium	µg/L	60	53	66	yes
Molybdenum	µg/L	56	53	64	yes
Nickel	µg/L	30.2	27.1	33.1	yes
Selenium	µg/L	11.8	10.3	13.4	yes
Silver	µg/L	6.03	5.40	6.60	yes
Strontium	µg/L	61	54	66	yes
Thallium	µg/L	3.10	0.00	6.00	yes
Tin	µg/L	56	54	66	yes
Titanium	µg/L	29.5	27.0	33.0	yes
Uranium	µg/L	29.2	27.0	33.0	yes
Vanadium	µg/L	6.0	5.4	6.6	yes
Zinc	µg/L	62	56	65	yes
Zirconium	µg/L	60	54	66	yes
Date Acquired: May 16, 2022					
Mercury	mg/L	0.000018	0.000006	0.000036	yes
Antimony	µg/L	2.0	1.8	2.2	yes
Arsenic	µg/L	2.0	1.7	2.2	yes
Barium	µg/L	10	9	11	yes
Beryllium	µg/L	1.0	0.8	1.1	yes
Bismuth	µg/L	5.1	4.6	5.4	yes
Boron	µg/L	19	17	23	yes
Cadmium	µg/L	0.10	0.089	0.113	yes
Chromium	µg/L	4.9	4.6	5.3	yes
Cobalt	µg/L	1.0	0.9	1.1	yes
Copper	µg/L	10	9	11	yes
Lead	µg/L	1.1	0.9	1.1	yes
Lithium	µg/L	10	9	11	yes
Molybdenum	µg/L	10	9	10	yes
Nickel	µg/L	5.0	4.5	5.5	yes
Selenium	µg/L	2.0	1.6	2.2	yes
Silver	µg/L	1.03	0.89	1.13	yes
Strontium	µg/L	10	9	11	yes
Thallium	µg/L	0.51	0.44	0.56	yes
Tin	µg/L	10	9	11	yes
Titanium	µg/L	5.0	4.2	5.7	yes
Uranium	µg/L	5.3	4.6	5.4	yes
Vanadium	µg/L	1.0	0.9	1.2	yes
Zinc	µg/L	10	9	11	yes
Zirconium	µg/L	10	9	11	yes

Date Acquired: May 16, 2022

Quality Control

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512	Lot ID: 1571114
Attn: Allisha Sordi	Project Name: Burnco West Cochrane Gravel	Control Number: 116931
Sampled By: R. Veitch	Project Location: West Cochrane Gravel Pit	Date Received: May 13, 2022
Company: Matrix Solutions Inc.	LSD:	Date Reported: May 19, 2022
	P.O.:	Report Number: 2747745
	Proj. Acct. code:	

Metals Total - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Aluminum	mg/L	19.5	18.80	20.60	yes
Calcium	mg/L	247	231.3	258.9	yes
Iron	mg/L	9.56	9.06	10.14	yes
Magnesium	mg/L	99.3	92.78	104.72	yes
Manganese	mg/L	2.38	2.290	2.590	yes
Potassium	mg/L	246	234.2	261.8	yes
Silicon	mg/L	9.89	9.13	10.93	yes
Sodium	mg/L	245	228.8	269.4	yes
Sulfur	mg/L	148	135.5	165.3	yes
Date Acquired: May 16, 2022					
Aluminum	mg/L	3.98	3.60	4.40	yes
Calcium	mg/L	51.3	46.5	56.5	yes
Iron	mg/L	2.05	1.87	2.27	yes
Magnesium	mg/L	20.0	18.05	22.07	yes
Manganese	mg/L	0.510	0.466	0.568	yes
Potassium	mg/L	52.1	45.4	55.5	yes
Silicon	mg/L	2.02	1.93	2.24	yes
Sodium	mg/L	51.7	45.9	55.9	yes
Sulfur	mg/L	10.2	9.3	11.3	yes
Date Acquired: May 16, 2022					
Aluminum	mg/L	0.40	0.36	0.44	yes
Calcium	mg/L	5.2	4.8	5.8	yes
Iron	mg/L	0.20	0.19	0.25	yes
Magnesium	mg/L	2.0	1.84	2.20	yes
Manganese	mg/L	0.052	0.047	0.059	yes
Potassium	mg/L	5.5	4.8	5.8	yes
Silicon	mg/L	0.21	0.17	0.23	yes
Sodium	mg/L	5.2	4.8	5.6	yes
Sulfur	mg/L	3.1	2.8	3.3	yes
Date Acquired: May 16, 2022					

