

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
<input type="checkbox"/> Approval <input type="checkbox"/> Registration <input checked="" type="checkbox"/> Authorization <input type="checkbox"/> Amendment	<u>LA25007</u>	<u>NW 10-11-21 W4M</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.

January 16, 2025

Date of signing

Vanden Dool Farms Ltd.

Corporate name (if applicable)

Signature

Peter Vanden Dool

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)
2 corrals	40x30x1
2 shelters with an open south side in the corrals	23x11x3.75
AO Note: The applicant is proposing 2 pens, each 40 m x 30 m. The total proposed dimensions are 80 m x 30 m. The shelters are within the footprint of the pens and are not separate facilities	

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

Existing facilities	Dimensions (m) (length, width, and depth)	NRCB USE ONLY
LA24038		All existing facilities confirmed

NRCB USE ONLY

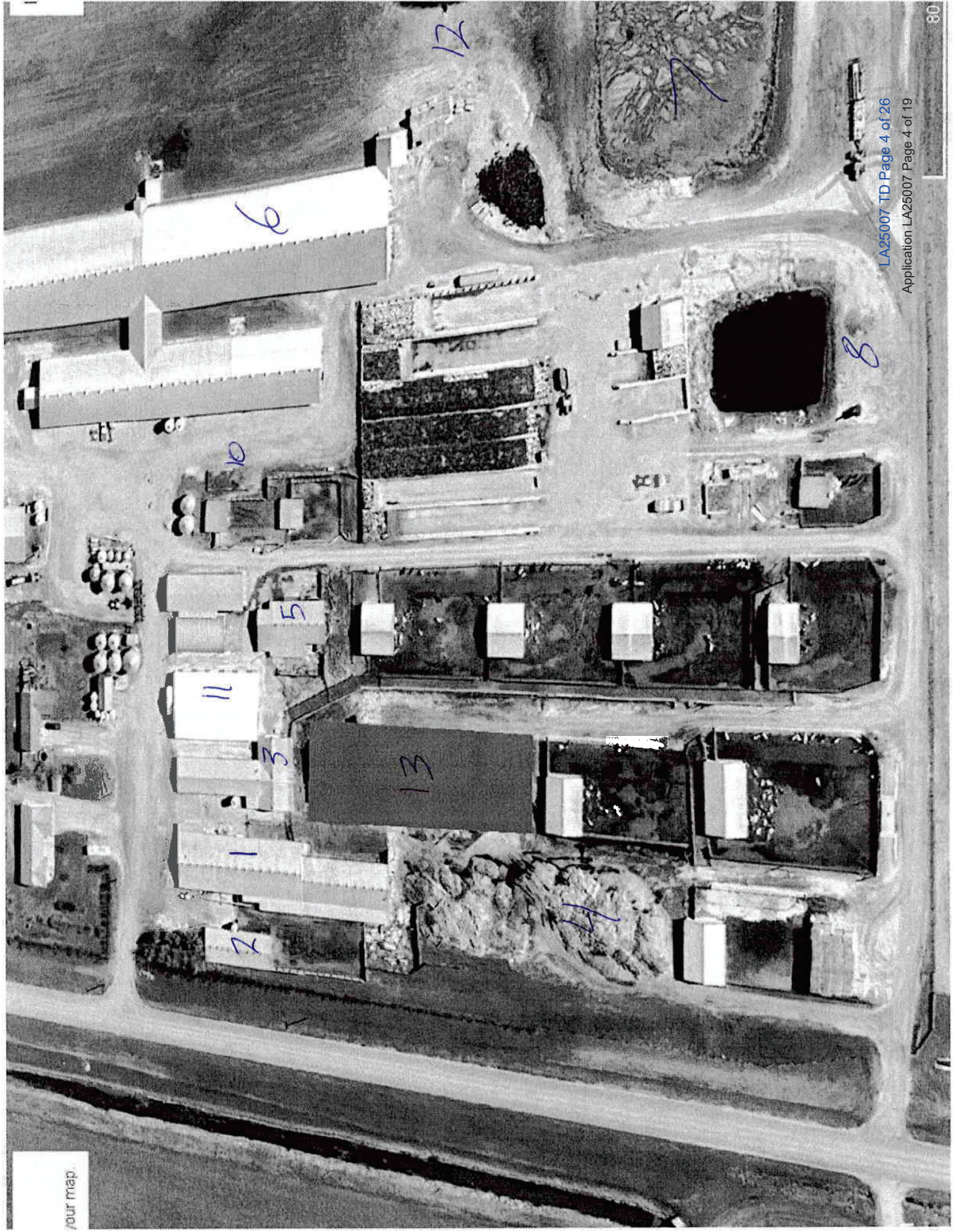
CFO site is permitted under Approval LA17027, and Authorizations LA18029, and LA24038

Existing Facilities

		dimensions in (m)
1	Old dairy barn	76 x 20.8
2	Calf barn 1	10 x 23
3	old maternity barn	21.8 x 10.8
4	old EMS	19.3 x 33 x 3.6
5	old dry cow barn	14.2 x 24
6	New dairy barn	31.9 x 182.8 + 21.6 x 114.6
7	new EMS	100 x 45 x 3.6 (actual size 115 x 66 x 6.5 deep)
8	old catch basin	40 x 40 x 3.6
9	feed pens	20 x 46 + 141.6 x 30 + 17 x 44.5 + 86 x 24 + 23 x 30.5
10	solid manure storage pad	6.1 x 7.3
11	New calf barn	31.7 x 19.5 + 7.3 x 3
12	New catch basin	75 x 50 x 6
13	Proposed corrals	80*30

Proposed pens





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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 December 2026

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
no changes			

Last updated September 11, 2023

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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 ____ day of _____, 20____.

