

# Technical Document LA24002

## Part 2 – Technical Requirements



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

<b>NRCB USE ONLY</b>	Application number	Legal land description
	<input checked="" type="checkbox"/> Approval <input type="checkbox"/> Registration <input type="checkbox"/> Authorization <input type="checkbox"/> Amendment	<u>LA24002</u>

### 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.

Nov 29, 2023  
Date of signing

Van Heugtenbos Farms  
Corporate name (if applicable)

[Redacted]  
Signature

Henry Van Heugtenbos  
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)
EAST PENS (18) (18 pens total, 3 pens per row, total of 6 rows. Measurements are for each row of pens.)	153.4 m x 36.9 m
WEST PENS (24) (6 rows of pens of pens measuring 152.1 m x 36.9 m and 2 rows of pens measuring 50.7 m x 36.9 m.)	<del>160.3 m x 36.9 m</del>
NORTH PENS (5) (5 pens total in the row. Measurements are for the entire row and row is irregularly shaped.)	152.1 m x 38.2 m <del>160.3 m x 36.8 m (approx)</del>
NORTH CATCH BASIN (Expansion)	Final dimensions: 185 m x 40 m x 2 m deep <del>130m x 40m x 2m</del>
SOUTH CATCH BASIN	105 m x 40 m x 2 m deep <del>105m x 36.6m x 2m</del>

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

Existing facilities	Dimensions (m) (length, width, and depth)	NRCB USE ONLY
<del>NORTH ROW (3 pens)</del>	<del>approx. 92m x 36m</del>	
<del>MIDDLE ROWS (8 pens)</del>	<del>approx. 212m x 36m</del>	
<del>SOUTH ROW (5 pens)</del>	<del>approx. 212m x 37m</del>	

**NRCB USE ONLY**

See next page for existing facilities.  
CFO currently permitted under NRCB issued Approval LA15045 and Authorization LA17054A.

Existing Facilities

Note: Numbers listed for facilities correspond with Figure 1 on page 4 of this document.

- 1 - Feedlot pens – row B – (237.7 m x 38.1m)
- 2 - Catch basin (51.8 m x 36.6 m x 2.0 m)
- 3 - Feedlot pens – row A – (298.7 m x 38.1m)
  - ~~Barn I (41.5 m x 14.0 m)~~
  - ~~Barn II (48.8 m x 14.6 m)~~
- 4 - Barn III (75.6 m x 24.2 m)
- 5 - Feedlot pens (305.0 m x 45.1 m) (39 m x 14.5 m, as per LA15037. Clerical error in LA15045 listed wrong
- 6 - Pole calf barn (~~39.0 m x 45.1 m~~ dimensions)
- 7 - Calf barn (210' x 140') with 18" pit (deep) (77.8 m x 38.2 m x 0.5 m deep)
- 8 - Transfer pit (210' long x 8' wide x 8' deep) (77.8 m x 2.4 m x 2.4 m deep)

- Manure pit (~~8' x 16' x 8'~~) - (10 x 5 x 3 m)

Note: Manure pit being re-purposed and no longer being used as a manure collection area.

Note: Barn 1 and 2 have been replaced by calf barn as part of Authorization LA17054A.

AO Comment: Existing catch basin (#2 above) is being incorporated into the new north catch basin. Therefore, it is being removed from the list of existing permitted facilities.



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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

Upon approval of new facility, the far north section of our existing facilities will be discontinued. Please see attached photo. (highlighted area). Photo #1  
 The existing catch basin will be expanded.

Construction completion date for proposed facilities July, 2027

**Additional information**

The applicant is applying for a naturally occurring protective layer to meet AOPA's groundwater protection requirements for the feedlot pens. Roller compacted concrete (RCC) will then be laid as a secondary liner. Because RCC is known to increase runoff volume, the required runoff volume has to be increased to a total volume of 12,832 m<sup>3</sup>. The total volume of the proposed catch basins is 13,426 m<sup>3</sup>.

**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
See Part 1			
<del>AO Comment: applicant proposing to remove all beef feeders (1,200) from CFO. Proposing to increase beef feeder calves by 14,000 from 2,500 (total proposed 16,500).</del>			

AO Comment: Condition in Approval LA24002 requiring the decommissioning of the entire north row of pens (highlighted in red and orange).

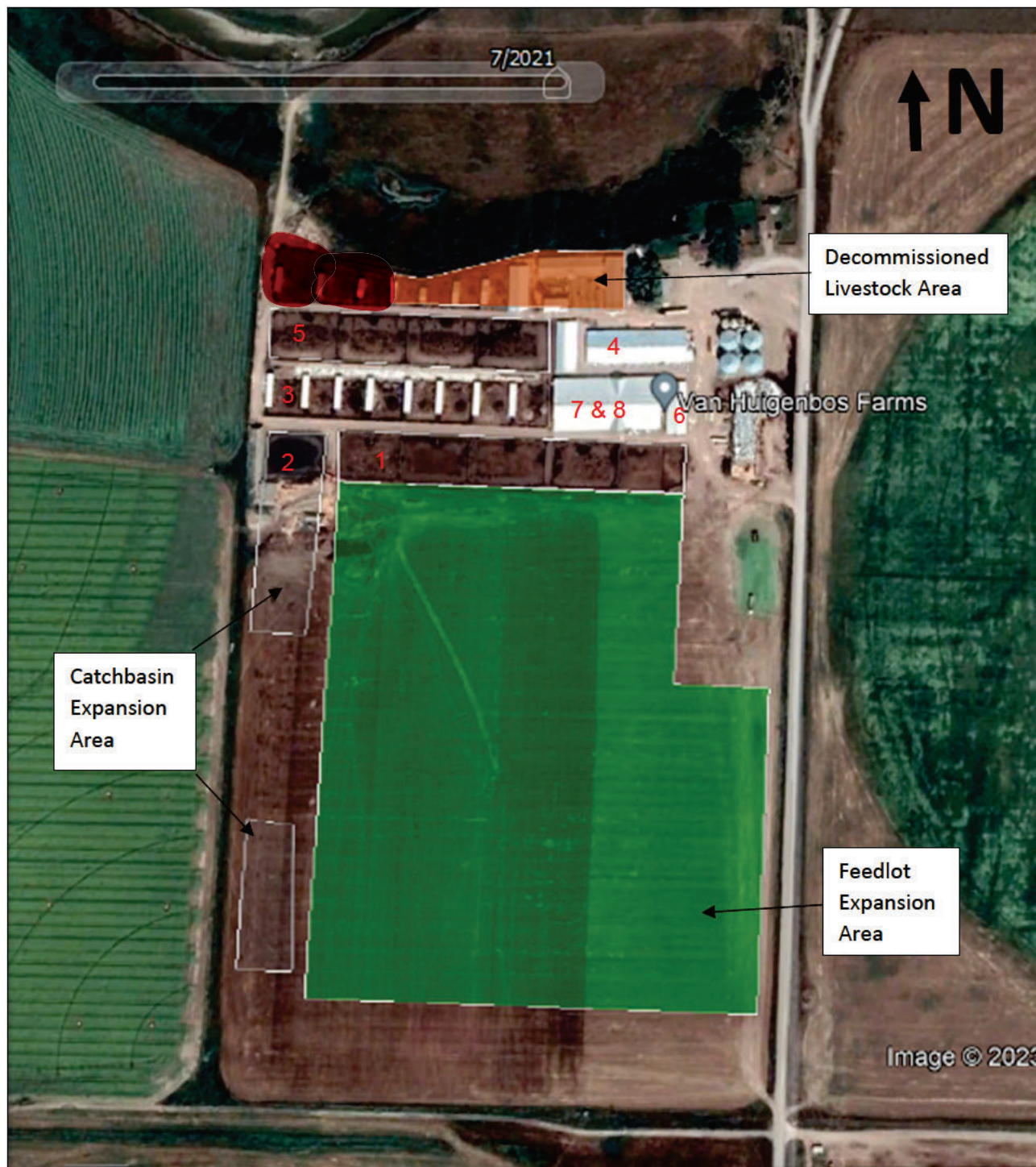


Figure 1 – Van Huigenbos Farms – Proposed Feedlot Expansion Map

AO Comment: Numbers in Figure 1 correspond with list of existing facilities on page 2 of this document.



## Part 2 – Technical Requirements

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

### **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 27 day of November, 2023.

\_\_\_\_\_  
*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*



# Water Well Drilling Report

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

GIC Well ID 9731008  
GoA Well Tag No.  
Drilling Company Well ID  
Date Report Received 2015/06/22

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

GOWN ID

Well Identification and Location										Measurement in Metric	
<b>Owner Name</b> VANHUIGENBOS FARMS LTD		<b>Address</b> P.O. BOX 2311			<b>Town</b> FORT MACLEOD		<b>Province</b> ALBERTA	<b>Country</b> CANADA	<b>Postal Code</b> T0L 0Z0		
<b>Location</b>	<i>1/4 or LSD</i> 8	<i>SEC</i> 21	<i>TWP</i> 9	<i>RGE</i> 26	<i>W of MER</i> 4	<i>Lot</i>	<i>Block</i>	<i>Plan</i>	<i>Additional Description</i>		
<b>Measured from Boundary of</b>					<b>GPS Coordinates in Decimal Degrees (NAD 83)</b>						
_____ m from _____					Latitude <u>49.748226</u> Longitude <u>-113.458337</u>					Elevation <u>960.12 m</u>	
_____ m from _____					How Location Obtained _____					How Elevation Obtained _____	
					Map _____					Other _____	

Drilling Information	
<b>Method of Drilling</b> Combination	<b>Type of Work</b> New Well
<b>Proposed Well Use</b> Domestic & Stock	

Formation Log			Measurement in Metric
Depth from ground level (m)	Water Bearing	Lithology Description	
3.96		Sand & Silt	
7.32		Brown Oxidized Till & Clay	
18.90		Gray Unoxidized Till & Clay	
20.42		Silt	
20.73		Silty Gravel	
23.77	Yes	Preglacial Gravel	
27.43	Yes	Silty Gravel	
28.35		Clayey Gravel	
31.09		Siltstone	
42.98		Fine Grained Sandstone	

Yield Test Summary			Measurement in Metric
<b>Recommended Pump Rate</b> <u>22.73 L/min</u>			
<b>Test Date</b>	<b>Water Removal Rate (L/min)</b>	<b>Static Water Level (m)</b>	
2015/06/05	59.10	21.34	

Well Completion				Measurement in Metric
<b>Total Depth Drilled</b>	<b>Finished Well Depth</b>	<b>Start Date</b>	<b>End Date</b>	
42.98 m	40.23 m	2015/05/27	2015/06/05	
<b>Borehole</b>				
<b>Diameter (cm)</b>	<b>From (m)</b>	<b>To (m)</b>		
19.05	0.00	28.35		
15.24	28.35	42.98		
<b>Surface Casing (if applicable)</b>		<b>Well Casing/Liner</b>		
Steel		Plastic		
<b>Size OD :</b>	<u>16.83 cm</u>	<b>Size OD :</b>	<u>13.97 cm</u>	
<b>Wall Thickness :</b>	<u>0.711 cm</u>	<b>Wall Thickness :</b>	<u>0.635 cm</u>	
<b>Bottom at :</b>	<u>21.34 m</u>	<b>Top at :</b>	<u>19.81 m</u>	
		<b>Bottom at :</b>	<u>40.23 m</u>	
<b>Perforations</b>				
<b>From (m)</b>	<b>To (m)</b>	<b>Diameter or Slot Width (cm)</b>	<b>Slot Length (cm)</b>	<b>Hole or Slot Interval (cm)</b>
21.34	32.00	0.114	15.24	10.16
Perforated by <u>Saw</u>				
<b>Annular Seal</b> <u>Bentonite Slurry</u>				
Placed from <u>2.44 m</u> to <u>19.81 m</u>				
Amount <u>32.00 Gallons</u>				
Other Seals				
<b>Type</b>		<b>At (m)</b>		
<b>Screen Type</b>				
Size OD : _____ cm				
<b>From (m)</b>	<b>To (m)</b>	<b>Slot Size (cm)</b>		
Attachment _____				
Top Fittings _____		Bottom Fittings _____		
<b>Pack</b>				
Type _____		Grain Size _____		
Amount _____				

Contractor Certification	
<b>Name of Journeyman responsible for drilling/construction of well</b> KEVIN BLAND	<b>Certification No</b> VC3171
<b>Company Name</b> CAMFIELD GROUNDWATER SERVICES LTD.	<b>Copy of Well report provided to owner</b> <b>Date approval holder signed</b> Yes 2015/06/22





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**NRCB USE ONLY**  
**WATER WELL AND SURFACE WATER INFORMATION**

Well IDs: 9731008 \_\_\_\_\_

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 Condition carried forward from LA15045

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

**Water Well Exemption Screening Tool**  N/A Water well exemption carried forward from LA15045

Water Well ID	Preliminary Screening Score	Secondary Screening Score	Facility

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**Groundwater or surface water related comments:**

AO Comment: Groundwater and surface water concerns from directly affected parties are addressed in Appendix C of Decision Summary LA24002.



Name Henry Van Huigenbos  
 Address  
 Legal Land  
 Location

**MDS Spreadsheet based on 2006 AOPA Regulations**

Category of Livestock	Type of Livestock	Factor A	Technology Factor	MU	LSU Factor	Number of Animals	LSU
Feedlot Animals	Beef Cows/Finishers (900+ lbs)	0.700	0.700	0.910	0.4459		-
	Beef Feeders (450 - 900 lbs)	0.700	0.700	0.500	0.2450		-
	Beef Feeder Calves (<550 lbs)	0.700	0.700	0.275	0.1348	16,500	2,223.4
	Horses - PMU	0.650	0.700	1.000	0.4550		-
	Horses - Feeders > 750 lbs	0.650	0.700	1.000	0.4550		-
	Horses - Foals < 750 lbs	0.650	0.700	0.300	0.1365		-
	Mules	0.600	0.700	1.000	0.4200		-
	Donkeys	0.600	0.700	0.670	0.2814		-
	Bison	0.600	0.700	1.000	0.4200		-
	Other						-
Dairy (*count lactating cows only)	Free Stall – Lactating Cows with all associated dries, heifers, and calves*	0.800	1.100	2.000	1.7600		-
	Free Stall – Lactating Cows with Dry Cows only*	0.800	1.100	1.640	1.4432		-
	Free Stall – Lactating Cows only	0.800	1.100	1.400	1.2320		-
	Tie Stall – Lactating Cows only	0.800	1.000	1.400	1.1200		-
	Loose Housing – Lactating Cows only	0.800	1.000	1.400	1.1200		-
	Dry Cow	0.800	0.700	1.000	0.5600		-
	Replacements – Bred Heifers (Breeding to Calving)	0.800	0.700	0.875	0.4900		-
	Replacements - Growing Heifers (350 lbs to breeding)	0.800	0.700	0.525	0.2940		-
	Calves (< 350 lbs)	0.800	0.700	0.200	0.1120		-
	Other						-
Swine Liquid (*count sows only)	Farrow to finish *	2.000	1.100	1.780	3.9160		-
	Farrow to wean *	2.000	1.100	0.670	1.4740		-
	Farrow only *	2.000	1.100	0.530	1.1660		-
	Feeders/Boars	2.000	1.100	0.200	0.4400		-
	Growers/Roasters	2.000	1.100	0.118	0.2600		-
	Weaners	2.000	1.100	0.055	0.1210		-
		Other					
Swine Solid (*Count sows only)	Farrow to finish *	2.000	0.800	1.780	2.8480		-
	Farrow to wean *	2.000	0.800	0.670	1.0720		-
	Farrow only *	2.000	0.800	0.530	0.8480		-
	Feeders/Boars	2.000	0.800	0.200	0.3200		-
	Growers/Roasters	2.000	0.800	0.118	0.1888		-
	Weaners	2.000	0.800	0.055	0.0880		-
		Other					
Poultry	Chicken - Breeders - Solid	1.000	0.700	0.010	0.0070		-
	Chicken - Layers - Liquid (includes associated pullets)	2.000	1.100	0.008	0.0176		-
	Chicken - Layers - (Belt Cage)	2.000	0.700	0.008	0.0112		-
	Chicken - Layers - (Deep Pit)	2.000	0.700	0.008	0.0112		-
	Chicken - Pullets/Broilers	1.000	0.700	0.002	0.0014		-
	Turkey - Toms/Breeders	1.000	0.700	0.020	0.0140		-
	Turkey - Hens (light)	1.000	0.700	0.013	0.0091		-
	Turkey - Broilers	1.000	0.700	0.010	0.0070		-
	Ducks	1.000	0.700	0.010	0.0070		-
	Geese	1.000	0.700	0.020	0.0140		-
		Other					
Sheep and Goats	Sheep - Ewes/Rams	0.600	0.700	0.200	0.0840		-
	Sheep - Ewes with lambs	0.600	0.700	0.250	0.1050		-
	Sheep - Lambs	0.600	0.700	0.050	0.0210		-
	Sheep - Feeders	0.600	0.700	0.100	0.0420		-
	Goats - Meat/Milk (per Ewe)	0.700	0.700	0.170	0.0833		-
	Goats - Nannies/Billies	0.700	0.700	0.140	0.0686		-
	Goats - Feeders	0.700	0.700	0.077	0.0377		-
		Other					
Cervid	Elk	0.600	0.700	0.600	0.2520		-
	Deer	0.600	0.700	0.200	0.0840		-
		Other					
Wild Boar	Feeders	2.000	0.800	0.140	0.2240		-
	Sow (farrowing)	2.000	0.800	0.371	0.5936		-
		Other					
Total							2,223.4

