Part 2 — Technical Requirements

NRCB Natural Resources Conservation Board

Application under the *Agricultural Operation Practices Act* for a confined feeding operation, manure collection area, and/or manure storage facility(ies)

NRCB USE ONLY	Application number	Legal land description
☑ Approval ☐ Registration ☐ Authorization ☐ Amendment	RA24043	E1/2 24-42-18 W4M W1/2 18-42-17 W4M SW 19-42-17 W4M

APPLICATION DISCLOSURE

This information is collected under the authority of the *Agricultural Operation Practices Act* (AOPA), and is subject to the provisions of the *Freedom of Information and Protection of Privacy Act*. This information is public unless the NRCB grants a written request that certain sections remain private.

Any construction prior to obtaining an NRCB permit is an offence and is subject to enforcement action, including prosecution.

I, the applicant, or applicant's agent, have read and understand the statements above, and I acknowledge that the information provided in this application is true to the best of my knowledge.

JAN 7 2025
Date of signing

[redacted]
Signature

DONALDA COLONY FARMING CO. LTD.
Corporate name (if applicable)

KENNETH HOFER
Print name

GENERAL INFORMATION REQUIREMENTS

Proposed facilities: list all proposed confined feeding operation facilities and their dimensions. Indicate whether any of the proposed facilities are additions to existing facilities. (attach additional pages if needed)

Proposed facilities	Dimensions (m) (length, width, and depth)
FEEDLOT PENS (consists of 2 rows with 5 pens each)	304.8M X 103.6M (total)
SICK PENS, SHIPPING & RECEIVING PENS	60.9M X 103.6M (total)
PROCESSING BARN	24.3M X 36.6M
AO note: applicant is also proposing a runoff catch basin: 103.6 x 60.9 x 2 m deep	

Existing facilities: list **ALL** existing confined feeding operation facilities and their dimensions

Existing facilities	Dimensions (m) (length, width, and depth)	NRCB USE ONLY
SEE ATTACHED LIST OF FACILITIES		

NRCB USE ONLY

Facilities listed on following page confirmed. Approval RA20018 also permitted a layer barn: 97 m x 25 m.

Facility	Dimensions (m)	Original permit
Layer barn	68.5 x 11.5	Deemed permit
Pullet barn	44.1 x 11.5	
Chicken broiler barn	58.0 x 10.4	
Turkey barn	21.0 x 8.8	
Turkey pen	60 x 35	
Duck and geese barn	25.8 x 6.1	
Dry cow corrals	6,000 m^2	
Corral 1 (dairy)	90 x 158 x 161 (triangular)	
Corral 2 (dairy)	108 x 80 x 57 (triangular)	
Corral 3 (dairy)	29 x 29	
Compost area	31 x 18	
Sheep barns	58.6 x 10.6 (dimensions includes both barns)	
Sheep pens	34 x 29, 27 x 29, and 44 x 46	
Permastore manure tank	32 (diameter) x 8 (deep)	
Dry cow shed	19.6 x 10.4	
Dairy barn	60 x 41	Approval RA15023
Calf barn	24 x 20	
Manure lift station	2.3 x 1.3 x 3.0	Authorization RA16049
Building housing manure separator/screw press	4.6 x 4.6	
Dry cow and young stock shed (with attached solid manure storage pad)	20.5 x 113	Approval RA15023A

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If a new facility is replacing an old facility, please explain what will happen to the old facility and when. ☐ N/A

Construction completion date for proposed facilities JAN 2027

Additional information

Livestock numbers: Complete only if livestock numbers are different from what was identified in the Part 1 application. Note: if livestock numbers increase in your Part 2 application, a new Part 1 application must be submitted which may result in a loss of priority for minimum distance separation (MDS).

Livestock category and type (Available in the Schedule 2 of the Part 2 Matters Regulation)	**Permitted number**	**Proposed increase or decrease in number (if applicable)**	**Total**
FEEDER FINISHER	0	3000	3000
ALL OTHER ANIMALS NUMBERS REMAIN			
THE SAME AS PERMIT ~~#RA15023A~~			
Approval RA20018			
Milking cows (plus associated dries and replacements)	120	0	120
Chicken layers	35,000	0	35,000
Chicken pullets	40,000	0	40,000
Geese	200	0	200
Turkeys	400	0	400
Sheep	209	0	209

DECLARATION AND ACKNOWLEDGMENT OF APPLICANT CONCERNING *WATER ACT* LICENCE

issued by Alberta Environment and Protected Areas (EPA) for a confined feeding operation (CFO)

Date and sign one of the following four options

OPTION 1: Applying through the NRCB for both the AOPA permit and the *Water Act* licence

I **DO** want my water licence application coupled to my AOPA permit application.

Signed this ____day of _____, 20____. _____

Signature of Applicant or Agent

OPTION 2: Processing the AOPA permit and *Water Act* licence separately

1. I (we) acknowledge that the CFO will need a new water licence from EPA under the *Water Act* for the development or activity proposed in this AOPA application.
2. I (we) request that the NRCB process the AOPA application **independently of** EPA's processing of the CFO's application for a water licence.
3. In making this request, I (we) recognize that, if this AOPA application is granted by the NRCB, the NRCB's decision will not be considered by EPA as improving or enhancing the CFO's eligibility for a water licence under the *Water Act*.
4. I (we) acknowledge that any construction or actions to populate the CFO with livestock pursuant to an AOPA permit in the absence of a *Water Act* licence will **not** be relevant to EPA's consideration of whether to grant the *Water Act* licence application.
5. I (we) acknowledge that any such construction or livestock populating will be at the CFO's sole risk if the *Water Act* licence application is denied or if the operation of the CFO is otherwise deemed to be in violation of the *Water Act*. This risk includes being required to depopulate the CFO and/or to cease further construction, or to remove "works" or "undertakings" (as defined in the *Water Act*).
6. **AS RELEVANT:** I (we) acknowledge that the CFO is located in the South Saskatchewan River Basin and that, pursuant to the *Bow, Oldman and South Saskatchewan River Basin Water Allocation Order* [Alta. Reg. 171/2007], this basin is currently closed to new surface water allocations.
7. **Provide:** Water licence application number(s) _____

Signed this 7 day of JANUARY, 2025. [redacted]

Signature of Applicant or Agent

OPTION 3: Additional water licence not required

1. I (we) declare that the CFO will not need a new licence from EPA under the *Water Act* for the development or activity proposed in this AOPA application.
2. **Provide**: Water license number(s) or water conveyance agreement details _____

Signed this ____ day of _____, 20____. _____

Signature of Applicant or Agent

OPTION 4: Uncertain if *Water Act* licence is needed; acknowledgement of risk (for existing CFOs only)

1. At this time, I (we) do not know whether a new water licence is needed from EPA under the *Water Act* for the development or activity proposed in this AOPA application.
2. If a new *Water Act* licence is needed, I (we) request that the NRCB process the AOPA application **independently of** EPA's processing of the CFO's application for a water licence.
3. In making this request, I (we) recognize that, if this AOPA application is granted by the NRCB, the NRCB's decision will not be considered by EPA as improving or enhancing the CFO's eligibility for a water licence under the *Water Act*.
4. I (we) acknowledge that any construction or actions to populate the CFO with additional livestock pursuant to an AOPA permit in the absence of a *Water Act* licence will **not** be relevant to EPA's consideration of whether to grant my *Water Act* licence application, if a new water licence is needed.
5. I (we) acknowledge that any such construction or livestock increase will be at the CFO's sole risk if the *Water Act* licence application is denied or if the operation of the CFO is otherwise deemed to be in violation of the *Water Act*. This risk includes being required to depopulate the CFO and/or to cease further construction, or to remove "works" or "undertakings" (as defined in the *Water Act*).
6. **AS RELEVANT:** I (we) acknowledge that the CFO is located in the South Saskatchewan River Basin and that, pursuant to the *Bow, Oldman and South Saskatchewan River Basin Water Allocation Order* [Alta. Reg. 171/2007], this basin is currently closed to new surface water allocations.
7. **Provide**: Water license number(s) or water conveyance agreement details _____

_____

Signed this ____ day of _____, 20____. _____

Signature of Applicant or Agent

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GENERAL ENVIRONMENTAL INFORMATION

(complete this section for the worst case of the existing facility which is the closest to water bodies or water wells and for each of the proposed facilities)

Facility description / name *(as indicated on site plan)*

Existing: NONE **Proposed 1:** FEEDLOT PENS

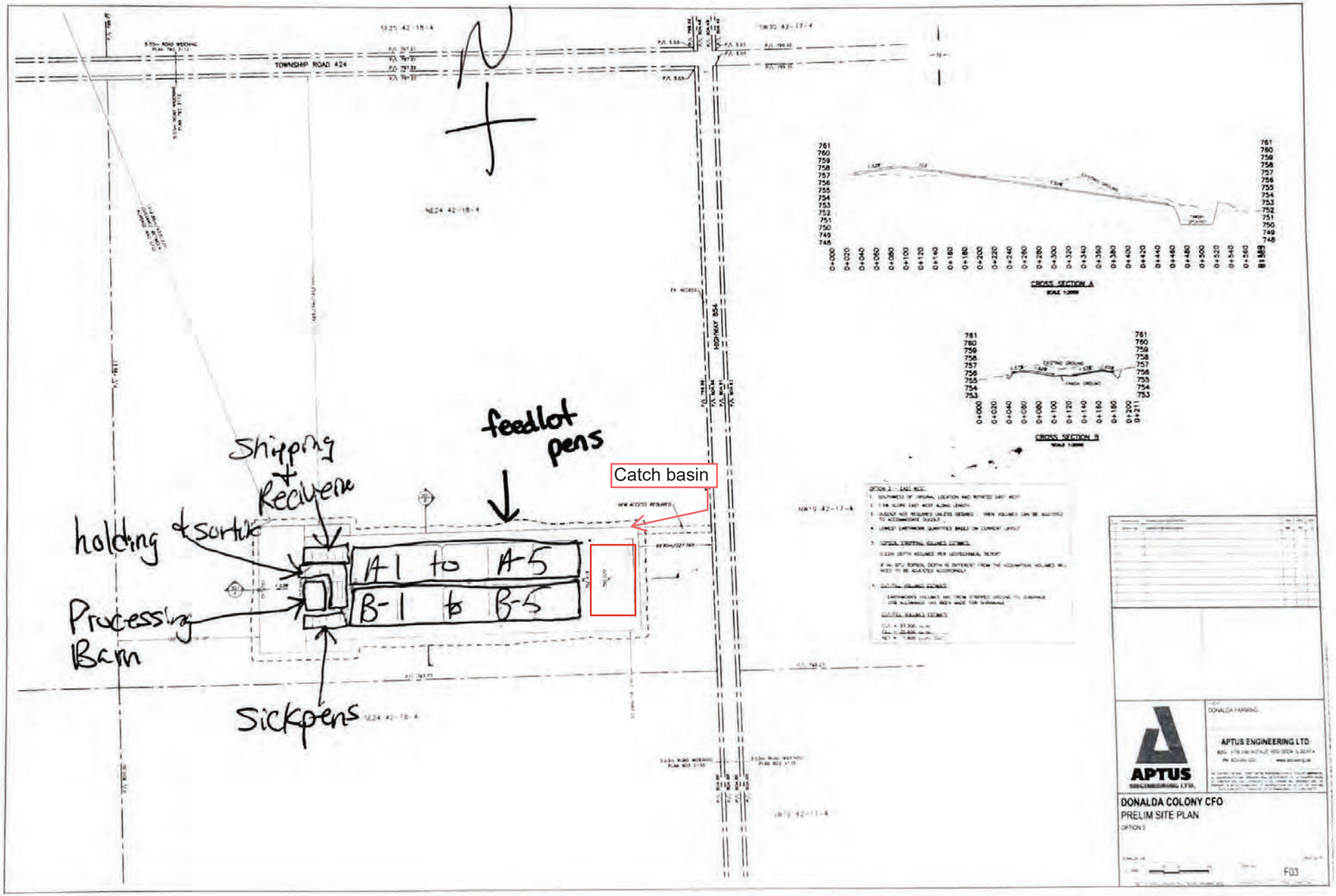
Proposed 2: CATCH BASIN **Proposed 3:**

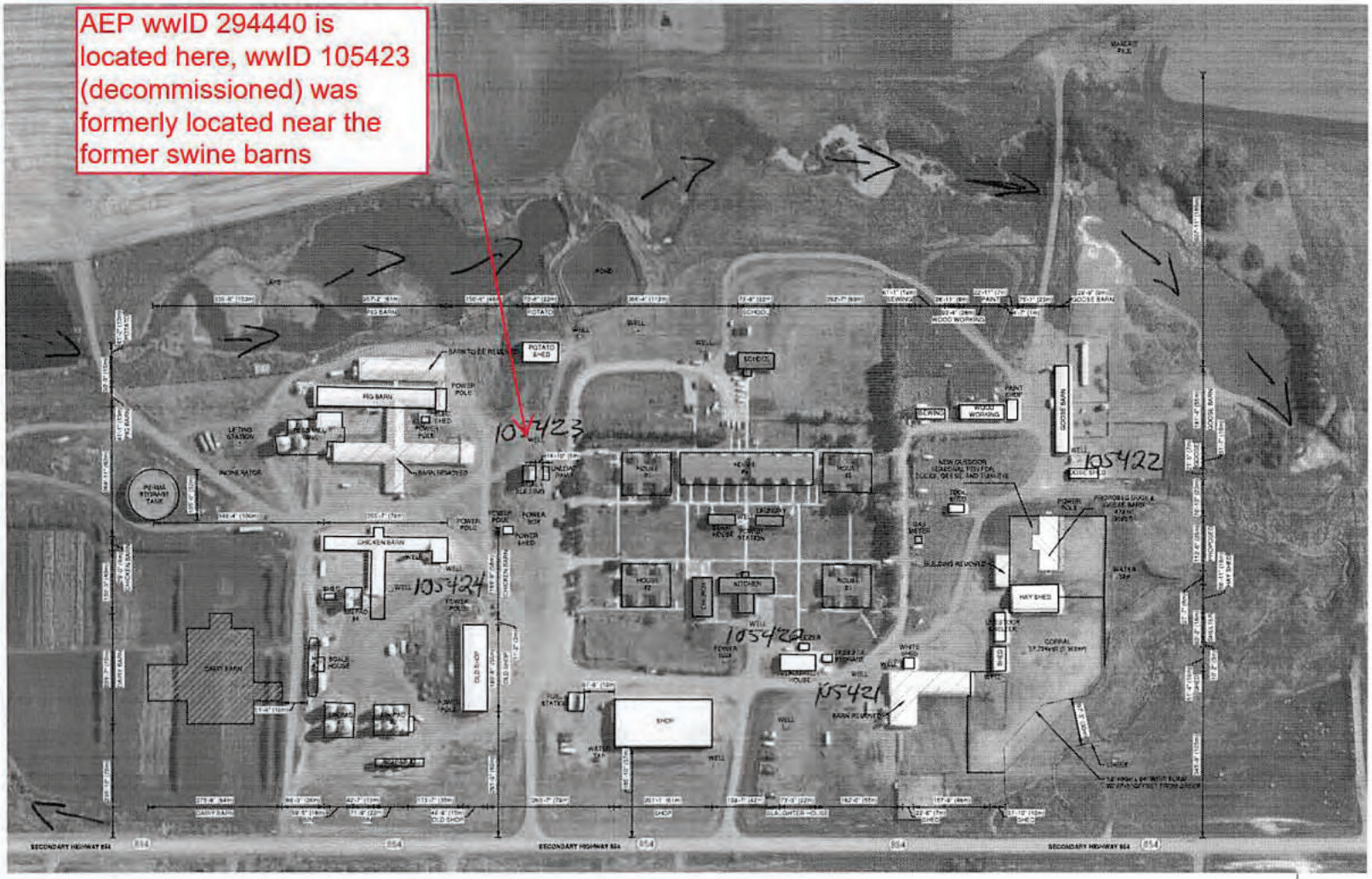
Facility and environmental risk information		Facilities				NRCB USE ONLY	
		Existing	Proposed 1	Proposed 2	Proposed 3	Meets requirements	Comments
Flood plain information	What is the elevation of the floor of the lowest manure storage or collection facility above the 1:25 year flood plain or the highest known flood level?	☐ >1 m ☐ ≤ 1 m	■ >1 m ☐ ≤ 1 m	■ >1 m ☐ ≤ 1 m	☐ > 1 m ☐ ≤ 1 m	☒ YES ☐ NO ☐ YES with exemption	Not located within a floodplain
Surface water information	How many springs are within 100 m of the manure storage facility or manure collection area?		0M	0M		☒ YES ☐ NO ☐ YES with exemption	None identified
	How many water wells are within 100 m of the manure storage facility or manure collection area?		0M	0M		☒ YES ☐ NO ☐ YES with exemption	None identified within 100 m of proposed facilities
	What is the shortest distance from the manure collection or storage facility to a surface water body? (e.g., lake, creek, slough, seasonal)		1000M	1000M		☒ YES ☐ NO ☐ YES with exemption	Intermittent creek ~550 m SE of proposed catch basin
Groundwater information	What is the depth to the water table?		7M	7M		☒ YES ☐ NO ☐ YES with exemption	~6.9 m identified in borehole logs
	What is the depth to the groundwater resource/aquifer you draw water from?		30.48M	30.48M		☒ YES ☐ NO ☐ YES with exemption	16.76 m identified in WWID 105503 drilling logs

Additional information (attach supporting information, e.g. borehole logs, records, etc. you consider relevant to your application)

AO note: no existing CFO facilities are located on the LLD in which the proposed feedlot is to be constructed.


Aerial photo added by AO
Proposed feedlot area
WWID 105503
Donalda Colony
Intermittent creek
Image © 2025 Airbus


TOWNSHIP ROAD 424
HIGHWAY 854
feedlot pens
Shipping + Receiving
holding & sorting
Processing Barn
Sickpens
Catch basin
A1 to A5
B-1 to B-5
CROSS SECTION A
CROSS SECTION B
APTUS ENGINEERING LTD.
DONALDA COLONY CFO
PRELIM SITE PLAN


AEP wwID 294440 is located here, wwID 105423 (decommissioned) was formerly located near the former swine barns
105423
105422
105424
105421
Site Plan
N

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NRCB USE ONLY

WATER WELL AND SURFACE WATER INFORMATION

Well IDs: 105503 105420 105422 105424 294440 298251 2029737

AO note: WWID 105503 is the closest well to proposed facilities; all other wells listed are located further away.

Surface water related concerns from directly affected parties or referral agencies: ☐ YES ☒ NO

Groundwater related concerns from directly affected parties or referral agencies: ☐ YES ☒ NO

Water wells ☒ N/A

If applicable, exemption for 100 m distance requirements applied: ☐ YES ☐ NO Condition required: ☐ YES ☐ NO

Surface water ☒ N/A

If applicable, exemption for 30 m distance requirements applied: ☐ YES ☐ NO Condition required: ☐ YES ☐ NO

Water Well Exemption Screening Tool ☒ N/A

Water Well ID	Preliminary Screening Score	Secondary Screening Score	Facility

Groundwater or surface water related comments:

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NRCB USE ONLY

ENVIRONMENTAL RISK SCREENING INFORMATION

ERST for **proposed** facilities

Facility	Groundwater score	Surface water score	File number
Feedlot pens	Low	Low	RA24043.
Processing barn	Low	Low	RA24043
Catch basin	Low	Low	RA24043

ERST for **existing** facilities

Facility	Groundwater score	Surface water score	File number
Layer barn	Low	Low	RA20018
Dry cow and young stock shed	Low	Low	RA15023A/RA17039
Dairy corrals	Low	Moderate	RA15023, RA15023A/RA17039
Permastore	Low	Low	RA15023
Compost pile	Low	Low	RA15023
Turkey pen	High	Low	RA15023
Sheep corrals	High	Low	RA15023
Manure separator	Low	Low	RA16049
Manure lifting station	Low	Low	RA16049

ERST related comments:

The turkey pen and sheep corrals have water wells located within them. The applicant had taken actions (precautionary measures) before Approval RA15023 was issued by mounding and compacting soil around these wells and by installing a concrete vault over the water wells. Approval RA15023 included a condition requiring annual testing of the water wells within these facilities, which was carried forward to Approval RA15023A, and subsequently carried forawrd to Approval RA20018. The condition will then be carried forward to the present Approval RA24043.