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 _____
C121111060NW

Signed this 16 day of January, 2025.

Signature of Applicant or Agent

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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: Catch Basin (old)

Proposed 1: corrals (proposed pens)

Proposed 2: _____

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?	<div><input checked="" type="checkbox"/> > 1 m</div> <div><input type="checkbox"/> ≤ 1 m</div>	<div><div><div></div></div>> 1 m</div> <div><input type="checkbox"/> ≤ 1 m</div>	<div><input type="checkbox"/> > 1 m</div> <div><input type="checkbox"/> ≤ 1 m</div>	<div><input type="checkbox"/> > 1 m</div> <div><input type="checkbox"/> ≤ 1 m</div>	<div><div><input checked="" type="checkbox"/> YES</div><div><input type="checkbox"/> NO</div></div> <div><input type="checkbox"/> YES with exemption</div>	Confirmed not in a flood plain
	Surface water information	How many springs are within 100 m of the manure storage facility or manure collection area?	None	None			<div><div><input checked="" type="checkbox"/> YES</div><div><input type="checkbox"/> NO</div></div> <div><input type="checkbox"/> YES with exemption</div>
How many water wells are within 100 m of the manure storage facility or manure collection area?		None	None			<div><div><input checked="" type="checkbox"/> YES</div><div><input type="checkbox"/> NO</div></div> <div><input type="checkbox"/> YES with exemption</div>	No water wells observed
What is the shortest distance from the manure collection or storage facility to a surface water body? (e.g., lake, creek, slough, seasonal)		30m to Canal				<div><div><input checked="" type="checkbox"/> YES</div><div><input type="checkbox"/> NO</div></div> <div><input type="checkbox"/> YES with exemption</div>	Proposed pens are 96 m to west canal, and 119 m to south canal
Groundwater information	What is the depth to the water table?	<10m				<div><div><input checked="" type="checkbox"/> YES</div><div><input type="checkbox"/> NO</div></div> <div><input type="checkbox"/> YES with exemption</div>	Not observed in soils assessment > 10 m below grade
	What is the depth to the groundwater resource/aquifer you draw water from?	None				<div><div><input checked="" type="checkbox"/> YES</div><div><input type="checkbox"/> NO</div></div> <div><input type="checkbox"/> YES with exemption</div>	No UGR identified as no water wells in area

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

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

Neighbour name(s)	Legal land description	Distance (m)	Zoning (LUB) category	MDS category (1-4)	NRCB USE ONLY		
					Distance (m)	Waiver attached (if required)	Meets regulations
Lyle Adams	SE-9-11-21-W4	560	Agriculture 1	1	565 m		
Brendan Grishnich	NE-10-11-21-W4	1144	Agriculture 1	1	1168 m		
unknown	NW-3-11-21-W4	908	Urban Fringe*	1	911 m		

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

Name of land owner(s)*	Legal land description	Usable area** (ha)	Soil zone ***	NRCB USE ONLY	
				Usable area (ha)	Agreement attached (if required)
N/A for authorizations					
Total					

* 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)

*In Lethbridge County's Land Use Bylaw, Urban Fringe is an agricultural use designation, with limitations to balance the fringe area of urban municipalities. Agricultural buildings, and extensive agriculture/grazing are permitted uses, with grouped country residential, industrial, and commercial (non-designated) are prohibited. Therefore, I assessed it as category 1.

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NRCB USE ONLY

MINIMUM DISTANCE SEPARATION

Methods used to determine distance (if applicable): Aerial photography

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

Requirements (m): Category 1: 494 m Category 2: 659 m Category 3: 824 m Category 4: 1319 m

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: N/A for authorizations

Land base listed: _____

Area not suitable: _____

Available area: _____

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 Authorization LA08010

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NRCB USE ONLY

ALL SIGNATURES IN FILE

☒ YES ☐ NO

DATES OF APPROVAL OFFICER SITE VISITS

February 26, 2025	

CORRESPONDENCE WITH MUNICIPALITIES AND REFERRAL AGENCIES

Date deeming letters sent: January 21, 2025

Municipality: Lethbridge County

☒ 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: LNID, Town of Picture Butte ☐ N/A

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

Other: Atco Gas, Fortis Alberta ☐ N/A

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

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NRCB USE ONLY

ENVIRONMENTAL RISK SCREENING INFORMATION

ERST for proposed facilities

Facility	Groundwater score	Surface water score	File number
New pens	Low	Low	LA25007

ERST for existing facilities

Facility	Groundwater score	Surface water score	File number
Solid manure pad	low	low	LA18029
calf barn	low	low	LA18029
catch basin	low	low	LA24038
EMS	low	low	LA18029
All other facilities presumed to be low risk to both ground and surface water			

ERST related comments:

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NRCB USE ONLY

WATER WELL AND SURFACE WATER INFORMATION

Well IDs: No water wells in area

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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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. 2 corrals
2. ~~LA24038~~

Manure storage capacity

	Length (m)	Width (m)	Depth below ground level (m)	NRCB USE ONLY Estimated storage capacity (m ³)
1.	80	30	0	9 months storage
2.				
TOTAL CAPACITY				

☐ 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

There is minimal run-on water. The run-off water will go to the catch basin in LA24038

