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

NRCB Natural Resources Conservation Board

NRCB USE ONLY	Application number	Legal land description
☒ Approval ☐ Registration ☐ Authorization ☐ Amendment	LA21037	NE 27-8-26 W4M

APPLICATION DISCLOSURE

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

Any construction prior to obtaining an NRCB permit is an offence and is subject to enforcement actic ...luding prosecution.

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

Nov 3, 2021
Date of signing

Signature

A&D cattle LTD
Corporate name (if applicable)

Adrian
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)
12 pens (12 pens each is 40 m x 50 m)	40m x 50m
catch Basin (61 m x 38 m x 1.6 m)	200ft x 124 ft x 5 ft
4 pens (4 pens each is 20 m x 30 m)	20m x 30m

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

Existing facilities	Dimensions (m) (length, width, and depth)	NRCB USE ONLY

NRCB USE ONLY

Application is for a new CFO and as discussed in DS LA21037, has been denied due to inconsistency with an Inter-municipal Development Plan

t 2 — Technical Requirements

NRCB | Natural Resou… Conservation …

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

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

Construction completion date for proposed facilities Dec 30, 2024

Additional information

Livestock numbers: Complete only if livestock numbers are different from what was identified in the Part 1 application. Note: 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**
Beef finishers	2000 →		2000

AO note: Application is for a new CFO. There is an existing CFO on an adjacent quarter but under different ownership. Application is for a maximum capacity of 2000 beef finishers.

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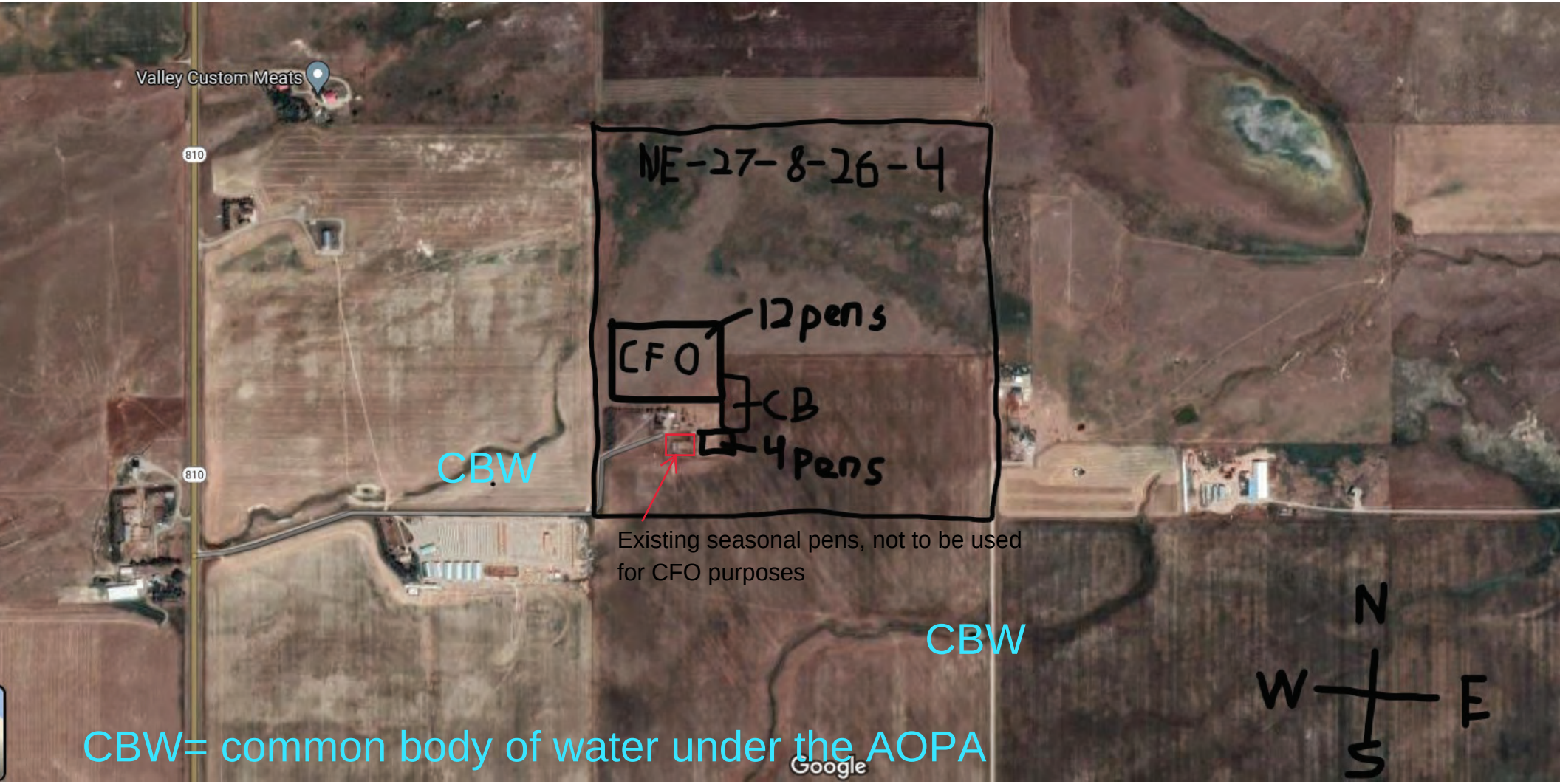
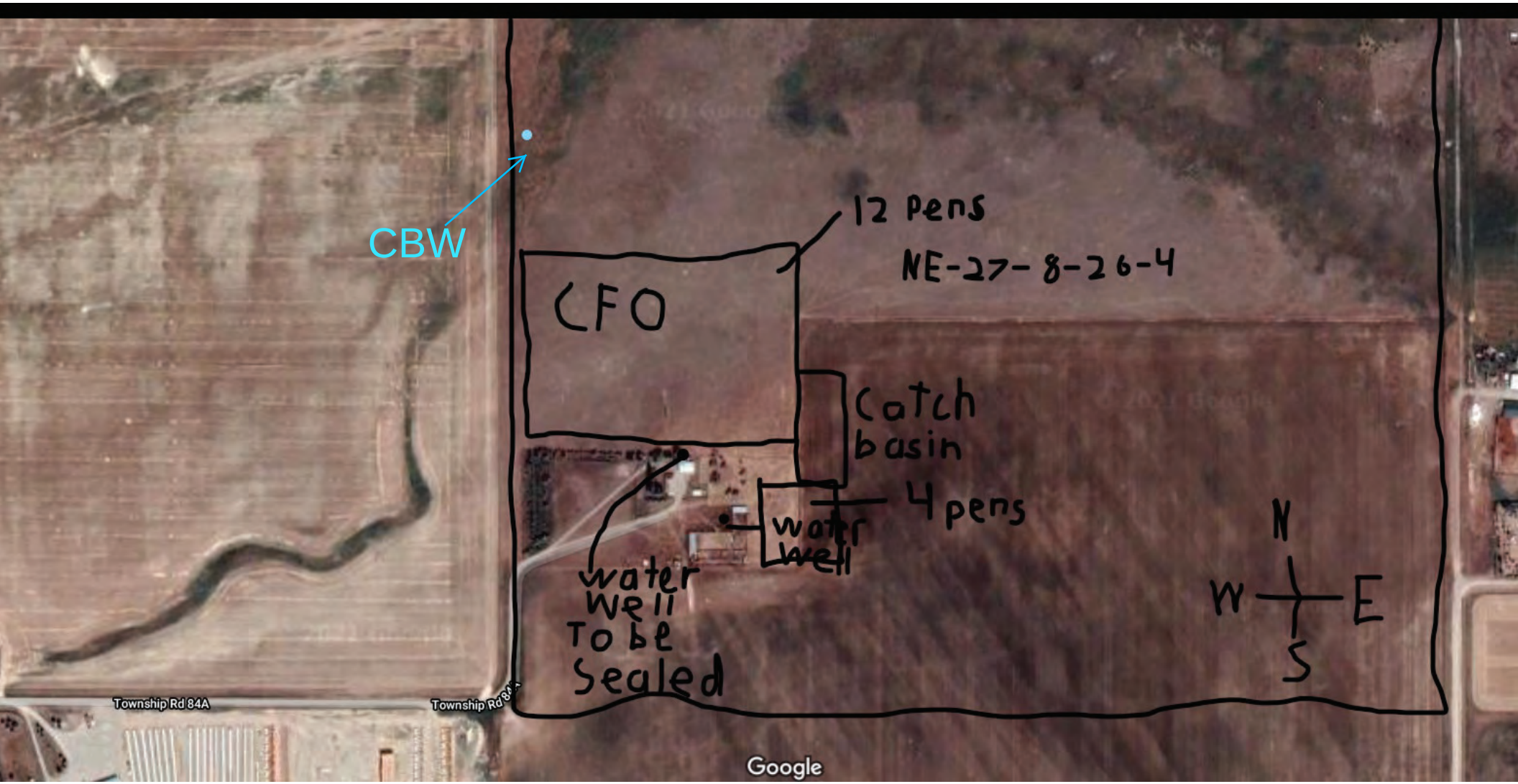


