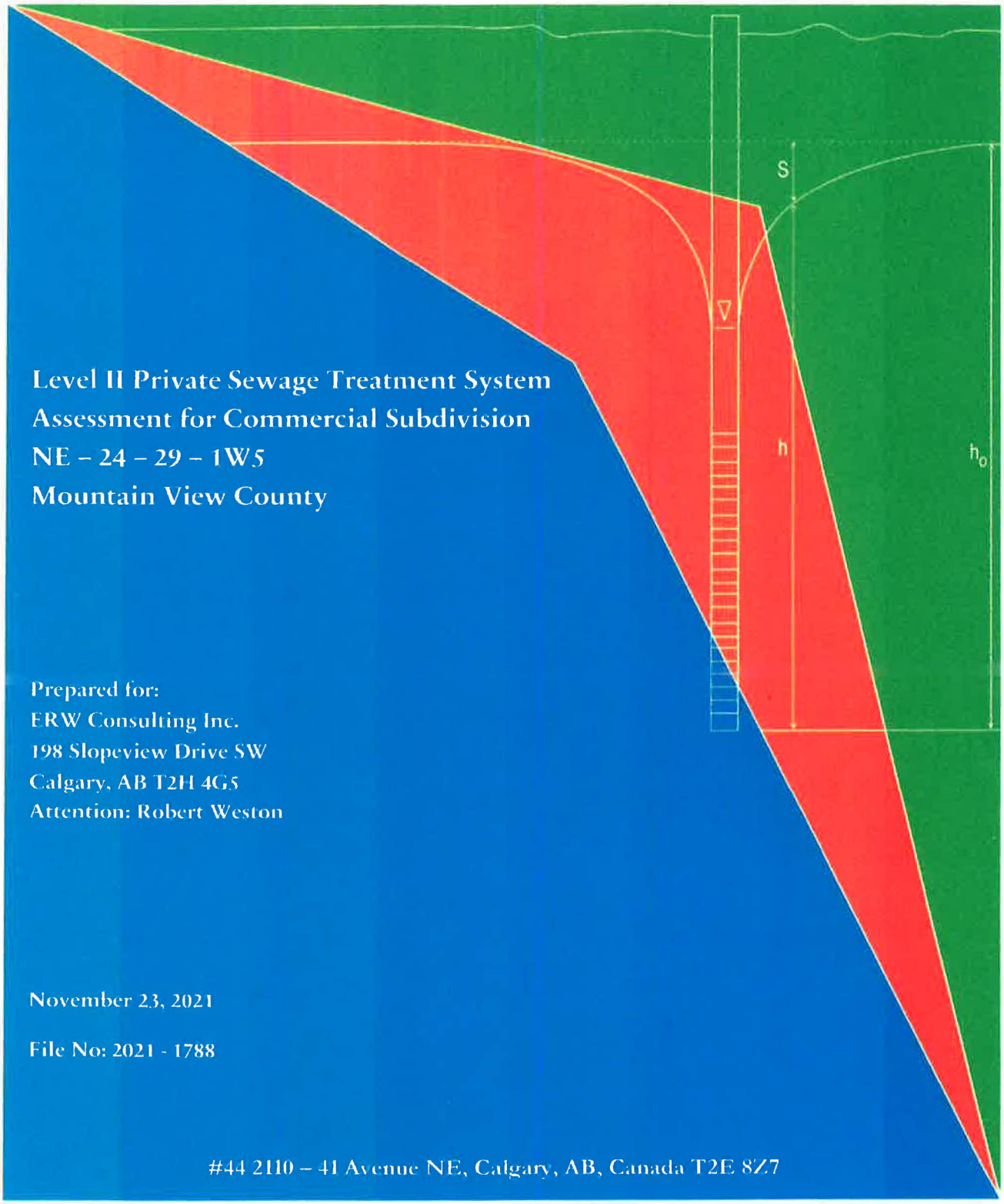
Groundwater Resources
Information Technologies Ltd.



Level II Private Sewage Treatment System Assessment for Commercial Subdivision NE – 24 – 29 – 1W5 Mountain View County

Prepared for:
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Attention: Robert Weston

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File No: 2021 - 1788

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Disclaimer

Groundwater Resources Information Technologies Ltd. (GRIT Ltd.) has performed the work as described below and made the findings and conclusions set out in the report in a manner consistent with the level of care and skill normally exercised by members of the geological science profession practicing under similar conditions at the time the work was performed. This report presents a reasonable review of information available to GRIT Ltd. Within the established scope, work schedule and budgetary constraints, GRIT Ltd. accepts no responsibility for any deficiency, misstatement or inaccuracy in this report resulting from misinformation from any individuals that provided information as part of this report. GRIT Ltd. appreciates the opportunity to present these finding on behalf of the Client. If you have any questions regarding the above report, please do not hesitate to contact the above signed.

Executive Summary

Groundwater Resources Information Technologies Ltd. (GRIT) was retained by ERW Consulting Inc. to complete a Level II Private Sewage Treatment System (PSTS) assessment for a commercial/industrial subdivision on land located within NE – 24 – 29 –1W5M in Mountain View County, Alberta (the "Site"). The PSTS assessment was completed following the *2021 Alberta Private Sewage Systems Standard of Practice* (SOP) and the *Model Process for Subdivision Approval* (Alberta Association of Municipal District and Counties, 2011).

Preliminary lot design has been determined but as lot use is not currently specified and effluent volume is based on lot use, only estimates can be provided for recommended septic field size. The results show that either mounded or below grade septic systems are feasible methods for treatment of septic field effluent at the site.

The Site is located on a hummocky portion of land which is mostly covered by cultivated crops or grasses. There is a localized topographic low which cuts through the middle of the property from northwest to the south of the site quarter section. This topographic low is occupied by an unnamed coulee draining to Carstairs Creek, located approximately 2 km north of the site. The parcel is located within an area with low development density, with the surrounding area comprising a mixture of pastureland, rangeland, and sparse farmsteads. There are currently two developed residential properties within the Site quarter section. Quarter sections adjacent to the site in all directions except to the northwest been developed with at least one residential acreage. The remaining quarter section is largely undeveloped.

Review of the drilling logs for water supply wells within the surrounding area indicate that 1 – 14 meters of a mixture of clay, sand, and gravel and at least 17 meters of interbedded sandstone and shale bedrock overlying the deeper aquifers in the area, which are used as a drinking water source. The overlying clay and bedrock should serve as a barrier to the migration of septic field effluent. Water well drilling reports for the wells within 150 m of the Site indicate the presence of one groundwater well that could be under the direct influence of surface water, #358144, which is listed for both stock and domestic use.

Twelve test holes were dug across the site quarter section to get a general assessment of the soils, log the soil, collect soil samples for grain size analysis, and determine if any shallow water table or restrictive layers are present. Strata underlying the site consists of silt loam, clay loam, loam, or silty clay loam soils with 5 – 40% gravel, cobbles, boulders, and

weathered bedrock pieces. Shallow bedrock (at depths less than 2 metres) is a restricting layer and was encountered in 9 of the 12 test holes. The soils overlying the shallow bedrock will support primary or secondary treated effluent disposal with a mounded septic field system. The remaining three test hole locations encountered soil that would support conventional below grade treatment fields. There were no indications of a shallow water table, and the water table likely sits around 4 metres below surface based off previously completed geotechnical investigations.