Physical and Aggregate Properties

Blanks		Units	Measured	Lower Limit	Upper Limit	Passed QC	
Turbidity		NTU	0.079	-0.1	0.1	yes	
Date Acquired:		May 18, 2022					
Turbidity		NTU	0.097	0.0	0.1	yes	
Date Acquired:		May 18, 2022					
Client Sample Replicates		Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Turbidity		NTU	1.5	1.6	10	0.2	yes
Solids		mg/L	10500	9900	10	2	yes
Date Acquired:		May 16, 2022					
Control Sample		Units	Measured	Lower Limit	Upper Limit	Passed QC	
Turbidity		NTU	1930	1856.7	2054.7	yes	
Date Acquired:		May 18, 2022					

Quality Control

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512 Project Name: Burnco West Cochrane Gravel Project Location: West Cochrane Gravel Pit	Lot ID: 1571114 Control Number: 116931 Date Received: May 13, 2022 Date Reported: May 19, 2022 Report Number: 2747745
Attn: Allisha Sordi Sampled By: R. Veitch Company: Matrix Solutions Inc.	LSD: P.O.: Proj. Acct. code:	

Physical and Aggregate Properties -

Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Turbidity	NTU	5900	4441.7	6661.7	yes
Date Acquired: May 18, 2022					
Turbidity	NTU	145	132.1	162.1	yes
Solids	mg/L	191	174	209	yes
Date Acquired: May 16, 2022					
Turbidity	NTU	13.9	12.6	15.6	yes
Solids	mg/L	16	10	22	yes
Date Acquired: May 16, 2022					
Turbidity	NTU	1.5	1.0	2.2	yes
Date Acquired: May 18, 2022					

Routine Water

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Calcium	mg/L	0.00874933	-0.2	0.2	yes
Magnesium	mg/L	0.00359515	-0.1	0.1	yes
Sodium	mg/L	0.0428041	-0.4	0.4	yes
Potassium	mg/L	0.0320457	-0.4	0.4	yes
Iron	mg/L	-0.000673408	-0.01	0.01	yes
Manganese	mg/L	0.000425349	-0.004	0.004	yes
Chloride	mg/L	0.13	-0.4	0.4	yes
Nitrate - N	mg/L	0	-0.01	0.01	yes
Nitrite - N	mg/L	0	-0.005	0.005	yes

Date Acquired: May 16, 2022

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
pH		7.67	7.67	0	0.10	yes
Electrical Conductivity	dS/m	0.820	0.818	10	0.002	yes
Calcium	mg/L	155	156	10	0.6	yes
Magnesium	mg/L	59.3	59.2	10	0.7	yes
Sodium	mg/L	23.0	22.9	10	1.2	yes
Potassium	mg/L	4.3	4.2	10	1.2	yes
Iron	mg/L	<0.01	<0.01	10	0.05	yes
Manganese	mg/L	<0.005	<0.005	10	0.010	yes
Chloride	mg/L	35.8	35.7	10	0.5	yes
Nitrate - N	mg/L	913	911	10	0.01	yes
Nitrite - N	mg/L	<0.5	<0.5	10	0.010	yes
Hydroxide	mg/L	<5	<5	10		yes
Carbonate	mg/L	<6	<6	10	6	yes
Bicarbonate	mg/L	528	526	10	6	yes
P-Alkalinity	mg/L	<5	<5	10	5	yes
T-Alkalinity	mg/L	433	431	10	5	yes

Date Acquired: May 16, 2022

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
----------------	-------	----------	-------------	-------------	-----------

Quality Control

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512	Lot ID: 1571114
Attn: Allisha Sordi	Project Name: Burnco West Cochrane Gravel	Control Number: 116931
Sampled By: R. Veitch	Project Location: West Cochrane Gravel Pit	Date Received: May 13, 2022
Company: Matrix Solutions Inc.	LSD:	Date Reported: May 19, 2022
	P.O.:	Report Number: 2747745
	Proj. Acct. code:	