CBW= common body of water under the AOPA


CBW
12 pens
NE-27-8-26-4
CFO
Catch basin
4 pens
water well
water well To be Sealed
N
W
E
S
Township Rd 84A
Google

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)

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ALL SIGNATURES IN FILE ☒ YES ☐ NO

DATES OF APPROVAL OFFICER SITE VISITS

November 3, 2021	

CORRESPONDENCE WITH MUNICIPALITIES AND REFERRAL AGENCIES

Date deeming letters sent: January 5, 2022

Municipality: MD of Willow Creek

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

Alberta Health Services:

☒ 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: _____ ☐ N/A

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

Other: _____ ☐ N/A

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

DECLARATION AND ACKNOWLEDGMENT OF APPLICANT CONCERNING *WATER ACT* LICENCE

issued by Alberta Environment and Parks (AEP) for a confined feeding operation (CFO)

Date and sign one of the following four options

PTION 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.

igned this ____day of _____, 20____.

Signature of Applicant or Agent

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

- I (we) acknowledge that the CFO will need a new water licence from AEP under the *Water Act* for the development or activity proposed in this AOPA application.
- I (we) request that the NRCB process the AOPA application **independently of** AEP's processing of the CFO's application for a water licence.
- 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 AEP as improving or enhancing the CFO's eligibility for a water licence under the *Water Act*.
- 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 AEP's consideration of whether to grant the *Water Act* licence application.
- 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*).
- **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.

gned this ____ day of _____, 20____.

Signature of Applicant or Agent

TION 3: Additional water licence not required

- I (we) declare that the CFO will not need a new licence from AEP under the *Water Act* for the development or activity proposed in this AOPA application.

gned this ____ day of _____, 20____.

Signature of Applicant or Agent

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

- At this time, I (we) do not know whether a new water licence is needed from AEP under the *Water Act* for the development or activity proposed in this AOPA application.
- If a new *Water Act* licence is needed, I (we) request that the NRCB process the AOPA application **independently of** AEP's processing of the CFO's application for a water licence.
- 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 AEP as improving or enhancing the CFO's eligibility for a water licence under the *Water Act*.
- 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 AEP's consideration of whether to grant my *Water Act* licence application, if a new water licence is needed.
- 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*).
- **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.

ned this 3rd day of November, 2021.

Signature of Applicant or Agent

Note: see DS LA21037 for discussion. Application is for a new CFO

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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: _____ **Proposed 1:** Pens

Proposed 2: Catch Basin **Proposed 3:** _____

Facility and environmental risk information		Facilities				NRCB USE ONLY	
		Existing	Proposed 1	Proposed 2	Proposed 3	Meets requirements	Comments
Flood plain information	What is the elevation of the floor of the lowest manure storage or collection facility above the 1:25 year flood plain or the highest known flood level?	☐ >1 m ☐ ≤ 1 m	☒ >1 m ☐ ≤ 1 m	☒ >1 m ☐ ≤ 1 m	☐ > 1 m ☐ ≤ 1 m	☒ YES ☐ NO ☐ YES with exemption	Not located in a flood plain
Surface water information	How many springs are within 100 m of the manure storage facility or manure collection area?		0	0		☒ YES ☐ NO ☐ YES with exemption	No springs observed
	How many water wells are within 100 m of the manure storage facility or manure collection area?		0	0		☐ YES ☐ NO ☒ YES with exemption	1 well located within 100 m*
	What is the shortest distance from the manure collection or storage facility to a surface water body? (e.g., lake, creek, slough, seasonal)		1/2 mile	1/2 mile		☒ YES ☐ NO ☐ YES with exemption	50 m**
Groundwater information	What is the depth to the water table?		15 ft	15 ft		☒ YES ☐ NO ☐ YES with exemption	4.2m, see attached engineering report
	What is the depth to the groundwater resource/aquifer you draw water from?		30 ft	30 ft		☒ YES ☐ NO ☐ YES with exemption	6.1 m Well ID103530

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

*two wells located within 100 m. Applicant has committed to decommissioning the well nearest the pens. If the NRCB board was to overturn my decision, a condition should be included requiring decommissioning of this well prior to construction.

