Preliminary Level II Private Sewage Treatment System Assessment for Residential & Commercial Subdivision

SE-03-33-01W5
Mountain View County
Lat/Long: 51.798843, -114.054976

Project #: AW.78.02
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arletta water resources

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1. EXECUTIVE SUMMARY

Arletta Water Resources (Arletta) was retained by 1273927 Alberta Ltd, to complete a Preliminary Level II Private Sewage Treatment System (PSTS) for a proposed 45-lot residential subdivision with an additional 56.5 acres of potential commercial/industrial development located within SE-03-33-01W5, 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).

The Site consists of a rural agricultural parcel with no existing residential development within the Site quarter section. Most of the site is covered by seeded grasses or native grasses with no trees or shrubs. There are no localized low-lying areas containing seasonally ponded water within the proposed subdivision. The closest major surface water body to the Site is Lonepine Creek, located 4.4 km northeast of the Site.

The Site is in a low development density area which is mostly occupied by rural residential lots, agricultural land and a golf course. There are no existing residential developments within the Site quarter section. Quarter sections adjacent to the Site in all directions, except to the west, are developed with at least one residential lot. The remaining quarter section contains no residential development and appears to be used for agricultural purposes.

Review of the drilling logs for water supply wells within the Site quarter section indicate that the upper strata consist of 24.4 metres of fine-grained soil overlying the bedrock surface. Wells in the area are completed over confined bedrock aquifer units which are not in direct communication with surface water sources. The surficial deposits and bedrock should serve as a barrier to the migration of septic field effluent to deeper aquifers.

Eight test pits were excavated on Site November 17, 2023, to get an assessment of the soil profile, 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 mainly of clay loam, loam, sandy clay loam. Soil texture and structure within the areas investigated indicate that the Site is acceptable for a mounded (above grade) septic field with primary (at some locations), secondary or greater treated effluent.

The geotechnical investigation conducted by Watt Consulting Group showed an area along the north side of the site where groundwater was located at a depth of 2 m below the surface. The test pits as part of this investigation also showed some soils with evidence of seasonal saturation (gleying/mottling) and certain area will have limited vertical separation distances between the septic field and this shallow groundwater restrictive condition but mounded fields will have a sufficient infiltration distance.

To aid in designing the final lot configuration for future residential development, approximate PSTS field areas have been calculated and are provided in the table below. Total field areas have been provided based on the soil textures and structures reported for the locations sampled and the type of system suitable based on the test pit profile. Infiltration areas

are based on a three-bedroom residence with a calculated peak effluent volume of 1,530 L/day and the linear hydraulic loading rate for each soil type outlined in Table 8.1.1.10 of the *SOP*.

Test Hole Location	Effluent Type	Infiltration Loading Rate (L/day/m²)	Infiltration Area (m²)	Hydraulic Linear Loading Rate (L/day/m)	Trench Length (m)	Number of Trenches	Approximate Total Field Area (m²)
TH-1 (Mounded)	Primary	15.7	98	56.7	27.0	4	189
	Secondary	30.8	50			2	81
TH-2 (Mounded)	Primary	13.2	116	43.2	35.4	4	248
	Secondary	22.0	70			2	106
TH-3 (Mounded)	Primary	13.2	116	43.2	35.4	4	248
	Secondary	22.0	70			2	106
TH-4 (Mounded)	Primary	8.8	174	37.3	41.0	5	369
	Secondary	13.2	116			3	205
TH-5 (Mounded)	Primary	22.0	80	56.7	27.0	4	189
	Secondary	30.8	50			2	81
TH-6 (Mounded)	Primary	0.0	--	25.3	60.5	--	--
	Secondary	7.3	210			4	424
TH-7 (Mounded)	Primary	13.2	116	43.2	35.4	4	248
	Secondary	22.0	70			2	106
TH-8 (Mounded)	Primary	13.2	116	43.2	35.4	4	248
	Secondary	22.0	70			2	106

Final sitting of the PSTS 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.

2. INTRODUCTION

Arletta Water Resources (Arletta) was retained by 1273927 Alberta Ltd. to complete a Preliminary Level II Private Sewage Treatment System (PSTS) assessment for a proposed 45-lot residential subdivision with an additional 56.5 acres of potential commercial/industrial development located within SE-03-33-01W5, Mountain View County, Alberta (the "Site"). The purpose of the investigation was to establish the soil texture and structure across the new subdivision Site to determine the feasibility of future PSTS installation within the development. Site maps showing the Site land location and proposed subdivision boundaries are provided in Appendix I.

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).

3. BACKGROUND

3.1. SITE DESCRIPTION

The Site consists of a rural agricultural parcel with no existing residential development within the Site quarter section. Most of the site is covered by seeded grasses or native grasses with no trees or shrubs. There are no localized low-lying areas within the proposed subdivision. The closest major surface water body to the Site is Lonepine Creek, located 4.4 km northeast of the Site. There is no existing access road developed on Site, but the property can be accessed from the east via Range Road 12.

The Site is in a low development density area which is mostly occupied by rural residential lots, agricultural land and a golf course. There are no existing residential developments within the Site quarter section. Quarter sections adjacent to the Site in all directions, except to the west, are developed with at least one residential lot. The remaining quarter section contains no residential development and appears to be used for agricultural purposes.

As per our understanding, the Site will be developed into 45 residential lots with an additional 56.5 acres of potential commercial/industrial development as outlined in Appendix I, Figure 2**.** 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 6.

3.2. LOCAL TOPOGRAPHY

The Site has mildly hummocky surface topography with surface elevations across the Site ranging less than 3 metres. There is a localized topographic low running through the centre of the Site with approximately 1 metre rises on the southwest and east side of the low. The entirety of the proposed development area has slopes less than 15% which are suitable for

septic field placement. A topographic map showing surface topographic contours of the area is shown in Appendix I, Figure 3.

3.3. Regional Geology

The surficial strata in the area are mapped in *Quaternary Geology, Southern Alberta* (Shetsen, 1987) and indicates that the Site is underlain by glacially derived till consisting of a mixture of clay, silt, sand and gravel. Locally this unit can include water sorted material and bedrock, with local bedrock exposes as thick as five metres.

Based on the strata listed on the Water Well Drillers Report for the existing well within the Site quarter section, the upper strata consist of 24.4 metres of clay. The presence of clay within the surficial deposits is favourable in preventing contamination from surface sources (such as septic field effluent) from entering lower bedrock aquifers, as long as rock/boulder content remains low.

The underlying bedrock geology consists of the early/lower Paleocene aged 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 varies between 4 – 25 metres below ground surface based off Water Well Drilling Reports in the area.

3.4. Surface Soil Conditions

The Alberta Soils Information Viewer indicates that the soils underlying the site are part of two soil polygons. The soil underlying the southern three-quarters of the Site belong to soil polygon 12864 and describe the soil as well drained Orthic Black Chernozem overlying medium textured loam, silt loam and very fine sandy loam deposits. Soils belong to the Lonepine soil series and are derived from medium to fine textured till parent material. The soil polygon underlying the remaining northern quarter of the Site belong to soil polygon 12956 and describe the soil as well drained Orthic Black Chernozem overlying moderately fine textured sand clay loam, clay loam and silty clay loam deposits. Soils belong to the Antler soil series and are derived from medium textured loam to clay loam till parent material.

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

One water well, GIC Well ID 10136136, was installed on the Site in December of 2023 to provide preliminary estimates of water supply. The well was installed to a depth of 42.7 metres and completed over a sandstone aquifer from 35.7 - 40.2 metres. This aquifer is overlain by approximately 25 metres of sandy clay till deposits and 10 metres of interbedded sandstone and shale bedrock.