**For New Operations**

Dispersion Factor 1

Category	Odour Objective	Distance	
		Feet	Metres
1	41.04	2,243	684
2	54.72	2,991	912
3	68.4	3,739	1,140
4	109.44	5,982	1,823

**For Expanding Operations**

Dispersion Factor 1  
 Expansion Factor 0.77

Category	Odour Objective	Distance	
		Feet	Metres
1	41.04	1,727	526
2	54.72	2,303	702
3	68.40	2,879	877
4	109.44	4,606	1,404

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**NRCB USE ONLY**  
**ENVIRONMENTAL RISK SCREENING INFORMATION**

ERST for proposed facilities

Facility	Groundwater score	Surface water score	File number
East Pens	Low	Low	LA24002
West Pens	Low	Low	LA24002
North Pens	Low	Low	LA24002
North Catch Basin	Low	Low	LA24002
South Catch Basin	Low	Low	LA24002

ERST for existing facilities

Facility	Groundwater score	Surface water score	File number
Feedlot pens Row A	Low	Low	LA15045
Feedlot pens Row B	Low	Low	LA15045
Calf barn (with transfer pit)	Low	Low	LA17054A
Pole calf barn	Low	Low	LA15037
Barn 3	Low	Low	Deemed permit
Feedlot pens	Low	Low	Deemed permit

ERST related comments:







Figure 2 – Van Huigenbos Farms – Site Map



Name Henry VanHuigenbos  
 Address  
 Legal Land  
 Location

0

**Landbase Requirements (hectares) based on 2006 AOPA requirements**

Category of Livestock	Type of Livestock	Number of Animals	Dark Brown & Brown (ha)	Grey Wooded (ha)	Black (ha)	Irrigated (ha)
Feedlot Animals	Cows/Finishers (900+ lbs)	0.0	0.0	0.0	0.0	0.0
	Feeders (450 - 900 lbs)	0.0	0.0	0.0	0.0	0.0
	Feeder Calves (<550 lbs)	16500.0	511.5	429.0	313.5	247.5
	Horses - PMU	0.0	0.0	0.0	0.0	0.0
	Horses - Feeders > 750 lbs	0.0	0.0	0.0	0.0	0.0
	Horses - Foals < 750 lbs	0.0	0.0	0.0	0.0	0.0
	Mules	0.0	0.0	0.0	0.0	0.0
	Donkeys	0.0	0.0	0.0	0.0	0.0
	Bison	0.0	0.0	0.0	0.0	0.0
	0.0					
Dairy (*count lactating cows only)	Free Stall – Lactating Cows with all associated dries, heifers, and calves*	0.0	0.0	0.0	0.0	0.0
	Free Stall – Lactating Cows with Dry Cows only *	0.0	0.0	0.0	0.0	0.0
	Free Stall – Lactating Cows only*	0.0	0.0	0.0	0.0	0.0
	Tie Stall – Lactating Cows only	0.0	0.0	0.0	0.0	0.0
	Loose Housing – Lactating Cows only	0.0	0.0	0.0	0.0	0.0
	Dry Cow (Solid manure)	0.0	0.0	0.0	0.0	0.0
	Dry Cow (Liquid manure)	0.0	0.0	0.0	0.0	0.0
	Replacements – Bred Heifers (Breeding to Calving)	0.0	0.0	0.0	0.0	0.0
	Replacements - Growing Heifers (350 lbs to breeding)	0.0	0.0	0.0	0.0	0.0
	Calves (< 350 lbs)	0.0	0.0	0.0	0.0	0.0
	0.0					
Swine Liquid (*count sows only)	Farrow to finish *	0.0	0.0	0.0	0.0	0.0
	Farrow to wean *	0.0	0.0	0.0	0.0	0.0
	Farrow only *	0.0	0.0	0.0	0.0	0.0
	Feeders/Boars	0.0	0.0	0.0	0.0	0.0
	Growers/Roasters	0.0	0.0	0.0	0.0	0.0
	Weaners	0.0	0.0	0.0	0.0	0.0
		0.0				
Swine Solid (*Count sows only)	Farrow to finish *	0.0	0.0	0.0	0.0	0.0
	Farrow to wean *	0.0	0.0	0.0	0.0	0.0
	Farrow only *	0.0	0.0	0.0	0.0	0.0
	Feeders/Boars	0.0	0.0	0.0	0.0	0.0
	Growers/Roasters	0.0	0.0	0.0	0.0	0.0
	Weaners	0.0	0.0	0.0	0.0	0.0
		0.0				
Poultry	Chicken - Breeders - Solid	0.0	0.0	0.0	0.0	0.0
	Chicken - Layers - Liquid (includes associated pullets)	0.0	0.0	0.0	0.0	0.0
	Chicken - Layers - (Belt Cage)	0.0	0.0	0.0	0.0	0.0
	Chicken - Layers - (Deep Pit)	0.0	0.0	0.0	0.0	0.0
	Chicken - Pullets/Broilers	0.0	0.0	0.0	0.0	0.0
	Turkey - Toms/Breeders	0.0	0.0	0.0	0.0	0.0
	Turkey - Hens (light)	0.0	0.0	0.0	0.0	0.0
	Turkey - Broilers	0.0	0.0	0.0	0.0	0.0
	Ducks	0.0	0.0	0.0	0.0	0.0
	Geese	0.0	0.0	0.0	0.0	0.0
		0.0				
Goats and Sheep	Sheep - Ewes/Rams	0.0	0.0	0.0	0.0	0.0
	Sheep - Ewes with lambs	0.0	0.0	0.0	0.0	0.0
	Sheep - Lambs	0.0	0.0	0.0	0.0	0.0
	Sheep - Feeders	0.0	0.0	0.0	0.0	0.0
	Goats - Meat/Milk (per Ewe)	0.0	0.0	0.0	0.0	0.0
	Goats - Nannies/Billies	0.0	0.0	0.0	0.0	0.0
	Goats - Feeders	0.0	0.0	0.0	0.0	0.0
		0.0				
Cervid	Elk	0.0	0.0	0.0	0.0	0.0
	Deer	0.0	0.0	0.0	0.0	0.0
		0.0				
Wild Boar	Feeders	0.0	0.0	0.0	0.0	0.0
	Sow (farrowing)	0.0	0.0	0.0	0.0	0.0
		0.0				
Total Hectares			512	429.0	313.5	247.5
Total Acres			1,264	1060.1	774.7	611.6

# Part 2 – Technical Requirements

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

## NRCB USE ONLY

### MINIMUM DISTANCE SEPARATION

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

Margin of error (if applicable): +/- 2 m

Requirements (m): Category 1: 526 Category 2: 702 Category 3: 877 Category 4: 1,404

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: 611.6 irrigated acres

Land base listed: 700 irrigated acres

Area not suitable: 88 acres

Available area: 612 irrigated acres

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 LA14004

Nico De Wit, manure receiver

Length of agreement: This agreement is valid for a time period of 5 years

Legal Land Location	Soil Type <sup>1</sup>	Acres suitable for manure spreading <sup>2</sup>
<u>SF 15-9-27(2)4</u>	<u>Irrigated</u>	<u>120</u>
<u>WF 15-9-27(2)4</u>	<u>Irrigated</u>	<u>130</u>

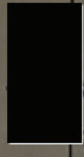
<sup>1</sup> Soil type choices: Dark brown and brown, grey wood, and or irrigated

<sup>2</sup> Land within required setback from water bodies, water wells, residences, etc is not included

Other Comments:

Manure Producer (Confined Feeding Operation) Legal Land Location: SF-21-09-26 WH


Dec 11, 2023  
Date (dd/mm/yyyy)

  
Signature

Henry Van Hugenbos  
Print Name

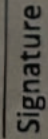
Manure Receiver - Landowner(s)<sup>3</sup>

Dec 13 2023  
Date (dd/mm/yyyy)

  
Signature

Nico de Wit  
Print Name

Dec 13 2023  
Date (dd/mm/yyyy)

  
Signature

Nico de Wit  
Print Name

<sup>3</sup> All registered owners of land, or authorized signing authorities must sign



Van Huigenbos Farms  
 Box 2517  
 Fort Macleod AB, T0L 0Z0  
[Office@vhffarms.com](mailto:Office@vhffarms.com)

Manure Receiver: **Triple VH Ltd.**

This agreement is valid from July 2024 till July 2034

Legal Land Location	Soil Type (1)	Acres suitable for manure spreading (2)
NW 15-09-26-W4	430 Acres Irrigation	470 Acres
NE 15-09-26-W4		
SE 22-09-26-W4	40 Acres Dry Land	
SW.N 15-09-26-W4		
SE.N 15-09-26-W4		

1: Soil type choices: Dark brown and brown, grey wood, and/or irrigated

2: Land within required setback from water bodies, water wells, residences, etc.

Comments:

Manure producer (Confined Feeding Operation) Legal Land Location: **SE-21-9-26-W4**

2024/07/03                      [Redacted Signature]                      Henry Van Huigenbos  
 Date                                      Signature                                      Print Name

Manure Receiver / Landowner(s) (3)

2024/07/03                      [Redacted Signature]                      Henry Van Huigenbos  
 Date                                      Signature                                      Print Name

3: All registered land owners or authorized signing authorities must sign

## Part 2 — Technical Requirements

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

### 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: Live Stock Corral Proposed 1: Feedlot Expansion

Proposed 2: Catch Basins Proposed 3: \_\_\_\_\_

Facility and environmental risk information	Facilities					NRCB USE ONLY	
	Existing	Proposed 1	Proposed 2	Proposed 3	Meets requirements	Comments	
<b>Flood plain information</b> 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?	<input checked="" type="checkbox"/> > 1 m <input type="checkbox"/> ≤ 1 m	<input checked="" type="checkbox"/> > 1 m <input type="checkbox"/> ≤ 1 m	<input checked="" type="checkbox"/> > 1 m <input type="checkbox"/> ≤ 1 m	<input type="checkbox"/> > 1 m <input type="checkbox"/> ≤ 1 m	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> YES with exemption	Not in flood plain; confirmed during site visit	
<b>Surface water information</b> How many springs are within 100 m of the manure storage facility or manure collection area?	0	0	0		<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> YES with exemption	Confirmed during site visit	
<b>Surface water information</b> How many water wells are within 100 m of the manure storage facility or manure collection area?	1	0	0		<input type="checkbox"/> YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> YES with exemption	Barn 3 is 72 m and Feedlot Pens are 90 m to well ID #9731008	
<b>Groundwater information</b> What is the shortest distance from the manure collection or storage facility to a surface water body? (e.g., lake, creek, slough, seasonal)	150 m	330 m	200 m		<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> YES with exemption	Approximately 190 m from closest existing feedlot pens to Willow Creek	
<b>Groundwater information</b> What is the depth to the water table?	> 3 m	> 3 m	> 3 m		<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> YES with exemption	Depth to water table is 1.2 m. However, determined to be a perched water table due to irrigation of site for proposed expansion.	
<b>Groundwater information</b> What is the depth to the groundwater resource/aquifer you draw water from?	> 3 m	> 3 m	73 m	73 m	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> YES with exemption	UGR is 23.77 m below grade in well ID# 9731008	

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

See attached soils report - AMEC (Dec 21, 2015)

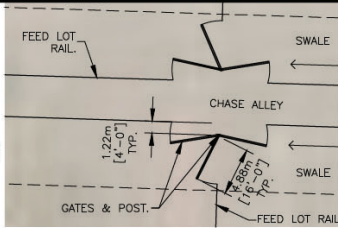




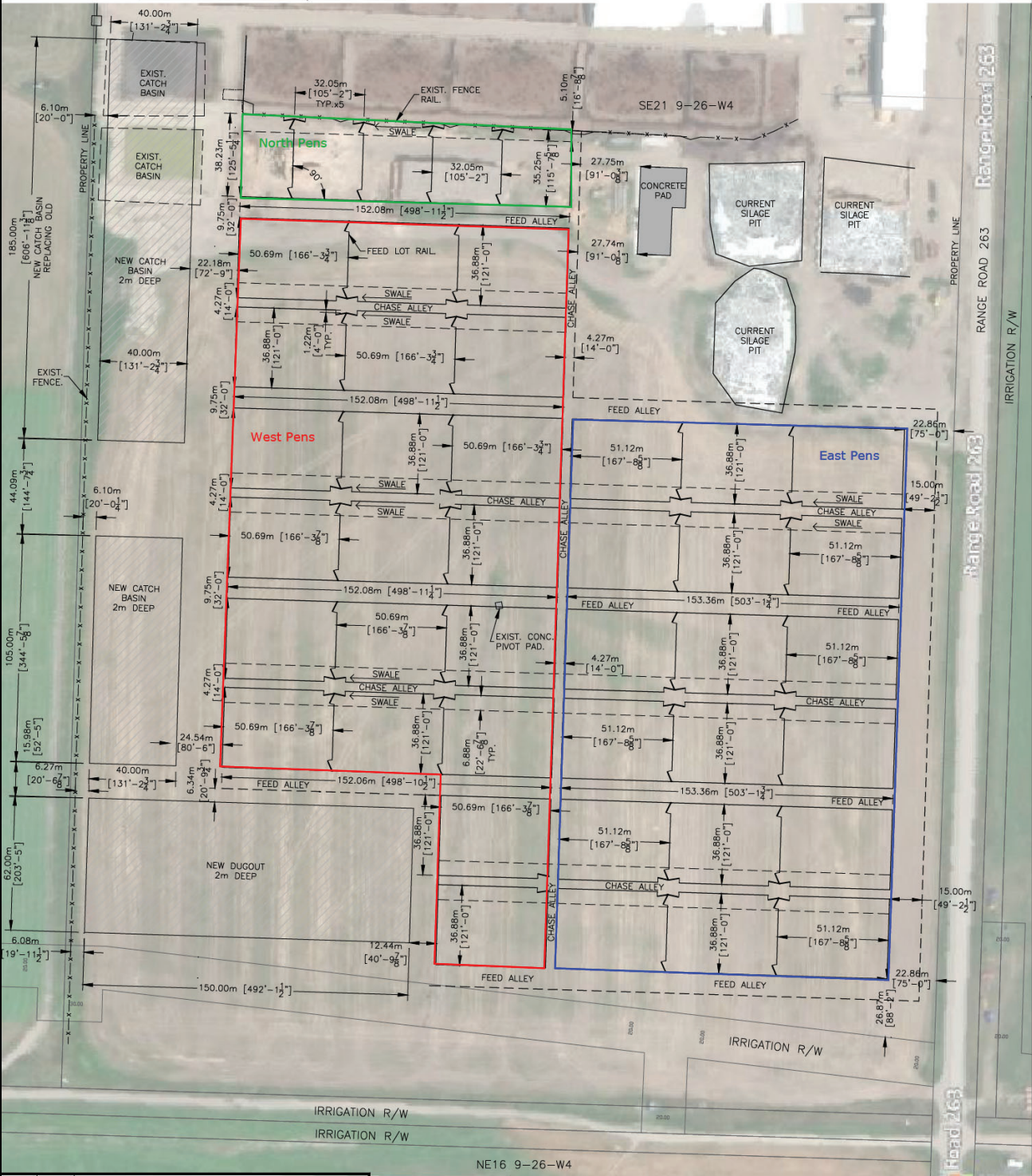
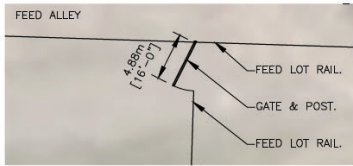
Figure 3 – Van Huigenbos Farms – Area Map – Proposed Feedlot Expansion