**unnamed drainage 50 m. Only conveys water during extreme flood events, CBW under AOPA.

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

ENVIRONMENTAL RISK SCREENING INFORMATION

Well IDs: ID103528 ID103529 ID103530

ID9681624 Well ID103530 most representative and indicates UGR at 6.1 m depth

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

ERST for **proposed** facilities

Facility	Groundwater score	Surface water score	File number
Proposed facilities meet AOPA requirements with a water well exemption. This exemption is discussed in decision summary LA21037			

ERST for **existing** facilities

Facility	Groundwater score	Surface water score	File number
Application is for a new CFO, no existing facilities			

NRCB USE ONLY
Groundwater or surface water related comments:

Concerns have been raised concerning the potential for contamination of groundwater and surface water near the CFO. The CFO meets all AOPA technical requirements aside from being too close to one water well (the second on site would be decommissioned). The exemption that could be granted for this well is discussed in Decision Summary LA21037. Even though the site theoretically poses a low risk to groundwater and surface water, If the NRCB board was to direct me to issue a permit, i would recommend additional conditions in the Approval to address some specific landscape attributes and to further minimize the chance of a risk being posed to the environment. These conditions are discussed further in Decision Summary LA21037.

The applicant has also committed to protecting the well that is not being decommissioned. The applicant would maintain the well as up gradient from any manure storage and has committed to maintaining at absolute minimum at least 20 m between the well and any manure storage.

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)

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

Neighbour name(s)	Legal land description	Distance (m)	NRCB USE ONLY: Zoning (LUB) category	MDS category (1-4)	Distance (m)	Waiver attached (if required)	Meets regulations
Martin vanhuisgenbos	SW-27-8-26-4	490(m)	RG*	1	510 m	Yes**	Yes
Eric Oskam	NW-27-8-26-4	780(m)	RG	1	750 m	NA	Yes
Jan Pieter Loeltson	NW-26-8-26	600(m)	RG	1	555 m	NA	Yes

*Rural General

**meets MDS but waiver ensures that a survey to nearest residence will not be required.

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)
Adrian vanhuisgenbos	NE-27-8-26-4	145 acres	DB	See below	
			Total		

NRCB note: applicant also submitted numerous spreading agreements, attached below

* 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)

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Minimum Distance Separation (MDS) Waiver (declaration)

Applicant information

NRCB application number: _____

Operator/operation name: Adin A & D Cattle

Address: Box 2468 Postal Code: T0L 0Z0

Legal land location of confined feeding operation: NE 27-8-26-4

I have requested the residence owner(s) named below to waive the required minimum distance separation (MDS) to their residence for the *Agricultural Operation Practices Act* (AOPA) permit application identified above. In making this request, I have provided the owner(s) with an opportunity to review my permit application and a copy of the Natural Resources Conservation Board (NRCB) Fact Sheet "Minimum Distance Separation (MDS) Waivers" available on the NRCB website at www.nrcb.ca. I have also explained:

- The MDS requirement set out in section 3 of the Standards and Administration Regulation of AOPA. I have advised the owner(s) that section 3(6)(a) of the Standards and Administration Regulation allows this requirement to be waived by the owners of residences, if they agree in writing to grant a waiver;
- That my proposed development does not meet the required MDS to the owner's residence; and,
- That this waiver applies only to this application as described. An increase in livestock capacity, annual manure production, level of odour production, change to the site plan or change to a facility that would increase the MDS would require a new waiver.

Following is a summary of the proposed development:

- The current scope of my confined feeding operation (CFO), including the type, number, and category of livestock, if any, is:

_____

_____

- My application for a new AOPA permit proposes the following changes to the existing livestock category, type and/or capacity at my CFO:

2000 Finishers

_____

- The proposed new CFO facility(ies), or changes to the existing CFO facilities, including manure storage, manure storage volume and any other pertinent details, if any, are (attach a site layout plan if available):

12 pens Catch Basin

_____

I the applicant understand that the waiver is not valid unless ALL registered owners of the residence sign this document.

Permit Applicant: _____ Date: Nov 13, 2021

Signature

Residence owner(s) to initial: [redacted] [redacted]

Minimum Distance Separation (MDS) Waiver

Residence owner(s) information

ALL Names on land title: 5 star Cattle

Legal land location of residence(s): SW-27-8-26-4

Telephone number(s)[1]: [redacted] Email address(es)[1]: [redacted]

Address(es)[1] and Postal code(s)[1]: [redacted] Fort Macleod, Alberta T0L 0Z0

[1] ***Please note that personal contact information is for NRCB use ONLY and not publicly released***

I am/we are the legal landowner(s) of a residence(s) located at the above noted legal land location/address:

- I/we have read the NRCB Fact Sheet "Minimum Distance Separation (MDS) Waivers";
- I/we have discussed this application with the applicant and understand its potential impacts to our residence(s);
- I/we understand that the application **does not** meet the MDS requirement to my/our residence(s), under the *Agricultural Operation Practices Act* (AOPA);
- **I/we understand that this waiver is not valid unless signed by ALL parties identified on the land title as owners;**
- **I/we are not obligated to waive the MDS requirement to our residence(s);**
- I/we understand that if I/we choose to waive the MDS requirement, I/we can revoke the waiver, by providing written notice to the NRCB approval officer, as set out in the "Minimum Distance Separation (MDS) Waivers" Fact Sheet; and
- I/we understand that this waiver is a public document.