AO Note, the applicant is proposing to construct shelters in these pens; therefore they will be partially covered

Naturally occurring protective layer details

Thickness of naturally occurring protective layer	10.7 (m)	Provide details (as required) AO Note: Clay till, screened from 6.9 m to 10.1 m below grade. Engineer concluded the 3.1 m thick clay layer represented equivalent of 67 m thick layer with HC of 1×10^{-6} cm/s.	
Soil texture	% sand	% silt	% clay
Hydraulic conductivity - naturally occurring protective layer	Depth and type of soil tested 10.7 clay	Hydraulic conductivity (cm/s) 4.6×10^{-8} cm/s	Describe test standard used 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

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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: > 10 m Requirements met: ☒ YES ☐ NO

Depth to uppermost groundwater resource: No UGR identified Requirements met: ☒ YES ☐ NO

ERST completed: ☒ see ERST page for details

Surface water control systems

Requirements met: ☒ YES ☐ NO Details/comments:

Naturally occurring protective layer details

Layer specification comments (e.g. sand lenses; layering uniform or irregular; number and location of boreholes):
BH17-02, 3.1 m thick clay till from 6.9 m to 10.1 m below grade.

I used Technical Guideline Agdex 096-63 "Subsoil Investigations for Naturally Occurring Protective Layers" when assessing the soils investigation report for this application. Based on the proximity from the test holes to the proposed pens, I can extrapolate that the naturally occurring protective layer extends under the pens.

Catch Basin Storage Volume Calculator

Construction Dimensions of Catch Basin

* Only cells in blue can be changed.

Overall Dimensions of Catch Basin

Total Length* ₄	-	m
Total Width* ₄	-	m
Total Depth* ₄	-	m
Design Capacity Depth	- 0.50	m
End Slope* ₄	3	run:rise
Side Slope* ₄	3	run:rise
Length of Bottom	-	m
Width of Bottom	-	m

Capacity @ top of Bank

- m³

Design Capacity of Catch Basin (freeboard level)

Length (design capacity depth)	-	3.0	m
Width (design capacity depth)	-	3.0	m
Total Depth	-	-	m
Design Capacity Depth	-	0.50	m
End Slope		3	run:rise
Side Slope		3	run:rise

Design Capacity (freeboard level) - 2 m³

(level) g m²

Catch Basin Dimensions

0 ft
0 ft
0 ft
-2 ft
3 run:rise
3 run:rise
3 run:rise
0 ft
0 ft

Capacity (@top)

0 ft³
0 Imp. Gal.

Design Capacity (freeboard level)

-10 ft
-10 ft
0 ft
-2 ft
3 run:rise
3 run:rise
3 run:rise

- 53 ft³
- 330 Imp. Gal.
97 ft²

CFO Name ₁ Vanden Dool new pens
Land Location ₁ 1-1-4-W5

Paved Runoff Catchment Area(s)

Area ₂	Length (m)	Width (m)	Area (m ²)
1			0.0
2			0.0
3			0.0
4			0.0
5			0.0
Total Area (m ²)			0

Unpaved Runoff Catchment Area(s)

Area ₂	Length (m)	Width (m)	Area (m ²)
6	40	30	1,200.0
7			0.0
8			0.0
9			0.0
10			0.0
Total Area (m ²)			1,200

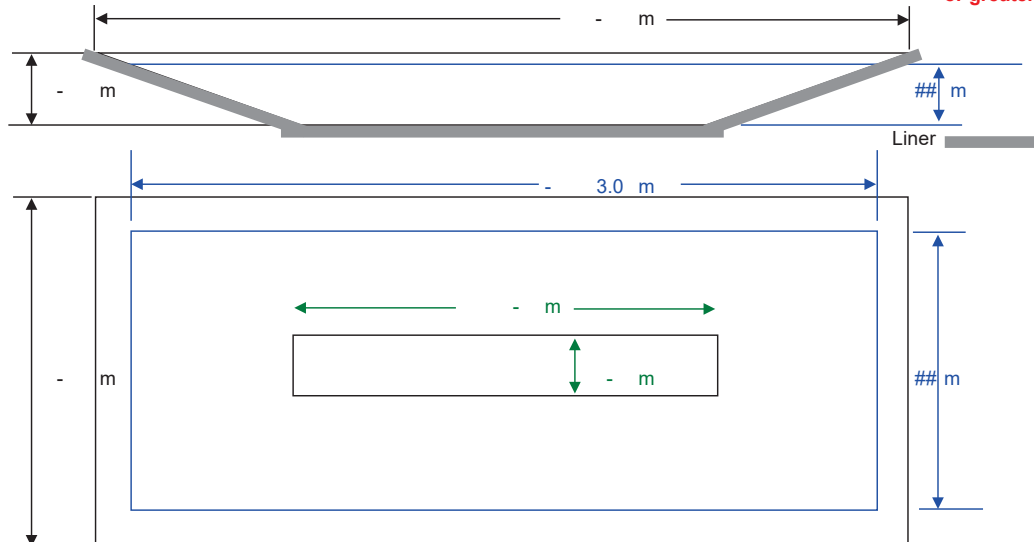
Rainfall (Select Town ₃)

Picture Butte 85
AOPA Design Rainfall 85 mm

Minimum Catchbasin Storage Volume Required

61 m³ ** 2161.2576 ft³
13462.113 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