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DISTANCE OF ANY MANURE STORAGE FACILITY (EXISTING OR PROPOSED) TO NEIGHBOURING RESIDENCES

			NRCB USE ONLY				
Neighbour name(s)	**Legal land description**	**Distance (m)**	**Zoning (LUB) category**	**MDS category (1-4)**	**Distance (m)**	**Waiver attached (if required)**	**Meets regulations**
ROBERT BOULTER	15-13-42-18-W4	1650M	Agriculture	1	1703 m		Yes
STEVE ARNETT	7-19-42-17-W4	2000M	Ag	1	1410 m		Yes

LAND BASE FOR MANURE AND COMPOST APPLICATION (complete only if an increase in livestock or manure production will occur)

				NRCB USE ONLY	
Name of land owner(s)*	**Legal land description**	**Usable area** (ha)**	**Soil zone ***	**Usable area (ha)**	**Agreement attached (if required)**
DONALDA COLONY FARMING	NUMEROUS LOCATIONS	2832	~~DARK BROWN~~		
	*see list below		Black		
			Total	2823 ha	

* If you are **not** the registered landowner, you must attach copies of land use agreements signed by all landowners.

** Available manure spreading area (excluding setback areas from residences, common bodies of water, water wells, etc. as identified in Agdex 096-5 Manure Spreading Regulations)

*** Brown, dark brown, black, grey wooded, or irrigated

Additional information (attach any additional information as required)

MASTER SHEET

Land List

Donalda Colony - Land

Owned land. Not leased.

FIELD NAME	Part		Township	Range	Meridian	ACRES
ROY	SECTION	23	42	18	W4	640
MEETING CREEK	SECTION	10	43	19	W4	600
PIGS OVER	NE 1/4	19	42	17	W4	154
PIGS OVER	SW 1/4	19	42	17	W4	154
FREDDY'S QUARTER	NE 1/4	6	43	17	W4	120
DONALDA TOWN	N 1/2	14	42	19	W4	235
RONNY ANDERSON QUARTER	NW 1/4	20	42	17	W4	155
ARNETT NORTH EAST	NE 1/4	20	42	17	W4	130
ARNETT SOUTH	S 1/2	17	42	17	W4	82
BOULTER	E 1/2	26	42	18	W4	310
ROSALIND OLD BARN QUARTER	NE 1/4	6	44	17	W4	110
ROSALIND WEST	E 1/2	7	44	17	W4	300
ROSALIND EAST	W 1/2	8	44	17	W4	300
30 ACRES	NE 1/4	7	42	17	W4	30
STONE QUARTER	NW 1/4	8	42	17	W4	70
SHEEP BARN	NW 1/4	18	42	17	W4	55
SHEEP BARN	SE 1/4	18	42	17	W4	160
SHEEP BARN	SW 1/4	18	42	17	W4	55
ARNETT WEST OF HOUSE	NE 1/4	18	42	17	W4	160
ARNETT EAST OF HOUSE	NW 1/4	16	42	17	W4	123
ARNETT GRAVEL PIT	SE 1/4	9	42	17	W4	95
HANGER	NE 1/4	24	42	18	W4	180
HANGER	SE 1/4	24	42	18	W4	180
RONNY BARNS QUARTER	NE 1/4	2	42	18	W4	150
BENSON QUARTER	NW 1/4	25	41	18	W4	140
KENNY QUARTER	SW 1/4	36	41	18	W4	145
DARYL QUARTER	NE 1/4	25	41	18	W4	145
PIGS OVER	SE 1/4	19	42	17	W4	160
NORTH EAST OF PLACE	NW 1/4	19	42	17	W4	110
SOUTH WEST OF PLACE	SE 1/4	13	42	18	W4	110
SECTION 7 NORTH	S 1/2	7	42	17	W4	68
SECTION 7 SOUTH		7	42	17	W4	98
HANGER ACROSS DITCH	NW 1/4	24	42	18	W4	55
HANGER ACROSS DITCH	SW 1/4	24	42	18	W4	160
KERCHER	SECTION	22	42	18	W4	640
ARINE	SW 1/4	12	42	18	W4	200
ARINE	NW 1/4	12	42	18	W4	200
DONNY HELMING	S 1/2	31	41	17	W4	290
DONNY HELMING	NW 1/4	30	41	17	W4	155
NIKIFORUK NORTH QUARTER	SE 1/4	8	44	17	W4	150
NIKIFORUK SOUTH QUARTER	E 1/2	5	44	17	W4	300
			TOTAL ACRES			7,674

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NRCB USE ONLY

MINIMUM DISTANCE SEPARATION

Methods used to determine distance (if applicable): Google Earth

Margin of error (if applicable): +/- 3 m

Requirements (m): Category 1: 661 Category 2: 881 Category 3: 1107 Category 4: 1761

Technology factor: ☐ YES ☒ NO

Expansion factor: ☐ YES ☒ NO

MDS related concerns from directly affected parties or referral agencies: ☐ YES ☒ NO

LAND BASE FOR MANURE AND COMPOST APPLICATION

Land base required: 553 ha

Land base listed: 2823 ha

Area not suitable: Accounted for

Available area 2823 ha Requirement met: ☒ YES ☐ NO

Land spreading agreements required: ☐ YES ☒ NO

Manure management plan: ☐ YES ☒ NO If yes, plan is attached: ☐

PLANS

Submitted and attached construction plans: ☒ YES ☐ NO

Submitted aerial photos: ☐ YES ☒ NO

Submitted photos: ☐ YES ☒ NO

GRANDFATHERING

Already completed: ☒ YES ☐ NO ☐ N/A

If already completed, see RA15023

SOLID MANURE, COMPOST, & COMPOSTING MATERIALS: Barns, feedlots, & storage facilities - Concrete liner

*(complete a copy of this section for **EACH** barn, feedlot, and storage facility for solid manure, composting materials, or compost with a concrete liner)*

Facility description / name *(as indicated on site plan)*

1. FEEDLOT PENS (total dimensions, see note below)
2. PROCESSING BARN

Manure storage capacity

	Length (m)	Width (m)	Depth below grade to the bottom of the liner (m)	**NRCB USE ONLY** Estimated storage capacity (m^3)
1.	365.7M	103.6M	0M	
2.	36.5M	24.3M	0M	
			TOTAL CAPACITY	Adequate storage

AO note: feedlot pen dimensions listed above are comprised of 10 feedlot pens, shipping/receiving pens, and a sick pen.

☐ I plan to use a short-term solid manure storage (STMS) as part of my manure storage and handling plan for this CFO. The AOPA requirements for STMS are set out in the NRCB Short-Term Solid Manure Storage Requirements Fact Sheet.

Surface water control systems

Describe the run-on and runoff control system

BARN IS ENCLOSED
PENS ARE SLOPED 1.5% TO THE CATCH BASIN

Liner protection

Describe how the physical integrity of the liner will be maintained

CHECK FOR CRACKS
FILL IF ANY

NRCB USE ONLY
Requirements met: ☒ YES ☐ NO

SOLID MANURE, COMPOST, & COMPOSTING MATERIALS: Barns, feedlots, & storage facilities - Concrete liner (cont.)

Concrete liner details

Concrete thickness 5"	Method of sulphate protection: HS CEMENT
Concrete strength 25MPA HS AO note: feedlot pens will be required to meet the specifications for category C	Concrete reinforcement size and spacing 15MM @ 16" O/C BOTH WAYS

Concrete requirements can be found in Technical Guideline Agdex 096-93
Guideline minimums:
Solid manure: 25MPa (D)
Solid manure (wet): 30MPa (C)
Method of sulphate protection:
Type 50 or Type 10 with fly ash or equivalent

NRCB USE ONLY

Requirements met:	☒ YES ☐ NO
Condition required:	☒ YES ☐ NO
Report attached:	☒ YES ☐ NO

Additional information *(attach as required)*

NRCB USE ONLY

Nine month manure storage volume requirements met ☒ YES ☐ YES With STMS ☐ NO

Depth to water table: >6.9 m — Requirements met: ☒ YES ☐ NO

Depth to Uppermost groundwater resource: 16.76 m — Requirements met: ☒ YES ☐ NO

ERST completed: ☒ see ERST page for details

Surface water control systems

Requirements met: ☒ YES ☐ NO Details/comments:

Concrete liner details

A condition will be added requiring the concrete liner of the feedlot pens and processing barn to meet the specifications for category C (solid manure - wet) and category D (solid manure - dry), respectively, in Technical Guideline Agdex 096-93 "Non-Engineered Concrete Liners for Manure Collection and Storage Areas

Leakage detection system required: ☐ YES ☒ NO If yes, please explain why.

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RUNOFF CONTROL CATCH BASIN: Compacted soil liner

*(complete a copy of this section for **EACH proposed** runoff control catch basin with a compacted soil liner)*

Facility description / name *(as indicated on site plan)*

1. CATCH BSAIN
2. _____
3. _____

Determination of runoff area

Provide a plan and show how you calculated the area contributing to runoff for each catch basin

393600 SQUARE FEET

AO note: total runoff area for pens = 37,887 m^2

Catch basin capacity

	Length (m)	Width (m)	Depth (m)	Depth below ground level (m)	Slope run:rise			NRCB USE ONLY
					Inside end walls	Inside side walls	Outside walls	Calculated storage capacity (excl. 0.5 m freeboard) (m^3)
1.	103.6	60.9	~~2.43~~	~~3~~	3.1	3.1	3.1	
2.			2 m	1.5 m				
3.								
							TOTAL CAPACITY	7,708 m^3

AO note: The attached engineering report recommends catch basin dimensions of 104m x 33m x 2 m. The applicant indicated they would like to build it larger, with dimensions of 103.6 x 60.9 x 2 m deep.

Compacted soil liner details

Thickness of compacted soil liner	1 (m)	Provide details (as required)	
Soil texture	14 % sand	36.8 % silt	48.7 % clay
Atterberg limits	Plastic limit 16.6%	Liquid limit 36.0%	Plasticity index 19.4%
Hydraulic conductivity	Hydraulic conductivity (cm/s) 2.19 X 10-9 CM/S		
	Describe test standard used ASTM D5084 LAB FLEXIBLE WALL PERMEAMETER ANALYSIS		

Catch Basin – Design and management requirements can be found in Technical Guideline Agdex 096-101

NRCB USE ONLY

Requirements met: ☒ YES ☐ NO

Condition required: ☒ YES ☐ NO

Report attached: ☒ YES ☐ NO

RUNOFF CONTROL CATCH BASIN: Compacted soil liner (cont.)

NRCB USE ONLY

Catch basin calculator (calculation attached). Total volume @ freeboard: 7,708 m^3

Runoff capacity requirements met: ☒ YES ☐ NO

Calculation of the volume attached: ☒ YES ☐ NO

Depth to water table: >6.9 m Requirements met: ☒ YES ☐ NO

Depth to Uppermost Groundwater Resource: 16.76 m Requirements met: ☒ YES ☐ NO

ERST completed: ☒ see ERST page for details

Liner specification comments (e.g. compaction required, moisture content, thickness):

Compacted liner must be a minimum of 1.0 m thick and constructed by placing till lifts not exceeding 200 mm and compacted to minimum density of 1,550 kg/m3 (100% SPMDD) at an optimum moisture content of 19.6%, or within +2% of that moisture content, perpendicular to the excavation face.

Leakage detection system required: ☐ YES ☒ NO If yes, please explain why.

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NRCB USE ONLY **RUNOFF CONTROL CATCH BASIN CAPACITY SUMMARY (if applicable)**	
Facility 1 Catch basin	
Name / description	Capacity 7,708 m^3
Facility 2	
Name / description	Capacity
Facility 3	
Name / description	Capacity
Facility 4	
Name / description	Capacity
TOTAL CAPACITY	7,708 m^3
RUNOFF VOLUME FROM CONTRIBUTING AREAS	3,410 m^3
MEETS AOPA RUNOFF CONTROL VOLUME REQUIREMENTS	☒ YES ☐ NO

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NRCB USE ONLY

ALL SIGNATURES IN FILE ☒ YES ☐ NO

DATES OF APPROVAL OFFICER SITE VISITS

January 7, 2025	

CORRESPONDENCE WITH MUNICIPALITIES AND REFERRAL AGENCIES

Date deeming letters sent: January 23, 2025

Municipality: County of Stettler

☒ letter sent ☒ response received ☒ written/email ☐ verbal ☐ no comments received

Alberta Health Services: ☒ N/A

☐ letter sent ☐ response received ☐ written/email ☐ verbal ☐ no comments received

Alberta Environment and Parks: ☐ N/A

☒ letter sent ☐ response received ☐ written/email ☐ verbal ☒ no comments received

Alberta Transportation: ☐ N/A

☒ letter sent ☒ response received ☐ written/email ☐ verbal ☒ no comments received

Alberta Regulatory Services: ☒ N/A

☐ letter sent ☐ response received ☐ written/email ☐ verbal ☐ no comments received

Other: Battle River Power Coop. ☐ N/A

☒ letter sent ☐ response received ☐ written/email ☐ verbal ☒ no comments received

Other: _____ ☐ N/A

☐ letter sent ☐ response received ☐ written/email ☐ verbal ☐ no comments received

3rd October, 2024

File No.: USG1884

Geotechnical Investigation
Donalda Colony Feedlot & Catch Basin
County of Stettler No. 6

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EXECUTIVE SUMMARY

Union Street Geotechnical Ltd. performed a geotechnical investigation, on behalf of the Donalda Colony, on the 5th June, 2024, for a proposed confined feedlot and catch basin development located within the E. ½ of 24-42-18 W4M in Stettler County No. 6, Alberta. The site is located approximately 9.45 km northeast of Donalda.

Eleven boreholes were drilled across the proposed development footprint to aid in the design and construction of the proposed feedlot and catch basin. The client indicated that the proposed pens, lanes/alleys, etc. may be surfaced with concrete or roller compacted concrete. Considering the type of facility proposed, the site location, and subsurface soil conditions, a clay liner and naturally occurring protective layer recommendations have been included. The encountered stratigraphy generally consisted of, in descending order, topsoil, sand, till, and mudstone.

The Scope of Work for this geotechnical investigation was outlined in Union Street Geotechnical Ltd.'s proposal, PN1859, issued to the client on the 7th May, 2024.

LIMITATIONS

Union Street Geotechnical Ltd. prepared this report for the exclusive use of the Donalda Colony, and their agents, for the design and construction of a confined feedlot and catch basin located within the E. ½ of 24-42-18 W4M in Stettler County No. 6, Alberta. The content reflect Union Street's best judgement available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on, or decisions to be made based on it, are the responsibility of such third party and Union Street accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Our recommendations and conclusions are based upon the information obtained from the subsurface exploration. The borings and associated laboratory testing indicate subsurface conditions only at the time and to the depth, of the specific boring location investigated and only for the soil properties tested. The subsurface conditions may vary between the boreholes, across the site, and over time. The interpretation of subsurface conditions provided is a professional opinion of encountered conditions and is not a certification or guarantee of site conditions. If variations, or other latent conditions become evident, Union Street should be notified immediately so that our conclusions

and recommendations can be re-evaluated. Although subsurface conditions have been explored, we have not conducted investigations, sampling, field or laboratory testing, evaluations, or modelling of the site or subsurface conditions with respect to the presence of contaminated soil or groundwater or slope stability conditions.

This report contains the results of our geotechnical investigation as well as certain recommendations arising from our investigation. The recommendations herein do not constitute a design, in whole or in part, of any of the structural elements of the proposed work. Incorporation of any or all of our recommendations into the design of any such element does not constitute us as designers or co-designers of such elements, nor does it mean that such design is appropriate in geotechnical terms. The designers of such elements must consider the appropriateness of our recommendations in light of all design criteria known to them, many of which are not known by us. Our mandate has been to perform a geotechnical investigation and recommend, which we have completed by means of this report. We have had no mandate to design, or review the design of any elements of the proposed work and accept no responsibility for such design or design review.

This report has been prepared in accordance with generally accepted geotechnical engineering practice common to the local area. No other warranty, expressed or implied, is made.

This document, and the information contained within, are the confidential property of the Donalda Colony and any disclosure of same is governed by the provisions of each of the applicable provincial or territorial Freedom of Information legislation, the Privacy Act (Canada) 1980-81-82-83, c.111, Sch. II “2”, and the Access to Information Act (Canada) 1980-81-82-83, c.111, Sch. I “1”, as such legislation may be amended or replaced from time to time.

1 INTRODUCTION

1.1 BACKGROUND

Union Street Geotechnical Ltd. (Union Street) was retained by the Donalda Colony to perform a field investigation, and subsequent laboratory testing on the subgrade, to aid in the design and construction of a proposed confined feedlot and catch basin development, located within the E. ½ of 24-42-18 W4M in the Stettler County No. 6, Alberta, as shown on Drawing No. A1. Eleven boreholes were advanced in the proposed feedlot, catch basin, and borrow pit footprints. Based on the stratigraphy encountered in the boreholes, it was determined that the subgrade is generally composed of, in descending order, topsoil, sand, till, and mudstone.

1.2 OBJECTIVES

The objectives of the geotechnical investigation are to:

- define the subsurface soil strata, their properties, and existing conditions;
- determine the groundwater depth;
- provide recommendations for cut/fill excavations and slopes;
- provide liner recommendations;
- identify potential geotechnical problems related to excavations and catch basin construction; and,
- provide recommendations on pertinent geotechnical issues identified during the subsurface investigation.

2 REFERENCES

The following was referenced while preparing this report:

- Province of Alberta, "*Agricultural Operation Practices Act and Regulations"*, Revised Statutes of Alberta 2000, Chapter A-7, Alberta Queen's Printer, 2010;

- Province of Alberta, "*Agricultural Operation Practices Act and Regulations"*, Standards and Administration Regulation, Alberta Queen's Printer, 2017;
- Alberta Government, "*Catch Basin Design and Management"*, Technical Guideline Agdex 096-101, August 2012;
- Natural Resources Conservation Board, "*Determining Equivalent Protective Layers and Constructed Liners"*, Technical Guideline Agdex 096-61, Updated June 2022;
- Natural Resources Conservation Board, "*Subsoil Investigations for Naturally Occurring Protective Layers"*, Technical Guideline Agdex 096-63, Updated March 2023;
- Natural Resources Conservation Board, "*Subsoil Investigations for Compacted Soil Liners"*, Technical Guideline Agdex 096-64, Updated November 2022; and,
- Natural Resources Conservation Board, "*Non-Engineered Concrete Liners for Manure Collection and Storage Areas"*, Technical Guideline Agdex 096-93, Updated June 2015.

3 DESCRIPTION OF THE PROJECT AND SITE

3.1 SITE DESCRIPTION

The site is located approximately 9.45 km northeast of Donalda, Alberta, within the E. ½ of 24-42-18 W4M, as shown on Drawing No. A1. The proposed development footprint was relatively flat with the geological drainage area sloping towards the Battle River to the northeast. The site is undeveloped, vacant and composed of agricultural cropland.

The site is bordered by agricultural cropland to the north, south, and west and by Highway 854 to the east. Photographs depicting general site conditions observed at the time of drilling are attached to this report.

3.2 PROPOSED DEVELOPMENT

The proposed feedlot development consists of pens, lanes/alleys, catch basin, and other infrastructure typically associated with a development of this type. Specific development details are unknown at the time of this report writing but are assumed to be typical to those in the area and for a development of this nature.

Recommendations contained in this report have been given for the above-described development and those typical of a development of this nature. If there are any changes to the proposed development, or its location, these changes should be reviewed by Union Street personnel to confirm the applicability of this report to the revised development plans.

4 FIELD INVESTIGATION AND LABORATORY ANALYSIS

The field investigation program included drilling eleven boreholes at the locations shown on Drawing No. A1. The borehole locations were established by Union Street personnel based off a client supplied site plan, proposed development footprint, utility clearance, and access. No formal surveying of the borehole locations or site were completed and therefore, all drawings, locations, and distances are approximate and conceptual in nature.

On 5th June, 2024, eleven boreholes (designated as BH101 to BH103, BH201 to BH206, BH301, and BH302) were advanced using a track-mounted auger drill utilizing 150 mm diameter, continuous flight augers, operated by Stoney Streets Drilling Ltd. The boreholes were advanced to depths varying from 4.57 m to 10.36 m below ground surface.

Supervision of the drilling, soil sampling, and logging of the various soil strata were performed by Union Street personnel. All soil samples and auger cuttings were visually examined and classified in the field in accordance with the Modified Unified Soil Classification System. The Borehole Logs are appended.