According to the Alberta Environment and Parks (AEP) water well database there are two records for the quarter section. One well, GIC Well ID 416139, was installed November 14, 1978, and decommissioned within a month of completion. A

second well, GIC Well ID 416138, was completed November 13, 1978, to a depth of 43.3 metres. No production interval is listed for the well and the recommended water removal rate is zero. This existing well on Site will have to be decommissioned by a licensed Water Well Driller at the Site development stage if not needed in the development.

The AEP water well database lists no additional water wells within ~150 meters of the Site boundary. No water supply wells located on Site or within 150 metres of the Site indicate wells that could be under the direct influence of surface water (GWUDI). An aerial photo showing well locations as listed on the AEP database relative to the Site is provided in Appendix I, Figure 4.

3.6. GEOTECHNICAL INVESTIGATION

A geotechnical investigation was conducted concurrently with this investigation by Watt Consulting Group (WATT). The investigation consisted of completing 27 boreholes to a depth of 6.45 metres, with one borehole encountering early refusal at a depth of 3 metres. The drilling investigation encountered soil strata consisting of 0.2 – 0.3 metres of topsoil overlying silty clay till with some sand and trace gravel. Evidence of oxidized stains attributed to groundwater influence or infiltration of surface water were noted at various depths. No competent bedrock surface was encountered during the drilling.

Piezometers were installed in each borehole to collect groundwater level data on December 1 – 2, 2023. The piezometers were subsequently damaged and had to be reinstalled on February 8, 2024. The depth to groundwater varied from 2.0 – 5.0 metres below surface with 12 of the borehole locations being dry. A contour map of depth to groundwater across the Site is shown in Appendix I, Figure 5. The piezometers that are currently dry are likely slowly filling in with water (tight soils) and the depth to groundwater would be expected to vary seasonally and as groundwater levels recover.

A map showing shallow groundwater elevation contours is shown in Appendix I, Figure 6, with groundwater flow generally towards the southwest.

The depth to water table map shows a relatively shallow groundwater table along the north side of the site with the water table found at depths of around 2 m below the surface. As the last two years have been relatively dry in terms of precipitation it would be expected that a higher water table may be present in wet years.

4. SOIL ASSESSMENT AND SHALLOW GROUNDWATER CONDITIONS

On November 17, 2023, eight test holes (TH-1 to TH-8) were excavated within the Site boundaries to give a general assessment of soil types across the proposed development. The test holes were in areas with slopes suitable for a septic field, clear of underground lines and where there was reasonable access for excavation equipment.

Soils were logged by personnel from Arletta on November 17, 2023. 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 I, Figure 7. GPS locations 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: 51.7964773° N -114.0577720° E											
A	Silt Loam	0.0 – 0.30	Black 10YR 2/1	No	No	Blocky	Moderate	Loose	Dry	0	No	Rooted
B	Silt Loam	0.30 – 0.40	Dark Brown 10YR 3/3	No	No	Blocky	Moderate	Loose	Dry	0	No	Rooted
C_1	Loam	0.40 – 0.75	Light Olive Brown 2.5Y 5/6	No	No	Blocky	Moderate	Loose	Dry	2	No	Rooted
C_2	Sandy Loam	0.75 – 1.40	Dark Olive Brown 2.5Y 3/3	Yes @ 1.1m	Yes @ 1.1m	Blocky	Moderate	Loose/ Slight Plastic	Moist	2	Yes	--
C_3	Loam	1.40 – 2.80	Light Yellow Brown 2.5Y 6/4	Yes	Yes	Platy	Strong	Firm	Dry	5	Yes	--
	TH-2 – GPS Location: 51.7986387° N -114.0577093° E											
A	Clay Loam	0.0 – 0.35	Black 10YR 2/1	No	No	Blocky	Strong	Loose/ Slight Plastic	Moist	2	No	Rooted
C_1	Silt Loam	0.35 – 0.42	Dark Grey 10YR 4/1	No	No	Platy	Strong	Firm	Dry	0	No	--
C_2	Clay Loam	0.42 – 0.88	Brown 10YR 4/3	Yes	Yes	Blocky	Strong	Firm/ Slight Plastic	Moist	2	Yes	Rooted
C_3	Loam	0.88 – 1.20	Olive Brown 2.5Y 4/3	Yes	Yes	Blocky	Moderate	Firm/ Slight Plastic	Moist	5	Yes	Light grey bentonite lenses
C_4	Silt Loam	1.20 – 2.80	Olive Brown 2.5Y 4/4	Yes	Yes	Blocky	Moderate	Firm/ Slight Plastic	Moist	5	No	Iron oxide and coal inclusions. Gravel and cobble coarse grains
	TH-3 – GPS Location: 51.8006604° N -114.0580607° E											
A	Silt	0.0 – 0.40	Black 10YR 2/1	No	No	Blocky	Strong	Loose	Dry	0	No	Rooted. Sand lenses
C_1	Clay Loam	0.40 – 0.70	Light Yellowish Brown 2.5Y 6/4	Yes @ 0.55 m	Yes @ 0.55 m	Blocky	Strong	Firm	Moist	0	Yes	--
C_2	Clay Loam	0.70 – 2.80	Olive Brown 2.5Y 4/3	Yes	Yes	Blocky	Moderate	Slight Plastic	Moist	2	Yes	Iron oxide and coal inclusions
	TH-4 – GPS Location: 51.8004071° N -114.0553131° E											
A	Silt Clay Loam	0.0 – 0.40	Black 2.5Y 2/1	No	No	Blocky	Weak	Firm/ Slight Plastic	Moist	2	No	--
C_1	Sandy Clay Loam	0.40 – 0.65	Brown 2.5Y 4/3	Yes	Yes	Platy	Weak	Slight Plastic	Moist	2	Yes	--