Having considered my/our rights, I/we hereby waive the MDS requirement to my/our residence, with respect to **application number** _____.

[redacted]

Signatures of **all** residence owner(s) on title

Martin VanHuigenbos

Printed names of **all** residence owner(s) on title

Date: Nov 3, 2021

Manure Spreading Agreement

This agreement is between H & D cattle, manure producer, and

James Feyter manure receiver.

Length of agreement: This agreement is valid for a time period of 2022 (minimum of one year).

Legal land location	Soil type[1]	Acres suitable for manure spreading[2]
W 1/2 - 23 - 8 - 26 - W4		270
NE - 16 - 8 - 26 - W4		160

[1] Soil type choices: Dark brown and brown, Grey wooded, Black, Irrigated.

[2] Land within required setbacks from water bodies, water wells, residences, etc. is not to be included.

Other comments:

Manure producer (Confined Feeding Operation) Legal Land Location NE - 27 - 8 - 26 - 4

Date of signing	Signature	Print name	Corporate name(if appl)
NOV 17, 2021	[signature]	Adrian	H & D Cattle

Manure Receiver – Landowner(s)[3]

Date of signing	Signature	Print name	Corporate name(if appl)
Nov 23/2021	[redacted]	James Feyter	Serene holdings Ltd.

[3] All registered owners of land, or authorized signing authorities must sign.

Manure Spreading Agreement

This agreement is between H & D Cattle, manure producer, and

H & D Cattle manure receiver.

Length of agreement: This agreement is valid for a time period of 2022 (minimum of one year).

Legal land location	Soil type[1]	Acres suitable for manure spreading[2]
NE-27-8-26-4		140

[1] Soil type choices: Dark brown and brown, Grey wooded, Black, Irrigated.

[2] Land within required setbacks from water bodies, water wells, residences, etc. is not to be included.

Other comments:

Manure producer (Confined Feeding Operation) Legal Land Location NE-27-8-26-4

Date of signing	Signature	Print name	Corporate name (if appl)
Nov 17, 2021	NO	Adrian	H & D cattle

Manure Receiver – Landowner(s)[3]

Date of signing	Signature	Print name	Corporate name (if appl)
Nov 17, 2021	NO	Adrian	H & D cattle

[3] All registered owners of land, or authorized signing authorities must sign.

This agreement is between H & D Cattle, manure producer, and

Gerrit van Haigenbos manure receiver.

Length of agreement: This agreement is valid for a time period of 2022 (minimum of one year).

Legal land location	Soil type[1]	Acres suitable for manure spreading[2]
NW-27-8-26-4		160

[1] Soil type choices: Dark brown and brown, Grey wooded, Black, Irrigated.

[2] Land within required setbacks from water bodies, water wells, residences, etc. is not to be included.

Other comments:

Manure producer (Confined Feeding Operation) Legal Land Location NE-27-8-26-4

Date of signing	Signature	Print name	Corporate name(if appl)
Nov 17, 2021	[redacted]	Adrian	H&D Cattle

Manure Receiver – Landowner(s)[3]

Date of signing	Signature	Print name	Corporate name(if appl)
Nov 20-21	[redacted]	Geert Van Haigenbos	Mountain View Ltd

[3] All registered owners of land, or authorized signing authorities must sign.

Serene Holdings Ltd

N½-23-8-26-W4 270 acre

NE-16-8-26-W4 160 acre.

James Fester

[redacted]

Manure Spreading Agreement

This agreement is between A $ D Cattle LTD., manure producer, and

Steven & Evelyn Joosse. manure receiver.

Length of agreement: This agreement is valid for a time period of 1 year (minimum of one year).

Legal land location	Soil type[1]	Acres suitable for manure spreading[2]
NE 26-8-33 W4	Dark Brown and Brown	130

[1] Soil type choices: Dark brown and brown, Grey wooded, Black, Irrigated.

[2] Land within required setbacks from water bodies, water wells, residences, etc. is not to be included.

Other comments:

Manure producer (Confined Feeding Operation) Legal Land Location NE 27-8-26-4

Mar. 16, 2022	[signature]	Adrian	A $ D Cattle LTD.
Date of signing	Signature	Print name	Corporate name(if appl)

Manure Receiver – Landowner(s)[3]

Mar 15/22	[signature]	Steven Joosse	—
Date of signing	Signature	Print name	Corporate name(if appl)
Date of signing	Signature	Print name	Corporate name(if appl)

[3] All registered owners of land, or authorized signing authorities must sign.

Part 2 — Technical Requirements

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NRCB USE ONLY

MINIMUM DISTANCE SEPARATION

Methods used to determine distance (if applicable): measurement from aerial photo

Margin of error (if applicable): _____

Requirements (m): Category 1: 490 m Category 2: 653 m Category 3: 816 m Category 4: 1306 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: 618 acres brown/ dark brown

Land base listed: _____

Area not suitable: Non cultivated areas, and setbacks to water, homes, etc

Available area 648 acres dark brown 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 _____

Name
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	2,000	891.8
	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		-
	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		891.8

For New Operations

Dispersion Factor 1

Category	Odour Objective	Distance	
		Feet	Metres
1	41.04	1,607	490
2	54.72	2,143	653
3	68.4	2,678	816
4	109.44	4,286	1,306

For Expanding Operations

Dispersion Factor 1
Expansion Factor 0.77

Category	Odour Objective	Distance	
		Feet	Metres
1	41.04	1,237	377
2	54.72	1,650	503
3	68.40	2,062	629
4	109.44	3,300	1,006

Name	0
Address	0
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)	2000.0	250.0	208.0	156.0	124.0
	Feeders (450 - 900 lbs)	0.0	0.0	0.0	0.0	0.0
	Feeder Calves (<550 lbs)	0.0	0.0	0.0	0.0	0.0
	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
	Other	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
	Other	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
	Other	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
	Other	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
	Other	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
	Other	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
	Other	0.0				
	Total Hectares		250	208.0	156.0	124.0
	Total Acres		618	514.0	385.5	306.4

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)

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. No catch Basin
2. _____
3. _____

Determination of runoff area

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

Catch basin capacity

	Length (m)	Width (m)	Total depth (m)	Depth below ground level (m)	Slope run:rise			NRCB USE ONLY
					Inside end walls	Inside side walls	Outside walls	Calculated storage capacity (excl. 0.5 m freeboard) (m^3)
1.	200	120	1.6	1.6*	3/1	3/1	3/1	
2.								
3.								