The soil sampling and testing sequences which are shown on the borehole logs consisted of:

- Disturbed ('grab') samples were obtained at select intervals for moisture content determinations. The moisture contents are shown on the logs; and,
- Three, relatively undisturbed, thin wall Shelby Tube samples were also obtained.

No seepage or sloughing was observed during drilling. Following drilling activities, piezometers were installed in Boreholes BH101 to BH103 and BH202 to BH204. The remaining boreholes were backfilled to surface with auger cuttings.

Subsequent to drilling activities, laboratory analyses were performed to determine visual soil classification and in-situ water contents of all collected samples and Atterberg Limits (ALs), Mechanical Wash Sieve (MWS), Particle Size Analysis (PSA), Density-Moisture (Proctor), and flexible wall permeameter analyses were performed on select soil samples. Observations made during the field investigation, visual descriptions of the soils, and the results of laboratory tests are presented in the attached Borehole Logs and Laboratory Test Results.

5 ANALYSIS AND DISCUSSION

5.1 GENERAL STRATIGRAPHY

The subsurface conditions were relatively uniform in all eleven borehole locations relative to the proposed development. In general, and to the depths drilled, the stratigraphy encountered at the borehole locations generally consisted of, in descending order, topsoil, sand, till, and mudstone. The soil is relatively uniform with little variations and the following soil properties depict the average observed characteristics. Mudstone extended to the maximum exploration depth in Boreholes BH101 to BH103, BH301, and BH302 and till extended to the maximum exploration depth in the remaining boreholes. Detailed soil descriptions are provided in the Borehole Logs, appended to this report.

5.1.1 Topsoil

Topsoil, ranging from 76 mm to 406 mm with an average approximately thickness of 222 mm, was encountered at surface in all eleven boreholes. Based on a visual observation, topsoil covers a majority of the site.

5.1.2 Sand

Sand was encountered underlying the topsoil in Boreholes BH101 to BH103, BH205, and BH301 which extended to an average depth of 0.84 m below grade. The sand contained some clay and some silt. It was dark yellowish brown (10YR 4/4), oxidized, moist to wet, loose to compact, massive, and was calcareous.

The moisture content of an analysed sand sample was 4.9%.

5.1.3 Till

Till was encountered underlying the topsoil or sand in all eleven boreholes, at an average depth of 0.50 m below grade, which extended to an average depth of 5.18 m in Boreholes BH101 to BH103, BH301, and BH302 and extended to the maximum exploration depth in remaining boreholes. The composition of the till varied but was generally composed of silty clay with some sand or clay and silt with some sand. It was brown (10YR 4/3) to dark grey (10YR 4/1), oxidized, moist, firm to hard, massive, contained trace gravel, sand pocket inclusions, and coal chip inclusions, and was calcareous.

The moisture content of the till samples ranged from 9.5% to 32.4% with an average moisture content of 19.7%.

Pocket Penetrometer (PP) readings of the till ranged from 48 kPa to 215 kPa with an average reading of 141 kPa. This corresponds to a soil with a very stiff consistency.

An Atterberg Limit (AL) analysis was performed on a till sample obtained from Borehole BH101. The AL result is summarized in Table 5.1.

TABLE 5.1: SUMMARY OF TILL ATTERBERG LIMIT TEST RESULT

Sample No. and Depth	Borehole No.	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Moisture Content (%)	MUSC - Soil Type
NT3 - 3.81 m	BH101	36.0	16.6	19.4	18.2	CI

Based on the result in Table 5.1, the till had a MUSC of "CI" - Clays or Silts of medium plasticity.

One Mechanical Wash Sieve (MWS) and eight Particle Size Analyses (PSA) were performed on till samples obtained from Boreholes BH101 to BH103, BH201, BH203, BH205, BH301, and BH302. The PSA and MWS results are summarized in Table 5.2.

TABLE 5.2: SIEVE RESULTS OF MWS AND PSA TESTS

Sample No. and Depth	Borehole No.	Gravel Content (%)	Sand Content (%)	Silt Content (%)	Clay Content (%)	Texture Class[1]
NT3 - 3.81 m	BH101	0.8	37.3	61.9[2]		-
NT5 - 5.33 m	BH101	0.0	13.1	50.1	36.8	SiCL
NT11 - 3.81 m	BH102	0.0	10.6	44.0	45.4	SiC
NT16 - 5.33 m	BH103	0.0	5.4	33.4	61.2	HC
JS1 - 0.76 m	BH201	0.0	18.5	37.0	44.5	C
JS7 - 0.76 m	BH203	0.0	9.5	33.1	57.4	C
JS14 - 0.76 m	BH205	0.0	19.7	32.6	47.7	C
DW3 - 3.81 m	BH301	1.0	9.6	33.2	56.2	C
DW6 - 2.29 m	BH302	0.0	5.6	36.7	57.7	C
Average:		**0.2**	**14.3**	**36.8**	**48.7**	**-**

Notes:
1 - Texture Class as per Canadian Soil Texture Triangle.
2 - The fines contents of Sample No. NT3 were split 50/50 to obtain the shown averages.

The AL and PSA results are appended to this report.

A standard density proctor was performed, according to ASTM D 698, on composite Sample No. W449, obtained from Borehole BH301 between 0.76 m to 4.57 m below grade. The proctor indicated an optimal corrected dry density of 1,550 kg/m^3 at an optimum moisture content of 19.6%. The proctor result is attached.

A Flexible Wall Permeameter analyses, as per ASTM D5084, was conducted on Sample No. NT4, obtained from Borehole BH101 at 4.57 m below grade. The result of the hydraulic conductivity analysis indicated a permeability of 6.51x10^{-9} cm/s. Additionally, a second analysis was also conducted on a reformed till sample conducted on Sample No. W449, obtained from Borehole BH301 between 0.76 m to 4.57 m below grade and the result of the hydraulic conductivity analysis indicated a permeability of 2.19x10^{-9} cm/s. The flexible wall permeameter reports are attached.

As till is a heterogeneous mixture of all grain sizes and while not encountered during drilling, cobbles and boulders may be encountered during construction.

5.1.4 Mudstone

Mudstone was encountered underlying the till in BH101 to BH103, BH301, and BH302 at an approximate average depth of 5.18 m below grade which extended to the maximum exploration depth in the indicated boreholes. The mudstone was generally composed of silty, sandy clay or clay and sand with trace to some silt. It was yellowish brown (10YR 5/6) to dark grey (10YR 4/1), non-oxidized, dry to moist, hard, massive, and was calcareous.

The moisture content of the mudstone samples ranged from 12.4% to 30.1% with an overall average moisture content of 20.2%.

Pocket Penetrometer (PP) readings of the mudstone samples indicated an average undrained shear strength of 215 kPa. This corresponds to a soil with a hard consistency.

5.2 GROUNDWATER

Seepage was not encountered during drilling. However, piezometers were installed in Boreholes BH101 to BH103 and BH202 to BH204 following drilling. The groundwater elevations were recorded on the 19th July, 2024, 44 days following drilling, and the results are summarized in Table 5.3.

TABLE 5.3: SUMMARY OF GROUNDWATER MEASUREMENTS

Borehole No.	Borehole Depth (m)	Water Level[1] (m), 19th July, 2024
BH101	10.36	8.46
BH102	6.10	Dry
BH103	7.47	5.40
BH202	4.57	Dry
BH203	4.57	Dry
BH204	4.57	Dry
Average:		**6.93**

Notes:
1 - Below existing grade.

Based on the lack of seepage encountered during drilling, piezometer readings, and experience in the area, the average depth to the groundwater table across the site is likely relatively deep (greater than 6.0 m below grade). Groundwater levels are subject to meteorological events, seasonal variations, site gradient, and other salient factors resulting in the water table varying with time. It should be noted however, that due to the mudstone, a "perched groundwater table" may be encountered across the site.

6 FEEDLOT

Manure storage facilities typically utilize one of three liner types: naturally occurring soil liner, compacted soil liner, or a concrete liner. The client indicated that they may utilize a concrete, or possibly explore the option of using a roller compacted concrete (RCC) liner, or soil liner.

6.1 STRIPPING

All organic soil, vegetation, sand, etc. should be stripped from the feedlot development footprint prior to the start of rough grading construction activities.

6.2 NATURALLY OCCURRING LINER

The Natural Resources Conservation Board (NRCB) requires naturally occurring protective layers for solid manure collection and storage facilities, such as feedlots, to have a minimum thickness of 2.0 m and a maximum hydraulic conductivity of $1.0x10^{-6}$ cm/s. However, till was not consistently encountered underlying the surficial topsoil as sand was encountered in various boreholes which extended to various depths across the development footprint. Therefore, as some rough grading activities will be required, a naturally occurring soil liner is not recommended for the proposed development at this site.

6.3 COMPACTED SOIL LINER

Following a review of the referenced NRCB documentation, it is understood that a minimum 0.5 m thick liner with a minimum hydraulic conductivity of $1.0x10^{-7}$ cm/s is required for a feedlot and the associated solid manure. Laboratory testing was conducted on a reformed till sample obtained from the proposed borrow pit source,

Borehole BH301 from approximately 0.76 m to 4.57 m below grade, which had a factored hydraulic conductivity of $2.19x10^{-8}$ cm/s. Based on the factored hydraulic conductivity of the reformed till, a constructed clay liner 0.02 m thick with a permeability of $2.19x10^{-8}$ cm/s offers equivalent protection than a 0.5 m thick clay liner with a permeability of $5.0x10^{-7}$ cm/s. However, to ensure the integrity of the clay liner, the liner must be no less than 0.5 m thick as measured perpendicular to the excavation face. The till from the borrow utilized for the liner must be compacted to a minimum 100% SPMDD.

Soil textures of the soils analyzed in Boreholes BH201 to BH205 were consistent and fell within the same texture class as the proposed borrow pit source, Boreholes BH301 and BH302, therefore till encountered in the proposed feedlot footprint can be stockpiled and utilized for the construction of the compacted soil liner.

6.4 Concrete Liner

The client has indicated that the pens may utilize a concrete liner. If concrete is utilized, it must offer the equivalent protection of a 0.50 m thick soil liner with a permeability of not more than $5.0x10^{-7}$ cm/s. The type of concrete proposed for the liner is unknown at this time, but typical concrete common to the area is expected to well exceed this requirement.

Concrete slabs should be placed on a prepared subgrade and sub-base.

6.5 Roller Compacted Concrete Liner

The client has also indicated that they may explore utilizing roller compacted concrete (RCC) for the pens. Current government legislation has been relatively indecisive on the use of RCC liners for feedlots and its is still currently under review and discussion. However, there are options to utilize RCC liners under NRCB supervision and guidelines if this is an option the client would like to pursue. It is recommended to contact the NRCB approval officer for more details as it is understood they will be discussed on a case-by-case basis.

7 CATCH BASIN

7.1 CAPACITY

For design purposes, the design volume of the catch basin must have a storage capacity that can accommodate a 1 in 30 year rainfall. For the Bashaw region a 1 in 30 year event equates to approximately 85 mm of rainfall. The drainage area of the feedlot (366 m by 104 m) is approximately 38,064 m^2. The following was utilized to determine the catch basins minimum required capacity.

$$V_{30} = \mathrm{D}_A \times R_{30} \times \mathrm{C}_R$$

Where:

V_{30} = One Day Rainfall Volume (m^3);
D_A = Drainage Area (m^2);
R_{30} = One Day Rainfall (m); and,
C_R = Runoff Coefficient (0.60 m for unpaved and 1.0 for a paved area).

Based on the referenced formula, it has been determined that the expected one-day rainfall volume for the feedlot is approximately 1,941 m^3 for unpaved and 3,235 m^3 for paved surfaces. However, to ensure the liners integrity due to drying out and cracking, to increase the timeframe between emptying, to accommodate future expansion or minor changes in the feedlot size during permitting, etc., it is recommended that the design capacity of the catch basin be greater than the 1 in 30 year rainfall minimum volume requirement. Union Street recommends increasing the total volume capacity by a minimum 10% of the 1 in 30 year rainfall, which would increase the catch basin's volume to approximately 2,135 m^3 and 3,559 m^3, respectfully.

The size and capacity of the catch basin may change depending on the liner option selected as, for example, a synthetic liner will allow a deeper catch basin, allowing a reduced footprint, reducing the required capacity. Therefore, although the general footprint will remain similar, the size and location of the catch basin shown on the attached drawing may slightly differ from that actually constructed.

The catch basin must have a marker that is clearly visible at all times indicating the minimum volume required to accommodate a 1 in 30 year one day rainfall event.

7.2 SIZING & LOCATION

Based on a client directed feedlot area of approximately 366 m by 104 m, a catch basin with dimensions of 23 m by 104 m by 2.0 m deep for unpaved and 33 m by 104 m by 2.0 m deep for paved feedlots is recommended. From top of berm, utilizing a 0.5 m freeboard, 1.5 m effluent depth, and 3H:1V side slopes, the catch basin was calculated to have a design capacity of approximately 2,254 m^3 and 3,701 m^3 for unpaved and paved, respectfully, as shown on the attached Catch Basin Dimension Calculator results in Appendix A.

The proposed catch basin location is shown on Drawing No. A1. This location was selected by the client based on topography, separation distances, and future proposed development.

7.3 STRIPPING

All organic soil and vegetation should be stripped from the catch basin footprint prior to the start of catch basin construction activities.

7.4 CATCH BASIN EXCAVATION

All till material from the catch basin excavation that is determined to be suitable for reuse should be stockpiled. If encountered during construction activities, the sand encountered during drilling will need to be excavated and replaced with till.

The banks of the catch basin should be cut at no steeper than 3H:1V. The capacity of the catch basin should be designed to ensure a minimum 0.5 m freeboard. It is the responsibility of the contractor to remove water from trenches and excavations, regardless of origin. If while constructing the slopes of the catch basin subsurface, groundwater begins eroding the slopes and entering the catch basin, construction will need to be halted immediately and dewatering techniques will need to be implemented before construction continues. It is anticipated that potential groundwater problems can be resolved with well graded ditching and the installation of subgrade sumps around the perimeter of the site. If extreme groundwater seepage

becomes present, more advanced dewatering techniques can be implemented. Although possible, it is not expected that seepage and sloughing will be encountered during construction unless the excavation exceeds 6.0 m in depth.

Pumps and other materials necessary to keep the excavation free of water while work is in progress should be provided. Provisions should be made in case of accidental stoppage of dewatering equipment to prevent damage to the work area. The excavations must be protected against flooding and damage from surface run-off. Water removed from the site is to be disposed of in a manner that will not damage the work area or other property or persons.

Materials will be excavated and removed to the depths necessary for the construction of the structure and drainage system. Care must be taken to minimize the disturbance to the supporting soil. After the excavation has been shaped, any over-excavated areas will be backfilled and compacted to a density equal to or greater than the undisturbed soil. All slopes in the subgrade are to be uniform and in a condition suitable for a catch basin.

7.5 EMBANKMENTS AND FILL

An embankment/berm is recommended to be constructed around the perimeter of the feedlot development to divert and minimize surface runoff from outside the operation from flowing into the catch basin. Additionally, a berm is recommended along the perimeter of the catch basin to prevent accidental effluent release outside of the operation and ensure a minimum 0.5 m freeboard. The exterior slope of a catch basin wall should be no steeper than 4H:1V. Any fills required can be constructed from the till subgrade encountered on-site. If an insufficient quantity of suitable on-site subgrade fill is not available, it will have to be analyses, imported, and compacted.

Areas requiring fills will be uniformly graded, scarified and re-compacted to the necessary density prior to being filled. Common excavated materials will be placed in the embankments, and in over-excavations if approved by the Geotechnical Engineer. Fills should be placed in lifts not exceeding 200 mm and compacted to minimum density of 1,550 kg/m^3 (100% SPMDD) at an optimum moisture content of 19.6%, or within +2% of that moisture content. Fill material may require moisture conditioning prior to compaction.

7.6 LINER

7.6.1 Naturally Occurring Soil Liner

Laboratory testing was conducted on one undisturbed till sample obtained from Borehole BH101, 4.57 m below grade, which had a factored hydraulic conductivity of $6.51x10^{-8}$ cm/s. However, the soil texture of the soils analyzed in Boreholes BH101 to BH103 were inconsistent and did not fall within the same texture class. Therefore, a naturally occurring soil liner is not recommended as the permeability of the subgrade may change across the catch basin footprint.

7.6.2 Compacted Soil Liner

As sand will have to be excavated out of the catch basin footprint and a naturally occurring soil liner is not suitable, a compacted soil liner is recommended. Following a review of the referenced NRCB documentation, it is understood that a constructed clay liner for a catch basin must have a minimum thickness of 1.0 m and a hydraulic conductivity of not more $5.0x10^{-7}$ cm/s. Laboratory testing was conducted on one reformed till sample obtained from the proposed borrow pit source, Borehole BH301 approximately 0.76 m to 4.57 m below grade, which had a factored hydraulic conductivity of $2.19x10^{-8}$ cm/s. Based on the factored hydraulic conductivity of the reformed till sample, a constructed clay liner 0.04 m thick, with a permeability of $2.19x10^{-8}$ cm/s, offers equivalent protection to a 1.0 m thick clay liner with a permeability of $5.0x10^{-7}$ cm/s. However, to ensure the integrity of the clay liner, the constructed liner must be no less than 1.0 m thick as measured perpendicular to the excavation face.

If a clay liner is utilized, or where excavation of the sand and replacement with the lower permeability till is required in catch basin footprint, the constructed liner should be a minimum 1.0 m thick and constructed by placing till lifts not exceeding 200 mm and compacted to minimum density of 1,550 kg/m^3 (100% SPMDD) at an optimum moisture content of 19.6%, or within +2% of that moisture content, perpendicular to the excavation face.

Although not expected to be a concern, due to the proposed depth of the catch basin and the groundwater depth, the bottom of the soil liner must be equal or greater than 1.0 m from the groundwater table at the time of construction.

7.7 Quality Control / Quality Assurance

As part of the quality control program, it is recommended that a geotechnical engineer or representative be on-site to inspect the excavation and compaction required. The geotechnical engineer will be able to provide immediate on-site recommendations to potential difficulties that may arise during construction.

7.8 Erosion

Due to the catch basin's size, these measures may not be necessary, but unchecked erosion can lead to slope and berm failure and erosion preventative measures may be required. Placing riprap is normally the most cost-effective erosion protection material, placed on the waterward side, due to its effectiveness, durability and availability.

Additionally, exposed soil should be graded to the required slope, overlain with topsoil, and seeded or hydroseeded with grass. The planting of trees and shrubs is not recommended as tree roots detrimentally affect berms by root penetration and shrubs cause obstructions in viewing piping, seepage, and burrowing animals. The vegetation will serve to protect the upper portions of the slope from erosion by surface runoff water and will also increase the stability of the slope. The grass should be trimmed regularly as to not obstruct the inspector's view.

7.9 Fence

It is recommended that continuous fencing around the perimeter of the catch basin is constructed. A fence will help prevent unauthorized entry to the catch basin and will also help reduce the detrimental effects of burrowing animals such as beavers, muskrats, gophers, etc.

7.10 INSPECTIONS

It is the responsibility of the owner to conduct routine and periodic inspections and to maintain and repair the catch basin to acceptable standards. It is recommended that the catch basin is inspected on a regular basis or as per the Natural Resources Conservation Board. The inspector shall note, but not be limited to noting, the presence or absence of settlement, seepage, burrowing animals, erosion, freeboard level, erosion protection performance and condition, fence condition, vegetation growth that my lead to a decreased performance of the liner, and general berm and catch basin condition.

8 CLOSURE

Union Street Geotechnical Ltd. prepared this report for the use of the Donalda Colony, and their agents, for the design and construction of a confined feedlot and catch basin located within the E. ½ of 24-42-18 W4M in Stettler County No. 6, Alberta.

Samples obtained from this geotechnical investigation will be retained in our laboratory for 30 days following the date of the final report. Should no instructions be received to the contrary, these samples will then be discarded.

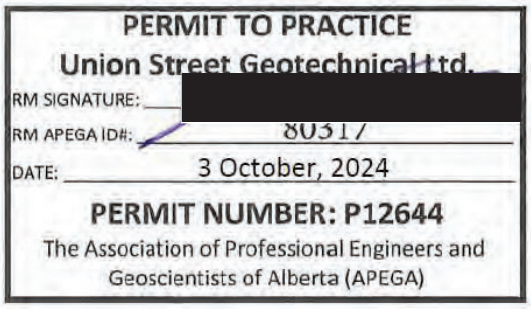
Respectfully,

Union Street Geotechnical Ltd.