Horizon	Texture	Depth (m)	Colour	Gleying	Mottling	Structure	Grade	Consistency	Moisture	% Coarse	Lab Analysis	Notes
C_2	Loam	0.65 – 1.30	Grayish Brown 10YR 5/2	Yes	Yes	Platy	Weak	Slight Plastic	Moist	0	Yes	Heavily gleyed and mottled
C_3	Clay Loam	1.30 – 2.80	Dark Brown 2.5Y 3/3	No	Yes	Blocky	Strong	Slight Plastic	Moist	2	No	--
	TH-5 – GPS Location: 51.8011400º N -114.0518732º E											
A	Silt Loam	0.0 – 0.25	Black 2.5Y 2/1	No	No	Blocky	Strong	Loose	Moist	0	No	Rooted
B	Silt	0.25 – 0.32	Dark Brown 10YR 3/3	No	No	Blocky	Moderate	Loose	Dry	0	No	--
C_1	Clay Loam	0.32 – 0.55	Light Olive Brown 2.5Y 5/4	No	No	Blocky	Moderate	Loose	Dry	2	Yes	--
C_2	Loam	0.55 – 0.70	Light Olive Brown 2.5Y 5/4	No	No	Blocky	Moderate	Loose	Dry	5	No	--
C_3	Sandy Clay Loam	0.70 – 1.20	Grayish Brown 2.5Y 5/2	No	No	Platy	Moderate	Firm	Dry	10	Yes	Thin bentonite clay layer at 0.9 m
C_4	Sandy Loam	1.20 – 2.80	Olive Brown 2.5Y 4/4	No	No	Blocky	Strong	Firm	Moist	10	No	--
	TH-6 – GPS Location: 51.7989370º N -114.0515503º E											
A	Silt Loam	0.0 – 0.35	Black 2.5Y 2/1	No	No	Blocky	Strong	Firm	Dry	0	No	Rooted
C_1	Clay Loam	0.35 – 0.55	Olive Brown 2.5Y 4/4	No	No	Platy	Weak	Loose	Dry	0	Yes	--
C_2	Loam	0.55 – 1.20	Olive Brown 2.5Y 4/3	Yes @ 0.7 m	Yes @ 0.7 m	Blocky	Weak	Loose	Moist	2	Yes	--
C_3	Loam	1.20 – 2.80	Olive Brown 2.5Y 4/4	No	No	Blocky	Weak	Firm/ Slight Plastic	Moist	10	Yes	Coal and iron oxide inclusions. Gravel, cobble and boulder coarse grains
	TH-7 – GPS Location: 51.7966631º N -114.0521082º E											
A	Silt	0.0 – 0.30	Black 2.5Y 2/1	No	No	Blocky	Strong	Firm	Moist	0	No	Rooted
C_1	Clay Loam	0.30 – 0.75	Light Olive Brown 2.5Y 5/4	No	No	Blocky	Moderate	Loose	Dry	0	Yes	--
C_2	Loam	0.75 – 1.70	Olive Brown 2.5Y 4/4	No	No	Blocky	Moderate	Loose	Moist	5	Yes	--
C_3	Loam	1.70 – 2.80	Olive Brown 2.5Y 4/4	Yes @ 2.1 m	Yes @ 2.1 m	Platy	Moderate	Firm	Moist	7	Yes	Iron oxide and coal inclusions
	TH-8 – GPS Location: 51.7986387º N -114.0577093º E											
A	Silt Loam	0.0 – 0.25	Black 2.5Y 2/1	No	No	Blocky	Strong	Loose	Moist	2	No	Rooted
B	Silt Loam	0.25 – 0.35	Very Dark Brown 10YR 2/2	No	No	Blocky	Strong	Loose	Dry	2	No	Rooted

Horizon	Texture	Depth (m)	Colour	Gleying	Mottling	Structure	Grade	Consistency	Moisture	% Coarse	Lab Analysis	Notes
C_1	Clay Loam	0.35 – 0.60	Olive Brown 2.5Y 4/3	No	No	Blocky	Strong	Loose	Moist	0	Yes	Rooted
C_2	Clay Loam	0.60 – 1.25	Dark Olive Brown 2.5Y 3/3	No	No	Blocky	Strong	Firm/ Slight Plastic	Moist	10	Yes	Gravel and boulder coarse grains
C_3	Clay Loam	1.25 – 2.80	Dark Olive Brown 2.5Y 3/3	Yes	Yes	Blocky	Strong	Firm/ Slight Plastic	Moist	5	No	--

Soil at the Site is characterized by well developed, rooted A horizon up to 0.4 metres thick with a silt, silt loam or silt clay loam soil texture and weak to strong blocky structure. The B horizon is poorly developed at the tested locations and is composed of silt or silt loam soil.

The C horizons generally consist of loam, clay loam or sandy clay loam soils with variable structure.

4.1. RESTRICTIVE CONSIDERATIONS

There were visual indications of a seasonally shallow water table present in the test pits in the form of gleying and/or mottling at variable depths. Gleying and mottling was found in the test pits at depths of 0.4 – 2.1 metres, depending on tested location. The depth in each test pit where gleying or mottling starts represents the limiting layer in septic field design considerations.

Typical below ground septic trenches are installed to 0.9 metres below ground and require a minimum additional 0.9 metres below the trench to treat septic effluent. As the gleyed/mottled restrictive layer is within 1.8 metres of surface at most test locations a mounded treatment field would be required. A mounded septic treatment field only requires 0.3 metres of suitable native soil material on which to place the mound. These soil conditions are available at the Site.

4.2. GRAIN SIZE ANALYSIS

Soil samples were collected by personnel from Arletta during the excavation of soil pits on November 17, 2023, for determination of grain size. 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 Arletta. Grain size analysis results are attached in Appendix II.

Table 2. Laboratory determination of grain size – finer component

Sample ID	Sample Depth (m)	% Sand	% Silt	% Clay	Texture	Grade/Structure
TH-1	0.9	63	19	18	Sandy Loam	Moderate/Blocky
TH-1	1.5	34	46	20	Loam	Strong/Platy
TH-2	0.8	36	31	33	Clay Loam	Strong/Blocky
TH-2	1.1	43	30	27	Loam	Moderate/Blocky
TH-3	0.6	39	27	34	Clay Loam	Strong/Blocky
TH-3	0.9	35	35	30	Clay Loam	Moderate/Blocky
TH-4	0.6	51	27	22	Sandy Clay Loam	Weak/Platy
TH-4	0.9	42	33	25	Loam	Weak/Platy
TH-5	0.5	40	30	29	Clay Loam	Moderate/Blocky
TH-5	1.0	45	27	28	Sandy Clay Loam	Moderate/Platy
TH-6	0.5	31	38	31	Clay Loam	Weak/Platy
TH-6	1.0	45	29	27	Loam	Weak/Blocky
TH-6	1.3	45	30	25	Loam	Weak/Blocky
TH-7	0.7	39	31	30	Clay Loam	Moderate/Blocky
TH-7	1.0	46	32	22	Loam	Moderate/Blocky
TH-7	1.8	48	30	22	Loam	Moderate/Platy
TH-8	0.5	28	39	33	Clay Loam	Strong/Blocky
TH-8	1.0	36	32	32	Clay Loam	Strong/Blocky

Soil texture at 0.3 – 0.6 meters depth, near the depth related to the septic mound effluent loading rates, indicate a clay loam with moderate to strong blocky structure or weak platy structure or a sandy clay loam with weak platy structure.

Soil texture at 0.8 – 1.1 metres depth, near the depth related to below ground septic field effluent loading rates, indicate a loam with weak to moderate blocky structure or weak platy structure, sandy loam with moderate blocky structure, clay loam with strong platy structure or moderate to strong blocky structure, sandy clay loam with moderate platy structure.

4.3. SEPTIC FIELD LOADING RATES

The infiltration 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 infiltration loading rates

Sample ID	Soil Texture	Grade/Structure	Infiltration Loading Rate (L/day/m^2)	
			Primary Treated	Secondary Treated
TH-1	Sandy Loam	Moderate/Blocky	15.7	30.8
TH-1	Loam	Strong/Platy	0.0	7.3
TH-2	Clay Loam	Strong/Blocky	13.2	22.0
TH-2	Loam	Moderate/Blocky	22.0	30.8

Sample ID	Soil Texture	Grade/Structure	Infiltration Loading Rate (L/day/m²)	
			Primary Treated	Secondary Treated
TH-3	Clay Loam	Strong/Blocky	13.2	22.0
TH-3	Clay Loam	Moderate/Blocky	13.2	22.0
TH-4	Sandy Clay Loam	Weak/Platy	0.0	7.3
TH-4	Loam	Weak/Platy	14.7	22.0
TH-5	Clay Loam	Moderate/Blocky	13.2	22.0
TH-5	Sandy Clay Loam	Moderate/Platy	0.0	0.0
TH-6	Clay Loam	Weak/Platy	0.0	7.3
TH-6	Loam	Weak/Blocky	14.7	30.8
TH-6	Loam	Weak/Blocky	14.7	30.8
TH-7	Clay Loam	Moderate/Blocky	13.2	22.0
TH-7	Loam	Moderate/Blocky	22.0	30.8
TH-7	Loam	Moderate/Platy	0.0	7.3
TH-8	Clay Loam	Strong/Blocky	13.2	22.0
TH-8	Clay Loam	Strong/Blocky	13.2	22.0

The corresponding septic effluent loading rates for soil samples across the Site are highly variable. Despite this variability all locations tested would be suitable for a mounded septic field treatment system. Some soil textures would require secondary treated effluent as corresponding loading rates for primary treated effluent are zero.