**(A) DETAIL**  
FEED LOT GATES  
SCALE: 1:500



**(B) DETAIL**  
FEED LOT GATE  
SCALE: 1:500



**(C) PLAN**  
FEED LOTS  
SCALE: 1:1800

4		
3		
2	24 JUN 24	ISSUED FOR REVIEW
1	20 OCT 23	ISSUED FOR REVIEW
ISSUE	DATE	REVISION DESCRIPTION

- LEGEND / NOTES**
- CONTRACTOR IS RESPONSIBLE FOR VERIFYING THE DEPTH OF SERVICES PRIOR TO CONSTRUCTION.
  - ALL UNDERGROUND UTILITIES, INCLUDING GAS, OIL, TELUS, ELECTRICAL, MUNICIPAL WATER, ETC., AS SHOWN ON THIS PLAN, ARE BASED ON INFORMATION RECEIVED FROM THE RESPECTIVE AUTHORITIES. NO RESPONSIBILITY IS IMPLIED OR ASSUMED BY THE ENGINEER AS TO LOCATION, OR OMISSIONS. THE CONTRACTOR MUST CONTACT THE VARIOUS UTILITIES FOR ON-SITE INFORMATION AS TO ACTUAL LINE LOCATIONS PRIOR TO STARTING CONSTRUCTION.
  - IT IS THE LANDSCAPER'S RESPONSIBILITY TO ENSURE THAT RUNOFF FOLLOWS THE RECOMMENDED DRAINAGE PATHS AND NO STANDING WATER OCCURS NEAR THE RESIDENCE.
- x — x — x — EXISTING FENCELINE

WILDE BROTHERS  
ENGINEERING LTD.  
PERMIT TO PRACTICE  
P08438

WILDE BROS. ENGINEERING LTD.  
Raymond, Alberta  
VAN HUIGENBOS FARMS LTD.  
FEED LOT LAYOUT  
PROPOSED PLAN & DETAILS

DESIGNED:	DJW
DRAWN:	J.L.J.
SCALE:	AS SHOWN
DATE:	OCTOBER 1, 2023
CHECKED:	DJW
JOB:	9923-18
DIMENSIONS:	METERS
DRAWING No:	<b>1</b>

# Part 2 – Technical Requirements

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

## SOLID MANURE, COMPOST, & COMPOSTING MATERIALS: Barns, feedlots, & storage facilities - Naturally occurring protective layer

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

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

1. East Pens (18 total) *(6 rows of pens, 3 pens per row)*
2. West Pens (24 total) *(6 rows of pens with 3 pens per row; 2 rows of pens with 1 pen per row)*
3. North Pens (5 total) *(1 row of pens)*

### Manure storage capacity

	Length (m)	Width (m)	Depth below ground level (m)	NRCB USE ONLY Estimated storage capacity (m <sup>3</sup> )
1.	153.4	36.9	0	
2.	152.9 50.7	36.9 36.9	0 0	
3.	152.1	38.2	0	TOTAL CAPACITY

AO Comment: Measurements are for each row of pens.

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

See attached runoff control plan and calculations

### Naturally occurring protective layer details

Thickness of naturally occurring protective layer	Provide details (as required) See attached WSP report for borehole locations, calculated equivalent layer thickness, soil textural analyses and permeability test results		
	7.3 (m)		
Soil texture	28 % sand	55 % silt	17 % clay
Hydraulic conductivity - naturally occurring protective layer	Depth and type of soil tested 2.9 - 4.5 m	Hydraulic conductivity (cm/s) 2.2 x 10 <sup>-7</sup> cm/s	Describe test standard used Modified falling head test

Additional information *(attach copies of soil test reports)*

#### NRCB USE ONLY

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



## Part 2 – Technical Requirements

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

### **SOLID MANURE, COMPOST, & COMPOSTING MATERIALS: Barns, feedlots, & storage facilities - Naturally occurring protective layer (cont.)**

#### **NRCB USE ONLY**

Nine month manure storage volume requirements met:  YES  YES With STMS  NO

Depth to water table: 1.2 m below grade Requirements met:  YES  NO

Depth to uppermost groundwater resource: 23.77 m below grade Requirements met:  YES  NO

ERST completed:  see ERST page for details

#### **Surface water control systems**

Requirements met:  YES  NO Details/comments:

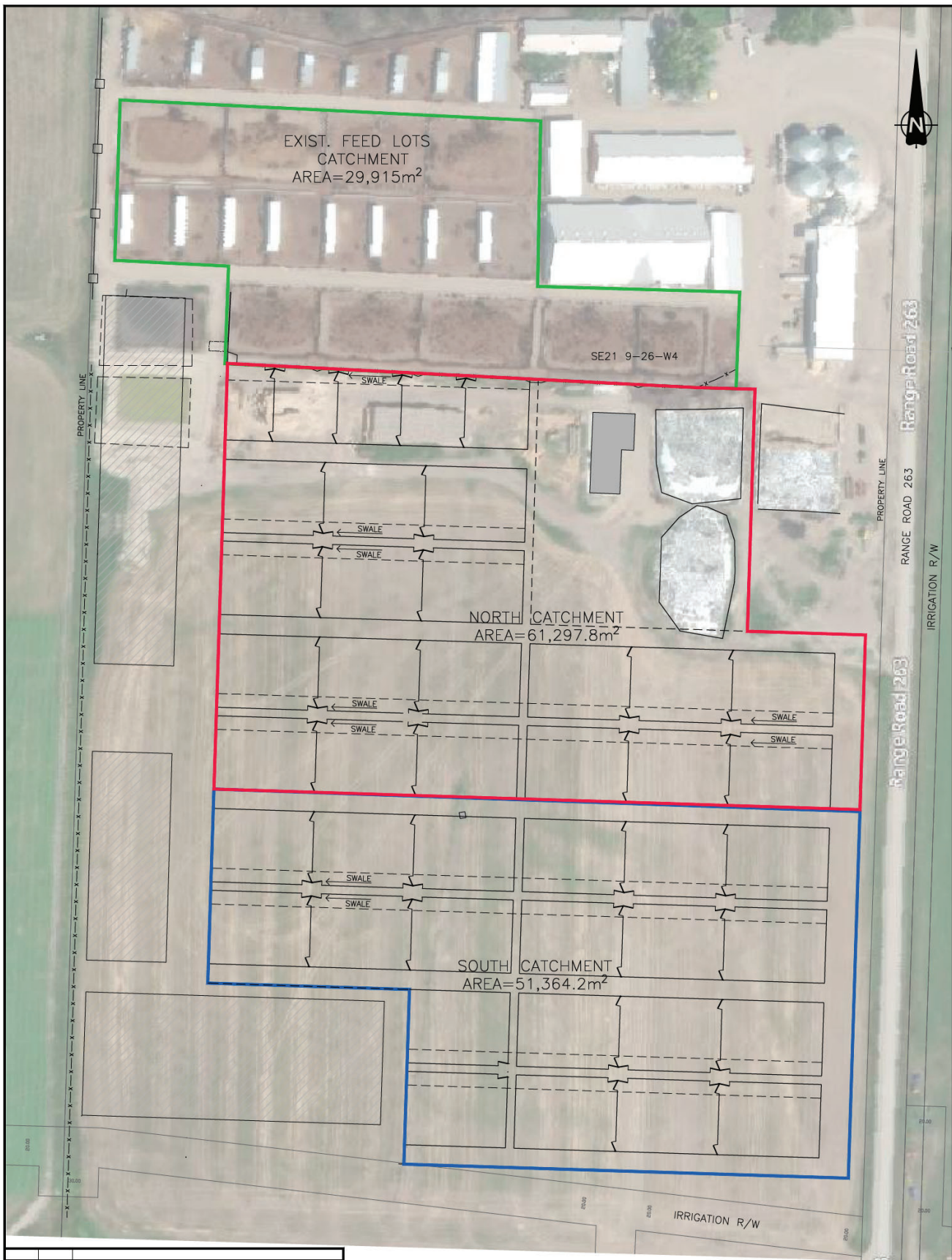
AO Comment: All run-off is directed to catch basins.

#### **Naturally occurring protective layer details**

Layer specification comments (e.g. sand lenses; layering uniform or irregular; number and location of boreholes):

AO Comment: WSP report shows an approximately 3 m thick naturally occurring protective layer.





4		
3		
2		
1	24 JUN '24	ISSUED FOR REVIEW
ISSUE	DATE	REVISION DESCRIPTION

**A** PLAN  
 FEED LOT AREAS  
 SCALE: 1:1800

**LEGEND / NOTES**

- CONTRACTOR IS RESPONSIBLE FOR VERIFYING THE DEPTH OF SERVICES PRIOR TO CONSTRUCTION.
- ALL UNDERGROUND UTILITIES, INCLUDING GAS, OIL, TELUS, ELECTRICAL, MUNICIPAL WATER, ETC., AS SHOWN ON THIS PLAN, ARE BASED ON INFORMATION RECEIVED FROM THE RESPECTIVE AUTHORITIES. NO RESPONSIBILITY IS IMPLIED OR ASSUMED BY THE ENGINEER AS TO LOCATION, OR OMISSIONS. THE CONTRACTOR MUST CONTACT THE VARIOUS UTILITIES FOR ON-SITE INFORMATION AS TO ACTUAL LINE LOCATIONS PRIOR TO STARTING CONSTRUCTION.
- IT IS THE LANDSCAPER'S RESPONSIBILITY TO ENSURE THAT RUNOFF FOLLOWS THE RECOMMENDED DRAINAGE PATHS AND NO STANDING WATER OCCURS NEAR THE RESIDENCE.

— x — x — x — x — EXISTING FENCELINE

WILDE BROTHERS  
 ENGINEERING LTD.  
 PERMIT TO PRACTICE  
 P08438

WILDE BROS. ENGINEERING LTD.  
 Raymond, Alberta

VAN HUIGENBOS FARMS LTD.

FEED LOT LAYOUT  
 PROPOSED PLAN & DETAILS

DESIGNED:	DJW
DRAWN:	J.L.J.
SCALE:	AS SHOWN
DATE:	JUNE 24, 2024
CHECKED:	DJW
JOB:	9923-18
DIMENSIONS:	METERS
DRAWING No:	<b>2</b>

# Part 2 – Technical Requirements

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

## RUNOFF CONTROL CATCH BASIN: Naturally occurring protective layer

(complete a copy of this section for **EACH proposed** runoff control catch basin with a naturally occurring protective layer)

Facility description / name (as indicated on site plan)

1. North Catch Basin
2. South Catch Basin
- 3.

### Determination of runoff area

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

See attached runoff calculation and site map

### Catch basin capacity

	Length (m)	Width (m)	Total depth (m)	Depth below ground level (m)	Slope run:rise			NRCB USE ONLY Calculated storage capacity (excl. 0.5 m freeboard) (m <sup>3</sup> )
					Inside end walls	Inside side walls	Outside walls	
1.	185	40	2	2	3:1	3:1	n/a	8,663
2.	105	40	2	2	3:1	3:1	n/a	4,763
3.								
TOTAL CAPACITY								13,426

### Naturally occurring protective layer details

Thickness of naturally occurring protective layer	12.3 (m)	Provide details (as required) See attached WSP report for borehole locations, calculated equivalent layer thickness, soil textural analyses and permeability test results		
Soil texture	15 % sand	66 % silt	19 % clay	
Hydraulic conductivity - naturally occurring protective layer	Depth and type of soil tested 4.4 - 6.0 m	Hydraulic conductivity (cm/s) 2.0 x 10 <sup>-7</sup> cm/s	Describe test standard used Modified falling head test	

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

If soil info differs per facility include additional soils page.

#### NRCB USE ONLY

- Requirements met:  YES  NO  
 Condition required:  YES  NO  
 Report attached:  YES  NO



## Catch Basin Storage Volume Calculator

Construction Dimensions of Catch Basin	
* Only cells in blue can be changed.	
Overall Dimensions of Catch Basin	
Total Length* <sub>4</sub>	185.0 m
Total Width* <sub>4</sub>	40.0 m
Total Depth* <sub>4</sub>	2.0 m
Design Capacity Depth	1.50 m
End Slope* <sub>4</sub>	3 run:rise
Side Slope* <sub>4</sub>	3 run:rise
Length of Bottom	173.0 m
Width of Bottom	28.0 m
Capacity @ top of Bank	12,196 m <sup>3</sup>
Design Capacity of Catch Basin (freeboard level)	
Length (design capacity depth)	182.0 m
Width (design capacity depth)	37.0 m
Total Depth	2.0 m
Design Capacity Depth	1.50 m
End Slope	3 run:rise
Side Slope	3 run:rise
Design Capacity (freeboard level)	8,663 m <sup>3</sup>
level)	6,734 m <sup>2</sup>
Catch Basin Dimensions	
	607 ft
	131 ft
	7 ft
	5 ft
	3 run:rise
	3 run:rise
	3 run:rise
	568 ft
	92 ft
Capacity (@top)	430,698 ft <sup>3</sup>
	2,682,744 Imp. Gal.
Design Capacity (freeboard level)	
	597 ft
	121 ft
	7 ft
	5 ft
	3 run:rise
	3 run:rise
	305,940 ft <sup>3</sup>
	1,905,648 Imp. Gal.
	72,484 ft <sup>2</sup>

CFO Name <sub>1</sub>	Van Huigenbos Farms
Land Location <sub>1</sub>	

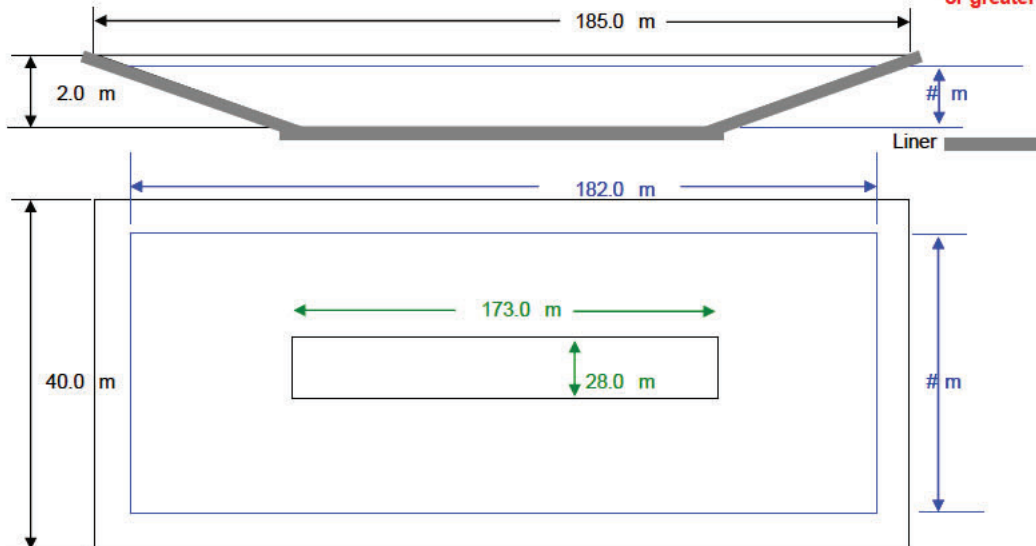
Paved Runoff Catchment Area(s)			
Area <sub>2</sub>	Length (m)	Width (m)	Area (m <sup>2</sup> )
1	61,298	1	61,297.8
2	29,915	1	29,915.0
3			0.0
4			0.0
5			0.0
Total Area (m <sup>2</sup> )			91,213

Unpaved Runoff Catchment Area(s)			
Area <sub>2</sub>	Length (m)	Width (m)	Area (m <sup>2</sup> )
6			0.0
7			0.0
8			0.0
9			0.0
10			0.0
Total Area (m <sup>2</sup> )			0

Rainfall (Select Town <sub>3</sub> )	
Fort Macleod 90	
AOPA Design Rainfall	90 mm

Minimum Catchbasin Storage Volume Required	
8,209 m <sup>3</sup> **	289903.47 ft <sup>3</sup>
	1805760.3 Imp. Gal.