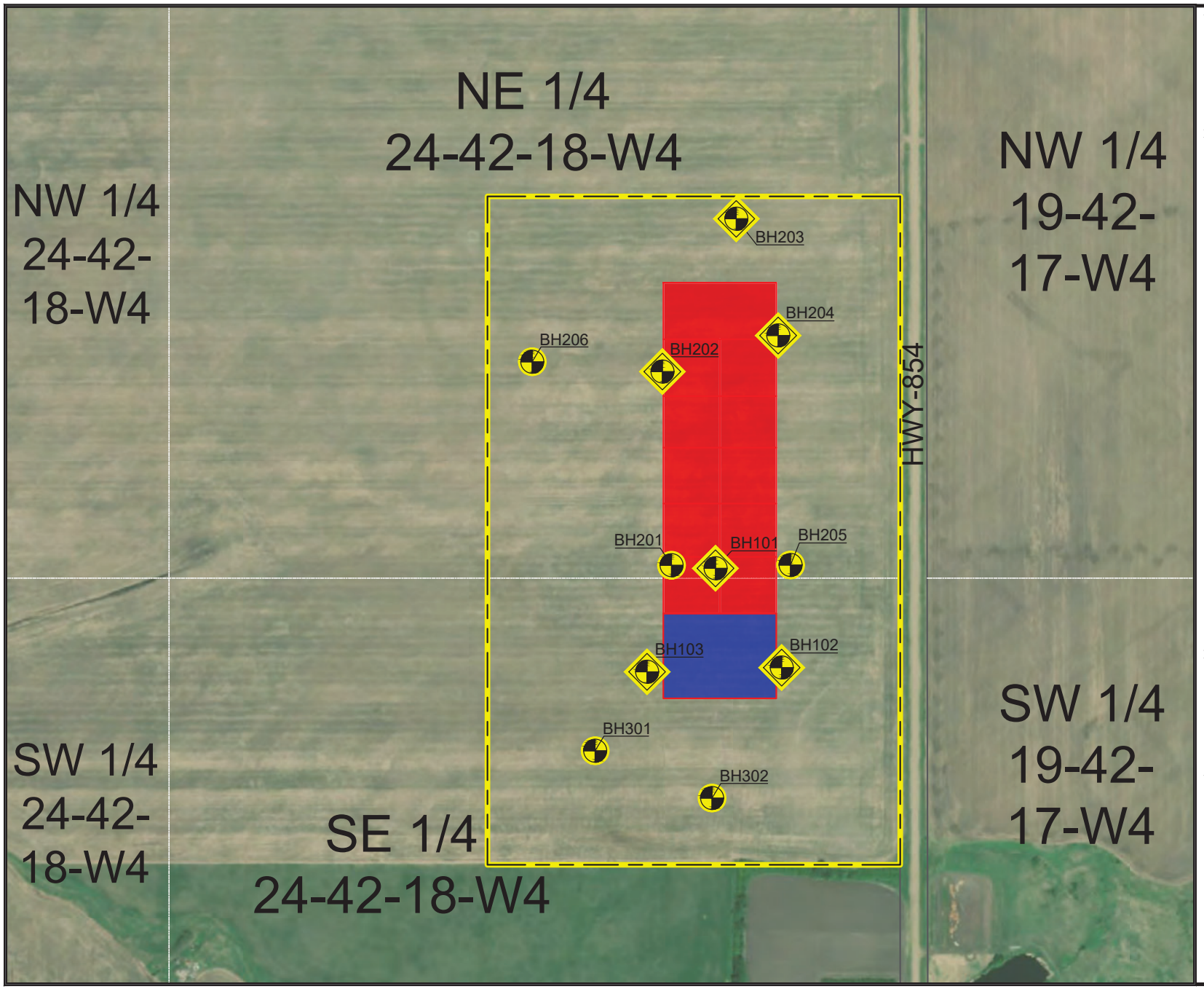
3rd October, 2024

Neil Tomaszewski, P.Eng.
Project Engineer

Joshua Wilson, P.Eng.
Project Engineer




Union Street Geotechnical
Drawing



USG1884 - Drawing.dwg

02.03.2022

LEGEND:
- SITE BOUNDARY
- ROAD RIGHT OF WAY
- PROPERTY LINE (WHITE)
- PROPOSED FEEDLOT
- PROPOSED CATCH BASIN
- BOREHOLE LOCATION
- PIEZOMETER LOCATION

GENERAL NOTES:

1. DRAWINGS COMPILED FROM:

   MULTIPLE VECTOR AND RASTER GIS FIELDS AS PUBLISHED BY THE GOVERNMENT OF CANADA; THE GOVERMENT OF ALBERTA; NATURAL RESOURCES CANADA; EARTH SCIENCES SECTOR; CANADA CENTRE FOR MAPPING AND EARTH OBSERVATION, STETTLER COUNTY NO. 6,

   AREIAL PHOTOGRAPH (C) 2022 MAXAR TECHNOLOGIES (C) GOOGLE EARTH PRO,

   UNION STREET GEOTECHNICAL INVESTIGATION,

   & PDF SKETCH PROVIDED BY THE CLIENT

2. LEGAL ADDRESS WITHIN THE E. 1/2 24-42-18-W4

0 20 40 60 80 100 120 m
0 50 100 150 200 250 300 350 400 ft

N

SCALE 1:6,000
NOTE: SCALE IS APPROXIMATE IN NATURE, AND IS INCLUDED ONLY FOR REFERENCE PURPOSES.

UNION STREET GEOTECHNICAL LTD.

Union Street Geotechnical

PROJECT NAME & LOCATION
DONOLDA COLONY FEEDLOT
WITHIN THE E. 1/2 24-42-18-W4
STETTLER COUNTY NO. 6
ALBERTA

DRAWING NAME: SITE AND BOREHOLE LOCATION PLAN	
PROJECT NUMBER: USG1884	SHEET: A1
DATE (YY-MM-DD): 2024-08-23	
PROJECT TYPE: GEOTECHNICAL INVESTIGATION	VERSION: 0001

Union Street Geotechnical

Photographs

Photographs - Geotechnical Investigation
Within the E. ½ of 24-42-18 W4M
Stettler County No. 6, Alberta

Photograph No. 1: Photograph taken from near the northeast corner of the proposed feedlot, facing southwest, showing a majority of the proposed development footprint, site grading, and general site conditions observed at the time of drilling. Photograph taken on 5th June, 2024.

Photograph No. 2: Photograph taken from near Borehole BH201, facing southeast, showing a portion of the proposed catch basin development footprint, Highway 854 to the east, site grading, and general site conditions observed at the time of drilling. Photograph taken on 5th June, 2024.

Borehole Logs

FIELD BOREHOLE LOG

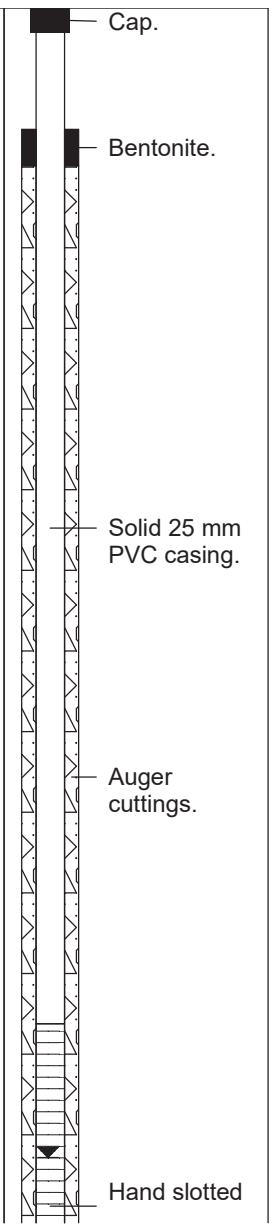
BOREHOLE NUMBER
BH101

PROJECT NUMBER: **USG1884**
PROJECT NAME: **Geotechnical Investigation**
LOCATION: **N.E. ¼ of 24-42-18 W4M, Stettler County No. 6, Alberta**
CLIENT: **Donalda Colony**
DRILLING METHOD: **150 mm Solid Stem Auger**
LOGGED BY: **N.T.**
DATE BEGUN: **5 June, 2024**
DATE COMPLETED: **5 June, 2024**

CASING STICKUP: **1.11 m**
TOTAL DEPTH: **10.36 m**
GROUND SURFACE ELEVATION: **N/A**

Union Street Geotechnical

DEPTH (m)	LITHOLOGY	DESCRIPTION	SAMPLE Type	SAMPLE No.	SPT "N"	POCKET PEN (kPa)	MOISTURE CONT. (%)	USC	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	SULPHATE (%)	WELL INSTALLATION
0.0		TOPSOIL: 305 mm thick.										
1.0		SAND: Clayey, silty. Dark yellowish brown (10YR 4/4). Oxidized. Dry. Loose. Massive. Calcareous.		NT1		48	4.9					
2.0		TILL: Clay, silty, some sand. Brown (10YR 5/3) to dark greyish brown (10YR 4/2). Oxidized. Moist. Stiff to very stiff. Massive. Gravel and coal chip inclusions. Calcareous.		NT2		120	15.5					
3.0												
4.0		@ 3.81 m, clay and sand.		NT3		144	18.2	CI	36.0	16.6		
5.0				NT4		96	15.5					
		@ 5.33 m, clay and silt, some sand.		NT5		192	32.4					
6.0												
7.0		MUDSTONE: Clay, silty, some sand. Dark greyish brown (10YR 4/2) to very dark greyish brown (10YR 3/2). Non-oxidized. Dry to moist. Hard. Massive. Non-calcareous.		NT6		-	18.8					
8.0		@ 6.71 m, hard drilling.		NT7		-	19.3					
9.0												



FIELD BOREHOLE LOG

BOREHOLE NUMBER
BH101

PROJECT NUMBER: **USG1884**
PROJECT NAME: **Geotechnical Investigation**
LOCATION: **N.E. ¼ of 24-42-18 W4M, Stettler County No. 6, Alberta**
CLIENT: **Donalda Colony**
DRILLING METHOD: **150 mm Solid Stem Auger**
LOGGED BY: **N.T.**
DATE BEGUN: **5 June, 2024**
DATE COMPLETED: **5 June, 2024**

CASING STICKUP: **1.11 m**
TOTAL DEPTH: **10.36 m**
GROUND SURFACE ELEVATION: **N/A**

Union Street Geotechnical

DEPTH (m)	LITHOLOGY	DESCRIPTION	SAMPLE Type	SAMPLE No.	SPT "N"	POCKET PEN (kPa)	MOISTURE CONT. (%)	USC	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	SULPHATE (%)	WELL INSTALLATION
9.0												25 mm PVC.
10.0				NT8		-	20.2					
11.0		NOTES: Refusal at 10.36 m below surface. No seepage or sloughing encountered during drilling. Piezometer installed, annulus backfilled to surface with auger cuttings. Water level at 8.46 m below grade on 19 July, 2024.										
12.0												
13.0												
14.0												
15.0												
16.0												
17.0												
18.0												
19.0												

FIELD BOREHOLE LOG

BOREHOLE NUMBER
BH102

PROJECT NUMBER: **USG1884**
PROJECT NAME: **Geotechnical Investigation**
LOCATION: **S.E. ¼ of 24-42-18 W4M, Stettler County No. 6, Alberta**
CLIENT: **Donalda Colony**
DRILLING METHOD: **150 mm Solid Stem Auger**
LOGGED BY: **N.T.**
DATE BEGUN: **5 June, 2024**
DATE COMPLETED: **5 June, 2024**

CASING STICKUP: **1.03 m**
TOTAL DEPTH: **6.10 m**
GROUND SURFACE ELEVATION: **N/A**

Union Street Geotechnical

DEPTH (m)	LITHOLOGY	DESCRIPTION	SAMPLE Type	SAMPLE No.	SPT "N"	POCKET PEN (kPa)	MOISTURE CONT. (%)	USC	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	SULPHATE (%)	WELL INSTALLATION
0.0		TOPSOIL: 152 mm thick.										Cap.
0.0 – 1.0		SAND: Some clay, some silt. Yellowish brown. Oxidized. Dry. Loose. Massive.		NT9		120	16.5					Bentonite.
1.0 – 4.0		TILL: Clay and silt, some sand. Brown (10YR 4/3) to dark greyish brown (10YR 4/2). Oxidized. Moist. Very stiff to hard. Massive. Gravel and coal chip inclusions. Calcareous.		NT10		120	16.6					Solid 25 mm PVC casing.
				NT11		-	23.6					Auger cuttings.
4.0 – 5.0		MUDSTONE: Clay, silty, sandy. Very dark grey (10YR 3/1). Non-oxidized. Dry to moist. Hard. Massive. Non-calcareous.		NT12		-	23.1					Hand slotted 25 mm PVC.
6.0		NOTES: End of borehole at 6.10 m below surface. No seepage or sloughing encountered during drilling. Piezometer installed, annulus backfilled to surface with auger cuttings. Piezometer dry on 19 July, 2024.										

FIELD BOREHOLE LOG

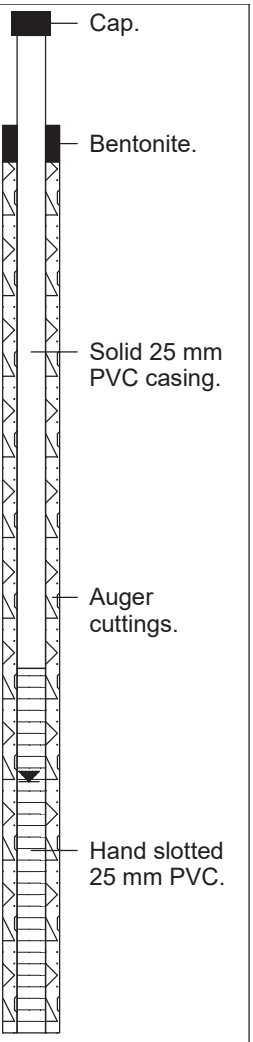
BOREHOLE NUMBER
BH103

PROJECT NUMBER: **USG1884**
PROJECT NAME: **Geotechnical Investigation**
LOCATION: **S.E. ¼ of 24-42-18 W4M, Stettler County No. 6, Alberta**
CLIENT: **Donalda Colony**
DRILLING METHOD: **150 mm Solid Stem Auger**
LOGGED BY: **N.T.**
DATE BEGUN: **5 June, 2024**
DATE COMPLETED: **5 June, 2024**

CASING STICKUP: **0.94 m**
TOTAL DEPTH: **7.47 m**
GROUND SURFACE ELEVATION: **N/A**

Union Street Geotechnical

DEPTH (m)	LITHOLOGY	DESCRIPTION	SAMPLE Type	SAMPLE No.	SPT "N"	POCKET PEN (kPa)	MOISTURE CONT. (%)	USC	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	SULPHATE (%)	WELL INSTALLATION
0.0		TOPSOIL: 203 mm thick.										
1.0		TILL: Clay, silty, some sand. Brown (10YR 4/3) to dark greyish brown (10YR 4/2). Oxidized. Moist. Stiff to hard. Massive. Gravel and coal chip inclusions. Calcareous.		NT13		215	12.6					
2.0				NT14		144	24.6					
3.0												
4.0				NT15		96	23.8					
		4.26 m, sandy.										
5.0		5.18 m, trace sand.		NT16		96	26.4					
6.0		MUDSTONE: Clay, silty, sandy. Very dark greyish brown (10YR 3/2). Non-oxidized. Dry to moist. Hard. Massive. Calcareous.		NT17		215	-					
7.0		6.71 m, hard drilling.		NT18		215	30.1					
8.0		NOTES: Refusal at 7.47 m below surface. No seepage or sloughing encountered during drilling. Piezometer installed, annulus backfilled to surface with auger cuttings. Water level at 5.40 m below grade on 19 July, 2024.										
9.0												



FIELD BOREHOLE LOG

BOREHOLE NUMBER
BH201

PROJECT NUMBER: **USG1884**
PROJECT NAME: **Geotechnical Investigation**
LOCATION: **N.E. ¼ of 24-42-18 W4M, Stettler County No. 6, Alberta**
CLIENT: **Donalda Colony**
DRILLING METHOD: **150 mm Solid Stem Auger**
LOGGED BY: **N.T.**
DATE BEGUN: **5 June, 2024**
DATE COMPLETED: **5 June, 2024**

CASING STICKUP: **N/A**
TOTAL DEPTH: **4.57 m**
GROUND SURFACE ELEVATION: **N/A**

Union Street Geotechnical

DEPTH (m)	LITHOLOGY	DESCRIPTION	SAMPLE Type	SAMPLE No.	SPT "N"	POCKET PEN (kPa)	MOISTURE CONT. (%)	USC	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	SULPHATE (%)	WELL INSTALLATION
0.0		TOPSOIL: 305 mm thick.										
		TILL: Clay and silt, some sand. Brown (10YR 5/3) to very dark grey (10YR 3/1). Oxidized. Moist. Stiff to very stiff. Massive. Coal chip inclusions. Calcareous.		JS1		60	26.4					
1.0												
2.0				JS2		168	15.2					Auger cuttings.
3.0												
4.0				JS3		168	13.6					
		NOTES: End of borehole at 4.57 m below surface. No seepage or sloughing encountered during drilling. Borehole backfilled to surface with auger cuttings.										
5.0												

FIELD BOREHOLE LOG

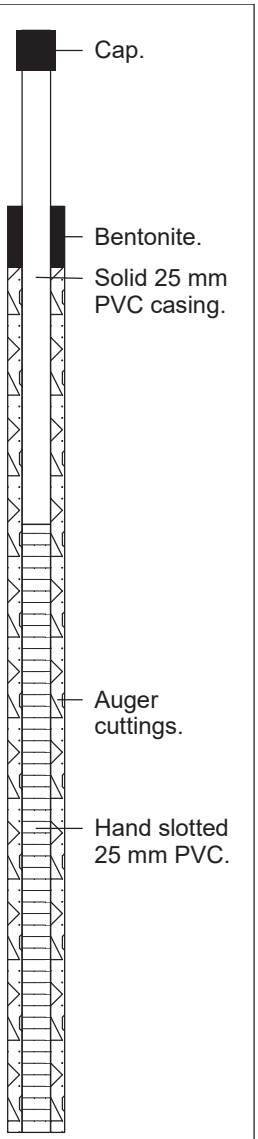
BOREHOLE NUMBER
BH202

PROJECT NUMBER: **USG1884**
PROJECT NAME: **Geotechnical Investigation**
LOCATION: **N.E. ¼ of 24-42-18 W4M, Stettler County No. 6, Alberta**
CLIENT: **Donalda Colony**
DRILLING METHOD: **150 mm Solid Stem Auger**
LOGGED BY: **N.T.**
DATE BEGUN: **5 June, 2024**
DATE COMPLETED: **5 June, 2024**

CASING STICKUP: **0.87 m**
TOTAL DEPTH: **4.57 m**
GROUND SURFACE ELEVATION: **N/A**

Union Street Geotechnical

DEPTH (m)	LITHOLOGY	DESCRIPTION	SAMPLE Type	SAMPLE No.	SPT "N"	POCKET PEN (kPa)	MOISTURE CONT. (%)	USC	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	SULPHATE (%)	WELL INSTALLATION
0.0		TOPSOIL: 203 mm thick.										
		TILL: Clay, silty, sandy. Greyish brown (10YR 5/2) to dark greyish brown (10YR 4/2). Oxidized. Moist. Stiff to very stiff. Massive. Gravel and coal chip inclusions. Calcareous.		JS4		84	17.0					
1.0		0.91 m, trace sand.										
2.0				JS5		144	19.3					
3.0												
4.0				JS6		144	16.5					
5.0		NOTES: End of borehole at 4.57 m below surface. No seepage or sloughing encountered during drilling. Piezometer installed, annulus backfilled to surface with auger cuttings. Piezometer dry on 19 July, 2024.										