AO note: Catch basin dimension to be 61 m x 38 m x 1.6 m deep

*engineer report says 1.2 m deepest. Condition would be required if a permit was issued

Naturally occurring protective layer details

Thickness of naturally occurring protective layer	0.5 (m)	Provide details (as required) VH 11-21	
Soil texture	See attached report _____% sand	_____% silt	_____% clay
Hydraulic conductivity - naturally occurring protective layer	Depth and type of soil tested	Hydraulic conductivity (cm/s) 1.5 E-07	Describe test standard used In situ

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			Catch Basin Dimensions
Total Length*[4]	61.0	m	200 ft
Total Width*[4]	38.0	m	125 ft
Total Depth*[4]	1.6	m	5 ft
Design Capacity Depth	*1.10*	m	4 ft
End Slope*[4]	3	run:rise	3 run:rise
Side Slope*[4]	3	run:rise	3 run:rise
Length of Bottom	51.4	m	169 ft
Width of Bottom	28.4	m	93 ft
Capacity @ top of Bank	*2,998*	m^3	*Capacity @tob* *105,860* ft^3 *659,387 Imp. Gal.*

Design Capacity of Catch Basin (freeboard level)			Design Capacity (freeboard level)
Length (design capacity depth)	58.0	m	190 ft
Width (design capacity depth)	35.0	m	115 ft
Total Depth	*1.6*	m	*5* ft
Design Capacity Depth	1.10	m	4 ft
End Slope	3	run:rise	3 run:rise
Side Slope	3	run:rise	3 run:rise
Design Capacity (freeboard level)	**1,911**	m^3	67,500 ft^3
			420,445 Imp. Gal.
level)	*2,030*	m^2	*21,851* ft^2

CFO Name [1]

Land Location [1]

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	200	150	30,000.0
7	20	30	600.0
8	20	30	600.0
9	20	30	600.0
10	20	30	600.0
		Total Area (m^2)	**32,400**

Rainfall (Select Town [3])

Fort Macleod 90

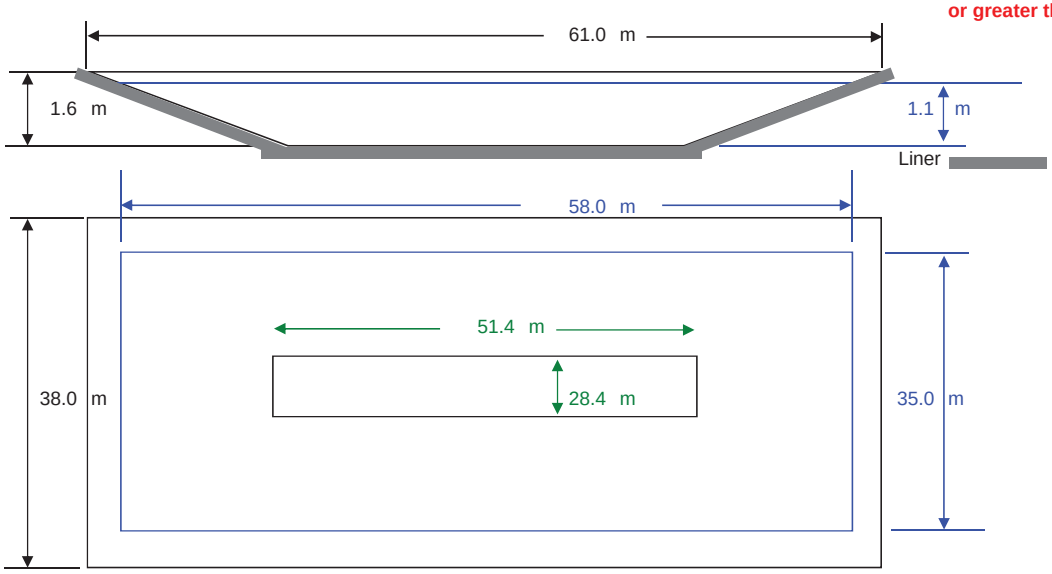
AOPA Design Rainfall **90 mm**

Minimum Catchbasin Storage Volume Required

1,895 m^3 ** 66935.4193 ft^3

416929.549 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

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

NRCB USE ONLY

Catch basin calculator. Total volume @ freeboard level: 1911 m3 Runoff capacity requirements met: ☒ YES ☐ NO

Calculation of the volume attached: ☒ YES ☐ NO See above

Depth to water table: 4.2 m Requirements met: ☒ YES ☐ NO

Depth to uppermost groundwater resource: 6.1 m 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):

See attached report. If a permit was to be issued, a condition should be attached to ensure the catch basin is constructed in accordance with the engineering report as attached.

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

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)

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 Pens 40 x 50(m) each pen
2. 4 pens 20 m 30 m each pen

Manure storage capacity

	Length (m)	Width (m)	Depth below ground level (m)	NRCB USE ONLY Estimated storage capacity (m^3)
1.	40 (m)	50 (m) each pen	~~1.6 m~~ 0	Meets AOPA 9 month storage requirements
2.	20	30 each pen	0	
			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

Slope into catch Basin

Naturally occurring protective layer details

Thickness of naturally occurring protective layer	3.7 (m)	Provide details (as required) Bore hole VHS-21	
Soil texture	See attached report % sand	% silt	% clay
Hydraulic conductivity - naturally occurring protective layer	Depth and type of soil tested	Hydraulic conductivity (cm/s) 23E-07	Describe test standard used Situ

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

See attached

NRCB USE ONLY

Requirements met: ☒ YES ☐ NO

Condition required: ☒ YES ☐ NO

Report attached: ☒ YES ☐ NO

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: 4.2 m Requirements met: ☒ YES ☐ NO

Depth to uppermost groundwater resource: 6.1 m Requirements met: ☒ YES ☐ NO

ERST completed: ☒ see ERST page for details

Surface water control systems

Requirements met: ☒ YES ☐ NO Details/comments:

Applicant has committed to sloping all pens into a catch basin

Naturally occurring protective layer details

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

See attached report. Though the site meets AOPA technical requirements, due to inconsistency among boreholes and the depth of UGR a condition should be included in the approval requiring additional inspection of the catch basin walls and floor for potential porous layers if the NRCB board was to direct a permit be issued.

wood.