\*\* Design capacity of catch basin should be equal to or greater than, minimum storage volume required.



— Lines in Black - Overall catch basin dimensions  
 — Lines in Blue - Design capacity depth dimensions (excludes freeboard)

NTS - Not To Scale

## Part 2 – Technical Requirements

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

### RUNOFF CONTROL CATCH BASIN: Naturally occurring protective layer (cont.)

**NRCB USE ONLY**

Catch basin calculator: Total volume @ freeboard level: 8,663 m<sup>3</sup> Runoff capacity requirements met:  YES  NO

Calculation of the volume attached:  YES  NO

Depth to water table: 1.2 m below grade Requirements met:  YES  NO

Depth to uppermost groundwater resource: 23.77 m below grade Requirements met:  YES  NO

ERST completed:  See ERST page for details

Protective layer specification comments (e.g. sand lenses; layering uniform or irregular; number and location of boreholes):

AO Comment: Water encountered during drilling appears to be a perched water table from irrigation of the site for the proposed expansion. The accompanying soil report and water well log for well ID#9731008 show an impermeable clay layer between the perched water and the uppermost groundwater resource.

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

# Catch Basin Storage Volume Calculator

Construction Dimensions of Catch Basin			
* Only cells in blue can be changed.			
Overall Dimensions of Catch Basin		Catch Basin Dimensions	
Total Length* <sub>4</sub>	105.0 m	344 ft	
Total Width* <sub>4</sub>	40.0 m	131 ft	
Total Depth* <sub>4</sub>	2.0 m	7 ft	
Design Capacity Depth	1.50 m	5 ft	
End Slope* <sub>4</sub>	3 run:rise	3 run:rise	
Side Slope* <sub>4</sub>	3 run:rise	3 run:rise	
Length of Bottom	93.0 m	305 ft	
Width of Bottom	28.0 m	92 ft	
Capacity @ top of Bank	6,756 m <sup>3</sup>	Capacity (@top)	238,586 ft <sup>3</sup>
			1,486,112 Imp. Gal.
Design Capacity of Catch Basin (freeboard level)			
Length (design capacity depth)	102.0 m	335 ft	
Width (design capacity depth)	37.0 m	121 ft	
Total Depth	2.0 m	7 ft	
Design Capacity Depth	1.50 m	5 ft	
End Slope	3 run:rise	3 run:rise	
Side Slope	3 run:rise	3 run:rise	
Design Capacity (freeboard level)	4,763 m <sup>3</sup>	168,213 ft <sup>3</sup>	
level)	3,774 m <sup>2</sup>	1,047,768 Imp. Gal.	40,623 ft <sup>2</sup>

CFO Name <sub>1</sub>	Van Huigenbos Farms
Land Location <sub>1</sub>	

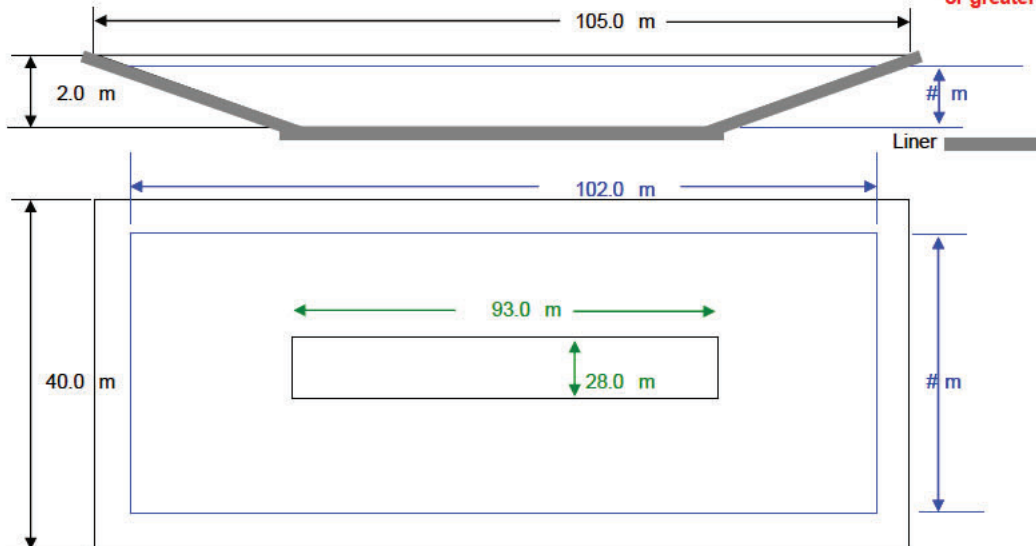
Paved Runoff Catchment Area(s)			
Area <sub>2</sub>	Length (m)	Width (m)	Area (m <sup>2</sup> )
1	51,364	1	51,364.2
2			0.0
3			0.0
4			0.0
5			0.0
Total Area (m <sup>2</sup> )			51,364

Unpaved Runoff Catchment Area(s)			
Area <sub>2</sub>	Length (m)	Width (m)	Area (m <sup>2</sup> )
6			0.0
7			0.0
8			0.0
9			0.0
10			0.0
Total Area (m <sup>2</sup> )			0

Rainfall (Select Town <sub>3</sub> )	
Fort Macleod 90	
AOPA Design Rainfall	90 mm

Minimum Catchbasin Storage Volume Required	
4,623 m <sup>3</sup> **	163251.86 ft <sup>3</sup>
	1016868.6 Imp. Gal.

\*\* Design capacity of catch basin should be equal to or greater than, minimum storage volume required.



— Lines in Black - Overall catch basin dimensions  
 — Lines in Blue - Design capacity depth dimensions (excludes freeboard)

NTS - Not To Scale



## Part 2 – Technical Requirements

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

### **RUNOFF CONTROL CATCH BASIN: Naturally occurring protective layer (cont.)**

**NRCB USE ONLY**

Catch basin calculator: Total volume @ freeboard level: 4,763 m<sup>3</sup> Runoff capacity requirements met:  YES  NO

Calculation of the volume attached:  YES  NO

Depth to water table: 1.2 m below grade Requirements met:  YES  NO

Depth to uppermost groundwater resource: 23.77 m below grade Requirements met:  YES  NO

ERST completed:  See ERST page for details

Protective layer specification comments (e.g. sand lenses; layering uniform or irregular; number and location of boreholes):

AO Comment: Water encountered during drilling appears to be a perched water table from irrigation of the site for the proposed expansion. The accompanying soil report and water well log for well ID#9731008 show an impermeable clay layer between the perched water and the uppermost groundwater resource.

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

# Part 2 – Technical Requirements

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

<b>NRCB USE ONLY</b>	
<b>RUNOFF CONTROL CATCH BASIN CAPACITY SUMMARY (if applicable)</b>	
<b>Facility 1</b>	
Name / description      North catch basin	Capacity      8,663 m <sup>3</sup>
<b>Facility 2</b>	
Name / description      South catch basin	Capacity      4,763 m <sup>3</sup>
<b>Facility 3</b>	
Name / description	Capacity
<b>Facility 4</b>	
Name / description	Capacity
<b>TOTAL CAPACITY</b>	13,426 m <sup>3</sup>
<b>RUNOFF VOLUME FROM CONTRIBUTING AREAS</b>	12,832 m <sup>3</sup>
<b>MEETS AOPA RUNOFF CONTROL VOLUME REQUIREMENTS</b>	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO



# Part 2 – Technical Requirements

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

**NRCB USE ONLY**

**ALL SIGNATURES IN FILE**  YES  NO

**DATES OF APPROVAL OFFICER SITE VISITS**

April 3, 2024	
May 22, 2024	

**CORRESPONDENCE WITH MUNICIPALITIES AND REFERRAL AGENCIES**

Date deeming letters sent: April 17, 2024

**Municipality:** MD of Willow Creek

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:** Fortis Alberta Inc., South Alta Rural Electrification, ATCO Gas  N/A

letter sent       response received       written/email       verbal       no comments received

**Other:** Town of Fort Macleod  N/A

letter sent       response received       written/email       verbal       no comments received

December 21, 2015

AMEC File: BX30375

Van Huigenbos Farms  
P.O. Box 2311  
Fort Macleod, Alberta T0L 0Z0



**Attention: Mr. Garrett Van Huigenbos**

**Re: Geotechnical Review and Evaluation  
Proposed Calf Pens and Catch Basin  
SE-21-9-26-W4, near Fort Macleod, Alberta**

As requested, Amec Foster Wheeler Environment & Infrastructure has carried out a geotechnical review and evaluation of the above captioned site relative to the required protection of the groundwater resource, as required by the Agricultural Operation Practices Act, AB Reg. 267/2001 (hereinafter referred to as "AOPA").

This letter encompasses the soil conditions associated with a row of recently constructed calf pens, a proposed row of calf pens, and a proposed catch basin, at the general locations illustrated on Figure 1.

In order to demonstrate the suitability of the natural clay soils at the site of the calf barn for consideration as a naturally occurring protective layer, a series of boreholes were advanced at the site on March 24, 2014 and September 9, 2015, at the locations illustrated on Figure 1. The boreholes were advanced by a truck-mounted drill rig owned and operated by Chilako Drilling Services, and extended to depths ranging between about 3 m and 6 m below existing grades. Boreholes VH1-14 to VH9-14 were logged by Mr. Larry DeLong of Chilako Drilling Services Ltd (see attachments), while boreholes VH10-15 to VH16-15 were logged by an Amec geotechnical engineer.

In general, the soils encountered within the current test holes near surface lacustrine silt and sand (to depths of up to 1.5 m below grade), and underlain by low permeable lacustrine clay to the termination depths of the boreholes. A minimum of 1.5 m of clay was encountered at each of the borehole locations

In order to demonstrate the permeability of the subsurface clay soil, 50 mm diameter PVC monitoring wells were constructed in boreholes VH6-14 and VH11-15. Borehole VH6-14 was screened from 2.5 m to 3.9 m depth and borehole VH11-15 was screened from 2.7 m to 3.8 m depth. Well saturation of the 50 mm diameter monitoring well was carried out by filling the monitoring well to the top of the well for several consecutive days. On the third and fourth days, the water depth was measured at a consistent depth of about 0.17 m at VH6-14, and at a depth of about 0.54 m at VH11-15. During the testing, the well locations were protected, and care was taken to ensure that the column of water being monitored in the well was not frozen during the testing.

In order to calculate the permeability of the screened portion of the clay stratum, a modified falling head test (as outlined in the USBR *Engineering Geology Field Manual Volume 2* [2001]) was used. The input variables and output data are outlined on the *In Situ Permeability Test*

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reports, attached. As outlined on the reports, the results of the *in situ* permeability testing indicate a hydraulic conductivity,  $k_s$ , of  $2.2 \times 10^{-8}$  cm/s at borehole VH6-14, and  $8.4 \times 10^{-8}$  cm/s at borehole VH11-15

Using the measured permeability of the clay stratum, the 1.4 m portion of clay which has been screened at VH6-14 has been estimated to represent an equivalent of about 64 m of naturally occurring materials having a hydraulic conductivity of  $1 \times 10^{-6}$  cm/s. This represents natural material protection well in excess of the minimum requirements outlined by the AOPA for solid manure storage (minimum 2 m, Section 9.5-c).

Similarly, the 1.1 m portion of clay which has been screened at VH11-15 has been estimated to represent an equivalent of about 13 m of naturally occurring materials having a hydraulic conductivity of  $1 \times 10^{-6}$  cm/s. This represents natural material protection in excess of the minimum requirements outlined by the AOPA for a catch basin (minimum 5 m, Section 9.5-b).

### Conclusion


Based on the results of the current investigation and permeability testing, and our understanding of the site and proposed development at the site, it is AMEC's opinion that the naturally occurring materials at the existing feedlot pens and catch basin satisfy the requirements for a naturally occurring 'protective layer' for the existing pens, as outlined in the AOPA.

It is noted that a layer of near surface silty sand was encountered at the proposed catch basin location. This sand will require removal from the side slope areas at the time of construction, and reconstruction of the upper catch basin side slopes using low permeable clay soils will be required. The existing clay soils below the upper sandy soils is considered suitable for the upper side slope construction. Geotechnical review of the entire catch basin excavation and reconstruction of these upper side slopes is recommended.

We trust this satisfies your present requirements. If you have questions or require further information or clarification, please don't hesitate to contact the undersigned.