FIELD BOREHOLE LOG

BOREHOLE NUMBER
BH203

PROJECT NUMBER: **USG1884**
PROJECT NAME: **Geotechnical Investigation**
LOCATION: **N.E. ¼ of 24-42-18 W4M, Stettler County No. 6, Alberta**
CLIENT: **Donalda Colony**
DRILLING METHOD: **150 mm Solid Stem Auger**
LOGGED BY: **N.T.**
DATE BEGUN: **5 June, 2024**
DATE COMPLETED: **5 June, 2024**

CASING STICKUP: **0.79 m**
TOTAL DEPTH: **4.57 m**
GROUND SURFACE ELEVATION: **N/A**

Union Street Geotechnical

DEPTH (m)	LITHOLOGY	DESCRIPTION	SAMPLE Type	SAMPLE No.	SPT "N"	POCKET PEN (kPa)	MOISTURE CONT. (%)	USC	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	SULPHATE (%)	WELL INSTALLATION
0.0		TOPSOIL: 76 mm thick.										Cap.
		SAND: Clayey, some silt. Yellowish brown. Oxidized. Moist. Loose. Massive.										Bentonite.
1.0		TILL: Clay, silty, trace sand. Greyish brown (10YR 5/2) to dark grey (10YR 4/1). Oxidized. Moist. Very stiff. Massive. Coal chip inclusions. Calcareous.		JS7		144	28.4					Solid 25 mm PVC casing.
2.0				JS8		192	23.5					Auger cuttings.
3.0		3.05 m, sand, clayey, silty.										Hand slotted 25 mm PVC.
4.0				JS9		-	16.7					
		NOTES: End of borehole at 4.57 m below surface. No seepage or sloughing encountered during drilling. Piezometer installed, annulus backfilled to surface with auger cuttings. Piezometer dry on 19 July, 2024.										
5.0												

FIELD BOREHOLE LOG

BOREHOLE NUMBER
BH204

PROJECT NUMBER: **USG1884**
PROJECT NAME: **Geotechnical Investigation**
LOCATION: **N.E. ¼ of 24-42-18 W4M, Stettler County No. 6, Alberta**
CLIENT: **Donalda Colony**
DRILLING METHOD: **150 mm Solid Stem Auger**
LOGGED BY: **N.T.**
DATE BEGUN: **5 June, 2024**
DATE COMPLETED: **5 June, 2024**

CASING STICKUP: **1.02 m**
TOTAL DEPTH: **4.57 m**
GROUND SURFACE ELEVATION: **N/A**

Union Street Geotechnical

DEPTH (m)	LITHOLOGY	DESCRIPTION	SAMPLE Type	SAMPLE No.	SPT "N"	POCKET PEN (kPa)	MOISTURE CONT. (%)	USC	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	SULPHATE (%)	WELL INSTALLATION
0.0		TOPSOIL: 76 mm thick.										Cap.
		TILL: Clay, silty, some sand. Dark yellowish brown (10YR 3/4) to dark greyish brown (10YR 4/2). Oxidized. Moist. Firm to very stiff. Massive. Gravel and coal chip inclusions. Calcareous.										Bentonite.
1.0				JS10		84	9.5					Solid 25 mm PVC casing.
2.0		2.13 m, clay and sand.		JS11		168	-					
				JS12		48	18.2					Auger cuttings.
3.0		3.05 m, clay, silty, sandy.										Hand slotted 25 mm PVC.
4.0				JS13		-	20.9					
		NOTES: End of borehole at 4.57 m below surface. No seepage or sloughing encountered during drilling. Piezometer installed, annulus backfilled to surface with auger cuttings. Piezometer dry on 19 July, 2024.										
5.0												

FIELD BOREHOLE LOG

BOREHOLE NUMBER
BH205

PROJECT NUMBER: **USG1884**
PROJECT NAME: **Geotechnical Investigation**
LOCATION: **N.E. ¼ of 24-42-18 W4M, Stettler County No. 6, Alberta**
CLIENT: **Donalda Colony**
DRILLING METHOD: **150 mm Solid Stem Auger**
LOGGED BY: **N.T.**
DATE BEGUN: **5 June, 2024**
DATE COMPLETED: **5 June, 2024**

CASING STICKUP: **N/A**
TOTAL DEPTH: **4.57 m**
GROUND SURFACE ELEVATION: **N/A**

Union Street Geotechnical

DEPTH (m)	LITHOLOGY	DESCRIPTION	SAMPLE Type	SAMPLE No.	SPT "N"	POCKET PEN (kPa)	MOISTURE CONT. (%)	USC	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	SULPHATE (%)	WELL INSTALLATION
0.0		TOPSOIL: 203 mm thick.										
		SAND: Clayey, some silt. Yellowish brown. Oxidized. Moist. Compact. Massive.										
		TILL: Clay, silty, some sand. Brown (10YR 4/3) to dark brown (10YR 3/3). Oxidized. Moist. Very stiff. Massive. Coal chip inclusions. Calcareous.		JS14		120	15.0					
1.0												
2.0				JS15		168	14.8					Auger cuttings.
3.0												
4.0				JS16		192	25.5					
		NOTES: End of borehole at 4.57 m below surface. No seepage or sloughing encountered during drilling. Borehole backfilled to surface with auger cuttings.										
5.0												

FIELD BOREHOLE LOG

BOREHOLE NUMBER
BH206

PROJECT NUMBER: **USG1884**
PROJECT NAME: **Geotechnical Investigation**
LOCATION: **N.E. ¼ of 24-42-18 W4M, Stettler County No. 6, Alberta**
CLIENT: **Donalda Colony**
DRILLING METHOD: **150 mm Solid Stem Auger**
LOGGED BY: **N.T.**
DATE BEGUN: **5 June, 2024**
DATE COMPLETED: **5 June, 2024**

CASING STICKUP: **N/A**
TOTAL DEPTH: **4.57 m**
GROUND SURFACE ELEVATION: **N/A**

Union Street Geotechnical

DEPTH (m)	LITHOLOGY	DESCRIPTION	SAMPLE Type	SAMPLE No.	SPT "N"	POCKET PEN (kPa)	MOISTURE CONT. (%)	USC	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	SULPHATE (%)	WELL INSTALLATION
0.0		TOPSOIL: 203 mm thick.										
		TILL: Clay, silty, some sand to sandy. Pale brown (10YR 6/3) to dark brown (10YR 3/3). Oxidized. Moist. Very stiff to hard. Massive. Gravel and coal chip inclusions. Calcareous.		JS17		192	14.2					
1.0												
2.0				JS18		192	16.1					Auger cuttings.
3.0												
4.0				JS19		215	31.6					
5.0		NOTES: End of borehole at 4.57 m below surface. No seepage or sloughing encountered during drilling. Borehole backfilled to surface with auger cuttings.										

FIELD BOREHOLE LOG

BOREHOLE NUMBER
BH301

PROJECT NUMBER: **USG1884**
PROJECT NAME: **Geotechnical Investigation**
LOCATION: **S.E. ¼ of 24-42-18 W4M, Stettler County No. 6, Alberta**
CLIENT: **Donalda Colony**
DRILLING METHOD: **150 mm Solid Stem Auger**
LOGGED BY: **N.T.**
DATE BEGUN: **5 June, 2024**
DATE COMPLETED: **5 June, 2024**

CASING STICKUP: **N/A**
TOTAL DEPTH: **6.10 m**
GROUND SURFACE ELEVATION: **N/A**

Union Street Geotechnical

DEPTH (m)	LITHOLOGY	DESCRIPTION	SAMPLE Type	SAMPLE No.	SPT "N"	POCKET PEN (kPa)	MOISTURE CONT. (%)	USC	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	SULPHATE (%)	WELL INSTALLATION
0.0		TOPSOIL: 406 mm thick.										
1.0		SAND: Trace clay, trace silt. Yellowish brown. Oxidized. Moist. Compact. Massive.		DW1		96	14.2					
2.0		TILL: Clay, silty, sandy, trace gravel. Brown (10YR 4/3) to very dark brown (10YR 2/2). Oxidized. Moist. Stiff to very stiff. Massive. Coal chip inclusions. Calcareous.		DW2		192	24.2					
		1.52 m, some sand.										
3.0		3.05 m, sandy.										Auger cuttings.
4.0		3.81 m, trace sand.		DW3		120	23.5					
5.0		MUDSTONE: Clay and sand, some silt. Grey (10YR 5/1). Non-oxidized. Dry. Dense. Massive. Non-calcareous.		DW4		-	17.5					
		5.49 m, clay, silty, sandy.										
6.0		NOTES: End of borehole at 6.10 m below surface. No seepage or sloughing encountered during drilling. Borehole backfilled to surface with auger cuttings.										
7.0												
8.0												
9.0												
10.0												

FIELD BOREHOLE LOG

BOREHOLE NUMBER
BH302

PROJECT NUMBER: **USG1884**
PROJECT NAME: **Geotechnical Investigation**
LOCATION: **S.E. ¼ of 24-42-18 W4M, Stettler County No. 6, Alberta**
CLIENT: **Donalda Colony**
DRILLING METHOD: **150 mm Solid Stem Auger**
LOGGED BY: **N.T.**
DATE BEGUN: **5 June, 2024**
DATE COMPLETED: **5 June, 2024**

CASING STICKUP: **N/A**
TOTAL DEPTH: **5.03 m**
GROUND SURFACE ELEVATION: **N/A**

Union Street Geotechnical

DEPTH (m)	LITHOLOGY	DESCRIPTION	SAMPLE Type	SAMPLE No.	SPT "N"	POCKET PEN (kPa)	MOISTURE CONT. (%)	USC	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	SULPHATE (%)	WELL INSTALLATION
0.0		TOPSOIL: 305 mm thick.										
1.0		TILL: Clay and silt, sandy. Light yellowish brown (10YR 6/4) to dark brown (10YR 3/3). Oxidized. Moist. Stiff to very stiff. Massive. Coal chip inclusions. Calcareous. 0.61 m, sand seam, 76 mm thick. 1.22 m, sand seam, 76 mm thick. 1.52 m, some sand. 2.29 m, trace sand.		DW5		96	16.5					
2.0				DW6		180	22.8					Auger cuttings.
3.0												
4.0		MUDSTONE: Clay and sand, trace silt. Yellowish brown (10YR 5/6). Non-oxidized. Dry. Hard. Massive. Non-calcareous.		DW7		-	12.4					
5.0		NOTES: Refusal at 5.03 m below surface. No seepage or sloughing encountered during drilling. Borehole backfilled to surface with auger cuttings.										
6.0												
7.0												
8.0												
9.0												
10.0												

Union Street Geotechnical

Laboratory Test Results

Laboratory Hydrometer — Sample No.: NT5

Sample Information

Date: 07-Jun-24 **By:** N.T. **of:** USG **Type:** Pail / Bag

Location: BH101, 5.33 m BG **Specification:** ASTM D 422

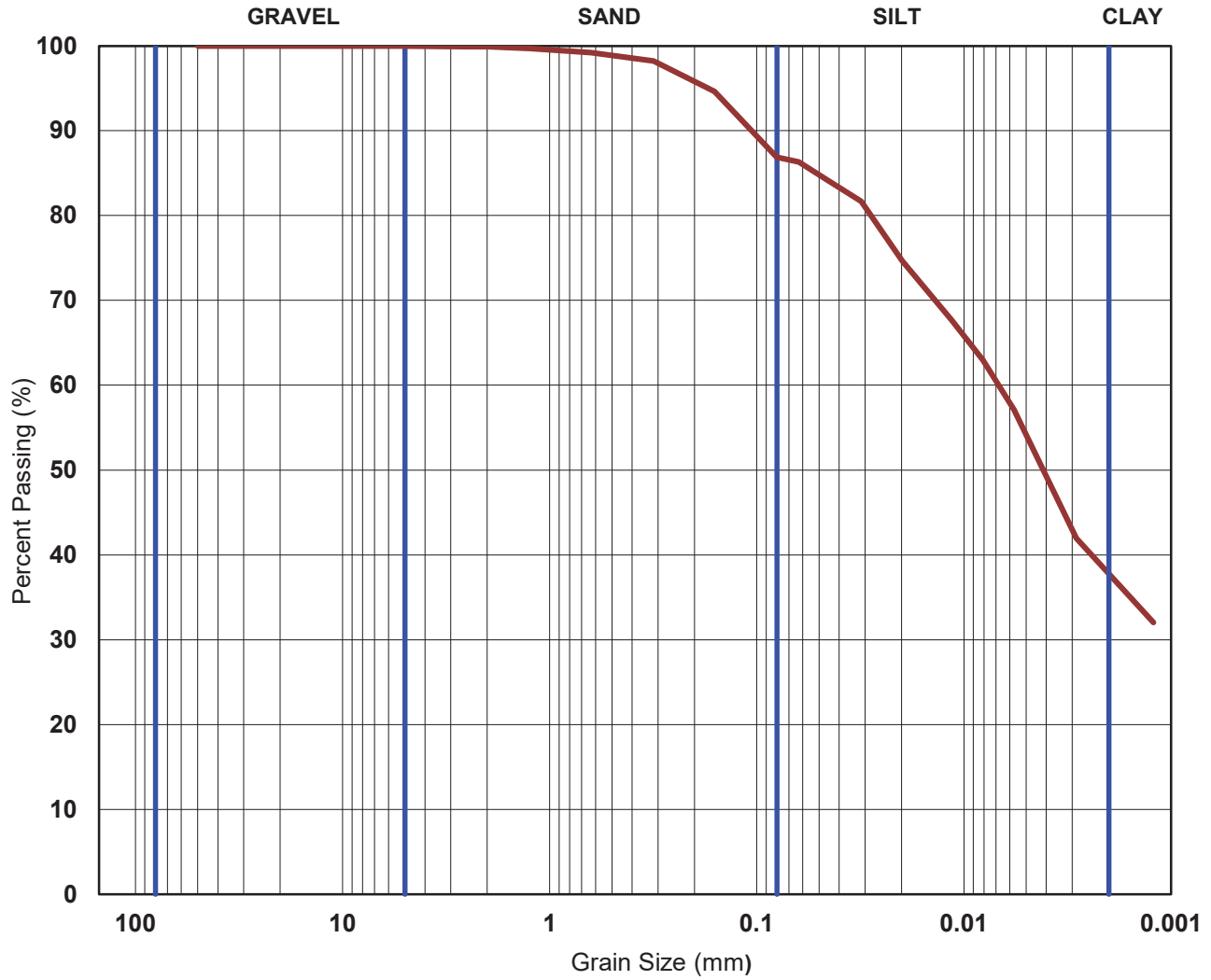
Description: Clay and silt, some sand

Specifications: Laboratory Specifications as per ASTM D 422.

Comments:

Sieve Results:

By Type (%): Gravel = **0.0** Sand = **13.1** Silt = **50.1** Clay = **36.8**



Union Street Geotechnical

CLIENT:	Donolda Colony	**FILE No.:**	USG1884
PROJECT:	2024 Geotech. Inv.	**DATE:**	18-Jun-24
LOCATION:	Red Deer, Alberta	**TECH:**	G.S.

Laboratory Hydrometer — Sample No.: NT11

Sample Information

Date: 07-Jun-24 **By:** N.T. **of:** USG **Type:** Pail / Bag

Location: BH102, 3.81 m BG **Specification:** ASTM D 422

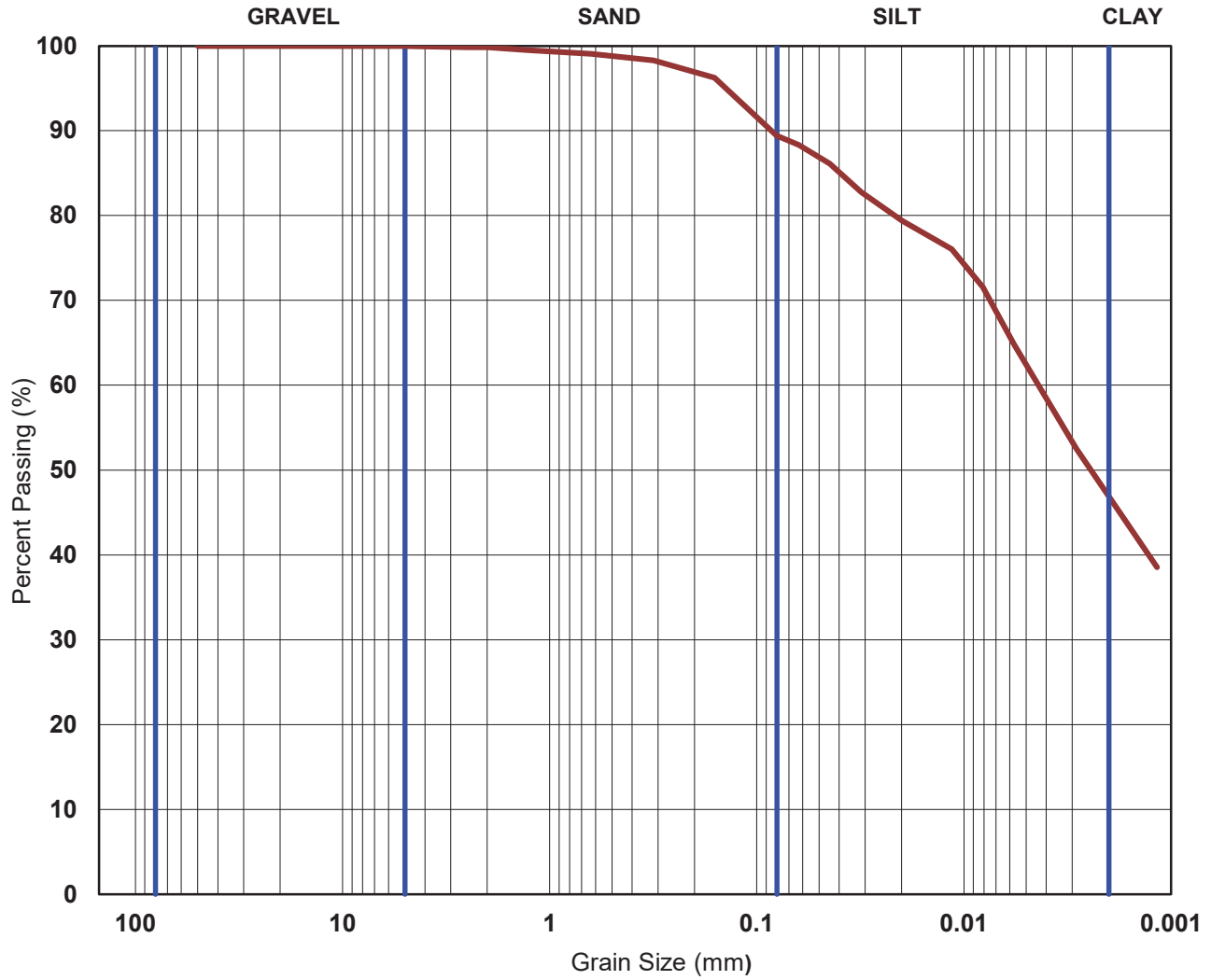
Description: Clay and silt, some sand

Specifications: Laboratory Specifications as per ASTM D 422.

Comments:

Sieve Results:

By Type (%): Gravel = **0.0** Sand = **10.6** Silt = **44.0** Clay = **45.4**



Union Street Geotechnical

CLIENT:	Donolda Colony	**FILE No.:**	USG1884
PROJECT:	2024 Geotech. Inv.	**DATE:**	18-Jun-24
LOCATION:	Red Deer, Alberta	**TECH:**	G.S.