Routine Water - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Chloride	mg/L	2020	1847.4	2256.0	yes
Date Acquired: May 16, 2022					
Electrical Conductivity	dS/m	32.1	27.200	36.800	yes
Date Acquired: May 16, 2022					
pH		9.22	8.90	9.44	yes
Temperature of observed	°C	17.5	15.5	24.5	yes
Electrical Conductivity	dS/m	2.73	2.631	2.829	yes
Calcium	mg/L	243	230.0	260.0	yes
Magnesium	mg/L	99.7	92.6	104.6	yes
Sodium	mg/L	252	234.6	259.2	yes
Potassium	mg/L	252	229.0	259.0	yes
Iron	mg/L	9.47	8.91	10.20	yes
Manganese	mg/L	2.38	2.240	2.540	yes
Nitrate - N	mg/L	10.1	9.03	11.13	yes
Nitrite - N	mg/L	9.81	9.010	10.990	yes
Nitrate and Nitrite - N	mg/L	19.9	19.10	20.90	yes
P-Alkalinity	mg/L	490	442	584	yes
T-Alkalinity	mg/L	1000	925	1063	yes
Date Acquired: May 16, 2022					
pH		6.89	6.79	6.97	yes
Temperature of observed	°C	17.6	15.5	24.5	yes
Electrical Conductivity	dS/m	0.075	0.069	0.085	yes
Calcium	mg/L	50.9	44.9	56.9	yes
Magnesium	mg/L	20.3	17.9	22.0	yes
Sodium	mg/L	50.7	47.7	55.5	yes
Potassium	mg/L	51.1	45.8	55.8	yes
Iron	mg/L	2.00	1.89	2.25	yes
Manganese	mg/L	0.500	0.468	0.552	yes
Chloride	mg/L	81.6	74.9	86.9	yes
Nitrate - N	mg/L	4.78	4.37	5.33	yes
Nitrite - N	mg/L	4.74	4.370	5.330	yes
Nitrate and Nitrite - N	mg/L	9.52	8.80	10.60	yes
P-Alkalinity	mg/L	47	28	72	yes
T-Alkalinity	mg/L	128	114	140	yes
Date Acquired: May 16, 2022					
Calcium	mg/L	5.1	4.7	5.8	yes
Magnesium	mg/L	2.1	1.9	2.2	yes
Sodium	mg/L	5.5	4.7	5.7	yes
Potassium	mg/L	5.1	4.6	5.6	yes
Iron	mg/L	0.20	0.19	0.24	yes
Manganese	mg/L	0.051	0.046	0.057	yes
Chloride	mg/L	14.6	13.3	16.5	yes
Nitrate - N	mg/L	0.50	0.42	0.57	yes
Nitrite - N	mg/L	0.499	0.424	0.564	yes

Quality Control

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512	Lot ID: 1571114
Attn: Allisha Sordi	Project Name: Burnco West Cochrane Gravel	Control Number: 116931
Sampled By: R. Veitch	Project Location: West Cochrane Gravel Pit	Date Received: May 13, 2022
Company: Matrix Solutions Inc.	LSD:	Date Reported: May 19, 2022
	P.O.:	Report Number: 2747745
	Proj. Acct. code:	

Routine Water - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Nitrate and Nitrite - N	mg/L	1.00	0.85	1.15	yes
Date Acquired: May 16, 2022					

Methodology and Notes

Bill To: Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID: 26388-512	Lot ID: 1571114
Attn: Allisha Sordi	Project Name: Burnco West Cochrane Gravel	Control Number: 116931
Sampled By: R. Veitch	Project Location: West Cochrane Gravel Pit	Date Received: May 13, 2022
Company: Matrix Solutions Inc.	LSD:	Date Reported: May 19, 2022
	P.O.:	Report Number: 2747745
	Proj. Acct. code:	