4.4. SHALLOW GROUNDWATER CONDITIONS

The water level in standpipes installed in four of the test pits during excavation work were measured on December 4, 2023. Depths to shallow groundwater are summarized in Table 4.

Table 4. Depth to shallow groundwater in test pits

Standpipe ID	Depth to Shallow Groundwater (m BGS)
TH-1	Dry to 2.80
TH-4	Dry to 2.80
TH-6	Dry to 2.80
TH-8	Dry to 2.80

The standpipes were dry to the base of the test pits (2.80 meters below ground surface). Despite the test pits being dry on the date of measurement there are indications of a shallow water table present in seven of the eight test pits in the form of soil gleying or mottling, which indicate seasonally water saturated conditions.

The geotechnical investigation completed on the Site identified the water table at depths ranging from 2.0 – 5.0 metres below ground at the locations tested. Some of the geotechnical standpipes were still recovering or dry upon measurement. Depth to groundwater is also expected to vary seasonally. As was previously mentioned the last few years have had less than average precipitation and the water table may rise in wetter years. Based on shallow indications of groundwater (gleyed and mottled soils) mounded systems would still be required.

5. SITE SUITABILITY

Soil texture and structure within the areas investigated indicate that much of the Site is acceptable for the installation of mounded septic treatment fields with primary (at some tested locations), secondary or greater treated effluent. Impervious bedrock conditions that would limit vertical infiltration capacity were not identified during the site assessment. No shallow groundwater was measured at the locations tested but there were soil indicators of seasonally saturated conditions present in seven of the eight tested locations which limit vertical infiltration capacity.

Approximate PSTS field areas have been calculated based on the type of system suitable at each test pit location and are provided in Table 5. Depending on the placement of the final septic treatment mound additional area will be taken up by the toes of the mounding depending on the land surface percent incline. Infiltration areas have been provided based on the soil textures and structures reported for the locations sampled. Infiltration areas are based on a three-bedroom residence with a calculated peak effluent volume of 1,530 L/day. Linear loading rates for the septic system are calculated based on land slopes of 0 – 4%, an available infiltration distance of 0.3 – 0.6 metres. Linear loading rates are taken from Table 8.1.1.10 of the *SOP*.

Table 5. Infiltration area and approximate field area based on soil texture and effluent treatment type (excluding toes of treatment mound)

Test Hole Location	Effluent Type	Infiltration Loading Rate (L/day/m^2)	Infiltration Area (m^2)	Hydraulic Linear Loading Rate (L/day/m)	Trench Length (m)	Number of Trenches	Approximate Total Field Area (m^2)
TH-1 (Mounded)	Primary	15.7	98	56.7	27.0	4	189
	Secondary	30.8	50			2	81
TH-2 (Mounded)	Primary	13.2	116	43.2	35.4	4	248
	Secondary	22.0	70			2	106
TH-3 (Mounded)	Primary	13.2	116	43.2	35.4	4	248
	Secondary	22.0	70			2	106
TH-4 (Mounded)	Primary	8.8	174	37.3	41.0	5	369
	Secondary	13.2	116			3	205

TH-5 (Mounded)	Primary	22.0	80	56.7	27.0	4	189
	Secondary	30.8	50			2	81
TH-6 (Mounded)	Primary	0.0	--	25.3	60.5	--	--
	Secondary	7.3	210			4	424
TH-7 (Mounded)	Primary	13.2	116	43.2	35.4	4	248
	Secondary	22.0	70			2	106
TH-8 (Mounded)	Primary	13.2	116	43.2	35.4	4	248
	Secondary	22.0	70			2	106

To minimize the final area of the treatment field, secondary treated effluent should be used. Final siting of the treatment field should take into consideration the setback distances for a treatment field, as outlined in Table 6.

6. SUMMARY FOR NEW PSTS

The site is suitable for soil treatment of septic effluent using a mounded treatment field with primary (at some tested location), secondary or greater treated effluent.

Further siting considerations for a septic field are included in the following table:

Table 6. Minimum recommended setback requirements for septic treatment field

Minimum Setback Distance (metres)	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 7. New parcel suitability for Private Sewage Treatment System

Site Variable	Suitability	Description
Soil texture and structure	Moderate	Acceptable structure and suitable permeability for receiving and treating septic field effluent using an above ground (mounded) treatment field
Depth of Suitable Soil	Moderate	Suitable soil extends to a depth of at least 0.35 metres; suitable for a mounded treatment field
Hydraulic Capability	Low	Evidence of seasonal wetting found in seven of the eight test pits
Soil Horizons	Moderate	There is still an acceptable depth (0.3 m) of native material available for treatment of septic effluent utilizing a mounded treatment field
Depth to Water Table	Moderate	The shallowest depth to the water table at the site was 2.0 metres (from geotechnical investigation). As mounded treatment fields are already required due to evidence of seasonally wet soils at shallower depths this depth to the water table would not further limit septic system selection
Topography	High	Site is hummocky with low surface releif
Flooding	Moderate	Issues with flooding are unlikely with the use of a mounded treatment field. Evidence of seasonally wet soil indicates seasonally high or perched water table.
Density	High	Low development density within the site quarter section and surrounding area
Encumbrances	High	Parcels are of sufficient size for an alternate PSTS location.
Parcel Size	High	Parcel are of sufficient size for alternate PSTS location.
Surface Water	High	Lonepine Creek is located 4.4 km from the Site. The new lots are sized appropriately to allow for the required setbacks from surface water to be maintained
Overall Suitability	Moderate	Good parcel size, suitable soil types, evidence of shallow seasonally saturated soils, no shallow bedrock
Recommendations	The Site is suitable for a mounded treatment field utilizing secondary or greater treated effluent.	

7. 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. **2021**. 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.

Shetsen, I. **1987**. Quaternary Geology, Southern Alberta. Alberta Research Council

8. CLOSURE

This report has been prepared for the sole use of 1273927 Alberta Ltd. Any third party that intends to rely on this report must obtain the prior written consent of Arletta Environmental Consulting Corp. Any use of, or reliance on, this report by a third party without the prior written consent of Arletta Environmental Consulting Corp. is the sole responsibility of any such third party. Arletta Environmental Consulting Corp. as author of this report, assumes no liability for damages whatsoever suffered by any party as a result of decisions made or actions taken based on this report. This limitation of liability includes decisions to either purchase or sell the Property.

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If you require additional information, please feel free to contact the undersigned.