Respectfully submitted,

**Amec Foster Wheeler Environment & Infrastructure**  
**A division of Amec Foster Wheeler Americas Ltd.**

  
John Lobbezoo, P.Eng.  
Geotechnical Engineer



**APEGA Permit: P04546**

Attachments:

Figure 1 – Borehole Location Plan

*In Situ* Permeability Test Calculations – VH6-14 & VH11-15

Soil Profile and Parent Material Description, Chilako Drilling Services (VH1-14 to VH9-14)

Test Pit Summary Table (VH10-15 to VH16-15)



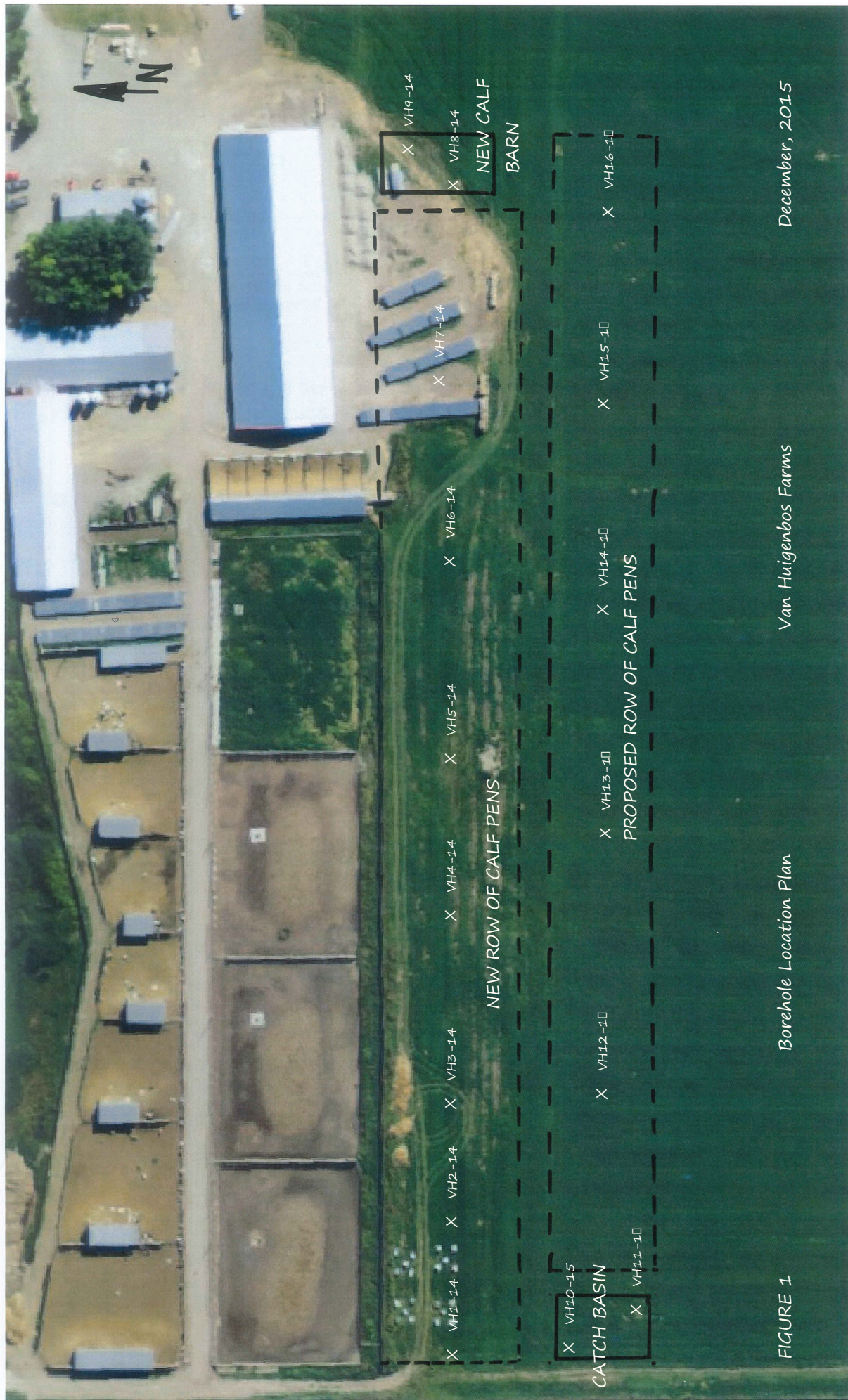


FIGURE 1

Borehole Location Plan

Van Huigenbos Farms

December, 2015



VH6-14



In Situ Permeability Test

Modified Falling Head Permeability Equation

$$K_s = \frac{r^2}{2\ell\Delta t} \left[ \frac{\sinh^{-1} \frac{\ell}{r_e}}{2} \ln \left[ \frac{2H_1 - \ell}{2H_2 - \ell} \right] - \ln \left[ \frac{2H_1H_2 - \ell H_2}{2H_1H_2 - \ell H_1} \right] \right]$$

taken from USBR Engineering Geology Field Manual Volume 2 (2001)

VH6-14

AMEC File: BX30375

INPUT VARIABLES	Terms	Value	Definition
	D	0.0520	diameter of standpipe (m)
	De	0.1500	diameter of borehole (m)
	L	1.30	length of sand section (m)
	h1	4.60	initial height of water above base of hole (m)
	h2	4.43	final height of water above base of hole (m)
t	24.0	time of test (h)	

Ks = 2.2E-08 cm/sec



### In Situ Permeability Test

Modified Falling Head Permeability Equation

$$K_s = \frac{r^2}{2\ell\Delta t} \left[ \frac{\sinh^{-1} \frac{\ell}{r_e}}{2} \ln \left[ \frac{2H_1 - \ell}{2H_2 - \ell} \right] - \ln \left[ \frac{2H_1H_2 - \ell H_2}{2H_1H_2 - \ell H_1} \right] \right]$$

taken from USBR Engineering Geology Field Manual Volume 2 (2001)

VH11-15

AMEC File: BX30375

INPUT VARIABLES	Terms	Value	Definition
	D	0.0520	diameter of standpipe (m)
	De	0.1500	diameter of borehole (m)
	L	1.10	length of sand section (m)
	h1	4.40	initial height of water above base of hole (m)
	h2	3.86	final height of water above base of hole (m)
t	24.0	time of test (h)	

**Ks = 8.4E-08 cm/sec**





# CHILAKO DRILLING SERVICES LTD

Box 942 Coaldale, Alberta, T1M 1M8  
(403) 345-3710

## SOIL PROFILE AND PARENT MATERIAL DESCRIPTION

Site Location: Van Huigenbos Farms SE21-9-26W4

Date: 24-Mar-14

Hole #	Location	Depth	Texture	Moisture	Geological	Sample	Remarks
VH1-14	West end of proposed corrals	0-1.0	FSL	D	Lac		Sand, silty  Med plastic, olive brown
		1.0-1.05	S+Gr	D	Lac		
		1.05-2.0	SiCL	D	Lac		
		2.0-3.0	SiCL	VM-Sat	Lac		
VH2-14	~40m east of VH-1	0-1.2	FSL	D	Lac		Sand lens @ 1.2m Med plastic, olive brown Med plastic, olive brown, high plastic layers and silt layers
		1.2-1.5	SiC	M	Lac		
		1.5-3.0	SiCL	VM-Sat	Lac		
VH3-14	~40m east of VH-2	0-1.1	FSL	D	Lac		Med-high plastic, olive brown, silt layers VM-Sat @ 1.8m
		1.1-3.0	SiC	M	Lac		
VH4-14	~40m east of VH-3	0-0.6	FSL	D	Lac	0.6-1.5	Some Silt Oxidized, trace silt Med plastic, olive brown, stiff
		0.6-1.5	LFS	SM	Lac		
		1.5-3.0	SiC	VM-Sat	Lac		
VH5-14	~40m east of VH-4	0-1.2	FSL	D	Lac		Med plastic, olivebrown, stiff, silt lenses WTW Installed
		1.2-3.0	SiC	VM-Sat	Lac		
VH6-14	~40m east of VH-5	0-1.2	FSL	D	Lac	1.5-3.0	Med-high plastic, olive brown, stiff HC Well Total Depth 4.0m Screen 2.5-3.9m Sand 2.7-4.0m Bent 0.6-2.7m Stickup 0.6m
		1.2-1.5	FSL	VM	Lac		
		1.5-4.0	SiC	VM	Lac		
VH7-14	~40m east of VH-6 ~10m east of west boundary of proposed barn	0-1.2	FSL	D	Lac	1.5-3.0	Trace very small gravel Some gravel
		1.2-1.5	FM.S	D	Lac		
		1.5-3.0	SCL	VM-Sat	Till		

VH8-14	~30m NE of VH-7 center of proposed barn	0-1.0 1.0-1.4 1.4-3.0	FSL LM.S CL	D D M	Lac Lac Till		Trace silt, trace gravel Some gravel, sand lenses (VM-Sat), stiff Low-med plastic
VH9-14	~30m NE of VH-8 NE corner of proposed barn	0-0.3 0.3-1.2 1.2-1.6 1.6-2.6 2.6-3.0	LFS FSL LM.S SiC SiCL	D D D M VM-Sat	Lac Lac Lac Lac Lac		Trace gravel, trace silt Stiff, med-high plastic Firm, med plastic, olive brown





## BOREHOLE SUMMARY TABLE (VH10-15 – VH10-16)

Amec File: BX30375  
 Van Huigenbos Farms  
 Proposed Catch Basin and Calf Pens, SE21-9-26-W4M near Fort Macleod, Alberta

<b>Borehole VH10-15</b>		
<i>Depth:</i>		
0.0 – 0.9	<b>SILTY SAND</b> – fine to medium grained, compact, damp	<i>Monitoring Well Detail:</i> 25mm PVC Standpipe to 6.0m depth, hand-slotted  Groundwater at 4.0m depth, Sept 15, 2015
0.9 – 4.6	<b>CLAY</b> – medium plastic, lacustrine, silty, trace sand, laminations, brown, stiff moist -becoming very silty below 4.3m depth	
4.6 – 5.0	-gravelly silty and sand, very moist to wet	
5.0 – 6.0	<b>CLAY TILL</b> – medium plastic, silty, trace sand, trace gravel, coal and oxide inclusions, brown, stiff to very stiff, moist	
6.0	<b>End of Borehole at 6.0 m depth</b> -some seepage from 4.2m depth	
<b>Borehole VH11-15</b>		
<i>Depth:</i>		
0.0 – 0.8	<b>SILTY SAND</b> – fine to medium grained, compact, damp	<i>Monitoring Well Detail:</i> 50mm PVC Standpipe Screened: 2.7m – 3.8m Sand Pack: 2.7m – 3.8m Bentonite Seal: 0m – 2.7m Stick-up: 0.6m
0.8 – 4.5	<b>CLAY</b> – medium plastic, lacustrine, silty, trace sand, laminations, brown, stiff moist -becoming very silty below 4.2m depth	
4.5 – 5.0	-gravelly silty and sand, very moist to wet	
5.0 – 6.0	<b>CLAY TILL</b> – medium plastic, silty, trace sand, trace gravel, coal and oxide inclusions, brown, stiff to very stiff, moist	
6.0	<b>End of Borehole at 6.0 m depth</b> -some seepage from 4.2m depth	
<b>Borehole VH12-15</b>		
<i>Depth:</i>		
0.0 – 0.9	<b>SILTY SAND</b> – fine to medium grained, compact, damp	
0.9 – 3.0	<b>CLAY</b> – medium plastic, lacustrine, silty, trace sand, laminations, brown, stiff moist	
3.0	<b>End of Borehole at 3.0 m depth</b> -borehole open and dry upon completion	



<b>Borehole VH13-15</b>		
0.0 – 1.0	<b>SILTY SAND</b> – fine to medium grained, compact, damp	
1.0 – 3.0	<b>CLAY</b> – medium plastic, lacustrine, silty, trace sand, laminations, brown, stiff moist	
3.0	<b>End of Borehole at 3.0 m depth</b> <i>-borehole open and dry upon completion</i>	
<b>Borehole VH14-15</b>		
0.0 – 1.0	<b>SILTY SAND</b> – fine to medium grained, compact, damp	
1.0 – 3.0	<b>CLAY</b> – medium plastic, lacustrine, silty, trace sand, laminations, brown, stiff moist	
3.0	<b>End of Borehole at 3.0 m depth</b> <i>-borehole open and dry upon completion</i>	
<b>Borehole VH15-15</b>		
0.0 – 1.1	<b>SILTY SAND</b> – fine to medium grained, compact, damp	
1.1 – 3.0	<b>CLAY</b> – medium plastic, lacustrine, silty, trace sand, laminations, brown, stiff moist	
3.0	<b>End of Borehole at 3.0 m depth</b> <i>-borehole open and dry upon completion</i>	
<b>Borehole VH16-15</b>		
0.0 – 1.2	<b>SILTY SAND</b> – fine to medium grained, compact, damp	
1.12 – 3.0	<b>CLAY</b> – medium plastic, lacustrine, silty, trace sand, laminations, brown, stiff moist	
3.0	<b>End of Borehole at 3.0 m depth</b> <i>-borehole open and dry upon completion</i>	

Table Notes:

- borehole information to be read in conjunction with AMEC report BX30375.
- boreholes advanced using C1172 drill provided by Chilako Drilling Services on September 9, 2015
- see Figure 1 for borehole locations





13 March 2024

WSP File: BX11613

Van Huigenbos Farms  
c/o Linkage Ag Solutions  
Box 1120  
Coaldale, Alberta T1M 1M9

3102 – 12 Avenue North  
Lethbridge, Alberta T1H 5V1  
T: +1 403 327-7474  
www.wsp.com

Attention: Mr. Cody Metheral:

**Re: Geotechnical Review and Evaluation  
NRCB Permitting of Proposed Pens  
SE-21-009-26-W4M, near Fort Macleod, Alberta**

As requested, WSP E&I Canada Limited (WSP) has carried out a geotechnical review and evaluation of the above-captioned site relative to the required protection of the groundwater resource, as required by the Agricultural Operation Practices Act, AB Reg. 267/2001 (hereinafter referred to as "AOPA"). This letter describes site soil conditions to support a permit application related to an area of proposed feedlot pens and a proposed catch basin within SE-21-009-26-W4M (refer to Figure 1, attached).

In order to demonstrate the suitability of the naturally existing soils for consideration as a naturally occurring protective layer to the groundwater, fifteen (15) boreholes were advanced at the site on May 1, 2023. The boreholes were advanced at the approximate locations denoted as VF1-23 to VF15-23 on Figure 1, attached.

The boreholes were advanced by a truck-mounted drill rig owned and operated by Chilako Drilling Services and extended to depths ranging between 3.0 m and 9.2 m below existing grades. The boreholes were logged by Larry Delong of Chilako Drilling Services.

In general, the natural mineral soils encountered within the boreholes comprised of a layer of lacustrine sand loam, which was generally underlain by stiff medium plastic clay till below approximately 3.0 m depth. It was noted that perched water and saturated lacustrine soils were encountered to depths of up to about 1.2 m below existing grade. The perched water in this area appears to be localized, and is not considered to be a groundwater resource as defined by the AOPA.

Samples of soil collected from the screened zone of the boreholes VF5-23, VF10-23, VF11-23, and VF14-23 were subjected to laboratory grain size (i.e., hydrometer) analyses. The results (attached) indicate a textural breakdown of approximately:

**Table 1: Soil Textural Analyses**

<b>Borehole/Depth</b>	<b>% Sand</b>	<b>% Silt</b>	<b>% Clay</b>
VF5-23 / 2.0-3.7m	24	55	21
VF10-23 / 4.5-5.5m	15	66	19
VF11-23 / 3.1-4.0m	28	55	17
VF14-23 / 3.0-4.5m	20	62	18



To measure the *in situ* permeability of the subsurface soils, 50 mm diameter PVC monitoring wells were constructed in boreholes VF5-23, VF10-23, VF11-23, and VF14-23. The test wells were screened at various depths from 2.7 m to 6.0 m below existing grades (see Table 2). Well saturation of the 50 mm diameter monitoring wells was carried out by filling the monitoring well to the top for several consecutive days. After several days of saturation, the 4-hour water drop for the wells ranged between 0.28 m and 0.43 m. The 4-hour water drop for each of the monitoring wells are listed in Table 2.

To calculate the permeability of the screened portion of the clay till strata at the test well locations, a modified falling head test (as outlined in the USBR Engineering Geology Field Manual Volume 2 [2001]) was used. The input variables and output data are outlined on the attached In Situ Permeability Test reports. The results of the permeability testing indicate an *in situ* hydraulic conductivity,  $k_s$ , values ranging between  $2.0 \times 10^{-7}$  cm/s and  $3.6 \times 10^{-7}$  cm/s (see Table 2).