Method of Analysis

Method Name	Reference	Method	Date Analysis Started	Location
Alkalinity, pH, and EC in water	APHA	* Alkalinity - Titration Method, 2320 B	May 16, 2022	Element Edmonton - Roper Road
Alkalinity, pH, and EC in water	APHA	* Alkalinity - Titration Method, 2320 B	May 16, 2022	Element Edmonton - Roper Road
Alkalinity, pH, and EC in water	APHA	* Conductivity, 2510 B	May 16, 2022	Element Edmonton - Roper Road
Alkalinity, pH, and EC in water	APHA	* Conductivity, 2510 B	May 16, 2022	Element Edmonton - Roper Road
Alkalinity, pH, and EC in water	APHA	* pH - Electrometric Method, 4500-H+ B	May 16, 2022	Element Edmonton - Roper Road
Alkalinity, pH, and EC in water	APHA	* pH - Electrometric Method, 4500-H+ B	May 16, 2022	Element Edmonton - Roper Road
Anions (Routine) by Ion Chromatography	APHA	* Ion Chromatography with Chemical Suppression of Eluent Cond., 4110 B	May 16, 2022	Element Edmonton - Roper Road
Approval-Edmonton	APHA	Checking Correctness of Analyses, 1030 E	May 17, 2022	Element Edmonton - Roper Road
Approval-Edmonton	APHA	Checking Correctness of Analyses, 1030 E	May 17, 2022	Element Edmonton - Roper Road
Approval-Edmonton	APHA	Checking Correctness of Analyses, 1030 E	May 18, 2022	Element Edmonton - Roper Road
Chloride in Water	APHA	* Automated Ferricyanide Method, 4500-Cl- E	May 16, 2022	Element Edmonton - Roper Road
Mercury (Dissolved) in water	APHA	* Cold Vapour Atomic Absorption Spectrometric Method, 3112 B	May 16, 2022	Element Edmonton - Roper Road
Mercury (Dissolved) in water	EPA	* Mercury in Water by Cold Vapor Atomic Fluorescence Spectrometry, 245.7	May 16, 2022	Element Edmonton - Roper Road
Mercury (Total) in water	EPA	* Mercury in Water by Cold Vapor Atomic Fluorescence Spectrometry, 245.7	May 16, 2022	Element Edmonton - Roper Road
Metals ICP-MS (Dissolved) in water	APHA/USEPA	* Metals By Inductively Coupled Plasma/Mass Spectrometry, APHA 3125 B / USEPA 200.2, 200.8	May 16, 2022	Element Edmonton - Roper Road
Metals ICP-MS (Dissolved) in water	US EPA	* Determination of Trace Elements in Waters and Wastes by ICP-MS, 200.8	May 16, 2022	Element Edmonton - Roper Road
Metals ICP-MS (Total) in water	APHA/USEPA	* Metals By Inductively Coupled Plasma/Mass Spectrometry, APHA 3125 B / USEPA 200.2, 200.8	May 16, 2022	Element Edmonton - Roper Road
Metals ICP-MS (Total) in water	US EPA	* Determination of Trace Elements in Waters and Wastes by ICP-MS, 200.8	May 16, 2022	Element Edmonton - Roper Road
Metals Trace (Dissolved) in water	APHA	Hardness by Calculation, 2340 B	May 16, 2022	Element Edmonton - Roper Road
Metals Trace (Dissolved) in water	APHA	* Inductively Coupled Plasma (ICP) Method, 3120 B	May 16, 2022	Element Edmonton - Roper Road
Metals Trace (Total) in water	APHA	* Inductively Coupled Plasma (ICP) Method, 3120 B	May 16, 2022	Element Edmonton - Roper Road
Solids Suspended (Total, Fixed and Volatile)	APHA	* Total Suspended Solids Dried at 103-105°C, 2540 D	May 16, 2022	Element Edmonton - Roper Road

Methodology and Notes

Bill To:	Matrix Solutions Inc. 11312 - 100 Avenue Fort St. John, BC, Canada V1J 1Z9	Project ID:	26388-512	Lot ID:	1571114
		Project Name:	Burnco West Cochrane Gravel	Control Number:	116931
		Project Location:	West Cochrane Gravel Pit	Date Received:	May 13, 2022
Attn:	Allisha Sordi	LSD:		Date Reported:	May 19, 2022
Sampled By:	R. Veitch	P.O.:		Report Number:	2747745
Company:	Matrix Solutions Inc.	Proj. Acct. code:			
Method Name	Reference	Method	Date Analysis Started	Location	
Turbidity in Water	APHA	* Turbidity - Nephelometric Method, 2130 B	May 18, 2022	Element Edmonton - Roper Road	