Additional CB requirements for addition of new pens

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NRCB USE ONLY	
RUNOFF CONTROL CATCH BASIN CAPACITY SUMMARY (if applicable)	
Facility 1	
Name / description Catch basin east	Capacity 9809 cubic metres
Facility 2	
Name / description catch basin south	Capacity 2468 metres cubed
Facility 3	
Name / description	Capacity
Facility 4	
Name / description	Capacity
TOTAL CAPACITY	12,277 metres cubed
RUNOFF VOLUME FROM CONTRIBUTING AREAS	1200 cubic metres from LA24038 + 61 cubic metres from LA25007 = 1261 cubic metres required
MEETS AOPA RUNOFF CONTROL VOLUME REQUIREMENTS	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO

July 24, 2017

Amec Foster Wheeler File: BX30484

Vanden Dool Farms Ltd.
P.O. Box 610
Picture Butte, AB T0K 1V0



Attention: Mr. Peter Vanden Dool

**Re: Geotechnical Review and Evaluation
Proposed Catch Basin
NW-10-11-21-W4, near Picture Butte, 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 the proposed catch basin, to be located north of an existing lagoon, as illustrated on Figure 1.

In order to demonstrate the suitability of the natural clay soils for consideration as a naturally occurring protective layer, a series of three boreholes were advanced at the site on June 14, 2017. The boreholes were advanced at the approximate locations illustrated on Figure 1.

The boreholes were advanced by a truck-mounted drill rig, and extended to depths of 7.6 m below existing grades. Chilako Drilling Services returned to the site on July 14, 2017 in order to redrill and install a new test well in borehole BH17-02. At this time, borehole BH17-02 was extended to 10.7 m depth. These boreholes were logged by an Amec Foster Wheeler EIT (see attachments).

In general, the soils encountered in the boreholes were predominantly clay till, with lacustrine medium plastic clay observed to about 3 m depth. No groundwater resource (as defined by the AOPA) was identified within the 10.7 m drilling depth.

In order to demonstrate the permeability of the subsurface soils, a 50 mm diameter PVC monitoring well was constructed in borehole BH17-02. The test well was screened from 6.9 m to 10.1 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. After several days, the 24 hour water drop in the standpipe at BH17-02 was measured to be about 1.47 m.

In order to calculate the permeability of the screened portion of the clay stratum at the test well location, 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* report, attached. As outlined on the report, the results of the *in situ* permeability testing indicate a hydraulic conductivity, k_s , of 4.6×10^{-6} cm/s.

Using the measured permeability of the clay stratum, the 3.1 m portion of clay which has been screened at borehole BH17-02 has been estimated to represent an equivalent of about 67 m of naturally occurring materials having a hydraulic conductivity of 1×10^{-6} cm/s. This represents

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natural material protection in excess of the minimum requirements outlined by the AOPA for catch basins (minimum 5 m, Section 9.5-b).

Conclusion

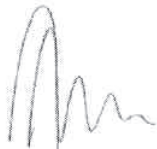
Based on the results of the current investigation and permeability testing, and our understanding of the site and proposed development at the site, it is Amec Foster Wheeler's opinion that the naturally occurring materials at the site satisfy the requirements for a naturally occurring 'protective layer'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

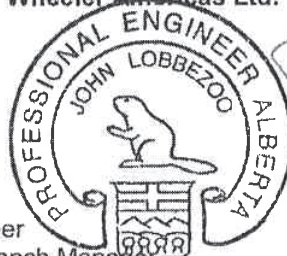
While a naturally occurring protective layer was ascertained for the site, it is noted that localized silty sand lenses were encountered at about 1.3 m depth in one of the boreholes. Following excavation of the lagoon, the base and sideslopes should be reviewed, and any sandy layers observed should be subexcavated to a minimum depth of 1.0 m and replaced with well compacted low permeable clay soils. The extent of excavation will require field determination at the time of construction. Amec Foster Wheeler can assist further in this regard.

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.