To aid in designing the final lot sizes for future commercial development, approximate PSTS field areas have been calculated for lots that can accept traditional below grade fields and are provided in the below table. Total field areas have been provided based on the soil textures and structures reported for the locations sampled. Infiltration areas are based on a calculated peak effluent volume of 1,530 L/day. Calculations assume that the field has 15 m long by 0.9 m wide laterals, separated by 0.9 m.

Soil Texture	Effluent Type	Loading Rate (L/day/m^2)	Infiltration Area (m^2)	Number of 15 m x 0.9 m Laterals	Total Field Area (m^2)
Clay Loam	Primary	13.2	116	8	225
	Secondary	22.0	70	5	135
Sandy Loam	Primary	15.6	100	7	195
	Secondary	30.8	50	4	105
Loam	Primary	15.6	100	7	195
	Secondary	30.8	50	4	105

Approximate PSTS field areas have been calculated for areas requiring mounded treatment field systems with primary treated effluent in the below table. Total field areas have been provided based on the soil textures and structures reported for the locations sampled. Infiltration areas are based on a calculated peak effluent volume of 1,530 L/day, which may need to be adjusted depending on use of each lot.

Calculations assume that the mounded treatment field is composed of a sand layer contained in a mound overlying the native in situ treatment field. The below calculations follow the process outlined in the 2015 SOP (Safety Codes Council) for mounded treatment fields.

Calculated Parameter	Grain Size
	Silt Loam
Primary Treated Infiltration Loading Rate (L/day/m^2)	15.6
Hydraulic Linear Loading Rate (L/day/m^2)	47.7
Area Required for Sand Layer (m^2)	38.25
Required Soil Infiltration Area (m^2)	98.1
Length of Sand Treatment Layer (m)	32.1
Width of Sand Treatment Layer (m)	1.2
Width of Required Soil Infiltration Area (m)	3.1
Upslope Mound Length (m)*	6.4
Downslope Mound Length (m)*	10.3
In-situ Soil Infiltration Width (m)	11.5
Toe to Toe Width of Mound (m)	17.9
Final Mound Area (m^2)	574.6

*Assumes land slope of 2%

Final siting of the PSTSs should maintain the required setback distances from the treatment field to property lines, water wells, water courses, buildings and septic tanks as outlined in the SOP.

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[1.0] Introduction

Groundwater Resources Information Technologies Ltd. (GRIT) was retained by ERW Consulting Inc. to complete a Level II Private Sewage Treatment System (PSTS) assessment for a proposed four phase commercial/industrial subdivision within NE– 24 – 29 – 1W5 in Mountain View County, Alberta (hereinafter referred to as the Site). The purpose of the investigation was to establish the soil texture and structure across the Site to establish the feasibility of a future PSTS installations on the new commercial development. A site map of the proposed development area is provided in **Appendix A**.

The PSTS assessment was completed according to the *Alberta Private Sewage Systems Standard of Practice* (Safety Codes Council, 2021) or *SOP*. General reporting has been completed following *The Model Process for Subdivision Approval and Private Sewage* (2011).

[2.0] Background

[2.1] Site Description

The Site is located on a hummocky portion of land which is mostly covered by cultivated crops or grasses. There is a localized topographic low which cuts through the middle of the property from northwest to the south of the site quarter section. This topographic low is occupied by an unnamed coulee draining into Carstairs Creek, located approximately 2 km north of the site. There is an access road within the Site boundaries, and the property can be accessed from the east via Range Road 10 or from the north via Township Road 294.

The parcel is located within an area with low development density, with the surrounding area comprising a mixture of pastureland, rangeland, and sparse farmsteads. There are currently two developed residential properties within the Site quarter section. Quarter sections adjacent to the site in all directions except to the northwest been developed with at least one residential acreage. The remaining quarter section is largely undeveloped.

As per our understanding, the Site will be developed into approximately 23 commercial/industrial use lots in four phases as outlined in **Appendix A, Plate No. 1**. Lot boundaries have yet to be finalized and are subject to change. The amount of septic effluent generated will be dependent on the number of employees at each site, which is not determined at this point. As a result the septic field investigation conducted provides a

general assessment of the suitability of PSTS across the site quarter section. The lots are sized appropriately to allow for an alternate area for septic fields and to meet applicable setback distances from structures, water wells and property boundaries as outlined in the SOP and summarized in **Table 7, Section 5.0.**

[2.2] Local Topography

The site elevation ranges from 1,038 meters above sea level (m asl) near the northeast corner of the property to 1,024 m asl near the low-lying coulee running through the middle of the site quarter section. The largest slopes on the site are in the middle of the site near the coulee and near the northeast corner of the site, with slopes in these areas exceeding 15%. The remaining portions of the site have shallower slopes (3 – 10%) which would be suitable for septic field installation. The closest major water body is Carstairs Creek, located 2 km north of the site. An air photo showing topographic contours of the site is shown in **Appendix A, Plate No. 2.**

[3.3] Regional Geology

According to the Alberta Research Council map *Quaternary Geology, Southern Alberta* (I. Shetsen, 1987) the area is covered by glacially derived till consisting of a mixture of clay, silt, sand and gravel with local water-sorted material and bedrock. The till is generally of even thickness. Topography is described as flat to undulating, reflecting the topography of the underlying bedrock surface.

According to the Water Well Drillers Report for the three wells within the site boundaries the surficial sediments consist of 1 – 14 meters of mixed clay, sand, and gravel. The presence of clay is favourable in preventing contamination from surface sources (such as septic field effluent) from entering lower aquifers, as long as gravel content remains low enough.

The underlying bedrock geology consists of the early/lower Paleocene fluvial sandstones of the Paskapoo Formation. The Paskapoo Formation is a non-marine fluvial deposit consisting of interbedded sandstone channel bodies and overbank mudstone, siltstone and shale. Bedrock near the Site is located approximately 1 – 14 meters below ground surface based off Water Well Drilling Reports from wells completed within the site quarter section.

[3.4] Surface Soil Conditions

The Alberta Soils Information Viewer indicates that the soils underlying the Site are part of three separate soil polygons.

The southwest corner of the site is part of soil polygon 11227 and is composed of well drained Orthic Black Chernozem overlying moderately fine textured sand clay loam, clay loam and silty clay loam deposits. Soils belong to the Delacour soil series and are derived from medium textured surficial till sediments.

The center north portion of the site where part of the low-lying area exists is part of soil polygon 13101 and is composed of well drained Orthic Regosol overlying variable textured undifferentiated deposits. Soils belong to a miscellaneous undifferentiated mineral soil series and are derived from underlying undifferentiated sediments.

The remainder of the lot is part of soil polygon 13082 and is composed of well drained Orthic Black Chernozem overlying moderately fine textured sandy clay loam, clay loam and silty clay loam deposits. Soils belong to the Antler soil series and are derived from medium texture surficial till sediments.