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

14 October 2021

Wood File: BX30697

A & D Cattle
Box 2468
Fort Macleod, AB T0L 0Z0

Attention: Adrian Van Huigenbos:

Re: Geotechnical Review and Evaluation
NRCB Permitting of Proposed Pens & Catch Basin
NW-27-008-26-W4M, near Fort Macleod, Alberta

As requested, Wood Environment & Infrastructure Solutions (Wood) 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 new cattle pens to be located just north of the existing farmyard, with a new catch basin to be located just east of the proposed pen area (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, ten boreholes were advanced at the site on September 1, 2021, followed by three additional confirmatory boreholes in the proposed catch basin area in October, 2021. The boreholes were advanced at the approximate locations denoted as VH1-21 to VH13-21 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 4.5 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 thin surficial layer of lacustrine or eolian deposits of sand, silt and or clay loam, which was underlain by stiff medium plastic clay till. Toward the north and east, the clay was observed to be underlain by sandier soils, including sand and gravel below about 3.5 m depth at boreholes VH9-21 to VH11-21, with sand and gravel becoming shallower further north of the proposed development area, in the area of VH8-21. Groundwater was encountered in the area of the proposed catch basin (borehole VH9-21) below about 4.2 m depth.

A sample of soil collected from the screened zone of borehole VH5-21 was subjected to laboratory grain size (i.e., hydrometer) analyses. The results (attached) indicate a textural breakdown of approximately 24% sand, 54% silt, and 22% clay.

To measure the *in situ* permeability of the subsurface soils, 50 mm diameter PVC monitoring wells were constructed in borehole VH5-21 (proposed pen area) and borehole VH11-21 (proposed catch basin area). Test well VH5-21 was screened from 2.1 m to 3.7 m depth while test well VH11-21 was screened from 1.2m to 2.0m depth. It is noted that the length of screen at VH11-21 was constrained by both the anticipated depth of catch basin, and by the presence of the more permeable underlying soils.

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, the average 24-hour water drop at VH5-21 was about 1.52 m, while the average 24-hour water drop at VH11-21 was about 0.4 m.

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, of 2.3×10^{-7} cm/s at VH5-21, and a hydraulic conductivity, k_s, of 1.5×10^{-7} cm/s at VH11-21.

Using the measured permeability of the clay stratum, the 1.6 m of clay screened at VH5-21 is estimated to represent the equivalent of approximately 7 m of naturally occurring materials having a hydraulic conductivity of 1×10^{-6} cm/s (the reference standard in AOPA). At VH11-21, the 0.8 m of clay screened is estimated to represent the equivalent of approximately 5.3 m of naturally occurring materials having a hydraulic conductivity of 1×10^{-6} cm/s. 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).

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 Wood's opinion that the naturally occurring materials at the site satisfy the AOPA requirements for permitting the proposed pens and catch basin at this location.

It is noted that the depth of the proposed catch basin is constrained by the progression to more coarse-grained soils at increasing depth. Accordingly, the catch basin depth must be limited to 1.2 m below existing grade, and should not extend further north or east of the limits indicated on Figure 1.

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

Yours truly,

Wood Environment and Infrastructure Solutions,
A Division of Wood Canada Limited

PROFESSIONAL ENGINEER ALBERTA JOHN LOBBEZOO

14 October 2021

John Lobbezoo, P.Eng.
Associate Engineer, Geotechnical
Lethbridge & Medicine Hat Area Lead

Co-authored by:
James Le, EIT
Geotechnical Services

PERMIT TO PRACTICE
WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS
RM SIGNATURE: _____
RM APEGA ID #: 1450
DATE: 14 October 2021
PERMIT NUMBER: P004546
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

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


Figure 1
Borehole Locations
Proposed Pens & Catch Basin
A&D Cattle
Wood File: BX30697
October, 2021
Legend
Feature 1
Feature 2
NE-27-008-26-W4M
VH8-21
VH2-21
VH1-21
PROPOSED PEN AREA
VH5-21
VH6-21
VH9-21
VH13-21
PROPOSED
CATCH BASIN
VH11-21
VH12-21
VH10-21
Google Earth
© 2021 Google
Image © 2021 CNES / Airbus
200 m
N

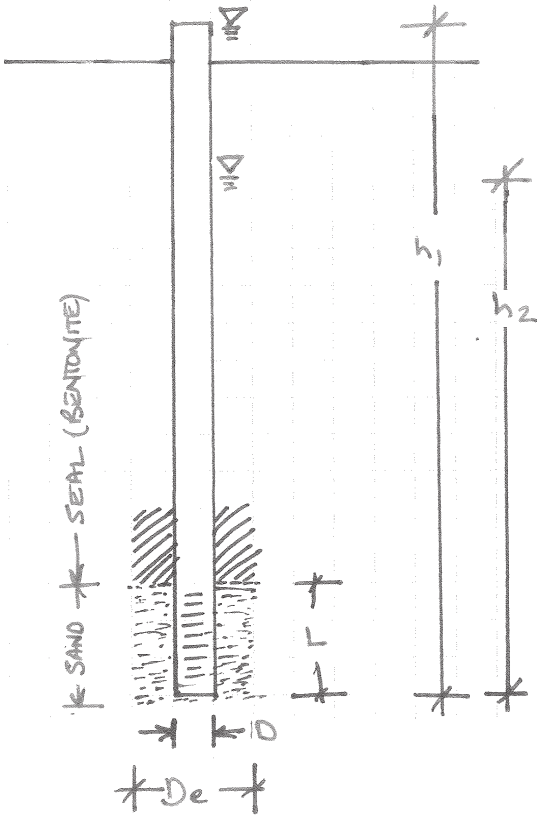
VH5-21

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)