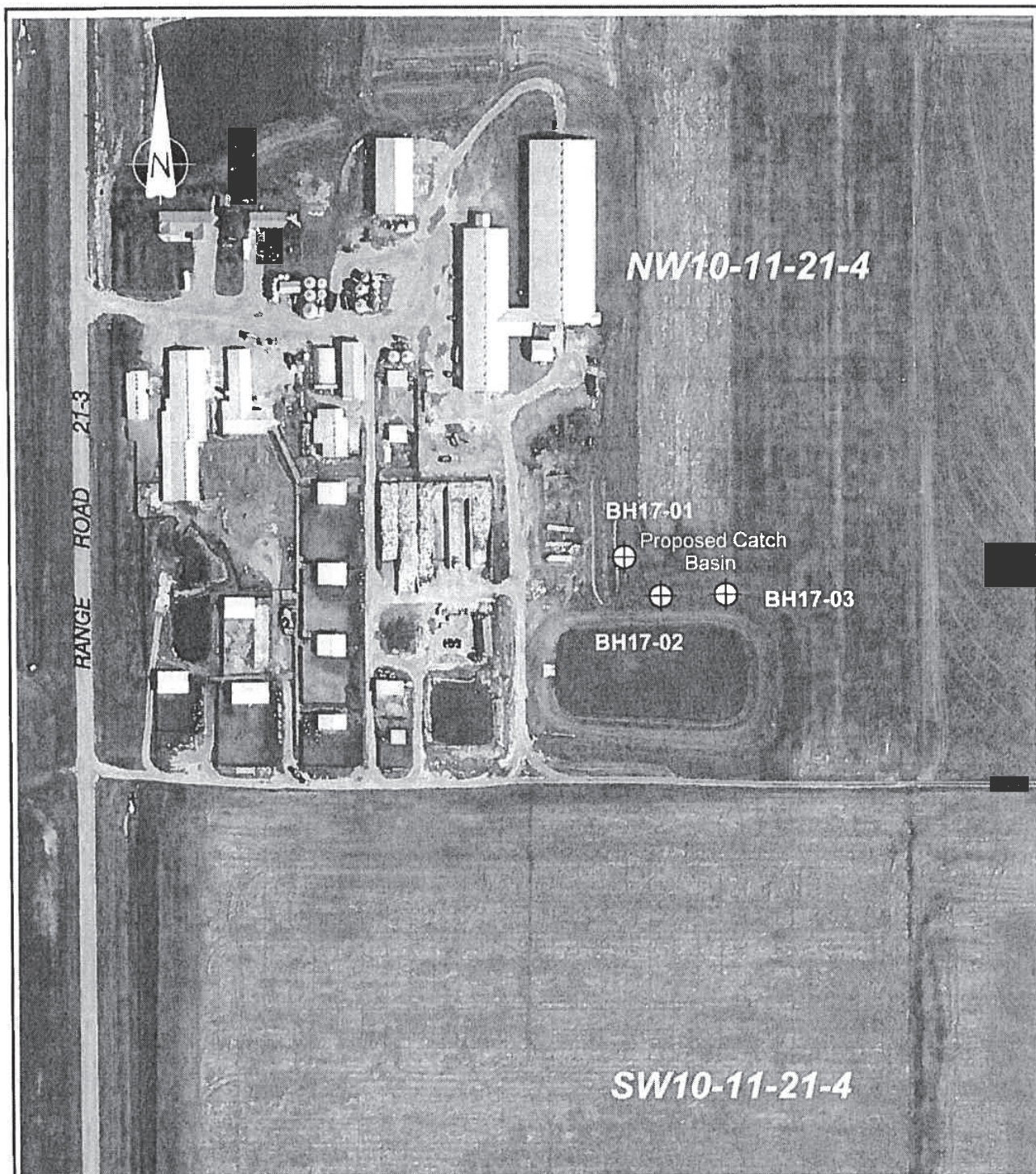

John Lobbezoo, P.Eng.
Senior Geotechnical Engineer
Lethbridge/Medicine Hat Branch Manager



APEGA Permit: P04546

Attachments:

Figure 1 – Borehole Location Plan
In Situ Permeability Test Calculations
Borehole Logs
Explanation of Symbols and Terms used on Logs



Amec Foster Wheeler Environment & Infrastructure 469 - 40th Street South Lethbridge, Alberta CANADA T1J 4M1 Tel. (403) 327-7474 Fax (403) 327-7682		amec foster wheeler		Vanden Dool Farms Ltd.	
TITLE BOREHOLE LOCATION PLAN		DWN BY: BJ	DATUM: NA	DATE: JUNE 2017	
PROJECT Vanden Dool NRCB Permeability Testing NW10-11-21-W4M near Picture Butte, Alberta		CHK'D BY: BM	PROJECT NO: BX30484	FIGURE 1	
		SCALE: NTS			

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BH17-02

In Situ Permeability Test



Modified Falling Head Permeability Equation

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

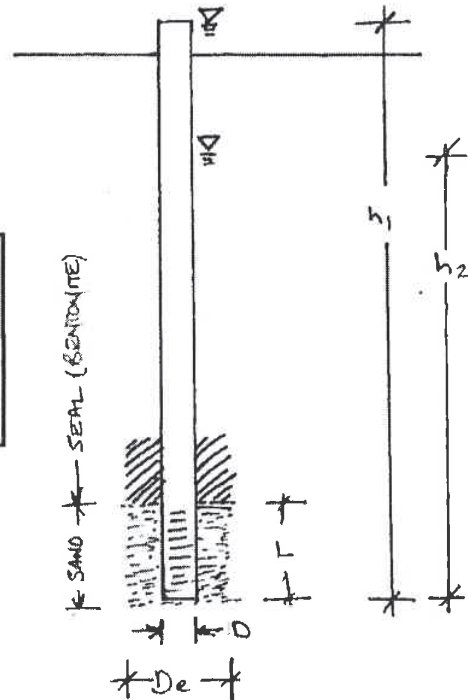
taken from USBR Engineering Geology Field Manual Volume 2 (2001)

BH 17-02 - Vanden Dool Farms Ltd.

Amec Foster Wheeler File: BX30484

INPUT VARIABLES	Terms	Value	Definition
	D	0.0520	diameter of standpipe (m)
	De	0.1500	diameter of borehole (m)
	L	3.10	length of sand section (m)
	h1	10.60	initial height of water above base of hole (m)
	h2	9.13	final height of water above base of hole (m)
	t	24.0	time of test (h)

Ks = 4.6E-08 cm/sec



PROJECT: Vanden Dool NRCB Permeability Testing		DRILLER: Biantoo Environmental Services Inc.		BOREHOLE NO: BH17-01	
CLIENT: Vanden Dool Farms Ltd.		DRILL/METHOD: Truck Mounted Drill/SSA		PROJECT NO: BX30484	
LOCATION: Near west edge of proposed catch basin; Refer to Figure 1				ELEVATION: --	
SAMPLE TYPE <input checked="" type="checkbox"/> Shelby Tube		<input checked="" type="checkbox"/> No Recovery		<input checked="" type="checkbox"/> SPT Test (N)	
<input type="checkbox"/> Grab Sample		<input type="checkbox"/> Split-Pen		<input type="checkbox"/> Core	
BACKFILL TYPE <input checked="" type="checkbox"/> Bentonite		<input type="checkbox"/> Pea Gravel		<input type="checkbox"/> Slough	
<input type="checkbox"/> Grout		<input checked="" type="checkbox"/> Drill Cuttings		<input type="checkbox"/> Sand	