Arletta Water Resources

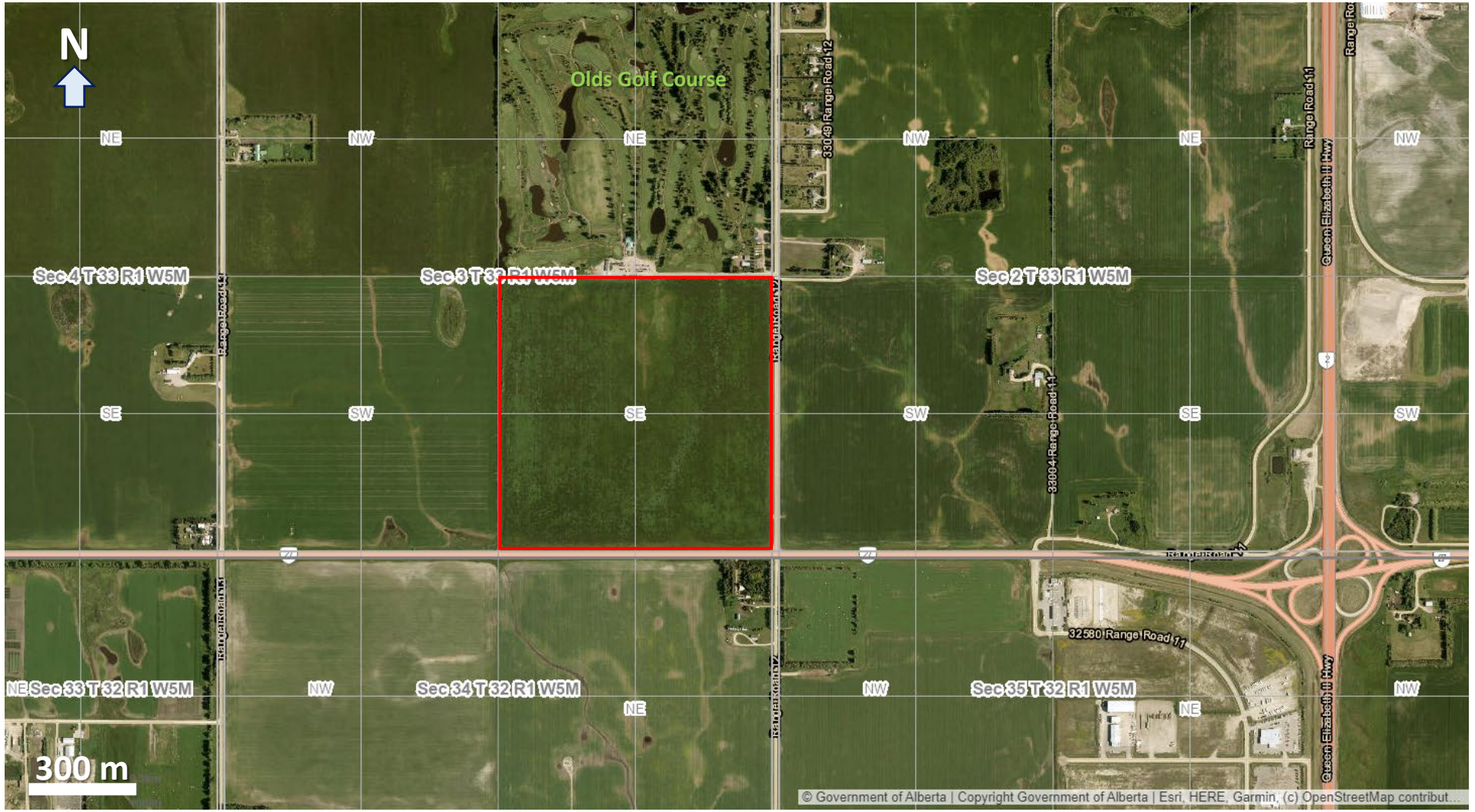
2024-08-23

Alanna Felske, P.Geo
Junior Hydrogeologist

Ken Hugo, P.Geol.,
Senior Hydrogeologist

APPENDICES

Appendix I:
Site Maps



LEGEND

Subject Site Property Boundaries

Figure 1: Site Location

Surface Location: SE-03-33-01W5	
Project #: AW.78.02	Date: December 2023
Client: 1273927 Alberta Ltd.	

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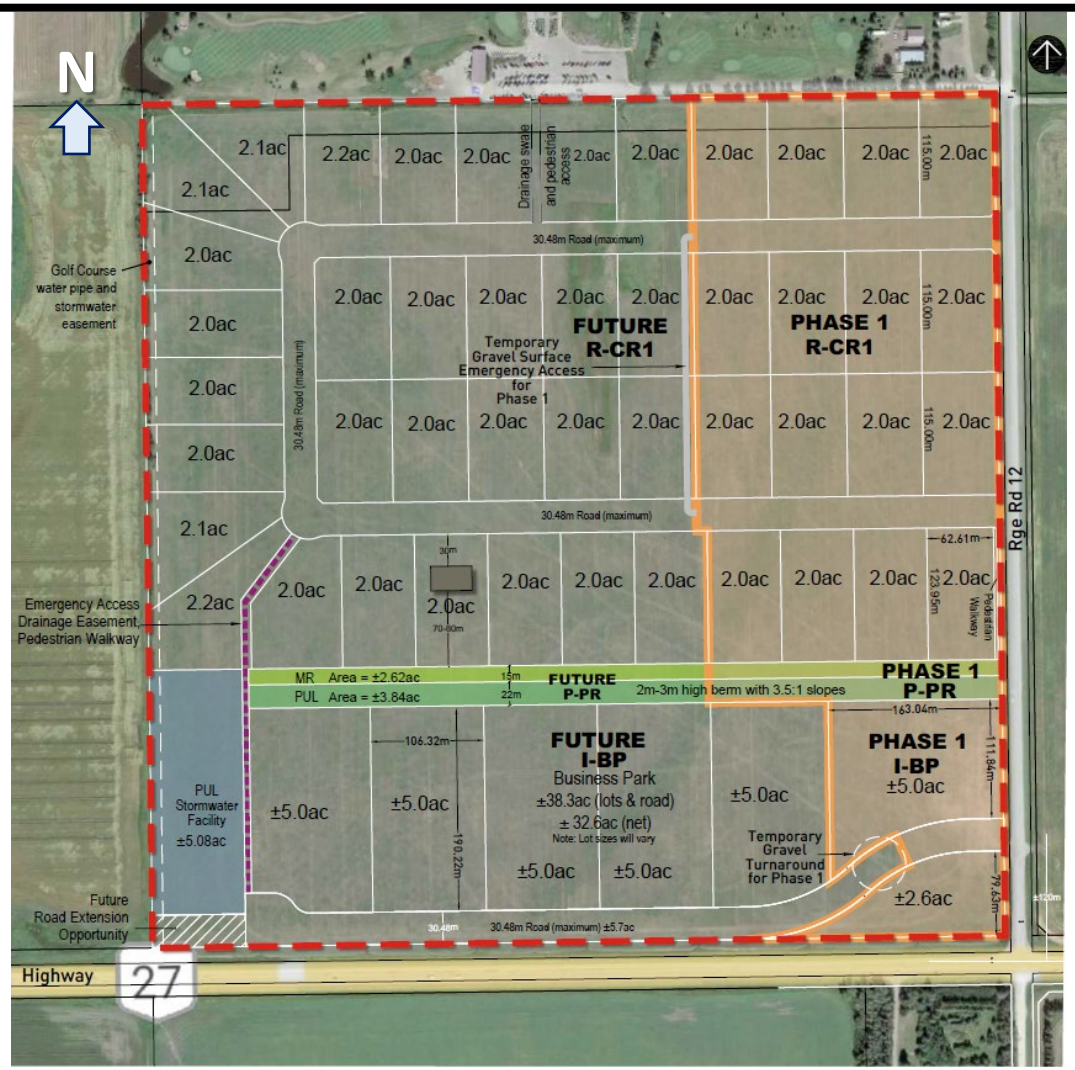

LEGEND

Figure 2: Preliminary Site Plan

Surface Location: SE-03-33-01W5	
Project #: AW.78.02	Date: August 2024
Client: 1273927 Alberta Ltd.	