[3.5] Water Wells and Groundwater Under the Direct Influence of Surface Water (GWUDI)

According to the Alberta Environment and Parks (AEP) water well database there are records for three water supply wells on the Site: GIC Well ID's 340368, 358144 and 2086022. The location of wells #340368 and #358144 are listed on the AEP water well database as sitting in the middle of the quarter section and thus does not accurately reflect the true location of these wells. The AEP water well database lists one water well within ~150 meters of the Site boundary. An aerial photo showing well locations as listed on the AEP database relative to the Site is provided in **Appendix A, Plate No. 3.**

The Water Well Drilling Reports for the wells located on site and within 150 meters of the Site date from 1991 to 2017. Three of the supply wells produce from confined aquifers and are completed within a single bedrock sandstone aquifer or across interbedded sandstone-shale aquifers. Supply well #358144 is completed over both surficial clay and gravel deposits and bedrock sandstone.

Soil strata reported on the Water Well Drilling Reports include 1 – 14 meters of a mixture of clay, sand and gravel and at least 17 meters of interbedded sandstone and shale bedrock

overlying the screened interval. The clay and bedrock will serve as barriers to the migration of septic field effluent to the underlying aquifers.

Water well drilling reports for the wells within 150 m of the Site indicate the presence of one groundwater well that could be under the direct influence of surface water, #358144, which is listed for both stock and domestic use.

[3.6] Previous Geotechnical Investigation

A previous geotechnical report was completed for the site by Metro Testing + Engineering Ltd. out of Edmonton, Alberta in May 2021. The investigation consisted of drilling four boreholes (BH21-01 to BH21-04) to depths of 2 – 15 metes below surface to evaluate subsurface soil and groundwater conditions.

The subsurface investigation identified silty clay overburden deposits overlying weathered bedrock deposits. The overlying silty clay till was noted as being heterogenous and a mixture of soil particles with fine grained to boulder sized material. According to borehole logs these surficial till sediments are present from 2 to 15 meters below surface.

Bedrock consisted of layers of shale, mudstone and sandstone belonging to the Paskapoo Formation. The bedrock was extremely variable in its physical properties, ranging from loose soil like consistency to weakly weathered. Bedrock at the site generally starts around 2 meters below surface but may be even closer to surface as the highly weathered bedrock looks very similar to soil.

None of the boreholes were completed as monitoring wells and depth to groundwater was not measured. Based on the drilling log descriptions (indications of grey color change, increasing moisture content, increasing plasticity) the water table below the site on the upland areas likely sits around 4 meters below surface.

[4.0] Field Assessment and Shallow Groundwater Conditions

On November 5, 2021, 12 test holes (TH – 1 to TH – 12) were excavated with a track hoe within the Site boundaries to give a general assessment of soil types throughout the property. The test holes were located in areas with slopes suitable for a septic field and where there was reasonable access for excavation equipment.

Soils were logged by personnel from GRIT on November 5, 2021. Soils were logged according to the Canadian System of Soils Classification (1998). A summary of the test hole profiles, field observations and field tests are provided in **Table 1.** Test hole locations are illustrated in **Appendix A, Plate No. 4.** GPS location of the test holes were measured using a cellphone.

Table 1: Soil Profile and Observations

Horizon	Texture	Depth (m)	Colour	Gleying	Mottling	Structure	Grade	Consistency	Moisture	% Coarse	Lab Analysis	Notes
	TH-1 – GPS Location: 51.5024601° N -114.0128309° E											
A	Silt Loam	0.0 – 0.15	Dark Brown 7.5YR 3/2	No	No	Blocky	Strong	Loose	Moist	2	No	Rooted
B	Silt Loam	0.15 – 0.25	Dark Yellowish Brown 10YR 3/6	No	No	Blocky	Strong	Loose	Moist	7	No	Iron oxide and precipitate inclusions
C	Clay Loam	0.25 – 1.22	Light Olive Brown 2.5Y 5/4	No	No	Blocky	Strong	Loose	Moist	2	Yes	Iron oxide and coal flecks
R	Sandstone Bedrock	1.22 - ?	-	-	-	-	-	-	-	-	-	Weathered
	TH-2 – GPS Location: 51.5013018° N -114.0119421° E											
A	Silt Loam	0.0 – 0.18	Very Dark Brown 7.5YR 2.5/2	No	No	Blocky	Strong	Loose	Moist	0	No	Rooted
B	Silt Loam	0.18 – 0.33	Dark Olive Brown 2.5Y 3/3	No	No	Blocky	Strong	Firm	Dry	2	No	-
C_1	Clay Loam	0.33 – 0.91	Light Grayish Brown 2.5Y 6/2	No	No	Blocky	Strong	Loose	Dry	40	No	Rafted bedrock and boulders
C_2	Clay Loam	0.91 – 1.63	Olive Brown 2.5Y 4/4	No	No	Blocky	Strong	Hard	Dry	5	Yes	Anhydrite precipitates
R	Bedrock	1.63 - ?	-	-	-	-	-	-	-	-	-	-
	TH-3 – GPS Location: 51.5004959° N -114.0104729° E											
A	Silt Loam	0.0 – 0.08	Black 10YR 2/1	No	No	Blocky	Strong	Loose	Moist	0	No	Rooted
C_1	Silt Loam	0.08 – 1.73	Light Grayish Brown 10YR 6/2	No	No	Blocky	Strong	Loose	Dry	30	No	Rafted bedrock and cobbles
C_2	Clay Loam	1.73 – 2.29	Light Olive Brown 2.5Y 5/4	No	No	Blocky	Moderate	Loose	Moist	5	Yes	Gravel coarse grains
	TH-4 – GPS Location: 51.4994998° N -114.0120843° E											
A	Silt Loam	0.0 – 0.15	Black	No	No	Blocky	Strong	Loose	Dry	10	No	-

			7.5YR 2.5/1									
C_1	Clay Loam	0.15 – 2.13	Light Grayish Brown 10YR 6/2	No	No	Blocky	Strong	Loose	Dry	25	Yes	-
C_2	Silt Clay Loam	2.13 – 2.29	Olive Brown 2.5Y 4/3	No	No	Blocky	Strong	Loose	Moist	7	-	-
	TH-5 – GPS Location: 51.4975013° N -114.0120990° E											
A	Silt Clay Loam	0.0 – 0.15	Black 10YR 2/1	No	No	Blocky	Strong	Loose	Moist	2	No	Rooted
B	Loam	0.15 – 0.20	Dark Yellowish Brown 10YR 3/6	No	No	Blocky	Strong	Loose	Dry	5	No	-
C_1	Gravelly Clay Loam	0.20 – 0.45	Very Pale Brown 10YR 7/3	No	No	Blocky	Moderate	Loose	Dry	25	No	Gravel, cobble and boulder coarse grains
C_2	Sandy Loam	0.45 – 2.70	Olive Brown 2.5Y 4/4	No	Yes	Blocky	Moderate	Slight Plastic	Moist	7	Yes	Preclpitates
	TH-6 – GPS Location: 51.4978329° N -114.0074803° E											
A	Silt Loam	0.0 – 0.25	Black 10YR 2/1	No	No	Blocky	Strong	Loose	Moist	2	No	Rooted
C_1	Clay Loam	0.25 – 0.90	Light Gray 10YR 7/2	No	No	Blocky	Moderate	Loose	Dry	25	No	-
C_2	Loam	0.90 – 2.30	Very Dark Gray 7.5YR 3/1	No	No	Blocky	Moderate	Loose	Moist	10	Yes	-
R	Bedrock	2.30 - ?	-	-	-	-	-	-	-	-	-	-
	TH-7 – GPS Location: 51.4971452° N -114.0041171° E											
A	Silt Loam	0.0 – 0.20	Very Dark Brown 10YR 2/2	No	No	Blocky	Strong	Loose	Moist	0	No	Rooted
C	Silt Loam	0.20 – 0.50	Light Olive Brown 2.5Y 5/4	No	No	Blocky	Strong	Loose	Moist	0	No	-
R	Sandstone Bedrock	0.50 – 2.70	-	-	-	-	-	-	-	-	No	Highly weathered
	TH-8 – GPS Location: 51.4978444° N -114.0031458° E											
A	Silt Loam	0.0 – 0.20	Black 10YR 2/1	No	No	Blocky	Strong	Loose	Moist	2	No	-
R	Cemented Sandstone	0.20 – 0.50	Light Grey 10YR 7/2	No	No	-	-	-	-	-	No	Weathered
R	Sandstone Bedrock	0.50 – 1.70	Light Yellowish Brown 2.5Y 6/4	Yes	Yes	-	-	-	Moist	-	No	Highly weathered
	TH-9 – GPS Location: 51.4995569° N -114.0038221° E											
A	Silt Loam	0.0 – 0.20	Black 2.5Y 2.5/1	No	No	Blocky	Strong	Loose	Moist	0	No	Rooted
R	Bedrock	0.20 – 0.80	Light	No	No	-	-	-	-	-	No	Weathered