Using the measured permeability of the clay stratum, the equivalent natural soil thicknesses of naturally occurring material having a hydraulic conductivity of  $1 \times 10^{-6}$  cm/s (the reference standard in AOPA) at the monitoring well locations has been calculated, and those thickness equivalents are presented in Table 2. As indicated, the equivalent thicknesses range between 6.4 m and 12 m. This represents natural material protection in excess of the minimum requirements outlined by the AOPA for solid manure storage (minimum 2 m, Section 9.5-c) and for catch basins (minimum 5 m, Section 9.5-b).

**Table 1: Permeability Test Results**

<b>Borehole</b>	<b>4-hr Water Drop in Well (m)</b>	<b>Length of Screened Zone (m)</b>	<b>Depth of Screen (m)</b>	<b>Calculated Permeability</b>	<b>Calculated Equivalent <math>1 \times 10^{-6}</math> cm/s Thickness (m)</b>
VF5-23	0.43	1.80	2.7 – 4.5	$2.7 \times 10^{-7}$ cm/s	6.7
VF10-23	0.28	1.60	4.4 – 6.0	$2.0 \times 10^{-7}$ cm/s	12.3
VF11-23	0.36	1.60	2.9 – 4.5	$2.2 \times 10^{-7}$ cm/s	7.3
VF14-23	0.40	1.55	2.95 – 4.5	$2.5 \times 10^{-7}$ cm/s	6.4

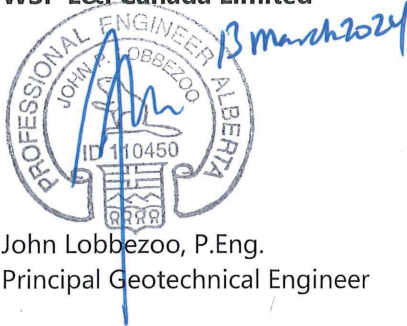
**Conclusion**

Based on the results of the current investigation, permeability testing, and our understanding of the site and proposed development at the site, it is WSP's opinion that the naturally occurring materials at the site satisfy the AOPA requirements for permitting the proposed pens and proposed catch basin at this location.

We trust that this report satisfies your present requirements. Should you have any questions, please contact the undersigned at your convenience.

Yours truly,

**WSP E&I Canada Limited**



John Lobbezoo, P.Eng.  
Principal Geotechnical Engineer

Co-authored by:  
James Le, EIT  
Geotechnical Services

Reviewed by:  
Kevin Spencer, P.Eng., M.Eng.  
Senior. Associate, Geotechnical Engineer

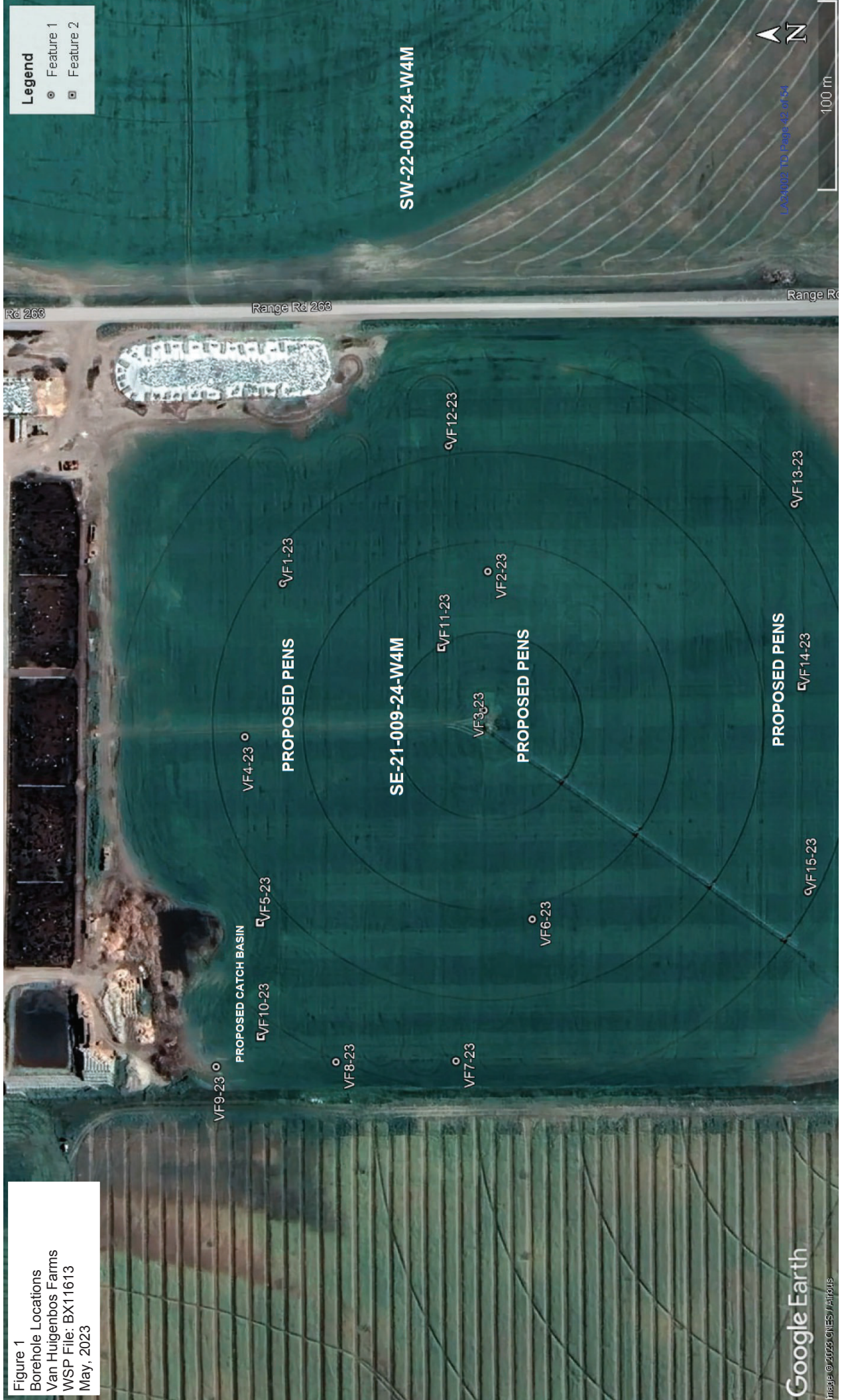
**Attachments**

- Figure 1 Borehole Locations
- In Situ Permeability Test Calculations
- Hydrometer Test
- Soil Profile and Parent Material Description, Chilako Drilling Services

<b>PERMIT TO PRACTICE WSP E&amp;I CANADA LIMITED</b>	
RM SIGNATURE:	
RM APEGA ID #:	11450
DATE:	13 March 2024
<b>PERMIT NUMBER: P004546</b> The Association of Professional Engineers and Geoscientists of Alberta (APEGA)	



Figure 1  
 Borehole Locations  
 Van Huigenbos Farms  
 WSP File: BX11613  
 May, 2023

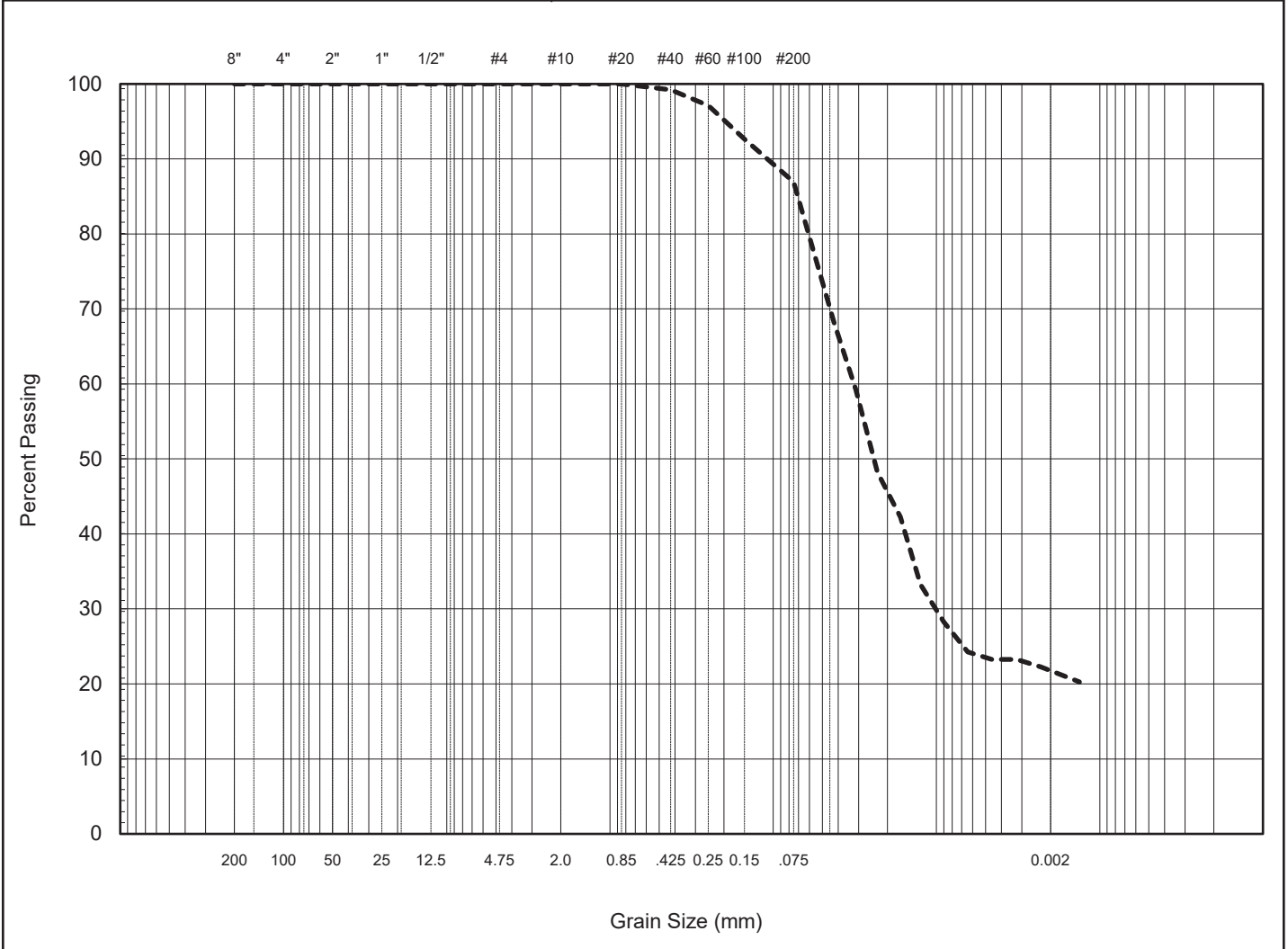


# HYDROMETER TEST

WSP E&I Canada Limited



COBBLES	GRAVEL		SAND			SILT	CLAY
	Coarse	Fine	C	M	F		



Remarks:

Summary			
D10 =	#N/A	mm	<b>Gravel</b> 0 %
D30 =	0.0102	mm	<b>Sand</b> 13 %
D60 =	0.0322	mm	<b>Silt</b> 65 %
Cu =	#N/A		<b>Clay</b> 22 %
Cc =	#N/A		

**Project No:** BX11613  
**Hole No:** VF4-23  
**Depth (m):** 1.5-3.0

**Client:** Linkage Ag Solution  
**Sample:** --  
**Date:** June 1, 2023

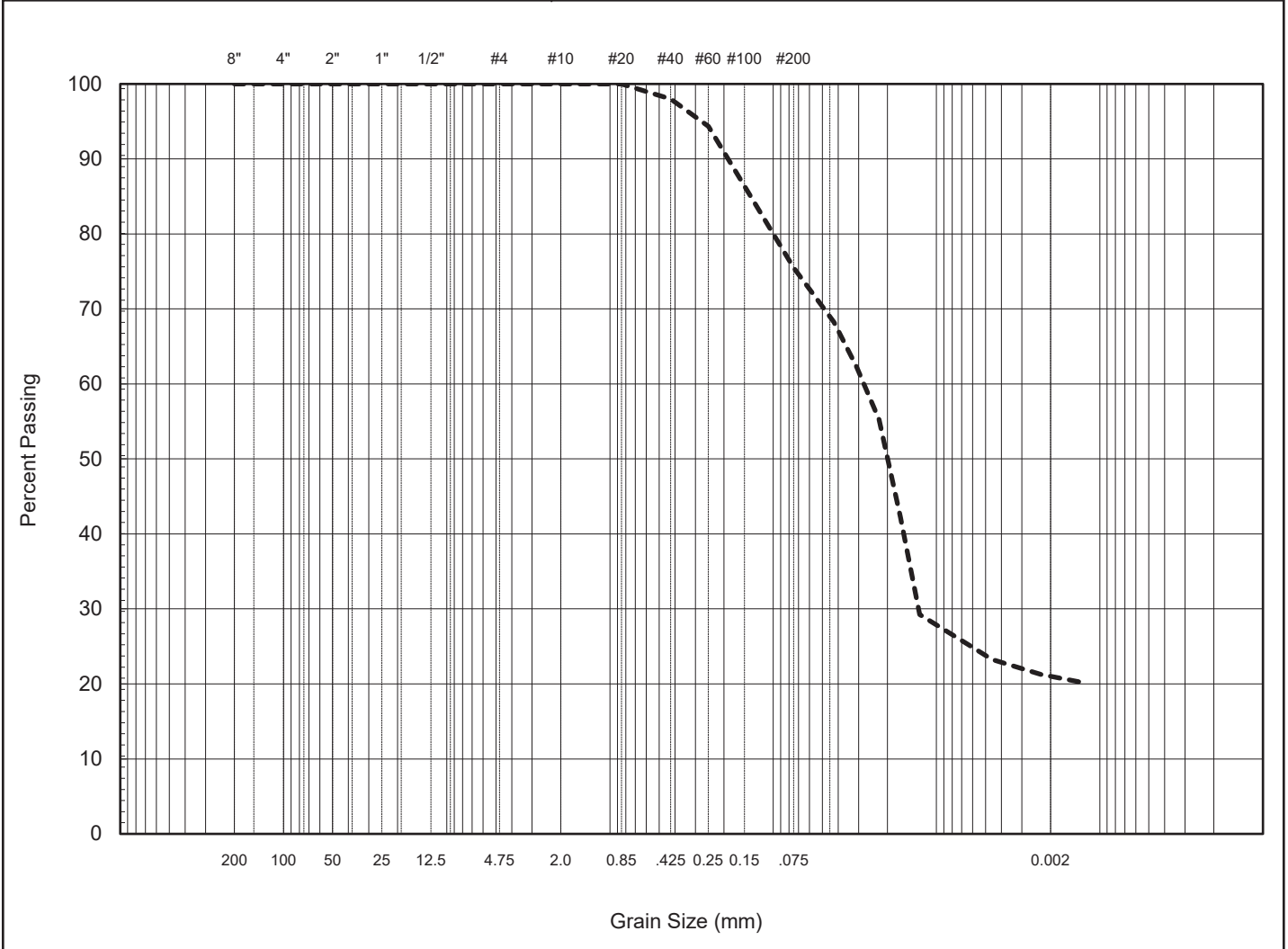
**Tech:** TMW

# HYDROMETER TEST

WSP E&I Canada Limited



COBBLES	GRAVEL		SAND			SILT	CLAY
	Coarse	Fine	C	M	F		



Remarks:

Summary			
D10 =	#N/A	mm	<b>Gravel</b> 0 %
D30 =	0.0129	mm	<b>Sand</b> 24 %
D60 =	0.0281	mm	<b>Silt</b> 55 %
Cu =	#N/A		<b>Clay</b> 21 %
Cc =	#N/A		