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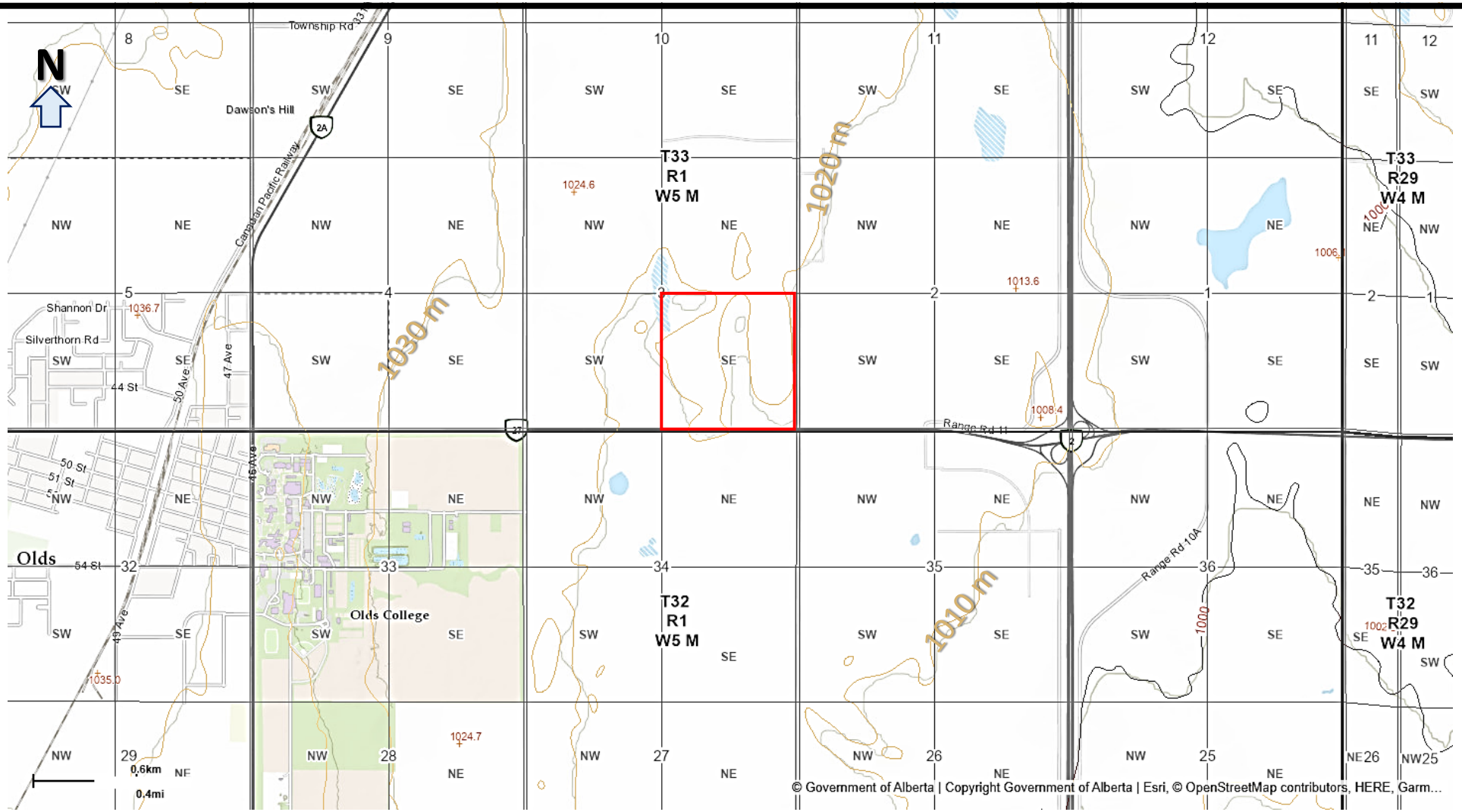

LEGEND

- Subject Site Property Boundaries
- Surface Topographic Contours (Contour Interval = 10 m)

Figure 3: Area Topographic Map

Surface Location: SE-03-33-01W5	
Project #: AW.78.02	Date: December 2023
Client: 1273927 Alberta Ltd.	

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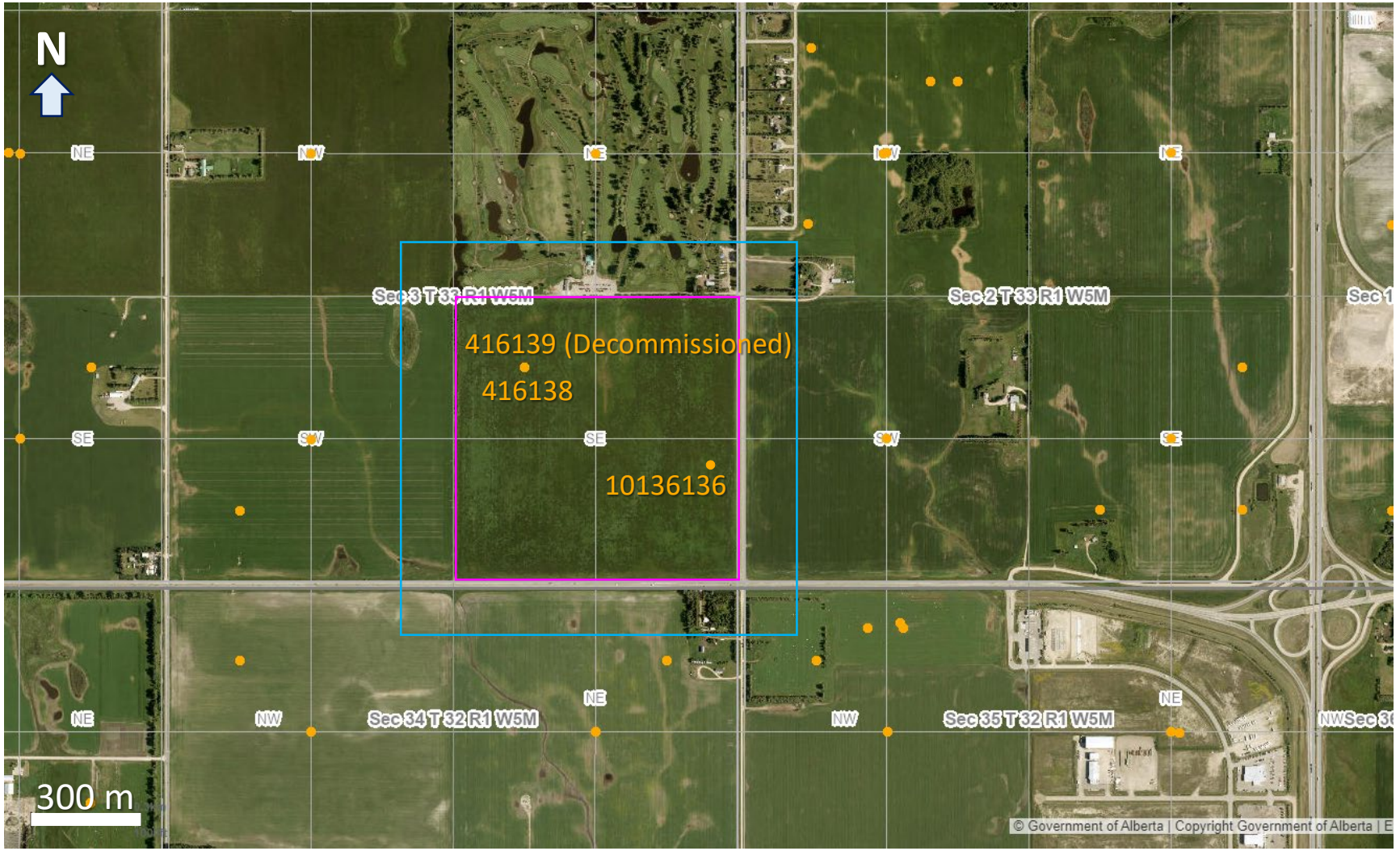

LEGEND

- Subject Site Property Boundary
- 150 Metre Radius
- Water Supply Well Location (as listed on AEP database) with GIC Well ID

Figure 4: Water Wells Within 150 Metres

Surface Location: SE-03-33-01W5	
Project #: AW.78.02	Date: December 2023
Client: 1273927 Alberta Ltd.	