			Brownish Gray 10YR 6/2									
R	Sandstone Bedrock	0.80 – 1.50	Light Yellowish Brown 2.5Y 6/3	Yes	Yes	-	-	-	-	-	-	Weathered
	TH-10 – GPS Location: 51.5029094° N -114.0060587° E											
A	Loam	0.0 – 0.18	Black 2.5Y 2.5/1	No	No	Blocky	Strong	Loose	Moist	0	No	Rooted
B	Silt Loam	0.18 – 0.25	Dark Brown 10YR 3/3	No	No	Blocky	Strong	Firm	Moist	0	No	-
R	Sandstone Bedrock	0.25 – 1.78	Olive Brown 2.5Y 4/3	-	-	-	-	Hard to Loose	-	-	No	Variable depth to weathering
	TH-11 – GPS Location: 51.5027421° N -114.0027807° E											
A	Loam	0.0 – 0.25	Black 2.5Y 2.5/1	No	No	Blocky	Strong	Firm	Moist	2	No	Rooted
B	Silt Loam	0.25 – 0.33	Dark Brown 10YR 3/3	No	No	Blocky	Strong	Firm	Moist	2	No	Rooted
R	Bedrock	0.32 – 1.80	Olive Brown 2.5Y 4/3	-	-	-	-	Hard	-	5 - 20	No	Weathered bedrock fragments increase with depth
	TH-12 – GPS Location: 51.5017136° N -114.0025453° E											
A	Loam	0.0 – 0.25	Black 2.5Y 2.5/1	No	No	Blocky	Strong	Firm	Moist	2	No	Rooted
B	Silt Loam	0.25 – 0.36	Dark Brown 10YR 3/3	No	No	Blocky	Strong	Hard	Dry	0	No	Rooted
R	Bedrock	0.36 – 1.83	Olive Brown 2.5Y 4/3	No	No	-	-	Hard	Dry	30	No	Weathered bedrock fragments coarse grains

Soil at the Site is characterized by a developed, well rooted A horizon up to 25 cm thick with a silt loam soil texture and strong blocky structure. The B horizon is generally thin or absent and comprises a silt loam soil texture with strong blocky structure. The C horizon varies greatly across the site from being a bedrock in some test holes to a clay loam or silt clay loam soil texture extending to depths of 2.70 metres. Where the C horizon consists of an unconsolidated unit it contains a coarse grain content near the surface (30 – 40 %) but generally decreases with depth to around 7%.

There were visual indications of a shallow water table present in two of the test holes (TH-8 and TH-9) in the form of gleying and mottling. These indicators were present within the weathered sandstone bedrock.

Shallow bedrock was encountered in nine of the twelve test holes. The bedrock was highly weathered, and the degree of weathering increased with depth. Solid pieces of bedrock were present in some holes overlying extremely weathered loose sandstone. Shallow bedrock presents a limiting layer for future septic field installations and mounded treatment fields would be required to accommodate areas with shallow bedrock.

4.1 Grain Size Analysis

Soil samples were collected by personnel from GRIT during the excavation of soil pits on November 5, 2021 for determination of grain size of the sand and finer portion of the soil (no coarse grains). Sample depth, grain size distribution and texture are summarized in **Table 2**. Structure of the soil was determined during test hole logging by personnel from GRIT on November 5, 2021. Grain size analysis results are attached in **Appendix B**.

Table 2: Laboratory Determination of Grain Size – Sand and Finer Components

Sample ID	Sample Depth (m)	% Sand	% Silt	% Clay	Texture	Grade/Structure
TH-1	0.9	37.8	28.7	33.5	Clay Loam	Strong/Blocky
TH-2	1.1	31.2	31.1	37.7	Clay Loam	Strong/Blocky
TH-3	1.8	22.2	39.9	37.9	Clay Loam	Moderate/Blocky
TH-4	0.8	35.6	34.9	29.5	Clay Loam	Strong/Blocky
TH-5	1.2	60.0	24.2	15.8	Sandy Loam	Moderate/Blocky
TH-6	1.0	37.2	36.6	26.2	Loam	Moderate/Blocky
TH-10	0.2	40.0	35.0	25.0	Loam	Strong/Blocky

Soil texture at 0.8 – 1.2 meters depth, near the typical installation depth for lateral trenches (0.9 metres), indicate a clay loam, loam or sandy loam texture with moderate to strong blocky structure. During test pit logging soils near this depth also contained 5 – 40% coarse fragments.

The effluent loading rates acceptable for the soil texture for primary (five day Biochemical Oxygen Demand [BOD] 30 – 150 mg/L) and secondary treated (BOD of less than 30 mg/L) effluent for the areas sampled are summarized in **Table 3**.

Table 3: Laboratory Determination of Grain Size and Corresponding Effluent Loading Rates

Sample ID	Grain Size	Structure/Grade	Effluent Loading Rate (L/day/m²)	
			Primary Treated	Secondary Treated
TH-1	Clay Loam	Strong/Blocky	13.2	22.0
TH-2	Clay Loam	Strong/Blocky	13.2	22.0
TH-3	Clay Loam	Moderate/Blocky	13.2	22.0
TH-4	Clay Loam	Strong/Blocky	13.2	22.0
TH-5	Sandy Loam	Moderate/Blocky	15.6	30.8
TH-6	Loam	Moderate/Blocky	15.6	30.8
TH-7*	Silt Loam	Strong/Blocky	15.6	30.8
TH-8*	Silt Loam	Strong/Blocky	15.6	30.8
TH-9*	Silt Loam	Strong/Blocky	15.6	30.8
TH-10	Loam	Strong/Blocky	15.6	30.8
TH-11*	Silt Loam	Strong/Blocky	15.6	30.8
TH-12*	Silt Loam	Strong/Blocky	15.6	30.8

* Grain size determined through hand texture. Bedrock present at shallow depths, would require a mounded treatment field.