Laboratory Hydrometer — Sample No.: NT16

Sample Information

Date: 07-Jun-24 **By:** N.T. **of:** USG **Type:** Pail / Bag

Location: BH103, 5.33 m BG **Specification:** ASTM D 422

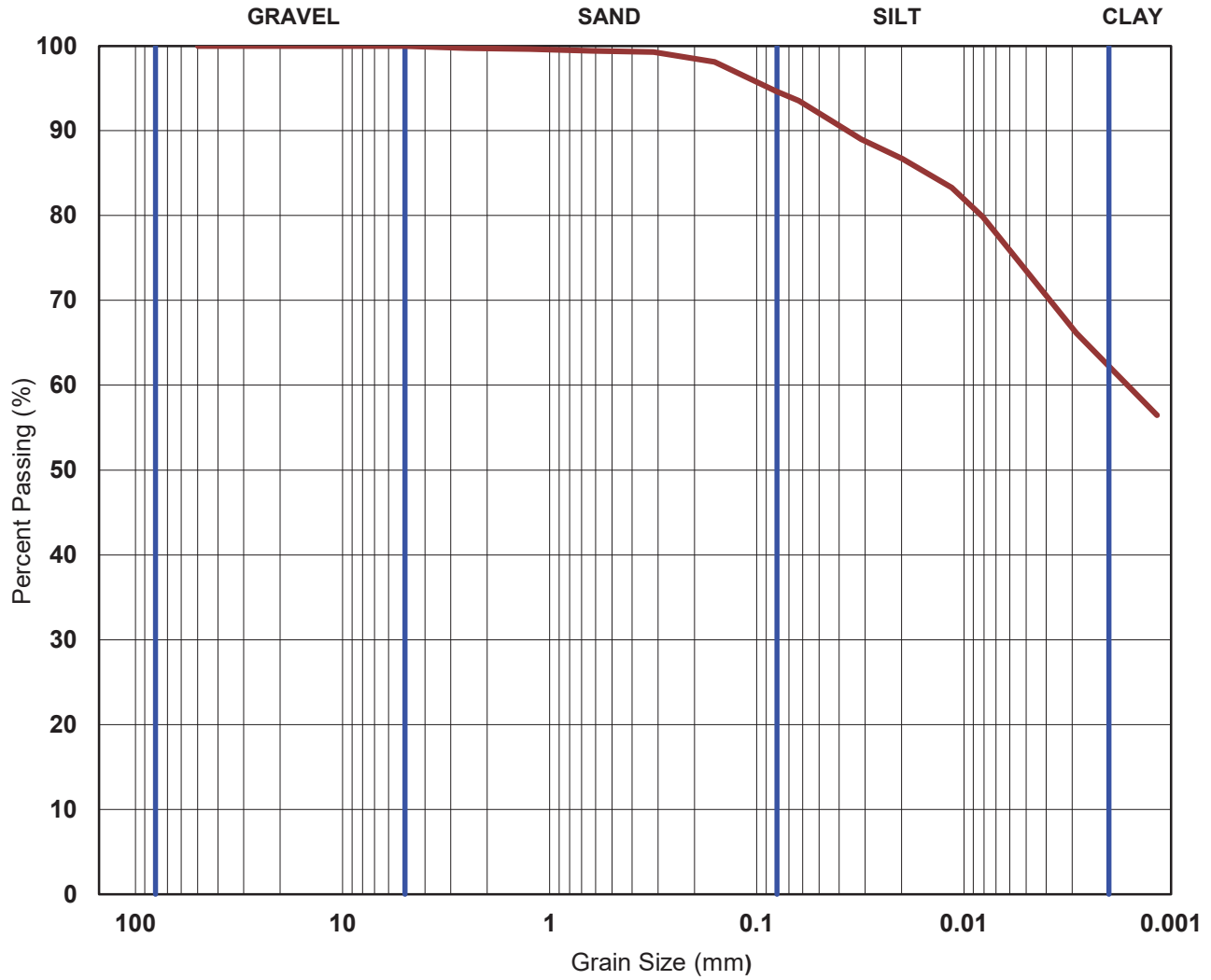
Description: Clay, silty, trace sand

Specifications: Laboratory Specifications as per ASTM D 422.

Comments:

Sieve Results:

By Type (%): Gravel = **0.0** Sand = **5.4** Silt = **33.4** Clay = **61.2**



Union Street Geotechnical

CLIENT:	Donolda Colony	**FILE No.:**	USG1884
PROJECT:	2024 Geotech. Inv.	**DATE:**	18-Jun-24
LOCATION:	Red Deer, Alberta	**TECH:**	G.S.

Laboratory Hydrometer — Sample No.: JS1

Sample Information

Date: 07-Jun-24 **By:** N.T. **of:** USG **Type:** Pail / Bag

Location: BH201, 0.76 m BG **Specification:** ASTM D 422

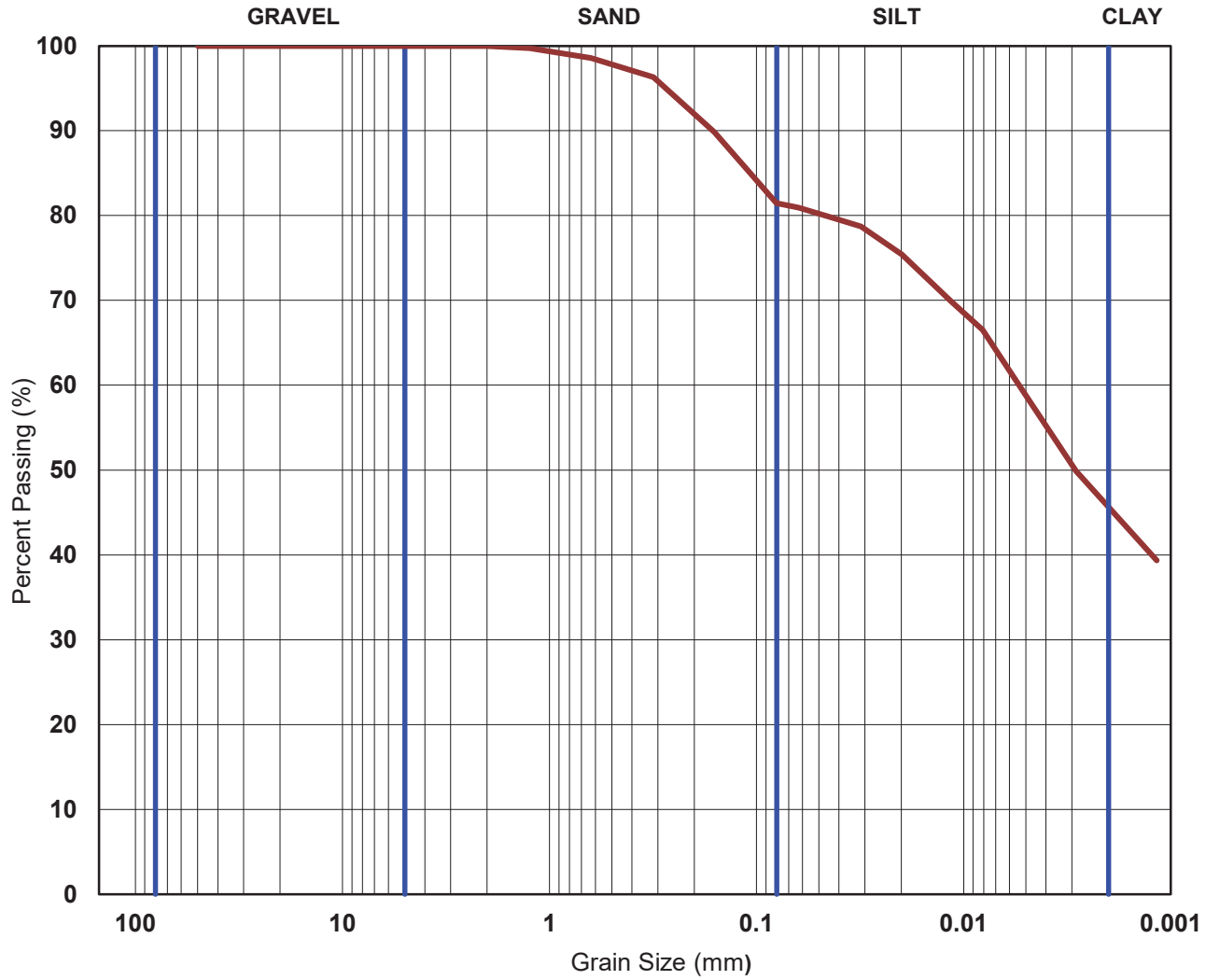
Description: Clay and silt, some sand

Specifications: Laboratory Specifications as per ASTM D 422.

Comments:

Sieve Results:

By Type (%): Gravel = **0.0** Sand = **18.5** Silt = **37.0** Clay = **44.5**



Union Street Geotechnical

CLIENT:	Donolda Colony	**FILE No.:**	USG1884
PROJECT:	2024 Geotech. Inv.	**DATE:**	14-Jun-24
LOCATION:	Red Deer, Alberta	**TECH:**	G.S.

Laboratory Hydrometer — Sample No.: JS7

Sample Information

Date: 07-Jun-24 **By:** N.T. **of:** USG **Type:** Pail / Bag

Location: BH203, 0.76 m BG **Specification:** ASTM D 422

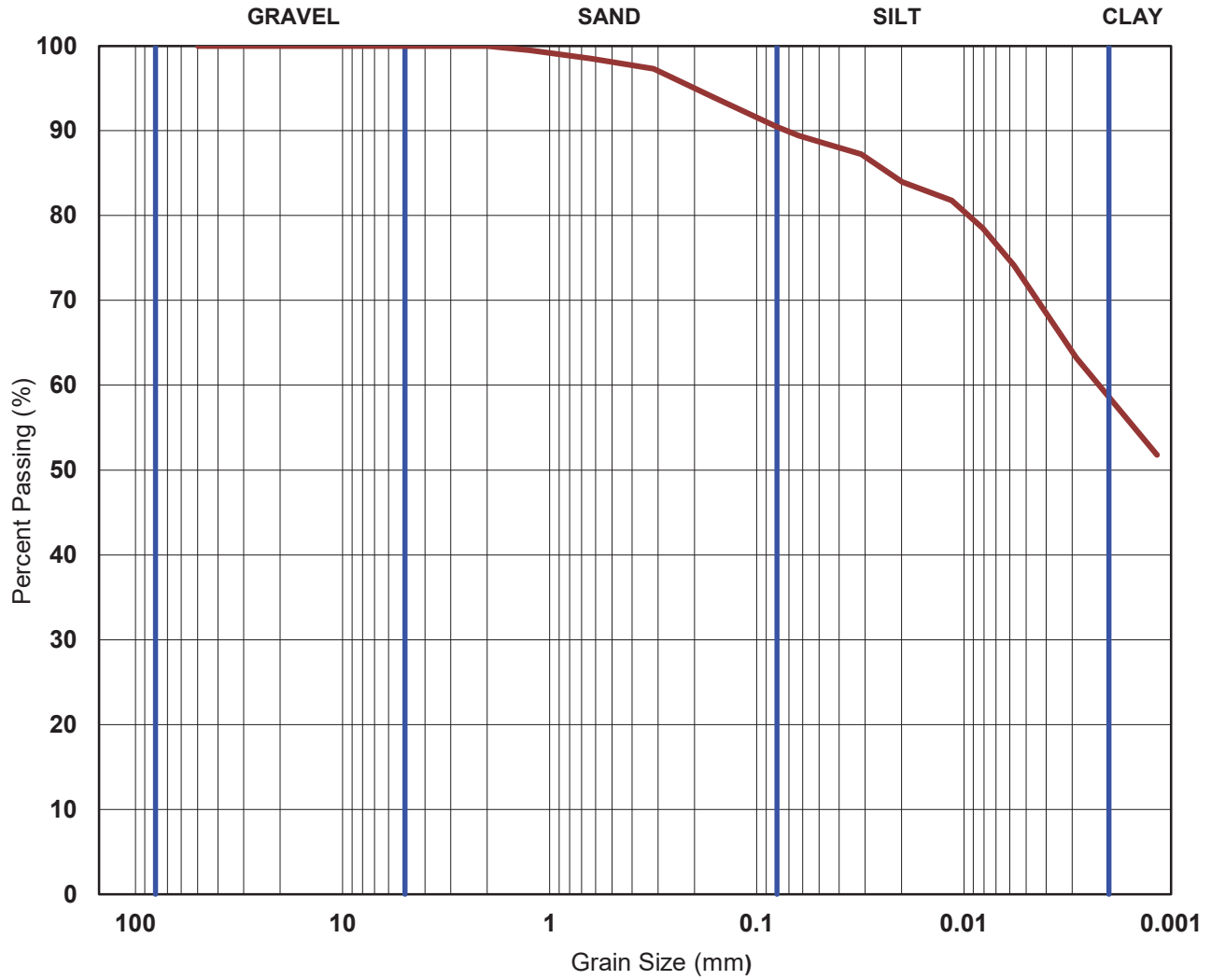
Description: Clay, silty, trace sand

Specifications: Laboratory Specifications as per ASTM D 422.

Comments:

Sieve Results:

By Type (%): Gravel = **0.0** Sand = **9.5** Silt = **33.1** Clay = **57.4**



Union Street Geotechnical

CLIENT: Donolda Colony **FILE No.:** USG1884

PROJECT: 2024 Geotech. Inv. **DATE:** 14-Jun-24

LOCATION: Red Deer, Alberta **TECH:** G.S.

Laboratory Hydrometer — Sample No.: JS14

Sample Information

Date: 07-Jun-24 **By:** N.T. **of:** USG **Type:** Pail / Bag

Location: BH205, 0.76 m BG **Specification:** ASTM D 422

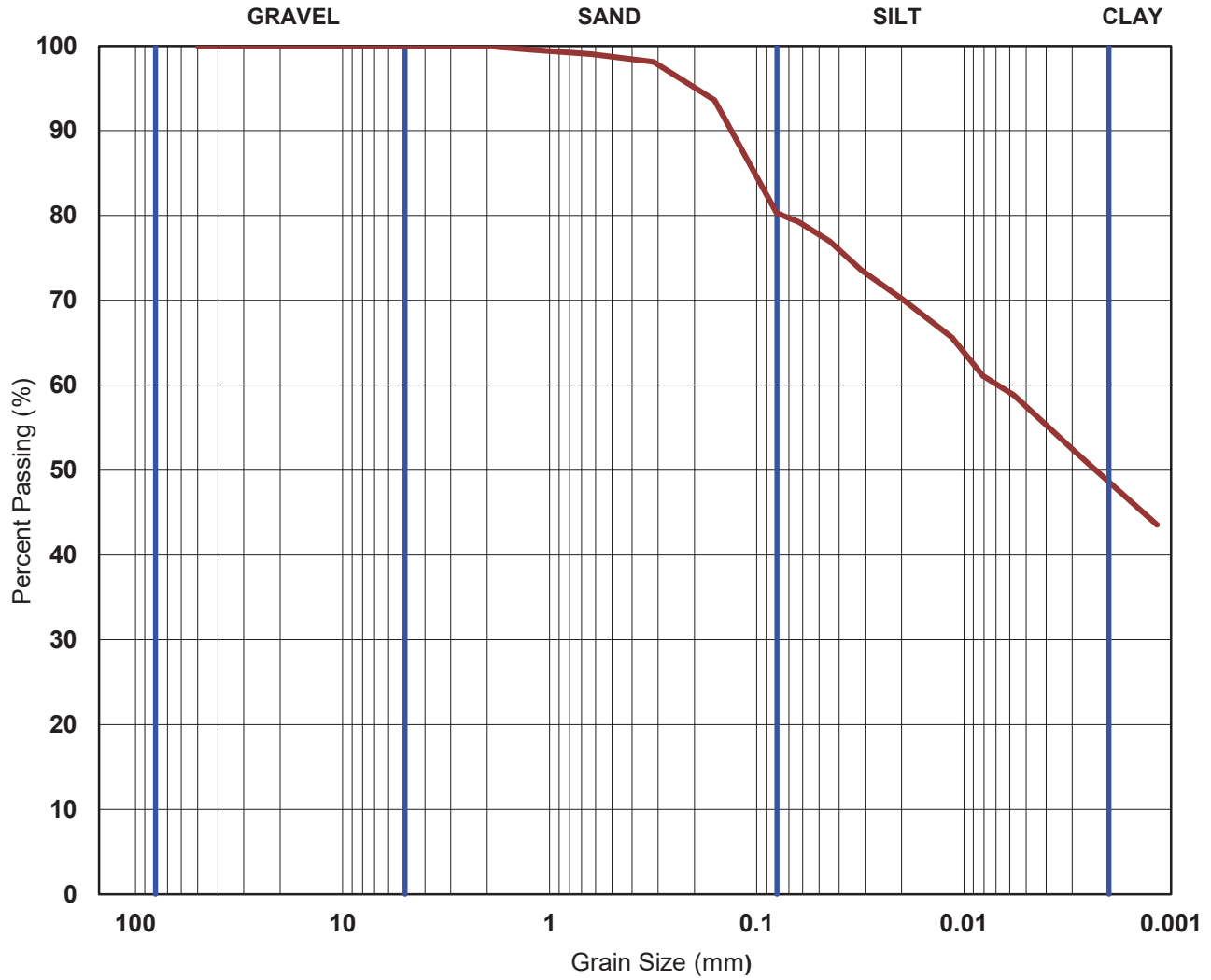
Description: Clay, silty, some sand

Specifications: Laboratory Specifications as per ASTM D 422.

Comments:

Sieve Results:

By Type (%): Gravel = **0.0** Sand = **19.7** Silt = **32.6** Clay = **47.7**



Union Street Geotechnical

CLIENT:	Donolda Colony	**FILE No.:**	USG1884
PROJECT:	2024 Geotech. Inv.	**DATE:**	14-Jun-24
LOCATION:	Red Deer, Alberta	**TECH:**	G.S.

Laboratory Hydrometer — Sample No.: DW3

Sample Information

Date: 07-Jun-24 **By:** N.T. **of:** USG **Type:** Pail / Bag

Location: BH301, 3.81 m BG **Specification:** ASTM D 422

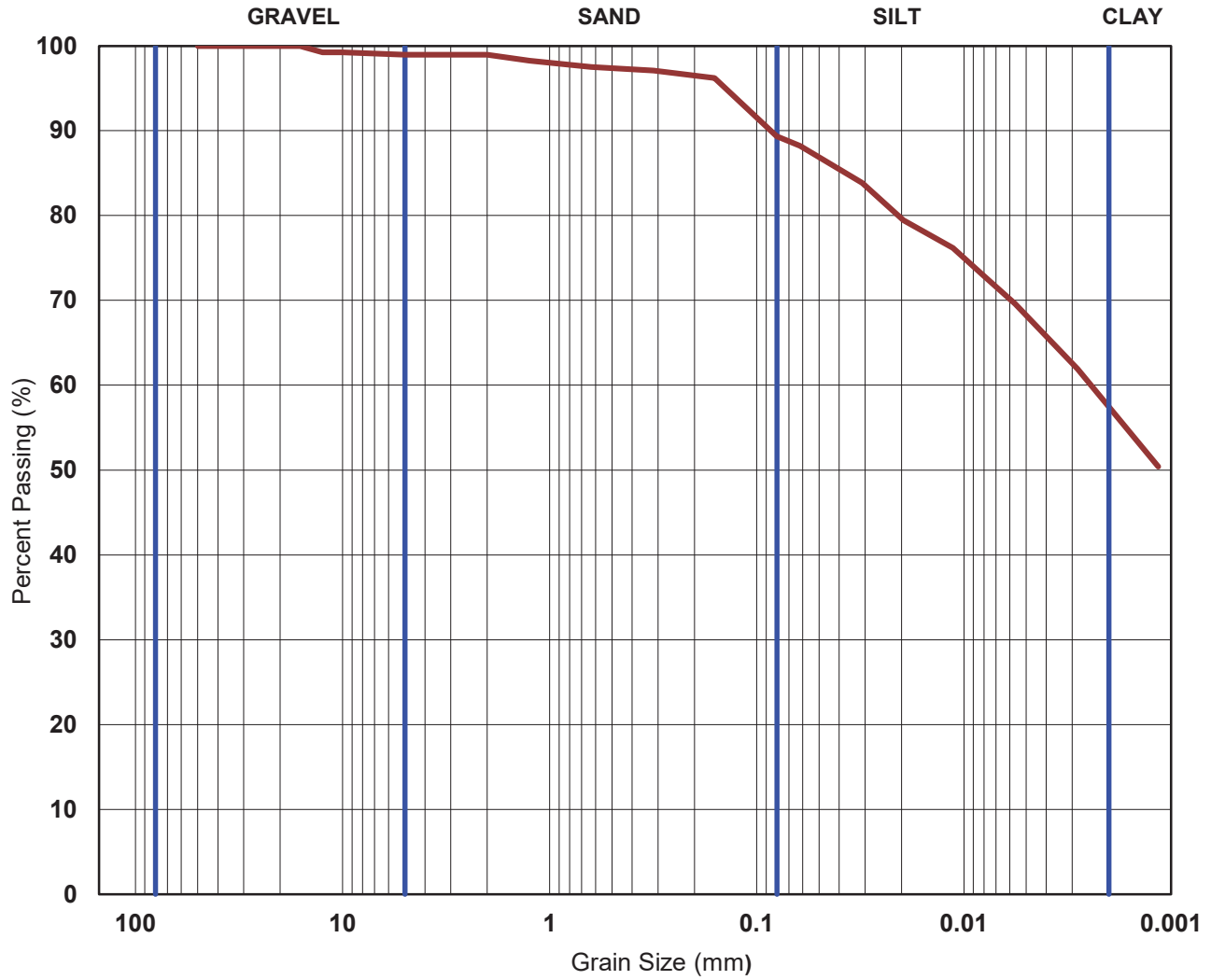
Description: Clay, silty, trace sand, trace gravel

Specifications: Laboratory Specifications as per ASTM D 422.