** Reference Method Modified*

References

APHA	Standard Methods for the Examination of Water and Wastewater
APHA/USEPA	Standard Methods For Water/ Environmental Protection Agency
EPA	Environmental Protection Agency Test Methods - US
US EPA	US Environmental Protection Agency Test Methods

Comments:

- May 16, 2022 - Sample 1571114-9; 8047280: Sample 1571114-9 : There was insufficient sample volume to reach a detection limit of 2 mg/L for TSS analysis. The detection limit was adjusted accordingly.
- May 17, 2022 - Some trace total metal results were less than dissolved metal results for sample 157114-2. The results were verified and are within expected measurement uncertainty.
- May 18, 2022 - Some ICP-MS total metal results were less than dissolved metal results for samples 1571114-1 to 9. The results were verified and are within expected measurement uncertainty.
- May 18, 2022 - Total copper results were less than dissolved copper results for sample(s) 1571114-2, 7 and 9. Total metals were analyzed from the metals bottle and dissolved from the field filtered bottle. Results were verified.

Please direct any inquiries regarding this report to our Client Services group.

Results relate only to samples as submitted.

The test report shall not be reproduced except in full, without the written approval of the laboratory.

COC # 116931

 Lab Submitted to: ELEMENT Page: 1 of 1
 Lab Agreement no: _____
 Lab Job ID: _____

 Invoice to: _____ Require Report: Y ___ N ___
 Company Name: MATRIX SOLUTIONS INC.
 Contact Name: ATTN: ALLISHA SORDI
 Address: _____
 Phone / Fax#: _____ Ph: _____ Fax: _____

Conv of Report to:

 M
S
C
T
P
en

Lot: 1571114 COC


 Matrix Project #: 26388-512
 Matrix Proj. Name: BURNED WEST COCHRANE GRAVEL
 Location: WEST COCHRANE GRAVEL PIT
 Sampler's Name(s): R. VEITCH

AFE #:

REGULATORY REQUIREMENTS: (check)

- ☒ Alberta Tier 1 ☐ BC CSR
☐ Alberta SW FAL
☐ Canadian Drinking Water
☐ CCME FAL
☐ SPIGEC
☐ SEQG Other: _____

SERVICE REQUESTED:

☐ RUSH (Please ensure you contact the lab) Due Date: _____

☒ REGULAR Turnaround

REPORT DISTRIBUTION: always send to eds@matrix-solutions.com

☒ Additional

Emails

ckillam@matrix-solutions.com
asordi@matrix-solutions.com

	Sample Number (14 digits only) yr-mth-day	Sample Point Name	Depth (m)	Sample Type	Date/Time Sampled	Quantity # of Containers			Analysis Required					HOLD
						J/V	Bags	Bottles	DISSOLVED METALS	TOTAL METALS	ROUTINE	TSS	TURBIDITY	
1	26388220510101	-	-	H2O	10-MAY-22	0/2	0	4	X	X	X	X	X	
2	102	-	-			0/2	0	4	X	X	X	X	X	
3	103	-	-			0/2	0	4	X	X	X	X	X	
4	104	-	-			0/2	0	4	X	X	X	X	X	
5	105	-	-			0/2	0	4	X	X	X	X	X	
6	106	-	-			0/2	0	4	X	X	X	X	X	
7	26388220512001	-	-		12-MAY-22	0/2	0	4	X	X	X	X	X	
8	107	-	-			0/2	0	4	X	X	X	X	X	
9	108	-	-			0/2	0	4	X	X	X	X	X	
10														
11														
12														
13														
14														
15														

For metals in water samples indicate if you want Total (T) or Dissolved (D) as part of "Analysis Required"

Preserved/Filtered

Relinquished by:

RORY VEITCH

Date/Time:

12-MAY-22

Received by:

LR
13°C

Date/Time:

MAY 13 2022 07:15

Signature:

Signature:

Drop Box

COMMENTS/SPECIAL INSTRUCTIONS

DISSOLVED METALS FIELD FILTERED + PRESERVED. TOTAL METALS PRESERVED
 CALL RORY WITH QUESTIONS: 403-789-1919

I = jars V = vials