[4.2] Shallow Groundwater Conditions

The water level in the standpipes installed in test holes were measured on November 12, 2021. Depths to shallow groundwater, as measured on November 12, 2021, are summarized in **Table 4**.

Table 4: Depth to Shallow Groundwater

Standpipe ID	Depth to Shallow Groundwater (m)
TH-2	Dry to 1.60
TH-3	Dry to 2.20
TH-4	Dry to 2.30
TH-5	Dry to 2.70
TH-6	Dry to 2.30
TH-7	Dry to 2.70
TH-8	Dry to 1.70
TH-9	Dry to 1.50
TH-10	Dry to 1.75
TH-11	Dry to 1.80
TH-12	Dry to 1.80

All standpipes were dry, although depth of investigation was limited due to the presence of shallow bedrock in many of the test holes. Based off the previous geotechnical investigation (see Section 3.6) it is likely the water table is located around 4 meters below surface, indicating that a shallow water table will likely not be a concern when installing a septic field system on the site.

[5.0] Parcel suitability

Soil texture and structure within the areas investigated indicate that the Site is acceptable for either traditional septic fields with secondary treated effluent or for mounded septic fields with primary or secondary treated effluent. Shallow bedrock that would limit infiltration capacity was identified in 9 of the 12 test holes. No shallow groundwater that would limit vertical separation was encountered.

To aid in designing the final lot sizes for future commercial development, approximate PSTS field areas have been calculated for lots that can accept traditional below grade fields and are provided in **Table 5**. Total field areas have been provided based on the soil textures and structures reported for the locations sampled. Infiltration areas are based on a calculated peak effluent volume of 1,530 L/day. Calculations assume that the field has 15 m long by 0.9 m wide laterals, separated by 0.9 m.

Table 5: Infiltration Area and Total Field Area Based on Soil Texture and Effluent Type for Below Grade Septic Field Systems

Soil Texture	Effluent Type	Loading Rate (L/day/m²)	Infiltration Area (m²)	Number of 15 m x 0.9 m Laterals	Total Field Area (m²)
Clay Loam	Primary	13.2	116	8	225
	Secondary	22.0	70	5	135
Sandy Loam	Primary	15.6	100	7	195
	Secondary	30.8	50	4	105
Loam	Primary	15.6	100	7	195
	Secondary	30.8	50	4	105

Approximate PSTS field areas have been calculated for areas requiring mounded treatment field systems with primary treated effluent in **Table 6**. Total field areas have been provided based on the soil textures and structures reported for the locations sampled. Infiltration areas are based on a calculated peak effluent volume of 1,530 L/day. Calculations assume that the mounded treatment field is composed of a sand layer contained in a mound overlying the native in situ treatment field. The below calculations follow the process outlined in the 2015 SOP (Safety Codes Council) for mounded treatment fields.

Table 6: Infiltration Area, Treatment Area and Total Mound Area Based on Soil Texture and Primary Effluent Type

Calculated Parameter	Grain Size
	Silt Loam
Primary Treated Infiltration Loading Rate (L/day/m²)	15.6
Hydraulic Linear Loading Rate (L/day/m²)	47.7
Area Required for Sand Layer (m²)	38.25

Required Soil Infiltration Area (m^2)	98.1
Length of Sand Treatment Layer (m)	32.1
Width of Sand Treatment Layer (m)	1.2
Width of Required Soil Infiltration Area (m)	3.1
Upslope Mound Length (m)*	6.4
Downslope Mound Length (m)*	10.3
In-situ Soil Infiltration Width (m)	11.5
Toe to Toe Width of Mound (m)	17.9
Final Mound Area (m^2)	574.6

*Assumes land slope of 2%

Final siting of the treatment fields should take into consideration the setback distances for a treatment field, as measured from any part of a lateral trench, as outlined in **Table 7**. Parcels are of sufficient size to allow for a secondary area for installation of a PSTS.

Table 7: Minimum Recommended Setback Requirements for Treatment Field

Minimum Setback Distance (in meters)	Setback From
15	Water Source or Water Well
100	Licensed Municipal Water Well
15	Water Course
1.5	Property Line
10	Basement, Cellar or Crawl Space
1	Building without Permanent Foundation
5	Building with Permanent Foundation but no Basement
5	Septic Tank or Packaged Sewage Treatment Plant

A summary of the overall parcel suitability and limiting characteristics for the site can be described as follows:

Table 8: Parcel Suitability for Private Sewage Treatment System

Site Variable	Suitability	Description
Soil texture and structure	Moderate	Where suitable soil exists the soil structure and texture are for a mounded or traditional field with primary or secondary treated effluent.
Depth of Suitable Soil	Low to Moderate	Suitable soil is located to depths of 0.2 – 2.7 metres. Depth is variable across the quarter section
Hydraulic Capability	Very	Evidence of seasonal wetting in two test pits, however gleying and mottling were present within the weathered bedrock which is already a limiting characteristic. Evidence of seasonal wetting was not found within soil layers capable of receiving septic effluent.
Soil Horizons	Low	Bedrock was encountered at depths of 0.2 – 2.3 metres in nine of the test holes. Despite the high degree of weathering noted in many of the test holes where shallow bedrock was

		encountered, a septic field cannot be placed on bedrock according to the Alberta PSTS SOP (2021).
Depth to Water Table	Very	No shallow groundwater was encountered
Topography	Very	Site has rolling, sloping topography and future PSTS would be located on slopes less than 10%
Flooding	Very	Issues with flooding are not likely to occur based on site topography and proximity to surface water bodies
Density	Very	Low development density
Encumbrances	Very	Parcels are of sufficient size for an alternate PSTS location.
Parcel Size	Very	Parcels are of sufficient size for alternate PSTS location.
Surface Water	Moderate	Coulee runs through the middle of the site quarter section.
Overall Suitability	Very	Good parcel size, acceptable soil type, and no shallow water table issues.
Recommendations	Most locations tested would require mounded treatment systems with either primary or secondary treated effluent. Based off the investigation there were also tested locations that could accommodate conventional below grade treatment field with primary or secondary treated effluent.	

[7.0] References

Alberta Association of Municipal Districts and Counties. 2011. *The Model Process for Subdivision Approval and Private Sewage.*

Alberta Environment and Parks Groundwater Well Information Database, available at: http://groundwater.alberta.ca/WaterWells/d/.