Comments:

Sieve Results:

By Type (%): Gravel = **1.0** Sand = **9.6** Silt = **33.2** Clay = **56.2**



Union Street Geotechnical

CLIENT:	Donolda Colony	**FILE No.:**	USG1884
PROJECT:	2024 Geotech. Inv.	**DATE:**	18-Jun-24
LOCATION:	Red Deer, Alberta	**TECH:**	G.S.

Laboratory Hydrometer — Sample No.: DW6

Sample Information

Date: 07-Jun-24 **By:** N.T. **of:** USG **Type:** Pail / Bag

Location: BH302, 2.29 m BG **Specification:** ASTM D 422

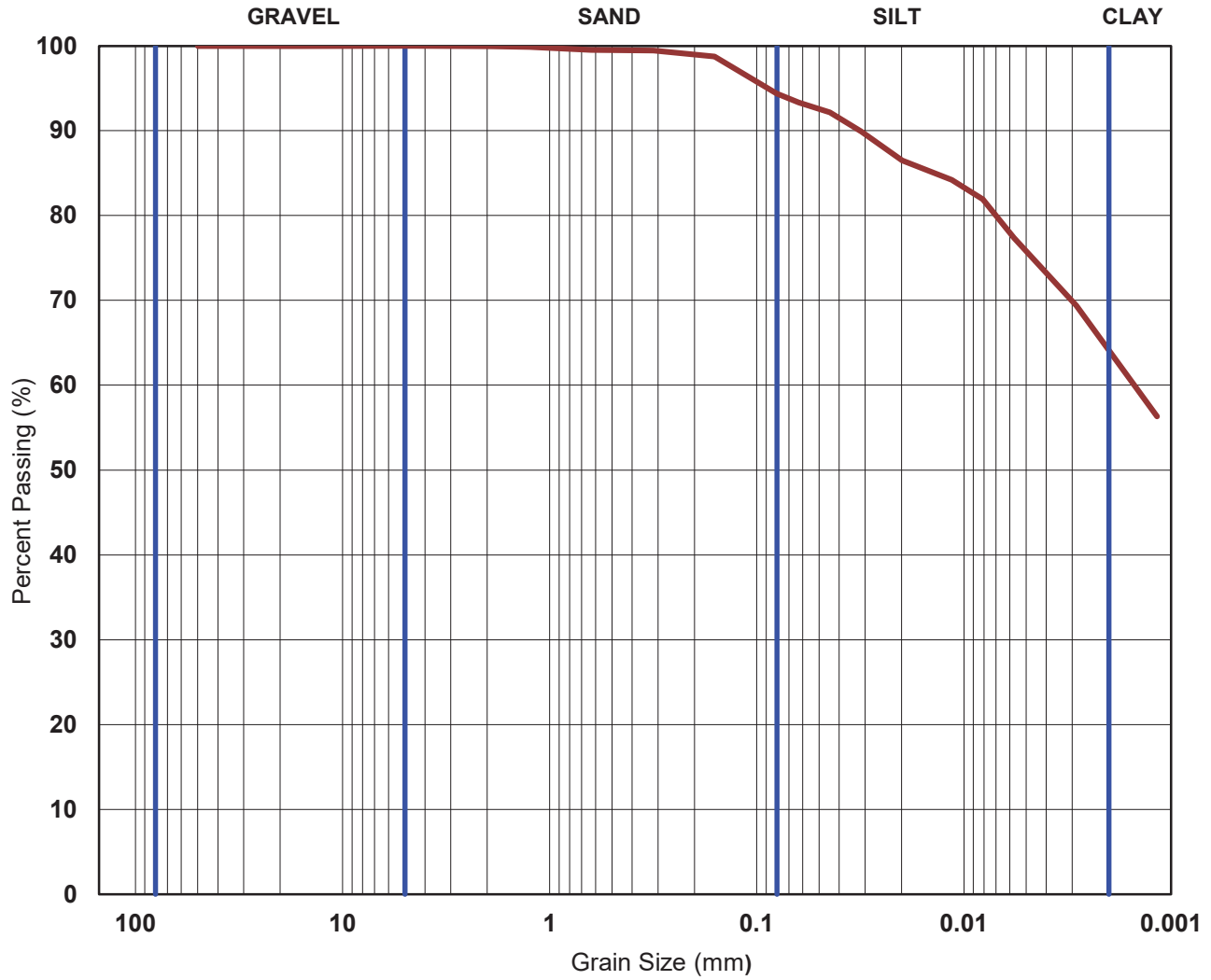
Description: Clay and silt, trace sand

Specifications: Laboratory Specifications as per ASTM D 422.

Comments:

Sieve Results:

By Type (%): Gravel = **0.0** Sand = **5.6** Silt = **36.7** Clay = **57.7**



Union Street Geotechnical

CLIENT:	Donolda Colony	**FILE No.:**	USG1884
PROJECT:	2024 Geotech. Inv.	**DATE:**	14-Jun-24
LOCATION:	Red Deer, Alberta	**TECH:**	G.S.

Project Name:	2024 Geotech. Inv.	Depth:	
Project Number:	USG1884	Testing Company:	Union Street Geo.
Client:		Field Technician:	N.T.
Testhole:	BH301	Sample Date:	5 June, 2024
Location:		Lab Technician:	B.B.
Sample Number:	W449	Date Tested:	28 June, 2024

Flexible Wall Permeameter (ASTM D5084-10)

Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

Material and Test Description

Material Description:

CLAY - trace coal, alkaline, oxide inclusions, dark olive grey

Test Type:	Constant Head
Mould Size:	Flexible Wall
Sample Source:	Re-moulded
Fluid Used:	Deaired Water
Fluid Reservoir:	Burrettes

Remoulding Details	
Max Dry Density (kg/m^3):	-
Proctor ID:	-
Percent Max (%):	-
Target Dry Density (kg/m^3):	-

Initial Sample Characteristics

Water Content	
Wet + Tare (g):	522.6
Dry + Tare (g):	430.0
Tare (g):	11.0
Water Content (%):	22.1%

Sample Size					
Trial	1	2	3	4	Average
Diameter (mm):	73.1	73.2	73.6	73.2	73.3
Length (mm):	75.8	75.7	75.8	75.8	75.8
Weight (g)	618.5				

Area (cm^2):	42.2
Volume (cm^3):	319.5
Wet Density (kg/m^3):	1936
Dry Density (kg/m^3):	1585

Specific Gravity (Note 2):	2.62
Void Ratio:	0.65
Saturation:	88.6%
Porosity:	39.5%

Final Sample Characteristics

Water Content	
Wet + Tare (g):	652.2
Dry + Tare (g):	516.4
Tare (g):	11.8
Water Content (%):	26.9%

Sample Size					
Trial	1	2	3	4	Average
Diameter (mm):	73.9	74.1	74	73.9	74.0
Length (mm):	76.2	76.4	76.5	76.6	76.4
Weight (g)	640.7				

Area (cm^2):	43.0
Volume (cm^3):	328.5
Wet Density (kg/m^3):	1951
Dry Density (kg/m^3):	1537

Specific Gravity (Note 1):	2.62
Void Ratio:	0.71
Saturation:	100.0%
Porosity:	41.4%

Note 1: Specific gravity for final sample characteristics calculation adjusted to result in 100.0% saturation.

Note 2: Specific gravity for initial sample characteristics calculation set equal to that of the final.

Project Name:	2024 Geotech. Inv.	Depth:	
Project Number:	USG1884	Testing Company:	Union Street Geo.
Client:		Field Technician:	N.T.
Testhole:	BH301	Sample Date:	5 June, 2024
Location:		Lab Technician:	B.B.
Sample Number:	W449	Date Tested:	28 June, 2024

Flexible Wall Permeameter (ASTM D5084-10)

Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

Saturation Data

Cell Pressure (kPa):	160.0	Top Pressure (kPa):	130.0
Bottom Pressure (kPa):	130.0	Pressure Difference (kPa):	-

Date & Time	Elapsed Time (Days)	Room Temp (°C)	Top Burret (mL)	Bottom Burret (mL)	Cell (mL)	Total Vol. Change (mL)	Volume Strain (%)
6/28/24 7:33	0.00	21.0	4.7	4.6	14.0	0	0.00%
6/28/24 14:13	0.28	21.0	4.9	5.0	15.1	-1.70	-0.53%
6/29/24 6:59	0.98	21.0	5.5	5.8	14.9	-2.96	-0.93%
7/1/24 15:01	3.31	21.0	7.7	7.6	13.3	-5.30	-1.66%
7/2/24 7:07	3.98	21.0	8.2	8.0	13.0	-5.85	-1.83%
7/3/24 7:23	4.99	21.0	8.8	8.4	12.4	-6.31	-1.97%
7/4/24 7:21	5.99	21.0	9.3	8.8	12.0	-6.78	-2.12%
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
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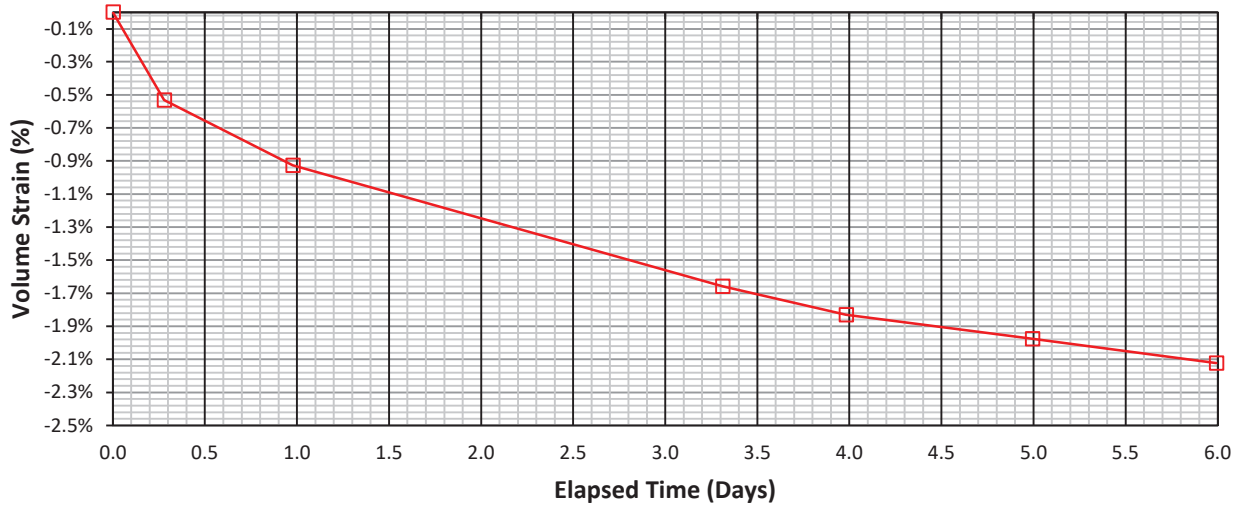
-	-	-	-	-	-	-	-



Project Name:	2024 Geotech. Inv.	Depth:	
Project Number:	USG1884	Testing Company:	Union Street Geo.
Client:		Field Technician:	N.T.
Testhole:	BH301	Sample Date:	5 June, 2024
Location:		Lab Technician:	B.B.
Sample Number:	W449	Date Tested:	28 June, 2024

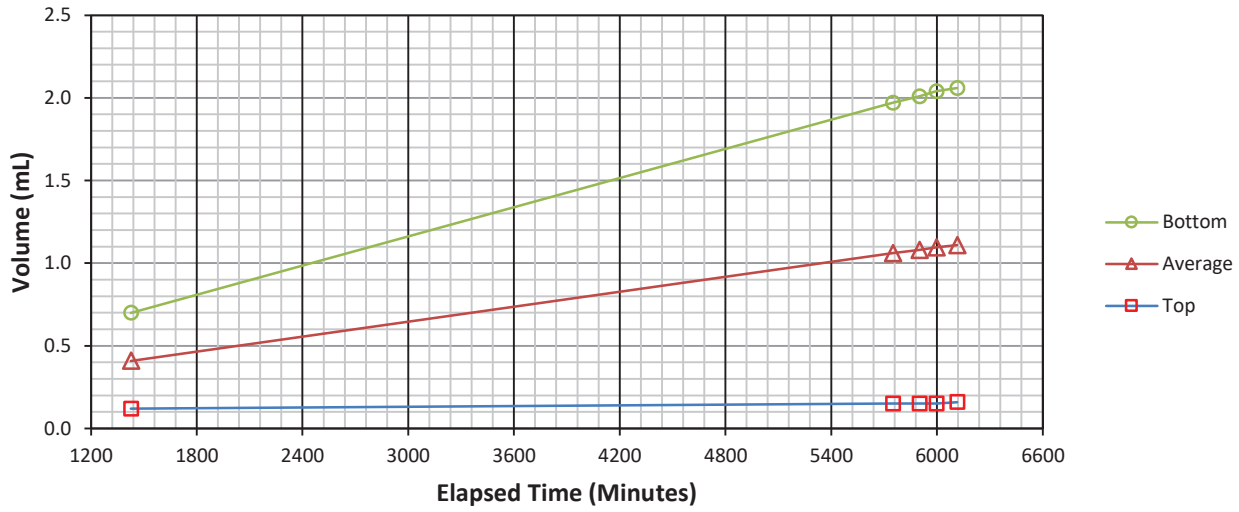
Flexible Wall Permeameter (ASTM D5084-10)

Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

Permeation Data

Cell Pressure (kPa):	160.0	Top Pressure (kPa):	120.0
Bottom Pressure (kPa):	140.0	Pressure Difference (kPa):	20.0

Date & Time	Elapsed Time (Minutes)	Room Temp (°C)	Top Burret (mL)	Bottom Burret (mL)	Top Vol. Change (mL)	Bottom Vol. Change (mL)	Average Vol. Change (mL)
7/4/24 7:25	0	22.0	9.97	0.10	0.00	0.00	0.00
7/5/24 7:10	1425	22.0	9.85	0.80	0.12	0.70	0.41
7/8/24 7:15	5750	22.0	9.82	2.07	0.15	1.97	1.06
7/8/24 9:45	5900	22.0	9.82	2.11	0.15	2.01	1.08
7/8/24 11:22	5997	22.0	9.82	2.14	0.15	2.04	1.10
7/8/24 13:19	6114	22.0	9.81	2.16	0.16	2.06	1.11
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-



Project Name:	2024 Geotech. Inv.	Depth:	
Project Number:	USG1884	Testing Company:	Union Street Geo.
Client:		Field Technician:	N.T.
Testhole:	BH301	Sample Date:	5 June, 2024
Location:		Lab Technician:	B.B.
Sample Number:	W449	Date Tested:	28 June, 2024

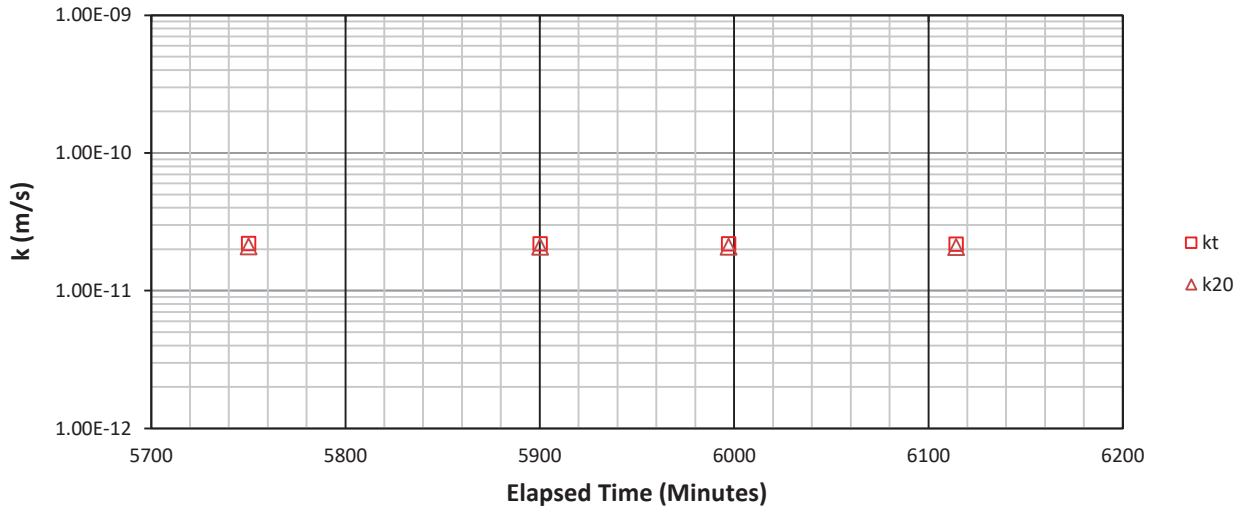
Flexible Wall Permeameter (ASTM D5084-10)

Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

Permeation Data

Head Difference (m):	2.0	Area of Sample (m^2)	4.257E-03
Length of Sample (m):	7.610E-02	Gradient, i	2.679E+01

Elapsed Time (Minutes)	Average Volume Change (mL)	Average Temperature (°C)	k_t (m/s)	R_T	k_{20} (m/s)
5750	1.06	22.0	2.196E-11	0.953	2.093E-11
5900	1.08	22.0	2.188E-11	0.953	2.085E-11
5997	1.10	22.0	2.189E-11	0.953	2.086E-11
6114	1.11	22.0	2.181E-11	0.953	2.079E-11
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	AVERAGE	2.188E-11		2.086E-11



Project Name:	2024 Geotech. Inv.	Depth:	4.57 m
Project Number:	USG1884	Testing Company:	Union Street Geo.
Client:		Field Technician:	N.T.
Testhole:	BH101	Sample Date:	5 June, 2024
Location:		Lab Technician:	B.B.
Sample Number:	NT4	Date Tested:	18 June, 2024

Flexible Wall Permeameter (ASTM D5084-10)

Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

Material and Test Description

Material Description:

Clay Till - trace gravel, coal,oxide inclusions, alkalines, dark grey

Test Type:	Constant Head
Mould Size:	Flexible Wall
Sample Source:	Shelby Tube (Un-disturbed)
Fluid Used:	Deaired Water
Fluid Reservoir:	Burrettes

Remoulding Details	
Max Dry Density (kg/m^3):	-
Proctor ID:	-
Percent Max (%):	-
Target Dry Density (kg/m^3):	-

Initial Sample Characteristics

Water Content	
Wet + Tare (g):	427.5
Dry + Tare (g):	371.5
Tare (g):	11.0
Water Content (%):	15.5%

Sample Size					
Trial	1	2	3	4	Average
Diameter (mm):	72.1	71.8	71.9	72	72.0
Length (mm):	77.1	76.9	76.9	77.1	77.0
Weight (g)	668.8				

Area (cm^2):	40.7
Volume (cm^3):	313.1
Wet Density (kg/m^3):	2136
Dry Density (kg/m^3):	1849

Specific Gravity (Note 2):	2.65
Void Ratio:	0.43
Saturation:	95.3%
Porosity:	30.1%

Final Sample Characteristics

Water Content	
Wet + Tare (g):	689.9
Dry + Tare (g):	588.4
Tare (g):	12.5
Water Content (%):	17.6%

Sample Size					
Trial	1	2	3	4	Average
Diameter (mm):	72.3	72.6	72.5	72.2	72.4
Length (mm):	77.7	77.6	77.4	77.6	77.6
Weight (g)	678				

Area (cm^2):	41.2
Volume (cm^3):	319.4
Wet Density (kg/m^3):	2123
Dry Density (kg/m^3):	1805

Specific Gravity (Note 1):	2.65
Void Ratio:	0.47
Saturation:	100.0%
Porosity:	31.8%

Note 1: Specific gravity for final sample characteristics calculation adjusted to result in 100.0% saturation.

Note 2: Specific gravity for initial sample characteristics calculation set equal to that of the final.