VH5-21 - A & D Cattle

Wood File: BX30697

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	4.30	initial height of water above base of hole (m)
h2	2.78	final height of water above base of hole (m)
t	24.0	time of test (h)

k_s = 2.3E-07 cm/sec

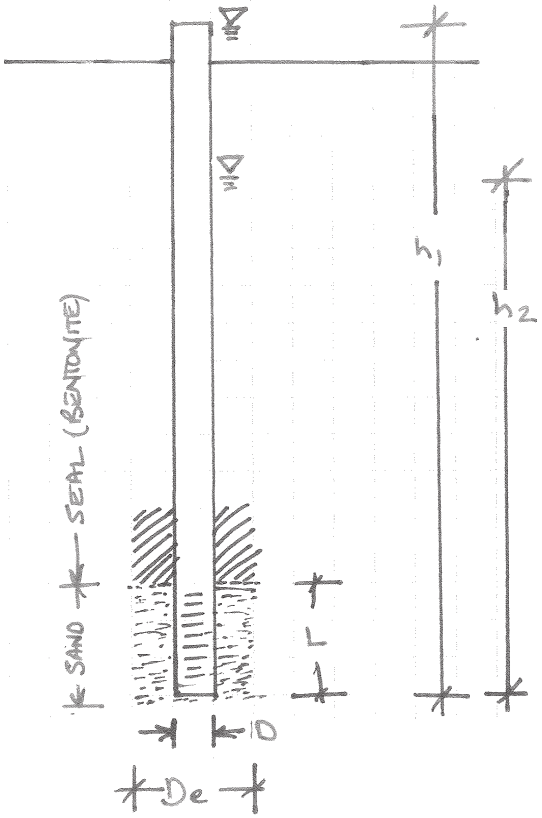
VH11-21

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)



VH11-21 - A & D Cattle

Wood File: BX30697

INPUT VARIABLES

Terms	Value	Definition
D	0.0520	diameter of standpipe (m)
De	0.1500	diameter of borehole (m)
L	0.80	length of sand section (m)
h1	2.30	initial height of water above base of hole (m)
h2	1.90	final height of water above base of hole (m)
t	24.0	time of test (h)

k_s = 1.5E-07 cm/sec

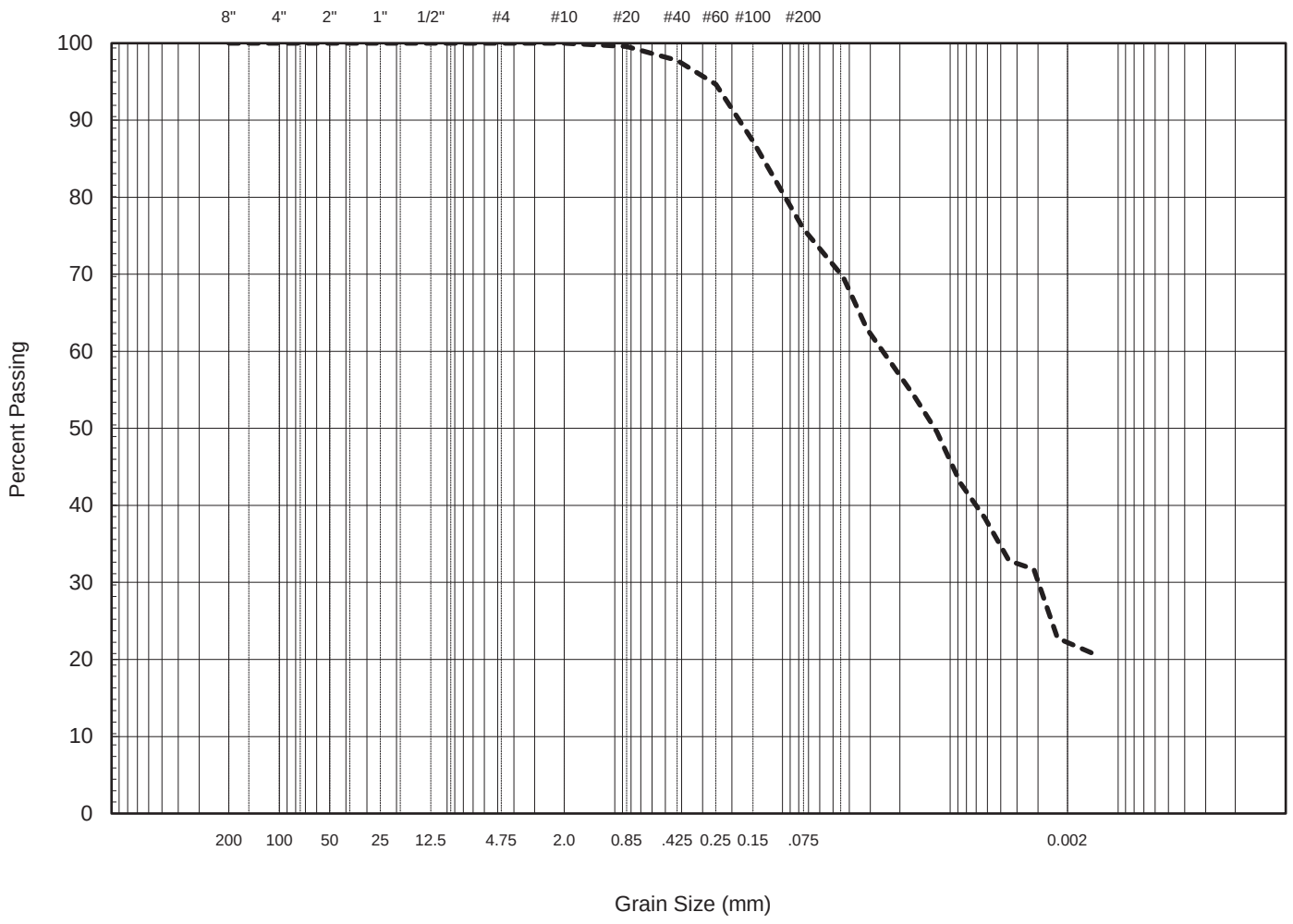
TO: A & D Cattle
Fort Macleod, AB

HYDROMETER TEST

wood.