**Project No:** BX11613  
**Hole No:** VF4-23  
**Depth (m):** 2.0-3.7

**Client:** Linkage Ag Solution  
**Sample:** --  
**Date:** June 1, 2023

**Tech:** TMW

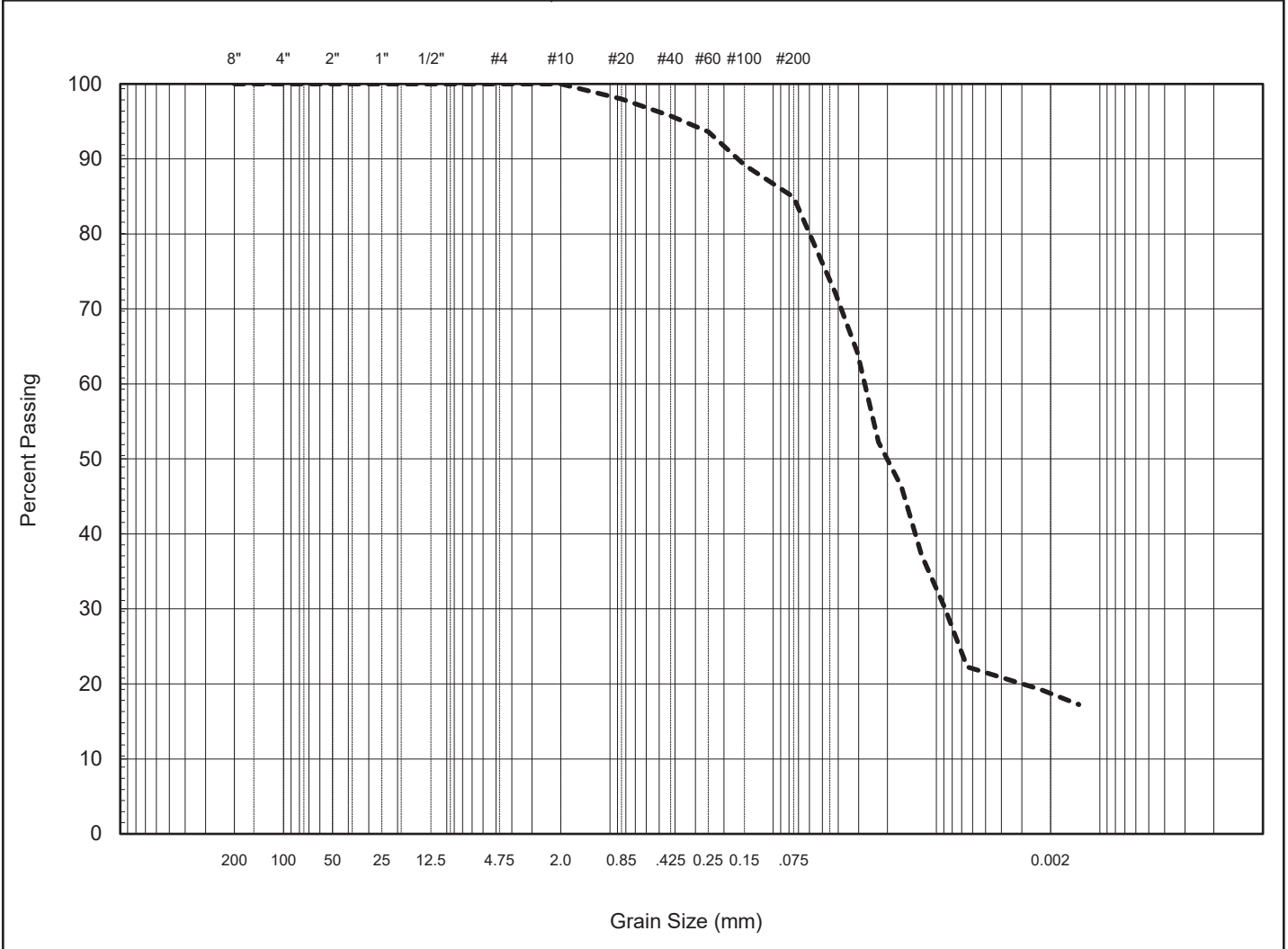


# HYDROMETER TEST

WSP E&I Canada Limited



COBBLES	GRAVEL		SAND			SILT	CLAY
	Coarse	Fine	C	M	F		



Remarks:

Summary			
D10 =	#N/A	mm	<b>Gravel</b> 0 %
D30 =	0.0089	mm	<b>Sand</b> 15 %
D60 =	0.0278	mm	<b>Silt</b> 66 %
Cu =	#N/A		<b>Clay</b> 19 %
Cc =	#N/A		

**Project No:** BX11613  
**Hole No:** VF10-23  
**Depth (m):** 4.5-5.5

**Client:** Linkage Ag Solution  
**Sample:** --  
**Date:** June 1, 2023

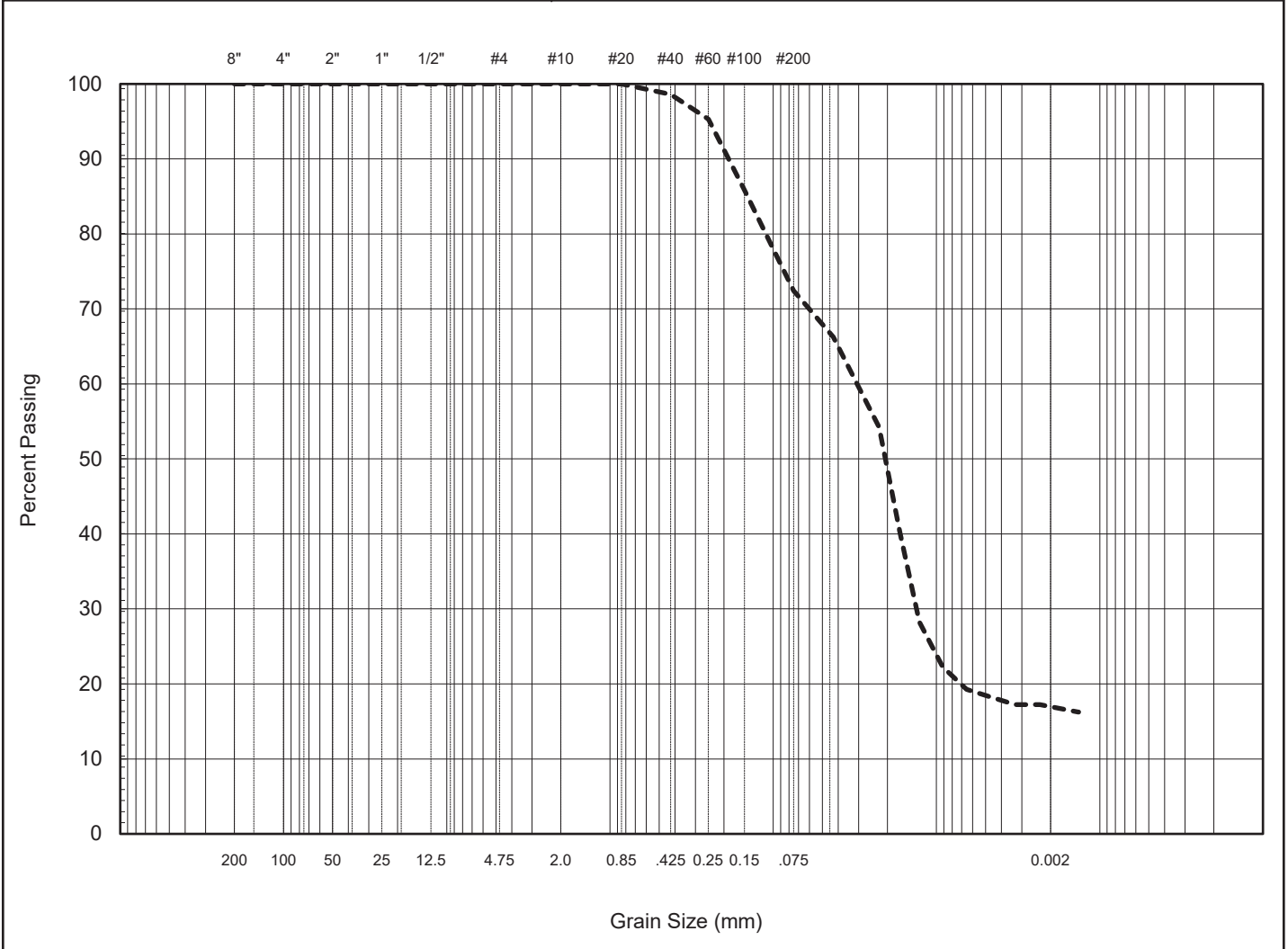
**Tech:** TMW

# HYDROMETER TEST

WSP E&I Canada Limited



COBBLES	GRAVEL		SAND			SILT	CLAY
	Coarse	Fine	C	M	F		



Remarks:

Summary				
D10 =	#N/A	mm	<b>Gravel</b>	0 %
D30 =	0.0133	mm	<b>Sand</b>	28 %
D60 =	0.0307	mm	<b>Silt</b>	55 %
Cu =	#N/A		<b>Clay</b>	17 %
Cc =	#N/A			

**Project No:** BX11613  
**Hole No:** VF11-23  
**Depth (m):** 3.1-4.0

**Client:** Linkage Ag Solution  
**Sample:** --  
**Date:** June 1, 2023

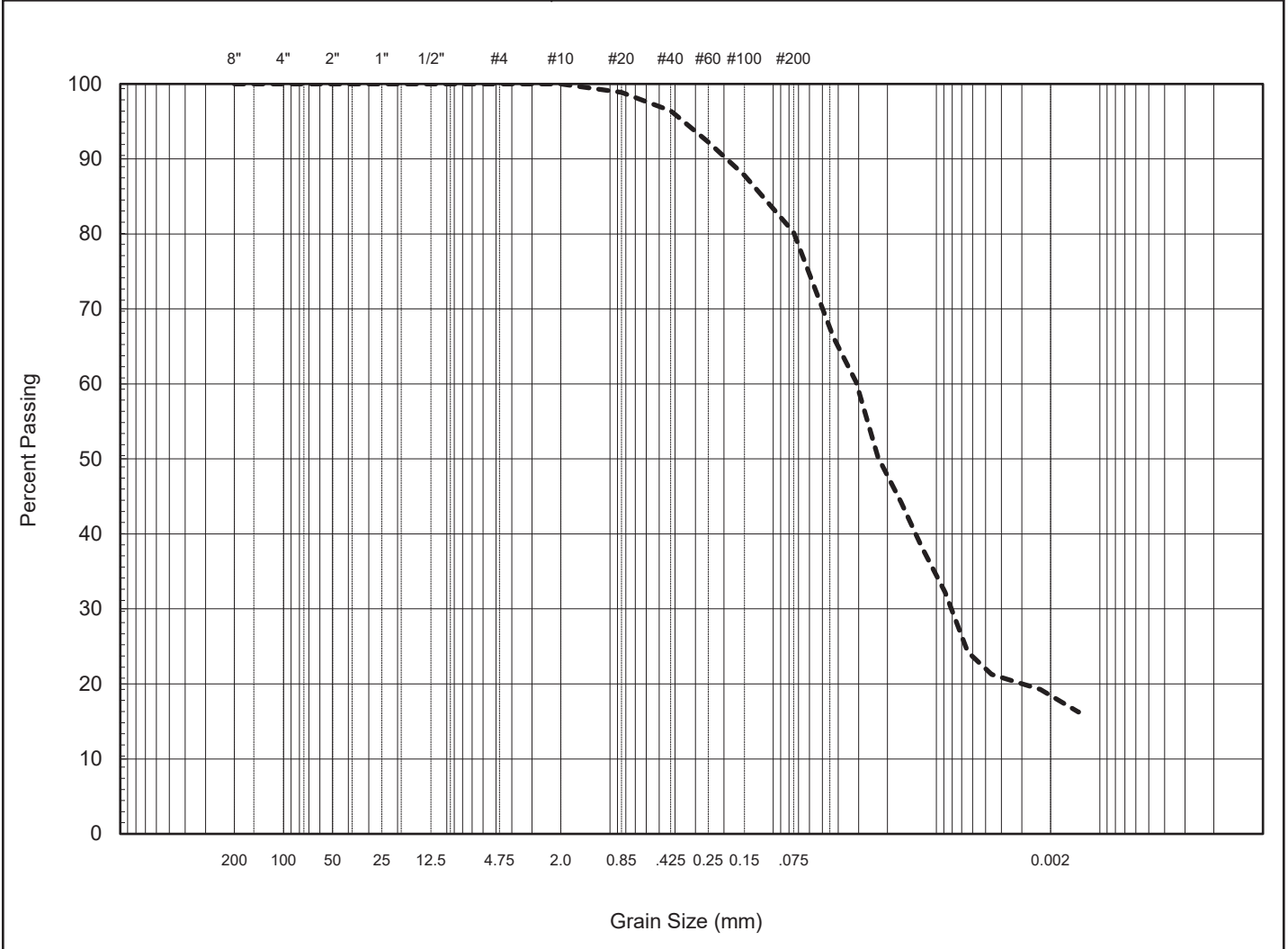
**Tech:** TMW

# HYDROMETER TEST

WSP E&I Canada Limited



COBBLES	GRAVEL		SAND			SILT	CLAY
	Coarse	Fine	C	M	F		



Remarks:

Summary			
D10 =	#N/A	mm	<b>Gravel</b> 0 %
D30 =	0.0082	mm	<b>Sand</b> 20 %
D60 =	0.0309	mm	<b>Silt</b> 62 %
Cu =	#N/A		<b>Clay</b> 18 %
Cc =	#N/A		

**Project No:** BX11613  
**Hole No:** VF14-23  
**Depth (m):** 3.0-4.5

**Client:** Linkage Ag Solution  
**Sample:** --  
**Date:** June 1, 2023

**Tech:** TMW



# VF5-23

## In Situ Permeability Test

Modified Falling Head Permeability Equation

$$K_s = \frac{r^2}{2\ell\Delta t} \left[ \frac{\sinh^{-1} \frac{\ell}{r_e}}{2} \ln \left[ \frac{2H_1 - \ell}{2H_2 - \ell} \right] - \ln \left[ \frac{2H_1H_2 - \ell H_2}{2H_1H_2 - \ell H_1} \right] \right]$$

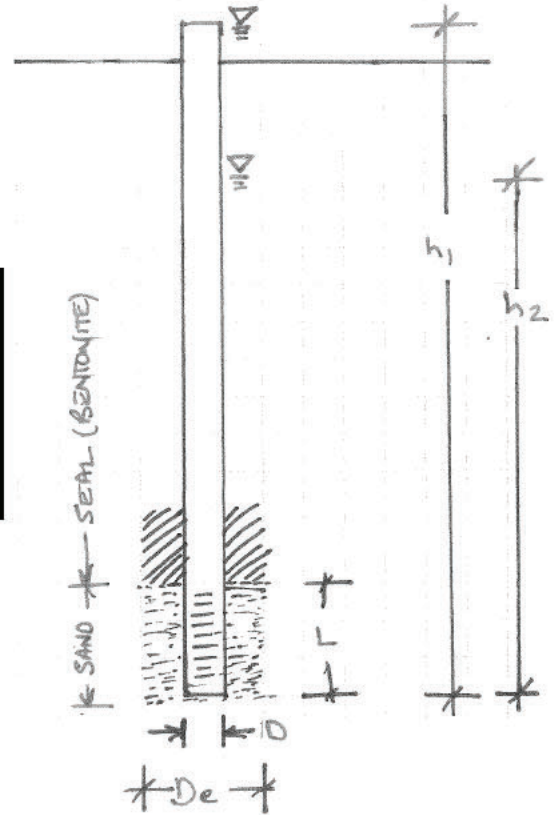
taken from USBR Engineering Geology Field Manual Volume 2 (2001)