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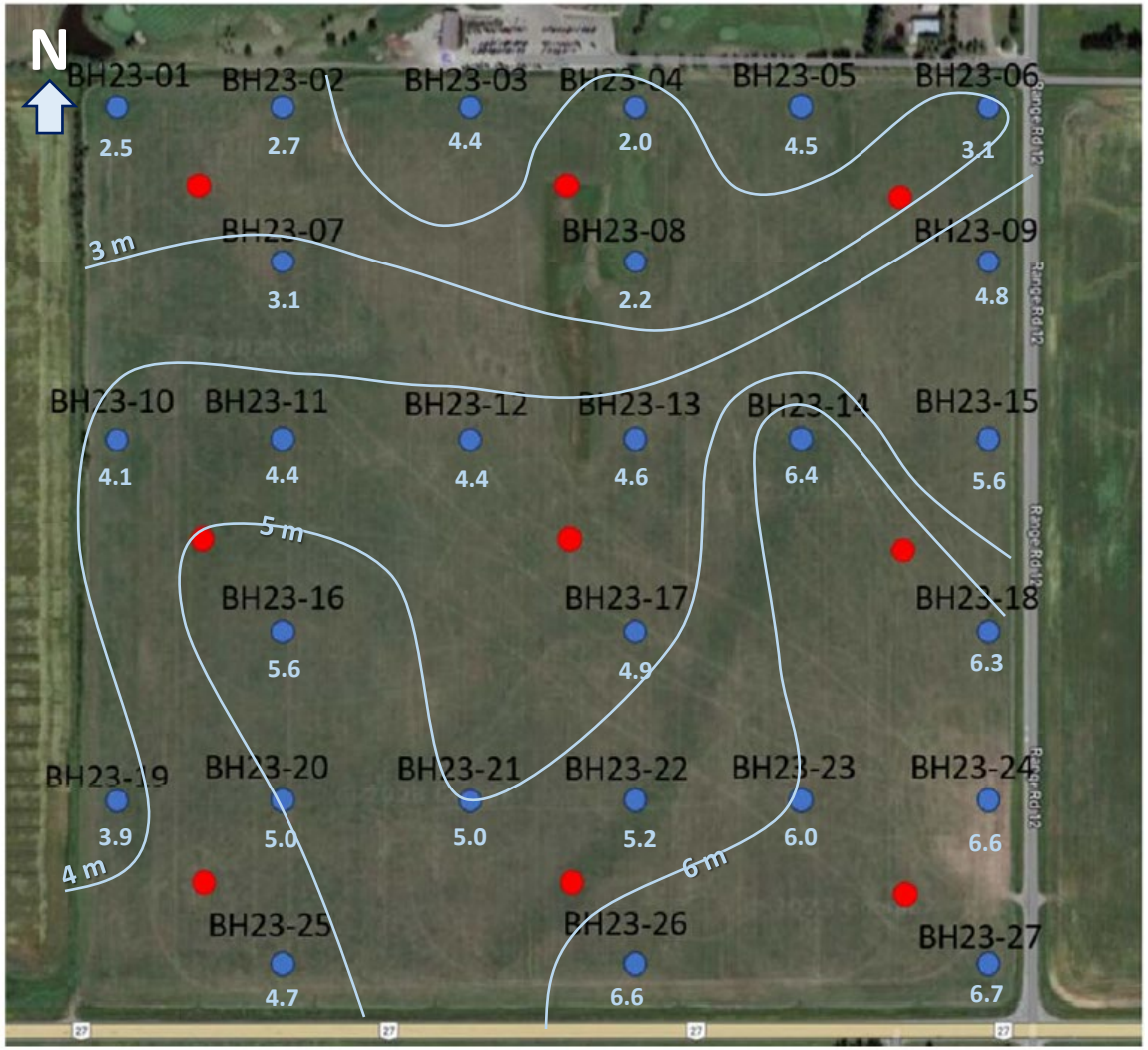

LEGEND

- Depth to Groundwater Contour (1 metre Intervals)
- 2.5 Posted Depth to Groundwater (metres)
- Geotechnical Borehole Location (2023)
- Geotechnical Borehole Location (2008)

Figure 5: Depth to Groundwater

Surface Location: SE-03-33-01W5	
Project #: AW.78.02	Date: March 2024
Client: 1273927 Alberta Ltd.	

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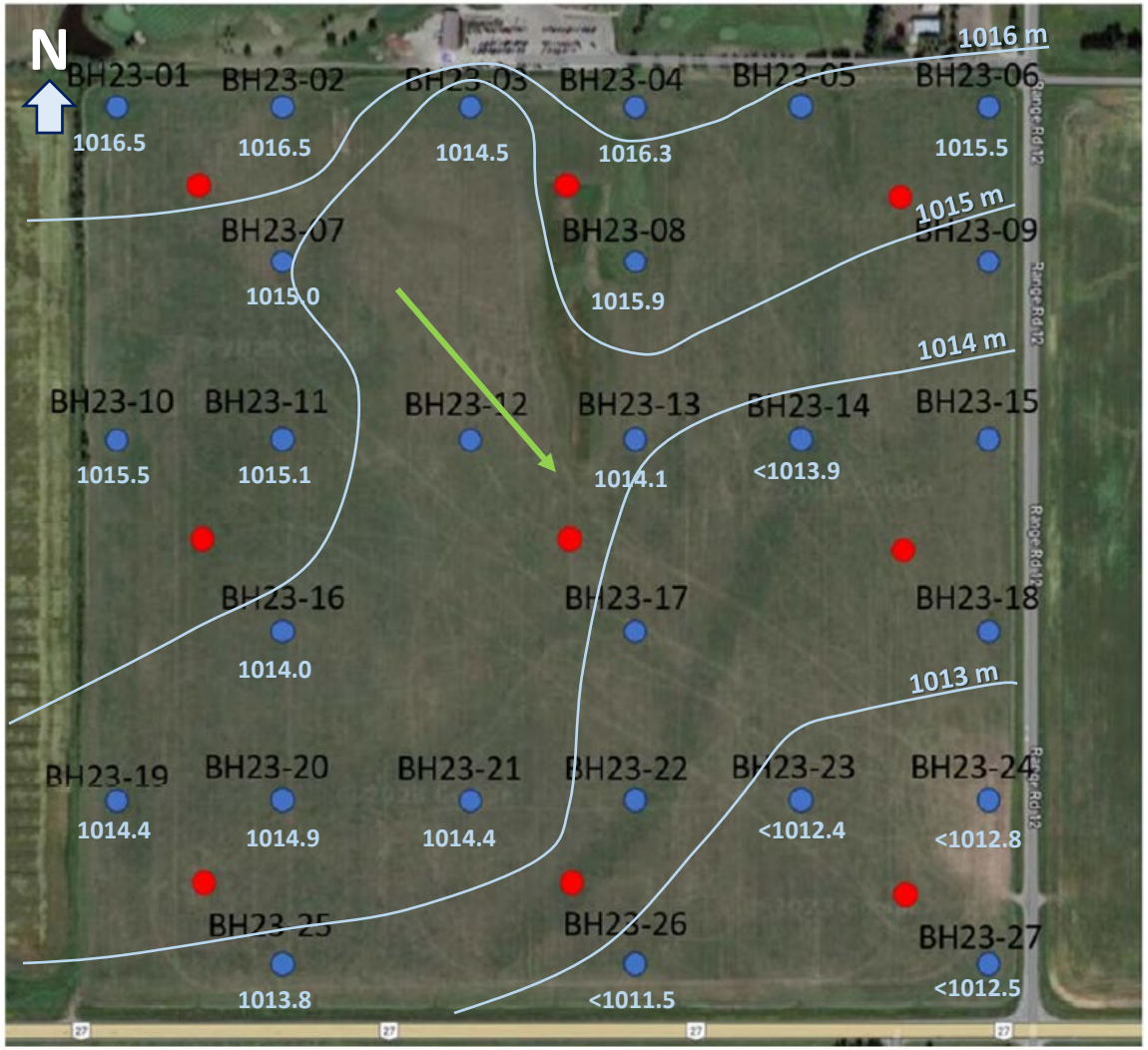