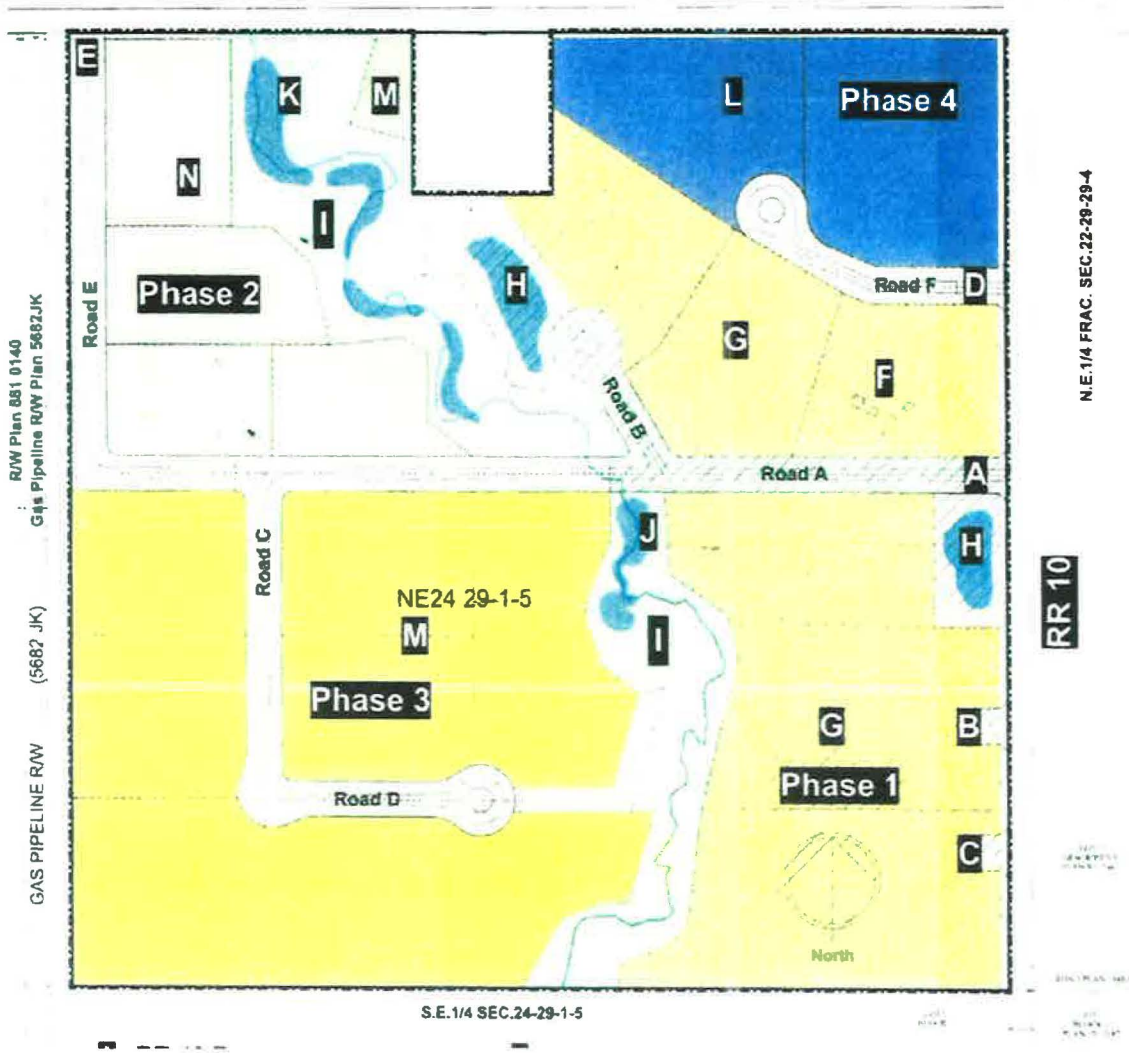
Brierley, J. A., Martin, T. C., Spiess, D. J. and Hildebrand, D. 2014. *Agricultural Region of Alberta Soil Inventory Database (AGRASID)* [Online]. Available at: http://www4.agric.gov.ab.ca/agrasidviewer/.

Canadian Soils Information Services (CANSIS), [Online] available at: http://sis.agr.gc.ca/cansis/soils/provinces.html.

Safety Codes Council. 2015. *Alberta Private Sewage System Standard of Practice 2021.* 1000, 10665 Jasper Avenue, Edmonton, AB Canada.

Soil Classification Working Group. 1998. *The Canadian System of Soil Classification*, 3rd Ed. Agriculture and Agri-Food Canada Publication.

Appendix A: Site Maps



- A RR 10 Entry
- B RR 10 Entry
- C RR 10 Entry
- D RR 10 Entry
- E TWP 294 Entry
- F Existing Buildings
- G Industrial / Commercial Phase 1
- H Storm Pond PUL
- I Green Space
- J Existing Pond / New Storm Pond
- K New Wetland / Storm Ponds in Greenspace
- L Industrial Phase 4
- M Industrial / Commercial Phase 3
- N Industrial / Commercial Phase 2

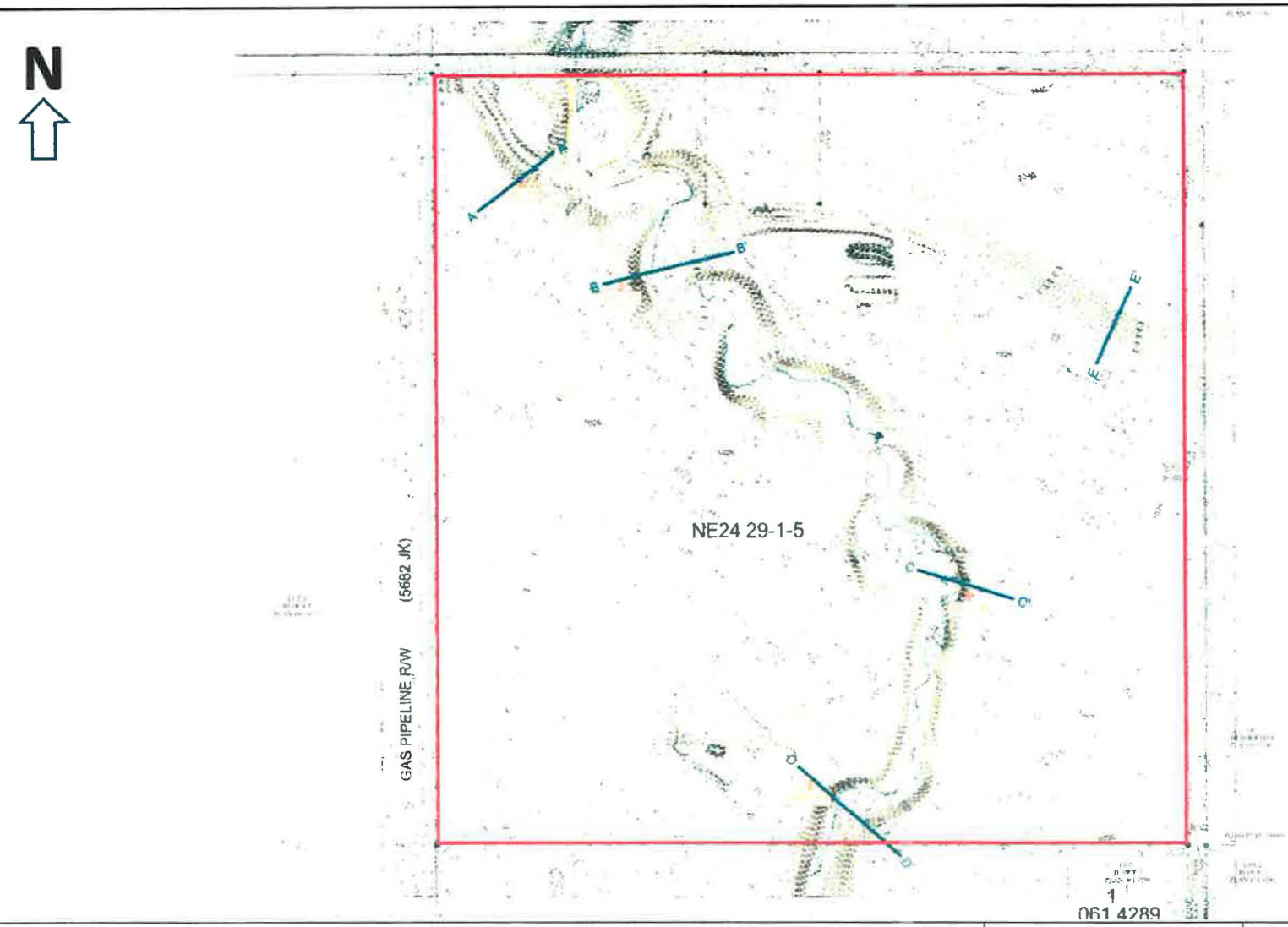
Note: Lot lines and phases are conceptual and subject to change