ATTENTION: **Adrian Van Huigenbos**

COBBLES	GRAVEL		SAND			SILT	CLAY
	Coarse	Fine	C	M	F		



Remarks:

Summary					
D10 =	--	mm	**Gravel**	0	%
D30 =	0.0030	mm	**Sand**	24	%
D60 =	0.0256	mm	**Silt**	54	%
Cu =	--		**Clay**	22	%
Cc =	--				

Project No: **BX30697**
Hole No: **VH5-21** **Sample:** **--**
Depth (m): **2.5-3.5m** **Date:** October 5, 2021 **Tech:** TMW

CHILAKO DRILLING SERVICES LTD

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

SOIL PROFILE AND PARENT MATERIAL DESCRIPTION

Site Location: NE27-8-26W4, A&D Cattle Date: 1-Sep-21

Hole #	Location	Depth	Texture	Moisture	Geological	Sample	Remarks
VH1-21	0323822	0-0.15	FSCL	D	Eol		
	5505909	0.15-1.0	FSL	D	Eol		
		1.0-1.7	CL	D	Till		Stiff, med plastic, yellow brown
		1.7-2.0	CL	D	Till		Stiff, med plastic, yellow brown
		2.0-3.0	CL	M	Till		Mixed with some gravel
VH2-21	0323738	0-0.15	CL-FSCL	D	Topsoil		
	5505914	0.15-0.5	CL-FSCL	D	Lac		
		0.5-1.1	CL-SiCL	D	Lac		Stiff, med plastic, olive brown
		1.1-1.6	CL	D	Till		Stiff, med plastic, yellow brown
		1.6-3.0	CL	M	Till		Stiff, med plastic, brown, trace sand streaks
VH3-21	0323642	0-0.15	FSL	D	Topsoil		
	5505919	0.15-1.5	FSL	D	Eol	1.0-1.5	
		1.5-1.9	CL-SiCL	M	Lac		Stiff, med plastic, olive brown
		1.9-3.0	CL	M	Till		Stiff, med plastic, brown
VH4-21	0323633	0-0.15	FSL	D	Topsoil		
	5505848	0.15-0.4	SiL	D	Eol		
		0.4-1.0	SiCL	D	Lac		Stiff, med plastic, olive brown
		1.0-1.5	CL	D	Till		Stiff, med plastic, gray brown
		1.5-3.0	CL	SM	Till		Stiff, med plastic, yellow brown, trace gravel
VH5-21	0323708	0-0.15	SiCL	D	Topsoil		
	5505848	0.15-1.6	SiCL	D	Lac		V. firm, med plastic, olive brown
	toe of hill	1.6-3.7	CL	SM	Till	2.5-3.2	Stiff, med plastic, yellow brown, a few stones 50mm H.C. well installed to 3.7m BGL Screen: 3.7-2.2m Sand: 3.7-2.1m Bentonite: 2.1-0.0m Stickup: 0.6m Hole Diameter: 0.15m
VH6-21	0323820	0-0.15	SiCL	D	Topsoil		
	5505837	0.15-1.1	SiCL	D	Lac		V. firm, med plastic, light brown
		1.1-1.6	CL	D	Till		Stiff, med plastic, brown
		1.6-3.0	CL	M	Till		Stiff, med plastic, brown, trace gravel
VH7-21	0323687	0-0.15	FSL	D	Topsoil		
	5506098	0.15-0.5	FSL	D	Eol		
	proposed	0.5-1.2	FSCL	D	Lac		
	catch	1.2-1.6	CL	M	Till		
	basin	1.6-3.0	S+Gr	VM	Till		Coarse gravel, some clay

SOIL PROFILE AND PARENT MATERIAL DESCRIPTION (CONTINUED)

Hole #	Location	Depth	Texture	Moisture	Geological	Sample	Remarks
VH8-21	0323883	0-0.15	FSL	D	Topsoil		
	5505987	0.15-1.2	SiCL	D	Lac		
	proposed	1.2-1.7	CL	D	Till		Mixed with gravel
	catch basin	1.7-3.0	S+Gr	M	Till		Coarse gravel
VH9-21	0323871	0-0.15	FSCL	D	Topsoil		
	5505834	0.15-0.9	SiCL	D	Lac		
	proposed	0.9-1.5	CL	D	Till		
	catch	1.5-3.1	CL	M	Till		Stiff, med plastic, some gravel
	basin	3.1-3.6	FSL-FSCL	VM-Sat	Till		
		3.6-4.5	CL*S+Gr	M	Till		CL mixed with sand and gravel
							25mm WTW installed to 4.5m (1ft of water)
VH10-21	0323833	0-0.15	SiCL	D	Topsoil		
	5505680	0.15-0.75	SiCL	D	Lac		Stiff, med plastic, varved
	proposed	0.75-1.9	CL	M	Till		Stiff, med plastic, brown
	catch	1.9-3.1	FSL	M	Till		
	basin	3.1-3.9	FSL-FSCL	VM	Till		
		3.9-4.5	S+Gr	Sat	Till		Some clay
VH11-21	0323871	0-0.15	CL-FSCL	SM	Topsoil		
	5505797	0.15-1.2	CL	SM	Lac		
		1.2-1.6	CL	SM	Till		Sand lensing, some gravel
		1.6-2.1	CL	SM	Till	1.6-2.1	Stiff, med plastic, brown, trace gravel
		2.1-3.6	SCL	SM	TIll		Some sand & gravel mixed with clay
		3.6-4.5	S&Gr	M	Till		Mixed with clay
							50mm H.C. well installed to 1.9m BGS
							Bentonite: 4.5-2.0m
							Screen: 1.9-1.3m
							Sand: 2.0-1.2m
							Bentonite: 1.2-0.0m
							Stickup: 0.3m
							Hole Diameter: 0.15m
VH12-21	0323897	0-0.15	FSCL	SM	Topsoil		
	5505797	0.15-0.4	FSCL	SM	Lac		
		0.4-2.3	CL	SM	Till		Stiff, med plastic, brown
		2.3-2.5	FSCL	M	Till		Trace gravel
		2.5-3.0	FSL	M	Till		
VH13-21	0323901	0-0.15	SiCL	SM	Topsoil		
	5505833	0.15-0.6	SiCL	SM	Lac		
		0.6-2.2	CL	SM	Till		Stiff, med plastic, trace gravel
		2.2-2.6	FSCL	M	Till		
		2.6-3.0	FSL	M	Till		

Legend:

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