Depth (m)	STANDARD PEN (N) 20 40 60 80 PLASTIC M.C. LIQUID 20 40 60 80	SOIL SYMBOL	SOIL DESCRIPTION	SPT (N)	SAMPLE TYPE	SAMPLE NO	SLOTTED PIEZOMETER	OTHER TESTS COMMENTS	Depth (m)
0			TOPSOIL (300 mm thick)						
0.5	45		CLAY -medium plastic, silty, sandy, mottled brown, moist			S1		PP=1.5 kg/cm2	0.5
1.0	55					S2		PP=1.5 kg/cm2	1.0
1.5	60					S3		PP=2.0 kg/cm2	1.5
2.0	65		CLAY TILL -medium plastic, silty, sandy, trace gravel mottled brown, moist			S4		PP=1.0 kg/cm2	2.0
2.5	60		...softer at 2.9m depth			S5		PP=2.0 kg/cm2	2.5
3.0	55		...coal and oxide inclusions below 3.0m depth			S6		PP=2.0 kg/cm2	3.0
3.5	50					S7		PP=2.0 kg/cm2	3.5
4.0	45		...intermittent sand stringers from 5.1m to 5.5m depth, loose			S8		PP=1.0 kg/cm2	4.0
4.5	40					S9			4.5
5.0	35		...softer from 6.1m to 7.4m depth			S10		PP=1.5 kg/cm2	5.0
5.5	30								5.5
6.0	25								6.0
6.5	20								6.5
7.0	15								7.0
7.5	10		End of Borehole at 7.6 m depth						7.5
8.0									8.0
8.5									8.5
9.0									9.0
9.5									9.5
10.0									10.0
10.5									10.5
11.0									11.0
11.5									11.5
12.0									12.0
12.5									12.5
13.0									13.0
13.5									13.5
14.0									14.0
14.5									14.5
15.0									15.0

Amec Foster Wheeler Environment & Infrastructure	LOGGED BY: BM	COMPLETION DEPTH: 7.60 m
	REVIEWED BY: JL	COMPLETION DATE: 14/6/17
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PROJECT: Vanden Dool NRCB Permeability Testing		DRILLER: Blantco Environmental Services Inc./Chilako		BOREHOLE NO: BH17-02	
CLIENT: Vanden Dool Farms Ltd.		DRILL/METHOD: Truck Mounted Drill/SSA		PROJECT NO: BX30484	
LOCATION: Near center of proposed catch basin; Refer to Figure 1				ELEVATION: --	
SAMPLE TYPE		<input checked="" type="checkbox"/> Shelby Tube	<input type="checkbox"/> No Recovery	<input checked="" type="checkbox"/> SPT Test (N)	<input type="checkbox"/> Grab Sample
BACKFILL TYPE		<input type="checkbox"/> Bentonite	<input type="checkbox"/> Pea Gravel	<input type="checkbox"/> Slough	<input type="checkbox"/> Grout
		<input type="checkbox"/> Split-Pen	<input type="checkbox"/> Core	<input type="checkbox"/> Drill Cuttings	<input type="checkbox"/> Sand

Depth (m)	STANDARD PEN (N)	SOIL SYMBOL	SOIL DESCRIPTION	SPT (N)	SAMPLE NO	WELL INSTALLATION	OTHER TESTS COMMENTS	Depth (m)
0			TOPSOIL (300 mm thick)					0
0.5			CLAY -medium plastic, silty, sandy, dark brown, moist		S1			0.5
1.0			...brown below 0.7m depth		S2			1.0
1.5			...sand/silt lens (200mm thick) at 1.3m depth		S3		PP=0.5 kg/cm2	1.5
2.0			...softer below 1.5m depth		S4		PP=0.5 kg/cm2	2.0
2.5					S5		PP=0.5 kg/cm2	2.5
3.0			CLAY TILL -medium plastic, silty, sandy, trace gravel, coal and oxide inclusions, brown, moist		S6		PP=0.5 kg/cm2	3.0
3.5					S7			3.5
4.0					S8			4.0
4.5					S9		PP=1.5 kg/cm2	4.5
5.0					S10		PP=1.5 kg/cm2	5.0
5.5			...sand stringer at 6.7m depth					5.5
6.0								6.0
6.5								6.5
7.0								7.0
7.5								7.5
8.0								8.0
8.5								8.5
9.0			...becoming grey (basal till) below 9.2m depth					9.0
9.5								9.5
10.0								10.0
10.5								10.5
11.0			End of Borehole at 10.7 m depth					11.0
11.5			Notes:					11.5
12.0			1. Borehole log to be read in conjunction with Amec Foster Wheeler report BX30484. For definitions of terms and symbols used on logs refer to sheets following logs.					12.0
12.5			2. Near surface seepage & sloughing (1.3m)					12.5
13.0			3. 50mm monitoring well installed by Chilako Drilling on July 14, 2017; Machine screen from 7.0m to 10.0m depth; Sand bedding from 6.95m to 10.05m depth. Bentonite plug from 2m to 6.95m.					13.0
13.5								13.5
14.0								14.0
14.5								14.5
15.0								15.0