ERW Consulting Inc.

Groundwater Resources Information Technologies Ltd.

Site Location
NE – 24 – 29 – 1W5
Mountain View County

Date: November 2021	Project: 2021-1788	Plate No. 1



LEGEND

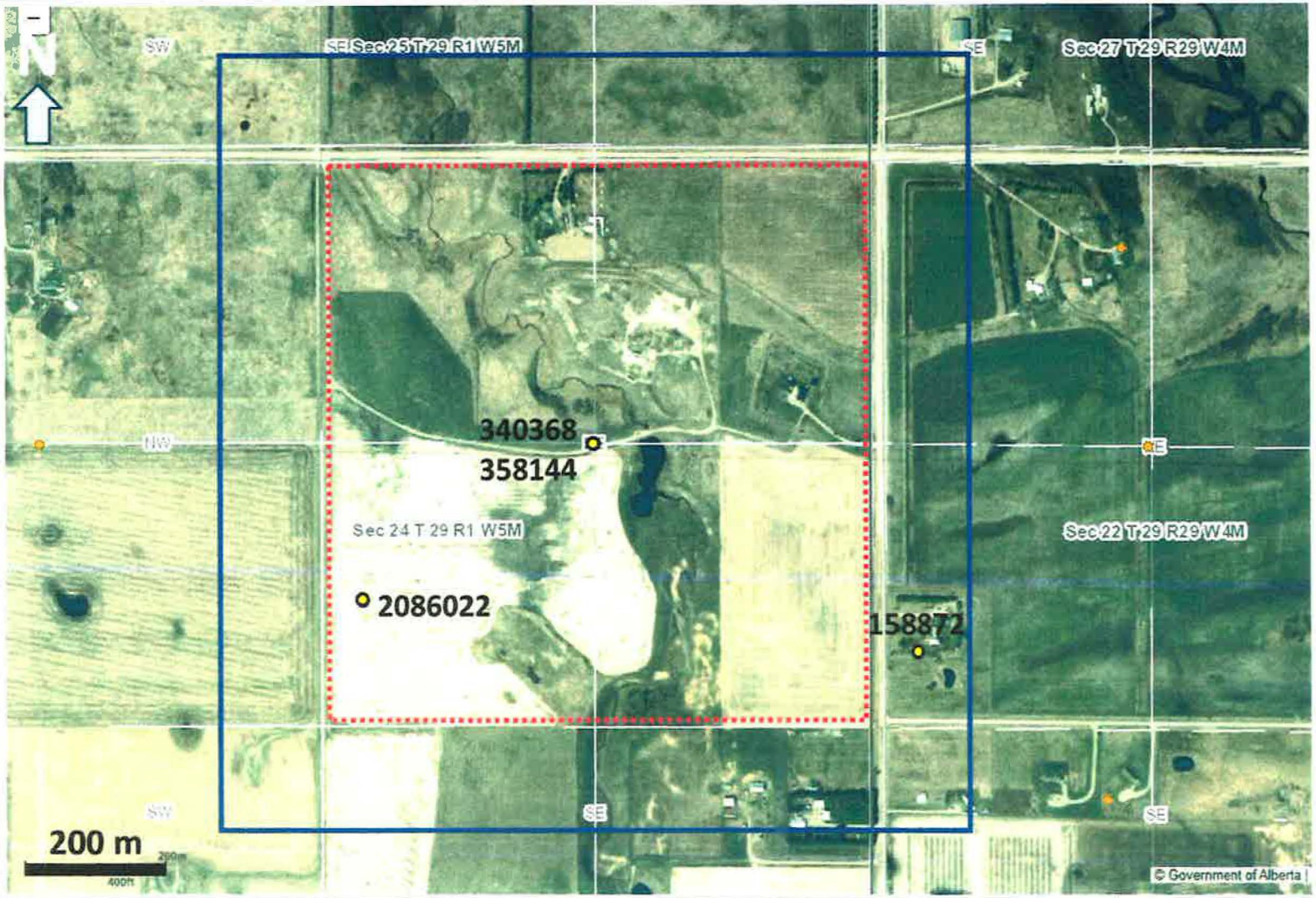
- Site Boundaries
- Surface Topography Contours (Interval = 2 m)
- Surface Topography Contours (Interval = 0.5 m)

ERW Consulting Inc.

Groundwater Resources Information Technologies Ltd.