### VF5-23 - VanHuigenbos Farms

WSP File: BX11613

INPUT VARIABLES	Terms	Value	Definition
	D	0.0520	diameter of standpipe (m)
	De	0.1500	diameter of borehole (m)
	L	1.80	length of sand section (m)
	h1	5.10	initial height of water above base of hole (m)
	h2	4.67	final height of water above base of hole (m)
t	4.0	time of test (h)	

$$k_s = 2.5E-07 \text{ cm/sec}$$



# VF10-23

## In Situ Permeability Test

Modified Falling Head Permeability Equation

$$K_s = \frac{r^2}{2\ell\Delta t} \left[ \frac{\sinh^{-1} \frac{\ell}{r_e}}{2} \ln \left[ \frac{2H_1 - \ell}{2H_2 - \ell} \right] - \ln \left[ \frac{2H_1H_2 - \ell H_2}{2H_1H_2 - \ell H_1} \right] \right]$$

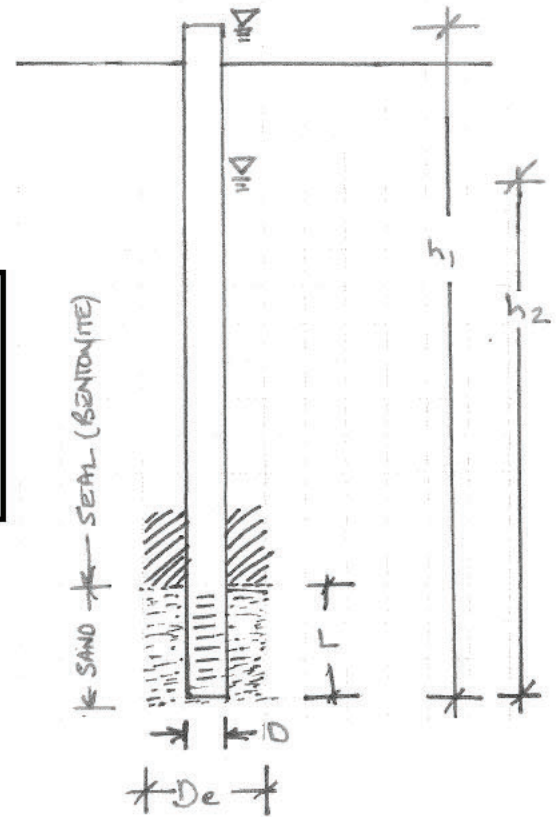
taken from USBR Engineering Geology Field Manual Volume 2 (2001)

### VF10-23 - VanHuigenbos Farms

WSP File: BX11613

INPUT VARIABLES	Terms	Value	Definition
	D	0.0520	diameter of standpipe (m)
	De	0.1500	diameter of borehole (m)
	L	1.60	length of sand section (m)
	h1	6.60	initial height of water above base of hole (m)
	h2	6.32	final height of water above base of hole (m)
t	4.0	time of test (h)	

$$k_s = 1.3E-07 \text{ cm/sec}$$



# VF11-23

## In Situ Permeability Test

Modified Falling Head Permeability Equation

$$K_s = \frac{r^2}{2\ell\Delta t} \left[ \frac{\sinh^{-1} \frac{\ell}{r_e}}{2} \ln \left[ \frac{2H_1 - \ell}{2H_2 - \ell} \right] - \ln \left[ \frac{2H_1H_2 - \ell H_2}{2H_1H_2 - \ell H_1} \right] \right]$$

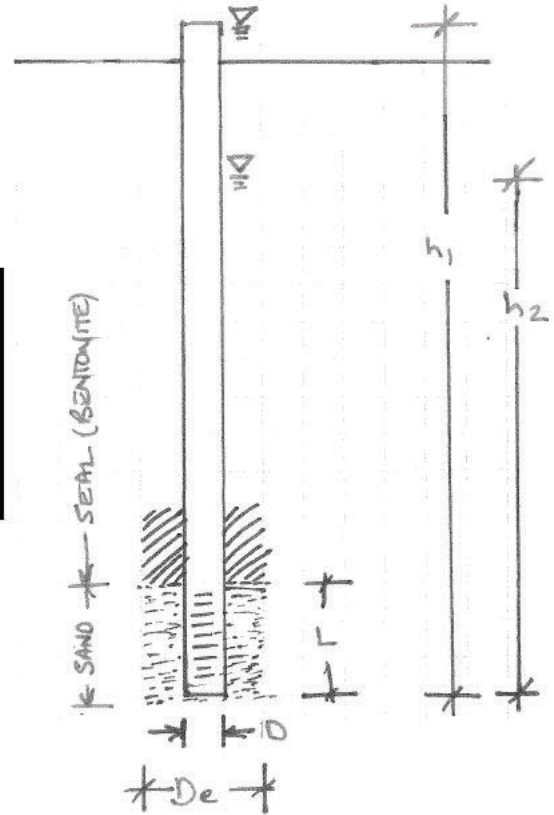
taken from USBR Engineering Geology Field Manual Volume 2 (2001)

### VF11-23 - VanHuigenbos Farms

WSP File: BX11613

INPUT VARIABLES	Terms	Value	Definition
	D	0.0520	diameter of standpipe (m)
	De	0.1500	diameter of borehole (m)
	L	1.60	length of sand section (m)
	h1	5.10	initial height of water above base of hole (m)
	h2	4.74	final height of water above base of hole (m)
t	4.0	time of test (h)	

$$k_s = 2.2E-07 \text{ cm/sec}$$





# VF14-23

## In Situ Permeability Test

Modified Falling Head Permeability Equation

$$K_s = \frac{r^2}{2\ell\Delta t} \left[ \frac{\sinh^{-1} \frac{\ell}{r_e}}{2} \ln \left[ \frac{2H_1 - \ell}{2H_2 - \ell} \right] - \ln \left[ \frac{2H_1H_2 - \ell H_2}{2H_1H_2 - \ell H_1} \right] \right]$$

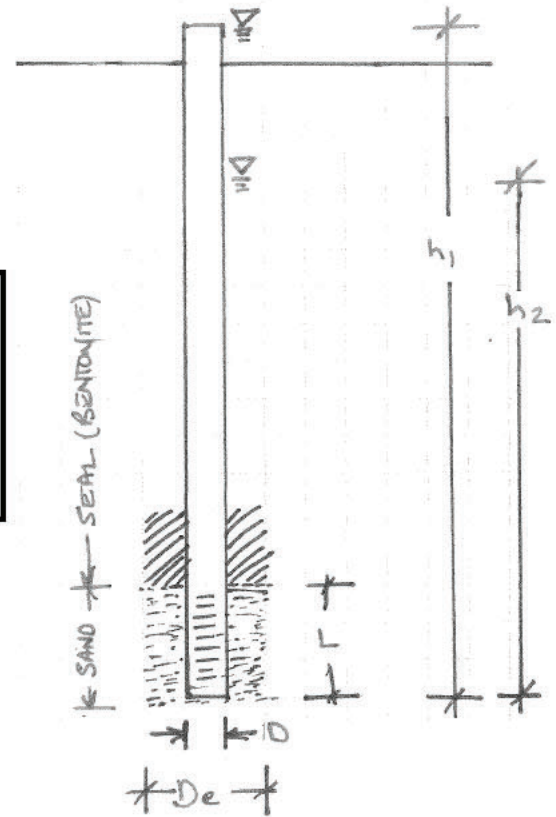
taken from USBR Engineering Geology Field Manual Volume 2 (2001)

### VF14-23 - VanHuigenbos Farms

WSP File: BX11613

INPUT VARIABLES	Terms	Value	Definition
	D	0.0520	diameter of standpipe (m)
	De	0.1500	diameter of borehole (m)
	L	1.55	length of sand section (m)
	h1	5.10	initial height of water above base of hole (m)
	h2	4.70	final height of water above base of hole (m)
t	4.0	time of test (h)	

$$k_s = 2.5E-07 \text{ cm/sec}$$



# CHILAKO DRILLING SERVICES LTD

Box 942 Coaldale, Alberta, T1M 1M8  
(403) 345-3710



## SOIL PROFILE AND PARENT MATERIAL DESCRIPTION

Site Location: SE21-9-26W4, Vanhuigenbos Farms

Date: 1-May-23

Hole #	Location	Depth	Texture	Moisture	Geological	Sample	Remarks
VF1-23	0322880 5513240	0-0.15	LS	M	Topsoil		
		0.15-1.2	LS	M	Lac		Loose
		1.2-1.3	LS	Sat	Lac		Sat @ clay contact, free water
		1.3-3.0	SiC	M-VM	Lac		Stiff, med-high plastic, olive brown Sluff @ 1.2m
VF2-23	0322883 5513133	0-0.15	LS	M	Topsoil		
		0.15-1.2	LS	M	Lac		Loose
		1.2-1.5	LS	Sat	Lac		Loose, free water
		1.5-3.0	SiC	M-VM	Lac		Stiff, med-high plastic, olive brown Sluff @ 1.2m
VF3-23	0322809 5513139	0-0.15	LS	M	Topsoil		
		0.15-1.2	LS	M	Lac		Loose
		1.2-1.6	LS	Sat	Lac		Free water
		1.6-3.0	SiC	M	Lac		Stiff, med-high plastic, olive brown
		3.0-4.5	CL-SiCL	M-VM	Till		Stiff, med plastic, brown Sluff @ 1.2m
VF4-23	0322801 5513264	0-0.15	LS	M	Topsoil		
		0.15-1.2	LS	M	Lac		Loose
		1.2-1.3	LS	Sat	Lac		Loose
		1.3-3.0	SiC	M-VM	Lac	1.5-3.0	Stiff, high plastic, olive brown
VF5-23	0322702 5513260	0-0.15	LS	M	Topsoil		
		0.15-1.1	LS	M	Lac	0.5-1.0	Loose
		1.1-1.2	LS	Sat	Lac		
		1.2-3.7	SiC	M-VM	Lac	2.0-3.7	V.firm, med-high plastic, olive brown
		3.7-4.5	SiCL	M-VM	Lac		V.firm, med plastic, olive brown, sand streaks 50mm H.C. Well installed to 4.5m bgs Screen: 4.5-3.0m Sand: 4.5-2.7m Bentonite: 2.7-0.0m Stickup: 0.6m Hole Diameter: 0.15m
VF6-23	0322696 5513117	0-0.15	LS	M	Topsoil		
		0.15-1.4	LS	M	Lac		Loose
		1.4-1.5	LS	Sat	Lac		Loose
		1.5-3.0	SiC	M-VM	Lac		V.firm, med-high plastic, olive brown

**SOIL PROFILE AND PARENT MATERIAL DESCRIPTION (CONTINUED)**

Hole #	Location	Depth	Texture	Moisture	Geological	Sample	Remarks
VF7-23	0322625 5513160	0-0.15	LS	M	Topsoil		
		0.15-0.6	LS+Gr	M	Lac		
		0.6-1.1	LS	M	Lac		Loose
		1.1-2.0	LS	Sat	Lac		Free water
		2.0-4.6	SiC	M-VM	Lac		V.firm, high plastic, olive brown
		4.6-5.8	CL-C	M	Till		Stiff, med plastic, dark brown
		5.8-9.0	CL	M	Till		Stiff, med plastic, grey, trace gravel, sat. lenses, sluff and free water @ 1.2m
VF8-23	0322627 5513223	0-0.15	LS	M	Topsoil		
		0.15-1.1	LS	M	Lac		
		1.1-1.5	C.S+Gr	Sat	Lac		Free water
		1.5-2.3	SiC	M-VM	Lac		V.firm, high plastic, olive brown
		2.3-4.7	SiCL	M-VM	Lac		V.firm, high plastic, olive brown
		4.7-9.2	C	M	Till	4.7-6.2	Stiff, med-high plastic, dark brown, trace gravel Sluff and Free water @ 1.1m
VF9-23	0322617 5513296	0-0.9	LS	M	Lac		
		0.9-1.0	LS	Sat	Lac		Loose
		1.0-4.3	SiC	VM	Lac		Firm, high plastic, olive brown
		4.3-9.2	C	M	Till		Stiff, med plastic, brown Sluff and free water @ 0.9m
VF10-23	0322641 5513263	0-0.15	LFS	M	Lac		
		0.15-1.0	LFS	M	Lac		
		1.0-1.2	LM.S	M	Lac		
		1.2-1.9	LM.S	Sat	Lac		Free water @ 1.2m
		1.9-3.7	SiC	VM	Lac		V. Firm, med plastic, olive brown
		3.7-5.5	CL-C	M	Till	4.5-5.5	Stiff, med plastic, brown
		5.5-6.0	CL-C	M	Till		Stiff, med plastic, gray 50mm H.C. Well installed to 6.0m BGS Screen: 6.0-4.5m Sand: 6.0-4.4m Bentonite: 4.4-3.2m Stickup: 0.6m Hole Diameter: 0.15m
VF11-23	0322843 5513160	0-0.15	LFS	M	Lac		
		0.15-1.5	LFS	M	Lac		
		1.5-2.0	LFS	Sat	Lac		Free water @ 1.5m
		2.0-3.1	SiC	M	Lac		Stiff, med plastic, olive brown
		3.1-4.0	SiCL	VM	Lac	3.1-4.0	Stiff, med-high plastic, olive brown
		4.0-4.5	CL-C	M-VM	Till	4.0-4.5	Stiff, med-high plastic, brown, sand streaks 50mm H.C. Well installed to 4.5m BGS Screen: 4.5-3.0m Sand: 4.5-2.9m Bentonite: 2.9-0.0m Stickup: 0.6m Hole Diameter: 0.15m



### SOIL PROFILE AND PARENT MATERIAL DESCRIPTION (CONTINUED)

Hole #	Location	Depth	Texture	Moisture	Geological	Sample	Remarks
VF12-23	0322950 5513151	0-0.15	FSL	M	Lac	3.0-4.5	Free water @ 1.3m Stiff, med plastic, olive brown
		0.15-1.0	FSL	M	Lac		
		1.0-1.3	LFS	VM	Lac		
		1.3-1.5	LFS	Sat	Lac		
		1.5-4.5	SiCL-SiC	M	Lac		
VF13-23	0322912 5512994	0-0.15	LS	M	Topsoil	3.5-4.5	V. Firm, med plastic, olive brown V. Firm, med plastic, olive brown Stiff, med plastic, olive brown
		0.15-0.7	LS	M	Lac		
		0.7-1.5	LS	M	Lac		
		1.5-3.4	SiCL	M-VM	Lac		
		3.4-3.5	CL	VM	Till		
3.5-4.5	CL-C	M	Till				
VF14-23	0322816 5512971	0-0.15	FLS	M	Topsoil	3.0-4.5	Soft, VM, silt lenses Stiff, med plastic, brown Stiff, med plastic, brown, sand streaks 50mm H.C. Well installed to 4.5m BGS Screen: 4.5-3.0m Sand: 4.5-2.95m Bentonite: 2.95-0.0m Stickup: 0.6m Hole Diameter: 0.15m
		0.15-0.8	LS+Gr	M	Lac		
		0.8-1.2	SiCL-SiC	M	Lac		
		1.2-2.8	SiCL-SiC	M	Lac		
		2.8-4.5	CL-C	M	Till		
VF15-23	0322707 5512972	0-0.15	FLS	M	Topsoil	2.6-3.0	Soft, med plastic, silty layers Stiff, med plastic, brown, sand streaks
		0.15-1.0	FLS	M	Lac		
		1.0-2.6	SiCL	M	Lac		
		2.6-3.0	CL	M	Till		

Legend: L           Loam  
C           Clay  
S           Sand  
Gr.       Gravel  
Si       Silt  
F       Fine (sand)  
VF      Very Fine (sand)

Eg. VFSCL = Very Fine Sandy Clay Loam