Amec Foster Wheeler Environment & Infrastructure	LOGGED BY: BM	COMPLETION DEPTH: 7.60 m
	REVIEWED BY: JL	COMPLETION DATE: 14/6/17
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PROJECT: Vanden Dool NRCB Permeability Testing		DRILLER: Biantco Environmental Services Inc.		BOREHOLE NO: BH17-03	
CLIENT: Vanden Dool Farms Ltd.		DRILL/METHOD: Truck Mounted Drill/SSA		PROJECT NO: BX30484	
LOCATION: Near east edge of proposed catch basin; Refer to Figure 1				ELEVATION: --	
SAMPLE TYPE	<input checked="" type="checkbox"/> Shelby Tube	<input checked="" type="checkbox"/> No Recovery	<input checked="" type="checkbox"/> SPT Test (N)	<input checked="" type="checkbox"/> Grab Sample	<input checked="" type="checkbox"/> Split-Pen
BACKFILL TYPE	<input checked="" type="checkbox"/> Bentonite	<input checked="" type="checkbox"/> Pea Gravel	<input checked="" type="checkbox"/> Slough	<input checked="" type="checkbox"/> Grout	<input checked="" type="checkbox"/> Drill Cuttings
<div style="display: flex; justify-content: space-between;"> <div style="width: 20%;"> <p>Depth (m)</p> <p>STANDARD PEN (N)</p> <p>20 40 60 80</p> <p>PLASTIC M.C. LIQUID</p> <p>20 40 60 80</p> </div> <div style="width: 40%; text-align: center;"> <p>SOIL SYMBOL</p> <p>SOIL DESCRIPTION</p> </div> <div style="width: 20%;"> <p>SPT (N)</p> <p>SAMPLE TYPE</p> <p>SAMPLE NO</p> </div> <div style="width: 20%;"> <p>OTHER TESTS COMMENTS</p> </div> <div style="width: 10%;"> <p>Depth (m)</p> </div> </div>					
<p>0 TOPSOIL (300 mm thick)</p> <p>1 CLAY -medium plastic, trace organics to 0.7m depth, silty, sandy, dark brown, moist</p> <p>2 ...brown below 0.7m depth</p> <p>3</p> <p>4 CLAY TILL -medium plastic, silty, sandy, trace gravel, coal and oxide inclusions, brown, moist</p> <p>5</p> <p>6</p> <p>7</p> <p>8 End of Borehole at 7.6 m depth</p> <p>9 Notes:</p> <p>10 1. Borehole log to be read in conjunction with Amec Foster Wheeler report BX30484. For definitions of terms and symbols used on logs refer to sheets following logs.</p> <p>11 2. Borehole open upon completion, surface water entry during drilling.</p> <p>12 3. Borehole backfilled with drill cuttings.</p> <p>13</p> <p>14</p> <p>15</p>					
<p>Amec Foster Wheeler</p> <p>Environment & Infrastructure</p>				<p>LOGGED BY: BM</p> <p>REVIEWED BY: JL</p>	
				<p>COMPLETION DEPTH: 7.60 m</p> <p>COMPLETION DATE: 14/6/17</p>	

BX30484.GPJ 17/07/25 08:38 AM (BOREHOLE LOG)