Project Name:	2024 Geotech. Inv.	Depth:	4.57 m
Project Number:	USG1884	Testing Company:	Union Street Geo.
Client:		Field Technician:	N.T.
Testhole:	BH101	Sample Date:	5 June, 2024
Location:		Lab Technician:	B.B.
Sample Number:	NT4	Date Tested:	18 June, 2024

Flexible Wall Permeameter (ASTM D5084-10)

Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

Saturation Data

Cell Pressure (kPa):	160.0	Top Pressure (kPa):	130.0
Bottom Pressure (kPa):	130.0	Pressure Difference (kPa):	-

Date & Time	Elapsed Time (Days)	Room Temp (°C)	Top Burret (mL)	Bottom Burret (mL)	Cell (mL)	Total Vol. Change (mL)	Volume Strain (%)
6/19/24 7:37	0.00	20.0	4.7	4.7	14.8	0	0.00%
6/19/24 17:07	0.40	20.0	4.9	5.0	14.5	-0.12	-0.04%
6/20/24 7:15	0.98	20.0	5.1	5.2	14.2	-0.29	-0.09%
6/20/24 16:56	1.39	20.0	5.2	5.3	14.0	-0.29	-0.09%
6/21/24 6:59	1.97	20.0	5.3	5.4	13.8	-0.30	-0.10%
6/24/24 7:13	4.98	20.0	5.4	5.6	13.7	-0.48	-0.15%
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
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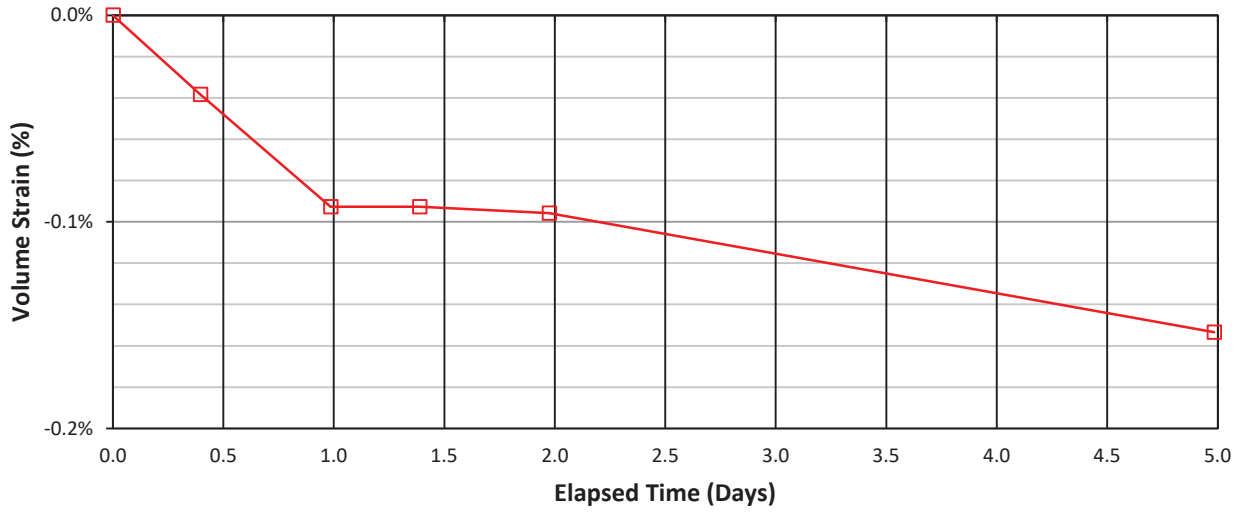
-	-	-	-	-	-	-	-



Project Name:	2024 Geotech. Inv.	Depth:	4.57 m
Project Number:	USG1884	Testing Company:	Union Street Geo.
Client:		Field Technician:	N.T.
Testhole:	BH101	Sample Date:	5 June, 2024
Location:		Lab Technician:	B.B.
Sample Number:	NT4	Date Tested:	18 June, 2024

Flexible Wall Permeameter (ASTM D5084-10)

Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

Permeation Data

Cell Pressure (kPa):	160.0	Top Pressure (kPa):	120.0
Bottom Pressure (kPa):	140.0	Pressure Difference (kPa):	20.0

Date & Time	Elapsed Time (Minutes)	Room Temp (°C)	Top Burret (mL)	Bottom Burret (mL)	Top Vol. Change (mL)	Bottom Vol. Change (mL)	Average Vol. Change (mL)
6/24/24 7:26	0	21.0	9.86	0.09	0.00	0.00	0.00
6/25/24 7:09	1423	21.0	9.17	0.95	0.69	0.86	0.78
6/27/24 7:20	4314	20.0	8.07	2.31	1.79	2.22	2.01
6/27/24 9:53	4467	20.0	8.02	2.38	1.84	2.29	2.07
6/27/24 12:27	4621	20.0	7.98	2.45	1.88	2.36	2.12
6/27/24 15:01	4775	20.0	7.93	2.51	1.93	2.42	2.18
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
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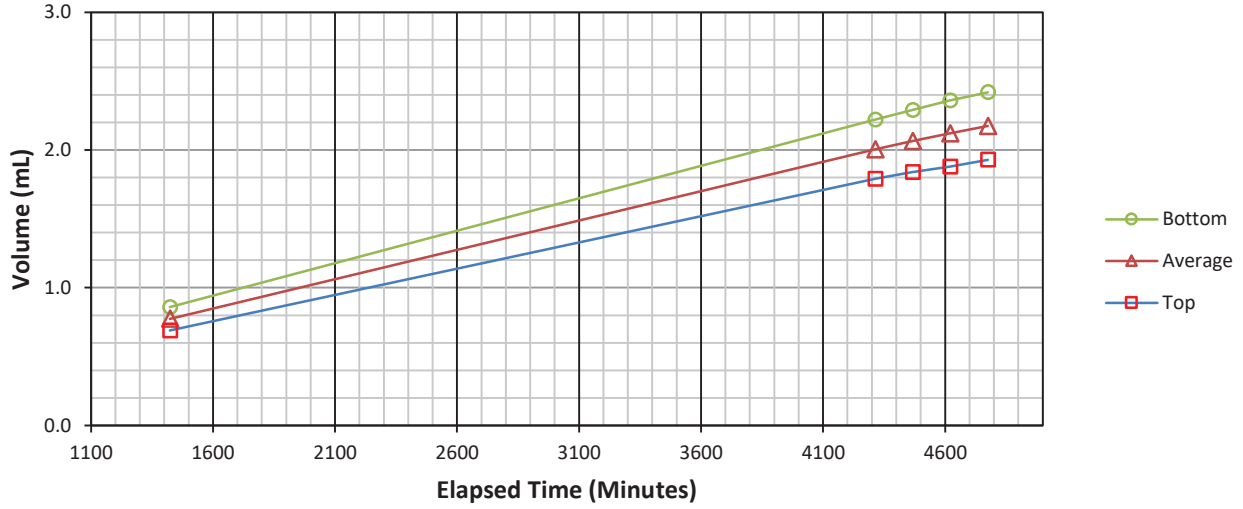
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-



Project Name:	2024 Geotech. Inv.	Depth:	4.57 m
Project Number:	USG1884	Testing Company:	Union Street Geo.
Client:		Field Technician:	N.T.
Testhole:	BH101	Sample Date:	5 June, 2024
Location:		Lab Technician:	B.B.
Sample Number:	NT4	Date Tested:	18 June, 2024

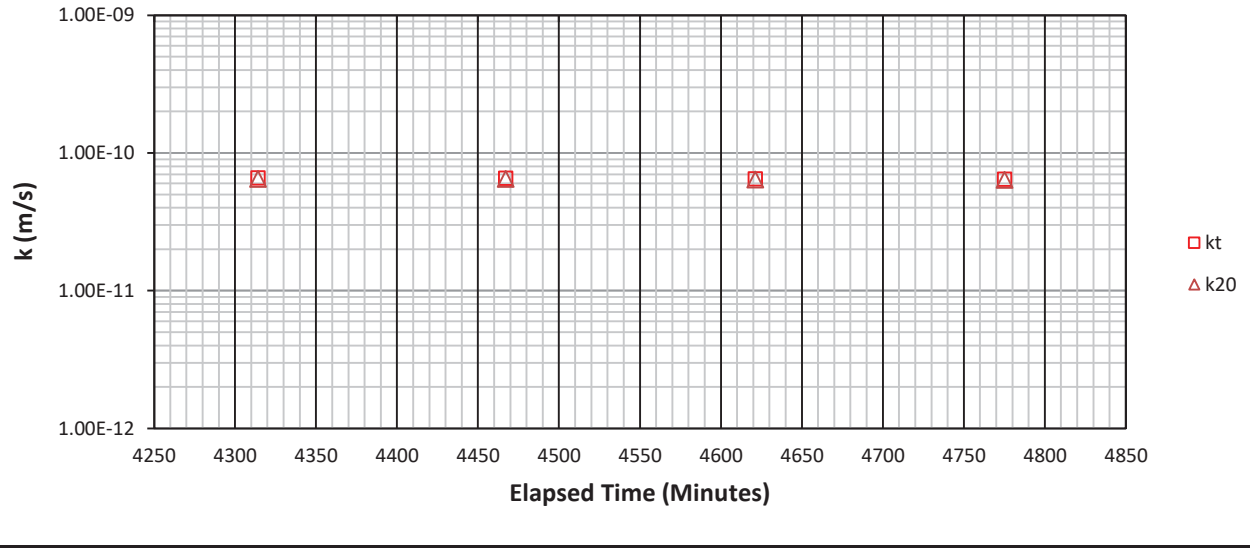
Flexible Wall Permeameter (ASTM D5084-10)

Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

Permeation Data

Head Difference (m):	2.0	Area of Sample (m^2)	4.091E-03
Length of Sample (m):	7.729E-02	Gradient, i	2.638E+01

Elapsed Time (Minutes)	Average Volume Change (mL)	Average Temperature (°C)	k_t (m/s)	R_T	k_{20} (m/s)
4314	2.01	20.5	6.570E-11	0.988	6.491E-11
4467	2.07	20.5	6.544E-11	0.988	6.465E-11
4621	2.12	20.5	6.494E-11	0.988	6.416E-11
4775	2.18	20.5	6.449E-11	0.988	6.372E-11
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	AVERAGE	6.514E-11		6.436E-11



Laboratory Proctor — Sample No.: W449

Sample Information

Date: 05-Jun-24 **By:** N.T. **of:** USG **Type:** Pail

Location: Donalda Colony, BH301, 0.76 m to 4.57 m BG **Natural Moisture:** 20.8 %

Description: Clay till

Specfication: ASTM D 698 - Method A

Comments:

Proctor Results:

Test Number	1	2	3	4	5
Dry Density (Kg/m^3)	**1519**	**1532**	**1548**	**1516**	**1483**
Moisture Content (%)	**17.4**	**18.0**	**19.9**	**21.9**	**23.1**

Oversize Correction (Calculated using assumed Specific Gravity of 2.40)

Oversize (%)	5	10	15	20	25
Density	**1589**	**1630**	**1671**	**1712**	**1753**

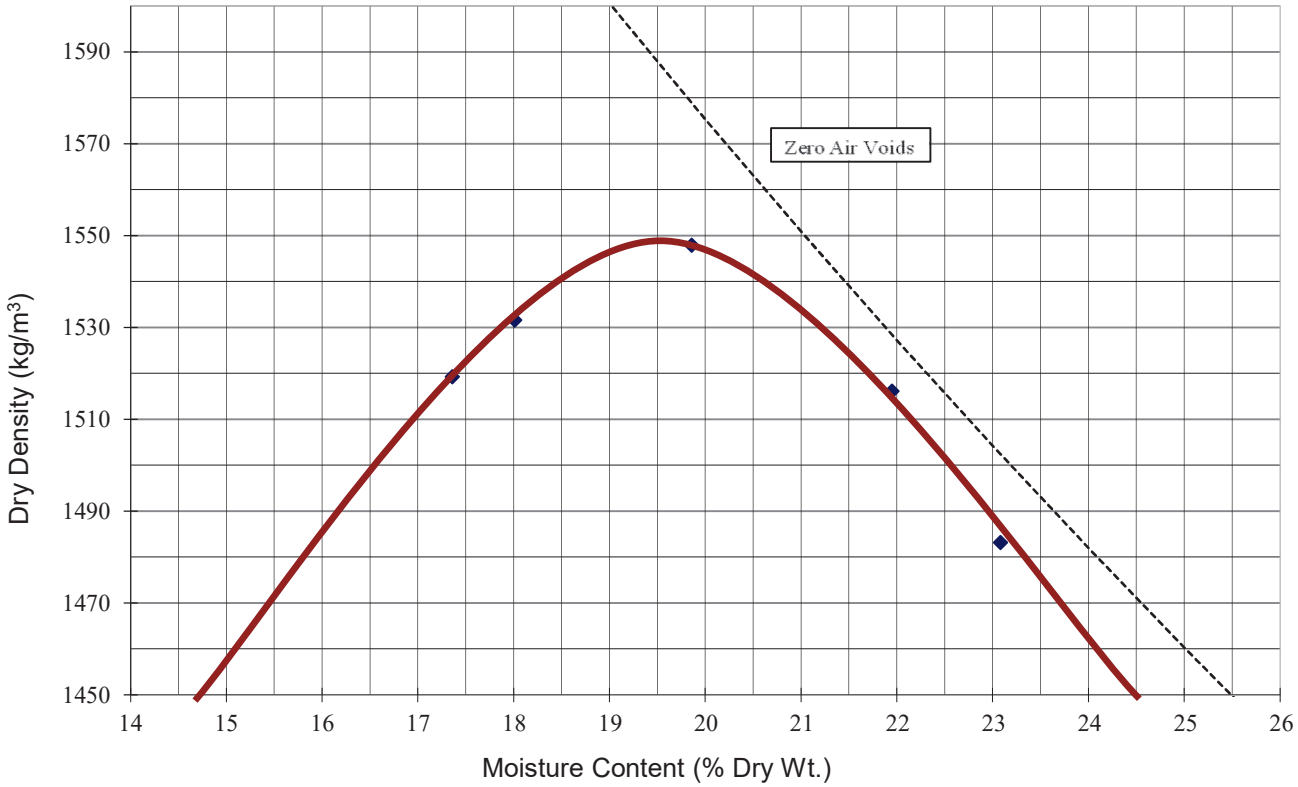
Optimum Results:

Moisture Content = **19.6** %

Dry Density = **1548** Kg/m^3

Corrected Density = **1550** Kg/m^3

Oversize Material = **0.3** %



Union Street Geotechnical

CLIENT:	Donalda Colony	**FILE No.:**	USG1884
PROJECT:	Geotech. Inv.	**DATE:**	11-Jun-24
LOCATION:	Red Deer, Alberta	**TECH:**	G.S.

Union Street Geotechnical

Appendix A

Name: Donalda Colony - Unpaved

Land Location:

Units to be used for calculation: metres

Estimating Runoff Potential

1. Estimate the total area impacted with manure that will contribute to water runoff and any additional uplands that will drain to the catch basin. It may be easier to calculate the area in small pieces. Click the + to add more areas.

Area	Length (m)	Width (m)	Paved?	Area (m^2)
1	366	104	NO	38064.00 +
	Total Area			38064.00

2. Select the nearest city/town to obtain local rainfall data for a one day rainfall event with 1 in 30 year probability. A portion of the rainfall amount will be multiplied by the runoff area (above) to determine runoff volume.

Select Town: Bashaw (85)

Calculate

Estimation of water runoff to be collected in the catch basin:

1941.26	m^3
68555	ft^3
427018	Imp. Gal

Calculating Catch Basin Volume:

3. Enter the dimensions of the proposed catch basin including length, width and total depth (0.5m will be subtracted for freeboard level). Side slopes and end slopes are set to 3 to 1 (run:rise). Berm width can be added for additional information.

	Construction Dimensions	Storage Dimensions
Length (m):	23	20.0
Width (m):	104	101.0
Depth (m):	2.0	1.5

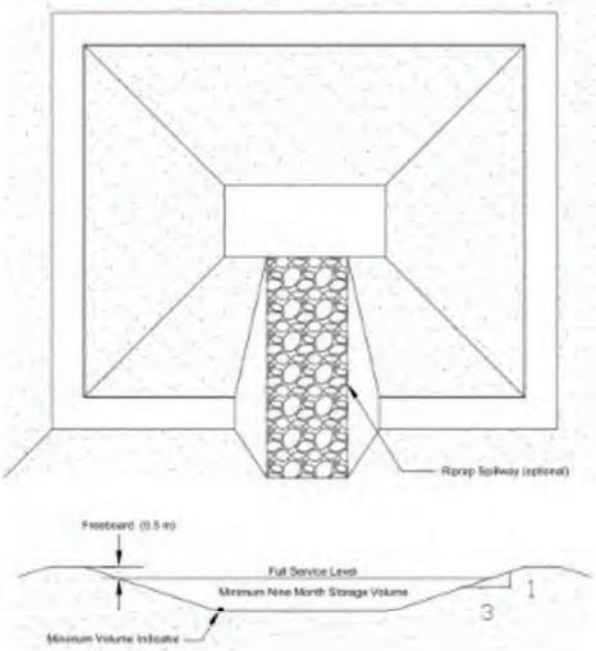
Calculate

Evacuation Capacity:

3356	m^3
118516	ft^3
738216	Imp. Gal

Catch basin volume (minus freeboard):

2254	m^3
79599	ft^3
495809	Imp. Gal



Comparing Catch Basin Volume versus Runoff Potential:

Runoff potential:	1941.26	m^3
Catch basin volume:	2254	m^3

The catch basin dimensions meet the design requirements in AOPA

Name: Donalda Colony - Paved

Land Location:

Units to be used for calculation: metres

Estimating Runoff Potential

1. Estimate the total area impacted with manure that will contribute to water runoff and any additional uplands that will drain to the catch basin. It may be easier to calculate the area in small pieces. Click the + to add more areas.

Area	Length (m)	Width (m)	Paved?	Area (m^2)
1	368	104	YES	38064.00 +
	Total Area			38064.00

2. Select the nearest city/town to obtain local rainfall data for a one day rainfall event with 1 in 30 year probability. A portion of the rainfall amount will be multiplied by the runoff area (above) to determine runoff volume.

Select Town: Bashaw (85)

Calculate

Estimation of water runoff to be collected in the catch basin:

3235.44	m^3
114258	ft^3
711697	Imp. Gal

Calculating Catch Basin Volume:

3. Enter the dimensions of the proposed catch basin including length, width and total depth (0.5m will be subtracted for freeboard level). Side slopes and end slopes are set to 3 to 1 (run:rise). Berm width can be added for additional information.

	Construction Dimensions	Storage Dimensions
Length (m):	33	30.0
Width (m):	104	101.0
Depth (m):	2.0	1.5

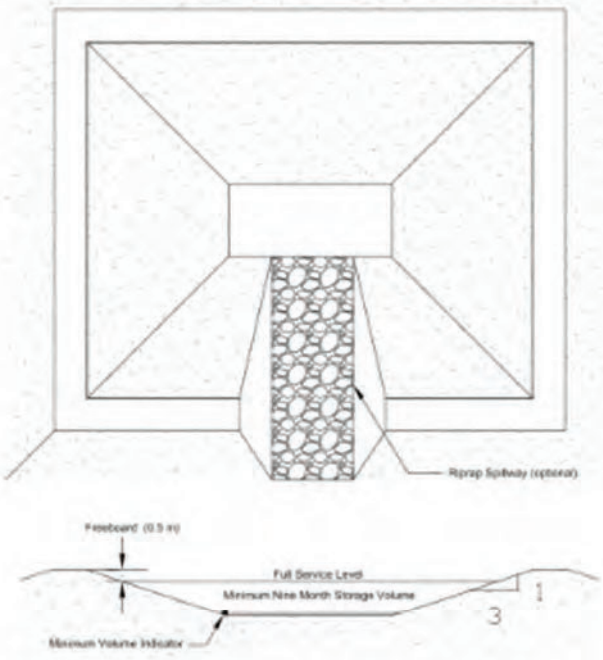
Calculate

Evacuation Capacity:

5316	m^3
187733	ft^3
1169357	Imp. Gal

Catch basin volume (minus freeboard):

3701	m^3
130700	ft^3
814108	Imp. Gal



Comparing Catch Basin Volume versus Runoff Potential:

Runoff potential:	3235.44	m^3
Catch basin volume:	3701	m^3

The catch basin dimensions meet the design requirements in AOPA