Topographic Map
NE – 24 – 29 – 1W5
Mountain View County

Date: November 2021	Project: 2021-1788	Plate No. 2



LEGEND

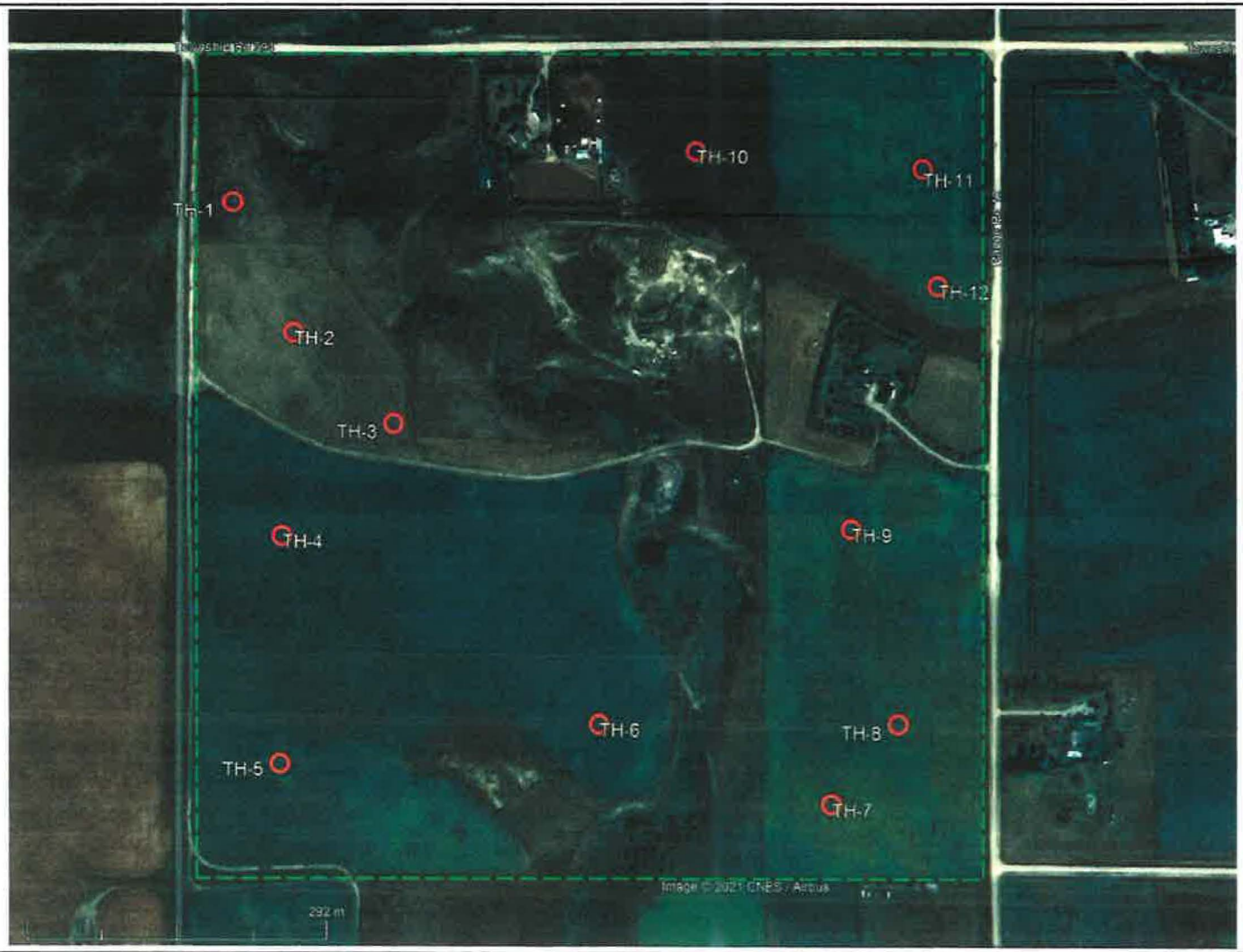
- Site Boundary
- ~ 150m radius
- Water Well Location (with listed well ID)

ERW Consulting Inc.

Groundwater Resources Information Technologies Ltd.

Water Wells within 150 m
NE – 24 – 29 – 1W5
Mountain View County

Date: November 2021	Project: 2021-1788	Plate No. 3



LEGEND

Test Hole Location

Approximate Site Boundaries

ERW Consulting Inc.

Groundwater Resources Information Technologies Ltd.

Test Hole Locations
NE – 24 – 29 – 1W5
Mountain View County

Date: November 2021	Project: 2021-1788	Plate No. 4

Appendix B: Grain Size Analysis

Groundwater Information Technologies
(GRIT) LTD.
ATTN: Alanna Felske
#44, 2110 - 41 Avenue NE
Calgary AB T2E 8Z7

Date Received: 11-NOV-21
Report Date: 22-NOV-21 13:43 (MT)
Version: FINAL

Client Phone: 403-470-1237

Certificate of Analysis

Lab Work Order #: L2661496

Project P.O. #: NOT SUBMITTED
Job Reference: 2021-1788
C of C Numbers: 17-849631
Legal Site Desc:

Milica Papic
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2661496-1 TH-1@36 INCHES							
Sampled By: CLIENT on 10-NOV-21 @ 08:00							
Matrix: SOIL							
Particle Size							
% Sand	37.8		1.0	%		21-NOV-21	R5654981
% Silt	28.7		1.0	%		21-NOV-21	R5654981
% Clay	33.5		1.0	%		21-NOV-21	R5654981
Texture	Clay loam					21-NOV-21	R5654981
L2661496-2 TH-2@44 INCHES							
Sampled By: CLIENT on 10-NOV-21 @ 08:00							
Matrix: SOIL							
Particle Size							
% Sand	31.2		1.0	%		21-NOV-21	R5654981
% Silt	31.1		1.0	%		21-NOV-21	R5654981
% Clay	37.7		1.0	%		21-NOV-21	R5654981
Texture	Clay loam					21-NOV-21	R5654981
L2661496-3 TH-3@70 INCHES							
Sampled By: CLIENT on 10-NOV-21 @ 08:00							
Matrix: SOIL							
Particle Size							
% Sand	22.2		1.0	%		21-NOV-21	R5654981
% Silt	39.9		1.0	%		21-NOV-21	R5654981
% Clay	37.9		1.0	%		21-NOV-21	R5654981
Texture	Clay loam					21-NOV-21	R5654981
L2661496-4 TH-4@30 INCHES							
Sampled By: CLIENT on 10-NOV-21 @ 08:00							
Matrix: SOIL							
Particle Size							
% Sand	35.6		1.0	%		21-NOV-21	R5654981
% Silt	34.9		1.0	%		21-NOV-21	R5654981
% Clay	29.5		1.0	%		21-NOV-21	R5654981
Texture	Clay loam					21-NOV-21	R5654981
L2661496-5 TH-5@1.2M							
Sampled By: CLIENT on 10-NOV-21 @ 08:00							
Matrix: SOIL							
Particle Size							
% Sand	60.0		1.0	%		21-NOV-21	R5654981
% Silt	24.2		1.0	%		21-NOV-21	R5654981
% Clay	15.8		1.0	%		21-NOV-21	R5654981
Texture	Sandy loam					21-NOV-21	R5654981
L2661496-6 TH-6@1.0M							
Sampled By: CLIENT on 10-NOV-21 @ 08:00							
Matrix: SOIL							
Particle Size							
% Sand	37.2		1.0	%		21-NOV-21	R5654981
% Silt	36.6		1.0	%		21-NOV-21	R5654981
% Clay	26.2		1.0	%		21-NOV-21	R5654981
Texture	Loam					21-NOV-21	R5654981

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2661496-6 TH-6@1.0M Sampled By: CLIENT on 10-NOV-21 @ 08:00 Matrix: SOIL							
L2661496-7 TH-7@1.0M Sampled By: CLIENT on 10-NOV-21 @ 08:00 Matrix: SOIL							
Particle Size							
% Sand	19.2		1.0	%		21-NOV-21	R5654981
% Silt	57.6		1.0	%		21-NOV-21	R5654981
% Clay	23.3		1.0	%		21-NOV-21	R5654981
Texture	Silt loam					21-NOV-21	R5654981
L2661496-8 TH-10@8 INCHES Sampled By: CLIENT on 10-NOV-21 @ 08:00 Matrix: SOIL							
Particle Size							
% Sand	40.0		1.0	%		21-NOV-21	R5654981
% Silt	35.0		1.0	%		21-NOV-21	R5654981
% Clay	25.0		1.0	%		21-NOV-21	R5654981
Texture	Loam					21-NOV-21	R5654981

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

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
PSA-1-CL	Soil	Particle Size	CSSS 55.3 - Hydrometer
Particle Size analysis in soil using a hydrometer			

** 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 ENVIRONMENTAL - CALGARY, ALBERTA, CANADA

Chain of Custody Numbers:

17-849631

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
mg/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.