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MODIFIED UNIFIED CLASSIFICATION SYSTEM FOR SOILS									
MAJOR DIVISION			GROUP SYMBOL	GRAPH SYMBOL	COLOUR CODE	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA		
COARSE GRAINED SOILS (MORE THAN HALF BY WEIGHT LARGER THAN 75µm)	GRAVELS MORE THAN HALF THE COARSE FRACTION LARGER THAN 4.75mm	CLEAN GRAVELS (LITTLE OR NO FINES)	GW		RED	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}} > 4$; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$		
			GP		RED	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS		
		DIRTY GRAVELS (WITH SOME FINES)	GM		YELLOW	SILTY GRAVELS, GRAVEL-SAND SILT MIXTURES	CONTENT OF FINES EXCEEDS 12 %		
			GC		YELLOW	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I. LESS THAN 4		
	SANDS MORE THAN HALF THE COARSE FRACTION SMALLER THAN 4.75mm	CLEAN SANDS (LITTLE OR NO FINES)	SW		RED	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}} > 6$; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$		
			SP		RED	POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS		
		DIRTY SANDS (WITH SOME FINES)	SM		YELLOW	SILTY SANDS, SAND-SILT MIXTURES	CONTENT OF FINES EXCEEDS 12 %		
			SC		YELLOW	CLAYEY SANDS, SAND-CLAY MIXTURES	ATTERBERG LIMITS ABOVE "A" LINE OR P.I. MORE THAN 7		
FINE-GRAINED SOILS (MORE THAN HALF BY WEIGHT SMALLER THAN 75µm)	SILTS BELOW "A" LINE NEGLECTIBLE ORGANIC CONTENT	$W_L < 50\%$	ML		GREEN	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY	CLASSIFICATION IS BASED UPON PLASTICITY CHART (SEE BELOW)		
		$W_L < 50\%$	MH		BLUE	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDS OR SILTY SOILS			
	CLAYS ABOVE "A" LINE NEGLECTIBLE ORGANIC CONTENT	$W_L < 30\%$	CL		GREEN	INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY OR SILTY CLAYS, LEAN CLAYS			
		$30\% < W_L < 50\%$	CI		GREEN-BLUE	INORGANIC CLAYS OF MEDIUM PLASTICITY, SILTY CLAYS			
		$W_L > 50\%$	CH		BLUE	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS			
	ORGANIC SILTS & CLAYS BELOW "A" LINE	$W_L < 50\%$	OL		GREEN	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY		WHENEVER THE NATURE OF THE FINES CONTENT HAS NOT BEEN DETERMINED, IT IS DESIGNATED BY THE LETTER "P", E.G. SP IS A MIXTURE OF SAND WITH SILT OR CLAY	
		$W_L > 50\%$	OH		BLUE	ORGANIC CLAYS OF HIGH PLASTICITY			
	HIGHLY ORGANIC SOILS		Pt		ORANGE	PEAT AND OTHER HIGHLY ORGANIC SOILS		STRONG COLOUR OR ODOR, AND OFTEN FIBEROUS TEXTURE	
	SPECIAL SYMBOLS								
	LIMESTONE				OILSAND				
SANDSTONE				SHALE					
SILTSTONE				FILL (UNDIFFERENTIATED)					
SOIL COMPONENTS									
FRACTION	U.S. STANDARD SIEVE SIZE		DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS						
GRAVEL	PASSING	RETAINED	PERCENT	DESCRIPTOR					
COARSE	75mm	19mm	35-50	AND					
	4.75mm	2.00mm							
FINE	19mm	4.75mm	20-35	Y/RY					
	4.75mm	2.00mm							
SAND	4.75mm	2.00mm	10-20	SOME					
	2.00mm	425µm							
COARSE	4.75mm	2.00mm	1-10	TRACE					
	2.00mm	425µm							
FINE	425µm	75µm	1-10	TRACE					
	75µm	75µm							
FINES (SILT OR CLAY BASED ON PLASTICITY)									
OVERSIZED MATERIAL									
ROUNDED OR SUBROUNDED COBBLES 75mm TO 200mm			NOT ROUNDED: ROCK FRAGMENTS > 75mm						
BOULDERS > 200mm			ROCKS > 0.75 CUBIC METRE IN VOLUME						

NOTES:

- ALL SIEVE SIZES MENTIONED ON THIS CHART ARE U.S. STANDARD A.S.T.M. E. 11
- COARSE GRAIN SOILS WITH 5 TO 12% FINES GIVEN COMBINED GROUP SYMBOLS. E.G. GW-GC IS A WELL GRADED GRAVEL SAND MIXTURE WITH CLAY BINDER BETWEEN 5 AND 12% FINES

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EXPLANATION OF TERMS AND SYMBOLS

The terms and symbols used on the borehole logs to summarize the results of field investigation and subsequent laboratory testing are described in these pages.

It should be noted that materials, boundaries and conditions have been established only at the borehole locations at the time of investigation and are not necessarily representative of subsurface conditions elsewhere across the site.

TEST DATA

Data obtained during the field investigation and from laboratory testing are shown at the appropriate depth interval.

Abbreviations, graphic symbols, and relevant test method designations are as follows:

*C	Consolidation test	*ST	Swelling test
D _R	Relative density	TV	Torvane shear strength
*k	Permeability coefficient	VS	Vane shear strength
*MA	Mechanical grain size analysis and hydrometer test	w	Natural Moisture Content (ASTM D2216)
N	Standard Penetration Test (CSA A119.1-60)	w _L	Liquid limit (ASTM D 423)
N _d	Dynamic cone penetration test	w _p	Plastic Limit (ASTM D 424)
NP	Non plastic soil	E _r	Unit strain at failure
pp	Pocket penetrometer strength (kg/cm ²)	γ	Unit weight of soil or rock
*q	Triaxial compression test	γ _d	Dry unit weight of soil or rock
q _u	Unconfined compressive strength	ρ	Density of soil or rock
*SB	Shearbox test	ρ _d	Dry Density of soil or rock
SO ₄	Concentration of water-soluble sulphate	C _u	Undrained shear strength
		→	Seepage
		∇	Observed water level

* The results of these tests are usually reported separately

Soils are classified and described according to their engineering properties and behaviour.

The soil of each stratum is described using the Unified Soil Classification System¹ modified slightly so that an inorganic clay of "medium plasticity" is recognized.

The modifying adjectives used to define the actual or estimated percentage range by weight of minor components are consistent with the Canadian Foundation Engineering Manual².

Relative Density and Consistency:

<u>Cohesionless Soils</u>		<u>Cohesive Soils</u>		
Relative Density	SPT (N) Value	Consistency	Undrained Shear Strength c _u (kPa)	Approximate SPT (N) Value
Very Loose	0-4	Very Soft	0-12	0-2
Loose	4-10	Soft	12-25	2-4
Compact	10-30	Firm	25-50	4-8
Dense	30-50	Stiff	50-100	8-15
Very Dense	>50	Very Stiff	100-200	15-30
		Hard	>200	>30

Standard Penetration Resistance ("N" value)

The number of blows by a 63.6kg hammer dropped 760 mm to drive a 50 mm diameter open sampler attached to "A" drill rods for a distance of 300 mm.

¹ "Unified Soil Classification System", Technical Memorandum 36-357 prepared by Waterways Experiment Station, Vicksburg, Mississippi, Corps of Engineers, U.S. Army, Vol. 1 March 1953.

² "Canadian Foundation Engineering Manual", 4th Edition, Canadian Geotechnical Society, 2006.