LEGEND

- Water Table Contour (1 metre Intervals)
- 1015 Posted Water Level Elevation (metres above sea level)
- Geotechnical Borehole Location (2023)
- Shallow Groundwater Flow Direction
- Geotechnical Borehole Location (2008)

Figure 6: Water Table Elevation

Surface Location: SE-03-33-01W5	
Project #: AW.78.02	Date: March 2024
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LEGEND

- Subject Site Property Boundaries
- Test Hole Location

Figure 7: Test Hole Locations

Surface Location: SE-03-33-01W5	
Project #: AW.78.02	Date: December 2023
Client: 1273927 Alberta Ltd.	

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Appendix II:
Grain Size Analysis

Bureau Veritas Job #: C394318
Report Date: 2023/11/30

ARLETTA ENVIRONMENTAL CONSULTING CORP.
Client Project #: AW.78.01
Site Location: Netook Crossing
Sampler Initials: AF

PHYSICAL TESTING (SOIL)

Bureau Veritas ID		CEW787	CEW788	CEW789	CEW790	CEW791		
Sampling Date		2023/11/17	2023/11/17	2023/11/17	2023/11/17	2023/11/17		
COC Number		76458	76458	76458	76458	76458		
	UNITS	TH-1 @0.9 m	TH-1 @ 1.5 m	TH-2 @ 0.8m	TH-2 @ 1.1 m	TH-3 @ 0.6 m	RDL	QC Batch
Physical Properties								
% sand by hydrometer	%	63	34	36	43	39	2.0	B218185
% silt by hydrometer	%	19	46	31	30	27	2.0	B218185
Clay Content	%	18	20	33	27	34	2.0	B218185
Texture	N/A	SANDY LOAM	LOAM	CLAY LOAM	LOAM	CLAY LOAM	N/A	B204651

RDL = Reportable Detection Limit
N/A = Not Applicable

Bureau Veritas ID		CEW792	CEW793	CEW794	CEW795	CEW796		
Sampling Date		2023/11/17	2023/11/17	2023/11/17	2023/11/17	2023/11/17		
COC Number		76458	76458	76458	76458	76458		
	UNITS	TH-3 @ 0.9 m	TH-4 @ 0.6 m	TH-4@ 0.9 m	TH-5 @ 0.5 m	TH-5 @ 1.0 m	RDL	QC Batch
Physical Properties								
% sand by hydrometer	%	35	51	42	40	45	2.0	B218185
% silt by hydrometer	%	35	27	33	30	27	2.0	B218185
Clay Content	%	30	22	25	29	28	2.0	B218185
Texture	N/A	CLAY LOAM	SNDY CL LO	LOAM	CLAY LOAM	SNDY CL LO	N/A	B204651

RDL = Reportable Detection Limit
N/A = Not Applicable

Bureau Veritas ID		CEW797	CEW798	CEW799	CEW800	CEW801	CEW802		
Sampling Date		2023/11/17	2023/11/17	2023/11/17	2023/11/17	2023/11/17	2023/11/17		
COC Number		76458	76458	76458	76458	76458	76458		
	UNITS	TH-6 @ 0.5 m	TH-6 @ 1.0 m	TH-6 @ 1.3 m	TH-7 @ 0.7 m	TH-7 @ 1.0 m	TH-7 @ 1.8 m	RDL	QC Batch
Physical Properties									
% sand by hydrometer	%	31	45	45	39	46	48	2.0	B218185
% silt by hydrometer	%	38	29	30	31	32	30	2.0	B218185
Clay Content	%	31	27	25	30	22	22	2.0	B218185
Texture	N/A	CLAY LOAM	LOAM	LOAM	CLAY LOAM	LOAM	LOAM	N/A	B204651

RDL = Reportable Detection Limit
N/A = Not Applicable

Bureau Veritas Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Bureau Veritas Job #: C394318
Report Date: 2023/11/30

ARLETTA ENVIRONMENTAL CONSULTING CORP.
Client Project #: AW.78.01
Site Location: Netook Crossing
Sampler Initials: AF

PHYSICAL TESTING (SOIL)

Bureau Veritas ID		CEW802	CEW803	CEW804		
Sampling Date		2023/11/17	2023/11/17	2023/11/17		
COC Number		76458	76458	76458		
	UNITS	TH-7 @ 1.8 m Lab-Dup	TH-8 @ 0.5 m	TH-8 @ 1.0 m	RDL	QC Batch
Physical Properties						
% sand by hydrometer	%	47	28	36	2.0	B218185
% silt by hydrometer	%	29	39	32	2.0	B218185
Clay Content	%	24	33	32	2.0	B218185
Texture	N/A	N/A	CLAY LOAM	CLAY LOAM	N/A	B204651

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

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GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	19.7°C

Sample CEW793 [TH-4 @ 0.6 m] : SNDY CL LO = SANDY CLAY LOAM

Sample CEW796 [TH-5 @ 1.0 m] : SNDY CL LO = SANDY CLAY LOAM

Results relate only to the items tested.

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Bureau Veritas Job #: C394318
Report Date: 2023/11/30

ARLETTA ENVIRONMENTAL CONSULTING CORP.
Client Project #: AW.78.01
Site Location: Netook Crossing
Sampler Initials: AF

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
B218185	RDL	QC Standard	% sand by hydrometer	2023/11/30		97	%	75 - 125
			% silt by hydrometer	2023/11/30		105	%	75 - 125
			Clay Content	2023/11/30		99	%	75 - 125
B218185	RDL	RPD [CEW802-01]	% sand by hydrometer	2023/11/30	1.9		%	30
			% silt by hydrometer	2023/11/30	3.7		%	30
			Clay Content	2023/11/30	8.7		%	30

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

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Bureau Veritas Job #: C394318
Report Date: 2023/11/30

ARLETTA ENVIRONMENTAL CONSULTING CORP.
Client Project #: AW.78.01
Site Location: Netook Crossing
Sampler Initials: AF

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Ghayasuddin Khan, M.Sc., P.Chem., QP, Scientific Specialist, Inorganics

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